MEMORANDUM

To: Council, SSC, and AP members

From: Clarence G. Pautzke
Executive Director

Date: June 3, 1988

Subject: Bering Sea/Aleutian Islands Groundfish FMP

ACTION REQUIRED

(a) Final approval of Amendment 12 and implementing regulations for Secretarial review.

(b) Approve Resource Assessment Document (RAD) policy (also applies to the Gulf of Alaska groundfish FMP).

BACKGROUND

In April the Council approved draft environmental and socioeconomic documents on Amendment 12 for public review. The amendment consists of six proposals and their management alternatives:

1. Establish a bycatch management system for king crab, Tanner crab, and halibut.

2. Require all floating processors receiving groundfish caught in the EEZ to obtain federal permits and report catch weekly.

3. Establish non-retainable catch limits on the bycatch of groundfish species for which the TAC has been previously attained.

4. Remove the July 1 deadline for the annual Resource Assessment Document (RAD).

5. Establish limits on the amount of roe-bearing rock sole that can be retained by joint ventures.

6. Revise the upper limit to the optimum yield (OY) range.

The first five proposals were analyzed in an environmental assessment/regulatory impact review/initial regulatory flexibility analysis (EA/RIR/IRFA); the last proposal was analyzed in a supplemental environmental impact statement (SEIS). The public comment period on these documents ended on June 17 and 20, respectively. A summary of those comments is included in your supplemental materials.

Final action on Amendment 12 should be taken in three steps:

1. On Wednesday afternoon or Thursday morning the Council will identify their preferred alternative for each amendment topic. Item D-4(a) is a worksheet for use in considering recommendations of the AP and the SSC and selecting preferred alternatives.

2. The plan team and NOAA General Counsel will revise the amendment text, if necessary, and prepare the implementing regulations. A supplement to the EA/RIR, or changes to the SEIS, also may be needed.

3. On Friday the Council will consider recommendations of the plan team and NOAA General Counsel and give final approval to send Amendment 12 to Secretarial review.

These documents (the EA/RIR, SEIS, and draft regulations) will constitute most of the formal Amendment 12 package submitted to the Secretary. The remaining transmittal documents, preamble, etc. will be prepared as soon as possible. The amendment should be implemented by November-December 1988, in time for the 1989 fishing year.

In response to suggestions from John Peterson, and as a result of part of Amendment 12, the Council may want to formalize a policy on the Resource Assessment Documents for the Bering Sea/ Aleutian Islands and Gulf of Alaska. Item D-4(b) outlines a suggested policy and supporting rationale.

BERING SEA/ALEUTIAN ISLANDS GROUNDFISH FMP
AMENDMENT 12 SUMMARY

1. Implement the Bycatch Committee's management program for red king crab, Tanner crab, and halibut bycatch.

   Alternative 1: Maintain the status quo (i.e., do nothing). Current bycatch controls under Amendment 10 expire December 31, 1988.

   Alternative 2: Continue Amendment 10 controls indefinitely.

   Alternative 3: Implement the Bycatch Committee's framework to annually establish bycatch caps for specific target fisheries, based upon annual assessment of bycatch species' population size and groundfish TACs.

   OPTION A: Use specific definitions for target fisheries against which individual bycatch allowances are counted.

   OPTION B: Use general target fishery definitions (e.g., DAP trawl, DAP longline, JVP trawl, JVP longline).

   Alternative 4: Establish numerical bycatch limits for specific zones in the BS/AI.

2. Require all vessels receiving groundfish caught in the U.S. EEZ to have federal permits.

   Alternative 1: Maintain the status quo (i.e., do nothing). Only vessels fishing in the EEZ are required to have a federal permit. Processing vessels located within three miles or outside 200 miles that receive fish from the EEZ are not required to report their processed catch weekly as do processors operating in the EEZ. No report or one that is delayed could lead to overharvests.

   Alternative 2: Require all vessels receiving groundfish from the EEZ to have a federal permit regardless of processing location.

3. <u>Establish non-retainable groundfish catch limits that are outside the groundfish OY</u>.

Alternative 1: Maintain status quo (i.e., do nothing). Currently no bycatches of fully U.S. harvested groundfish are available to TALFF. In addition there is no limit to DAP and JVP on the discarded bycatch of a groundfish species after its TAC has been reached.

Alternative 2: Establish non-retainable groundfish bycatch limits, outside the groundfish OY but within each species ABC, that would be allocated to DAP, JVP, and TALFF as required in other species target fisheries.

Alternative 3: Establish non-retainable groundfish bycatch limits that are not within the groundfish OY for groundfish species applicable only to JVP and foreign fisheries (i.e., no specified limit to DAP bycatch of non-targeted groundfish).

4. <u>Remove July 1 deadline for Resource Assessment Document</u>.

Alternative 1: Maintain status quo (i.e., do nothing). The Resource Assessment Document now must be produced by July 1, even though summer survey results are unavailable.

Alternative 2: Remove July 1 deadline, but maintain Council policy to require draft RAD prior to September meeting and final RAD prior to December meeting.

5. <u>Prohibit joint venture targeting on roe-bearing rock sole</u>.

Alternative 1: Maintain status quo (i.e., do nothing). Rock sole now is part of the "other flatfish" TAC for purposes of apportionment to DAP and JVP.

Alternative 2: Prohibit the retention of more than 30% rock sole by joint ventures between January 1 and April 1 (rock sole spawning season).

Alternative 3: Create separate TAC for rock sole and apportion on a split-season (spawning and non-spawning) basis.

6. <u>Revise the upper limit to the optimum yield (OY) range</u>.

Alternative 1: Maintain status quo (i.e., do nothing). The current upper limit to OY for the groundfish complex is 2.0 million metric tons.

Alternative 2: Set the upper limit to the OY range equal to the annual sum of estimates for acceptable biological catch (ABC).

OPTION A: Sum of ABCs.

OPTION B: 90% of sum of ABCs.

OPTION C: 5% maximum increase per year up to sum of ABCs.

Alternative 3: Set the upper limits to the OY range equal to the estimate of maximum sustainable yield (MSY) for the groundfish complex.

OPTION A: Groundfish complex MSY.

OPTION B: 85% of groundfish complex MSY.

OPTION C: 5% maximum increase per year up to complex MSY.

Table D-4(a). Bering Sea/Aleutian Islands Groundfish FMP Amendment 12: Alternatives Worksheet, June 1988

Proposals/Alternatives	AP Recommendation	SSC Recommendation	Council Preference
1 Bycatch Control (king crab, Tanner crab, halibut)			
Alt. 1: Status quo			
Alt. 2: Continue Amendment 10			
Alt. 3: Bycatch Committee recommendation	3A w/pollock fishery included	3 A-B?	
Option A: Detailed target fishery definitions			
Option B: General target fishery definitions			
Alt. 4: More restrictive numerical limits			
2 Federal Permit Requirements			
Alt. 1: Status quo			
Alt. 2: Federal permits for all vessels	2	2	
3 Non-retainable Groundfish Catch Limits			
Alt. 1: Status quo w/ Reg ..., bycatch TALFF	1	NONE Problem ... to implem expensive	
Alt. 2: NRC limits for DAP, JVP, and TALFF			
Alt. 3: NRC limits for JVP and TALFF only			
4 Resource Assessment Document (RAD) Deadline			
Alt. 1: Status quo			
Alt. 2: Remove July 1 deadline	2	2	
5 JVP Prohibition on Roe-bearing Rock Sole (6-5 vote)			
Alt. 1: Status quo			
Alt. 2: JVP retention limited to 30% 20 Variation delay to AP APR 1	No JV targeting Jan 1-Apr. 1, separate TAC		
Alt. 3: Separate rock sole TAC/two seasons *also take out of flatfish category		NONE (3)? qualified	
6 Upper Limit to Optimum Yield (OY) Range			
Alt. 1: Status quo			
Alt. 2: Sum of ABCs			
Option A: Sum of ABCs SSC - NO			
Option B: 90% of sum of ABCs			
Option C: 5% increase per year - Limit 2.205 mt (3 yrs. wth.) AP	5% annual increase up to 2.205 m mt	NO Specific Rec.	
Alt. 3: Groundfish Complex MSY			
Option A: Complex MSY			
Option B: 85% of MSY			
Option C: 5% increase per year			

2.2-2.9 Sugg Range

DRAFT COUNCIL POLICY ON RESOURCE ASSESSMENT DOCUMENTS (RADs) FOR GROUNDFISH FMPs

In response to suggestions from John Peterson, and in association with a portion of Amendment 12 dealing with the Resource Assessment Documents (RADs) for groundfish, the Council may wish to formalize a policy on the content and scheduling of these annual reports. The following is a suggested RAD policy to be applied to the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish FMPs:

1. A draft RAD will be delivered to the Council family (Council, Advisory Panel, and Scientific and Statistical Committee members) at least five working days (one week) prior to the September Council meeting.

Summer biomass surveys in the Gulf and Bering Sea/Aleutians often extend late into August and sometimes into September; data from these surveys take time to collate and analyze. Writing of stock assessment reports, subsequent review by the plan teams, and final editing take additional time. Delivery of a document at any time in September will likely require omission of some of the summer survey information. Giving the plan team the opportunity to add information up to five working days before the Council week will add substantially to the draft. Understanding that the September RAD is just a draft and that the Council is charged only to issue preliminary recommendations of acceptable biological catch (ABC) and total allowable catch (TAC) at the

September meeting, five working days is a reasonable compromise between the demand, availability, and necessity of incorporating summer survey information into the RAD in September.

2. The final RAD will be delivered to the Council family at least 10 working days (two weeks) prior to the December Council meeting.

The final RAD must be a rigorous assessment, to be used by the Council in making firm recommendations on ABCs and TACs. Between September and December many adjustments to the draft RAD can be accomplished, including incorporation of previously omitted summer survey information. Given these considerations, it appears feasible and appropriate to deliver the final RAD ten working days prior to the December Council meeting. Earlier delivery may be possible, but difficult to assure, considering demands on staff of the Northwest and Alaska Fisheries Center (NWAFC) and the plan teams to finalize stock assessments, present materials to the International North Pacific Fisheries Commission (INPFC), address specific questions on harvest strategies (to be discussed below), and to begin evaluation of plan amendment proposals received on October 1.

3. The final RAD will identify any substantive changes from the draft RAD.

For clarity only substantive changes between drafts will be identified in the final RAD. Simple editing or language changes will not be noted. A summary section will be included in the final RAD outlining substantive changes.

4. Both the draft and final RAD will contain a glossary of commonly used technical terms and their acronyms.

Many terms used by the Council are technically or legally defined and used repetitively throughout many of our documents. Although acronyms can be irritating and confusing at times, they also serve to facilitate discussion and presentation. Most of the commonly used acronyms are understood by the Council family and quickly assimilated by the interested public. It is feasible to identify the phrase associated with each acronym at its first use in every document; it would also be reasonable to standardize a glossary of definitions and acronyms to be placed in each Council document.

5. The final RAD will specifically address questions on harvest strategy and risk posed by the Council at the September meeting.

Currently the RAD presents assessments of stock condition and estimates of ABC prepared by the plan teams. These estimates may also be accompanied by simulations of future stock condition and ABC under the projected harvest of estimated ABC. However, the plan teams do not always analyze or simulate a large array of potential harvest strategies, mostly because such strategies must rely on policy decisions by the Council on their objectives for each fishery. It would be possible for the Council to propose distinct harvest strategies for each species and request the plan teams to estimate appropriate ABCs and simulate future stock conditions under such strategies. For example, the Council might wish to assure that harvests of Shelikof Strait pollock be of fish larger than 12 inches. If the Council posed such a strategy in September, the plan team could report back in the December RAD the accompanying ABC, simulations of future stock condition, risks or sensitivity, as well as any amendment proposals that might be needed to implement the strategy (such amendment proposals could possibly be fashioned in time for the usual October 1 deadline in the amendment cycle).

The types of questions or strategies posed by the Council will change the estimates of ABC for the respective species. This policy for the RADs would provide the Council a forum to discuss and analyze more specific objectives for the harvest of groundfish, rather than simply relying on the plan team estimates of ABCs that maximize the biomass of allowable catch.

AGENDA D-4
SUPPLEMENTAL
JUNE 1988

BS/AI AMENDMENT 12: OVERVIEW OF COMMENTS BY ISSUE

1. Bycatch controls.

   All written comments supported Alternative 3, except for a technical and legal critique of the Bycatch Committee's proposal submitted by the Alaska Crab Coalition. Favorable comments centered upon the responsiveness of this alternative to fluctuating biomass levels of the bycatch species and to various groundfish target fisheries. The Midwater Trawlers supported Option B, presumably due to its relative simplicity in defining target fishery.

2. Federal permit requirements.

   Both written comments supported Alternative 2, to require all vessels receiving groundfish from the EEZ to hold federal permits and report catch weekly.

3. Non-retainable groundfish catch limits.

   Two commenters supported Alternative 2, citing the added protection that such limits would provide against discard and waste. The Alaska Factory Trawlers Association supported Alternative 1 (status quo), stating that necessary management tools already exist (except for consideration of foreign fisheries) and that additional regulations would only add to administrative costs.

4. RAD deadline.

   All three commenters supported Alternative 2, to remove the existing July 1 deadline.

5. JVP prohibition on roe-bearing rock sole.

   Four commenters supported Alternative 1 (status quo), stating that there is no evidence that DAP markets for roe-bearing rock sole need such protection and that the proposed restrictions on joint venture take of rock sole would unnecessarily burden those fishermen. The Alaska Factory Trawlers Association supported either Alternatives 2 or 3, stating that either would provide the necessary regulations to protect DAP priority to a limited market for roe-bearing rock sole; Trawl Resources, Inc. also supported Alternative 3.

6. Upper limit to optimum yield (OY) range.

Four commenters supported Alternative 1 (status quo), citing that there is insufficient information to justify potential increased risk to groundfish stocks and other components of the ecosystem; the Alaska Factory Trawlers Association and the Pacific Seafood Processors Association also cited probable economic hardship to domestic interests that would occur if the OY were raised. Four other commenters supported Alternative 2, Option A, citing the improved condition of groundfish stocks and potential economic loss to U.S. fishermen participating in joint ventures if increased harvests are not allowed; the American High Seas Fisheries Association and the Midwater Trawlers Cooperative also noted that increasing the upper limit to the OY range only provides the flexibility to increase harvests, but does not require that they be raised.

AGENDA D-4
SUPPLEMENTAL
JUNE 1988

D-4 Supplemental -- Summary of written comments on Bering Sea/Aleutian Islands Groundfish FMP Amendment 12.

	Amendment topic					
Commenter	Bycatch controls	Federal permit requirements	Non-retainable groundfish catch limit	July RAD deadline	Roe-bearing rock sole/JVP prohibition	Optimum yield (OY) range
Kodiak and Western Trawler Group					Status quo	
Fred Yeck						Alt. 2A
Alaska Crab Coalition	Technical/ Legal					
Trawl Resources, Inc	Alt. 3	Alt. 2	Alt. 2	Alt. 2	Alt. 3	
American High Seas Fisheries Assoc.	Alt. 3A				Status quo	Alt. 2A
Alaska Factory Trawlers Assoc.	Alt. 3A		Status quo		Alt. 2 or 3	Status quo
Pacific Seafood Processors Assoc.						Status quo
Gary L. Painter	Technical					
Northern Deep Sea Fisheries, Inc.	Alt. 3A			Alt. 2	Status quo	Alt. 2A
Midwater Trawlers Cooperative	Alt. 3B	Alt. 2	Alt. 2	Alt. 2	Status quo	Alt. 2A
Greenpeace						Status quo
U.S. Fish and Wildlife Service						Technical
Minerals Management Service						Technical
University of Alaska/IMS						Technical
International Pacific Halibut Commission	Alt. 3 or 4					Status quo
National Marine Mammal Laboratory/NMFS						Technical
Alaska Department of Fish and Game	Technical					Technical

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

STEVE COWPER, GOVERNOR

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June 20, 1988

JUN 20 1988

Mr. Clarence G. Pautzke
Executive Director
North Pacific Fishery
Management Council
P. O. Box 103136
Anchorage, AK 99510

Dear Mr. Pautzke:

Thank you for the opportunity to comment on the draft of the EA/RIR for Amendment 12 to the Bering Sea/Aleutian Islands Groundfish FMP. Although I will be able to comment more fully on the specific items of Amendment 12 during the June council meeting, there is one issue with which I am especially concerned. Regardless of whether the council is facing a purely allocative issue or one primarily biological in nature, the need for catch accounting continues to limit the council's management options and to frustrate the fisheries agencies' ability to manage. Whether the issue is bycatch allocation or optimum yield determination, a common problem is our inability to determine how much of which species is removed by the fishery. Resolution of increasingly complex management problems, such as effort limitation, will demand that we have good estimates of catch, both retained and discarded.

The council and fisheries agencies must come to grips with the need for observers and the means to fund observer programs.

It may be that before we can proceed much further with proposals for bycatch allocation and the limitation of effort, we will have to resolve our limitation of information. I believe the council should make the issue of observers and the documentation of fishing removals a high priority.

Again, thank you for the opportunity to comment. I look forward to seeing you next week.

Sincerely,

Don W. Collinsworth
Commissioner

11-K2LH

AGENDA D-4
SUPPLEMENTAL
JUNE 1988

CHANGES TO THE BERING SEA/ALEUTIAN ISLANDS GROUNDFISH FMP

June 24, 1988

14.0 CHANGES TO THE FMP

14.1 Amendment 12 Summary

In Chapter 2.0, Section 2.1 entitled "History and Summary of Amendments," page 2-2, add the date _______ after Amendment 11.

Also add to the summary, page 2-4:

Amendment 12 on _________, 1988:

(1) Established a bycatch management program to control the catch of Tanner crab, red king crab, and Pacific halibut in all DAH groundfish fisheries.

(2) Revised federal permit requirements to include all vessels harvesting and receiving groundfish from the EEZ.

(3) Established a prohibited species catch limit procedure for fully utilized groundfish species taken incidentally in JVP and TALFF fisheries.

(4) Removed a July 1 deadline for delivery of the Resource Assessment Document (RAD).

(5) Established rock sole as a distinct target species.

14.2 Bycatch Controls

[THESE ARE DRAFT CHANGES FOR BYCATCH CONTROL AT THIS TIME]

In Chapter 14, Section 14.4.2 entitled "Prohibited Species," delete the fourth paragraph, referring to voluntary compliance, under Item D entitled "Policy."

In Chapter 14, Section 14.4.2 entitled "Prohibited Species," delete Paragraph E entitled "PSC Limits and Time/Area Closures for DAH Fisheries."

In Chapter 14, Section 14.4.2.1 entitled "Bycatch Limitation Zones," delete Item B referring to Zone 2, and renumber Item C referring to the Crab and Halibut Protection Zone.

In Chapter 14, Section 14.4.2.2 is replaced with the following, entitled "Target Fisheries":

It is the intent of the Council to define individual target fisheries by DAP and JVP, gear type, species composition, and time and area. Individual target fisheries will be defined annually in accordance with data availability and the monitoring capability of NMFS.

In Chapter 14, a Section 14.4.2.3 is added, entitled "Prohibited Species Catch Limits:"

The incidental catch, or bycatch, of prohibited species will be controlled in fisheries for target species through the implementation of specific PSC limits. Any directed fishing for a target species which is likely to take a bycatch greater than a PSC limit is prohibited.

A. For C. bairdi Tanner crab, the PSC limit will be specified annually as an amount equal to 1.0 percent of the biomass of this species.

B. For red king crab, the PSC limit, applicable only to joint venture fisheries, will be specified annually as an amount equal to 0.75 percent (reduced annually in proportion to the ratio of JVP apportionments to total TACs) of the biomass of this species within Bycatch Limitation Zone 1. No PSC limit is applied to DAP.

C. For Pacific halibut, the PSC limit will be specified annually as an amount of halibut mortality equal to 3,900 mt.

In Chapter 14, a Section 14.4.2.4 is added, entitled "Management Procedures:"

Prior to each fishing year, the likely bycatch of C. bairdi Tanner crab, red king crab, and Pacific halibut in each target fishery will be estimated and individual bycatch allowances specified for each target fishery.

Appropriate restrictions, short of closure, will be placed on any target fishery that exceeds its individual bycatch allowance when the aggregate bycatch of C. bairdi and halibut is less than 0.75 percent of the estimated population of C. bairdi or 2,925 metric tons of halibut mortality.

Further, all target fisheries will be restricted if aggregate bycatch of C. bairdi and halibut in all target fisheries sum to an amount equal to or greater than 0.75% of the estimated population of C. bairdi or 2,925 mt mortality for Pacific halibut. The NMFS Regional Director, in consultation with the Council, will impose area closures, gear restrictions, or other appropriate measures to assure that the PSC limits for these prohibited species are not exceeded.

For JVP target fisheries operating in Zone 1, the Regional Director, in consultation with the Council, will impose appropriate measures to control bycatch of red king crab such that bycatch of red king crab will not exceed the JVP red king crab PSC for Zone 1.

For DAP target fisheries operating in Zone 1, the Regional Director will impose appropriate measures to control bycatch of red king crab when any of the following conditions occur:

1. the DAP harvest of yellowfin sole equals 25 percent or more of the Zone 1 total yellowfin sole harvest,

2. the DAP bycatch in the Zone 1 yellowfin sole fishery equals 0.3 percent or more of the red king crab population, or

3. the combined DAP harvest of Pacific cod, pollock, and other flatfish in Zone 1 is equal to 225,000 metric tons or more.

In Chapter 14, remove Zone 2 from Figure 27a.

In Chapter 14, delete Section 14.4.3.4 entitled "Implementation of Time and Area Limitations."

In Chapter 14, delete text in Section 14.4.3.5 entitled "Discretionary Authority of the Secretary," and reserve for later use.

In Appendix III, entitled "Descriptions of Closed Areas," Item 4, delete reference and description of Bycatch Limitation Zone 2.

14.2.3 Federal Permit Requirement

In Chapter 14, Section 14.4.1 entitled "Permit Requirement," replace the existing sentence with the following:

"All U.S. vessels that are fishing in the Bering Sea and Aleutian Islands management area or are receiving fish from the Bering Sea and Aleutian Islands management area must have a current fishing permit issued annually by the Secretary of Commerce. Information required when applying for a Federal fishing permit is contained in 50 CFR 675.4 of domestic regulations implementing the FMP."

14.2.4 Prohibited Species Catch Limits for Fully Utilized Groundfish

In Chapter 11 entitled "Optimum Yield (OY) and Total Allowable

Catch (TAC)," add a Section 11.7 entitled "Prohibited Species Catch Limits for Fully Utilized Groundfish Species" and include the following text:

> The timing of actions and procedure to be taken in establishing prohibited species catch limits (PSCs) of fully utilized groundfish species are as follows:
>
> (1) September. Following the initial determination of TACs for all managed groundfish species as described in Section 11.3, the plan team will identify those groundfish species that are fully utilized by the wholly domestic fishery. For those species, initial PSC limits will be calculated for joint venture and foreign fisheries using the best available bycatch rates obtained by NMFS observers from the respective fisheries and applying them to initial joint venture (JVP) and foreign (TALFF) TAC apportionments.
>
> (2) September Council meeting. Council will review and approve preliminary PSCs and release the RAD for 30-day public review.
>
> (3) October 1. As soon as practicable after October 1 the Secretary, after consultation with the Council, will publish a notice in the Federal Register specifying the proposed PSCs for JVP and TALFF. Public comments on the proposed PSCs will be accepted by the Secretary for 30 days after the notice is published.
>
> (4) November. Plan Team prepares final RAD.
>
> (5) December Council meeting. Council reviews public comments, takes public testimony and makes final decisions on annual PSC limits.
>
> (6) By January 1 the Secretary will publish a notice of final PSC limits in the Federal Register.
>
> (7) January 1. Annual PSC limits take effect for the current fishing year.

14.2.5 Resource Assessment Document Deadline

In Chapter 11, page 11-3, remove the phrase "by July 1" from the first sentence in the section entitled "Biological Condition of the Stocks."

14.2.6 Rock Sole

In Chapter 14, Section 14.2 entitled "Area, Fisheries, and Stocks Involved," Item B. 2., replace existing language with the following:

> Target species -- are those species which are commercially important and for which a sufficient data base exists that allows each to be managed on its own biological merits. Accordingly, a specific TAC is established annually for each target species. Catch of each species must be recorded and reported. This category includes pollock, Pacific cod, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, "other flatfish," sablefish, Pacific ocean perch, "other rockfish," Atka mackerel, and squid.

15.0 CHANGES TO THE REGULATIONS [not complete]

15.1 Summary

The following draft regulations would implement the preferred amendment alternatives approved by the North Pacific Fishery Management Council on June 24, 1988 for Amendment 12 to the FMP for Bering Sea/Aleutian Islands groundfish. Final approval by the Secretary of Commerce would change current federal regulations implementing the FMP under 50 CFR 611 and 675 as indicated. After the Secretary receives the Council's approved FMP amendment, analysis and draft proposed implementing regulations, the regulations will be published in the Federal Register as proposed rules with public comment invited. Pending Secretarial approval and after changes are made due to public comments, the proposed rules will be republished as final rules.

15.2 Changes to Relevant Regulations

15.2.1 Bycatch Controls

[TO BE DRAFTED LATER]

15.2.2 Federal Permit Requirements

In Section 675.1, entitled "Purpose and scope," paragraph (a) is revised to read:

> (a) Regulations in this part implement the Bering Sea and Aleutian Islands Groundfish Fishery Management Plan.

In Section 675.4, entitled "Permits," paragraph (a) is revised to read:

> (a) General. No vessel of the United States may fish for groundfish in the Bering Sea and Aleutian Islands Management Area or receive fish caught in the Bering Sea and Aleutian Islands Management Area without first obtaining a permit issued under this Part. Permits shall be issued without charge.

15.2.3 Prohibited Species Catch Limits for Fully Utilized Groundfish Species

In 50 CFR Part 675, Section 675.20, paragraph (a) is relabeled, new paragraphs (a)(6) and (a)12) are added, existing paragraphs (a)(6)-(a)(10) are redesignated as (a)(7)-(a)(11), the newly redesignated paragraph (a)(7) is amended, paragraph (b) is relabeled, and paragraph (b)(1)(iv) is added as follows:

Section 675.20 General Limitations.

(a) OY, TAC, Reserve, DAH, TALFF, and PSC:

* * *

(6) Prohibited species catch limits. (i) When the Secretary determines after consultation with the Council that the TAC for any species or species group will be fully harvested in the DAP fishery, the Secretary may specify for each calendar year the prohibited species catch (PSC) limit applicable to the JVP and TALFF fisheries for that species or species group. Any PSC limit specified under this paragraph shall be provided as bycatch only, and may not exceed an amount determined to be that amount necessary to harvest target species. Species for which a PSC limit has been specified under this paragraph shall be treated in the same manner as prohibited species under paragraph (c) of this section.

(ii) The annual determinations of the PSC limit for each species or species group under paragraph (a)(6) of this section may be adjusted, based upon a review of the following:

(A) Assessments of the biological condition of each PSC species. Assessments will include where practicable updated estimates of maximum sustainable yield (MSY), and acceptable biological catch (ABC); estimates of groundfish species mortality from non-groundfish fisheries, subsistence fisheries, recreational fisheries, and the difference between groundfish mortality and catch. Assessments may include information on historical catch trends and current catch statistics; assessments of alternative harvesting strategies and related effects on component species and species groups; relevant information relating to changes in groundfish markets; and recommendations for PSC limits for species or species group fully utilized by the DAP fisheries:

(B) Socioeconomic considerations that are consistent with the goals and objectives of the FMP.

* * *

(7) Notices of harvest limits and PSC limits. As soon as practicable after October 1 of each year, the Secretary, after consultation with the Council, will publish a notice in the FEDERAL REGISTER specifying preliminary TAC, Reserve,

DAP, JVP, TALFF for each target species and the "other species" category, and PSC limits, for the next calendar year. Public comment on these amounts will be accepted by the Secretary for a period of 30 days after the amounts have been published in the FEDERAL REGISTER. The Secretary will consider all timely comments when determining, after consultation with the Council, the final annual TAC, initial DAH, initial TALFF for each target species and the "other species" category and the applicable PSC limits for the next year. These figures will be published as a notice in the FEDERAL REGISTER as soon as practicable after December 15 and made available to the public through other suitable means by the Regional Director.

*   *   *

(13) If the Regional Director determines that a PSC limit applicable to a directed JVP or TALFF fishery in Table 1 has been or will be reached, the Secretary will publish a notice of closure in the FEDERAL REGISTER closing all further JVP or TALFF fishing in all or part of the management area.

(b) Apportioning the reserve, surplus DAH, and JVP, and adjustment of PSC limits.

*   *   *

(iv) Adjustments of PSC limits resulting from apportionments. If the Secretary makes inseason apportionments of target species, the Secretary may proportionately increase any PSC limit amount of species fully utilized by the DAP fishery if such increase will not result in overfishing of that species. Any adjusted PSC limit may not exceed the amount determined to be necessary to harvest a target species.

*   *   *

15.2.4 Resource Assessment Document Deadline

No changes to the regulations are required for this FMP amendment.

15.2.5 Rock Sole

No changes to the regulations are required for this FMP amendment.

NPFMC
DRAFT WORKING DOCUMENT
4 APRIL 88
For Discussion Purposes
Only

DRAFT

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

AND

REGULATORY IMPACT REVIEW/INITIAL REGULATORY FLEXIBILITY ANALYSIS

FOR A PROPOSAL TO

INCREASE THE OPTIMUM YIELD (OY) RANGE

(A Portion of Amendment 12)

IN THE FISHERY MANAGEMENT PLAN FOR THE

GROUNDFISH FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS

Prepared by the Plan Team for the
Groundfish Fishery of the Bering Sea/Aleutian Islands
and the Staff of the
North Pacific Fishery Management Council

APRIL 1988

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COVER SHEET

RESPONSIBLE AGENCIES:

National Marine Fisheries Service
National Oceanic and Atmospheric Admin.
U.S. Department of Commerce
Washington, D.C. 20235

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

PROPOSED ACTION:

Approval and implementation of an increase of the upper end of the optimum yield (OY) range for groundfish in the Bering Sea/Aleutian Islands from the current value of 2.0 million metric tons to a value equal to the annual sum of estimates of acceptable biological catch (ABC).

FOR FURTHER INFORMATION CONTACT:

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TYPE OF STATEMENT:

(X) Draft ( ) Final

ABSTRACT:

This supplemental environmental impact statement, combined with a regulatory impact review/initial regulatory flexibility analysis, evaluates environmental and socioeconomic impacts of revising the upper limit of the optimum yield (OY) range for the groundfish fishery in the Bering Sea/Aleutian Islands, under authority of the Magnuson Fishery Conservation and Management Act and the Fishery Management Plan for the Groundfish Fishery of the Bering Sea/Aleutian Islands. Impacts revolve around probable increases in harvests of currently under-utilized species in the groundfish complex. Such allowable increases would not jeopardize groundfish stocks and might reduce competition for prey to the advantage of other predators such as seabirds and marine mammals. Increased harvests would result in substantial increases in revenues, particularly for joint ventures between domestic fishermen and foreign processors, and could result in substantial fees paid to the U.S. if foreign allocations are granted. Some price reductions may accrue to domestic fishermen and processors, however such fluctuations are not expected to be large considering the size of international markets for these whitefish.

COMMENTS:

Comments on this draft are invited until _____ __, 1988. Send written comments to Robert W. McVey, Director of the Alaska Region, National Marine Fisheries Service, at the address above.

EXECUTIVE SUMMARY

This supplemental environmental impact statement (SEIS) to the original EIS prepared for the Fishery Management Plan for the Groundfish Fishery in the Bering Sea and Aleutian Islands (FMP) discusses the potential impacts of revising the upper end of the optimum yield (OY) range from 2.0 million metric tons (mt) to a value equal to the annual sum of estimates of acceptable biological catch (ABC) of the target species and "other species" categories in the FMP. This analysis is combined with those required in a regulatory impact review/initial regulatory flexibility analysis (RIR/IRFA) addressing social and economic considerations.

Revising the optimum yield for Bering Sea/Aleutian Islands groundfish would not require the North Pacific Fishery Management Council to raise annual harvest levels, but would allow them flexibility to equate annual total allowable catches (TACs) to acceptable biological levels, rather than to the current constraint at 2.0 million mt. Potential increases could result, at least in the near future, in TACs particularly for Pacific cod and miscellaneous flatfish. These species are currently harvested at levels much below those proposed by stock assessment studies conducted by the Council' Plan Team and the Northwest and Alaska Fisheries Center of NMFS.

Increased harvest of Pacific cod, miscellaneous flatfish, and other species would reduce their consumption of prey which consists in large part of juvenile fish also utilized by seabirds and marine mammals. So long as groundfish stocks are not overharvested, which is addressed by annual estimates of ABC, increased groundfish harvests within these levels may benefit other apex predators.

Increased harvests will also result in substantial increases in revenue, most notably for joint ventures between domestic fishermen and foreign processors. Increased revenue to the U.S., as well as other direct benefits of foreign participation, would result if allocations of surplus fish are made to foreign nations.

Market impacts are difficult to assess, however increased processing of groundfish by foreign nations, through either joint ventures or direct allocation, could result in price reductions for product of domestic enterprises. The extent of this adverse impact will depend upon how responsive prices are to changes in harvest; considering the large international markets for these whitefish products, such market impacts may be mitigated.

1.0 INTRODUCTION

Domestic and foreign groundfish fisheries in the Exclusive Economic Zone (EEZ) of the United States (3-200 miles offshore) in the Bering Sea and around the Aleutian Islands are managed under the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands (FMP). The FMP was developed by the North Pacific Fishery Management Council under authority of the Magnuson Fishery Conservation and Management Act (Magnuson Act). The FMP was approved by the Assistant Administrator for Fisheries of the National Oceanic and Atmospheric Administration (NOAA), became effective on January 1, 1982 (46 FR 63295, December 31, 1981), and is implemented by Federal regulations appearing at 50 CFR 611.93 and Part 675. Nine of eleven amendments to the FMP have subsequently been implemented.

This document describes and assesses potential effects of proposed changes to the FMP that would constitute a portion of Amendment 12 to the FMP. Specifically, this document describes proposed changes to the upper limit of the optimum yield (OY) range which currently sets an upper bound of 2.0 million metric tons (mt) to annual total allowable catch (TAC) of groundfish from the Bering Sea/Aleutian Islands.

The Council solicits public recommendations for amending the FMP on an annual basis. Amendment proposals are then reviewed by the Council's Bering Sea Plan Team (PT), Plan Amendment Advisory Group (PAAG), Advisory Panel (AP), and Scientific and Statistical Committee (SSC). These advisory bodies make recommendations to the Council on which proposals merit consideration for plan amendment. Amendment proposals and appropriate alternatives accepted by the Council are then analyzed by the PT for their efficacy and for their potential biological and socioeconomic impacts. After reviewing this analysis, the AP and SSC make recommendations as to whether the amendment alternatives should be rejected or changed in any way, whether and how the analysis should be refined, and whether to release the analysis for general public review and comment. If an amendment proposal and accompanying analysis is released for public review, then the AP, SSC, and the Council will consider subsequent public comments before deciding whether or not to submit the proposal to the Secretary of Commerce for approval and implementation.

1.1 <u>List of Amendment Proposals</u>

Although the Council forwarded seven proposals to the PT for analysis, at their meeting January 18-22, 1988, only one was considered of potential impact to warrant an environmental impact statement (EIS) rather than a more typical initial environmental assessment (EA). This proposal is to revise the upper limit of the OY range from its current ceiling of 2.0 million metric tons (mt) to a level equal to the annual sum of groundfish acceptable biological catches (ABCs). Currently the sum of ABCs exceeds 2.0 million mt.

1.2 Purpose and Structure of the Document

This document provides background information and assessments necessary for the Secretary of Commerce to determine that the FMP amendment is consistent with the Magnuson Act and other applicable law. Other principal statutory requirements that this document is intended to satisfy are the National Environmental Policy Act (NEPA), the Regulatory Flexibility Act (RFA), and Executive Order 12291 (E.O. 12291); other applicable law addressed by this document include the Coastal Zone Management Act, the Endangered Species Act, and the Marine Mammal Protection Act.

Specifically, this document is a combined supplemental environmental impact statement (SEIS) and regulatory impact review/initial regulatory flexibility analysis (RIR/IRFA).

1.2.1 Supplemental Environmental Impact Statement (SEIS)

In order to analyze the potential impacts of the proposed action on the quality of the human environment, compliance with NEPA requires that an environmental assessment or impact statement be prepared. According to NOAA directive, an EIS must be prepared if the proposed action may reasonably be expected:

(a) To jeopardize the productive capability of the target resource species or any related stocks that may be affected by the action.

(b) To allow substantial damage to the ocean or coastal habitiats.

(c) To have a substantial adverse impact on public health or safety.

(d) To affect adversely an endangered or threatened species or a marine mammal population.

(e) To result in cumulative effects that could have a substantial adverse effect on the target resource species or any related stocks that may be affected by the action.

Moreover, two factors to be considered in any determination of significance are controversy and socioeconomic effects.

At a preliminary scoping meeting held in Seattle, Washington on January 5, 1988, concern was expressed that the proposed action might jeopardize target species, might adversely affect marine mammal populations, and is a controversial action which might result in adverse socioeconomic impacts. At a regularly scheduled Council meeting later in January, the Regional Director of the National Marine Fisheries Service determined that a supplement to the original EIS produced for the FMP, rather than an initial EA, would be required. Subsequently, a Notice of Intent to prepare an SEIS was published in the Federal Register (53 FR 4055, February 11, 1988) and a working session/scoping meeting was held in Anchorage, Alaska on February 16, 1988 to gather initial reference materials; to outline the scope, extent, and direction of analyses; and to receive further scoping comments from the public prior to drafting of the SEIS. Written comments on the scope of this SEIS were accepted until March 11, 1988.

The determination requiring an SEIS was not intended to prejudice any decision by the Council or the Secretary of Commerce, but instead was designed to provide the best information on which to base any decision.

1.2.2 Regulatory Impact Review/Initial Regulatory Flexibility Analysis (RIR/IRFA)

Other portions of this document constitute a RIR/IRFA that is required by NOAA for all regulatory actions or for significant policy changes that are of public interest. The RIR/IRFA:

(a) Provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action.

(b) Provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problems.

(c) Ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost effective manner.

This analysis also serves as the basis for determining whether any proposed regulations are major under criteria provided by E.O. 12291 and whether proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the RFA. The primary purpose of the RFA is to relieve small businesses, small organizations, and small governmental jurisdictions (collectively "small entities") of burdensome regulatory and recordkeeping requirements.

1.3 Purpose of and Need for the Action

Amendment 1 to the Bering Sea/Aleutian Islands Groundfish FMP established an optimum yield (OY) for the groundfish complex in the BS/AI equal to a range of 1.4-2.0 million metric tons, a range defined as equal to 85% of the groundfish species complex maximum sustainable yield (MSY). The complex has 12 commercial species or species groups of groundfish. Annually the OY for the complex is set equal to the sum of the total allowable catch (TAC) for the component species, but within the OY range. Each year the Council determines TAC for each species using the best available information concerning the biological condition of each stock and socioeconomics of the fisheries. Currently, the sum of the TACs cannot exceed 2.0 million mt, or be less than 1.4 million mt, without amending the definition of OY in the FMP.

Maximum sustainable yield for the groundfish complex was estimated to be 1.7-2.4 million mt at the time Amendment 1 to the FMP was drafted in 1979. This amount was equal to the sum of the MSYs for the major individual species groups. Since then, MSYs have been re-estimated as more data have become available. New estimates, made in 1987, total 3.4 million mt.

Biological condition of the stocks generally has been estimated by acceptable biological catch (ABC) or equilibrium yield (EY). In 1987, the Council standardized the definition of ABC; EY is no longer used. When Amendment 1 to the BS/AI groundfish FMP was developed and implemented, the sum of individual species EYs/ABCs was below 2.0 million mt. Management of groundfish resources made posssible under the Magnuson Act and the FMP has since led to considerable improvements in condition of the stocks. As a result, ABCs have increased steadily from a sum of 1.5 million mt in 1977 to 2.25 million mt in 1987. For 1988, the sum of ABCs was estimated to be 2.86 million mt, considerably above the upper end of OY.

The 2.0 million mt upper limit of OY, therefore, has constrained the Council in recent years from setting a total sum of TACs at a level that would allow for full utilization of surplus production. This constraint has occurred in six out of the last seven years--1982, 1983, 1984, 1985, 1987, and 1988 when ABCs exceeded 2.0 million mt. Present trends suggest that biological condition of the stocks is expected to remain good and the sum of ABCs is expected to continue to exceed 2.0 million mt in the near future.

An increase in the upper limit of the OY range would provide the Council and the Secretary of Commerce broader latitude to fully utilize groundfish resources in a manner consistent with the biological condition of the stocks.

1.4 <u>The Proposed Action and Alternatives</u>

1.4.1 Alternative 1: Status quo; maintain the upper end of the OY range at the current level of 2.0 million mt.

This alternative maintains a very conservative management system, given the present condition of the stocks. It provides the Council and the Secretary with limited flexibility to make groundfish available for harvest when ABCs are greater than 2.0 million mt.

1.4.2 Alternative 2: Set the upper end of the OY range equal to the sum of the annual estimates of ABC.

This alternative would be responsive to changing condition of the stocks as measured by ABCs. The alternative removes the 2.0 million mt upper limit to annual decisions on OY (the sum of TACs), yet maintains a conservation-based upper limit. Following past Council practice, individual species' TACs would continue to be set according to biological conditions and socioeconomic concerns; OY would be set equal to or lower than the sum of ABCs, whether or not the sum of ABCs is greater than or less than 2.0 million mt.

Three options of this alternative will be considered:

(a) The alternative as stated,

(b) Limiting the upper end of the OY range to 90% of the sum of the annual estimates of ABC, and

(c) Limiting any annual increase of OY, defined as equal to the sum of annual estimates of ABC, to 5% of the upper end of the OY range in the previous year.

Option B imposes further conservatism onto each year's setting of OY and TACs. Option C imposes an incremental implementation schedule onto the alternative.

1.4.3 Alternative 3: Set the upper end of the OY range equal to the groundfish complex MSY.

This alternative would set the upper end of OY equal to the best estimate of the groundfish complex MSY. At present, the sum of individual species MSYs totals 3.4 million mt. The MSY for the groundfish complex, however, could be lower than 3.4 million mt since it may not be practical to achieve MSY for all the species at the same time.

Harvesting at MSY is a long-term goal to obtain a theoretical long-term yield from the groundfish complex. Following past Council practice, however, annual harvest of any particular species would more reasonably be constrained by annual estimates of ABC which measure the current status of each stock. Therefore, although this alternative reflects the original intent of Amendment 1 to the FMP to manage on an ecosystem or groundfish complex basis, resulting harvest levels under this alternative will likely be the same as under Alternative 2.

Three options of this alternative will be considered:

(a) The alternative as stated,

(b) Set the upper end of the OY range equal to 85% of the groundfish complex MSY, and

(c) Limiting any annual increase of OY, defined as equal to the groundfish complex MSY, to 5% of the upper end of the OY range in the previous year.

Option B reflects further conservatism embodied in Amendment 1 to the FMP which set the upper end of the OY range equal to 85% of the estimate of MSY applicable at that time. Option C imposes an incremental implementation schedule onto the alternative.

1.5 Relation of Proposed Action to Existing Council Procedures

The FMP currently embodies a procedure for setting of annual harvest levels whereby the Council receives recommendations for acceptable biological catch (ABC) from the PT and the SSC and, based upon these recommendations, votes to set ABCs for each species group. The Council also soloicits recommendations from the AP regarding economic and social concerns in order to derive total allowable catches (TACs) for each species group. These proposed ABCs and TACs are then released for public review. At a subsequent meeting the Council entertains refined recommendations on ABCs from the PT and SSC, refined recommendations on economic and social concerns from the AP, and any public comment before deriving final ABCs and TACs. The Council's final recommendations for TACs are then forwarded to the Secretary of Commerce for federal review, approval, and implementation. Approved TACs constitute harvest limits for each species which are apportioned among domestic, joint venture, and foreign harvesters.

Although the Council is not obligated to restrict species' TACs to values equal to or less than their ABCs, in practice it has rarely set TACs that exceed ABC for any species (Table 1.1). This reflects the Council's primary concern for conservation of groundfish resources. In those few cases when TAC has exceeded ABC, the Council's intent was to maintain some stability in harvest regimes while recognizing potential conservation concerns. Extensive opportunities for public comment and final federal review and approval further assure that the conservation of stocks is adequately accommodated.

The proposed action in no way contemplates altering of established procedures for derivation of individual species' ABCs and subsequent setting of individual species' TACs. The proposal deals only with the present OY range, established at a time when the abundance of harvestable groundfish was much lower, which currently constrains the total allowable harvest of groundfish to 2.0 million mt.

1.6 Analytical Framework

Revising the upper end of the OY range would not alter the Council's procedure in setting ABCs or TACs nor the harvest level of species already fully utilized up to their ABCs, but rather

Table 1.1 ABCs and TACs for groundfish of the Bering Sea/Aleutian Islands, 1984-1988 (in metric tons).

Species	Area	1984 ABC	1984 TAC	1985 ABC	1985 TAC	1986 ABC	1986 TAC	1987 ABC	1987 TAC	1988 ABC	1988 TAC
Pollock	BS	1,200,000	1,200,000	1,100,000	1,200,000	1,100,000	1,200,000	1,200,000	1,200,000	1,500,000	1,300,000
	AI	100,000	100,000	100,000	100,000	100,000	100,000	100,000	88,000	160,000	45,000
Pacific cod		291,300	210,000	347,400	220,000	249,300	229,000	400,000	280,000	385,300	200,000
Yellowfin sole		310,000	230,000	310,000	226,900	230,000	209,500	187,000	187,000	254,000	254,000
Greenland turbot		67,500	59,610	57,500	42,000	35,000	33,000	20,000	20,000	14,100	11,200
Arrowtooth flounder		a	a	a	a	20,000	20,000	30,900	9,795	99,500	5,531
Other flatfish		150,200	111,490	150,200	109,900	137,500	124,200	193,300	148,300	331,900	131,369
Sablefish	BS	4,430	3,740	2,600	2,625	2,250	2,250	3,700	3,700	3,400	3,400
	AI	1,755	1,600	3,360	1,875	4,200	4,200	4,000	4,000	5,800	5,000
Pacific ocean perch	BS	1,360	1,780	1,360	1,000	1,200	825	3,800	2,850	6,000	5,000
	AI	10,800	2,700	11,400	3,800	11,250	6,800	10,900	8,175	16,600	6,000
Other rockfish	BS	3,100	1,550	1,120	1,120	450	825	450	450	400	400
	AI	7,900	5,500	7,830	5,500	1,425	5,800	1,430	1,430	1,100	1,100
Atka mackerel		25,500	23,130	38,734	37,700	30,800	30,800	30,800	30,800	21,000	21,000
Squid		10,000	8,900	10,000	10,000	10,000	5,000	10,000	500	10,000	1,000
Other species		61,400	40,000	46,700	37,580	35,900	27,800	49,500	15,000	54,000	10,000
TOTAL		2,245,245	2,000,000	2,188,204	2,000,000	1,969,275	2,000,000	2,245,780	2,000,000	2,863,100	2,000,000

a/ ABC and TAC for Greenland turbot and arrowtooth flounder combined under Greenland turbot.

would allow the Council to increase TACs for species that are currently underutilized. Pertinent differences in possible harvest levels can be illustrated by comparing TACs established for 1988 under constraint of the 2.0 million mt cap (Table 1.2) against TACs that likely would have been recommended if the cap did not exist (Table 1.3). The values in Table 1.3 are not strictly hypothetical, but are based upon the same projections and requests for domestic annual processing (DAP), joint venture processing (JVP), and total allowable level of foreign fishing (TALFF) used by the Council to set TACs for 1988.

The comparison (Table 1.4) shows that removal of the 2.0 million mt cap for 1988 could have resulted in:

(a) Large increases of TACs for Pacific cod and flatfish.

(b) A possible increase in TAC for arrowtooth flounder (although there was no explicit request for harvest of this species).

(c) Moderate increases in TACs for pollock and Pacific ocean perch.

(d) A potentially large increase in the use of other species.

It must be noted, however, that the Council may not have increased the TAC for pollock up to the ABC, due to their stated concern for the conservation of this species in light of large harvests in adjacent international waters (the "donut hole"); nor for POP, due to an implicit schedule to rebuild those stocks. Moreover, it should be noted that the upper limit to the OY range is a maximum potential harvest level, not a harvest level that must be allowed or achieved.

Therefore, the analyses that follow should generally be viewed as upper bounds on the range of likely impacts. Actual Council action under any of the alternatives will depend, on a year-to-year basis, upon current and projected status of stocks, biological uncertainty and risk, bycatch concerns and a mix of economic and social considerations.

Likely or possible increases in harvests of currently under-utilized (TAC less than ABC) species, plus socioeconomic impacts of subsequent changes in DAP, JVP, and TALFF apportionments comprise the sources of possible impact of the proposed action and, therefore, have received the emphasis of analyses described in this document. In deference to more general concerns, however, potential impacts of increasing groundfish harvests as a whole are also discussed. General issues include:

(a) Effects on groundfish stocks.

(b) Predator-prey interactions.

Table 1.2 1988 TACs and apportionments (mt), established within 2.0 million mt OY limit, based upon DAP and JVP requests as constrained by ABCs for groundfish of the Bering Sea/Aleutian Islands.

Species	Area	ABC	TAC	DAP	JVP	TALFF
Pollock	BS	1,500,000	1,300,000	614,162	685,838	0
	AI	160,000	45,000	4,160	40,840	0
Pacific cod		385,300	200,000	87,416	112,584	0
Yellowfin sole		254,000	254,000	26,356	227,644	0
Greenland turbot		14,100	11,200	11,200	0	0
Arrowtooth flounder		99,500	5,531	3,808	1,723	0
Other flatfish		331,900	131,369	26,403	104,966	0
Sablefish	BS	3,400	3,400	3,400	0	0
	AI	5,800	5,000	5,000	0	0
Pacific ocean perch	BS	6,000	5,000	5,000	0	0
	AI	16,600	6,000	6,000	0	0
Other rockfish	BS	400	400	400	0	0
	AI	1,100	1,100	1,100	0	0
Atka mackerel		21,000	21,000	80	20,920	0
Squid		10,000	1,000	1,000	0	0
Other species		54,000	10,000	2,000	8,000	0
TOTAL		2,863,100	2,000,000	797,485	1,202,515	0
		OY=	2,000,000			

Note: 15% of each TAC is subtracted from JVP, and DAP if necessary, and placed into reserves for possible reapportionment during the year.

Table 1.3 Probable 1988 TACs and apportionments (mt), without 2.0 million mt OY limit, based upon DAP and JVP requests, and potential TALFF as constrained by ABCs for groundfish of the Bering Sea/Aleutian Islands.

Species	Area	ABC	TAC	DAP	JVP	Potential TALFF
Pollock	BS	1,500,000	1,500,000	614,162	885,838	0
	AI	160,000	54,160	4,160	50,000	105,840
Pacific cod		385,300	226,957	87,416	139,541	158,343
Yellowfin sole		254,000	254,000	26,356	227,644	0
Greenland turbot		14,100	14,100	14,100	0	0
Arrowtooth flounder		99,500	5,531	3,808	1,723	93,969
Other flatfish		331,900	149,331	26,403	122,928	182,569
Sablefish	BS	3,400	3,400	3,400	0	0
	AI	5,800	5,800	5,800	0	0
Pacific ocean perch	BS	6,000	6,000	6,000	0	0
	AI	16,600	16,600	16,600	0	0
Other rockfish	BS	400	400	400	0	0
	AI	1,100	1,100	1,100	0	0
Atka mackerel		21,000	21,000	80	20,920	0
Squid		10,000	1,000	1,000	0	9,000
Other species		54,000	10,000	2,000	8,000	44,000
TOTAL		2,863,100	2,269,379	812,785	1,456,594	593,721

OY = 2,269,379 for DAP + JVP.

Potential OY = 2,863,100 for DAP + JVP + PTALFF as constrained by ABC.

Note: 15% of each TAC would be subtracted from TALFF, and JVP then DAP if necessary, and placed into reserves for possible reapportionment.

Table 1.4 Possible increases of 1988 TACs and apportionments (mt) without 2.0 million mt OY limit for groundfish of the Bering Sea/Aleutian Islands.

Species	Area	Δ TAC	Δ DAP	Δ JVP	Potential TALFF
Pollock	BS	200,000	0	200,000	0
	AI	115,000	0	9,160	105,840
Pacific cod		185,300	0	26,957	158,343
Yellowfin sole		0	0	0	0
Greenland turbot		2,900	2,900	0	0
Arrowtooth flounder		93,969	0	0	93,969
Other flatfish		200,531	0	17,962	182,569
Sablefish	BS	0	0	0	0
	AI	800	800	0	0
Pacific ocean perch	BS	1,000	1,000	0	0
	AI	10,600	10,600	0	0
Other rockfish	BS	0	0	0	0
	AI	0	0	0	0
Atka mackerel		0	0	0	0
Squid		9,000	0	0	9,000
Other species		44,000	0	0	44,000
TOTAL		863,100	15,300	254,079	593,721

(c) Implications for bycatch of incidental species.

(d) Implications of marine debris.

(e) Effects on seabirds.

(f) Effects on marine mammals.

(g) Market and related impacts.

Analysis of all of these potential impacts will be discussed relative to the status quo (future Council action under the 2.0 million mt upper limit to OY). Thus, the analysis will not represent total biological and economic impact of the groundfish fishery, but rather the relative impacts of increasing the harvest beyond 2.0 million mt.

2.0 DESCRIPTION OF THE PHYSICAL AND BIOLOGICAL ENVIRONMENT

The FMP applies to waters of the EEZ (3-200 miles offshore) in the eastern Bering Sea and north and south of the Aleutian Islands westward of 170° west longitude (Figure 2.1). These waters support a complex ecosystem driven by physical impacts on primary producers (phytoplankton), secondary producers (mainly zooplankton), and consumers. Consumers include forage fishes, groundfish species managed by the FMP, other commercial finfishes (including salmon, herring and halibut), benthic invertebrates (including commercially important stocks of king and Tanner crab as well as mollusks), and large populations of seabirds and marine mammals.

This chapter describes those portions of the physical and biological environment that affect or may be affected by groundfish harvests contemplated by the proposed action. Readers already familiar with physical and biological aspects of the Bering Sea/Aleutian Islands may wish to proceed directly to Chapters 4 and 5 for an analysis of the proposed action.

2.1 Physical Environment

The physical environment consists of waters that lie over the broad continental shelf characteristic of the eastern Bering Sea, over the continental slope, and over portions of the deeper Aleutian Basin. Northern portions of the area are seasonally covered by sea ice.

The area of the Bering Sea is about 2.3 million square kilometers. Of this area, 44% consists of continental shelf; 13% of continental slope; and 43% of deepwater basin. The continental shelf of the northeastern Bering Sea is one of the largest in the world. It is extremely smooth and has a gentle, uniform gradient. The continental slope bordering this shelf is abrupt and very steep, and is scored with valleys and large submarine canyons. On the south, the Aleutian/Commander Islands Arc forms a partial barrier between the Bering Sea and the Pacific Ocean. This chain consists of more than 150 islands, and is about 2,260 kilometers long. The continental shelf of the Aleutians is narrow and discontinuous, with a breadth ranging between 4 and 46 kilometers. The broader parts of this shelf are in the eastern Aleutians. The Aleutian Trench, a large canyon stretching from the central Gulf of Alaska to the Kamchatka Peninsula, adjoins the Aleutian/Commander chain on the south.

Bowers Bank is a submerged ridge extending to the northwest from the westcentral Aleutians into the Bering Sea. It is about 550 kilometers long and 75 to 110 kilometers wide, increasing in width as it approaches the continental shelf of the Aleutians. The summit of the ridge is 150 to 200 meters deep in the south, 600 to 700 meters deep in the center, and 800 to 1,000 meters deep in the north.

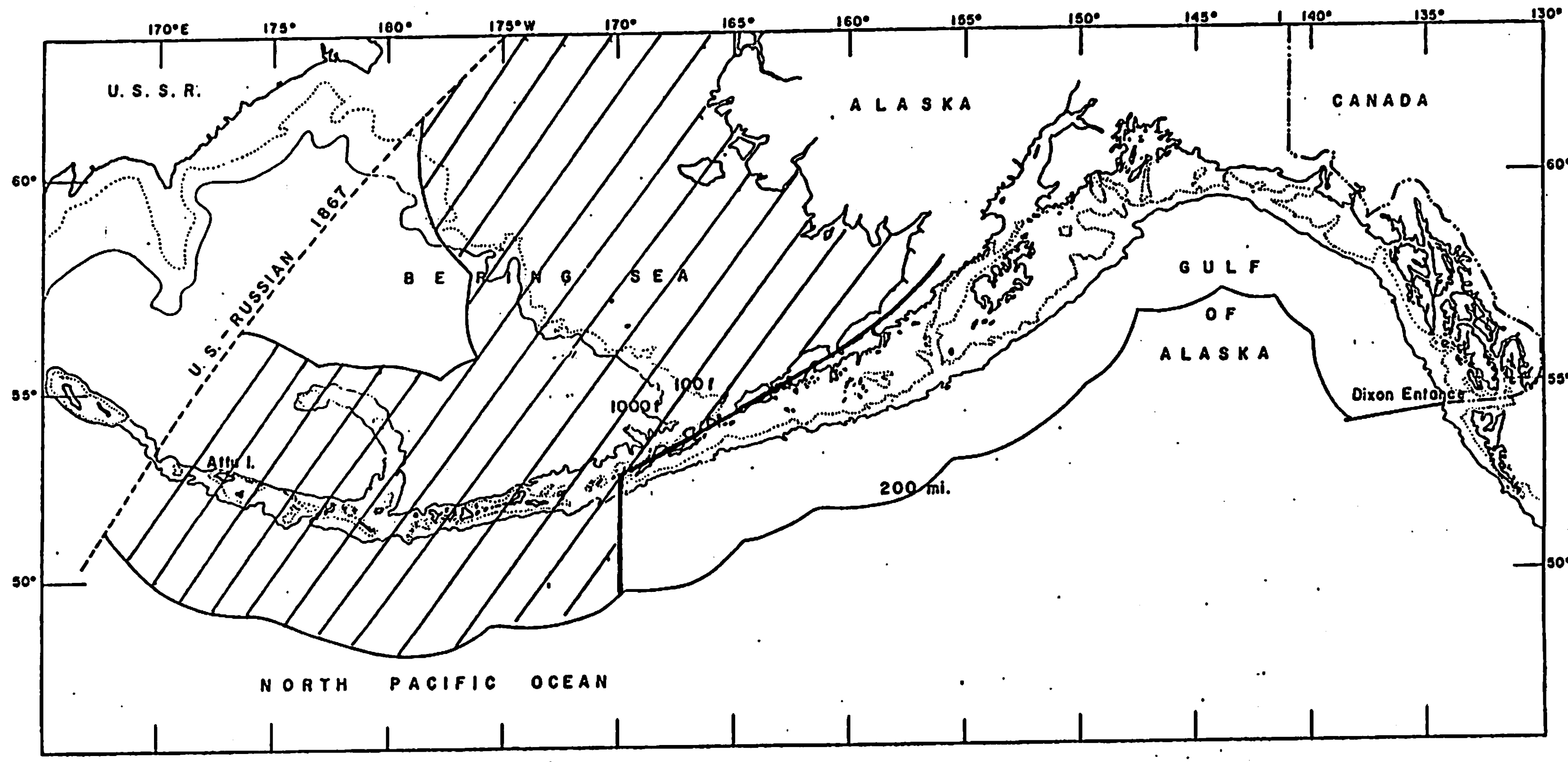

Figure 2.1 Bering Sea/Aleutian Islands Management Area.

Aside from the Aleutians and Commanders, the Bering Sea has relatively few islands. The small Pribilof and St. Matthew Island groups lie adjacent to the continental slope of the northeastern Bering Sea. Nunivak Island lies just off the Alaska mainland between the Yukon and Kuskokwim deltas. St. Lawrence Island lies in the northern part of the Bering Sea, between Norton Sound and the Chukchi Peninsula.

Water flows into the Bering Sea from the Pacific Ocean and from the rivers and surface of the adjoining land areas. Water moves from the Bering Sea into the Arctic Ocean through the Bering Strait. Thus, there is a net movement of water northward throughout the Bering Sea. On the eastern Bering Sea continental shelf, the dominant movement of water involves water entering the Bering Sea from the Pacific in the area of Unimak Pass. This water moves northward to St. Matthew Island and eastward toward Bristol Bay. Dividing near St. Matthew Island, the northward stream reunites and passes through the Bering Strait.

2.1.1 Continental Shelf

Between nearshore waters and deeper portions of the ocean lies a relatively shallow region over the continental shelf. The outer limit of the shelf occurs at the shelf break, at a depth of approximately 180-200 meters. Three physical domains have been identified across the shelf (Coachman 1986).

Waters out to a depth of approximately 50 meters are well mixed by a combination of winds and tidal action (Schumacher et al. 1979) and exhibit small mean current flow. This area hosts a nearshore zooplankton community (Cooney 1981) and forage fish populations including herring, capelin, and sandlance. Seaward of the coastal domain lies an inner front--strong gradients of temperature and salinity that separate this water mass from the middle shelf domain.

The middle shelf (50-100 meters) is a vertically stratified system exhibiting almost no mean current (Coachman 1986). During summer these waters experience high rates of primary production, due to occasional mixing of nutrient-rich bottom waters into the surface layer, but large grazing zooplankton are absent so much of this production sinks to the bottom, supporting high abundance of benthic animals including crabs and flounders (Haflinger 1981, Cooney and Coyle 1982). The middle shelf domain is separated from outer shelf waters by another area of high physical gradients, the middle front.

Outer shelf waters (100-200 meters) are vertically stratified, with shelf water overlying a layer of fine structure which itself overlies intruding oceanic waters (Coachman 1986). Due to occasional mixing of nutrient-rich oceanic waters into surface layers, this area also exhibits high rates of primary production, but vertically migrating oceanic zooplankton effectively graze these plants to divert energy into a pelagic ecosystem (Cooney and Coyle 1982). Pollock and Pacific cod are predominant species in outer shelf waters.

2.1.2 Continental Slope and the Aleutian Basin

An outer shelf front separates these waters from the oceanic domain over the continental slope and Aleutian Basin. These oceanic waters are typically poor in nutrients and support less productivity than waters on the shelf and slope. However, localized areas, particularly close to the bottom in areas of topographic irregularity, support concentrations of rockfish and sablefish. Waters particularly along the shelf break exhibit moderate mean current flow parallel to the bathymetry.

2.1.3 Seasonal Sea Ice

Except for the southernmost part, which is in the temperate zone, the Bering Sea has a subarctic climate. It experiences moderate to strong atmospheric pressure gradients, and is subject to numerous storms. The distribution of sea ice in the Bering Sea is subject to great seasonal variation. Ice begins to form along south-facing shorelines during the early fall and, in October and November, extends to northern sections of Bristol Bay. The ice edge advances southward under the influence of prevailing winds, with more ice formed behind it, in a conveyer belt fashion. Sometime in March or April the sea ice reaches its maximum southern extent, and then begins a rapid retreat due to melting and shifts in prevailing winds (Overland and Pease 1981, Niebauer 1981, Webster 1981).

2.2 Biological Environment

The biological environment consists of various trophic levels that translate energy from producers to consumers. Major groups discussed in this document include lower trophic levels consisting of phytoplankton and zooplankton, commercially important groundfish species, other finfish and shellfish, and apex consumers such as seabirds, marine mammals and man.

2.2.1 Lower Trophic Levels

The flora and fauna that comprise the lower-trophic levels of the Bering Sea can be separated into three communities: (1) epontic or organisms associated with the undersurface of sea ice; (2) pelagic or organisms living in the water column; and (3) benthic or organisms living on or in the sea bottom. In this section, the primary and secondary producers are described and interactions among trophic levels are discussed.

Epontic Community

From November through May, portions of the Bering Sea are covered by sea ice. Such ice serves as a substrate for algae, small invertebrates, and cryopelagic fish. Alexander and Chapman

(1981) identified over 20 species of epontic phytoplankton in the Bering Sea--almost exclusively diatoms. More than half of the ice algae species also occurred in water-column samples. Vertical distribution of epontic algae is confined to the bottom few centimeters of the icepack. Chlorophyll a (a measure of phytoplankton abundance) at concentrations as high as 70 milligrams per square meter of sea ice has been observed (Alexander and Chapman, 1981), but these dense concentrations are patchily distributed within the icepack.

Epontic algae are adapted to low-light conditions and grow from the onset of adequate light conditions until ice breakup. McRoy and Goering (1974) found that the highest production and standing stock of epontic algae occurred just as the ice breaks up. Although ice algae initiate the annual cycle of primary production, ice algae contribute less than 1.5 grams of carbon per square meter annually (Alexander and Chapman, 1981).

Within the Bering Sea, primary production by ice algae is more important in its timing rather than in its contribution to the total primary productivity (Tamm and Jarvela, 1984). Alexander and Chapman (1981) estimated that ice algae contribute less than 1% of the annual primary production of the southeastern Bering Sea. However, production by ice algae precedes phytoplankton blooms in the water column by at least 1 month. The ice-algae bloom serves primarily as an early source of concentrated food for amphipods, copepods, ciliates and fishes, and secondarily, as a spring inoculum of algae cells that seeds the water column (Niebauer, Alexander, and Cooney, 1981). Alexander and Chapman (1981) estimated the influx of ice-algae cells into the water column as 105 to 106 cells per liter.

<u>Pelagic Community</u>

Phytoplankton, zooplankton, and micro-nekton comprise the lower-trophic levels of the pelagic community. Planktonic organisms are principally found in the upper-water column and are subject to wind and tidal currents that control their distribution. Micronekton also inhabit pelagic waters but are capable of swimming effectively. The system of hydrographic fronts and domains of the Bering Sea plays an integral part in the patterns of distribution and abundance of these organisms.

<u>Phytoplankton</u>: Alexander and Cooney (1979) found that 65% of the primary production in the Bering Sea occurs from April through June. Three phytoplankton blooms encompass this period: An ice-algae bloom (discussed earlier), followed by a bloom at the ice edge, and then the typical spring bloom in open water. Similar to the ice algae, phytoplankton in the water column are primarily diatoms. At least 90 species of diatoms occur in the Bering Sea (Alexander and Chapman, 1978).

During winter, the abundance and productivity of phytoplankton is low due to low-light intensities. As the ice separates into smaller floes, light penetration into the sea increases significantly resulting in an extremely intense bloom at the ice edge. The bloom usually begins in April and follows the receding icepack northward.

Productivities as high as 725 milligrams of carbon per square meter per hour have been measured at the ice edge (Niebauer et al., 1981). The bloom extends to depths of 30 to 60 meters and distances of 50 to 100 kilometers away from the ice edge. As the ice edge melts, the upper layer of the water column stabilizes because of decreased salinity and dampened wind mixing, thus permitting such an intense bloom. The ice-edge bloom persists for 2 to 3 weeks until nutrients are depleted. Because the bloom develops so rapidly, the phytoplankton cannot be completely grazed, so much of the organic matter sinks to the bottom. Primary species of the ice-edge bloom include Thalassiosira sp., Nitzschia sp., Achnanthes sp., Navicula pelagica, Navicula vanhoffeni, Chaetoceros sp., and Detonula sp. (Schandelmeier and Alexander, 1981).

In ice-free waters, a spring bloom occurs after formation of the seasonal thermocline. The open-water bloom occurs in spring in the Aleutian Islands and in summer in the Bering Strait (Alexander and Niebauer, 1981). Diatoms in the warmer, open waters of the Bering Sea are considerably larger than those found at the ice front (Alexander and Cooney, 1979). Species associated with the spring bloom include Chaetoceros convolutus, C. socialis, C. compressus, C. radicans, and T. nordenskioldii (Schandelmeier and Alexander, 1981). Compared to the ice-edge bloom, the spring bloom is less intense but of longer duration throughout a greater depth of the water column.

Iverson and Goering (1979) estimated primary production for the hydrographic domains in the Bering Sea. Annual production was 400 grams of carbon per square meter in the middle-shelf domain, 200 grams of carbon per square meter over the outer shelf and 90 grams of carbon per square meter in the oceanic domain. Thus, the ice-edge and spring blooms produce the highest carbon input over the middle shelf (50-100 m isobaths).

Zooplankton: Zooplankton are the major grazers of the phytoplankton, and the grazing stress exerted upon phytoplankton ultimately determines whether the food web leading to higher-trophic levels is pelagic or benthic. In the Bering Sea, copepods are the dominant zooplankton, both in terms of abundance and diversity. Cooney (1981) identified 22 numerically common species of copepods in the Bering Sea. Approximately 80% of the zooplankton standing stock occurs in the upper 80 meters of the water column (Motoda and Minoda, 1974), corresponding to the vertical distribution of phytoplankton.

In the southeastern Bering Sea, two distinct copepod communities occur, segregated by the middle-shelf front at approximately the 100-meter isobath. Seaward of the front, the oceanic species

Calanus plumchrus, C. cristatus, Eucalanus bungii bungii and Metridia pacifica are dominant members of the oceanic/outer-shelf communities (Cooney and Coyle, 1982). The cold water of the midshelf front blocks penetration of these large, oceanic species into the middle-shelf waters (Alexander, 1981). The middle shelf is seasonally dominated by smaller copepods: Pseudocalanus sp., Acartia longiremis, and Oithona simulus (Cooney and Coyle, 1982). C. glacialis and C. marshallae may also be abundant in midshelf waters (Zenkevitch, 1963; Cooney, 1981).

The reproductive strategies of midshelf and oceanic zooplankton result in differential grazing on the phytoplankton blooms. Oceanic copepods reproduce in winter, and hence, large numbers of both mature and immature copepods inhabit pelagic waters before the spring bloom. Midshelf copepods must first feed before reproducing, and therefore do not attain peak densities until after the spring bloom. Cooney (1981) estimated grazing efficiencies of 2% and 15% for the midshelf and oceanic/outer-shelf copepods, respectively. Thus, the phytoplankton/zooplankton link is much more tightly coupled seaward of the middle front, leading to a pelagic food web rich in nekton, pelagic fishes (e.g., pollock), marine mammals, and birds. In the midshelf domain, as much as 90% of the phytoplankton sinks to the sea bottom ungrazed (Goering and Iverson, 1981), leading to a rich benthic food web of infauna, epifauna, demersal fishes (e.g., yellowfin sole), and marine mammals.

Micronekton: Small invertebrates that graze phytoplankton and zooplankton comprise the micronekton, of which amphipods and euphausiids are the most important components. Similar to zooplankton, micronekton are geographically separated by the middle-shelf front. Seaward of the front, the amphipod Parathemisto pacifica and euphausiids Thysanoessa longipes and T. inermis are most abundant (Lewbel, 1983). P. libellula and T. raschii predominate in the middle-shelf domain.

Although micronekton are much less abundant than zooplankton, micronekton form dense swarms approaching 100 per square meter and are abundant throughout the summer (English, 1979). Amphipods and euphausids are significant in the diets of many seabirds (Hunt et al., 1981; Hunt, 1981b), finfish (Cooney et al., 1980; Lowry and Frost, 1981a), seals (Lowry and Frost, 1981b), and baleen whales (Frost and Lowry, 1981).

Benthic Community

The benthic food web is primarily composed of invertebrates and demersal fishes. The invertebrate benthic community can be further divided into infauna (organisms living in the sediments) and epifauna (organisms living on the sediment surface). This section discusses the invertebrate infauna and slow-moving epifauna. Benthic fishes and macro-epifauna (e.g., crabs) are discussed in the next section.

Invertebrate infauna form a vital link between accumulated flora and fauna in the bottom sediments (e.g., detritus) and epifauna, fishes, and marine mammals. The benthic invertebrate community of the Bering Sea is abundant and diverse. At least 472 species of invertebrates comprise the macroinfauna, including 143 species of polychaete worms, 76 species of amphipods, 76 species of gastropods, and 54 species of bivalves (Stoker, 1981).

Two trends characterize the distribution of infauna within the Bering Sea: (1) density and biomass increase from south to north (Stoker, 1981; Alton, 1974; Feder and Jewett, 1981), and (2) infaunal biomass is highest in the middle shelf waters (Haflinger, 1981; Nagai and Suda, 1976; Stoker, 1981). The inefficient link between phytoplankton and zooplankton in midshelf waters results in rich standing stocks of infauna, epifauna and demersal fish between the 50- and 100-meter isobaths. Although infaunal biomass is higher in the northeastern Bering Sea, reduced numbers of demersal fishes occur, presumably due to the low bottom water temperatures normally present.

2.2.2 Principal Groundfish Stocks

This group of fishes comprises the major harvest in both numbers and value from the eastern Bering Sea at this time. The group is also called bottomfish and, in marketing, whitefish. For management purposes involving catch statistics and in determination of economic value this fish complex is subdivided into the following categories: pollock, pacific cod, yellowfin sole, Greenland turbot, arrowtooth flounder, other flatfish, sablefish, pacific ocean perch, other rockfish, Atka mackerel, squid, and other species.

Walleye Pollock (*Theragra chalcogramma*)

This species is the most abundant demersal fish on the continental shelf in the Bering Sea and is estimated to comprise approximately 85% of the total biomass of all demersal fish in the Bering Sea (Bakkala et al., 1987). Large schools of pollock occur on the outer continental shelf and upper slope, from the surface to 500 meters in depth. Pollock populations peaked in the early 1970s, declined thereafter because of overharvesting by foreign fisheries, then slowly increased to a standing stock biomass of approximately 10 million tons by 1982 (NPFMC 1987). The Bering Sea stock is currently declining slightly following passage of the strong 1978 year class.

Pollock undergo seasonal and diurnal migrations associated with spawning and feeding in the eastern Bering Sea. Seasonal distribution appears to be related to water temperature (Smith, 1980). Overwintering occurs along the outer shelf and upper slope at depths of 150 to 300 meters, where bottom temperatures are warmer. As water temperatures rise in the spring, pollock move to more shallow waters (90 to 140 m), where they spawn.

From March through July, spawning occurs along the outer shelf, with major concentrations of spawning fish between the Pribilof Islands and Unimak Island (Lewbel, 1983). Pollock also move vertically in the water column. Adults aggregate near the bottom during the day and rise to near-surface waters in the evening to feed.

Spawning occurs from February through July from off the shelf edge into approximately 90-meter water depths along the outer shelf. The eggs are pelagic and abundant in surface waters until they hatch in 2 to 3 weeks, depending on the water temperature (Walline, 1985). The larvae also are pelagic and remain in surface waters until they are 35 to 50 millimeters long, when they begin a demersal existence (Pereyra et al., 1976). Larvae are most abundant between Unimak Pass and the Pribilof Islands along the continental slope (Waldron, 1981). In the summer, they show a more widespread distribution from the Aleutian Islands to 60° 30'N latitude, and from well up on the continental shelf in Bristol Bay across the central basin to 177°E longitude (Waldron, 1981). Larvae may take 2 or 3 months to develop into juveniles, depending on water temperature. Juvenile pollock are found in near-surface waters. Groundfish trawl surveys have found 2- to 4-month-old pollock over a large area of the northwestern outer shelf, with highest concentrations of 0-age juveniles directly west of the Pribilof Islands (Smith, 1981). Following spawning along the southeastern outer continental shelf, the northwest drift apparently carries larvae and metamorphosing juveniles to the vicinity of the Pribilofs.

By one year of age, pollock are distributed broadly over the entire central and outer continental shelf, completely overlapping the adult range, but also extending inshore beyond the adult range (Smith, 1981). By 2 years of age, pollock are more restricted to deep water. As they mature at age 3 to 4, juveniles join the adult demersal population on the outer continental shelf.

Larval pollock feed on copepod eggs and nauplii after their yolk reserves have been exhausted (Cooney et al., 1980). Juvenile pollock prey on larger copepods, euphausiids, and amphipods. Adults feed on copepods, euphausiids, and fish (a majority of which are juvenile pollock) (Morris, 1981).

Feder and Jewett (1981) show a food web which depicts the major flows of energy to adult walleye pollock in the eastern Bering Sea. Juvenile walleye pollock and euphausiids serve as the main sources of energy for adult pollock. In addition, copepods, mysids, amphipods, sandlance, smelt, and herring form minor portions of the diet. Livingston et al.(1986) and Dwyer et al. (1988) show the seasonal change in pollock diet and the total amount of juvenile pollock consumed by adults. Adult pollock are cannibalistic mostly during autumn and winter and they consume mainly age 0 juveniles.

Many other fish predators rely on juvenile walleye pollock for food (Livingston and Dwyer 1986; Livingston et al. 1986; Brodeur and Livingston 1988): including Pacific cod, sablefish, flathead sole, Pacific halibut, Greenland turbot, arrowtooth flounder, Atka mackerel and great sculpins.

There are apparent annual variations in the distribution of juvenile pollock, based mostly upon water temperature. Since spawning adult pollock do not penetrate continental shelf waters colder than 1 to 2 degrees, larval pollock are more concentrated near the shelf break during colder years but more widely dispersed across the shelf in warmer years (Nishiyama, 1982; Chen, 1983; Bakkala and Alton, 1986). Juveniles aged 1 and 2 also tend to be constrained by cold water temperatures (Chen, 1983) and tend to be concentrated near the shelf break and outer shelf waters during colder years (Bakkala and Alton, 1986).

Recent assessments (NPFMC 1987) indicate that 1988 exploitable biomass in the Bering Sea is 6.5 million mt, 690,000 mt for the Aleutian Islands. Stocks are characterized as relatively high in abundance and stable.

Pacific Cod (Gadus macrocephalus)

In the Bering Sea, schools of this demersal species are most abundant on the continental shelf and upper slope. Pacific cod are similar to pollock in distribution, but occur in more shallow waters, commonly at depths of 80 to 260 meters (Pereyra et al., 1976). The greatest concentrations of adult cod are at depths of 100 to 200 meters (Wespestad et al., 1982). As a result of an extremely strong year-class in 1977 (and possibly 1978), the biomass of Pacific cod has increased significantly in recent years (NPFMC, 1987).

Adult cod are abundant along the northern side of the Alaska Peninsula throughout the area from Cape Seniavin to Cape Sarichef (Thorsteinson, 1984). Pacific cod migrate seasonally between the continental slope and shelf in the Bering Sea. Cod overwinter and spawn in deeper waters in the canyons across the shelf and along the shelf edge and upper slope at depths of 100 to 400 meters, and move to more shallow waters (30-75 m) in the summer.

This species spawn from January to May, with the bulk of spawning occuring in February and March (Wespestad et al., 1982). The demersal eggs hatch within 10 to 20 days and the pelagic larvae are found at water depths from 25 to 150 meters, with concentrations at 75 to 100 meters (Lewbel, 1983). Larvae have been caught in ichthyoplankton surveys in the Aleutian Islands and on the continental shelf south of Nunivak Island (Waldron, 1981). Some larvae have been caught in nearshore waters (less than 50 m deep) in northern Bristol Bay, and others within the 50- to 100-meter contours (Waldron, 1981). Coastal areas with rocky bottoms are used by juveniles before they move offshore into deeper waters. The North Aleutian Shelf area is important as a nursery area for Pacific cod (USDOC, NMFS, 1980).

Pacific cod feed on benthic and planktonic organisms. They also prey on fish such as herring and sand eels, and on invertebrates including polychaetes, clams, snails, and shrimp (Morris et al., 1983; Thorsteinson, 1984). Cod are a major predator on juvenile crabs.

The food web of energy flow to Pacific cod (Feder and Jewett 1981) shows Tanner crab, pandalid shrimp and walleye pollock as the main sources of food for adults. Cod also consume flatfish, herring, capelin, sandlance, and other shrimp and crabs. Livingston et al.(1986) and Shimada et al.(1988) show that cod become increasingly piscivorous with increasing size. In particular, cod larger than 60cm consume mostly fish, which consists mainly of walleye pollock 10-30cm long or about 1-3 years of age. During spring when female red king crab are molting, cod will consume soft-shell king crabs. Preliminary analysis shows that the number of red king female crabs eaten by Pacific cod is directly proportional to the number of female crab present.

Recent assessments (NPFMC 1987) indicate that exploitable biomass for 1988 in the Bering Sea/Aleutian Islands is almost 1.5 million mt. Stocks are characterized as very high in abundance and stable.

Yellowfin Sole (Limanda aspera)

This flatfish is found in continental shelf waters at depths of 5 to 360 meters in the North Pacific Ocean, the Bering Sea, and the Chukchi Sea. Its largest population is found in the eastern Bering Sea (Pereyra et al., 1976).

Yellowfin sole have complex seasonal movements in the eastern Bering Sea. During winter (September-March), adults are concentrated in dense schools on the outer shelf and upper slope at depths of 100 to 360 meters, with largest trawl catches at depths of 100 to 200 meters (Fadeev, 1970; Salverson and Alton, 1976; Bakkala, 1981). One of the primary winter concentrations of adult yellowfin sole is located north of Unimak Island. Smaller concentrations are found in Bristol Bay (Bakkala, 1981). Winter concentrations generally do not feed until April, although exceptions have been reported (Fa-deev, 1970). In the spring, yellowfin sole move inshore to more shallow waters (100 m) along the Alaska Peninsula, where feeding intensity remains low (Skalkin, 1963; Smith et al., 1978). In April and May, the fish migrate northward into outer Bristol Bay where, at depths of 40 to 100 meters, spawn-ing and intensive feeding occur (Bakkala, 1981). It is believed that the water temperature and the extent of winter ice cover in the Bering Sea affect the rate of these summer migrations and the summer distributional patterns (Bakkala, 1981). With the advent of winter, adult yellowfin sole migrate back to deeper waters, probably in response to the advance of pack ice that covers portions of the Bering Sea in winter (Bakkala et al., 1983). In warmer years, the fish may remain in more shallow, central-shelf areas throughout winter (Bakkala et al., 1983). Young yellowfin sole (less than 8 years old) are found year-round in the inner-shelf region, including Bristol Bay (Fadeev, 1970). Large numbers of juvenile yellowfin sole have been found along the southern shore of Bristol Bay and on the northern side of the Alaska Peninsula and Unimak Island (Morris, 1981) during International Halibut Commission surveys. During the winter, adult yellowfin sole also move up vertically in the water column (Fadeev, 1965).

Yellowfin sole populations have been depleted significantly due to intense fishing pressure by foreign trawlers and have only recently begun to improve. Populations were significantly reduced by 1963 (Lewbel, 1983), when fishing efforts switched to pollock. The estimated biomass of exploitable yellowfin sole in the eastern Bering Sea ranges from 1.3 to 2.0 million metric tons (Alverson et al., 1964; Wakabayashi, 1975, cited in Bakkala, 1981). By 1963, the exploitable population was reduced by approximately 60% (NPFMC, 1983). In the mid-1960s, the population showed signs of recovery but again declined in 1970 (Bakkala, 1981). The yellowfin sole population has recovered since 1970 (INPFC, 1982; NPFMC, 1983), and its current biomass is estimated to be at an all time high (NPFMC, 1987).

Yellowfin sole spawning begins in early July and continues into September in the Bering Sea (Musienko, 1970), in waters up to 75 meters deep (Thorsteinson, 1984). Spawning is concentrated southeast and northwest of Nunivak Island (Bakkala, 1981; Thorsteinson, 1984), but also has been observed in Bristol Bay (Fadeev, 1965; Bakkala, 1981). Females release millions of pelagic eggs that hatch in approximately 4 days (Thorsteinson, 1984); 3 days later yolk sacs are absorbed (Bakkala, 1981). The pelagic larvae are found in nearshore areas of the continental shelf at depths of less than 50 meters (Thorsteinson, 1984). After 4 or 5 months as pelagic larvae, they metamorphose into juvenile sole that settle to the bottom along the inner shelf (Morris, 1981), including Bristol Bay, which they occupy year-round (Fadeev, 1970). Bristol Bay is an important nursery area for yellowfin sole (Thorsteinson, 1984). Large numbers of juvenile yellowfin sole have been found along the southern shore of Bristol Bay and on the northern side of the Alaska Peninsula and Unimak Island during International Pacific Halibut Commission surveys (Morris, 1981). After spending their first few years in nearshore waters, the juveniles gradually disperse to deeper offshore waters (Thorsteinson, 1984).

The diet of the yellowfin sole in the Bering Sea varies with both depth and location (Skalkin, 1963). In the southeastern Bering Sea, major prey species include small amphipods, mysids, euphausiids, bivalve mollusks and some fish species. Sole are generally benthic feeders, but they may feed on nonbenthic organisms when benthic prey are scarce. Fadeev (1965) suggested that yellowfin growth in the Bering Sea is limited by food abundance. Concentrations of plankton in rearing areas are probably important for yellowfin larvae (Cooney et al., 1979).

The food web for yellowfin sole (Feder and Jewett 1981) does not show any one item as a dominant food source. Yellowfin sole are mostly benthic feeders as evidenced by their consumption of clams, shrimp, mysids, and worms. Occasionally, yellowfin sole also swim up in the water column and consume pelagic prey such as euphausiids, crab larvae, and juvenile pollock or cod (Livingston et al. 1986).

Recent assessments (NPFMC 1987) indicate that exploitable biomass in the Bering Sea/Aleutian Islands for 1988 is approximately 1.4 million mt. Stocks are characterized as very high in abundance but are expected to decline slightly over the next few years due to poor recruitment.

Greenland Turbot (Reinhardtius hippoglossoides)

This flatfish is widely distributed over the continental shelf and slope of the eastern Bering Sea with a depth range of 70 to 760 meters (Pereyra et al., 1976). Greenland turbot are concentrated in an area located between Unimak Island and the Pribilofs, and in an area west of St. Matthew Island (Morris, 1981). The biomass of this species in the Bristol Bay area (where it is not as abundant) was estimated at 4,000 metric tons (USDOC, NMFS, 1980). Turbot also inhabit areas south of the Alaska Peninsula.

This species has complex seasonal movements that are not well understood. Greenland turbot generally are found at more shallow depths in the summer than in the winter (Morris, 1981).

Spawning occurs from October to December on the continental shelf and slope at water depths greater than 100 meters (Lewbel, 1983). The eggs are bathypelagic, developing in deep water. The larvae are pelagic, rising to more shallow waters (30-130 m). When they reach a length of approximately 80 millimeters, the larvae become demersal (Pereyra et al., 1976). Generally, juveniles are found in shelf waters at depths of less than 200 meters, and adults inhabit slope waters at depths of 200 meters or greater. They feed on a variety of pelagic and demersal fish and crustaceans (Lewbel, 1983).

Greenland turbot become almost exclusively piscivorous at a fairly small size (Livingston et al. 1986; Yang and Livingston 1988). Beyond sizes of about 20cm, turbot consume mostly walleye pollock. Turbot less than 50cm eat mostly age 0-1 pollock while turbot larger than 50 cm eat pollock 20-45cm in length. Other fish consumed include zoarcids, and deep-water fish such as bathylagids and myctophids. Cephalopods (mostly squid) are also an important dietary component. Young turbot (<20cm) eat mostly euphausiids.

Recent assessments (NPFMC 1987) indicate that exploitable biomass in 1988 is 414,000 mt. Stocks are characterized as average in abundance but are expected to decline due to poor recruitment.

Arrowtooth Flounder (Atheresthes stomias)

This species is the more common of the two arrowtooth flounder species in the eastern Bering Sea. This species is abundant on the continental slope in the southeastern, central, and northwestern Bering Sea at depths of 200 to 500 meters (Pereyra et al., 1976; Morris, 1981). During winter, arrowtooth flounder occupy deeper waters (300-500 m), and they migrate to more shallow waters (200-400 m) in the summer. These migrations are believed to be associated with changes in water temperature (Pereyra et al., 1976).

Arrowtooth flounder spawn from December to February. They release up to 500,000 eggs, which are bathypelagic (Pereyra et al., 1976). Larvae occupy shallow, nearshore shelf waters for several months prior to settling to the bottom (Morris, 1981). Juvenile fish gradually migrate to deeper waters. Their prey include crustaceans (euphausiids, shrimps, and crabs) and fish (pollock and other flatfish) (Lewbel, 1983).

Arrowtooth flounder have diets very similar to Greenland turbot: they are piscivorous from sizes less than 20cm and their diet is composed mainly of walleye pollock (Livingston et al. 1986; Yang and Livingston 1986). Euphausiids, shrimp and other fish such as zoarcids and flatfish are minor dietary components. Arrowtooth flounder consume mostly age 0-1 walleye pollock. These studies indicate that arrowtooth flounder feeds up in the water column using sight to locate their prey.

Recent assessments (NPFMC 1987) indicate that exploitable biomass in 1988 is 377,700 mt. Stocks are characterized as very high in abundance and are expected to increase.

Other Flatfish

This group of miscellaneous flatfish includes three predominant species: flathead sole, rock sole, and Alaska plaice.

Flathead Sole (Hippoglossoides elassodon): This flatfish is most abundant in the eastern Bering Sea. The species inhabits shelf and slope waters ranging from the surface to 550 meters (Lewbel, 1983). Flathead sole also are present south of the Alaska Peninsula.

Seasonal distributions of flathead sole change as the fish migrate from deeper waters inhabited in the winter to more shallow waters, where they spend the spring and summer. Adult fish overwinter on the outer shelf and upper slope at depths of 70 to 400 meters, and then migrate eastward to more shallow shelf waters of 20 to 180 meters (Pereyra et al., 1976). During the summer, flathead sole are widely distributed over the outer shelf from Unimak Island northwest to the central Bering Sea. These fish rise toward the surface at night, possibly to feed on pelagic organisms.

Flathead sole spawn from February to May within the shelf boundaries of the Bering Sea at depths of 50 to 150 meters (Lewbel, 1983). The eggs are pelagic and become widely distributed at depths ranging from 30 to 500 meters (Pereyra et al., 1976). The larvae are pelagic and float near the surface until they metamorphose and descend to the bottom. The area north of the Alaska Peninsula is an important nursery area (USDOC, NMFS, 1980).

Adults prey on benthic crustaceans and echinoderms in deeper waters (Lewbel, 1983). In shallow waters, adults feed on planktonic crustaceans and chaetognaths (Lewbel, 1983).

Flathead sole less than 25cm consume mostly small crustaceans such as mysids, gammarid amphipods, and crangonid shrimp (Livingston et al. 1986). Other invertebrates consumed are polychaetes and brittle stars. Small amounts of pandalid shrimp and Tanner crab are also eaten. Walleye pollock (age 0) may comprise about 20% by weight of the diet of both large (>25cm) and smaller (<25cm) flathead sole.

Rock Sole (Lepidopsetta bilineata): This species of flatfish is most abundant in the southeastern portion of the Bering Sea, where it inhabits shelf areas to depths of 300 meters (Pereyra et al., 1976). The rock sole biomass in Bristol Bay was estimated at 67,200 metric tons by the NMFS survey in 1975. This species is also present south of the Alaska Peninsula.

Seasonal movements of this species are not well understood, but they are believed to be similar to those of other flounders. Adults are believed to inhabit more shallow waters during the spring, summer, and fall.

Rock sole spawn from February to June at depths near 100 meters. Their eggs are demersal and adhesive. Larvae are pelagic and are believed to spend their first year near the spawning areas or in slightly more shallow waters.

Adult rock sole prey on benthic invertebrates, including mollusks, polychaetes, and crustaceans (Lewbel, 1983). They occasionally feed on other fish.

Alaska Plaice (Pleuronectes quadrituberculatus): Alaska plaice are found in the waters of the continental shelf in the Gulf of Alaska, Bering Sea, and Chukchi Sea. The eastern Bering Sea population of plaice appears to be restricted to shelf areas south of St. Matthew Island (Lewbel, 1983).

Alaska plaice make seasonal migrations from deeper shelf waters (130 m) to more shallow waters (30 m) during the summer and fall. During the winter and spring, they inhabit the deeper waters and spawn during the spring (late April to mid-June) at depths of 75 to 150 meters. The eggs are pelagic and widely distributed in the water column for up to 2 months prior to hatching. Larvae also are pelagic, but occur near the surface (Lewbel, 1983). Plaice prey upon benthic polychaetes, mollusks, and crustaceans (Lewbel, 1983).

Recent assessments (NPFMC 1987) indicate that exploitable biomass of other flatfish including flathead sole, rock sole, and Alaska plaice for 1988 is above 2.1 million mt. Stocks are characterized as very high in abundance and stable.

Sablefish (Anoplopoma fimbria)

In the Bering Sea, the sablefish (or black cod) is most abundant on the continental slope (200-600 m), where approximately 13% of the total species biomass is found (Pereyra et al., 1976). Although present in the Bering Sea, the greatest abundance of sablefish is in the Gulf of Alaska (Morris et al., 1983). This species occupies a wide range of depths from 0 to 1,200 meters (Pereyra et al., 1976). A small fraction of sablefish undergo extensive migrations in the North Pacific, but most undergo more localized movements (Pereyra et al., 1976; Wespestad et al., 1983).

Sablefish spawn during the winter at depths of 250 to 750 meters (Morris et al., 1983). Their pelagic eggs are buoyant and develop near the surface (Pereyra et al., 1976; Morris, 1981). Larvae also are planktonic and are common in surface waters of the shelf and in shallow bays and inlets during the late spring and early summer (Morris et al., 1983). One-year-old juveniles are found in shallow coastal waters (Morris, 1981). These shallow areas in and adjacent to the North Alaska Peninsula are important as a nursery area for sablefish (USDOC, NMFS, 1980). Gradually, the juveniles move into deeper waters and assume a demersal existence.

Sablefish are omnivorous and feed on both pelagic and benthic prey, depending on the season, location, and age of fish (Pereyra et al., 1976). Sablefish prey include squid, capelin, pollock, sand lance, herring, euphausiids, polychaetes, and crustaceans (Morris, 1981; Morris et al., 1983).

Recent assessments (NPFMC 1987) indicate that exploitable biomass for 1988 is 56,500 mt in the Bering Sea, 96,300 mt in the Aleutian Islands. Stocks are characterized as high in abundance; Bering Sea stocks are expected to decline somewhat due to poor recruitment but Aleutian Island stocks are stable.

Rockfish

Eleven known species of rockfish occur in the Bering Sea (Quast and Hall, 1972). Rockfish species are primarily demersal, but are distributed from the surface to depths of up to 2,800 meters (Hart, 1973). Because little is known about Bering Sea distributions of other rockfish species, only the Pacific Ocean perch will be discussed. Other rockfish are believed to have similar life histories.

Pacific Ocean Perch (Sebastes alutus): This rockfish is present in the Bering Sea in offshore waters at depths of 0 to 600 meters (Hart, 1973) and is commonly found in and along canyons and depressions on the upper continental slope (Pereyra et al., 1976). Two main stocks have been identified in the Bering Sea: an Aleutian stock (probably the most abundant), and a stock along the continental slope in the eastern Bering Sea with large concentrations from the Pribilofs to Unimak Island. Pacific Ocean perch (POP) also are known to be present along the southern side of the Alaska Peninsula.

Pacific Ocean perch mate during the fall and winter (October-February), and their live young are released in the following spring (March-June). The larvae are believed to be planktonic for approximately 1 year (Morris, 1981), after which the young become demersal at depths of 125 to 150 meters. Rocky areas and pinnacles are used as nursery areas for juveniles (Carlson and Straty, 1981). As the juveniles mature, they move into deeper waters.

Juvenile POP prey primarily on copepods. Adults feed on copepods, euphausiids, fish, and squid (Pereyra et al., 1976; Morris, 1981).

Recent assessments (NPFMC 1987) indicate that 1988 exploitable biomass for POP in the Bering Sea is 101,000 mt, 276,500 mt in the Aleutian Islands; exploitable biomass for other rockfish in the Bering Sea is 7,100 mt, and 18,500 mt in the Aleutians. POP stocks are characterized as below average in abundance but are expected to increase. Other rockfish stocks are characterized as average in abundance and stable.

Atka Mackerel (Pleurogrammus monopterygius)

Large schools of this species inhabit the upper water layers of the outer continental shelf; and they are found throughout the Bering Sea to its northern boundary, the Bering Strait (Andriyashev, 1954). Atka mackerel also are found south of the Alaska Peninsula, particularly near the Shumagin Islands.

Atka mackerel are pelagic during much of the year, but they migrate annually to moderately shallow waters where they become demersal during spawning (Morris et al., 1983). While spawning, they are distributed in dense aggregations near the bottom. Larvae are found north of the Alaska Peninsula from Port Moller southwest to Umnak Island, (Lewbel, 1983).

Spawning occurs from June through September (Musienko, 1970; Morris, 1981). Atka mackerel generally deposit their eggs on rocky substrates at 10 to 17 meters (Gorbunova, 1962), but also may deposit them on kelp (Andriyashev, 1954). The adhesive eggs hatch in 40 to 45 days (Musienko, 1970). The larvae are planktonic and are dispersed at distances of 320 to 800 kilometers from shore. The life history of young mackerel is not known.

Larvae feed on plankton soon after hatching (Gorbunova, 1962). Adults consume a variety of prey including plankton, microcrustaceans, euphausiids, and small fish (Andriyashev, 1954; Gorbunova, 1962; Rutenberg, 1962).

Recent assessments (NPFMC 1987) have had difficulty in estimating a specific figure for exploitable biomass, primarily due to the disjunct distribution of Atka mackerel. However, stocks are characterized as below average in abundance; future trends are unknown.

Squid

Two species, Berryteuthis magister and O. borealijaponicus, predominate in commercial catches in the Bering Sea and Aleutian Islands, respectively. Although little is known of their population dynamics, these stocks are characterized as average in abundance and stable.

Other Species

Other species in the groundfish complex include those for which there is only slight economic value at this time but for which there may be demand in the future. Because there is insufficient data to manage each of these species separately, they are considered collectively. The species include: skates, sharks, sculpins, octopuses, and smelts. Recent assessments (NPFMC 1987) indicate that exploitable biomass is on the order of 540,000 mt; stocks are considered to be at average abundance and stable.

2.2.3 Other Finfish and Shellfish Species

Pacific Halibut (*Hippoglossus stenolepis*)

Halibut is a flatfish species that is widespread on the shelf and slope to depths of up to 700 meters in the Bering Sea (Pereyra et al., 1976; Morris, 1981). Although more numerous in the Gulf of Alaska, halibut also are distributed throughout the eastern Bering Sea, from the Alaska Peninsula to as far north as Norton Sound and St. Lawrence Island. Substantial numbers of juvenile halibut are found distributed along the southern shore of the southeastern Bering Sea from Unimak Island into Bristol Bay (Thorsteinson, 1984).

During the winter months, ice covers much of the Bering Sea and water temperatures near the bottom drop to 0° C or lower, which forces the halibut to concentrate in the deeper, warmer waters along the continental edge. During this time, the major portion of the halibut population of the eastern Bering Sea occupies outer continental shelf and slope areas from Unimak Island to west of the Pribilof Islands (Webber and Alton, 1976). With the retreat of the ice and rising water temperatures in April and May, halibut migrate eastward along the northern side of the Alaska Peninsula into the more shallow (30-140 m) spring feeding areas of the inner shelf (Morris, 1981). Throughout the summer and fall, halibut are found scattered over the shelf in shallow waters. With declining bottom-water temperatures in the late fall, halibut migrate back to the deeper waters of the continental slope (250 to 550 m) where they overwinter and spawn (Morris, 1981).

Spawning occurs from October to March (Novikov, 1964; Lewbel, 1983) along the continental shelf at depths from 228 to 456 meters (Bell, 1981) between Unimak Island and the Pribilofs (Best, 1981). Females release up to 2 million pelagic eggs (Lewbel, 1983), which hatch after approximately 15 days (Webber and Alton, 1976), depending on water temperature (Forrester and Alderice, 1973). Larvae are planktonic for 6 to 7 months prior to metamorphosis (Webber and Alton, 1976; Morris et al., 1983). Larvae have been caught over the continental slope and in deeper water, and a few have been caught on the edge of the continental shelf, distributed in a narrow band extending from the vicinity of Unimak Pass to northwest of the Pribilofs (Waldron, 1981). Later larval developmental stages tend to rise in the water column, where they are moved by winds into more shallow shelf waters (Gusey, 1978).

Juveniles settle to the bottom in shallow, nearshore nursery areas (Best, 1981). Juveniles also undergo seasonal movements related to water temperatures as described by Best (1981). During winter months, ice cover and cold water temperatures force them to concentrate in deeper waters (330 to 370 m) between Unimak Pass and the Pribilof Islands. As the ice retreats and the water warms in the spring, juveniles disperse over the shallow flats, which provide suitable habitat for a nursery for young halibut. In April, halibut have been found concentrated near the northern entrance of Unimak Pass at depths of 80 and 104 meters. As warming continues, juveniles move eastward along the northern side of the Alaska Peninsula and are found throughout Bristol Bay in June. Large numbers of juveniles have been caught in the eastern Bering Sea from Unimak Island to Bristol Bay (Thorsteinson, 1984).

In the 1960s, halibut stocks in the eastern Bering Sea supported an intensive fishery, which resulted in a reduction in the population. Both the high level of exploitation and the large incidental catches of immatures by foreign trawlers contributed to this decline in abundance. The stock has increased since the reduction in incidental catch.

Halibut are omnivorous and consume a variety of prey, which vary with age and area of the halibut. Halibut of up to 30 centimeters feed primarily on crustaceans, such as shrimp and small crabs (Novikov, 1964; Morris et al., 1983). Adult fish consume a wide variety of crustaceans and fish including flatfishes, smelt, capelin, pollock, sand lance, and particularly yellowfin sole (Novikov, 1964). Halibut prey heavily on yellowfin sole, and the summer distribution of halibut in the Bering Sea is believed to be determined largely by the movements of yellowfin sole (Novikov, 1964).

Recent assessments (IPHC 1988) indicate that exploitable biomass in the Bering Sea/Aleutian Islands has dramatically increased from the 1970s, but is still somewhat lower than a biomass that would support MSY.

King Crab

Red King Crab (Paralithodes camtschatica): King crab are the most prominent members of the epifaunal community of the southeastern Bering Sea (Lewbel, 1983). They inhabit the continental shelf at depths up to 400 meters. Red king crab are concentrated immediately north of the Alaska Peninsula and around Bristol Bay.

Historically, the abundance of the red king crab population in the southeastern Bering Sea has been cyclic on 7- to 14-year intervals influenced primarily by environmental conditions (Thorsteinson, 1984). Cycles of abundance suggest that year-class failure or success may be based on survival of critical lifestages (i.e., larvae and young juveniles) in nearshore areas (Armstrong et al., 1983). Instantaneous mortality rates of juvenile and sublegal, sexually mature crab are estimated to be low, approximately 10% per year, until entering the fishery (Balsiger, 1976; Reeves and Marasco, 1980). Consequently, the size of a future fisheries cohort is determined predominantly by reproductive success and survival of larvae and young of the year (0+ crab) in nursery areas.

Larval survival is influenced strongly by water temperature (Kurata, 1960, 1961; McMurray et al., 1983), and also by food supply and predation (Armstrong et al., 1983). Lethal temperatures are those greater than 15° C or lower than 0.5 to 1.8° C (Kurata, 1960) and survival of zoeae is greater between 5 to 10° C (McMurray et al., 1984). In addition, the number and location of spawning females may significantly influence larval survival and location of megalopae relative to optimal substrates at metamorphosis (Armstrong et al., 1983).

Although the magnitude of initial larval hatch and numbers surviving to metamorphosis may be important determinants of year-class strength, the geographic location of survivors at metamorphosis may be more important if refuge habitat is scarce and/or patchy. If optimal bottom type does not occur uniformly along the North Aleutian Shelf into Bristol Bay, location of spawning female populations and the interplay of oceanographic factors and influences (i.e., currents and direction, windspeed and direction) during development time could be the major determinants of placement and survival rates of larvae over optimal bottom types at metamorphosis (Armstrong et al., 1983).

Any source of mortality that substantially reduces numbers of large males could threaten the breeding potential of the red king crab population. Insemination of larger females by smaller males results in reduced clutch size. A male-female weight ratio of 1:7 is required for 100% copulation (Reeves and Marasco, 1980); below this weight, smaller males have less success breeding mature females. This may have been the case in the 1982 National Marine Fisheries Service observations, which found an unusually large number of barren female crabs (i.e., which had not extruded eggs) in a year of very low male abundance. It is not clear whether or not there is a relationship between spawners and eventual recruits for this species (Reeves and Marasco, 1980).

The abundance of male red king crabs in the southeastern Bering Sea decreased from 1981 through 1985, but the population is now increasing. As summarized in Reeves (1985), the precipitous decline in this stock may have resulted from the occurrence of weak year-classes recruiting to the fishery and increased mortality among adult, and especially sublegal crabs, of these weaker year-classes (Reeves, 1985). The occurence of weak year-classes is related to conditions that affect survival during the immature lifestages. Increased mortality of adult crabs appears to be related to a number of factors, including predation by halibut, Pacific cod, and yellowfin sole; competition; fishery effects (handling mortality); disease; and temperature; all of which showed some correlation. No single factor showed a dominant correlation, however, when factors were grouped (i.e., halibut and yellowfin sole predation, catchers/processors, and temperature), correlations increased. Apparently, many factors may influence the declines in this population.

The life cycle of the red king crab is characterized by a spring spawning migration and a summer-fall feeding migration. Beginning in January, females move from deep, offshore waters into more shallow, coastal waters (70 m or less) north of the Alaska Peninsula. Males are more abundant in the deeper waters farther offshore to the north and west of the Alaska Peninsulain the winter, and they migrate into the more shallow waters in or near the Alaska Peninsula a month later than the females to mate. Pereyra et al. (1976) indentified spawning areas near Amak Island and in the Black Hills-Port Moller areas. Reviews of studies have indicated that spawning occurs in nearshore waters between

Unimak Island and Cape Seniavin (Armstrong et al., 1983; McMurray et al., 1984). After mating, the males and the ovigerous females feed in coastal areas before returning to deeper waters in the late summer or fall. Eggs are carried by the females for approximatley 11 months before hatching after the females have returned to nearshore waters. Hatching generally occurs from April 1-20, although the timing can vary up to a month (Weber, 1967; Haynes, 1974).

Red king crab larvae are present in nearshore areas from April to August. Important larval release areas are the Port Moller area and off the Black Hills area of the Alaska Peninsula (Lewbel, 1983). Larvae develop at depths of 40 to 70 meters (Armstrong et al., 1981). They are found only immediately off the North Alaska Peninsula and in a nearshore band that extends from Unimak Pass northeast into Bristol Bay along the 50-meter isobath (Fig. 2). The highest known densities of red king crab larvae occur from western Unimak Island to Port Moller, but the extent and abundance of larvae from Cape Seniavin into Bristol Bay remain unknown (McMurray et al., 1984). The larvae are planktonic and tend to drift northeastward with the prevailing water currents along the Alaska Peninsula toward Bristol Bay, and may be carried quite some distance before reaching the benthic stage (Haynes, 1974; Hebard, 1979). Data on development time and current speeds (Kinder and Schumacher, 1981b) suggest that larvae could be transported more than 200 kilometers during the time from hatch to metamorphosis. By August, inshore areas contain very low densities of larvae. Relatively heavy pelagic larval distributions have been found from the Black Hills area to Port Heiden, with largest concentrations found 200 km offshore between Cape Seniavin and Port Heiden (Armstrong et al., 1983), which correlates with high concentrations of phytoplankton. Red king crab larvae also exhibit a diel vertical migration, which probably is influenced by tidal action. The larvae pass through several molts before finally settleing to the bottom as juveniles.

The juveniles migrate into shallow waters and starting at age 3, form dense pods (thousands to hundreds of thousands of individuals) that inhabit the intertidal and shallow subtidal zones. Smaller juvenile crabs (to 60 mm carapace length) have not been caught by nets in the NMFS survey area, and are consequently presumed to be concentrated in nearshore areas. Larger juveniles (to 110 mm) are found on the coastal, middle, and outer shelf around the 50-100 meter isobaths (Kinder and Schumacher, 1981a). Age-3 to -5 juveniles appear to form pods in the Port Moller area at water depths of 40 to 60 meters. The nearshore area along the northern side of the Alaska Peninsula also has extensive gravel and rocky substrates necessary for the survival of the early benthic lifestages of this species (Sharma, 1979). This substrate also supports the invertebrate fauna that are food for juvenile red king crab (Armstrong et al., 1983). It is hypothesized that postlarval survival is related to settlement onto this refuge habitat that is thought to consist of gravel or larger-sized rocky substrates inhabited by several attached epifaunal invertebrates, which are food for juvenile crab and the vegetation that provides protective cover for these juveniles. King crab mature sexually at 5 or 6 years of age, at which time podding behavior ceases and they join the seasonal feeding and breeding migrations of adults.

Planktonic larval crabs feed on phyto- and zooplankton. Juveniles feed on diatoms, protozoa, algae, echinoderms, small mollusks, and other benthic species. Adult king crab are omnivorous and feed on small benthic inverte-brates, including bivalves, gastropods, polychaetes, brittle stars, and Tanner crab. They also feed on small fish and dead organisms. Age-3 to -5 juveniles appear to form pods in the Port Moller area at water depths of 40 to 60 meters. Waters to the east of Port Moller are very important to red king crab.

Recent assessments (Stevens et al. 1987) indicate that numbers of legal male crabs are increasing and that recruitment is improving.

Blue King Crab (Paralithodes platypus): This king crab species is lesser in both abundance and distribution to the red king crab, with some populations along the Asian coast and the eastern Bering Sea, near the Pribilofs Saint Lawerence, and St. Matthew islands. There are also some numbers of this crab in Herenden Bay on the North Alaska Peninsula.

The life history of the blue king crab is similar to that of the red king crab excepting that reproduction in this species may be only biennial with a later spawning period during the spring. Habitat conponents may also be more specific as juvenile blue king crab seem to be concentrated over limited areas of "shell bash" substrate near the Pribilofs during a part of their life cycle. This substrate affects protection from predators and also harbors the food organisms on which these crab subsist.

Recent assessments (Stevens et al. 1987) indicate that although numbers of legal male crabs may be increasing, the fishery is stable but poor, with future recruitment questionable due to inadequate data.

Tanner Crabs (Chionoecetes opilio and C. bairdi)

Two species of commercial importance are distributed widely throughout the southeastern Bering Sea. These species generally occur at depths of 40 to 100 meters and greater (Lewbel, 1983). Chionoecetes opilio is common throughout the southeastern Bering Sea. Chionoecetes bairdi is concentrated in two areas: around the Pribilof Islands and immediately north of the Alaska Peninsula (Jewett and Feder, 1981). In the southeastern Bering Sea, this species was common only at depths below 100 meters. Tanner crab populations are cyclic. The stocks have been depressed, but are currently stable and recovering slowly. Both species may have distributions and abundances inversely related to the densities of king crabs (Gusey, 1978).

Tanner crab make seasonal movements related to spawning. They move into more shallow waters (less than 100 m) in the spring and summer for spawning. During the fall and winter, they inhabit deeper waters.

Tanner crabs breed in shallow shelf waters from January to May. Eggs are carried by females on their abdomens for approximately 11 months. Hatching is temperature-dependent. Chionoecetes bairdi eggs have a prehatching mortality of approximately 20% (Thorsteinson, 1982). The larvae are pelagic and concentrated in nearshore areas in the upper 60 meters of water (Thorsteinson, 1984) for approximately 3 months, depending on the availability of food and on water temperatures. Juveniles are bottom dwellers. The area north of the Alaska Peninsula is a nursery area for Tanner crab. There is a higher abundance of C. bairdi larvae and juveniles in the outer Bristol Bay, although larvae of both species are present from April through October (Thorsteinson, 1984).

Tanner crab larvae feed on phyto- and zooplankton. As demersal juveniles, they feed on benthic diatoms, hydroids, and detritus. Adults consume dead mollusks and crustaceans and prey on shrimp, polychaetes, clams, hermit crabs, and brittle stars.

Recent assessments (Stevens et al. 1987) indicate that both populations and fisheries are improving, with significant increases in juvenile abundance and recruitment.

Dungeness Crab (Cancer magister)

The shallow, nearshore waters north and south of the Alaska Peninsula are the northern limit of this species. They inhabit bays, estuaries, and open-ocean, nearshore areas from the intertidal zone to depths of 90 meters. There is a seasonal movement to more shallow waters associated with breeding.

Dungeness crab mate from July to September. The females carry the eggs for 7 to 10 months before the eggs hatch in April and May. The larvae are planktonic for 3 to 4 months before molting to juveniles. Juveniles generally are associated with stands of eelgrass or, in the absence of eelgrass, with masses of detached algae that are believed to provide them protection from predation.

Korean Hair Crab (Erimacrus isenbeckii)

The Korean hair crab occurs in water depths of 10 to 360 meters. The largest concentrations of this species are found in the shallow waters along the northern shore of the Alaska Peninsula and around the Pribilof Islands. Hair crabs hatch in the spring, and the larval stage lasts approximately 5 months (Armstrong et al., 1983).

Recent assessments (Stevens et al. 1987) indicate that the fishery is declining although juvenile production is apparently improving.

Shrimp

Two commercially important species of shrimp are common throughout the Bering Sea, pink shrimp (Pandalus borealis) and humpy shrimp (P. goniurus). They are most abundant along the central outer shelf and slope of the Bering Sea. The pink shrimp inhabits depths of 85 to 110 meters in zones of deep, warm waters and is found concentrated near Nome and northwest of St. Paul Island (Lewbel, 1983). The humpy shrimp is found at similar depths, but in cooler waters, with a concentration between the Pribilof Islands and Bristol Bay.

Pandalid shrimp spawn in September and October. Eggs are carried on females during the winter and hatch the following spring. The larvae spend 2 to 3 months in the nearshore plankton, feeding and molting before they metamorphose to juveniles and assume the semidemersal habit of adults. Juveniles inhabit waters less than 40 meters deep in the winter and deeper waters in the summer (University of Alaska, AEIDC, 1974).

The larvae feed on diatoms and plankton. Adults feed on benthic organisms, including polychaetes, and small crustaceans pandalidicl shrimp make diurnal feeding migrations, rising in the water column at night to feed (Thorsteinson, 1984).

Bivalve Mollusks

Although bivalves are widely distributed on the shelf, they are concentrated in the midshelf region of the Bering Sea (Lewbel, 1983). Some species are found in the nearshore surf zones. The Pacific razor clam (Siliqua patula) is found on sand beaches of the Alaska Peninsula, including Izembek Bay and Bechevin Bay (Nickerson, 1975). Other clams inhabiting the Alaska Peninsula include the surf clam (Spisula polynyma), distributed between Port Moller and Ugashik Bay; the Great Alaskan Tellin (Tellina lutea); two species of cockle (Serripes groenlandicus and S. laperousii); and other less frequently taken species. The surf clam biomass has been estimated at 286,184 metric tons and the Great Alaskan Tellin biomass has been estimated at 82,000 metric tons (Hughes et al., 1977).

Clams generally spawn in the summer during periods of warmer water temperatures. The eggs and/or larvae may be planktonic before metamorphosing into sedentary juvenile stages.

Large Gastropods

These snails are concentrated along the outer shelf at depths from 40 to 100 meters. Neptunea heros and N. ventricosa are the dominant species. From May to October, they produce eggs that hatch after about 3 months. Neptuniids prey on polychaetes, bivalves, barnacles, crustaceans, and fish (MacIntosh and Somerton, 1981).

Pacific Salmon (Onchorynchus sp.)

Five species of Pacific salmon inhabit the waters of the eastern Bering Sea: chinook (king), sockeye (red), coho (silver), pink (humpback), and chum (dog). Their feeding migrations in the North Pacific and the Bering Sea are extensive, and salmon migrate long distances to their spawning streams. Salmon runs fluctuate greatly from year to year, largely dependent on climatic factors during egg development and during early fry stages.

The life history of the Pacific salmon occurring within the eastern Bering Sea has been separated into three phases for consideration (Thorsteinson, 1984): (1) seaward migration of juveniles through the area; (2) temporary residence of immatures in and adjacent to the area; (3) and return spawning migrations of adults through the area. Adult salmon migrating through the eastern Bering Sea are a complex mixture of stocks of five species returning to streams on the northern side of Unimak Island or the Alaska Peninsula, in Bristol Bay, or farther north along the Bering Sea coast (Thorsteinson, 1984). Adult salmon are present in the area from May through October, and a number of immatures are present in the area year-round.

In general, the life histories of the five species in this area are similar. Adults migrate through the eastern Bering Sea area to their natal streams for spawning. Chinook are the first to enter coastal areas, followed in order by sockeye, chum, pink, and coho (Thorsteinson, 1984). Migration rates from the shelf edge to the Kvichak River in Bristol Bay were estimated by Straty (1981) as ranging from 45 to 60 kilometers per day. Along the southeastern Bering Sea coast, salmon migrate in a band that extends to 162 kilometers offshore, with a center of abundance 50 to 100 kilometers from shore (Straty, 1981). Once they reach their spawning grounds, salmon deposit their eggs in the gravel beds of streams, rivers, or lakes (depending on the species and its origin). Alevins hatch in the winter and remain in the gravel substrate until they have absorbed their yolk sacs in the spring. They emerge from the gravel as fry, some of which stay in fresh water for a period ranging from a few weeks to 1 or more years, while others migrate immediately to the sea.

Juvenile salmon are present in the nearshore waters of the eastern Bering Sea from May through September annually (Straty, 1974). Outmigration of Juvenile salmon is species- and stock-specific and varies with annual differences in environmental conditions (i.e., ice breakup on lakes and streams, over-winter stream-water temperatures).

Only sockeye salmon have been studied sufficiently to describe their seaward migration in some detail; however, general information on outmigration of all five species is known. After entering the Bering Sea, juvenile salmon remain in nearshore waters for varying lengths of time and grow rapidly during the initial few months of seaward migration (Hart et al., 1967; Straty, 1974; Barton, 1979a). Observations from other ocean waters off Alaska indicate that coastal movement during the first few months of seaward migration is typical behavior for Pacific salmon throughout their range (Straty, 1981). Juveniles move along the coastline of the southeastern side of Bristol Bay and the northern side of the Alaska Peninsula. The migratory route apparently is determined by salinity gradients and water temperatures (Favorite et al., 1977; Straty and Jaenicke, 1980). Speed of migration is determined in large part by water temperatures and consequent growth and energy rates (Straty and Jaenicke, 1980). With increased growth in these nearshore areas from early summer to late fall, the fish move offshore to more pelagic regions (Straty, 1974; Barton, 1979). This offshore migration is species-specific and variable according to annual differences in time of entry into the Bering Sea. Infor-mation on shelf distribution of juvenile salmon after leaving coastal waters is only fragmentary (Straty, 1981).

Offshore, adults are epipelagic, usually found in the upper 10 to 30 meters of water. Adults spend 1 to 4 years at sea (depending on the species), return to their natal streams to spawn, and subsequently die. Maturing salmon are most abundant in the southeastern Bering Sea shelf region from mid-May to early September and are concentrated in the upper 5 meters of water (Hokkaido University, 1965, 1968).

Sockeye Salmon (Oncorhynchus nerka): This species is the most important commercial salmon of the Bering Sea. Sockeye spawning runs are widespread throughout Bristol Bay and along the northern side of the Alaska Peninsula. Bristol Bay produces more sockeye than any other area in the world. Major Bristol Bay runs are in the Kvichak, Naknek, and Nushagak Rivers. Bristol Bay sockeye runs peak every 5 years. On the northern side of the Alaska Peninsula, nearly every drainage supports a run of sockeye. Major runs occur in the area from the Bear River to north of Port Moller, and in the Nelson, Sandy, and Ilnik Rivers. On the southern side of the Peninsula, there are numerous, but small, runs including those on Shumagin Island and in the Stepovak and Chignik Rivers.

Mature sockeye have been captured in many places throughout the Bering Sea during their spawning migrations. In May and early June, stocks from the northern portions of the Bering Sea and stocks from the Gulf of Alaska which have migrated through the Aleutian passes begin to move into Bristol Bay. These prespawning adults concentrate in two bands offshore (one north and one south of the Pribilof Islands), and traverse Bristol Bay as they migrate to rivers around Bristol Bay, along the northern side of the Alaska Peninsula and in Kuskokwim Bay. Spawning runs occur from July to September (Musienko, 1970; Barton, 1979; Morrow, 1980), with sockeye most abundant on the southeastern Bering Sea shelf between mid-June and late July as they migrate to their natal streams (Thorsteinson, 1984). Following spawning, fry emerge in the spring, generally between April and June (Morrow, 1980). A few sockeye populations have individuals that migrate immediately to the sea, but most sockeye spend 1 to 2 years in fresh water before migrating to the ocean (Lewbel, 1983).

Juveniles are abundant in the eastern Bering Sea from mid-May through at least September (Thorsteinson, 1984). Juveniles originating in rivers along Bristol Bay and along the northern side of the Alaska Peninsula enter the Bering Sea at different times during late spring and early summer, depending on environmental conditions. Young sockeye leave Bristol Bay from mid-May to August, with a peak around June. Juveniles leave the northern side of the Alaska Peninsula during the same period, but peak later. Young sockeye entering the sea are segregated during the first weeks of seaward migration by age, class, and origin, so they are distributed throughout most of the migration-route area from late May through late July. From late May to early August, the greatest biomass of juveniles occurs along the coast of Bristol Bay to northeast of Port Heiden (Straty, 1974). Food is less abundant in inner Bristol Bay than farther seaward, so juveniles move rapidly to the Port Heiden area, which has a more abundant food supply (Thorsteinson, 1984). After early August, the majority of the sockeye occur west (seaward) of Port Heiden. The young move westward along the northern shore of the Alaska Peninsula, and eventually turn north or move south through the Aleutian passes. From late May to late September, the juveniles travel in a belt between the coast and 48 kilometers offshore, avoiding the colder offshore waters (Thorsteinson, 1984). These seaward-migrating juveniles are most abundant in the upper 2 meters of the water column during the day and in the uppermost meter at night (Straty, 1974). Sockeye usually spend 1 to 3 years in the sea before returning to their natal streams to spawn.

Juveniles feed on euphausiids, copepods, cladocerans, and sand lance. Adults prey on copepods, euphausiids, amphipods, and small fish (Hart, 1973; Nishiyama, 1977; Morrow, 1980).

Chinook Salmon (Oncorhynchus tschawytscha): Chinook are widely distributed throughout the Bering Sea, but are relatively low in abundance. This salmon species comprises approximately 2.2% of the commercial catch for the Bering Sea (Straty, 1981). Bristol Bay supports approximately 40% of the total annual chinook production (Straty, 1981).

Chinook salmon enter the Bering Sea through Unimak Pass and migrate some distance offshore through the Bering Sea toward their natal streams along the Alaska Peninsula and Bristol Bay. This species is more abundant farther offshore of the northern side of the Alaska Peninsula than sockeye (Thorsteinson, 1984). The Nushagak River supports the largest run of chinook into Bristol Bay, but the Togiak, Alagnak, Naknek, and Mulchatna River systems all support major runs. Bristol Bay-area populations have increased in recent years; runs in 1981 and 1982 were particularly high. Streams and rivers on the northern side of the Alaska Peninsula also support significant numbers of spawning salmon, particularly the Sapsuk River system (Nelson Lagoon), the Meshik River system (Port Heiden), and the Cinder River.

Chinook spawning migrations into Bristol Bay occur from mid-June to July. Eggs hatch in 7 to 12 weeks, and alevins generally emerge in 2 to 3 weeks. Chinook fry live in fresh water for 1 to 2 years before migrating to the sea. Juveniles are most abundant along the southeastern coast of the Bering Sea; few have been caught in Bristol Bay, perhaps because sampling has not been conducted during periods of assumed peak abundance (late April-May) or because, for some unexplained reason, they have been missed by fishing gear (Thorsteinson, 1984). After migrating to the sea, smolts remain in coastal waters during their initial months (Straty, 1981). Juveniles move out of coastal waters, migrating seaward during May and early June, earlier than the offshore migration of other salmon species (Thorsteinson, 1984). Immatures spend 1 to 6 years in the ocean before returning to spawn. Thorsteinson (1984) reported that 2% of the immatures had spent 1 year at sea; 77% had spent 2 years; 19% had spent 3 years; and 2% had spent 4 to 6 years. Maturing chinook have been captured throughout the Bering Sea during their spawning migrations, but the route of this migration has not been established in detail. Straty (1981) hypothesized that chinook follow the same migration route as other salmon species in responding to the same environmental clues.

Scott and Crossman (1973) reported that 97% of the chinook diet consists of herring, sand lance, capelin, and smelt. Although chinook are highly piscivorous, they also consume some squid, amphipods, euphausiids, and crustaceans.

Pink Salmon (Oncorhynchus gorbuscha): Of the three commercially important salmon species in the Bering Sea, pink salmon is the least abundant. Within the Bering Sea, 92% of the pink salmon production is from Bristol Bay (Lewbel, 1983), where the primary system is the Nuyakuk River, a tributary to the Nushagak River. On the northern side of the Alaska Peninsula, pink salmon are not abundant, but they occur in limited numbers in several systems in Bechevin Bay.

Pink salmon have been captured throughout offshore areas of the Bering Sea during their spawning migrations. The heaviest concentrations are in two bands north and south of the Pribilof

Islands. The band south of the Pribilofs, which migrates through Bristol Bay, heads primarily for rivers entering Bristol and Kuskokwim Bays and a few streams along the northern side of the Alaska Peninsula. Spawning runs occur from July to October. Pink salmon rarely migrate more than 160 kilometers upstream, and some spawn in intertidal areas (Lewbel, 1983). The young hatch from December to February and remain in the gravel as yolk-sac larvae until spring.

After emerging, fry immediately migrate seaward, where they form large schools in estuaries and remain nearshore for their first summer. Juveniles captured in Bristol Bay after late June are primarily in coastal areas of inner Bristol Bay east of 159˜W longitude, where they increase in abundance from late June through mid-August (Thorsteinson, 1984). Pink salmon do not reach the outer coastal areas of inner Bristol Bay until late August and September, (Thorsteinson, 1984). Once in the sea, fry remain on the continental shelf in areas with estuarine salinities (Straty, 1981). Adult pink salmon are widely distributed during their ocean period. With few exceptions, they return to spawn after 2 years. Prey of adult pink salmon are believed to be similar to that of other salmon species, including euphausiids, squid, amphipods, and small fish.

Chum Salmon (Oncorhynchus keta): Chum salmon are widely distributed through-out the Bering Sea. During their spawning migrations, chum are more exten-sively distributed throughout the Bering Sea than are sockeye (Thorsteinson, 1984). In Bristol Bay, chum salmon are produced largely in the Nushagak, Togiak, and Naknek-Kvichak River systems. Bristol Bay chum populations are stable. On the northern side of the Alaska Peninsula, major systems used by this species include: Izembek-Moffet Bay, Bechevin Bay, the Sapsuk River (Nelson Lagoon), Herendeen-Moller Bay, and Frank's Lagoon. Populations in these areas fluctuate in size.

Chum salmon use areas in and adjacent to the North Alaska Peninsula for their spawning migrations and their seaward migrations as juveniles. During their spawning migrations, chum concentrate in two bands north and south of the Pribilofs. The southern band traverses Bristol Bay and includes fish returning to rivers in Bristol and Kuskokwim Bays and on the northern side of the Alaska Peninsula. While migrating through outer Bristol Bay, these salmon begin to segregate according to the location of their spawning streams. By mid-June and late July, they are most abundant on the southeastern Bering Sea shelf, with largest numbers found in estuaries and at the mouths of streams. Most populations of chum salmon are fall spawners (August-November) (Lewbel, 1983). Chum salmon sometimes spawn in intertidal areas.

Following emergence, fry migrate to the sea. Small numbers of young have been captured in the coastal waters of Bristol Bay as early as mid-June, but they generally are not abundant until after mid-July (Thorsteinson, 1984). Once they reach the sea, juveniles remain in nearshore areas for several months before migrating offshore in the early fall. Young fish follow estuarine salinities as they feed and migrate along the continental shelf (Straty, 1981). Juveniles have been found to remain abundant along the southwest coast of Bristol Bay (seaward of 159 degrees W longitude) through August and until at least mid-September (USDOC, NOAA, NMFS, 1966-72). Chum generally spend 3 to 4 years at sea before returning to fresh water to spawn. Adults feed on euphausiids, amphipods, squid, and planktonic crab larvae (Hart, 1973).

Coho Salmon (Oncorhynchus kisutch): Coho is the least abundant salmon species in the Bering Sea. The most abundant populations of maturing coho in the Bering Sea (in decreasing order) are in Kuskokwim Bay, Bristol Bay, and along the northern side of the Alaska Peninsula (Straty, 1981). Coho are found in streams throughout Bristol Bay, but are harvested primarily in the Nushagak and Togiak Rivers. On the northern side of the Alaska Peninsula, coho are harvested at Nelson and Swanson Lagoons, and at the Ilnik River, Port Heiden, and the Cinder River.

Mature coho salmon enter the Bering Sea shelf areas in mid- to late July on their spawning migrations and begin to congregate at river mouths in late summer. Spawning runs are generally from September to October. Fry emerge from the gravel from March to July, depending on water temperatures (Hart, 1973; Scott and Crossman, 1973). Juveniles remain in fresh water for 1 to 3 years before entering the ocean.

Coho is the salmon species whose juveniles enter Bristol Bay latest each year on their seaward migrations. Although they have been captured along the southeast coast of Bristol Bay as early as mid-June, coho are not abundant until late June or early July (USDOC, NOAA, NMFS, 1962-66); they remain abundant throughout July and August. Smolt remain nearshore and near-surface for several months, feeding before moving farther offshore.

Juveniles feed on small fish and planktonic crustaceans. Adults feed on squid, euphausiids, and small fish. Herring and sand lance may make up to 80% of the adult coho diet (Morrow, 1973; Scott and Crossman, 1973).

Forage Fishes

This is a broad term for generic classification purposes to encompass the generally smaller pelagic and some demersal fishes on which larger fishes and other marine animals prey. Of the group, the Pacific herring may be a major portion of the diet of many of the larger pelagic fishes, marine birds, and mammals although in itself it is of commercial value. Forage fishes may also be characterized by their schooling behavior.

Pacific Herring (Clupea harengus pallasi): This pelagic species is abundant and widespread in the Bering Sea, where it is important both commercially and as a forage fish. Herring migrate along the Alaska Peninsula as they move from their shallow, coastal spawning areas to offshore overwintering grounds. The nearshore areas used for spawning, are generally from Togiak in Bristol Bay northward to Nelson Island although some spawning also occurs along the North Slope Peninsula.

Herring have a seasonal distribution in the Bering Sea. This species over-winters in offshore waters near the edge of the continental shelf. Identified overwintering grounds include an area between St. Matthew Island and the Pribilofs (Warner and Shafford, 1981; Wespestad and Barton, 1981), and the Navarin Basin (Morris, 1981; Wespestad and Barton, 1981). In the spring, adults migrate from their overwintering grounds, through or along the lease area, to nearshore spawning areas. This major wintering ground of eastern Bering Sea herring is northwest of the Pribilofs, between approximately 57 and 59° N latitude, and encompasses an area of 1,600 to 3,000 square kilometers (Shaboneev, 1965) which shifts in relation to the severity of the winter. In mild winters, herring concentrate farther north and west, and in severe winters, further south and east. Dense schools are found during the day a few meters off the bottom at depths of 105 to 137 meters, at water temperatures of 2 to 3.5° C (Dudnik and Usoltsev, 1964). Very few are found in more shallow areas on the continental shelf, where lower temperatures prevail. Distinct diurnal, vertical migrations occur in early winter; however, as the season progresses, diurnal movements diminish and herring remain on-bottom during the day and slightly off-bottom at night (Shaboneev, 1965). Only a small number of herring are believed to remain offshore in the summer; most inhabit coastal waters. Herring are believed to remain in coastal waters in the summer because of heavy phytoplankton blooms (1-3 g/m2) in nearshore waters and poor feeding conditions on the outer shelf (Rumyantsev and Darda, 1970). In late summer, herring migrate along the coast and concentrations begin reappearing in offshore waters in the areas of Nunivak and Unimak Islands in August (Rumyantsev and Darda, 1970). Migrations to the winter grounds continue through September, with the herring progressively moving to deeper water and concentrating in the 2° to 4° C temperature stratum (Wespestad and Barton, 1981). Mature fish arrive at the wintering grounds before the immature fish arrive (Rumyantsev and Darda, 1970), with concentration in wintering grounds beginning in October (Wespestad and Barton, 1981).

Pacific herring spawn in two types of habitats along the northern side of the Alaska Peninsula: (1) rocky headlands and (2) intertidal or shallow subtidal bays and lagoons (Barton, 1978; Hameedi, 1982). The preferred spawning substrate is vegetation, usually rockweed kelp (Fucus) or eelgrass (Zostera) (Barton, 1979b; Morris, 1981; Warner and Shafford, 1981). During dense spawning, other substrates may be used, including bare rock, pilings, and submerged tree branches (Reid, 1972; Hart, 1973). South of Norton Sound, most spawning occurs on Fucus in the intertidal zone (Wespestad and Barton, 1981).

The relative abundance of spawning herring along the northern side of the Alaska Peninsula (Port Moller and Port Heiden) is low compared to other areas (i.e., Togiak, Cape Newenham) (Wespestad and Barton, 1981). In the eastern Bering Sea, herring biomass was estimated to be 2.16 million metric tons, based on a Soviet hydroacoustic survey of the wintering grounds in 1963 (Shaboneev, 1965). Spawning time varies with latitude, beginning earlier in the south (i.e., late May at Port Moller) (Rumyantsev and Darda, 1970; Barton, 1979). Some herring spawn for the first time at age 2, but the majority do not spawn until ages 3 (50% mature) and 4 (78% mature) (Wespestad and Barton, 1981). By age 5, 95% of the population has matured (Rumyantsev and Darda, 1970). Sexual maturity of eastern Bering Sea herring coincides with recruitment into the fishery, primarily at ages 3 and 4 (Wespestad and Barton, 1981).

Herring eggs hatch in 10 to 23 days (Musienko, 1970; Hart, 1973) depending on water temperature. Hatching success is usually low due to failure of fertilization, dessication during low tides, uprooting of substrate, or predation. A hatching rate of 50% is considered high, but hatching success may be as low as 1% (Morris et al., 1983). Larvae are pelagic drifters during their 6- to 8-week planktonic stage. Concentrations of larval herring occur in nearshore areas. Larvae generally remain within the vicinity of their hatching locations (Checkley, 1983a). The distribution and abundance of herring larvae are related to the presence of abundant prey (copepod, nauplii, and microzooplankton) (Checkley, 1983b). In ichthyoplankton surveys, herring larvae have been collected in shallow waters in Bristol Bay and Norton Sound, and are scarce in offshore areas (outside the intertidal areas, where spawning occurs) (Waldron, 1981). Larval mortality is also high and has been attributed to larvae being caught in offshore currents and presumably perishing (Morrow, 1980).

After larval metamorphosis, free-swimming juvenile herring inhabit kelp beds for protection during their first summer. By fall, they form dense schools and start to move offshore (Taylor, 1964). The movements of juveniles in the Bering Sea from the time they leave the coast following their first summer until they are recruited into the adult population are not documented specifically, but their general seasonal movements are known. Juveniles feed in coastal waters in the summer, and move to deeper waters in the winter (Rumyantsev and Darda, 1970). Significant numbers of age-1 herring have been observed in June in nearshore waters of Hagemeister Strait in northern Bristol Bay (Barton, 1979b). In October, after migrating along the Alaska Peninsula, immature herring are found from St. Matthew Island almost to the shelf break (Wespestad and Barton, 1981, modified by Rumyantsev and Darda, 1970), and they overwinter in this area to the northwest of the Pribilof Islands (Hameedi, 1982).

Herring fry feed on immobile prey, such as diatoms. Adult herring feed on copepods, amphipods, euphausiids, and fish fry (Hart, 1973; Barton, 1979; Morrow, 1980).

Recent assessments (ADF&G _____) indicate that stocks of herring in the Bering Sea have not experienced good recruitment in recent years and that, if no strong year class enters soon, the fishery will decline dramatically.

Capelin (Mallotus villosus): This forage fish is distributed throughout the Bering Sea, including most coastal areas, and extending offshore to the conti-nental shelf break (Lewbel, 1983). Capelin are found in large bathypelagic schools, often long distances from shore, during much of the year (Macy et al., 1978). Nearshore waters of the North Alaska Peninsula are traversed by large schools of capelin that have been encountered during the herring fishery in April and May. Capelin are believed to be the most abundant forage species in the spring and summer (Thorsteinson, 1984).

Mature adults migrate toward the shore in the spring and spawn from May through July (Musienko, 1970; Warner and Shafford, 1981). Capelin usually begin to spawn at 2 years of age. Specific spawning locations used by capelin along the northern shore of the Alaska Peninsula are not well-defined. Capelin are believed to use the area between Moffet Point and Port Heiden (Jackson and Warner, 1976) and north to Cape Menshikof (Barton, 1977b). They may spawn over a broader area from Urilia Bay into Bristol Bay. Areas around Port Moller (Herendeen Bay) and Port Heiden have been observed being used for spawning (Hale, 1983). It is also known that capelin use sand or gravel beaches for spawning at night during high tides and that eggs can be found at or below the high-tide mark (Warner and Shafford, 1979). In some years, capelin reproduce en masse along open beaches to the extent that windows of trapped capelin may be observed for miles. Capelin have very specific grain-size requirements (0.5- to 1.5-mm diameter pebbles) for spawning substrate (Warner and Shafford, 1981). The types of substrates preferred by capelin are very prominent along the northern shore of the Alaska Peninsula (Michel et al., 1982). In addition, offshore spawning has been reported to depths of 280 meters, but usually occurs in water less than 75 meters deep (Hale, 1983).

The cohesive eggs form small masses that adhere to the gravel substrate (Musienko, 1970). Depending on temperature, eggs hatch in 1 to 4 weeks (Musienko, 1970; Macy et al., 1978; Warner and Shafford, 1981). Distribution of capelin larvae in the Bristol Bay area is only generally known. Since capelin spawn on beaches from Moffet Point to Point Heiden, the larval distribution is assumed to include the coastal nearshore waters adjacent to the beaches between these points. Larvae, drift in the nearshore zone during the summer months, until winter temperatures force them into deeper waters (Warner and Shafford, 1979). There also are indications, however, that larval distributions are more widespread than just in coastal waters. Capelin larvae have been caught in ichthyoplankton surveys in the Bering Sea, generally south of 60° N latitude, almost exclusively over the continental shelf and extending into the easternmost part of Bristol Bay (Waldron, 1981).

Capelin prey primarily on small crustaceans, including euphausiids, amphipods, decapod larvae, and copepods, and on small fish (Hart, 1973; Macy et al., 1978; Vesin et al., 1981).

Pacific Sand Lance (Ammodytes hexaptera): In the Bering Sea, sand lance are present in much of Bristol Bay, along the Aleutian Chain, south of St. Lawrence Island, and along the coast near the Yukon and Kuskokwim deltas (Waldron, 1981). Their distribution and abundance appear to be related to temperature (Lewbel, 1983), with sand lance showing an affinity for warmer waters.

In the Bering Sea, it is believed that sand lance spawn in the winter in areas with sandy substrates (Lewbel, 1983). The demersal, adhesive eggs usually hatch within a month, depending on the temperature (Macy et al., 1978). Yolk-sac larvae bury themselves in the sandy substrate until their yolks have been absorbed. Once they emerge, the larvae are pelagic. Sand lance larvae have been captured near the Pribilofs from July to September (Musienko, 1963).

Sand lance distribution and abundance along the Alaska Peninsula is described in Houghton (1984). Of the fish captured in a 1984 sampling, sand lance was the dominant species, comprising 62.6% of all fish captured, which indicates that sand lance is one of the most important species of forage fish in the southeastern Bering Sea. From late June to mid-August, densities appeared greater in the inshore waters. They were widely, but irregularly, distributed throughout the study areas. Concentrations were found in and outside Port Moller during late June to mid-July and in Izembek Lagoon from mid-August to mid-September. After mid-July, there was a progressive, significant decline in catches and a shift from the inshore waters into midbay by midsummer. By late summer, there was a strong offshore movement.

Sand lance larvae feed on phytoplankton (Macy et al., 1978). Adults prey on crustaceans, barnacle larvae, copepods, and chaetognaths (Clemens and Wilby, 1949; Hart, 1973; Macy et al., 1978). Sand lance are important as forage fish for numerous other species including halibut, coho, and chinook salmon.

Rainbow Smelt (Osmerus mordax): This smelt is distributed along the entire coastline of the Bering Sea. They generally occur in the continental shelf area to depths of 120 meters (Macy et al., 1978). Rainbow smelt are a schooling pelagic fish.

Rainbow smelt migrate upstream to spawn in the spring. The eggs are adhesive and attach to the substrate. Eggs incubate for 19 to 29 days (McKenzie, 1964), depending on temperature. Larvae drift downstream to lakes or estuaries after hatching.

Larval smelt feed on copepods, amphipods, cladocerans, and aquatic insects (Scott and Crossman, 1973). As they grow, smelt feed on mysids and amphipods, and as adults they become piscivorous, feeding on cod and other small marine and anadromous fish (Macy et al., 1978).

Eulachon (Thaleichthys pacificus): The Bering Sea distribution of this smelt includes both coastal and oceanic areas. They inhabit waters around the Aleutian Chain and the Pribilof Islands and in most of Bristol Bay (Hart, 1973; Scott and Crossman, 1973; Carl et al., 1977). These anadromous fish are especially abundant in the Meshik-Port Heiden area from mid-April through July (Thorsteinson, 1984).

These anadromous fish spend most of the year in marine or estuarine waters before returning to spawn from March to May in deep rivers with coarse-sand or gravel substrates (Scott and Crossman, 1973). Most eulachon die after spawning, but a few survive and return the following year to spawn again (Barraclough, 1964). The demersal, adhesive eggs hatch in 3 to 6 weeks, depending on the temperature. Because the larvae are weak swimmers, many are carried out to estuarine areas (Hart, 1973), but some remain in backwater areas. Spawning occurs after 2 or 3 years of growth (Warner and Shafford, 1981).

Young eulachon feed on larval and adult copepods, mysids, ostracods, and cladocerans (Hart, 1973). Adults feed on euphausiids (Barraclough, 1964; Hart, 1973) and small fish (McPhail and Lindsey, 1970).

2.2.4 Seabirds

The Bering Sea contains a majority of Alaska's largest seabird colonies (100,000+ individuals) as well as hundreds of lesser concentrations (Sowls et al., 1978; Trapp, 1980). In addition, critical staging areas, migration routes and overwintering areas occur in this region. Recent studies in the Bering Sea have examined pelagic distribution and abundance of birds (Hunt et al., 1981d, 1981e; Gould et al., 1982; Schneider, 1982; Eppley and Hunt, 1984; Springer et al., 1984a; Hunt and Harrison, 1986, 1987; Harrison, 1987; Piatt, per. comm., 1987; Troy, per. comm., 1987), as well as numbers, productivity and food habits of birds nesting in Norton Sound (Murphy et al., 1986), on St. Lawrence Island (Roseneau et al., 1982; Springer et al., 1984a; Piatt, per. comm., 1987), St. Matthew Island (Springer et al., 1983, 1984a, Martin et al., 1985), Cape Peirce (Lloyd, 1985, Johnson, 1985), the Pribilof Islands (Hunt et al., 1981a,b; Craighead and Oppenheim, 1982; Johnson, 1985; Lloyd, 1985; Byrd, 1985, 1986, 1987), and the eastern Aleutian Islands (Nysewander and Forsell, 1981; Byrd et al., 1983; Troy, per. comm., 1987). Concentration of these resources ultimately depends upon an extensive and productive food base in the Bering Sea (Hunt et al., 1981c; Springer and Roseneau, 1985; Springer et al., 1984b, 1986, 1987).

Over 75 species of seabirds, as well as waterfowl and shorebirds--many of which represent major segments of their world, North American or regional populations--breed, migrate or overwinter in this region. Of particular importance are several species of waterfowl, and the Alcidae (murres, auklets, puffins), a majority of which have their centers of abundance in the Bering Sea.

Pelagic Distribution and Abundance of Seabirds

Pelagic distribution of birds in the Bering Sea varies considerably between species and seasons. Typically, a variable pattern of distribution is evident with scattered, highly mobile unit or single individuals coalescing into larger assemblages for short intervals and then dispersing (Hunt et al., 1981c). This results in a "patchy" pattern of high and low densities, determined to a great extent by the distribution of prey concentrations and proximity to nesting areas.

In the Bering Sea, greatest pelagic bird densities are observed in spring, summer and fall over the outer continental shelf and shelfbreak (Gould et al., 1982) where plankton and forage fish diversity and abundance are greater than in surrounding waters (Schneider et al., 1984). This probably is due to enhanced biological productivity where nutrient upwelling and mixing takes place at boundaries between several Bering Sea water masses as well as in the vicinity of the shelfbreak. Presumably because of the favorable foraging conditions, surface-feeding species such as fulmars, storm-petrels and kittiwakes are associated especially with outer shelf waters. Densities are also influenced by the presence of suitable nesting areas and the occurrence of enormous numbers of southern hemisphere shearwaters (estimates range from 9-20 million) which frequently concentrate in huge flocks. Thus, densities also are especially high in summer in the inner shelf zone (within the 50 meter depth contour) and in certain coastal areas, in the vicinity of large colonies and preferred shearwater foraging habitat.

Likewise, major kittiwake, murre and auklet nesting areas near the outer shelf (e.g., Pribilof Islands) considerably increase bird densities in this zone, and the presence of St. Matthew Island in the middle shelf zone (between 50 and 100 meter isobaths) results in much higher bird densities than would otherwise be expected in this relatively depauperate zone.

During winter and early spring months (December-April), most pelagic birds, including some waterfowl species, typically are restricted to areas south of the consolidated pack ice, although substantial numbers also occupy open leads in the ice front or polynyas on the lee sides of islands or peninsulas. These latter habitats are of obvious importance to overwintering birds, which tend to concentrate along the ice edge where foraging conditions may be improved by concentration of prey species attracted to favorable nutrient conditions and spring algal blooms in the ice-edge habitat (Alexander and Niebauer, 1981; Bradstreet, 1982; Bradstreet and Cross, 1982; Niebauer and Alexander, 1985). Comparing density in open-water habitat with that in the ice front, Divoky (1979) recorded 99 and 561 birds/km2, respectively. Densities of up to 10,000 birds/km2 have been observed and 1000 birds/km2 are not uncommon (Divoky, 1981). Murres are the most abundant species associated with ice. In open water near St. Matthew Island, flocks of harlequin duck, oldsquaw, king eider, common eider, murres, several gull species, and other seabirds have been observed (McRoy et al., 1971; Sowls, per. comm., 1983). Polynyas south of St. Lawrence Island support large concentrations of oldsquaw and eiders (Fay and Cade, 1959). Open-water areas within the pack ice also provide early access to breeding sites for birds returning to their colonies in spring (Brown and Nettleship, 1981).

For many species breeding in the northern Bering Sea, numbers peak in spring prior to breakup of the pack ice, when overwintering individuals and migrants are concentrated in the vicinity of the ice front. Decomposition of the ice in late spring (April-June) proceeds throughout much of the pack ice simultaneously, and leads which open soon after melting and breakup begin facilitate the northward migration of seabirds and waterfowl. By April or May, many birds apparently are moving over a broad front to the vicinity of nesting colonies or breeding grounds where they are concentrated in leads or other open water. In general, birds breeding in more southern localities, such as the Pribilof or Aleutian Islands, are freed from the constraint of surrounding pack ice. At this time, average pelagic shelf densities have declined to about 40 birds/km2 while densities of 100 birds/km2 or greater have been found near nesting colonies. The most abundant species recorded during pelagic cruises by Eppley and Hunt (1984) were fulmar, storm petrel, least auklet, and murres. Densities observed by these investigators over deeper water, and in the area west of St. Matthew Island in late spring 1982, were 6 and 16 birds/km2, respectively. More extensive data sets indicate average shelf (including coastal embayments) density of 67.3 birds/km2 in this season, and somewhat lower mean density (54.2/km2) along the shelfbreak (Gould et al., 1982). Outer shelf densities as high as 1048 birds/km2 have been recorded (Gould et al., 1982).

Summer densities reflect the concentration of birds at nesting areas and their associated patterns of foraging in the region. In the northern Bering, average density on the outer shelf, where many of the birds associated with the regionally important St. Matthew Island colony complex forage, more than doubles to 97 birds/km2. Near St. Matthew, where most of the summer residents forage, density increases to 193 birds/km2 (Eppley and Hunt, 1984). Murres and auklets are the most abundant species.

Critical foraging areas for most species probably lie within 50 kilometers of the island. Density over the middle shelf (50-100 meter depth), away from St. Matthew, declines to 19 birds/km2 in summer after overwintering birds have dispersed. North of St. Matthew, summer density in the vicinity of St. Lawrence Island exceeds most other areas (343 birds/km2) because of large numbers of auklets (the most abundant species group) foraging near the island. Apparently a majority of both auklets and murres from this area forage north and west of the island (Bedard, 1969; Searing, 1977; Divoky, 1979; Roseneau et al., 1982).

By comparison, Hunt et al. (1981c) found breeding period densities in the Pribilof Islands, in the southern Bering Sea region, varying from 431 birds/km2 southwest of St. George Island to 530/km2 northeastward. Mean density over the shelf in summer exceeds 200 birds/km2. These densities suggest that about 600,000 birds are present over the water in this area at any given moment.

Postbreeding season dispersal of birds over large areas of the Bering Sea apparently results in the relatively low average densities (7-22 birds/km2) in all pelagic habitats sampled by Eppley and Hunt (1984). Densities in the vicinity of St. Matthew Island ranged from 30-75 birds/km2. Elsewhere, in late summer and fall, shelf densities also decline and shelfbreak densities increase as many shearwaters move further offshore and other common species (e.g., alcids) disperse from their summer foraging areas. Shearwater densities of 354 birds/km2 have been recorded during this season, equivalent to about 1.1 million individuals over the area surveyed (Gould, 1981).

High bird densities also occur in Unimak Pass. In particular, shearwaters forage here in summer and large numbers move between the North Pacific and Bering Sea. Flocks of over a million individuals have been observed in the pass in July and August, and movements in excess of 25,000 birds/hour for extended periods have been recorded in April and May (Gill et al., 1978). Other species are especially abundant in migration. For example, in late March, April and May, murres move through the pass typically at about 500 birds/hour with as many as 12,000/hour recorded (Gill et al., 1978). Mean density of all species in Unimak Pass in summer, including fulmars, storm petrels, gulls, and murres and other alcids, is 224 birds/km2, or about 720,000 birds at any given moment (Strauch and Hunt, 1982).

Seabird Breeding Colonies

In the Bering Sea region, major seabird colonies exist on St. Lawrence Island; King Island; St. Matthew, Hall and Pinnacle Islands; Nunivak Island; Capes Newenham and Peirce; the Walrus Islands; the Pribilof Islands; eight sites in the eastern Aleutian Islands; and four in the western Aleutians (Table 2.1). Substantial numbers of lesser colonies are found throughout the Aleutians, northern Bristol Bay and in Norton Sound. Population

Table 2.1 Total estimated numbers of seabirds nesting in major colony complexes, and the smaller coastal colonies, of the eastern Bering Sea.

Area	Estimated Population (millions) 1/	Percent
Western Aleutian Islands	3.31	21.2
Eastern Aleutian Islands	2.81	17.9
Pribilof Islands	2.68	17.1
Walrus Islands	0.57	3.6
Capes Newenham, Peirce	0.99	6.3
Nunivak Island	0.32	2.0
St. Matthew, Hall, Pinnacle Islands	1.44	9.2
St. Lawrence Island	1.84	11.7
King Island	0.25	1.6
Little Diomede Island, Fairway Rock	1.31	8.4
Small coastal colonies	0.16	1.0
TOTAL	15.68	99.9

1/ These values represent the best available estimates of seabird populations occupying Bering Sea colonies. As a result of the sheer numbers of colonies in Alaska, their isolation, and constraints of time and personnel availability, many of these colonies initially were censused superficially and have not been re-censused since originally done in 1976 or 1977. With the possible exception of the Pribilof Islands, totals for most colonies probably are underestimated, especially where crevice- and burrow-nesting species occur.

Sources: Sowls et al., 1978; Craighead and Oppenheim, 1982; Johnson, 1985; USFWS, 1986-87.

estimates in Sowls et al. (1978) suggest that Alaskan populations of most species are greater than presently recorded.

On the Pribilof Islands, the most abundant species occupying the extensive nesting cliffs are fulmars, kittiwakes and murres. Talus-nesting least and crested auklets also are abundant. About 88% of the world population of red-legged kittiwakes and 92% of the Alaskan thick-billed murre population breed on the Pribilofs. A large proportion of the murres and auklets forage within 50 kilometers of the colonies while fulmars and kittiwakes forage along the shelfbreak. Certain species (e.g. red-faced cormorant, both kittiwakes, thick-billed murre, parakeet and crested auklet) have exhibited poor reproductive success in recent years (Johnson and Baker, 1985; Byrd, in press) and apparently have undergone population declines (Craighead and Oppenheim, 1982; Johnson, 1985). Similarly poor reproductive success has been observed recently for kittiwakes and murres on St. Matthew Island (Murphy et al., 1987).

Burrow-nesting species, such as storm petrels, ancient murrelets and tufted puffins are abundant in the Aleutian Islands, while kittiwakes and auklets are generally less common than in the Pribilofs (Sowls et al., 1978). The Fox Islands (eastern Aleutians) support about 50% of the Alaskan population of endemic whiskered auklet and about 45% of Alaskan tufted puffins. The eastern Aleutians also are an important overwintering area for several waterfowl species including emperor goose, common eider, king eider, Steller's eider, harlequin duck, oldsquaw and goldeneye, as well as many gulls, alcids and shorebirds. Arneson (1980) has found a mean density of 94 birds/km2 in this area. At Samalga Island he recorded high densities of 1435 emperor geese/km2 and 416 seaducks/ km2.

Food Habits and Trophic Relations of Seabirds

The proportion of fish and invertebrates in the diet of seabirds varies between species, however the diets of several major species in the Bering Sea are approximately 50% juvenile groundfish of commercial importance. The proportion of walleye pollock in diets of northern fulmars on the Pribilof Islands is estimated at 61%, black-legged kittiwakes 25-60%, red-legged kittiwakes 2-24%, common murres 5 to more than 50%, thick-billed murres 25-50%, and for tufted puffins 40% (Hunt et al. 1981; Schneider and Hunt 1984). Other birds sampled in the Pribilofs eat negligible amounts of groundfish.

Very few studies have been completed in the Aleutian Islands, but tufted puffins on Aiktak Island near Unimak Pass consumed 76% pollock; those on Tangagm Island near Dutch Harbor 59% pollock and 8% Atka mackerel; and those on Buldir Island in the western Aleutians 6.3% Atka mackerel. These data on seabird diet are not standardized among studies and are extremely sparse compared with those for seabird communities in other parts of the world.

The biomass of pollock needed to sustain seabird populations in the eastern Bering Sea has been estimated at 150,000 mt (Hunt et al. 1981) to 272,000 mt (Kajimura and Fowler 1984). However, these estimates are only approximate, given that only rudimentary data and models are available for prediction of seabird consumption in northern latitudes.

Breeding success of seabirds has been correlated with consumption of preferred prey in Alaska and elsewhere (Belopol'skii, 1957; Harris, 1980, Murphy et al., 1984; Baird and Gould, 1986). Short-term fluctuations in fish prey or in their availability occur naturally due to environmental variations (Furness, 1982; MacCall, 1982; Murphy et al., 1984; Lloyd, 1985) and populations of birds can apparently follow and recover from such non-extreme fluctuations. However, population declines of 60 to 90% have been observed in association with steep reductions in stocks of commercial fish in areas other than Alaska (Schaeffer, 1970; Furness, 1982; Nettleship and Birkhead, 1985). When compared with seabird declines due to environmental fluctuations alone, these types of reductions are generally more severe and recovery is much slower.

2.2.5 Marine Mammals

Pinnipeds, Sea otters, and Polar bear

Substantial populations of 8 pinniped species as well as the sea otter and polar bear occupy a variety of Bering Sea habitats on either an annual or seasonal basis. Northern fur seals are highly migratory, seasonally occupying the southern Bering sea. Northern sea lion, harbor seal, and sea otter populations are concentrated in the southern Bering Sea and are relatively sedentary, although seasonal dispersals commonly occur. Some sea lion haulouts also exist further north. Walrus and some seals (spotted or largha, bearded, ribbon and ringed seals) are ice-associated for much of the year, depending on this substrate for critical phases of their annual cycle including birth, mating and molting, and their more northerly distribution reflects this habitat preference. Polar bears occupy ice habitats in the northern Bering Sea. For this species, as well as ice-associated pinnipeds, ice provides a substrate for resting and other activities near their food supply. Abundance of these latter species in the central and northern Bering Sea varies seasonally and is tied closely to the extent, physical characteristics and timing of formation or disintegration of sea ice (Burns, et al. 1980, 1981).

Sea ice of varying continuity and consistency dominates the northern Bering Sea from December through May (Burns, et al. 1980). Typically, the maximum southern ice advance lies near the shelf break from Bristol Bay northwestward past the Pribilof Islands and south of Cape Navarin. The most important ice habitats for pinnipeds are the ice front, where relatively small unconsolidated floes form a band of varying width along the southern edge of the pack ice (Burns et al., 1981), and areas within the pack where open leads and polynyas regularly occur.

Northern Fur Seal: The world population of the northern fur seal is estimated to be about 1.2 million (Fowler 1985a). Of these, between 800,000 and 830,000 comprise the Pribilof Islands population. From 1975 to 1981 the Pribilof population is estimated to have declined at a rate of about 4-8% per year (Fowler 1985b) as indicated by decreasing numbers of pups born and adult males present. Entanglement in nets, net fragments and other debris may be an important contributing factor in this decline (Fowler 1985b, 1987). Since 1981, the estimated rate of decline in pup numbers on St. Paul Island is about 1.8% per year (although this does not represent a statistically significant trend, York and Kozloff, 1987); the number of adult males has declined significantly on both islands.

Fur seals are highly migratory and lead a pelagic existence in the nonbreeding season from November to May or June (Kajimura et al. 1980; Kajimura 1984). During this period, they are widely dispersed in offshore waters of the North Pacific (70-130 km offshore), with various age- and sex-class segments of the population found from the southern Bering Sea south to the California/Mexico border. Females of all ages (and young males 1-4 yr old) are found in the Gulf of Alaska and the eastern North Pacific Ocean during winter and spring. Only the younger immature males (ages 1-5 yr) migrate south of Alaskan waters with few exceptions. Nearly all of the older males winter in Alaskan waters primarily in the Gulf of Alaska, north and south of the eastern Aleutian Islands and the Bering Sea (Kajimura 1984). Breeding males typically arrive in late April/May followed progressively by older pregnant females. Breeding males abandon their territories in August. Most fur seals begin their southward migration in late October-early November and the majority or all have departed the Pribilof Islands by mid-December.

Early July is the peak of pupping. Females nurse their pups for about 2.2 days following their return from pelagic foraging trips of 9- to 12-days. Nursing continues for 3-4 months. Fur seals typically forage over the outer shelf and shelfbreak as far as 400 km away (Harry and Hartley, 1981). This range incorporates the eastern Aleutian passes (Fox Islands) and also extends northwestward along the shelfbreak to at least 175° W. Long. Fur seals forage mainly at night and early morning on various schooling fishes which congregate in areas of nutrient upwelling. Approximately 400,000 individuals, including foraging females and nonbreeding individuals, may be at sea at any given time from June to November.

Bering Sea habitats of major importance to fur seals include: (1) rookeries and haulout areas on the Pribilof Islands, (2) outer shelf and shelf break areas where fur seals forage, (3) a broad corridor including the shelf break between the

Pribilofs and eastern Aleutian passes, (4) eastern Aleutian passes, primarily Unimak Pass, utilized as migratory routes in spring and fall.

Extensive studies of the diet of northern fur seals indicate variation by season and location, however dominant prey consist of pollock, capelin, squid, and other pelagic fishes (Lowry et al., 1982). Much of the pollock eaten by fur seals is from younger age classes (Frost and Lowry, 1986).

Northern Sea Lion: Sea lions occur over the continental shelf throughout the Bering Sea, though haulouts are less numerous north of the Pribilof Islands than in the south. A breeding rookery occurs in the Pribilof Islands (Walrus Island) and numerous rookery occur in the Aleutian Islands and elsewhere in Alaska. The sea lion population in most of Alaska, and particularly the eastern Aleutian Islands and Bering Sea, has exhibited a steady decline of about 2.7% per year since the 1950s (Merrick et al., 1987). This has resulted in a marked decline of adult sea lions in eastern Aleutian Island rookeries from about 50,000 in the 1960s to about 10,000 in 1985 (Merrick et al., 1987). Surveys in other areas indicate that this decline is not simply a result of dispersal from the eastern Aleutians.

Sea lions do not migrate; however, there is a definite dispersal from rookeries following the breeding season, and in late summer and early fall reach St. Lawrence Island and the Bering Strait (Frost et al., 1982). Several hundred nonreproductive sea lions occur infrequently at St. Matthew and Hall Islands in summer. Movement of males from the Aleutians (and possibly the Pribilofs) to the ice edge apparently occurs in winter. In spring (March-April) some sea lions utilize the ice front prior to the disintegration of ice in the central Bering Sea, especially in the vicinity of the shelfbreak (Burns et al., 1980; NMFS, unpub. data, 1983).

At least 25 rookeries have been identified in the Aleutian Islands; in addition, one is found in the Pribilof Islands, and one near Amak Island near the Alaska Peninsula (Braham et al., 1980; Loughlin et al., 1984). Males and subadults of both sexes haul out at many locations not used as rookeries, and many rookeries are occupied year-round. Mature males begin arriving at the rookeries in early May, preceding the arrival of pregnant females (Pitcher and Calkins 1981). Pupping begins in mid-May and lasts until early- to mid-July. During the first 6 or 7 weeks of the nursing period, females alternate periods on land and at sea (Sandegren 1970). By mid-July most breeding activity has ceased. The molting period lasts through October.

Sea lions usually forage from the continental slope shoreward within 24 kilometers of shore; however, they have been observed in excess of 150 km offshore (Kajimura and Loughlin, 1988). Many of the individuals that have been reported as migrating probably were just foraging at sea. Diet of northern sea lions includes squid and pelagic and demersal fishes, most importantly capelin, sand lance, pollock, and Pacific cod (Lowry et al., 1982). Size of pollock consumed by sea lions ranges from age 1 fish to adults greater than age 10, however most of the pollock consumed are ages 1 to 3 (Frost and Lowry, 1986).

Pacific Walrus: The Pacific walrus ranges from the Chukchi Sea to the southeastern Bering Sea and northern Kamchatka Peninsula (Fay, 1982). In 1985, the Pacific walrus population was estimated to number about 234,000 (Gilbert, 1986). Most of the animals migrate north in summer and south in winter in association with seasonal movements of the pack ice. Herds of migrant walrus moving south from the Chukchi Sea appear in the St. Lawrence-Punuk Islands area in fall (October-December). During winter months (January - March) walrus may be found wherever openings are numerous in the drifting pack ice; most animals occur in the relatively thin ice west and as much as 300 kilometers southwest of St. Lawrence Island (including St. Matthew Island), and in the Bristol Bay area A minimum of 2,000 were observed in the vicinity of St. Matthew Island in February of 1983 (Sowls, per. comm., 1983). Smaller concentrations occur east of the Pribilof Islands and southwest of Cape Navarin. Mating occurs during this period, primarily in the St. Lawrence Island and Bristol Bay areas (Fay et al., 1984).

As the seasonal pack ice melts and the ice edge recedes northward in spring, usually beginning in April, pregnant females and those with young move north with it, leaving behind many adult and subadult males which move to coastal haulouts mostly in Bristol Bay and Bering Strait. In early spring, densities of 13.0 individuals/nm2 between St. Lawrence and St. Matthew Islands and 4.2/nm2 west of this area have been recorded (Burns et al. 1980). Calves are born on the ice in the northern Bering Sea from April to June (peak in early May) during the northward migration. Some haulouts along the Chukchi peninsula and on St. Lawrence Island are used primarily during the full migration. Recent trends in several population parameters which have preceded declines in other wildlife populations suggest that the Pacific walrus population may experience a downward trend in the foreseeable future. Walrus are bottom feeders, feeding mainly on bivalve mollusks at depths of 80 meters or less (Fay 1982). Other prey include gastropods, polychaetes, echiuroids and other benthic invertebrates (Lowry et al., 1982).

Spotted Seal: From 200,000 to 250,000 spotted seals are estimated to inhabit the Bering-Chukchi region (Lowry et al., 1982); about 70,000 of these occur in Alaskan waters. According to Burns et al. (1980) winter/spring densities are greater east of the Pribilof Islands (6.8 seals/nm2,) than to the west (fewer than 2.0/nm2).

Spotted seals occur in the central Bering Sea area primarily from January through late April or early May (Burns et al., 1980). Their major winter/spring range extends from Bristol Bay west and northwest across the central Bering Sea (Frost et al., 1982; Lowry et al., 1982). Pupping occurs on the ice from late March to late April. After pupping and mating have occurred, spotted seals move generally northward and toward the coast as the ice disintegrates and recedes (Lowry et al., 1982).

Major spotted seal haulouts occur on St. Matthew/Hall Islands, St. Lawrence Island, Nunivak Island, and several other areas. Five to six hundred haul out in the St. Matthew Island area. They remain in coastal areas until early winter (late November-early December) when they move away from the coast and once again become associated with the ice front.

These seals feed primarily on fish including pollock, arctic cod, saffron cod, capelin, herring, and sand lance (Lowry et al., 1982). All pollock eaten are likely age 1 fish (Frost and Lowry, 1986).

Ribbon Seal: Estimates of the Bering Sea ribbon seal population range from 80,000 to 114,000 (Brooks, 1979; Burns, 1981). Like the spotted seal, ribbon seals are strongly associated with the ice front during winter and spring. From February to mid-May they are distributed throughout the front to as much as 150 km north of the ice edge; they are most numerous in the northern part of the front from the Pribilof Islands to the Soviet coast (Burns et al., 1980; Frost et al., 1982). Highest densities (0.13-0.83/nm2), are found between St. Lawrence Island and the shelfbreak west of St. Matthew Island (Burns et al., 1980). Pups are born from late March to mid-April.

As the pack ice disintegrates, ribbon seals are concentrated on ice remnants, where they undergo the annual molt. Ribbon seals apparently become pelagic during summer and autumn (Lowry et al., 1982). Burns (1981) speculated that they feed along the shelf break during this period. Ribbon seals feed on pollock, eelpout, capelin, as well as shrimp, squid and octopus (Lowry et al., 1982). Most pollock consumed by ribbon seals are likely age 1 (Frost and Lowry, 1986).

Bearded Seal: An estimated 300,000 bearded seals occupy the Bering-Chukchi region (Braham et al., 1977; Burns, 1981). Bearded seals undertake a marked migration in spring and fall, following seasonal ice movements. During winter and spring, they are widely distributed in the drifting ice of the central and northern Bering Sea and the Chukchi Sea where openings in the ice are frequent. Some individuals occupy the ice front from February to early April, but the species' center of abundance lies further north (Burns et al., 1980). In April they are most abundant north of the ice front, to the south and southwest of St. Lawrence Island, west of St. Matthew Island, and in the Gulf of Anadyr (Burns et al., 1980; Lowry et al., 1982). Northward migration begins in April. The majority of bearded seals spend the summer near the edge of pack ice in the Chukchi Sea.

Pupping takes place on the ice from late March to mid-May. Peak mating activity occurs from early to late May. Bearded seals feed almost exclusively on bottom invertebrates, chiefly crustaceans and mollusks, in water less than 150 meters deep (Burns, 1978; Lowry et. al. 1982).

Ringed Seal: Population estimates derived from observed densities (0.4-6.2 animals/nm2 on Chukchi and Beaufort Sea fast ice, 0.1-0.2/nm in pack ice) and estimates of available habitat, yield conservative values of 250,000 individuals in shorefast ice, and 1-1.5 million total Alaskan population (Burns, 1978, 1981). Density of ringed seals is greatest in stable landfast ice, but large numbers also occupy the drifting pack ice. During winter (January-March) they are abundant in the southern Chukchi Sea, Bering Strait, and northern Bering Sea, and less so south of St. Lawrence Island except in the stable ice of nearshore. They range as far south as Bristol Bay.

During March and April, most ringed seals establish their territories on fast ice. Few occupy the ice front at its southernmost advance in the Bering Sea (Burns et al., 1980). Most individuals move north with the receding pack ice in April (Lowry et al. 1982). Ringed seals feed chiefly on small fishes and crustaceans (Lowry et. al. 1980).

Harbor Seal: Harbor seals are common residents of coastal areas throughout the Aleutian Islands, Alaska Peninsula, and north through Kuskokwim Bay and the Pribilof Islands (Everitt and Braham, 1980; Braham and Dalheim, 1981; Burns et al., 1985). Accurate census of the population is difficult because seals haul out at hundreds of locations along the coast, and an unknown proportion of the population is always in the water. At least four major haulout-breeding sites occur in the southeastern Bering Sea: Port Moller (about 6100 individuals), Izembek Lagoon (1150), Bechevin Bay (400), and the Pribilof Islands (1500). Concentrations of 100 to 500 individuals have been observed at 16 of the numerous lesser haulouts in the eastern Aleutians at various times of year (Everitt and Braham, 1979). Conservative estimates for the Aleutian Islands-85,000, and the north side of the Alaska Peninsula, Bristol Bay and Pribilof Islands-30,000, indicate the general magnitude of the population (Burns et al., 1985). However, surveys conducted in 1985 indicate that harbor seal abundance along the Alaska Peninsula has declined by 3.5% per year since the mid 1970's (Pitcher, 1986).

Harbor seals appear generally to be a sedentary species, making local movements in response to food availability, tides and breeding activities. However, radio-tagged individuals have been found up to 194 km from the tagging site (Pitcher and McAlister 1981). Large-scale emigration of seals occurs from northern Bristol Bay in winter when the area usually is ice-covered (Burns et al., 1985). Apparently, some individuals also disperse to ice floes in winter, especially when the pack ice advances further into the southern Bering Sea than usual. While generally a coastal species (water depths less than 55m), harbor seals have been observed up to 80 km offshore.

Pupping generally occurs in June, followed by mating from late June to late July and molting in late summer. Pups enter the water soon, and are weaned in 3-5 weeks (Johnson, 1977; Pitcher and Calkins, 1979).

Harbor seals feed primarily on schooling fishes and cephalopods (Lowry et. al. 1982, Pitcher 1980). In the Bering Sea, major fish prey include sand lance, smelt, sculpins, pollock, and Pacific cod (Lowry et al. 1982). Most pollock consumed apparently are ages 1 to 3, although some larger pollock are taken (Frost and Lowry, 1986).

Sea Otter: Sea otter densities are at or near carrying capacity in the Rat, Delarof and Andreanof Islands of the Aleutians, Unimak Island (north) and part of the Alaska Peninsula north side. Significant concentrations also are found in the southwest Umnak Island area, in Umnak Pass and Tigalda Island area. Lower densities are found throughout the Aleutians and lower half of the Alaska Peninsula (Burns et al., 1985). Schneider (1976) conservatively estimated about 17,200 otters in the Port Moller-Unimak Island region. Pods of 100 animals are not uncommon in this area, and one containing over 1000 was sighted near Amak Island (Schneider, 1981). Estimates for the Aleutian Islands range from 55,100 to 73,700 (Burns et al., 1985). Since the otter population was expanding and increasing at the time these estimates were made, probably are quite conservative.

Although occurring throughout the year, breeding reaches a peak in September and October. Most pups are born in May (Burns et al., 1985).

Otters generally forage on benthic organisms in water less than 40 meters in depth; adults have been recorded feeding in water 80 meters deep. Since there is little indication that sea otters can obtain pelagic food, long open-ocean movements would seem to be precluded (Kenyon, 1969).

Polar Bear: In winter and spring (December-May), some bears occasionally may range as far south as St. Matthew and Nunivak Islands in extensive ice years (Lentfer, 1972); however they regularly occur only as far south as St. Lawrence Island.

Polar bears prefer drifting pack ice where openings and newly frozen areas provide optimal habitat for seals, their usual prey (Lentfer, 1978). Shorefast ice also is heavily utilized, since this is the preferred habitat of their principal prey, the ringed seal.

Nonendangered Cetaceans

There are at least 10 nonendangered cetaceans that may occur in the Bering Sea. The more commonly observed species include:

Minke whale (Balaenoptera acutorostrata)
Beluga (Delphinapterus leucas)
Killer whale (Orcinus orca)
Dall's porpoise (Phocoenoides dalli)
Harbor porpoise (Phocoena phocoena)

Other species that are either infrequent visitors or less frequently observed include:

Short-finned pilot whale (Globicephala macrorhynchus)
Bering Sea beaked whale (Mesoplodon stejnegeri)
Goosebeaked whale (Ziphius cavirostris)
Giant bottlenosed whale (Berardius bairdii)
Pacific white-sided dolphin (Lagenorhynchus obliquidens)

Minke Whale: Minke whales are one of the smaller baleen whales, which inhabit all oceans of the world except equatorial regions. The species occurs broadly over the North Pacific and into the southern Chukchi Sea during the summer months and migrates to lower latitudes during the winter. The North Pacific population is classified as abundant, and sightings of this species have occurred in the pack ice in April. Minke whales apparently occur in the Bering Sea on a year-round basis, with concentrations near the Aleutian Islands and the Pribilof Islands during the summer (Braham and Dahlheim, 1981). Over 95% of minke whale sightings in the NMFS data base were within the 200-meter isobath, and most were in shallow coastal waters (Morris, 1983). Minke whales feed locally on abundant fish, euphausiids, and copepods. Euphausiids are the preferred prey in the North Pacific, followed by schooling fish, and copepods. From March through December, minke whales are seen feeding most frequently in the lagoons and coastal waters along the northern shore of the Alaska Peninsula (i.e., Port Moller and Nelson Lagoon).

Beluga: Belugas are circumpolar in arctic and subarctic waters, numbering at least 30,000 in the North American Arctic (Sergeant and Brodie, 1975). Belugas are abundant in Alaska waters, especially above 60 N latitude. At least two stocks are generally recognized--one in the Cook Inlet/Gulf of Alaska region and the other larger population in the Bering, Chukchi, and Beaufort Seas. The Cook Inlet population has been estimated to number 4-5000, while a nimimum of 13,500-18,000 belukahas are estimated to occur in coastal waters of western and northern Alaska (Burns et al., 1985). Belugas occur in Bristol Bay year round and are found in association with the seasonal pack ice in the winter and early spring. The summer Bristol Bay population is estimated between 1,000 and 1,500 individuals (Frost et al., 1984). Belugas feed from midwater to the bottom, primarily on fish (such as salmon, smelt, herring, cods and flatfish) usually in shallow waters of the continental shelf and at the mouths of major rivers (Seaman et al., 1982). Gurevich (1980) reported movements twice a day of belugas (50 to over 500 whales foraging for red salmon and smelt up and down the Kvichak River during May and June. There have also been reports of concentrations north of Port Heiden (300 individuals) along the coast during the summer (Gurevich, 1980). Although belugas have been observed near the Pribilof Islands, they are generally characterized as a nearshore and estuarine species--where they feed and calve during the summer months. Belugas generally breed during the spring and early summer months and have a gestation period of 15 months.

Killer Whale: Killer whales are observed in all major oceans and seas of the world and appear to increase in abundance shoreward and toward the poles of both hemispheres (Mitchell, 1975). In the Pacific Ocean, they are more commonly seen in subarctic waters than in polar or tropical waters. Killer whales have been documented in the Bering Sea and have been observed as far north as the Chukchi and Beaufort Seas (Braham and Dahlheim, 1982; Lowry et al., 1987). Year-round occurrence may occur within Alaskan waters; however, their movements are poorly understood (Braham and Dahlheim, 1982). Whales are forced southward from the Chukchi and northern Bering Seas with the advancing pack ice and, under such circumstances, long-range movements may occur.

In ice-free waters, more restricted movements may occur. Killer whale concentrations have been noted in coastal waters, continental shelf waters and neritic zones. These areas of killer whale abundance are of particular interest as they overlap areas of high abundance of prey. Killer whales are top-level carnivores of the marine ecosystem with diets that vary regionally (Heyning and Dahlheim, 1988). Although primarily fish eaters, killer whales are known to prey on other cetaceans, pinnipeds, and sea birds (Dahlheim, 1981). Killer whales may feed upon fish when locally abundant and then switch to marine mammals when fish are less available. Population levels of Alaskan killer whales are unknown.

Dall's Porpoise: This species ranges from Northern Baja California, along the western coast of North America, and across the North Pacific Ocean to the coastal waters of Japan. The northern limit of the species is generally Cape Navarin in the Bering Sea, although that have been observed as far north as 66 N latitude (Morris, Alton, and Braham, 1983). Dall's porpoise are sighted in Bristol Bay through the year and in the Navarin Basin area from Spring through November (Brueggeman, Grotefendt, and Erickson, 1984). They can occur in shallow waters but have been most frequently sighted in waters over 100 meters deep. Concentrations occur from June through November along the shelf break from the Pribilof Islands to Cape Navarin. Migratory movements are not well understood, but available information suggests local migrations along the coast and seasonal onshore/offshore movements. The estimated size of the North Pacific Dall's Porpoise population (not including coastal waters from California to Washington) north of 40 N to the Aleutian Islands is approximately 1,349,000 animals (Turnock, 1987, and

Bouchet, Ferrero, and Turnock, 1986). In the Bering Sea the population is estimated as 212,000 (Turnock, 1987). Dall's porpoise usually travel in small schools of 2 to 20 animals and feed predominantly on squid and mesopelagic fish. Morejohn (1979), based on limited data, reported that Dall's porpoise breed and calve year-round in the northeastern Pacific waters from southern California to Alaska. However, data from throughout the North Pacific and Bering Sea show that Dall's porpoise reproduce annually and seasonally, starting in late July or early August to September (Jones, Rice, and Gosho, 1985). Killer whales are the natural predators of Dall's porpoise.

Harbor Porpoise: The harbor porpoise is a boreal-temperate species along the North Pacific coast from Point Barrow, Alaska, to central California. Harbor porpoise are generally sighted singly or in pairs. Sightings in the Bering sea are reported in Frost et al. (1982). Neave and Wright (1969) reported that harbor porpoise in the western North Atlantic move north in late May and south in early October. Harbor porpoise are generally seen in coastal environments such as harbors, bays, and the mouths of rivers. They feed primarily on small gadoid and clupeoid fish, such as cod, herring, and mackerel. Mating probably occurs from June or July through October, with peak calving in May and June. Gestation probably lasts about 11 months. Their life span is relatively short, perhaps not exceeding 15 years (Leatherwood and Reeves, 1983).

Short-Finned Pilot Whale: Pilot whales are accidental in Alaskan waters, and they have been reported in only a few occasions (Reilly, 1978). They normally range no farther north than southern California. They travel in groups of up to several hundred animals, frequently in association with other cetaceans. Although information on seasonal movements is limited, populations may shift northward in the summer and south in the winter in response to changes in water temperature. Pilot whales were sighted only three times within the 50-meter isobath. They are long-lived and apparently have a relatively long reproductive life; the oldest pregnant female was 35 years old (Kasuya, 1977). Squid is the preferred food of the short-finned pilot whale.

Bering Sea Beaked Whale: This species is endemic to the subarctic and cold temperate North Pacific Ocean, ranging from northern Japan, along the Aleutian and Pribilof Islands, through the Gulf of Alaska to southern California. During a summer survey in 1979 (along the central Aleutian Islands) 52 individuals were observed in 7 pods ranging from 5 to 15 animals per group. The whales were observed in waters off the continental slope ranging in depth from 730 to 1,560 meters (Loughlin et al., 1982).

Goosebeak Whale: This species is found in all oceans of the world, except for arctic and antarctic waters (Moore, 1963). It may be the most abundant beaked whale in the eastern North Pacific. There was only one sighting in the Bristol Bay/Bering

Sea area (Braham et al., 1977). Sightings of goosebeaked whales in the Gulf of Alaska occurred in water depths of greater than 1,200 meters. It appears that they inhabit the deeper waters of the Pacific (Morris et al., 1983). Goosebeaked whales feed on deep-sea fish and squid (Kenyon, 1961).

Giant Bottlenose Whale: This species is endemic to the North Pacific and ranges from St. Matthew Island, through the Gulf of Alaska, to southern California (Rice, 1974). Whaling records from Japan indicate that giant bottlenose whales are restricted to waters over the continental slope, and they may be similarly distributed in Alaskan waters. These whales feed predominantly on squid and demersal fishes (Rice, 1978). Studies in Japan indicate that mating activity peaks during October and November, and peak calving occurs from March to April (Kasuya, 1977).

Pacific White-Sided Dolphin: This species ranges is from Baja California to the Aleutian Islands, as well as off the coast of Japan. Pacific white-sided dolphin were observed north of the Aleutian Islands, primarily in waters 100 to 200 meters deep. Most abundant in the summer months, this species concentrates in areas of high fish abundance, such as along the shelf break. They are opportunistic feeders that eat a variety of fish and squid. Presumably, the dolphins shift their distribution farther north during the summer season and also may move offshore (Morris et al., 1983). They are frequently observed in groups exceeding 100 individuals; groups of between 500 and 2,000 individuals have been sighted.

Endangered Cetaceans

There are at least 18 cetacean species which may occur in the Bering Sea; 8 of these species are considered to be endangered. Listed endangered species as reported in the Federal Register (Vol. 44, No.12), include the:

Bowhead whale (*Balaena mysticetus*)
Right whale (*Balaena glacialis*)
Fin whale (*Balaenoptera physalus*)
Sei whale (*Balaenoptera borealis*)
Blue whale (*Balaenoptera musculus*)
Humpback whale (*Megaptera novaeangliae*)
Gray whale (*Eschrichtius robustus*)
Sperm whale (*Physeter macrocephalus*)

Bowhead Whale: The most recent estimate for the Western Arctic population is approximately 7,200 individuals (standard error + 2,400 individuals) (IWC, in press). Bowhead whales are associated with ice throughout their lives. Their winter range is from the ice-front fringe to the polynya of St. Matthew and St. Lawrence Islands, and their spring migration generally follows the ice leads along the western coast of Alaska after passing through the Bering Strait. East of Point Barrow, the migration moves farther offshore in the ice leads centering around 71 30'N. latitude until reaching Banks Island in Canada. Their summer feeding range is in the Canadian Beaufort Sea off the Mackenzie River delta and along the coast of the Yukon Territories and parts of the Alaskan Beaufort Sea (Lowry and Frost, 1984). The fall migration is closer to shore (generally along the 20- to 50-m isobath) following the north Alaskan coast. West of Point Barrow the migration fans out. Bowheads arrive at their winter feeding grounds around December, and by March most migrants have left the area.

Bowheads frequent the ice front of the central and southwest Bering Sea in winter. Bowheads have been infrequently sighted in the southern Bering Sea during heavy ice years. The Navarin Basin area of the Bering Sea was surveyed during four seasons between 1982 and 1983; bowheads were found mainly inside the marginal-ice front and fringe areas of ice adjacent to the St. Matthew Island polynya. Whales also were found in areas of highly concentrated thin ice (Brueggeman, Grotefendt, and Erickson, 1984). Over 75% of the whales observed were in areas of 80%-100% ice coverage and ice consisted predominantly of new and young ice. Few whales were observed in lower ice concentrations, and no whales were observed in first year ice (Brueggeman, 1985). Brueggeman determined the polynya area around St. Matthew Island was of particular importance because of the prevalence and persistence of light-ice conditions within the pack ice.

Most feeding occurs during the summer and fall migration periods. Bowhead whales are planktonic feeders, although benthic invertebrates are occasionally taken (Lowry and Frost, 1984). Since the whales' baleen plates do not meet in the front of the mouth, engulfed fish can escape.

Bowhead breeding and calving are thought to occur during their spring migration. Mating behavior has been observed in the northern Bering Sea during late winter and spring (Braham et al., 1980; Ljungblad, 1981; Ljungblad et al., 1980, 1982, 1983), and cows with small calves are regularly seen passing Point Hope and Barrow from mid-April to mid-June (Acoustical Society of America, 1981). Nerini et al. (1983) state that mating probably occurs in the Bering Sea in the late winter and calving from March through August, with peak calving occurring in May. Braham et al. (1984) described the peak period of mating and calving as March through June.

<u>Right Whale</u>: Although right whales were once abundant throughout the temperate latitudes, over exploitation by whalers reduced the population to probably a few hundred animals (Berzin and Yablakov, 1978). In the Pacific Ocean, they occur from the southern Bering Sea south to Baja California and from the Gulf of Anadyr in the Soviet Union south to Taiwan. St. Lawrence Island has been described as the extreme northern limit of their range (NARL, 1980).

Right whales are most likely to be found in the southeastern Bering Sea region bounded by St. Matthew Island, Nunivak Island, and to Atka Island from June through August. One right whale was sighted at 58°32'N, 167°32'W (Berzin and Rovnin, 1966) and two were observed at 60°48'N, 175°18'W (Brueggeman, 1982). In 1963, TINRO vessels allegedly observed about 200 right whales at 51° N latitude, 145° W longitude (Berzin and Doroshenko, 1982). Omura et al. (1969) indicated that Japanese whale catchers sighted high numbers of right whales between St. Matthew Island and the passes west of Unalaska Island (along the shelf break) in July. Brueggeman et al. (1984) observed two right whales in the Bering Sea northeast of St. Matthew Island in 1983. Right whales feed primarily on copepods near areas of upwelling (such as along the shelf break) that produce more copepods than deeper pelagic areas.

Fin Whales: Fin whales range from the North Pacific Ocean to the Bering Sea and, rarely, the Chukchi Sea. Fin whales generally winter off southern California and Baja California, although a few whales overwinter in the Gulf of Alaska and near the Commander Islands (Berzin and Rovnin, 1966). The North Pacific population has been estimated from 17,000 to 21,000 individuals; it is estimated that about 5,000 enter the Bering Sea during summer (Morris, 1981). Fin whales entering the Bering Sea are generally separated into two groups (Nasu, 1974). A group consisting mostly of mature males and females without calves migrate along the shelf break to Cape Navarin and more northern waters. A group of lactating females and immature whales summer along the shelf break between the Pribilof Islands and Unimak Pass. Other summer concentrations occur in the Gulf of Alaska and along the Aleutian Chain. Historically, a summer concentration was located between St. Matthew and Nunivak Islands (Berzin and Rovnin, 1966). Although the fall migration may begin in September, some fin whales may remain in the Aleutians and the Gulf of Alaska until November and possibly overwinter in these areas.

Observations by Brueggeman, Grotefendt, and Erickson (1984) during four seasonal surveys in the Navarin Basin, found fin whales to be the most abundant whale. Fin whales were observed in the area throughout the year and may be classified as a resident species. From spring throughout fall, fin whales were observed only in the shallow-shelf areas (200 meter). During the winter, they were observed along the marginal-ice front on the shallow side of the shelf break.

Fin whales feed by engulfing large concentrations of euphausiids, anchovies, capelin, and herring.

Sei Whales: Sei whales occur in all oceans. They are most commonly found in the Gulf of Alaska and southeast of the Aleutian Chain area during the summer months (May and June) and migrate to the southern latitudes during winter. Migration periods and routes are similar to those of the fin whales. Sei whales are rarely seen north of the Aleutian Islands (Brueggeman, 1987; Rice, 1974). Braham et al. (1977) reported one sighting in the Fox Islands and one sighting east of the Pribilof Islands. Fetal growth curves indicate that breeding occurs from October to March. The North Pacific population is estimated at between 22,000 and 37,000 individuals (Braham, 1984). The principal food source is copepods, which the sei whale catches by skimming. Other food sources include euphausiids, herring, sand lance, and pollock. In the 1960's the California population was suffering from a unique disease that causes progressive shedding of the baleen plates and their replacement by an abnormal papilloma-like growth (Rice, 1977).

Blue Whales: Blue whales are the largest of the rorquals, a family of baleen whales characterized by their pleated or corrugated throats. In the early 1900s their world population probably numbered over 200,000. Today, there are only about 12,000 blue whales left in the world; about 1,500 occur in the North Pacific (Rice, 1978). During the summer they range from the immediate offshore waters of central California and the northeastern coast of Honshu, Japan, north to the Gulf of Alaska and the Aleutian Chain. There are three general regions of summer use: (1) a narrow strip along the oceanic side of the Aleutian Chain from 170° E to 175° W longitude; (2) from 170° W to 160° W longitude; and (3) from Kodiak Island southeast across the northern portion of the Gulf of Alaska and along the coast approximately to Vancouver Island (Berzin and Rovnin, 1966). They rarely enter the Bering Sea, but Arsen'ev (1961) observed seven blue whales south of the Pribilof Islands. Whaling records indicate a peak occurrence near the Aleutian Islands in June and July; the fall migration begins in September (Rice, 1974). In the North Pacific blue whales eat primarily euphasiids (Lowery et al., 1982).

Humpback Whale: In the North Pacific, the humpback whales are distributed from the tropics north to 70° N latitude in the Chukchi Sea, and the summer range extends from the coast of California northward to the southern portion of the Chukchi Sea. The whales migrate from wintering grounds off Hawaii and Mexico north to the Gulf of Alaska (early April), the eastern Aleutian Islands (late June), and northward to the Bering and Chukchi Seas (July through September). The whales are found in the Bering Sea from May through November; the autumn migration begins in September. Photo-identification of humpbacks indicates that migratory routes exist between Hawaii and Prince William Sound and southeastern Alaska, and between Mexico and California and southeastern Alaska. Soviet and Japanese tagging and whaling records indicate that humpbacks heading for the St. George Basin area migrate between Japan and the southeastern Bering Sea (Hameedi, 1981). Berzin and Rovnin (1966) postulated that the summering humpbacks along the Soviet coast overwinter off Japan but that some mingling occurs with whales that overwinter around Hawaii and Mexico.

In the North Pacific, the humpback population estimate ranges from 850 to 1,400 individuals, and Morris (1981) estimated that up to 200 humpbacks were distributed throughout the Bering Sea in the summer.

Humpbacks feed on euphausiids and small schooling fish that they capture through lunging or a modified skim-feeding action. Specifically, euphausiids, arctic cod, herring, capelin, saffron, cod, mysids, pelagic amphipods, and shrimp comprise the most important humpback food (Klumov, 1963; Tomilin, 1957).

Gray Whale: Gray whales are found only in the North Pacific Ocean, migrating into the Bering, Chukchi, and occasionally the Beaufort Seas. The eastern Pacific stock is estimated at approximately 17,000 individuals, of which 80% enter the Bering Sea (Rugh, 1984).

Gray whales begin their northbound migration from their calving grounds in Baja California in February. Gray whales enter the Bering Sea through Unimak Pass from March through June on the northbound migration to summer feeding grounds in the Chirikov Basin and the Chukchi Sea. The migration route generally follows within 3 kilometers of shore along the north shore of the Alaska Peninsula and around Bristol Bay, until the whales reach Egegik Bay. There the whales begin to head west 5 to 8 kilometers offshore across northern Bristol Bay. Many whales have been sighted in Bristol Bay in April; however, most sightings along the north side of the Alaska Peninsula and Bristol Bay occurred in June (Braham, 1984). Small numbers of whales are present throughout the summer in nearshore waters and estuaries along the northern side of the Alaska Peninsula.

Feeding behavior has been observed in Izembek Lagoon, Port Moller, and Port Heiden, and between Bechevin Bay and Nelson Lagoon (Zimmerman and Merrell, 1976; ADF&G, 1983; Gill and Hall, 1983). Invertebrate samples taken near a feeding whale in Nelson Lagoon were identified as the sand shrimp Crangon alaskensis, which is very abundant during the summer in the Alaska Peninsula Lagoons.

Some whales migrate directly northwest from Unimak Pass to the area around the Pribilof Islands where several dozen are seen annually (Braham and Dahlheim, 1981). A portion of these whales proceed to more northern feeding grounds, while others summer around the Pribilof Islands (April through July). Recent evidence (Morris, 1981) suggests the subsidiary summer populations of gray whales do not migrate to the northernmost ranges but feed at scattered subarctic locations. Nerini (1984) indicates that some feeding probably occurs in winter and during their fall migration, as well as during their spring migration through Alaskan waters (Braham, 1984). Several gray whales were observed in English Bay, St. Paul Island during June 1976 (Zimmerman and Merrell, 1976).

From July to November, large concentrations of gray whales are found off the northeast side of St. Lawrence Island, where one of their major feeding grounds is located (Chirikov Basin). Gray whales, unlike other baleen whales, are predominantly benthic feeders. The preferred prey is amphipods, although polychaetes, mollusks, and small fish are occasionally taken.

The southbound migration from the summer feeding areas generally begins in mid-October (Johnson et al., 1981). The whales return to Baja California to calve between December and January, generally following the same route as the northbound migration but somewhat further offshore.

Sperm Whales: Sperm whales are the most abundant large cetaceans in the North Pacific and the only toothed whale listed as endangered. Their population is estimated at approximately 740,000 individuals (Rice, 1978) with approximately 15,000 distributed in the Bering Sea during the summer months (Morris, 1981). Sperm whales are distributed in the Pacific from the equator north to Cape Navarin in the Bering Sea (Berzin and Rovnin, 1966). Whales entering the Bering Sea are mostly males because females and juveniles seldom migrate north of the 10° C isotherm (approximately 50° N lat.). They enter the Bering Sea primarily through Unimak Pass and migrate along the shelf break between the Pribilof Islands and Cape Navarin. They are found in pelagic waters near the continental shelf edge. Sperm whales have been captured in the region centered at 56° N, 170° W just south of the Pribilof Islands. Sperm whales are likely to be in the Bering Sea from March through November.

They feed largely on squid, although deepwater bottom fish are common on their diet (Caldwell et al., 1966; Rice, 1978).

3.0 DESCRIPTION OF THE ECONOMIC AND SOCIAL ENVIRONMENT

This chapter continues the description of the environment begun in Chapter 2 by examining the social, cultural and economic environment in which the Bering Sea/Aleutian Islands groundfish fishery takes place.

3.1 Social and Cultural Characteristics

Detailed descriptions of western Alaskan communities with regard to their history, demographics, and culture can be found in a collection of documents prepared by the Minerals Management Service (MMS), and the U.S. Fish and Wildlife Service. These include both Environmental Impact Statements[1] and Technical Reports[2]. This information is summarized below, relying mostly on the more recent descriptive studies (Norton Basin Sale 100, FEIS, 1985; Technical Report 111, 1984; Technical Report 118, 1986; Alaska Maritime National Wildlife Refuge, DEIS, 1988).

Less extensive descriptive analysis has been undertaken for other areas geographically distant but potentially affected by the proposed amendment to the FMP. Other areas important in the economic and social systems of the Bering Sea groundfish fishery include southcentral Alaska (Anchorage, Kenai Peninsula, Prince William Sound, Kodiak), southeast Alaska, and the Pacific northwest. Some descriptive material for the Cook Inlet area exists, but it is either not recent or as detailed as the descriptive material for western Alaska[3]. With regard to the Pacific northwest, fishermen and fish processors from the region have played a key role in the development of the Alaskan groundfish fisheries. Moreover, fishing and processing vessels from that area account for a significant proportion of the total harvest off Alaska. These contributions are noted in Section 3.2, "Commercial Fishery Activity". Nevertheless, a description of the social and cultural structure of the northwest

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[1] Navarin Basin Lease Offering, FEIS, MMS, 1984; Togiak National Wildlife Refuge, FEIS, U.S.F.& W., 1986; St. George Basin Sale 89, FEIS, MMS, 1985; North Aleutian Basin Sale 92, FEIS, MMS, 1985; Alaska Maritime National Wildlife Refuge, DEIS, U.S.F.& W., 1988; Norton Basin Sale 100, FEIS, MMS, 1985.

[2] Unalaska: Ethnographic Study and Impact Analysis, Technical Report Number 92, MMS, 1983; Cold Bay: Ethnographic Study and Impact Analysis, Technical Report Number 93, MMS, 1983; Community Economic and Demographic Systems Analysis of the Norton Lease Sale 100, Technical Report Number 111, MMS, 1984; A Description of the Socioeconomic and Sociocultural Systems of the Aleutian-Pribolof Islands Region, Technical Report 118, MMS, 1986.

[3] Lower Cook Inlet Petroleum Development Scenarios: Commercial Fishing Industry Analysis, Technical Report Number 44, BLM, 1980; Alaska Maritime National Wildlife Refuge, DEIS, 1988.

would be impractical given the scope of the current analysis and is not included.

3.1.1 Demographics

The current population of various western Alaskan communities in or on the borders of the Aleutian Basin as indicated by U.S. Bureau of Census data is listed in Table 3.1. Also included are projections of future population (where available) in the absence of any unforseen new development, such as offshore oil leasing, or increased fishing activity.

3.1.2 Employment and Income

Likewise, the number of persons employed and the per capita income of the communities included in Table 3.1 is listed in Table 3.2 (where available). Much of the employment and income in these communities arises from commercial fishing as will be discussed in Section 3.2 below.

3.2 Commercial Fishery Activity

Since the fishery industry is the most important industrial sector in the communities profiled above and since the proposed alternatives to the status quo will, in some manner, potentially increase the fishery harvest in the Bering Sea, this section provides a review of recent fishery performance off Alaska, with particular emphasis on the groundfish harvest in the Bering Sea and Aleutian Islands.

3.2.1 Harvesting Sector

Fish landed and value of catch

Recent fishery performance for fisheries off Alaska, in terms of pounds landed and exvessel value of the harvest, is shown in Table 3.3 and Table 3.4. These data provide perspective on the contribution that groundfish makes to the total Alaskan fishery harvest. Note that in terms of weight, groundfish accounts for the majority of total landings (81%-83%, 1983-1986), but in terms of total exvessel value only one-quarter to one-third of total value (23%-31%, 1983-1986). Also, note that prior to 1986 and 1987, most of the groundfish catch was processed by foreign vessels and sold in foreign markets, therefore little value was added to the product. This is in contrast to the other species listed which are fully domestically processed.

The data contained in Tables 3.5-3.8 are extracted from a recent draft report of the Economics Workgroup at the NWAFC (NMFS, 1987) and hence should be considered preliminary. Catches are reported as whole weight in metric tons landed, and values are reported as millions of dollars at the exvessel level. Thus the values are in terms of gross revenue at the harvesting level.

Table 3.1 Current and projected populations - western Alaskan communities.1/

Community2/	Population 1980	1985	1990
Nome	2,301	3,876	3,810
St. George	158	179	---
St. Paul	551	595	---
Unalaska-Dutch Harbor	1,322	1,630 3/	1,686
Sand Point	794	870 3/	1,014
King Cove	684	521 3/	812
Cold Bay	226	186	159

1/ Population projections absent oil development impacts.
2/ Only the larger civilian communities are listed here. For information on other communities in the area see the source documents cited above.
3/ Population as of 1984, not 1985.

Sources: Alaska Maritime Wildlife Refuge, DEIS, 1988; Togiak National Wildlife Refuge, FEIS, 1986; Navarin Basin Lease Offering, FEIS, 1984.

Table 3.2 Employment income - selected western Alaskan communities.

Community1/	Employment, Jobs 1980	1984	Average Monthly Income, $ 1980	1984
Nome	---	1,448 2/	2,220	1,980
St. George/St. Paul	284	380	1,547	1,765
Unalaska-Dutch Harbor	1,322	1,865	---	1,768 3/
Sand Point	538	---	---	---
King Cove	---	411	---	---
Cold Bay	200	253 4/	---	---

1/ Only the larger civilian communities are listed here. For information on other communities in the area see the source documents cited above.
2/ Projection for 1990.
3/ Aleutian Islands census division.
4/ Projection for 1985.

Sources: Alaska Maritime Wildlife Refuge, DEIS, 1988; Togiak National Wildlife Refuge, FEIS, 1986; Navarin Basin Lease Offering, FEIS, 1984; Alaska Statistical Quarterly, Dept. of Labor, State of Alaska, 4th quarter, 1984.

Table 3.3 Alaska harvest, 1983-1987, (millions of pounds)

Year	Salmon	Shellfish	Herring	Halibut, All Alaska	Halibut, BS Area 4	Ground-fish
1983	622	112	108	33	4	3,704
1984	660	92	98	35	3	4,311
1985	674	120	121	45	4	4,571
1986	590	148	112	4	5	4,095
1987	N/A	N/A	N/A	57	7	3,992

Sources: Salmon, shellfish, herring - ADF&G Catch and Production reports; Halibut - IPHC; Groundfish - NMFS, 1987. N/A is not available. 1986 and 1987 data are preliminary and subject to change. Halibut landings - millions of pounds for areas off Alaska - (2C, 3A, 3B, 4A, 4B, 4C, 4D, 4E). Halibut, BS includes all of Area 4 noting that Area 4A extends into W. Gulf.

Table 3.4 Alaska harvest value, exvessel, 1982-1986 (millions of dollars).

Year	Salmon	Shellfish	Herring	Halibut, All Alaska	Ground-fish
1982	311	213	20	21	39
1983	321	147	30	37	158
1984	343	103	20	25	215
1985	390	106	37	45	255
1986	404	182	39	62	226

Sources: Salmon, shellfish, herring - ADF&G Catch and Production reports; Halibut - IPHC; Groundfish - NMFS, 1987. 1986 estimates are preliminary. Halibut value from landings in areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, 4E.

Table 3.5 Groundfish harvest off Alaska by species, fishery, and year, 1983-1987 (1000 mt, round weight).

		Alaska				BSAI			
		Domestic	JV	Foreign	Total	Domestic	JV	Foreign	Total
Atka mackerel	1983	--	11	13	24	--	11	1	12
	1984	0	37	1	38	--	36	0	36
	1985	--	40	0	40	--	--	--	--
	1986	0	32	0	32	0	32	0	32
	1987	0	30	0	30	0	30	0	30
Pacific cod	1983	46	17	71	134	42	14	42	98
	1984	42	35	74	152	39	31	59	128
	1985	49	44	66	159	46	41	57	144
	1986	42	65	55	163	37	64	40	141
	1987	74	59	54	187	45	57	54	157
Sablefish	1983	4	0	8	12	0	0	3	3
	1984	10	1	3	14	1	0	2	3
	1985	15	0	0	15	3	0	0	4
	1986	27	0	0	27	6	0	0	6
	1987	34	0	0	34	8	0	0	8
Pollock	1983	1	283	973	1,257	1	149	891	1,042
	1984	8	444	1,032	1,485	7	237	933	1,177
	1985	46	615	852	1,513	31	378	820	1,229
	1986	58	898	352	1,308	48	835	352	1,236
	1987	257	1,055	4	1,316	218	1,032	4	1,254
Flatfish	1983	0	37	176	213	0	34	166	201
	1984	0	54	189	243	0	50	186	236
	1985	1	175	148	324	0	173	148	320
	1986	9	218	78	305	7	217	78	302
	1987	27	222	7	256	24	215	7	246
Rockfish	1983	0	2	10	13	0	0	2	2
	1984	2	3	4	9	1	1	1	3
	1985	4	1	0	5	1	0	0	2
	1986	8	1	0	8	1	1	0	2
	1987	15	1	0	16	3	1	0	4
Groundfish	1983	56	353	1,271	1,680	46	210	1,124	1,380
	1984	63	577	1,315	1,955	48	358	1,191	1,597
	1985	115	884	1,074	2,073	81	636	1,033	1,751
	1986	144	1,222	491	1,857	100	1,156	475	1,732
	1987	408	1,374	68	1,850	298	1,342	68	1,708

Source: Pacific Fisheries Information Network, 7600 Sand Point Way N.E., BIN C15700, Seattle, WA 98115-0070; 1987 Data from PacFIN, 3/16/88 (from NMFS, 1987).

Table 3.6 Distribution of Alaska groundfish harvest among fisheries by species and area, 1983-1987 (percent).

		Alaska			BSAI		
		Domestic	JV	Foreign	Domestic	JV	Foreign
Atka Mackerel	1983	--	47.1	52.9	--	89.6	10.4
	1984	0.1	98.2	1.7	--	99.7	0.3
	1985	--	100.0	0.0	--	--	--
	1986	0.0	100.0	0.0	0.0	100.0	0.0
	1987	0.0	100.0	0.0	0.0	100.0	0.0
Pacific cod	1983	34.4	12.5	53.1	42.9	14.7	42.4
	1984	27.6	23.3	49.0	30.2	24.1	45.7
	1985	30.8	27.5	41.8	31.8	28.6	39.6
	1986	26.0	40.1	33.8	26.3	45.4	28.3
	1987	39.6	31.6	28.9	28.7	36.3	32.5
Sablefish	1983	31.1	3.1	65.8	2.7	3.4	94.0
	1984	71.8	6.3	21.9	31.7	10.5	57.8
	1985	95.6	2.2	2.3	88.9	2.9	8.2
	1986	97.8	1.8	0.4	91.5	6.8	1.7
	1987	100.0	0.0	0.0	100.0	0.0	0.0
Pollock	1983	0.1	22.5	77.4	0.1	14.3	85.6
	1984	0.6	29.9	69.5	0.6	20.1	79.2
	1985	3.0	40.7	56.3	2.5	30.7	66.8
	1986	4.5	68.6	26.9	3.9	67.6	28.5
	1987	19.5	80.2	0.3	17.4	82.3	0.3
Flatfish	1983	0.2	17.3	82.4	0.0	17.1	82.9
	1984	0.2	22.0	77.8	0.0	21.2	78.8
	1985	0.2	54.1	45.7	0.0	53.9	46.1
	1986	2.8	71.5	25.6	2.5	71.8	25.8
	1987	10.5	86.7	2.7	9.8	87.4	2.8
Rockfish	1983	3.5	19.1	77.4	0.4	6.8	92.8
	1984	26.1	29.1	44.8	46.3	21.7	32.0
	1985	80.2	16.9	2.9	62.0	30.3	7.7
	1986	92.2	7.4	0.5	66.0	31.9	2.0
	1987	93.8	6.3	0.0	75.0	25.0	0.0
Groundfish	1983	3.3	21.0	75.7	3.4	15.2	81.4
	1984	3.2	29.5	67.3	3.0	22.4	74.6
	1985	5.5	42.6	51.8	4.7	36.3	59.0
	1986	7.8	65.8	26.4	5.8	66.8	27.4
	1987	22.1	74.3	3.7	17.4	78.6	4.0

Source: Pacific Fishery Information Network, 7600 Sand Point Way N.E., BIN C15700, Seattle, WA 98115-0070; 1987 Data from PacFIN, 3/16/88 (from NMFS, 1987).

Table 3.7 Estimated exvessel value of Alaska groundfish harvests by species, fishery, and year, 1983-1987 (millions of dollars).

		Alaska				BSAI			
		Domestic	JV	Foreign	Total	Domestic	JV	Foreign	Total
Atka mackerel	1983	--	1.5	1.7	3.2	--	1.4	0.2	1.6
	1984	0.0	5.6	0.1	5.7	--	5.5	0.0	5.5
	1985	--	6.1	0.0	6.0	--	--	--	--
	1986	0.0	4.8	0.0	4.8	0.0	4.8	0.0	4.8
	1987	0.0	4.8	--	4.8	0.0	4.8	--	4.8
Pacific cod	1983	4.4	3.5	14.8	22.6	4.4	3.0	8.6	16.0
	1984	17.6	7.9	16.5	42.0	16.7	6.8	13.0	36.5
	1985	15.6	9.3	14.2	39.2	14.8	8.8	12.3	35.9
	1986	10.0	14.3	12.1	36.4	8.6	14.0	8.7	31.4
	1987	27.7	15.3	14.0	57.1	16.0	14.8	14.0	44.9
Sablefish	1983	0.1	0.2	3.2	3.4	0.0	0.0	1.2	1.3
	1984	7.0	0.4	1.4	8.8	0.4	0.2	0.9	1.4
	1985	19.4	0.1	0.1	19.6	3.7	0.0	0.1	3.9
	1986	35.1	--	--	35.1	7.2	--	--	7.2
	1987	36.9	--	--	36.9	0.1	--	--	0.1
Pollock	1983	0.1	26.1	89.6	115.8	0.1	13.7	82.1	96.0
	1984	1.4	41.6	96.6	139.7	1.3	22.2	87.3	110.9
	1985	6.3	59.8	82.8	148.9	3.6	36.7	79.8	120.1
	1986	7.0	94.3	37.0	138.3	5.7	87.7	37.0	130.4
	1987	47.1	134.2	0.5	181.7	39.0	132.0	0.5	172.4
Flatfish	1983	0.1	2.2	10.6	12.8	0.0	2.1	10.0	12.0
	1984	0.2	3.4	11.9	15.5	0.0	3.2	11.7	14.9
	1985	0.2	24.2	20.4	44.8	0.1	23.8	20.4	44.3
	1986	2.7	29.2	10.5	42.4	2.4	29.1	10.5	41.9
	1987	8.0	32.8	1.1	42.0	7.3	31.7	1.1	40.1
Rockfish	1983	0.0	0.7	3.0	3.7	--	0.0	0.6	0.6
	1984	1.3	0.8	1.2	3.3	0.4	0.2	0.3	0.8
	1985	1.8	0.2	0.0	2.0	0.3	0.1	0.0	0.4
	1986	3.8	0.2	0.0	3.9	0.4	0.1	0.0	0.6
	1987	9.0	---	---	9.0	1.3	---	---	1.3
Groundfish	1983	4.7	34.2	122.8	158.4	4.5	20.3	102.7	125.3
	1984	27.5	59.7	127.8	215.0	18.8	38.1	113.2	164.5
	1985	43.3	99.7	117.6	254.5	22.5	69.5	112.5	204.5
	1986	58.6	142.8	59.6	261.1	24.3	135.8	56.2	216.4
	1987	149.1	221.5	17.1	387.7	77.6	216.5	17.1	311.2

Source: Pacific Fisheries Information Network, 7600 Sand Point Way N.E., BIN C15700, Seattle, WA 98115-0070; 1987 Data from PacFIN, 3/16/88 (from NMFS, 1987).

Table 3.8 Distribution among fisheries of the estimated exvessel value of Alaska groundfish harvests by species, 1983-1987 (percent).

		Alaska			BSAI		
		Domestic	JV	Foreign	Domestic	JV	Foreign
Atka mackerel	1983	--	46.9	53.1	--	87.5	12.5
	1984	0.2	98.1	1.7	--	100.0	--
	1985	--	100.0	--	--	--	--
	1986	0.0	99.9	0.0	0.0	99.9	0.0
	1987	0.0	100.0	0.0	0.0	100.0	0.0
Pacific cod	1983	19.3	15.4	65.3	27.4	18.7	53.9
	1984	42.0	18.7	39.3	45.7	18.7	35.6
	1985	39.9	23.8	36.3	41.2	24.6	34.1
	1986	27.5	39.3	33.2	27.5	44.7	27.8
	1987	48.5	26.8	24.5	35.6	33.0	31.2
Sablefish	1983	2.9	4.4	92.7	1.9	3.4	94.7
	1984	79.8	4.5	15.6	28.3	11.0	60.7
	1985	98.9	0.5	0.6	96.5	0.9	2.6
	1986	100.0	--	--	100.0	--	--
	1987	100.0	--	--	100.0	--	--
Pollock	1983	0.1	22.5	77.4	0.1	14.3	85.6
	1984	1.0	29.8	69.2	1.2	20.0	78.8
	1985	4.2	40.2	55.6	3.0	30.6	66.4
	1986	5.1	68.2	26.8	4.4	67.3	28.4
	1987	25.9	73.9	0.3	23.1	76.6	0.3
Flatfish	1983	0.5	17.3	82.2	0.0	17.1	82.9
	1984	1.0	21.9	77.1	0.0	21.2	78.7
	1985	0.4	54.0	45.6	0.1	53.9	46.0
	1986	6.4	68.9	24.7	5.6	69.4	25.0
	1987	19.0	78.1	2.6	18.2	79.1	2.7
Rockfish	1983	0.1	19.8	80.1	--	--	100.0
	1984	38.0	24.4	37.6	44.1	22.6	33.3
	1985	91.0	7.7	1.3	72.1	22.2	5.7
	1986	95.6	4.1	0.3	73.4	25.0	1.6
	1987	100.0	--	--	100.0	--	--
Groundfish	1983	3.0	21.6	77.5	3.6	16.2	82.0
	1984	12.8	27.8	59.4	11.4	23.2	68.8
	1985	17.0	39.2	46.2	11.0	34.0	55.0
	1986	22.4	54.7	22.8	11.2	62.8	26.0
	1987	38.5	57.1	4.4	24.9	69.6	5.5

Source: Pacific Fisheries Information Network, 7600 Sand Point Way N.E., BIN C15700, Seattle, WA 98115-0070; 1987 Data from PacFIN, 3/16/88 (from NMFS, 1987).

Figure 3.1 Composition of Alaska Groundfish Harvests (Weight)

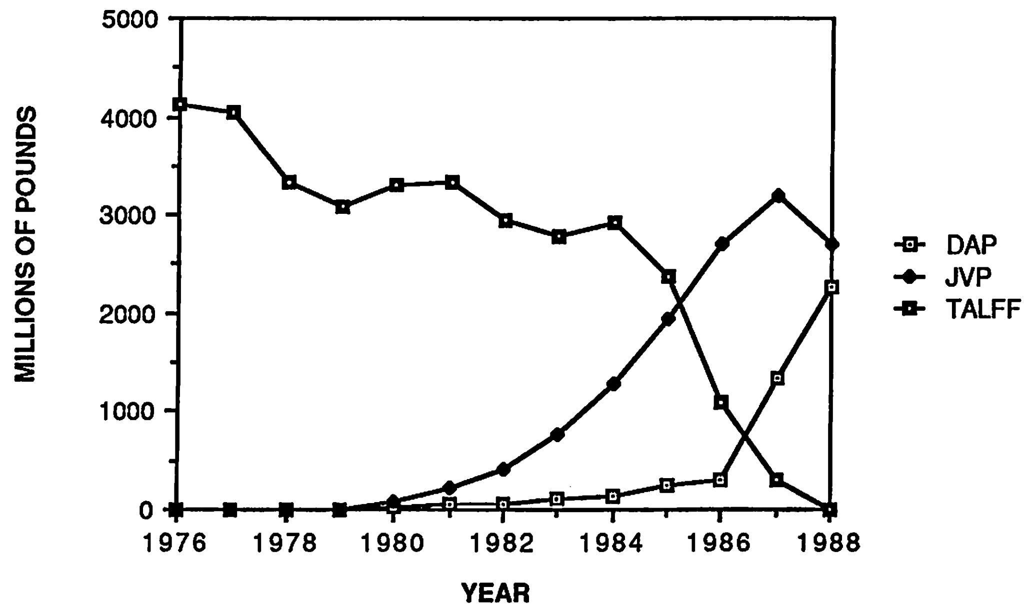
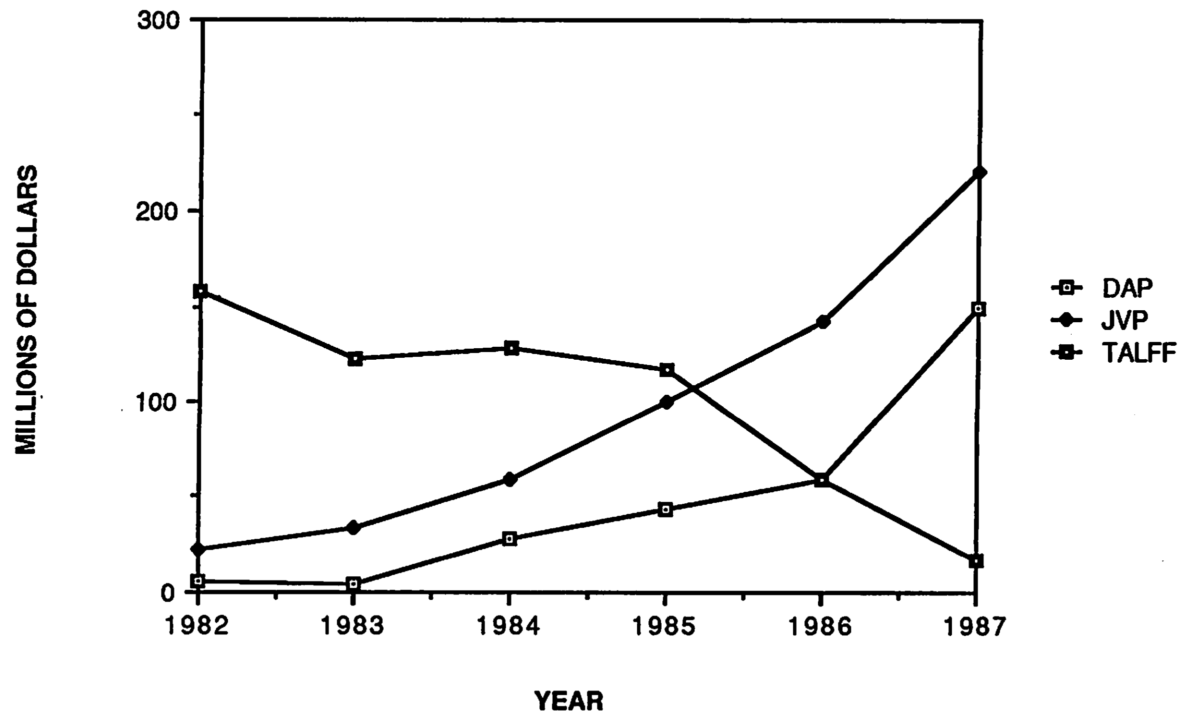


Figure 3.2 Composition of Alaska Groundfish Harvests (Exvessel Value)



Data are reported for the last five years for all of Alaska and for the Bering Sea/Aleutian Islands area, by species or species group, for three user groups: domestic caught and domestic processed (DAP), domestic caught and foreign processed (joint venture, JV, or JVP) and foreign caught and processed (TALFF).

Exvessel value for the domestic catch was calculated from reported shoreside domestic prices. This means that values for the catcher/processor and mothership/processor part of the fleet do not include value added by at-sea processing. Values for the joint venture and foreign component of the catch are based on information from the Alaska region of NMFS on contracted prices for deliveries to foreign processors.

As can be seen from the data of Table 3.5 and the percentages of Table 3.6, some groundfish species are wholly harvested and processed domestically. In the Bering Sea, as of 1987, fully "Americanized" species include sablefish and rockfish, although joint ventures are provided small amounts of these species as catch incidental to other target fisheries.

Although the overall harvest in the Bering Sea, by weight, has not changed significantly over the last several years,[4] the DAP component of the catch has increased dramatically in recent years as has the joint venture share. These increases have come at the expense of the foreign directed harvest and, in 1988, there was no directed foreign allocation off the coast of Alaska (Table 3.6, Figure 3.1; see also Table 1.1).

In contrast, total exvessel value (in nominal dollars) has increased over the period (Table 3.7) from approximately $200 million in 1985 to in excess of $300 million in 1987. There is some indication that these trends will continue, at least in the short run, given the continuing increase in demand for seafood products and the current relative scarcity of substitute products worldwide. Moreover, as more of these species become fully utilized by U.S. processors the stream of benefits to the U.S. will also increase as benefits are generated at other market levels--processing, wholesale, and retail.

With respect to changes over the last five years in the distribution of the harvest by value, note that the increase in value over the period has been dramatic in the wholly domestic and joint venture sectors (Table 3.7, Figure 3.2) and that the largest gains in share of revenue have taken place in DAP (Table 3.8).

<u>Numbers of vessels and fishing effort</u>

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[4] Note that the sum of the TACs has been constrained by the current upper limit on OY of 2.0 mmt.

All sectors: Not coincidentally, the gains in harvest experienced in the domestic sector (DAP and JVP) have been associated with substantial increases in the numbers of domestic vessels participating in the groundfish fisheries. Federal fishing permit totals as indicated in Tables 3.9 (all Alaska) and 3.10 (Bering Sea only) illustrate this. The data in these tables are the number of permits issued, not necessarily permits fished, so, to some unknown extent, the numbers overestimate the number of vessels actually participating in the fishery. Nevertheless, the data are useful for examining trends in fleet size and effort.

For the Bering Sea/Aleutian Islands area (Table 3.10) the increase in the number of permits has occurred primarily in the longline sector, with stable or declining trends in the number of trawl permits and pot permits. Note that these changes may be reflective of changes in the way fishermen register their vessels rather than real changes in participation by gear group.

With respect to residency of the permit holder, both Alaskans and non-Alaskans have participated in the growth of the fisheries, with Alaskan permits increasing most rapidly in the longline sector, and non-Alaskan in the trawl and longline sector. Note that these data are for all permit holders regardless of size of the vessel or gross or net tonnage. To the extent that changes have occurred in the average size of the vessel by gear and by residency, measures of changes in "fishing power" may not be correctly represented by these permit breakdowns. More detailed permit information can be found in the draft NMFS data report cited earlier.

Joint ventures: In 1984 NMFS began keeping records on permits for joint ventures, allowing an examination of trends over the last four years (Tables 3.11, 3.12). As above, the permit totals are broken down by gear group and residency and thus reflect changes in participation by those particular groups. The most important trend to note is that, as of 1987, the total number of joint venture permits declined from the previous year. This is true in the Bering Sea alone and for all of Alaska (Table 3.11), both for Alaskan and non-Alaskan residents (Table 3.12).

Domestic fleet: The performance of the wholly domestic component of the fleet can be examined through review of the ADF&G groundfish fish ticket data base.

Tables 3.13 and 3.14 present the same information as was given above for joint ventures, with operations separated by the type of processing occurring--at-sea or shore-based. For these two tables, catcher vessels are separated into harvesting only; which includes catcher vessels delivering shoreside, and catchers delivering to at-sea processors (mothership/processors); and into a harvesting/processing component--the factory trawler fleet.

Table 3.9 Number of permits issued by area, gear type, and year 1981-1987, (all vessels).

Area	Gear Type	Year 81	82	83	84	85	86	87
Gulf of Alaska								
	Trawl Gear	53	83	128	209	240	148	187
	Longline Gear	148	169	270	677	868	971	1401
	Pot Gear	39	48	79	252	342	45	101
	Other Gear	49	76	126	354	483	55	77
	Total Vessels	197	247	389	843	1050	1171	1592
Bering Sea, Aleutian Islands								
	Trawl Gear	0	60	97	145	180	141	164
	Longline Gear	0	36	75	172	236	312	482
	Pot Gear	0	16	36	88	126	31	59
	Other Gear	1	10	27	88	109	14	17
	Total Vessels	1	96	161	291	380	475	647
Alaskan Total								
	Trawl Gear	53	92	133	223	258	155	197
	Longline Gear	148	169	270	696	892	991	1433
	Pot Gear	39	49	82	265	355	47	105
	Other Gear	50	76	126	369	502	59	79
	Total Vessels	198	256	395	872	1089	1202	1637

Source: Based on data from Federal Registration File, National Marine Fisheries Service, Alaska Region, P.O. Box 1668, Juneau, AK 99802 (from NMFS, 1987).

Note: Some of the changes in permit numbers may reflect changes in the manner of reporting rather than vessel entry/exit.

Table 3.10 Number of permits issued by gear type, residence, and year, Bering Sea/Aleutian Islands, 1981-1987.

		Year						
Gear Type	Residence	81	82	83	84	85	86	87
Trawl Gear								
	Alaska	0	13	22	55	65	29	39
	Washington	0	40	51	70	88	90	100
	Oregon	0	6	18	16	21	16	17
	Other	0	1	6	4	6	6	8
	ALL	0	60	97	145	180	141	164
Longline Gear								
	Alaska	0	16	40	107	169	221	343
	Washington	0	19	31	58	61	75	117
	Oregon	0	0	1	4	3	11	18
	Other	0	1	3	3	3	5	4
	ALL	0	36	75	172	236	312	482
Pot Gear								
	Alaska	0	7	19	54	95	16	37
	Washington	0	8	16	29	25	11	18
	Oregon	0	1	1	3	3	1	2
	Other	0	0	0	2	3	3	2
	ALL	0	16	36	88	126	31	59
Other Gear								
	Alaska	0	7	21	71	92	9	14
	Washington	1	3	6	16	15	5	3
	Oregon	0	0	0	0	0	0	0
	Other	0	0	0	1	2	0	0
	ALL	1	10	27	88	109	14	17
Total Vessels								
	Alaska	0	29	52	134	195	261	370
	Washington	1	59	81	129	151	173	228
	Oregon	0	6	19	20	22	27	35
	Other	0	2	9	8	12	14	14
	ALL	1	96	161	291	380	475	647

Source: Based on data from Federal Registration File, National Marine Fisheries Service, Alaska Region, P.O. Box 1668, Juneau, AK 99802 (from NMFS, 1987).

Note: Some of the changes in permit numbers may reflect changes in the manner of reporting rather than vessel entry/exit.

Table 3.11 Number of permits issued to joint venture vessels by area, gear type, and year, 1984-1987.

		Year			
Area	Gear Type	84	85	86	87
Gulf of Alaska					
	Trawl Gear	76	86	103	98
	Longline Gear	6	9	9	5
	Pot Gear	9	12	1	1
	Other Gear	2	2	0	0
	Total Vessels	79	92	111	100
Bering Sea, Aleutian Islands					
	Trawl Gear	75	90	105	102
	Longline Gear	3	9	8	3
	Pot Gear	9	12	1	1
	Other Gear	1	2	0	0
	Total Vessels	76	96	112	102
Alaskan Total					
	Trawl Gear	78	92	105	102
	Longline Gear	6	9	10	5
	Pot Gear	9	12	1	1
	Other Gear	2	2	0	0
	Total Vessels	81	98	114	104

Source: Based on data from Federal Registration File, National Marine Fisheries Service, Alaska Region, P.O. Box 1668, Juneau, AK 99802 (from NMFS, 1987).

interpretation made by the plan team.[53]

2. The definition of ABC in the FMP is subject to change. The definition has been changed twice in two years, and is likely to be changed again next year. Each change would dramatically effect the manner in which the upper limit of optimum yield is determined.

3. Under any definition, the ABC is arrived at using a number of assumptions that are consistent with the perceived management philosophy of the Council. As the management philosophy changes, the assumptions upon which the ABC's are based will also change, yielding different numbers.

While there is no discretion in the mechanics of setting the upper limit of optimum yield once the ABC's have been established, there are no bounds to the discretion in setting the underlying ABC's.

Second, and related, the DSEIS demonstrates the inability to anticipate and describe the situations that are likely to occur under the proposal, and to analyze the socioeconomic and biological impacts of actions made pursuant to the proposal.

The DSEIS focuses on impacts that would be expected to occur if the Council acts in a manner consistent with its 1987 actions. There are absolutely no assurances that this will be the case. The Council is subject to constant changes in personnel (at least 3 new Council members this year alone). The Council could easily change its management philosophy from one year to the next.

Under the status quo, if the Council wants to risk long-term stability in exchange for short-term harvest increases, it must comply with the amendment process. Under the proposal, the new philosophy would be implemented simply through a rule-related notice. The Council could increase the total optimum yield to any amount, so-long as it had selected ABC's that add to that amount.

In addition, the DSEIS fails to adequately address the likely impacts on the domestic processors that would result from this proposal. This is due to the fact that the likely situations that would result from this unstructured system are unlimited.

C. <u>Effect of Proposal on Procedural Safeguards</u>.

One of the key attributes of the fisheries management system created under the FCMA is the opportunity for public input into the decision making process. The degree of opportunity for public participation increases with the importance of the decision. In season adjustments in management may be made through rule-related notice, with the public having the opportunity to provide written comment or, in some cases, oral comment through the Council process. Substantial changes in management philosophy or objectives are subject to the increased scrutiny and analysis provided under the amendment procedure.

This proposal would remove the decision to increase the upper limit of the optimum yield from the scrutiny of the amendment process and put in the same category as in season management adjustments. Under this system, little analysis of the impacts of the decision need be made. Such decisions can be made with only the opportunity to submit written comments during a 30-day period, or even without any prior opportunity to comment.

Such a change would leave an aggrieved party little time or opportunity to challenge a decision. Industry would have only the 30-day period (or less) to react to dramatic increases or decreases in TAC due to changes in the upper limit on optimum yield.

Because the Council has adopted quota management as its principal management tool, the annual establishment of these quotas is the single most important function of the Council. Reducing the procedural safeguards and opportunity for public participation in that process would adversely effect the integrity of that system.

III. Biological Implications of an Increase in the Optimum Yield Range for Groundfish of the Bering Sea and Aleutian Islands.

A. <u>Bering Sea Resource</u>. The fishery for groundfish in the BS/AI is relatively new in comparison with both the U.S. and world fisheries for groundfish. Modern exploitation began in the early 1950's and reached 500,000 mt in 1966, 1,000,000 mt by 1968 and 2,000,000 mt by 1971. Catches remained near 2,000,000 mt until 1975 when increasing concern over stock condition resulted in management restriction on harvests.

Management began under separate bilateral International negotiations between the U.S. and Japan and the USSR. As a result of those negotiations, harvests were lowered to about 1,500,000 mt in 1975-1976. In 1977, after passage of the MFCMA, the U.S. took management jurisdiction and imposed further restrictions on harvests. Reduced and verified catches of about 1,200,000 mt for the years 1977-1983, 1,400,000 mt for the years 1984-1985 and 1,800,000 mt for 1986-1987 have resulted.

This history is important in relationship to any proposal to increase optimum yield. It demonstrates that catches in the range of 2,000,000 mt were followed by declines in stock condition that led to management restrictions. By most criteria the BS/AI stocks have responded to reduce catch limits and have been well-behaved under harvests in the range of 1.5-2.0 million mt during the first ten years of Council management.

There is a contention that catches in the early 1970's were under-reported. This contention leads to the conclusion that the historic fishery response was caused by harvests significantly greater than were recorded. Even if this contention is true, the fact remains that there was a fishery response at levels of harvest that existed in those years.

The history of the fishery suggests that harvests near 2,000,000 mt have resulted in target population declines in the exploited stocks.

B. Proposals to Increase Optimum Yield Depend Upon the Validity of the ABC's and Change Their Use in Management.

1. Importance of ABC's in the Management Process. The optimum yield range sets the latitude for the Council's management decisions; that is, the optimum yield sets the bounds and delimits the options for action. In considering change in the optimum yield range two aspects are important: (1) the impact of change in the optimum yield on the various user groups, and (2) the validity or basis for such change. The latter depends on the accuracy and variation of the underlying ABC's.

The DSEIS essentially addressed the first aspect. It describes the impacts of an increased OY based on the sum of the ABC's or sum of the MSY's without regard to the biological basis of the individual ABC's or MSY's used to establish the OY. This approach is clearly stated in the Executive Summary:

> Concerns regarding the validity of the annual estimates of ABC are equally germane to the status quo and the alternatives. The alternatives, by themselves, contemplate no change in how ABC's are estimated or utilized.[54]

While this text would imply that "validity" of the ABC's need not be considered in the context of the DSEIS, the very next sentence contradicts this implication:

> The potential risk of overharvest, however, could be somewhat increased under the alternatives, due to the likelihood that more species would be harvested up to their ABC.[55]

The validity of the ABC's is germane to this DSEIS because (1) the proposal is for change in the way the ABC's are utilized in management and because (2) there is an increased risk of overharvest.

Closely related to the concerns regarding the validity and risk inherent in the ABC's is the last sentence of the Executive Summary:

> So long as the TAC's do not substantially exceed ABC's for each species, no biological harm is anticipated.[56]

This statement essentially ignores the ecosystem context of the plan that formed one basis for the original cap on the optimum yield. There are two concepts that are important here (1) single species analysis to determine the individual ABC's and (2) species interaction in the ecosystem context - "the whole is less than the sum of the parts". (because of ecosystem interactions, compensation, and competition). These concepts were one of the bases for the two-tiered management method of the current BSAI groundfish Plan. That Plan creates a system that sets an overall OY at a level <u>less than the sum of the parts</u> (the 85% limitation) and then allocates TAC's to individual species in relationship to the individual ABC's.

The Alternatives <u>eliminates</u> the two-tiered management system based on an ecosystem approach and replace it with the older concept of single species analysis. The rationals that the ecosystem contains interactions, dependencies, and competition that formed one of the bases for the 85% restriction on the optimum yield in the BS/AI Groundfish Management Plan would be eliminated. This is a fundamental change in the way ABC's are used in Management and the rationale for this change is not included in the DSEIS. Yet the context of the DSEIS and major emphasis in much recent NMFS rhetoric is on the ecosystem approach. (Alternatives 2B and 3B retain a 90% to 85% qualification respectively but the only rationale presented seems to be a minor concession to uncertainty).

Also the last phrase of this statement implies that the criteria for ABC is "no biological harm". The definition of the term "biological harm" is not presented. The fisheries literature usually defines "biological harm" in the context of overfishing- either "growth overfishing" to maximize biological yield or "recruitment overfishing" to protect reproduction. Neither term covers the economic/social/ecological concept of "Optimum Yield" as envisioned in the MFCMA. On the other hand, the DSEIS is specifically designed to address the economic/social/ecological aspects of the rulemaking proposed. The management objective(s) that are to be addressed by the proposed change need to be specifically identified and related to the action proposed, for example. ABC's based on optimum size or catch per unit of effort ("CPUE").

Finally, with regard to the optimum yield, the distinction between the Alternatives 2 and 3 should be clearly understood.

Basing optimum yield on the sum of the MSY's implies a different management concept then that of basing optimum yield on the sum of the ABC's. The MSY method implies a limit based on the long-range capacity of the system to produce yield to man. The MSY-based concept produces an upper limit on yield that would only change with improved knowledge. The ABC method implies a pragmatic year-to-year evaluation of the system (status) and the current production (prediction) for yield to man. The ABC-based concept produces a variable yield that would change with the condition of the stocks (up or down). The rationale for choice between the two alternatives is not presented. (One rationale would be that the estimating procedures for MSY are much less precise than those for ABC).

2. Management Objectives determine the criteria for calculating ABC's. There is no single ABC calculation - that is, an ABC depends upon the objectives selected. The specific objectives for each single species calculation are often unstated and subsequently become implicit in the underlying assumption of the method used. The usual success criteria for management actions based on ABC's is the behavior of the population in response to the action taken. Because there responses are related to the life history of the species in question, it may take several years to see results.

The fisheries biological literature and the Guidelines for the MFCMA list two classic objectives for fisheries management (1) to prevent recruitment overfishing, and (2) to prevent growth overfishing.

At present, recruitment is poorly understood and there are no practical methodologies to calculate ABC to prevent recruitment overfishing. The usual response is to protect spawners, females, or to set thresholds at low population levels - but, there is little evidence that these have been effective for commercially exploited groundfish. Recruitment remains a very large uncertainly, but in a practical sense it is more important with respect to short term variation in abundance (year-class phenomena) than to survival of the species for commercial fisheries.

Growth, by comparison with recruitment, is well understood. The classic methods of fisheries population dynamics balance growth of a population against mortalities to maximize yield in biomass and prevent growth overfishing. The ABC's based on these models have biologically determined critical size - that is, to take the maximum biomass, the fishing industry must accept the size of fish nature provides. The "cost" of larger or smaller fish is a smaller ABC. The important point here is that ABC is dependent on the growth objective selected - maximum yield at critical size or an equilibrium yield at some other size. While classic fisheries population dynamics models address growth overfishing and provide an objective estimate of ABC, their direct application in management is impractical in a multi-species fishery.

Other criteria than growth or recruitment overfishing can be used to specify or delimit ABC's - for example, stability, CPUE, size of fish, or roe condition.

3. Validity of the optimum yield depends on the validity of the individual calculations of ABC's or MSY's. The validity of the ABC's is an important criteria with respect to any decision to change the basis for setting the OY (1) because the alternatives change the way that ABC's are used in management, and (2) because any increase in optimum yield also increases the risk of overfishing.

The DSEIS has provided a discussion on its rationale for determination of the ABC's.[57] The methods are sequential in nature (the more sophisticated methods demand more detailed data) and represent the team's best interpretation of the scientific information available. While the methods vary from species to species and cannot (should not) be defined by any single simple formula, they do represent constructive improvement with each year's successive analysis.

But, even the best scientific information used to set ABC's in uncertain. These uncertainties arise from a number of sources, for example: (1) uncertainty arising from the mathematical properties and assumptions of the models used, (2) uncertainties arising from the adequacy of the data, (3) uncertainties in the accuracy of the data, and (4) uncertainties arising from statistical variation.

a. Quality of the Models. The validity and risk associated with estimates of ABC are directly related to the quality of the models. The classic yield models generally estimate long-term parameters which are of little value in the year-to-year management of fish populations. These are often used to estimate MSY's and when one examines the fit to the data it is often difficult to see the relationship because of the scatter of the data. ABC estimates based on these long-term parameters are subject to wide variation (the default method using F(MSY) times exploitable biomass is of this nature).

The modern models based on catch at age analysis and computer simulation, when combined with inventory information from fishery independent surveys, are quite reliable for short-term prediction. They are the method of choice when adequate catch-at-age data are available. But even with the best models there are major uncertainties in estimates of ABC's, for example, because of environmental change and because recruitment is difficult to predict. They do not address ecosystem interactions.

b. Quality of the Data. The validity and risk associated with estimates of ABC depend upon the quality of the data available for their estimate. At present, data from the fisheries is of very high quality primarily because of the federally-funded foreign observer program. As the foreign and JV fisheries are replaced by domestic fisheries, a way must be found to provide this data. In this latter regard, the factor of accountability becomes paramount if we are to detect early signs of overfishing.

The other major source of biological data is from the federally-funded fishery independent fishery surveys. This data is marginally adequate at present, but pressures to reduce federal budgets is continually eroding this data base. This data will become more important if optimum yield is raised because the fisheries will be operating nearer the margin and they will be in greater risk of overfishing. In particular, data to support near-term prediction of recruitment is needed to reduce this risk.

In summary, increasing the optimum yield increases risk of overfishing at a time when fisheries data is being reduced in quality.

c. Uncertainties in Accuracy of the Data. The validity of the estimates of ABC depends on the accuracy of the estimating process. This is a statistical term that expresses the degree to which the models/data reflect the real world - is the estimate correct? Does the survey measure the same population as the fishery? Are the fisheries data biased? Is there a trend or cycle that is not reflected in the models? Are the estimates too high or too low? The accuracy of short-term predictions (ABC) for fish populations is better than the accuracy of long-term predictions (MSY), primarily because we can estimate the portion of the population that remains "in the pipeline" for long-lived species.

d. Uncertainties in the Statistical Variation. Variation is a characteristic of any biological population and may be thought of as the degree to which different samples of the same population reflect the true value - the repeatability. There are standard statistical methods to estimate variation. These are usually expressed in terms of a confidence interval for the estimate or as a percentage of the mean value. The calculation of the error should be based on the variation in the parameter being measured and not in the variation of the sampling tool - for example, in acoustic estimates there is error associated with the target strength estimate as well as in the data set collected from the fishing ground.

Individual estimates of ABC are variable and should be presented to the Council in terms of ranges in order to indicate their reliability.

4. Biological characteristics of populations as related to uncertainty in calculations of ABC/Optimum Yield. The biological characteristics of groundfish populations have important implications in the setting of Optimum Yield/ABC's and are reflected in the uncertainty in the Optimum yield/ABC's. In our rush to quantify biology we often lose sight of the fundamental causes of variation in the abundance that we attempt to mirror in our mathematical models. These factors and others control the nature and degree of response of fish populations to exploitation and affect the validity and variation in the estimates of ABC's. Important biological characteristics in this context include: (1) homeostasis (stability), (2) variations in recruitment, (3) life history continuum - time, and (4) ecological interactions.

a. Homeostasis. Homeostasis is that property of biological populations that tend to return them to equilibrium after change. This is the basic biological property that leads to the "modern theory of fishing". The principle mechanism of this property are compensatory growth and reproduction and these vary with each species. The equilibrium may not be fixed and probably varies with change in the environment. It is this characteristic that fisheries scientists attempt to mirror (define) by their quasi deterministic mathematical models of fish populations. The degree that they are able to mirror nature is reflected in the accuracy of their models.

b. Recruitment variation. Recruitment variations is the major uncertainly in the prediction of abundance of fish populations. Many fisheries models make the assumption of constant recruitment or use of conceptual models (the Beverton-Holt of Schaeffer models) that often result in very poor fits to the data. In any case this source of variation causes major uncertainty in estimates of ABC.

c. Life History. Most fish species in the BS/AI management area are relatively long-lived species. Response to any change in management measures or environmental change will take a number of years to become effective. An increase in the optimum yield will cause changes that may take years to detect - and, conversely, changes we see today are the result of actions or changes that occurred years ago. Consequently, our management measures must not respond to short-term externalities but must be based on the long run response of the underlying populations.

d. Ecological Interaction. Whatever happened to the ecosystem concept? The "first law of Ecology" states that everything depends on everything else. Just as the individual species tends to return to an equilibrium the ecosystem does also. There is a "system" capacity for production and a natural limit to the yield for any component. These are very difficult to estimate. Yield to man is compensated in the system by changes in the yield available to support other components of the system. ABC's for individual species do not compensate for these exchanges and interactions. Consequently they generally over-estimate the yield. One of the arguments for the 85% restriction in the original BS/AI groundfish plan was to allow for the fact that "the whole is less than the sum of the parts" (as calculated by single species analysis).

C. Harvest of Pollock in International Waters of the Bering Sea ("Doughnut Hole") Increases Uncertaintyon Optimum Yield/ABC's for BS/AI Fishery for Groundfish. A major uncertainly in calculations of optimum yeild/ABC for pollock in the BS/AI management area is the relationship of the BS/AI stocks to the harvest of pollock in the International waters of the Bering Sea (the "doughnut hole" issue). The DSEIS indicated that the relationship will be taken into account in the calculation of ABC as the question is resolved.[58] The fact remains that the Plan Team, in the absence of information, has noted but ignored this major source of uncertainty in calculating ABC for pollock. In the worst case hypothesis, that the catches in International waters result from stocks of the BS/AI area, the exploitation rates for this stock in the last two years would have nearly doubled. And, if the DSEIS assumptions of current full utilization for BS/AI pollock are correct, then serious overfishing may already by occurring.

Over the past 10 years pollock has provided from 72 to 83% of the total harvest from the BS/AI area. Consequently uncertainty in this one component of the resource base could have serious impact for other species of the groundfish complex. The impact could go far beyond pollock if Alternatives 2BC and 3BC were chosen because of the percentage limitations are applied to the sums of the ABC's and MSY's.

The DSEIS indicated that short-term response of the domestic segments of the Fishing Industry to an increase in optimum yield would primarily affect the harvest of pollock[59] based on 1988 estimates. The DSEIS also suggests a dominate role for pollock in the ecosystem context. Perhaps the Council should consider treating pollock separately from the remaining part of the groundfish complex. In this context (increased harvest of pollock) the uncertainty concerning the doughnut hole harvests should be considered before raising the optimum yield.

D. Conclusions.

The proposal in Increase the optimum yield Range includes fundamental change in the management of BS/AI groundfish. The Alternatives contain significant biological implications with regard to the validity and management application of the individual ABC's.

There is significant biological risk inherent in management near the upper end of the yield estimates. Selection of Alternative proposals 2A and 3A alone would eliminate the ecological safety feature of the 85% limitation that currently applies to the Plan estimate of MSY. The whole is less than the sum of the parts because of competition, compensation and other interactions. Placing a cap on optimum yield such as the 85% in the plan and Alternative 3 or the 90% cap in Alternative 2 (Alternatives 2AB or 3AB) would allow for uncertainty and for ecosystem effects.

IV. Economic Analysis.

A. The DAP Fishery.

1. Introduction. We have attempted to assess the size and economic contribution of the at sea DAP fishery. This assessment is based in part on publicly available data and in part on information supplied by various factory trawler companies. Where these sources did not provide complete information, we have supplemented them with informed assumptions regarding other quantitative factors such as investment, crew size, and the size of on shore administrative and support operations.

2. Projected Fleet Size. Currently there are more than 30 factory trawlers and large floating processors operating in the DAP fishery. The Alaska Factory Trawler Association (AFTA) projects that this number will grow to 44 vessels by the end of 1988 and 60 by the end of 1989. Most of this fleet will operate in the BS/AI at least part of the year.

If construction schedules slip, the projection of 60 vessels may not be met by December 1989. However, a fleet of at least 55 to 60 vessels will almost certainly be on line by mid 1990. Assuming that 4 or 5 of the vessels in this fleet are floating processors, an additional 20 or 25 catcher vessels will be employed in supporting at sea processing operations.

Additional vessels will deliver to DAP operations on shore. The FOG Committee draft report estimates that 8 catcher/tender vessels are currently involved in delivering to shore based processors in Dutch Harbor and Akutan. This number could increase if shore based processing of Bering Sea resources expands.

3. DAP Capacity. Current on line processing capacity in the factory trawler and at sea processor fleet is approximately 680,000 mt of round fish. This is projected to increase to approximately 950,000 mt by the end of 1988 and to somewhat in excess of 1.5 million mt by the end of 1989. In addition the fleet of freezer longliners is expanding and could have a capacity of approximately 100,000 mt by 1989. If on shore processing reaches 300,000 mt, total DAP capacity will be very close to 2 million mt by 1990.

These figures are realistic estimates of actual operational capacities, not theoretical production maxima. Increases in production efficiency will result in additional capacity increases after 1990 even if the number of fishing and/or processing platforms does not continue to increase.

Actual DAP performance in 1988 and 1989 will be less than the figures given above because capacity is coming on line throughout the year during this period. Also, these capacities assume that the price relationship between pollock and other species, for example cod, is such that it is worthwhile for fillet vessels to target on pollock for most of the year. If this is not the case and vessels switch to other species the actual production will be significantly below the capacities reported above.

4. Direct Employment. A typical factory trawler provides full time equivalent (FTE) employment for approximately 25 to 35 crew for small to medium sized vessels, 35 to 55 for medium to large, and 55 to 75 or more for the largest vessels in the fleet. Based on these averages and assuming a rotation schedule, employment in the current factory trawler and at sea processor fleet would be in the range of 2200 to 2400 including crews on related catcher vessels. Even the lowest paying of these jobs would exceed an annualized compensation rate of $25,000 including catch based bonuses. A typical processor would receive $35,000 for 7 to 8 months work and could receive more if prices are at high levels. Skilled positions pay significantly higher rates.

Once the fleet has expanded to the numbers projected for 1990, employment will increase significantly. The 1990 total employment at sea could range as high as 4000 or more.

In addition to at sea employment, on shore support and administrative staff requirements generate a significant number of jobs. A rough estimate of 1990 on shore employment in factory trawler company offices is 200 positions. Perhaps 75 percent of these exist at the present time, and the remainder will be added as the number of vessels expands.

Pacific Seafood Processors Association (PSPA) estimates on shore employment in the processing industry based on BS/AI groundfish harvests at approximately 1000 jobs. In addition to this number, on shore processors generate direct employment in support positions and on the catcher vessels delivering to the plants in Akutan and Dutch Harbor.

5. Direct Investment. The actual cost of particular vessels is proprietary information that most companies are unwilling to divulge. This data has been published for certain vessels, however, and for others "standard cost" type estimates

are available from shipyards and marine architects.

Using a combination of published and estimated figures, we estimate investment in the current factory trawler and at sea processor fleet at approximately $350 million. Investment in the projected 1990 fleet of 60 vessels should be approximately $800 million. Most of the funds for these projects are already committed.

No estimate of direct investment in on shore processing for groundfish is available. However, based on the assumption that on shore production in Dutch Harbor/Akutan area will stabilize at approximately 300,000 mt of round fish per year, it is possible to approximate direct investment as follows: Production per year of one shore based line producing fillets -- 10,000 mt. Cost of one fillet line and installation -- $400 thousand. Additional cost of surimi production equipment -- $40 million. Total investment -- $52 million.

6. Related industries. Related industries include those which are involved in constructing and preparing vessels for fishing, those which support vessel operations, and those involved in handling and reprocessing fish up through retail sale.

Marine architects, shipyards and shipyard suppliers provide design, construction, and basic materials and equipment for factory trawler construction. Once in operation other firms are involved in providing a broad range of supplies and services to DAP operations. These include companies in the following areas:

- maintenance and repair
- freight
- fuel
- packaging
- transportation
- warehousing
- cold storage
- administrative support services such as communications, financial services, legal, accounting, and management.

Once fish has undergone its initial processing an extensive network of brokers exporters, secondary processors, jobbers, packaging, labeling, warehousing, transportation, wholesalers, distributors, retailers and food service operators are involved in preparing the product for the ultimate consumer.

7. Markets. Fish caught in the Bering Sea is sold in both the U.S. and international markets. The primary foreign market is Japan, which is a major market for surimi and headed and gutted sablefish, rockfish, pacific cod. Roe fisheries also are primarily destined for the Japanese market. These include pollock

roe and rock sole with roe. There is also a good market for yellowfin sole and turbot in Japan.

Pollock fillets and blocks and cod fillets are produced primarily for the U.S. and European market. European sales are restricted by tariff barriers and competition from fish processed by Polish joint ventures in U.S. waters. Opportunities for block sales in the U.S. by DAP operations are limited by fish caught in Polish and Korean joint ventures and reprocessed on shore in Korea for reshipment to the U.S. in the form of lower quality, twice frozen blocks.

B. Economic Contribution to the U.S. Economy.

1. DAP Fishery. Estimated and projected jobs and investment from the BS/AI groundfish fisheries were set forth above. To summarize, they are as follows:

	Estimated as of June 1988	Projected 1990
Investment in factory trawlers and at sea processors	$350 million	$800 million
Fishing and processing employment at sea	2200 to 2400	over 4000
Administrative and support jobs on shore in factory trawler industry	150	200
Investment in processing on shore	$35 million	$ 52 million
Processing jobs on shore	1,000	over 1500

The projected effect of the fishery on other sectors of the economy will vary depending on (among other things) the dollar volume of sales by DAP harvesters and processors. Estimates of the dollar volume of revenue generated by the DAP fishery vary depending on assumptions regarding species mix, product form, yield rates, and market conditions. Most estimates are in the range of $1 billion or higher when DAP reaches 100 percent.

Twelve years ago before the creation of the U.S. exclusive economic zone, virtually none of the benefits associated with this revenue stream accrued to the U.S. economy.

The full extent of benefits to the U.S. economy are difficult to quantify precisely. However, estimates can be made in both qualitative and quantitative terms. One beginning point for such estimates is the following very rough breakdown of the proportionate disposition of cash generated by operations of a hypothetical factory trawler:

Disposition of Cash	Percentage
Insurance	7
Vessel and Gear Repair and Maintenance	5
Processing Supplies and Maintenance	5
Fuel and Lubrication	6
Crew compensation and other crew costs	33
Miscellaneous operations	2
Administration	4
Debt service	22
Tax	6
Profit	10
Total	100

This breakdown suggests that a $1 billion DAP fishery would generate over $400 million in crew compensation and profit. This would result in expenditures for housing, food, and consumer spending as well as for saving and investment. The exact proportions of each type of expenditure and the multiplier effect throughout the economy are beyond the scope of this document. However, it is obvious that the direct and stimulative benefits are substantial.

Other expenditures directly support those U.S. industries which experience expanded sales or may even be created in response to the needs of the fishing industry. Expenditures in this category include insurance (to a considerable degree this is a multi-national industry), repair and maintenance, processing, fuel, and miscellaneous operating costs. These represent approximately $250 million in direct expenditures. Again, the stimulative effect is unknown but can be assumed to be substantial.

Additional benefits arise from projected federal tax payments of $60 million and $220 million in debt service payments.

The preceding discussion covers only those benefits that arise from harvesting and initial processing. Additional jobs and benefits arise as value is added in fish reprocessing, packaging, transportation, and retail sales. Again, the capability to quantify these benefits is beyond the scope of this document, but clearly it is substantial.

One example may suggest the extent of the value added activities (and the associated stimulative effects on the economy) of reprocessing and subsequent retail sales. An eight ounce package of breaded Alaska pollock portions typically sells for $2.00 at retail in supermarkets. Assuming a ratio of 50 percent fish and to 50 percent batter and breading, such packages contain 4 ounces of pollock.

At current prices, a factory trawler company would receive approximately $0.25 for 4 ounces of pollock. The difference between this and the retail price is $1.75 -- 7 times the revenue realized within the fish harvesting and primary processing sector. This is indicative of the economic opportunity that the fishing industry generates in the transportation, secondary processing, packaging, distribution, wholesaling and food retailing sectors of the economy once the product has left the harvesting/primary processing sector.

2. Joint Venture Fishery. The joint venture fishery has contributed to the U.S. economy in two primary ways:

- by fostering the development of skills and expertise that have led to the development of the DAP fishery.
- by the same earnings and investment effects that were described above, but on a much smaller scale.

The third benefit that the DAP fishery provides to the domestic economy -- stimulating employment in the domestic fish processing industry generally does not apply to the JV fishery.

Approximately 120 vessels participated in the JV fishery in 1987 and 1988. Investment in these vessels is difficult to determine since most were designed and built for crabbing or other fisheries and then converted for JV operations. In determining cost for the purposes of quantifying investment in the JV fishery, it is not clear whether it is appropriate to include the original cost of a vessel as configured for crabbing (for example) plus the conversion costs or just the conversion costs.

The highest investment estimate would be obtained by considering both initial costs (sunk costs) and conversion costs. Using this approach, these total costs probably range between $500 thousand and $2 million per vessel. Assuming an average cost as high as $1.25 million, investment in the JV fleet would be approximately $120 million. This figure is most likely high, actual investment is probably substantially less, perhaps as much as 50 percent less.

JV vessels typically employ 4 or 5 crew at one time so in a full year, the 120 person fleet would provide direct employment for 750 to 900 individuals assuming crew rotations. In recent years, the JV allocations have provided for only part year operations, so the actual employment in this segment of the industry probably approximates 300 full time equivalent positions. Direct on shore employment generated is not large.

The Alaska Fisherman's Journal, based on information from the American High Seas Fisheries association, reported the following results for the JV fisheries for 1987 -- the year in which JV harvests reached their historic maximum of almost 1.4 million mt.

Category of Expenditure	Millions of Dollars	Percentage
Crew shares	63.0	30
Profit	37.8	18
P&I insurance	31.5	15
Hull insurance	21.0	10
Fuel and lube	16.8	8
Maintenance	14.7	7
Professional services	8.4	4
Fishing gear	6.3	3
Administrative	4.3	2
Travel	4.2	2
Food	2.0	1
Total:	210.0	100

These figures reveal that the beneficial effects on the marine supply and support industries would be substantially less than those generated by the factory trawl fleet.

3. Comparison DAP vs JV Pollock Fishery. In order to get a sense of the relative benefits to the U.S. economy a DAP fillet operation is compared to a JV vessel making cod end deliveries in the pollock fishery.

A typical JV vessel was reported to deliver approximately 12,000 mt of pollock per year given the 1986 and 1987 harvest levels. That figure is the basis of this comparison. JV vessels have delivered as much as 750 mt of pollock in a single day, but the average is much lower, and for this computation the assumption is 150 mt per day and an average of 22 fishing days per month. The price per mt for cod end deliveries is assumed to be $145.00.

The factory trawler used for comparison is assumed to be a medium to large vessel employing 50 processors and crew with a capability of processing 8,000 mt per year of finished product per year requiring slightly over 36,000 mt of catch (at a yield rate of 22 percent). The vessel is assumed to produce a product mix of fillets and blocks averaging $1.00 per pound.

This comparison indicates the following:

	Joint Venture Vessel	Factory Trawler
Months of operation based on 15,000 mt available harvest	3.64	3.96
Direct employment on vessel during operation period (with rotations)	5 - 7	50 - 75
Gross revenue	$ 1.7 million	$ 5.8 million

This suggests that the benefits to the U.S. economy from DAP operations are significantly greater than from JV operations. In fact, the benefits are probably greater than indicated above given the multiplier effect of the larger factory trawler revenue.

It is also worth noting that crew compensation benefits are spread more broadly by the factory trawler operation. The factory trawler in this example employs 50 - 75 people at an average monthly compensation of approximately $7,000 while the JV vessel employs 5 - 7 people at an approximate average monthly compensation of $23,000. This computation is based on a crew share at the rate of 30 percent of gross revenue.

C. Market Effects of Increased Allocations to Joint Venture Processing or Directed Foreign Fishing.

1. Introduction. The DSEIS makes a statement which is unfathomable to our industry. It maintains with respect to DAP price effects of increased optimum yield that "given the large international markets for whitefish and other groundfish product

and the relatively minor role that Alaskan supply plays in the market, prices are not expected to be very responsive to changes in the level of TAC..."

Contrary to what the DSEIS would have the reader believe, the whitefish supplies out of the Bering Sea constitute an extremely significant portion of the world supply of whitefish. In fact virtually 100% of the worlds supply of Alaska pollock is extracted from the eastern Bering Sea or doughnut hole area. To the best of our knowledge, the Alaska pollock extracted from the Soviet zone is used for internal consumption in that country.

The suggestion by the economists that all whitefish of the world is interchangeable on one big whitefish market is simply naive. Alaska pollock has its own market and its own market price. Mackerel surimi, contrary to the suggestion of the DSEIS simply is not a substitute for pollock surimi. Hake surimi is simply not being manufactured in any significant quantity. Hoki optimum yields have been only 30,000 - 100,000 mt. While certain whitefishes may be substituted for others, one cannot go on, as the DSEIS seems to do, to conclude that whitefish are fungible goods on a world market that is totally insensitive to the nature of each fish species.

Thus an increase or decrease in the Alaska pollock quantities available to the fisheries through an adjustment in the optimum yields will directly and significantly impact the markets for DAP processors. Our industry does not feel that the possibility of raising the TAC of Alaska pollock from 1.3 millions tons to 1.5 million tons is insignificant on its market impact to DAP processors and feels that the DSEIS is extremely cavalier in its treatment of this issue.

With respect to cod, the DSEIS refers to the Crutchfield study, which was prepared on behalf of the Japanese Longline Association and the Querilo report. The DAP segment of the industry has rejected these reports as not reflective of the true market situation. In fact the major Japanese fisheries newspaper, substantiated that cod prices in Japan did respond to increased allocations of cod to the Japanese last year. (See attached Exhibit). Again what is being stated in these reports are textbook principles without reference to the market realities. It reflects a serious shortcoming in the economics analysis in the DSEIS.

Any time allocations are made to joint venture or foreign fishermen, there are two possible effects on the DAP segment of the industry. Both are bad. The least damaging of the two is a reduction in the prices they receive for their product due to expanded supply. The most damaging is that foreign markets are no longer available to U.S. producers because the needs of these markets are being filled by JV or foreign operations. A discussion of each of these possibilities follows.

2. Supply Increases, Price to U.S. Producers Declines. All U.S. producers believe that price declines result from allocations to JVP and TALFF. Given the complexity of the international seafood market, the portion of price changes attributable to a particular source of supply is difficult to document. Many U.S. producers recognize the changes as they are manifest in the negotiating postures of foreign buyers when JV and TALFF channels open and close.

U.S. producers also believe that the regulation of access to foreign markets through tariffs and quotas is strongly influenced by allocations to JV and TALFF. Many believe that access is much easier when a foreign government perceives that it cannot satisfy its needs from JV and directed foreign fishing in U.S. waters.

It is important to recognize that a small price change in response to an increase in JV or TALFF can have a very profound effect on total U.S. revenues when the DAP sector is large. For example, either Alternative 2 or Alternative 3 would provide the flexibility to increase the overall pollock TAC by at least 10 percent. If a 10 percent increase from 1.345 million mt (BS/AI) TAC to 1.480 million mt, only a slight drop in price would have to result from the increased TAC to result in a net loss to the U.S. economy. This is illustrated by the following example.

In this example, we assumed a 100 percent DAP fishery at 1.345 million mt with all additional TAC allocated to JVP. We compared processed pollock at a yield rate of 0.22 and a price of $1.00 per pound with cod end deliveries at $145 per mt. Three scenarios are shown -- 100 percent DAP fishery with a 1.345 million mt TAC, the baseline DAP fishery plus 10 percent allocated to JVP with no price effect on DAP, and the baseline DAP fishery plus 10 JVP with a 3 percent negative price effect on DAP. The results are as follows:

(1) 1.345 million mt, 100 percent DAP:

Allocation:	100 percent DAP
Catch:	1.345 million mt
Product:	652 million pounds
Price:	$1.00 per pound
Revenue:	$652 million

(2) 1.480 million mt -- no price effect on DAP

Allocation:	1.345 million mt to DAP
	.134 million mt to JVP
DAP Catch:	1.345 million mt
DAP Product:	652 million pounds

DAP Price:	$1.00 per pound
DAP Revenue:	$652 million
JVP Catch:	.134 million mt
JVP Price:	$145 per mt
JVP Revenue:	$19 million
Total Revenue	$671 million

(3) 1.480 million mt -- 3 percent DAP price decrease

Allocation:	1.345 million mt to DAP .134 million mt to JVP
DAP Catch:	1.345 million mt
DAP Product:	652 million pounds
DAP Price:	$0.97 per pound
DAP Revenue:	$632 million
JVP Catch:	.134 million mt
JVP Price:	$145 per mt
JVP Revenue:	$19 million
Total Revenue	$651 million

We are not able to compute the exact price elasticity of pollock nor the price relationships between different product forms. The point of this example is to illustrate that because of the potentially large size of the DAP fishery, even a relatively small price decrease can easily outweigh the revenue increase represented by the JV fishery. The effects might be even greater in other fisheries -- such as cod -- where the potential JVP allocations allowed under Alternatives 2 or 3 represent a much greater percentage of the fishery.

Other data is available suggesting that increases in the Pollock TAC and the release of pollock to joint venture producers can effect U.S. prices. The attached Exhibit Two indicates the price relationship between Korean and domestic pollock blocks from May 1986 through October 1987. With the exception of the May to October 1987 period, Korean pollock blocks are usually priced significantly below the U.S. product. This is substantiated by the price relationships in Tables 3.20, 3.21, and 3.22 of the DSEIS. Any further release of fish to this channel increasing the volume of low cost blocks cannot help but have a depressing effect on the prices available to U.S. companies.

The extreme sensitivity of price to supply is illustrated by the pollock fillet market. In the fall of 1987 there was a sharp drop in the price of pollock fillets, particularly IQF fillets, from a range of $1.30 to $1.50 per pound to well under $1.00 per pound. The reason for this drop was a growth in inventories.

How great was this inventory growth relative to pervious experience? As attached Exhibit Three indicates, the growth in total pollock inventories relative to baseline levels was approximately 20 million pounds. Assuming a yield of .22

percent, this 20 million pounds of inventory represents a catch of approximately 41,000 mt of round pollock. This is a relatively small harvest -- less than 2.5 percent of the BS/AI pollock ABC of 1.660 million mt. The total growth in fillet inventories from December 1986 to December 1987 was approximately 40 million pounds. This equates to approximately 80,000 mt of round pollock -- slightly less than 4 percent of the BS/AI pollock and cod ABC's.

3. Market Closures. U.S. producers have experienced instances in which foreign buyers switched completely to sources dependent on JV or foreign channels when allocations to JVP or TALFF were made. In other cases, U.S. producers have been unable to find markets due, in their opinions, to such allocations. The extent of these problems is not documented. Companies indicate that this was true with Pacific Cod as long as directed foreign fishing was allowed. Other market participants have experienced much greater interest in U.S. surimi by export buyers associated with the reductions in JVP and foreign fishing.

V. CONCLUSION

The proposal in increase the optimum yield to the sum of the annual ABC's for the groundfish species in the BS/AI region may have serious and adverse impacts upon both the domestic processing industry and on the groundfish resources. The amendment has been proposed and advocated by joint venture harvesters whose goal is to continue their method of operation for as long a period as possible. The proposal, however, is dangerous for the conservation of the resource and for development of the domestic industry; two of the primary goals and objectives of the Magnuson Act and the Nation's seafood industry.

Furthermore, the amendment appears to violate the MFCMA's requirement that optimum yield determinations take into consideration socio-economic factors.

We are entering a critically important period in the evolution of the North Pacific seafood industry. We have the opportunity to develop the greatest seafood industry in the world from the groundfish resources in the Bering Sea. Many times in the past, however, our industry has witnessed the pressure to over-harvest our fishery resources to the point where they become overfished. Well meaning fishery managers are working with less than adequate data and receive tremendous pressure from some sectors of the industry to maximize harvest to the point where conservation safeguards are ignored. Although the Council and the Secretary of Commerce face many important issues during deliberations on fishery management issues, none will be more important than the decision to maintain the 2.0 million mt optimum yield safeguard. It will allow the management regime which has proven its ability to protect the groundfish resource to continue, and it will show that the North Pacific Fishery Management Council and the Secretary of Commerce will not bow down to pressure from one sector of the industry to increase harvest.

[1] Pub.L. No. 94-265,90 Stat.331 (1976),codified at 16 USCA 1801-1882 (1986). The official title of the Act was changed from the "Fishery Conservation and Management Act of 1976" to the "Magnuson Fishery Conservation and Management Act" in 1980. American Fisheries Promotion Act, Sec.238(a)., Pub.L. No. 96-561; 94 Stat. 3300 (1980).

[2] 16 USCA 1801(a)(6)(1986).

[3] Memorandum to the Senate Foreign Relations Committee Concerning S.961, the Magnuson Fisheries Management and Conservation Act, p 2 reprinted A LEGISLATIVE HISTORY OF THE FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976, at. 612 (1976) (hereinafter "LEGISLATIVE HISTORY").

[4] 16 USCA 1801(A)(7)(1986).

[5] Alverson, The Role of conservation and Fishery Science Under the Fishery Conservation and Management Act of 1987. 52 Wash. Law R., 723 (1977).

[6] 16 USCA 1802 (18)(1986).

[7] 16 USCA 1801 (a)(7)(1986).

[8] 16 USCA 1801 (b)(3)(1986).

[9] 16 USCA 1851 (a)(5)(1986).

[10] 16 USCA 1851 (a)(6)(1986).

[11] 16 USCA 1801 (a)(4)(A)(1986).

[12] 16 USCA 1801 (a)(2)(1986).

[13] 16 USCA 1801 (a)(6)(1986).

[14] 16 USCA 1801 (b)(1)(1986).

[15] 16 USCA 1851 (a)(1)-(7)(1986).

[16] 16 USCA 1851 (a)(5)(1986).

[17] 16 USCA 1851 (a)(7)(1986).

[18] 16 USCA 1851 (a)(3)(1986).

[19] 16 USCA 1851 (a)(1)(1986) (emphasis added).

[20] 16 USCA 1851 (a)(2)(1986).

[21] 16 USCA 1851 (a)(4)(1986).

[22] 16 USCA 1851 (a)(6)(1986).

[23] 16 USCA 1802 (2)(1986)(emphasis added).

[24] 16 USCA 1851 (a)(1)(1986).

[25] 94 Cong. 1st sess Senate Rep.No. 94-416,October 7, 1985,reprinted in LEGISLATIVE HISTORY, 685 (emphasis added).

[26] 16 USCA 1851 (a)(2)(1986).

[27] "The term `scientific information' is meant to include not only biological and ecological data but also economic and sociological information as well..."94 Cong. 1st Sess. Senate Rep. No. 94-416, October 7, 1975, reprinted in LEGISLATIVE HISTORY, 685.

[28] Report of the King Mackerel Committee, January 7, 1987, p. 26; reprinted in, The Fifth Annaul National Fishery Law Symposium, presentation by Mr. James Brennan, Deputy General Counsel, NOAA,55. [hereinafter," King Mackerel Report"].

[29] King Mackerel Report, 57.

[30] 16 USCA 1851(a)(6)(1986).

[31] 94 Cong. 1st Sess Senate Rep. No. 94-416, October 7, 1975. reprinted in LEGISLATIVE HISTORY, 687.

[32] LEGISLATIVE HISTORY, 411-412 (statement of Sen. Stevens).

[33] 16 USCA 1801(18)(1986).

[34] CONG.REC.20054 (1978)(statement of Congressman Studds)(emphasis added).

[35] [V]irtually none of these benefits [increased jobs and greater value of exports] will flow to the American economy and the American consumer if foreign processing vessels operating within the FCZ receive U.S. harvested fish. Due to the absence of minimum wage, safety, and anti-pollution laws which have been enacted to preserve the quality of life in America, these foreign fish processors operating within the U.S. 200-mile zone can outbid U.S. fish processors. H.R. Rep. No. 95-1334,95 Cong., 2nd Sess.(1978), 5 and 6.

[36] H.R. Rep. No. 96-1138, Part 1, 96 Cong., 2nd Sess.(1980), 28.

[37] CONG.REC. 26715 (1980) (Statement of Congressman Breaux).

[38] CONG.REC. 28120 (1980) (Statement of Sen. Stevens)(emphasis added).

[39] 16 USCA 1801(a)(7)(1986).

Table 3.12 Number of permits issued to joint venture vessels by gear type, residence, and year, Bering Sea/Aleutian Islands, 1984-1987.

Gear Type	Residence	Year 84	85	86	87
Trawl Gear					
	Alaska	19	15	20	19
	Washington	43	55	68	65
	Oregon	10	16	13	14
	Other	3	4	4	4
	ALL	75	90	105	102
Longline Gear					
	Alaska	3	8	6	3
	Washington	0	1	0	0
	Oregon	0	0	1	0
	Other	0	0	1	0
	ALL	3	9	8	3
Pot Gear					
	Alaska	6	8	0	0
	Washington	2	3	1	1
	Oregon	1	1	0	0
	Other	0	0	0	0
	ALL	9	12	1	1
Other Gear					
	Alaska	1	2	0	0
	Washington	0	0	0	0
	Oregon	0	0	0	0
	Other	0	0	0	0
	ALL	1	2	0	0
Total Vessels					
	Alaska	20	20	25	19
	Washington	43	56	68	65
	Oregon	10	16	14	14
	Other	3	4	5	4
	ALL	76	96	112	102

Source: Based on data from Federal Registration File, National Marine Fisheries Service, Alaska Region, P.O. Box 1668, Juneau, AK 99802 (from NMFS, 1987).

Table 3.13 Number of permits issued by area, gear type, year, and vessel purpose, 1986-1987.

Area	Gear Type	1986 Harv. Only	1986 Harv/ Proc.	1987 Harv. Only	1987 Harv/ Proc.
Gulf of Alaska					
	Trawl Gear	121	27	148	39
	Longline Gear	768	203	1199	202
	Pot Gear	25	20	71	30
	Other Gear	43	12	63	14
	Total Vessels	925	246	1353	239
Bering Sea, Aleutian Islands					
	Trawl Gear	116	25	128	36
	Longline Gear	238	74	393	89
	Pot Gear	13	18	34	25
	Other Gear	9	5	12	5
	Total Vessels	363	112	518	129
Alaskan Total					
	Trawl Gear	125	30	155	42
	Longline Gear	785	206	1225	208
	Pot Gear	26	21	73	32
	Other Gear	46	13	63	16
	Total Vessels	948	254	1387	250

Source: Based on data from Federal Registration File, National Marine Fisheries Service Alaska Region, P.O. Box 1668, Juneau, AK 99802 (from NMFS, 1987).

Table 3.14 Number of permits issued by gear type, residence, year, and vessel purpose, Bering Sea/Aleutian Islands, 1986-1987.

Gear Type	Residence	1986 Harv. Only	1986 Harv/ Proc.	1987 Harv. Only	1987 Harv/ Proc.
Trawl Gear					
	Alaska	23	6	30	9
	Washington	75	15	77	23
	Oregon	13	3	15	2
	Other	5	1	6	2
	ALL	116	25	128	36
Longline Gear					
	Alaska	168	53	282	61
	Washington	56	19	91	26
	Oregon	10	1	17	1
	Other	4	1	3	1
	ALL	238	74	393	89
Pot Gear					
	Alaska	11	5	25	12
	Washington	2	9	8	10
	Oregon	0	1	1	1
	Other	0	3	0	2
	ALL	13	18	34	25
Other Gear					
	Alaska	6	3	11	3
	Washington	3	2	1	2
	Oregon	0	0	0	0
	Other	0	0	0	0
	ALL	9	5	12	5
Total Vessels					
	Alaska	199	62	305	65
	Washington	132	41	172	56
	Oregon	23	4	32	3
	Other	9	5	9	5
	ALL	363	112	518	129

Source: Based on data from Federal Vessel Registration File, National Marine Fisheries Service, Alaska Region, P.O. Box 1668, Juneau, AK 99802. (from NMFS, 1987).

As indicated in Tables 3.13 and 3.14, much of the growth in the fisheries over the last two years has been in the domestic fleet with increases in every gear category both in the Bering Sea and Alaska wide. Likewise, with respect to residency, all areas have experienced growth with the exception of other states' longliners and Washington's other gear category (Table 3.14).

From a different perspective, trends in effort can be examined via the number of vessels targeting on and delivering groundfish. This perspective avoids the problem mentioned above where a vessel chooses to not fish a permit.

As can be seen from the data of Table 3.15, effort in terms of numbers of vessels delivering fish has increased from 1986 to 1987 with the exception of the fishery using pots. Much of the increase has been in the longline component of the fleet as fishermen began to expand into cod and sablefish longlining. The at-sea processing growth has also occurred in the longlining sector with a modest decline indicated in the trawl component.

One last measure of effort is vessel-months. Data that reflect record effort trends are presented in Table 3.16. Because the at-sea processing vessels may land fish only infrequently the number of vessel-months for that particular category is understated, since, for example, they may have fished 12 months, but only landed fish three times during that period. Also, since the data are derived from fish tickets processed there is no information as to how fully utilized a particular vessel was in any one month.

Given these caveats, from 1986 to 1987, effort increased by vessels delivering to shore and declined for the at-sea processed harvest component. Note that these declines may not be indicative of decreased effort, but could, instead, reflect the fact that at-sea processed catch was landed less frequently in 1987 than 1986.

Employment and Income - Harvesting and Processing

This section describes recent trends in employment in the fishery harvesting sector. Ideally, these data should track those reported above on catch and effort levels. Unfortunately, information on the use of inputs, such as employment levels in the fishery sector, is not as readily available as basic production information (output). The State of Alaska through the Department of Labor, collects and publishes various statistics on income and employment, but does not routinely report employment and income at the production level disaggregated by region. They do, however, on a quarterly basis, report total state income and employment by industrial sector. Those data (Table 3.17) indicate both a seasonal trend in fisheries employment and a trend of increases in fisheries employment and income (in any one quarter) over the last several years.

Table 3.15 Number of vessels by gear type, species, and mode of operation, Bering Sea/Aleutian Islands, 1986-1987.

Gear Type	Species[1/]	1986 Catcher/ Processors, Motherships	1986 Shore Based	1987 Catcher/ Processors, Motherships	1987 Shore Based
Longline	Flatfish	17	9	28	66
	Pacific cod	0	13	3	34
	Pollock	0	1	0	2
	Rockfish	18	12	28	58
	Sablefish	20	38	29	75
	Other	0	1	0	0
	All Groundfish	20	48	32	81
Pot	Flatfish	1	3	3	1
	Pacific cod	1	3	1	1
	Pollock	0	1	0	0
	Rockfish	1	0	1	1
	Sablefish	3	4	4	3
	All Groundfish	3	6	5	3
Trawl	Flatfish	14	10	10	10
	Pacific cod	21	21	17	23
	Pollock	19	10	13	15
	Rockfish	9	4	5	1
	Sablefish	11	5	6	2
	Other	9	1	1	3
	All Groundfish	24	22	18	24
Other[2/]	Flatfish	0	0	4	8
	Pacific cod	1	0	1	7
	Pollock	1	0	1	2
	Rockfish	0	0	3	6
	Sablefish	0	0	6	7
	All Groundfish	1	0	7	10
All Vessels	Flatfish	32	21	42	77
	Pacific cod	23	35	21	59
	Pollock	20	11	13	18
	Rockfish	28	16	34	61
	Sablefish	34	47	40	81
	Other	9	2	1	3
	All Groundfish	48	73	56	109

1/ Flatfish: flounder, sole, turbot, Alaska plaice; Rockfish: rockfish, Pacific Ocean perch, thornyhead; Other Fish: Atka mackerel, lingcod, sculpin, greenling, shark, skate, unknowns

2/ Other Gear: seine, gillnet, jig, power troll, hand troll

Source: Alaska Department of Fish and Game domestic groundfish fish ticket database, Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau, AK (from NMFS, 1987).

Table 3.16 Number of vessel months by gear type, species, and mode of operation, Bering Sea/Aleutian Islands, 1986-1987.

Gear Type[1/]	Species[2/]	1986 Catcher/ Processors, Motherships	1986 Shore Based	1987 Catcher/ Processors, Motherships	1987 Shore Based
Longline	Flatfish	28	10	39	125
	Pacific cod	0	20	4	52
	Pollock	0	1	0	2
	Rockfish	30	12	37	107
	Sablefish	41	62	40	145
	Other	0	1	0	0
	All Groundfish	41	79	44	157
Pot					
	Flatfish	2	3	3	1
	Pacific cod	1	3	1	1
	Pollock	0	1	0	0
	Rockfish	2	0	1	1
	Sablefish	6	9	6	3
	All Groundfish	6	11	8	3
Trawl					
	Flatfish	33	30	23	19
	Pacific cod	73	59	52	52
	Pollock	54	34	45	28
	Rockfish	19	5	9	1
	Sablefish	23	7	9	2
	Other	13	1	1	3
	All Groundfish	90	61	59	54
Other					
	Flatfish	0	0	4	8
	Pacific cod	1	0	1	7
	Pollock	1	0	1	2
	Rockfish	0	0	3	6
	Sablefish	0	0	6	7
	All Groundfish	1	0	7	10
All Vessels					
	Flatfish	63	43	66	152
	Pacific cod	83	81	58	111
	Pollock	63	36	47	32
	Rockfish	51	17	47	115
	Sablefish	70	78	56	157
	Other	15	2	1	3
	All Groundfish	146	149	114	223

1/ Flatfish: flounder, sole, turbot, Alaska plaice; Rockfish: rockfish, Pacific Ocean perch, thornyhead; Other Fish: Atka mackerel, lingcod, sculpin, greenling, shark, skate, unknowns
2/ Other Gear: seine, gillnet, jig, power troll, hand troll

Source: Alaska Department of Fish and Game domestic groundfish fish ticket database, Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau, AK (from NMFS, 1987).

Table 3.17 Alaska Employment and Income, Commercial Fishing, by quarter, 1984-87.

Year/Quarter	Average Monthly Employment	Average Monthly Wage, $	Average Monthly Employment	Average Monthly Wage, $
1984				
1st quarter	48	2,215	206,740	2,369
2nd quarter	79	3,733	223,447	2,380
3rd quarter	156	2,286	236,511	2,395
4th quarter	39	3,250	223,553	2,381
1985				
1st quarter	43	1,525	214,173	2,324
2nd quarter	103	3,533	229,870	2,365
3rd quarter	205	3,275	242,209	2,386
4th quarter	169	2,395	225,965	2,399
1986				
1st quarter	67	2,577	213,677	2,300
2nd quarter	137	4,117	222,073	2,355
3rd quarter	219	3,298	228,493	2,332
4th quarter	107	2,065	211,191	2,387
1987				
1st quarter	117	2,401	198,265	2,235
2nd quarter	187	3,348	211,352	2,314

Source: Alaska Department of Labor, Statistical Quarterly, various years.

The Department of Labor may also profile a particular industry as part of their series entitled "Alaska Economic Trends". A report in July of last year presents a summary of fisheries employment and income from a more disaggregated view than presented in Table 3.17 (Fried and Boucher, 1987).

Seafood processing employment peaked in 1982 at 6,730 jobs, declined to 5,521 jobs in 1984 and increased again to 6,366 jobs in 1986, the last year for which data are available. The harvesting sector, however, has seen a steady increase in employment over the same period with 8,202 jobs reported in 1984 (Table 3.18).

Groundfish harvesting and processing only accounts for part of this employment. In 1984 the harvesting employment by species landed was 65% salmon, 14.4% shellfish, 11.3% halibut, 5.2% herring, and 4.0% groundfish (Fried and Boucher, 1987, p. 12).

Regionally, southwest Alaska has the largest number of seafood harvesters and is most dependent on the contributions of seafood harvesting to total regional income. A recent report from the Institute of Social and Economic Research indicates that in Southwest Alaska, 98% of the private sector basic industry income is from fisheries (Fried and Boucher, 1987, p. 13). Other important regions are the southeast and southcentral regions.

With respect to the processing sector, the southcentral region is most important regionally, at least over the period from 1982-1984 (Fried and Boucher, 1987, p. 12).

In sum, employment and income in the Alaskan seafood industry are increasing and much of the gains are taking place in the groundfish industry.

3.2.2 Processing Sector

Number and Type of Processing Plants/Vessels

The capacity of the domestic fleet has increased rapidly in the last several years as is evident from an examination of Figure 3.1 or the data of Tables 3.10-3.15. Alaska-wide, harvest by the DAP sector has increased eight-fold from 1983-1987 (56,000-408,000 mt) and six-fold in the Bering Sea management area (46,000-298,000 mt).

In 1988 a wholly domestic fleet intends to process almost 700,000 mt of groundfish in the Bering Sea area, almost double what was taken last year (Table 1.2).

In terms of specific processing requests, this year there are four shorebased plants in western Alaska with processing requests at about 192,000 mt (Table 3.19) and 32 at-sea processing vessels representing 22 different companies with processing requests of nearly 500,000 mt (Table 3.19).

Table 3.18 Alaska seafood industry employment, harvesting and processing, annual average, 1980-1986.

Year	Harvesting	Processing
1980	7,590	7,510
1981	7,821	7,884
1982	8,194	6,730
1983	8,029	6,132
1984	8,202	5,521
1985	N/A	6,149
1986	N/A	6,366

Source: Modified from Table 1, Fried and Boucher, 1987, p. 11.

Table 3.19 DAP intent to process, Bering Sea/Aleutian Islands Management Area, 1988 (in metric tons).

Operation	SPECIES				
	Pollock	P. Cod	Flounders	Other	Total
W. Alaska shore plants	178,500	11,400	2,140	0	192,040
At-sea processing[1/]	360,020	59,555	64,564	80	484,219
Total	538,520	70,955	66,704	80	676,259

1/ Some of these vessels have declared intent to catch and process from both the Bering Sea and Gulf of Alaska and it is not possible to separate catch.

Source: DAP revised survey, NMFS, Alaska Region.

Processing Capacity

Tonnage requests can be verified by an examination of current domestic processing capacity. According to the most recent survey conducted by NMFS, there are 22 Alaskan shore plants processing groundfish (4 in BSAI area), with a total of 5 surimi lines (4 in BSAI area), 33 fillet lines (9 in BSAI area), and 16 headed and gutted (H&G) lines (3 in BSAI area). A rough estimate of total shoreside processing capacity is 1,750 mt of groundfish/day. For a 180-day season this translates to 315,000 mt of fish.

The catcher/processor, mothership/processor fleet off Alaska will have 3 surimi lines, 42 fillet lines and 31 H&G lines in place in 1988 with an estimated total daily capacity of about 1,400 mt/day.

Geographic distribution of processing

As indicated by the permit information presented above (Tables 3.10, 3.12) much of the domestic catch and the majority of the joint venture catch is taken by vessels from Washington and Oregon. Likewise, the trawl portion of the catcher/processor fleet is dominated by vessels from Washington, and for all gear types, combined in the domestic at-sea processing fleet, permits are approximately equally distributed between Alaskan and non-Alaskan vessels (Table 3.14).

This means that Washington and, to a lesser extent, Oregon, are enjoying a substantial portion of benefits accruing from the domestic processing of Alaskan groundfish. According to a recent study by Natural Resources Consultants of Seattle (NRC, 1986), 92% of the seafood harvested by Washington fishermen in 1985 came from Alaskan waters. In terms of the amount of groundfish, 79% of the Washington catch comes from Alaska, and in terms of value, Alaska contributes 68% of the total exvessel revenue of the Washington-based fleet (NRC, 1986).

Thus, Alaska is very important to the Washington-based fishing industry. From the opposite perspective, the Washington share of total Alaska production is also substantial with approximately 60% of the domestic exvessel revenue being generated by the Washington fleet (Table 3.7, NRC, 1986; year of comparison, 1985).

3.2.3 Markets

Domestic[5]

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[5] For a more thorough description of marketing of domestic product see, "Market opportunities for processed Alaskan groundfish products," Technical Report 4, In "A strategy for the

Domestic markets for some of the species of groundfish taken in waters off Alaska are limited. This is true for sablefish, most of the flatfish species, and Atka mackerel. Although some progress is being made with regard to the domestic marketing of flatfish, for the short and intermediate term, these species will continue to be marketed primarily as exports.

The domestic industry has had more success in establishing domestic markets for Alaska pollock and cod although much of the domestic processed product may still be sold overseas. The domestic markets for these species are part of a worldwide market for whitefish as demonstrated in Queirolo (1986) and Crutchfield (1986), and thus, market reaction to changes in supply, quality, or price are only partially influenced by Alaskan producers.

International

Many groundfish species harvested in the BS/AI area compete in domestic and international markets with groundfish harvested in other areas. They also compete with meat and poultry. Therefore, the prices domestic fishermen and processors receive depend on a variety of factors including the international supply of competing fishery products, international exchange rates, consumer income, and the prices of other consumer goods.

The groundfish market from 1986 through the first half of 1987 can be characterized by demand outpacing supply, sharply higher prices in terms of U.S. dollars, and greater market acceptance of pollock and hake that had been considered to be lower quality substitutes for cod. Reduced supplies of cod from the North Atlantic in 1986, the increased awareness of the health benefits of fish, and large decreases in the value of the dollar relative to the currencies of most countries that trade in groundfish products were important factors.

In the second half of 1987, there were strong indications that the situation of excess demand for groundfish products had been replaced by one of a more balanced supply and demand situation for most species and by one of excess supply for several species. This is the result of increased imports and less rapid growth in sales stemming from large increases in groundfish prices. The indications of this change include higher cold storage holdings and declining prices, especially for lower priced species. The wholesale and import prices for a variety of groundfish products had similar trends characterized by rapid increases in 1986 and early 1987 followed by relative stability or declines in the latter part of 1987 and early 1988. Price series for various groundfish products are presented in Tables 3.20 through 3.23.

Americanization of the groundfish fisheries of the Northeast Pacific, Vol. 2," NRC, 1985; and Chapter 5, Gulf of Alaska FMP.

Table 3.20 Annual wholesale prices of frozen fish blocks and fillets, f.o.b. east coast, 1976-1987 (in cents per pound).

	Blocks				Fillets			
Year	Cod	Cod, minced	Pollock, Alaska	Whiting	Cod Canada	Cod Iceland	Flounder	Ocean perch
1976	74.1	31.1	43.0	42.4	NA	111.2	106.1	84.9
1977	97.8	36.1	60.7	54.4	NA	126.7	116.7	93.1
1978	100.0	37.7	68.6	59.8	NA	130.0	126.3	98.1
1979	103.9	50.4	68.8	67.2	NA	155.0	148.1	106.7
1980	105.6	51.8	69.5	74.1	NA	160.0	144.5	101.8
1981	109.2	51.1	80.5	74.3	NA	172.3	118.2	101.0
1982	110.9	51.3	72.4	66.2	127.5	180.0	141.0	108.1
1983	116.9	39.9	65.6	61.2	126.5	180.0	144.9	104.2
1984	104.0	30.4	67.9	56.8	130.0	180.0	158.5	101.4
1985	110.6	45.9	58.0	62.7	125.6	180.0	179.6	108.2
1986	141.7	60.5	78.9	69.0	165.0	196.4	186.0	141.0
1987	186.7	55.2	104.5	96.8	212.5	245.2	199.6	154.4

Source: Fishery Market News Report, Natl. Mar. Fish. Serv., 408 Atlantic Ave., Boston, MA 02210-2203.

Table 3.21 Monthly wholesale prices of selected frozen fish blocks and fillets, f.o.b. east coast, 1986-88 (in cents per pound).

	Blocks				Fillets			
Year	Cod	Cod, minced	Pollock, Alaska	Whiting	Cod Canada	Cod Iceland	Flounder	Ocean perch
1986								
Jan.	132.5	57.0	62.5	62.5	140.0	180.0	185.0	122.5
Feb.	135.0	59.0	64.0	62.5	145.0	180.0	185.0	122.5
Mar.	135.0	60.0	65.0	62.5	145.0	180.0	185.0	NQ
Apr.	135.0	61.0	67.0	62.5	150.0	185.0	185.0	NQ
May	135.0	61.0	67.0	62.5	147.5	185.0	185.0	135.0
June	135.0	61.0	70.0	63.5	142.5	190.0	185.0	137.5
July	140.0	61.0	NQ	66.5	150.0	190.0	185.0	137.5
Aug.	145.0	61.0	84.0	69.0	165.0	197.0	185.0	137.5
Sep.	150.0	61.0	91.0	73.0	175.0	205.0	185.0	150.0
Oct.	150.0	61.0	95.0	75.0	192.5	205.0	187.5	155.0
Nov.	150.0	61.0	98.0	81.0	207.5	230.0	187.5	152.5
Dec.	157.5	61.0	104.0	81.0	222.5	230.0	192.5	160.0
1987								
Jan.	160.0	61.0	105.0	87.5	225.0	230.0	190.0	157.5
Feb.	170.0	57.0	109.0	93.5	227.5	245.0	197.5	157.5
Mar.	172.5	54.0	107.0	97.5	227.5	245.0	197.5	152.5
Apr.	175.0	51.0	104.0	95.0	222.5	245.0	197.5	152.5
May	180.0	49.0	103.0	96.5	200.0	245.0	197.5	150.0
June	187.5	NQ	103.0	96.0	212.5	247.5	197.5	NQ
July	195.0	53.5	105.0	97.5	212.5	247.5	195.0	162.5
Aug.	200.0	55.0	105.0	100.0	212.5	247.5	200.0	NQ
Sep.	200.0	55.0	105.0	100.0	215.0	247.5	200.0	162.5
Oct.	200.0	55.0	105.0	100.0	212.5	247.5	207.5	NQ
Nov.	200.0	58.0	103.0	99.0	195.0	247.5	207.5	147.5
Dec.	200.0	59.0	99.5	99.0	187.5	247.5	207.5	147.5
1988								
Jan.	200.0	61.0	99.0	99.0	187.5	247.5	207.5	147.5
Feb.	200.0	60.0	96.5	98.0	172.5	260.0	205.0	147.5

NQ - No quote.

Source: Fishery Market News Report, Natl. Mar. Fish. Serv., 408 Atlantic Ave., Boston, MA 02210-2203.

Table 3.22 Monthly producer prices for domestic Alaska pollock and Pacific cod products, f.o.b. Seattle, November 1986-February 1988 (in cents per pound).*

	Alaska pollock					Pacific cod	
	Blocks			Fillet		Fillet, shatter-pack	
Month	16.5#	55#	Minced	Shatter	IQF	8-16 oz	16-32 oz
1986							
Nov.	108	92	45	160	160	218	223
Dec.	112	104	45	152	157	242	250
1987							
Jan.	115	105	47	152	160	260	270
Feb.	122	104	50	153	165	257	267
Mar.	120	104	45	146	155	252	262
Apr.	120	105	42	155	160	248	261
May	121	110	42	152	155	245	256
June	122	105	42	152	152	243	256
July	122	105	42	150	150	243	256
Aug.	121	104	42	147	147	243	256
Sep.	118	102	42	142	150	243	256
Oct.	120	102	--	138	145	238	251
Nov.	114	--	42	125	132	232	240
Dec.	112	--	42	118	130	228	235
1988							
Jan.	113	95	42	118	128	220	230
Feb.	114	--	--	110	128	--	--

* Mid-point of high and low for the month.

Source: Fishery Market News, Natl. Mar. Fish. Serv., 7600 Sand Point Way N.E., BIN C15700, Seattle, WA 98115-0070.

Table 3.23 Price indexes for various groundfish block and fillet imports by country and species (price indexes = 100 for December 1987).

YR/MO	CBC	CBK	HBC	PBC	PBK	WBA	WBU	CFC	CFK	CFJ	OFC	OFK	MBC	MBA	MBU	MBK	MBJ
85/01	57	47	61	59	60	56	60	68	66	62	74	58	84	0	0	0	64
85/02	57	48	58	57	58	45	60	68	65	27	94	53	81	0	71	0	60
85/03	57	53	66	59	60	56	60	67	71	62	92	50	80	71	0	0	69
85/04	58	0	59	54	60	0	67	70	64	60	81	54	71	0	74	0	60
85/05	57	0	64	54	60	50	64	70	71	62	72	53	78	0	74	0	62
85/06	55	45	65	48	60	53	64	66	65	61	72	49	84	64	84	58	66
85/07	57	53	67	64	58	53	63	67	67	59	73	55	81	79	72	23	64
85/08	56	43	29	53	57	56	0	67	58	63	71	53	76	0	0	0	66
85/09	58	50	66	60	57	45	63	66	58	63	81	47	85	71	80	57	65
85/10	59	52	61	56	57	20	62	68	61	62	77	50	92	64	78	17	71
85/11	63	54	64	53	57	49	62	68	57	62	75	52	90	49	78	21	77
85/12	64	60	63	57	57	47	63	71	68	60	83	51	90	43	77	0	82
86/01	65	55	68	61	59	57	63	73	61	70	93	56	96	72	0	0	90
86/02	70	61	73	68	59	25	64	72	66	75	96	44	106	73	83	28	82
86/03	70	64	70	67	59	51	66	75	64	75	94	54	98	74	84	19	93
86/04	70	70	74	57	62	0	53	75	65	71	93	58	98	71	87	0	94
86/05	70	60	67	61	60	48	65	74	67	80	80	50	100	97	78	0	102
86/06	72	50	73	72	62	49	63	74	79	74	78	55	103	74	81	21	110
86/07	72	66	72	68	63	53	71	76	71	74	87	58	107	97	96	94	108
86/08	71	69	67	73	65	47	78	77	74	75	89	57	101	49	84	0	114
86/09	75	73	68	72	69	54	89	82	72	72	91	60	108	57	96	96	122
86/10	75	82	73	88	81	69	73	91	76	77	99	73	121	95	96	91	121
86/11	77	72	77	94	87	74	57	96	80	79	104	67	113	124	0	90	98
86/12	79	71	81	98	91	67	86	103	76	82	152	72	113	103	96	87	90

Table 3.23 continued...

YR/MO	CBC	CBK	HBC	PBC	PBK	WBA	WBU	CFC	CFK	CFJ	OFC	OFK	MBC	MBA	MBU	MBK	MBJ
87/01	83	84	81	112	92	73	94	107	82	0	118	80	109	130	98	0	113
87/02	85	85	80	110	93	75	107	108	86	83	135	84	107	114	98	84	97
87/03	89	84	60	108	98	79	115	107	94	92	144	82	98	97	98	82	95
87/04	91	88	81	114	97	82	113	104	91	75	135	86	114	217	100	83	102
87/05	96	98	82	103	99	84	103	100	97	92	128	81	89	0	0	78	97
87/06	94	111	82	100	100	83	109	107	104	90	114	88	91	108	101	84	119
87/07	101	98	63	92	99	83	110	104	102	91	112	81	83	56	97	122	108
87/08	100	98	80	101	94	83	105	107	102	101	105	86	91	0	98	89	104
87/09	102	88	87	106	98	89	106	108	105	81	108	84	92	0	0	95	116
87/10	102	102	99	102	100	97	117	106	91	91	115	87	87	133	102	91	117
87/11	101	100	94	76	100	86	106	104	101	96	102	147	104	0	111	0	0
87/12	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
88/01	107	100	92	105	100	88	102	0	0	0	0	0	90	97	0	48	114

CBC = cod blocks, Canada
CBK = cod blocks, Korea
HBC = haddock blocks, Canada
PBC = pollock blocks, Canada
PBK = pollock blocks, Korea
WBA = whiting blocks, Argentina
WBU = whiting blocks, Uruguay
CFC = cod fillets, Canada
CFK = cod fillets, Korea
CFJ = cod fillets, Japan
OFC = other fillets, Canada
OFK = other fillets, Korea
MBC = minced blocks, Canada
MBA = minced blocks, Argentina
MBU = minced blocks, Uruguay
MBK = minced blocks, Korea
MBJ = minced blocks, Japan

Other fillets include cusk, haddock, hake, and pollock.

The similarity of the price trends is an indication of the interdependence among the markets for these products.

That dependency is in part explained by the fact that the prices of these fishery products are influenced by the prices of meat, poultry, and other consumer goods. It appears that the rapid increase in the prices of many fishery products relative to meat and poultry during the past several years has resulted in less rapid increases in the demand for groundfish in 1987 and is a major factor in explaining the lack of continued upward pressure on groundfish prices. Price index data for fish , meat, poultry, and other goods are presented in Tables 3.24 and 3.25.

The United States is a major consumer of groundfish and imports large quantities of fillets, blocks, and whole or dressed fish. In 1987, the U.S. imported 408 million pounds of fillets, 404 million pounds of blocks, and 112 million pounds of whole or dressed fish (all in product weight). Imports in 1987 exceeded those of 1986 by 10%. More specific import data are presented in Tables 3.26 through 3.30.

Cold storage holdings of groundfish blocks and fillets on December 31, 1987 were 62% and 92%, respectively, higher than a year earlier. Except for holdings of minced blocks and flounder fillets, all other categories were greater than those existing a year ago as increased imports and a slight slowdown in sales have allowed holdings to build. There were major increases in holdings of Alaska pollock blocks, up 169%, and whiting blocks, up 167%. For fillets, cod holdings were 165% above a year earlier, and holdings of pollock were 307% higher. However, in some cases the December 1986 holdings were exceptionally low because 1986 was characterized by excess demand. Cold storage holding data are presented in Tables 3.31 and 3.32.

Table 3.24 Annual U.S. economic indicators: Selected producer and consumer price indexes, 1976-86 (Index 1967=100).

	Producer price index					Consumer price index			
Year	All comm.	Meat	Poultry	Fish	Petrl. products	All items	Meat	Poultry	Fish
1976	183.0	173.6	166.2	272.4	276.6	170.5	178.2	155.7	227.3
1977	194.2	170.7	173.3	294.3	308.0	181.5	174.2	156.7	251.6
1978	209.3	209.6	194.0	313.0	321.0	195.4	206.8	172.9	275.4
1979	235.6	233.8	188.6	383.9	444.8	217.4	241.9	181.5	302.3
1980	268.8	235.9	193.3	370.9	674.7	246.8	248.8	190.8	330.2
1981	293.4	239.0	193.3	377.8	805.9	272.4	257.8	198.6	357.7
1982	299.3	250.6	178.8	422.4	761.2	289.1	270.3	195.1	370.6
1983	303.1	236.4	185.3	445.2	684.3	298.4	267.2	197.5	374.9
1984	310.3	236.8	206.0	476.0	665.1	311.1	268.1	218.5	386.8
1985	308.8	227.5	197.5	492.1	633.1	322.2	265.5	216.4	405.9
1986	299.8	235.2	207.8	530.4	405.2	328.4	273.9	232.7	443.2

Source: Producer prices and price indexes, and Consumer price indexes, U.S. Dep. of Labor, Bur. of Labor Statistics.

Table 3.25 Monthly U.S. economic indicators: Selected producer and consumer price indexes, 1985-87 (Index 1967=100).

Month	Producer price index					Consumer price index			
	All comm.	Meat	Poultry	Fish	Petrl. products	All items	Meat	Poultry	Fish
1985									
Jan.	309.5	237.1	198.9	508.6	635.5	316.1	270.8	217.4	406.1
Feb.	309.1	237.8	196.5	493.5	615.6	317.4	270.6	219.5	401.4
Mar.	308.6	231.1	193.9	491.8	620.6	318.8	269.5	217.3	403.3
Apr.	309.3	224.0	187.8	508.0	636.5	320.1	266.4	216.7	402.8
May	309.8	223.8	189.0	498.7	657.6	321.3	263.4	213.6	395.8
June	309.2	224.2	195.4	423.4	641.5	322.3	263.0	216.0	397.2
July	309.0	227.3	197.2	446.5	630.7	322.8	262.7	214.7	402.7
Aug.	307.2	221.0	195.1	461.5	620.5	323.5	261.2	213.9	406.1
Sep.	305.5	213.6	201.4	466.4	622.1	324.5	260.4	215.9	408.6
Oct.	307.9	225.1	199.8	465.7	625.0	325.5	261.4	214.3	407.9
Nov.	309.5	232.8	208.5	518.0	641.6	326.6	266.3	216.8	419.0
Dec.	310.2	237.1	204.1	527.9	650.4	327.4	270.1	220.3	420.3
1986									
Jan.	308.9	231.6	192.4	527.1	607.9	328.4	270.6	218.2	443.9
Feb.	304.4	223.1	188.5	527.9	524.4	327.5	268.4	218.5	430.6
Mar.	300.3	219.2	188.2	530.5	431.9	326.0	266.6	218.2	435.6
Apr.	298.2	215.0	188.9	527.6	396.2	325.3	262.3	215.7	437.[illegible]
May	299.2	225.5	192.5	513.5	405.4	326.3	262.1	218.7	437.1
June	299.0	227.7	201.9	522.9	406.0	327.9	264.4	223.7	434.5
July	297.4	242.2	228.0	510.8	340.6	328.0	272.9	240.3	447.3
Aug.	294.2	252.9	245.8	522.7	336.9	328.6	279.8	255.0	446.3
Sep.	297.5	251.9	223.0	527.5	367.2	330.2	283.6	249.5	447.2
Oct.	298.4	246.7	233.7	526.2	346.0	330.5	283.9	247.8	451.6
Nov.	298.7	244.3	216.1	536.1	346.2	330.8	285.4	245.2	449.7
Dec.	298.5	244.0	204.9	559.3	353.4	331.1	286.3	241.9	457.6
1987									
Jan.	300.9	238.2	194.6	604.7	386.6	333.6	288.3	238.3	479.4
Feb.	302.7	237.0	189.5	632.9	410.5	335.0	285.3	237.0	480.7
Mar.	302.8	234.4	187.4	610.8	402.8	336.3	286.1	234.1	490.1
Apr.	305.1	250.6	188.8	581.7	421.7	338.0	285.5	230.7	489.0
May	307.3	265.3	191.7	597.3	426.9	338.7	291.8	230.5	486.6
June	308.5	269.1	183.3	602.9	439.0	340.1	297.1	228.3	484.2
July	310.2	269.3	181.4	599.7	451.1	340.8	299.8	226.1	489.7
Aug.	310.5	257.4	185.6	578.3	468.6	342.7	301.0	223.0	493.7
Sep.	310.4	263.7	180.4	584.0	448.2	344.4	300.7	229.1	498.3
Oct.	311.4	253.5	174.1	660.3	448.8	345.3	300.2	227.8	496.0
Nov.	311.9	239.3	176.6	647.7	455.4	345.8	298.4	219.8	499.5
Dec.	311.7	233.4	172.1	660.4	430.5	345.7	296.4	219.7	503.3

Source: Producer prices and price indexes, and Consumer price indexes, U.S. Dep. of Labor, Bur. of Labor Statistics.

Table 3.26 U.S. imports of groundfish fillets, steaks, and blocks, 1976-87, quantity in million pounds, product weight and value in million dollars.

Year	Fillets and steaks		Blocks		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1976	337	273	379	211	716	484
1977	321	305	385	292	706	597
1978	333	341	406	325	739	666
1979	340	385	408	337	748	722
1980	297	341	336	289	633	630
1981	346	415	344	301	690	716
1982	371	458	319	274	690	732
1983	355	449	384	339	739	788
1984	373	459	316	263	689	722
1985	388	500	334	275	722	775
1986	366	542	364	380	730	922
1987	408	759	403	539	812	1,298

Source: U.S. Dep. of Commerce, Bur. of the Census, Washington, D.C. 20233, and Natl. Mar. Fish. Serv. data base and available from Northwest and Alaska Fish. Cen., 7600 Sand Point Way N.E., BIN C15700, Seattle, WA 98115-0070.

Table 3.27 U.S. imports of whole or dressed groundfish, 1976-1987, quantity in thousand pounds, product weight and value in thousand dollars.

Year	Canada		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
1976	13,935	4,932	4,526	6,216	18,461	11,148
1977	11,701	4,330	4,294	5,598	15,995	9,928
1978	10,659	4,115	4,248	5,838	14,907	9,953
1979	15,682	6,175	5,965	8,902	21,647	15,077
1980	16,402	6,617	2,668	5,243	19,070	11,860
1981	28,908	12,090	3,577	7,107	32,485	19,197
1982	38,342	14,215	3,487	7,006	41,829	21,221
1983	48,941	18,117	4,183	7,072	53,124	25,189
1984	80,882	30,029	4,773	7,334	85,655	37,363
1985	99,174	37,538	5,214	8,793	104,388	46,331
1986	99,521	47,703	7,886	12,499	107,407	60,202
1987	107,351	56,094	4,106	11,542	111,457	67,636

Source: U.S. Dep. of Commerce, Bur. of the Census, Washington, D.C. 20233, and Natl. Mar. Fish. Serv., Northwest and Alaska Fish. Cen., 7600 Sand Point Way N.E., Seattle, WA 98115-0070.

Table 3.28 U.S. imports of frozen fish blocks by major countries, quantity (1,000 lbs), percent change from 1986 to 1987, and average price ($/lb.) by product, January-December 1986-1987.

Product	Country	Quantity 1986	Quantity 1987	% Change 86 to 87	Average Price 1986	Average Price 1987
Cod						
	Total	172,675	162,910	-6	1.25	1.69
	Canada	89,615	94,683	+6	1.26	1.70
	Denmark, EEC	30,555	22,730	-26	1.27	1.67
Haddock						
	Total	24,491	27,245	+11	1.28	1.61
	Norway	7,139	10,358	+45	1.21	1.60
Minced, over 15 lbs.						
	Total	55,217	39,888	-28	0.80	0.68
	Canada	23,797	24,729	+4	0.60	0.55
	Japan	18,744	4,011	-79	1.22	1.31
Pollock						
	Total	69,725	89,216	+28	0.63	0.92
	Poland	18,015	27,784	+54	0.56	0.92
	Rep. of Korea	36,652	49,842	+36	0.65	0.91
Whiting						
	Total	16,080	32,745	+104	0.63	0.86
	Uruguay	9,116	13,859	+52	0.60	0.89
	Argentina	4,825	15,937	+230	0.57	0.81
Other						
	Total	25,708	51,573	+101	1.33	1.61
	Canada	5,637	6,455	+15	1.15	1.41
	Iceland	2,885	3,523	+22	0.98	1.29
	Denmark, EEC	4,982	25,503	+412	1.21	1.62
	Rep. of Korea	5,065	7,823	+54	0.96	1.26
	New Zealand	3,934	3,050	-22	2.50	2.88

Sources: U.S. Department of Commerce, Bureau of the Census, and National Marine Fisheries Service data base, Northwest and Alaska Fisheries Center, 7600 Sand Point Way N.E., Bin C15700, Seattle, WA, 98115-0070.

Table 3.29 U.S. imports of fresh and frozen groundfish fillets by major countries, quantity (1,000 lbs), percent change from 1986 to 1987, and average price ($/lb.) by product, January-December 1986-1987.

Product	Country	Quantity 1986	Quantity 1987	% Change 86 to 87	Average Price 1986	Average Price 1987
Atlantic Ocean Perch						
	Total	49,035	47,973	-2	1.32	1.54
	Canada	37,060	36,296	-2	1.38	1.58
Cod						
	Total	179,912	192,791	+7	1.48	1.94
	Canada	109,631	110,479	+1	1.45	1.94
	Iceland	48,598	51,140	+5	1.54	1.93
	Denmark, EEC	8,685	10,493	+21	1.59	2.09
Flatfish and Turbot						
	Total	75,902	90,454	+19	1.67	2.04
	Canada	36,019	44,414	+23	1.78	2.14
	Argentina	6,462	5,829	-10	1.76	2.10
	Netherlands, EEC	7,140	10,169	+42	1.78	2.45
	Rep. of Korea	9,701	10,349	+7	1.41	1.67
	Japan	4,691	6,652	+42	1.08	1.17
Haddock, Cusk, Hake, and Pollock						
	Total	57,907	74,110	+28	1.35	1.65
	Canada	19,251	25,299	+31	1.22	1.62
	Iceland	18,895	20,663	+9	1.35	1.64
	Denmark, EEC	9,431	11,214	+19	1.74	2.04
Wolffish						
	Total	3,088	2,874	-7	1.52	1.85
	Canada	1,098	1,273	+16	1.38	1.59
	Iceland	1,500	1,170	-22	1.79	2.24

Sources: U.S. Department of Commerce, Bureau of the Census and National Marine Fisheries Service data base, Northwest and Alaska Fisheries Center, 7600 Sand Point Way N.E., Bin C15700, Seattle, WA 98115-0070.

Table 3.30 U.S. imports of whole or dressed groundfish by major countries, quantity (1,000 lbs.), percent change from 1986 to 1987, and average price ($/lb.) by product, January-December 1986-1987.

Product	Country	Quantity 1986	Quantity 1987	% Change 86 to 87	Average Price 1986	Average Price 1987
Cod						
	Total	30,179	27,088	-10	0.52	0.66
	Canada	28,999	26,535	-8	0.51	0.65
	Rep. of Korea	1,201	220	-82	1.31	1.70
Flatfish, exc halibut cusk, hake, pollock						
	Total	22,282	19,033	-15	0.65	0.76
	Canada	20,962	18,116	-14	0.50	0.64
Haddock						
	Total	45,804	56,746	+24	0.46	0.45
	Canada	45,029	55,903	+24	0.46	0.44
Ocean Perch						
	Total	4,326	6,299	+46	0.39	0.39
	Canada	4,125	6,185	+50	0.35	0.35

Sources: U.S. Department of Commerce, Bureau of the Census and National Marine Fisheries Service data base, Northwest and Alaska Fisheries Center, 7600 Sand Point Way N.E., Bin C15700, Seattle, WA 98115-0070.

Table 3.31 Monthly U.S. cold storage holdings of selected groundfish blocks, EOM, 1985-88 (in thousands of pounds).

Month	Cod	Flounder	Alaska pollock	Whiting	Minced	Total*
1985						
Jan.	16,857	1,770	7,868	1,575	1,642	40,029
Feb.	17,597	1,945	13,861	1,291	1,484	43,387
Mar.	15,962	2,158	14,693	775	1,605	44,664
Apr.	16,556	2,410	12,101	788	1,927	41,229
May	19,732	2,127	11,118	593	1,475	40,892
Jun.	21,703	2,439	8,711	2,162	2,275	44,772
Jul.	20,209	2,164	9,210	3,558	2,857	46,678
Aug.	19,232	2,921	7,492	2,607	3,855	43,953
Sep.	14,711	3,809	9,356	2,947	3,333	41,996
Oct.	12,491	3,712	6,980	2,879	2,456	36,862
Nov.	8,204	3,099	5,252	2,914	3,025	30,079
Dec.	9,440	2,609	5,259	4,869	2,226	32,617
1986						
Jan.	8,464	2,463	6,403	5,083	1,919	30,031
Feb.	10,005	1,907	4,044	4,851	2,275	30,717
Mar.	15,301	1,553	5,147	3,703	1,032	37,359
Apr.	21,830	1,741	4,653	2,617	3,679	39,425
May	25,610	1,553	3,880	2,800	5,091	44,312
Jun.	22,850	1,852	2,686	2,400	5,608	40,829
Jul.	25,799	2,069	2,392	3,952	7,770	48,441
Aug.	24,158	2,380	2,697	3,734	8,720	48,986
Sep.	19,700	2,431	3,037	2,829	8,739	45,486
Oct.	15,205	3,709	4,545	1,444	9,126	42,552
Nov.	12,570	3,063	3,074	1,451	10,877	40,163
Dec.	13,491	2,989	4,397	2,505	12,622	45,044
1987						
Jan.	9,811	2,640	3,506	2,061	12,933	40,197
Feb.	13,975	2,226	5,080	2,255	12,058	41,878
Mar.	13,754	2,093	6,633	1,211	10,496	42,505
Apr.	12,283	1,906	8,456	1,753	9,759	41,200
May	11,474	1,319	8,123	1,636	7,960	38,397
Jun.	12,472	1,533	8,505	3,407	8,952	44,780
Jul.	20,963	2,042	10,496	5,158	9,012	59,852
Aug.	23,694	2,318	10,125	6,152	8,449	68,219
Sep.	26,559	2,422	15,694	7,076	9,505	77,547
Oct.	22,800	3,117	15,319	6,278	8,188	74,154
Nov.	21,578	3,470	15,806	7,261	6,830	76,186
Dec.	24,135	3,404	11,936	6,708	7,546	71,798
1988						
Jan.	23,645	3,265	10,370	6,212	7,998	68,272
Feb.	27,852	2,307	10,817	4,884	5,799	66,474

* Total includes other species not listed.
Source: Natl. Mar. Fish. Serv., Natl. Fish. Stat. Prog., Washington, D.C. 20235.

Table 3.32 Monthly U.S. cold storage holdings of selected groundfish fillets, EOM, 1985-88 (in thousands of pounds).

Month	Cod	Flounder	Ocean perch	Pollock	Whiting	Total*
1985						
Jan.	31,020	5,591	9,432	8,142	1,511	62,360
Feb.	25,092	5,544	6,608	6,482	1,344	49,660
Mar.	25,336	5,951	6,270	5,540	1,667	48,980
Apr.	26,186	5,956	4,901	5,604	2,206	48,660
May	32,228	5,673	4,151	5,498	1,764	52,860
Jun.	30,393	5,644	4,029	5,368	2,357	52,870
Jul.	37,186	6,166	5,058	6,363	3,072	64,380
Aug.	33,910	6,290	5,492	6,351	3,478	61,830
Sep.	35,010	7,076	6,745	6,707	3,568	68,060
Oct.	31,257	7,825	7,180	7,206	4,278	66,150
Nov.	26,913	8,656	6,831	7,575	4,742	64,060
Dec.	24,232	10,897	7,322	8,673	5,278	66,180
1986						
Jan.	17,789	7,937	4,863	6,573	5,201	49,630
Feb.	17,394	7,263	2,777	5,455	3,468	42,690
Mar.	15,475	6,365	2,159	4,397	2,892	37,930
Apr.	17,561	6,015	2,230	3,681	3,177	38,770
May	21,588	5,726	2,975	3,769	1,551	42,020
Jun.	16,085	6,872	3,848	3,394	2,156	37,820
Jul.	16,975	7,543	4,943	3,106	2,004	40,470
Aug.	14,599	8,539	6,535	3,699	2,269	41,130
Sep.	10,865	10,357	7,057	3,470	1,866	39,990
Oct.	8,799	9,982	8,538	4,301	1,674	38,940
Nov.	7,382	10,172	9,107	4,672	2,079	38,480
Dec.	10,267	9,539	9,260	5,146	1,980	42,050
1987						
Jan.	9,779	7,701	7,997	4,527	1,964	36,810
Feb.	11,797	5,968	6,436	3,862	1,864	34,050
Mar.	14,357	4,773	5,501	4,125	1,461	34,910
Apr.	18,215	4,288	4,899	5,071	3,038	41,050
May	20,407	4,403	5,881	5,724	2,208	44,460
Jun.	23,307	5,222	6,908	5,976	2,432	50,140
Jul.	24,901	6,783	7,685	6,601	3,260	56,400
Aug.	24,660	7,171	8,984	9,638	2,842	61,520
Sep.	24,300	8,142	8,201	12,271	4,227	65,210
Oct.	25,839	8,646	9,780	14,006	4,275	71,150
Nov.	27,702	9,172	10,649	16,334	4,761	77,114
Dec.	27,233	8,878	10,910	20,902	4,031	81,899
1988						
Jan.	25,667	7,636	10,067	23,731	4,286	79,361
Feb.	29,004	6,041	8,461	24,578	2,822	77,444

* Total includes other species not listed.
Source: Natl. Mar. Fish. Serv., Natl. Fish. Stat. Prog., Washington, D.C. 20235.

4.0 CHARACTERISTICS OF THE FISHERY UNDER EACH ALTERNATIVE

Regardless of the upper limit to the OY range, many characteristics of the groundfish fishery will depend directly upon the status of the stocks and resultants estimates of ABC. Each year, the Council determines the status of the stocks, calculates their ABCs and sets TACs accordingly. The calculation of ABCs has been standardized where;

> ABC is calculated by multiplying the maximum sustainable yield exploitation rate with the size of the biomass for the relevant time period unless other biological information justifies a different method of derivation. The ABC must equal zero when the stock is at or below its threshold."

Recognizing that the procedure may sometimes be an over-simplification of stock assessment, the Plan Team adopted the following process to estimate ABCs:

1. First, age-structured models are used extensively to estimate the status of the stock. Whenever possible, the model is extended to project the dynamics of the stock into the near future so that potential impacts of different catch levels can be evaluated.

2. Second, ABC = an exploitation rate x exploitable biomass is the general formula used. The default procedure uses the MSY exploitation rate. This rate is used by the Team when the stock is known to be in good condition, high in abundance, and not in danger of drastic declines. When more information is known about the stock, the Team may deviate from the MSY exploitation rate by using the F0.1 exploitation strategy developed by ICES (1984) since it leads to a more conservative exploitation strategy. When information is lacking, historical exploitation rates have also been used to estimate ABC.

3. Finally, when biomass of the stock is not known, an empirical approach of setting ABC according to historical catch levels may be applied.

Examples on how ABCs have been calculated are contained in the Resource Assessment Document written in 1987 for management of the 1988 fishery (NPFMC 1987).

While it is difficult to make long term predictions on how characteristics of the fishery would change under each Alternative, shorter term predictions are possible and reliable. Based upon the Resource Assessment Document above, projections of ABCs for 1989 and 1990 (Table 4.1) have been made. Based upon these projections, changes that can be expected to the fishery given each of the three alternatives can then be evaluated in a more realistically.

Table 4.1 ABCs for groundfish of the Bering Sea/Aleutian Islands for 1988, projected ABCs for 1989-90, and estimates of MSY (mt).

		Acceptable biological catch (ABC)				
Species	Area	1988	1989	1990	MSY	Comments
Pollock	BS	1,500,000	1,275,000	1,330,000	2,300,000	Lower recruitment since 1985
	AI	160,000	136,000	142,000	245,000	Average abundance
Pacific cod		385,300	371,000	355,000	283,600	High abundance, adult mortality
Yellowfin sole		254,000	230,000	200,000	150,000	High abundance, lower recruitment
Greenland turbot		14,100	13,100	12,100	19,300	Average abundance, low recruitment
Arrowtooth flounder		109,500	109,500	109,500	50,000	High abundance, stable
Other flatfish		331,900	331,900	331,900	229,700	High abundance, stable
Sablefish	BS	4,500	4,300	4,000	4,100	High abundance, declining
	AI	7,700	7,700	7,700	5,000	High abundance, stable
Pacific ocean perch	BS	6,000	6,000	6,000	7,400	Below average abundance, stable
	AI	16,600	16,800	17,000	18,900	Below average abundance, increasing
Other rockfish	BS	400	400	400	500	Average abundance, stable
	AI	1,100	1,100	1,100	1,300	Average abundance, stable
Atka mackerel		21,000	21,000	25,000	39,000	Below average abundance, increasing
Squid		10,000	10,000	10,000	10,000	Average abundance, stable
Other species		54,000	56,000	58,000	59,000	Average abundance, increasing
TOTAL		2,876,100	2,589,800	2,609,700	3,422,800	Stable

Note: Plan Team estimates for 1988 sablefish ABCs were slightly larger than those recommended by SSC and Council (see tables in Chapter 1).

Pollock ABCs are projected to decline by 15% from 1988-89 and increase slightly (4.3%) from 1989-90. These projections are based upon the same cohort analysis model that was used to estimate the 1988 ABCs (NPFMC 1987) according to the simulated age-structure and dynamics of the pollock population. The forward projection reflects below-average recruitment from the 1985 year class which would depress biomass in 1988 and better recruiment thereafter that would increase biomass slightly. Abundance would remain at average levels.

Pacific cod ABC is expected to decline about 4% per year from 1988-90 based upon declines of the older fish that are now in the population and assumed average recruitment levels of 1981-85. The projection is based upon the same cod model that was used to simulate the age-structured dynamins of the stock and dynamics of the fisheries last year (NPFMC 1987). Abundance would still be near historical high levels.

Yellowfin sole ABC is expected to decline by 10% from 1988-89 and 13% from 1989-90 based upon anticipated effects of below-average recriutment levels from 1978-80. Abundance would remain high.

Greenland turbot ABC is expected to decline by about 7% per year from 1988-90 to reflect progressively poorer recruitment levels from 1979-86. Abundance would be average, at best.

Other flatfish resources (Arrowtooth flounder and other flatfish category) are high in abundance and stable, if not increasing. ABCs, therefore, would remain stable.

Abundance of sablefish in the EBS is declining. ABCs are expected to decline by 4% from 1988-89 and 8% from 1989-90. Abundance would still be high relative to levels of the last 10 years. Abundance of the resource in the Aleutian region is stable and high. Therefore ABCs would remain stable through 1990.

The Pacific ocean perch resource in the EBS is stable while that in the Aleutian region is increasing slightly, reflecting better recriutment in recent years. Abundances, however, would remain below average, as they have for 15 years. ABCs are expected to remain stable in the EBS through 1990 and increase slightly in the Aleutian region. ABC of other rockfish resources are expected to remain stable through 1990 and abundance would remain at average levels.

Atka mackerel ABC should remain the same from 1988-89, but increase 19% from 1989-90. The increase is expected to come from higher abundance of young detected during the 1986 U.S.-Japan trawl surveys. Abundance, however, would remain below average.

There is no reason to believe that squid ABC would not remain the same as in 1988. Biomass of other groundfish resources have been estimated from trawl surveys to be increasing slightly.

Acoordingly, ABCs are expected to increase slightly from 1988-90. Both resources are expected to be of average abundance.

All of the alternatives, including the status quo, require an estimate of DAP growth both in overall and species-specific capacity. Joint venture harvests have declined during the past two years and will continue to do so as it is constrained between DAP utilization and TACs. Should the upper limit to OY be raised, then the decline in JVP fisheries would be dampened. Any excess TAC above the needs of DAP and JVP would potentially be available again for TALFF.

Several industry studies suggest that by 1989 the domestic factory trawler fleet will have an overall capacity of approximately 1 million mt (FOG, 1988). Shoreside processing facilities serving the Bering Sea/Aleutian Islands were estimated at approximately 200,000 mt in 1988 by a NMFS survey. A consensus of industry and governmental projections indicate that at-sea processing will provide the bulk of near future processing increases.

The breakdown of domestic processing by species is complicated by the uncertainty of several factors such as market penetration and exchange rates. To facilitate analysis, domestic processors were assumed to continue to expand in those fisheries in which they already participate. Also, it was assumed that excess DAP capacity would enter other fisheries which are currently dominated by JVP. The extent of domestic utilization of these new fisheries is assumed to be related to stock abundance, current JVP harvest levels, and potential markets. While it is possible that continued JVP or TALFF harvests would dampen the demand for domestically processed fish, this market factor is not taken into account by this analysis.

Joint venture harvests are restricted by DAP harvests for those species with insufficient TAC to accommodate both. Estimates of potential JVP requests with an increase in OY, then, are based on past requests and capacity. No expansion into previously unutilized species is anticipated. Surplus TAC, beyond DAP and JVP estimates, are assumed to be available as potential TALFF.

4.1 Alternative 1 -- Status quo

If the current limit of 2.0 million mt is maintained, then the growth of DAP fisheries may be accommodated but joint venture fisheries will be gradually curtailed. Using estimates of increasing DAP capacity and joint venture demands, potential TACs and apportionments have been derived (Table 4.2).

In 1989, total domestic processing capacity in the BSAI is expected in increase by approximately 420,000 mt over 1988. In 1990 there may be a further increase of an estimated 380,000 mt. The major increase in domestic processing capacity seems to be for pollock. To account for this, projected increases for pollock processing are 270,000 mt in 1989 and a further 281,000 in 1990. Increased market

Table 4.2 Scenarios for 1989-1990 TACs, DAPs, JVPs, and potential TALFFs for Bering Sea/Aleutian Islands groundfish (mt), with 2.0 million mt limit to OY.

		1989				1990			
Species/Region		TAC	DAP	JVP	Potential TALFF	TAC	DAP	JVP	Potential TALFF
Pollock	BS	1,275,000	925,000	350,000	0	1,300,000	1,200,000	100,000	0
	AI	78,000	36,000	42,000	0	84,000	42,000	42,000	0
Pacific cod		200,000	100,000	100,000	0	200,000	150,000	50,000	0
Yellowfin sole		230,000	50,000	180,000	0	200,000	75,000	125,000	0
Greenland turbot		13,100	13,100	0	0	12,100	12,100	0	0
Arrowtooth flounder		5,000	2,000	3,000	0	5,000	2,000	3,000	0
Other flatfish		150,000	50,000	100,000	0	150,000	75,000	75,000	0
Sablefish	BS	3,400	3,400	0	0	3,400	3,400	0	0
	AI	5,800	5,800	0	0	5,800	5,800	0	0
Pacific ocean perch	BS	5,200	5,200	0	0	5,200	5,200	0	0
	AI	6,000	6,000	0	0	6,000	6,000	0	0
Other rockfish	BS	400	400	0	0	400	400	0	0
	AI	1,100	1,100	0	0	1,100	1,100	0	0
Atka mackerel		21,000	100	20,900	0	21,000	1,000	20,000	0
Squid		2,000	2,000	0	0	2,000	2,000	0	0
Other species		4,000	2,000	2,000	0	4,000	2,000	2,000	0
TOTAL		2,000,000	1,202,100	797,900	0	2,000,000	1,583,000	417,000	0

penetration and domestic processing demand is anticipated in the yellowfin sole and other flatfish fisheries. This, together with an available supply of experienced JV harvesters, may result in domestic processing increases of 50,000 mt in both 1989 and 1990. Likewise, increased DAP processing of Pacific cod is anticipated to increase processing demand due both to improved markets and excess harvesting capacity. An increase of 13,000 mt is projected for 1989 and 50,000 mt more in 1990. Since greater longline activity is anticipated, a 1,000 mt increase in the turbot landings is expected in 1989 although it will be constrained by ABC in 1990. Demand for arrowtooth flounder is not great nor is it anticipated to grow. Therefore, domestic processing is restricted by 1,800 mt to allow greater JV harvests. Sablefish and POP domestic processing are expected to increase 800 mt and 200 mt, respectively, in 1989 due to increased demand and supply of harvesters. The TAC for these species is set below ABC for conservation and market reasons. Atka mackerel processing is assumed to increase to 1,000 mt in 1990 due to market penetration. Likewise, squid processing is assumed to increase to 2,000 mt in 1989 as a bait market develops. The domestic processing of other species is kept constant since no change in demand is anticipated.

As domestic processing increases, JV processing will be forced to decrease due to the 2.0 mmt limit. Most of this decrease is assumed to occur in pollock and yellowfin sole processing. Both of these species have a TAC set at ABC except for pollock in the AI where it is assumed to be uneconomical to harvest at the ABC level. Pacific cod harvest by JV may be limited by a TAC set below ABC and increased domestic processing demand. Arrowtooth flounder JV harvest is expected to increase as bycatch. JV harvest of other flatfish will decrease as DAP takes more of a limited TAC. Atka mackerel harvests will decrease as constrained by ABC and DAP in 1989 and 1990. The harvest of other species would be reduced in order to reach the 2.0 mmt cap. No harvests are expected of species not currently allowed in 1988.

Since the TAC would be constrained by the 2.0 mmt cap and since DAP would be constraining JVP in fisheries with surplus ABC, no TALFF would be expected.

4.2 Alternative 2 -- Sum of the ABCs

If the 2.0 million mt limit were removed, then both DAP and JVP fisheries could be accommodated, at least for several years, along with some potential surplus of some species for TALFF. Using estimates of DAP and JVP demand and capacity, potential TACs and apportionments have been derived (Table 4.3).

The difference in DAP between this alternative and the status quo is relatively unchanged through 1990. The only changes occur in sablefish and POP which may have a TAC set at the full ABC. This would result in an increased DAP of 2,800 mt and 2,400 mt in 1989 and 1990, respectively, for sablefish and an increased DAP of 11,600 mt and 11,800 mt in 1989 and 1990, respectively, for POP.

Table 4.3 Scenarios for 1989-1990 TACs, DAPs, JVPs, and potential TALFFs for Bering Sea/Aleutian Islands groundfish (mt), without 2.0 million mt limit to OY (assuming TAC = ABC).

		1989				1990			
Species/Region		TAC	DAP	JVP	Potential TALFF	TAC	DAP	JVP	Potential TALFF
Pollock	BS	1,275,000	925,000	350,000	0	1,330,000	1,200,000	130,000	0
	AI	136,000	36,000	100,000	0	142,000	42,000	100,000	0
Pacific cod		371,000	100,000	150,000	121,000	355,000	150,000	155,000	50,000
Yellowfin sole		230,000	50,000	180,000	0	200,000	75,000	125,000	0
Greenland turbot		13,100	13,100	0	0	12,100	12,100	0	0
Arrowtooth flounder		109,500	2,000	3,000	104,500	109,500	2,000	3,000	104,500
Other flatfish		331,900	50,000	150,000	131,900	331,900	75,000	150,000	106,900
Sablefish	BS	4,300	4,300	0	0	4,000	4,000	0	0
	AI	7,700	7,700	0	0	7,700	7,700	0	0
Pacific ocean perch	BS	6,000	6,000	0	0	6,000	6,000	0	0
	AI	16,800	16,800	0	0	17,000	17,000	0	0
Other rockfish	BS	400	400	0	0	400	400	0	0
	AI	1,100	1,100	0	0	1,100	1,100	0	0
Atka mackerel		21,000	100	20,900	0	25,000	1,000	24,000	0
Squid		10,000	2,000	100	7,900	10,000	2,000	100	7,900
Other species		56,000	2,000	8,000	46,000	58,000	2,000	8,000	48,000
TOTAL		2,589,800	1,216,500	962,000	411,300	2,609,700	1,597,300	695,100	317,300

JVP would likely increase for those species already targeted by joint ventures and not constrained by ABC or DAP limits. This involves increased JVP in pollock in the Aleutian Islands of 58,000 mt for both years, Pacific cod of 50,000 mt in 1989 and 100,000 mt in 1990, other flatfish of 50,000 mt in 1989 and 75,000 mt in 1990, Atka mackerel of 4,000 mt in 1990, squid of 100 mt in both years, and 6,000 mt of other species in both years.

Since the combined anticipated DAP and JVP harvest would not equal the sum of the ABCs, there would be fish potentially available for TALFF. Potential TALFF would be the difference between the combined DAP and JVP requests and the ABC. It is anticipated to occur in Pacific cod, arrowtooth flounder, other flatfish, squid, and other species. Total potential TALFF is expected to be 411,300 mt in 1989 and 317,300 mt in 1990.

A comparison of TACs and apportionments with and without the 2.0 million mt limit (Table 4.4) indicates that removal of the 2.0 million mt limit could result in the following for 1989 and 1990:

(a) small increases in TAC for pollock, mostly in the Aleutian Islands,

(b) large increase in TACs for Pacific cod and other flatfish,

(c) possibly large increase in TAC for arrowtooth flounder,

(d) moderate to relatively large increase in TAC for POP, and

(e) increases for squid and other species.

4.2.1 Option A -- Sum of the ABCs

This option reflects the discussion presented above, with resulting TACs and apportionments estimated in Table 4.3.

4.2.2 Option B -- 90% of the sum of ABCs

This option would likely result in slightly reduced TACs for currently under-utilized species such as other flatfish, Pacific cod, or other species.

4.2.3 Option C -- 5% per year maximum increase in OY

Imposition of a 5% maximum increase in optimum yield would drastically reduce the changes to TACs and apportionments described under this alternative. In 1989 OY could potentially equal 2.1 million mt, the extra 100,000 mt being added to desirable species such as Pacific cod and/or other flatfish. In 1990, a total OY of 2.205 million mt could be released. Under this implementation schedule OY could not reach 2.5 million until 1993, assuming that the sum of ABCs remains high for the entire five years.

Table 4.4 Possible increases of TACs and apportionments for Bering Sea/Aleutian Islands groundfish (mt), without 2.0 million mt limit to OY.

		1989				1990			
Species/Region		Δ TAC	Δ DAP	Δ JVP	Potential TALFF	Δ TAC	Δ DAP	Δ JVP	Potential TALFF
Pollock	BS	0	0	0	0	30,000	0	30,000	0
	AI	58,000	0	58,000	0	58,000	0	58,000	0
Pacific cod		171,000	0	50,000	121,000	155,000	0	105,000	50,000
Yellowfin sole		0	0	0	0	0	0	0	0
Greenland turbot		0	0	0	0	0	0	0	0
Arrowtooth flounder		104,500	0	0	104,500	104,500	0	0	104,500
Other flatfish		181,900	0	50,000	131,900	181,900	0	75,000	106,900
Sablefish	BS	900	900	0	0	600	600	0	0
	AI	1,900	1,900	0	0	1,900	1,900	0	0
Pacific ocean perch	BS	800	800	0	0	800	800	0	0
	AI	10,800	10,800	0	0	11,000	11,000	0	0
Other rockfish	BS	0	0	0	0	0	0	0	0
	AI	0	0	0	0	0	0	0	0
Atka mackerel		0	0	0	0	4,000	0	4,000	0
Squid		8,000	0	100	7,900	8,000	0	100	7,900
Other species		52,000	0	6,000	46,000	54,000	0	6,000	48,000
TOTAL		589,800	14,400	164,100	411,300	609,700	14,300	278,100	317,300

Under this option TACs and apportionments would likely be similar to those projected for Alternative 1 (Status quo), with some increase in more desirable species such as pollock or other flatfish.

4.3 Alternative 3 -- Groundfish Complex MSY

As described in Section 1.4.3, setting the upper end of the OY range equal to the groundfish complex MSY will likely result in the same annual TACs and apportionments as in Alternative 2.

5.0 CONSEQUENCES OF THE ALTERNATIVES

Based upon the description of the fishery under each alternative (Chapter 4) and knowledge of the physical, biological, and socioeconomic environment (Chapters 2 and 3), this chapter describes the likely consequences of each alternative action.

5.1 Physical and Biological Impacts

Physical and biological impacts of each alternative are assessed by category, as introduced in Section 1.6, including effects on groundfish stocks, predator-prey interactions, bycatch of incidental species, implications to marine debris, effects on seabirds, and effects on marine mammals.

As stated earlier, the analysis of all these potential impacts are to be discussed relative to the status quo where the upper limit of OY is 2.0 million t. Thus, the analysis on consequences of each alternative and options will focus on the relative impacts of increasing harvest beyond 2.0 million t.

5.1.1 Alternative 1 -- Status quo

Groundfish Stocks

Under status quo, the biological status of the stocks are evaluated each year. ABCs are calculated and reported in annual Resource Assessment Documents. The Council then sets TACs for each of the stocks based upon their individual status, status of the groundfish complex as a whole, and appropriate socioeconomic considerations. This system of assessment will continue as before under status quo.

The ABC is generally the estimated "surplus production" which can be harvested each year. The harvest of surplus production should not adversely impact the well-being of groundfish populations since the fish harvested are those amounts in excess necessary to maintain the population. Maintaining status quo would limit the harvest to 2.0 million t even though additional "surplus" could be harvested. This additional "surplus" may or may not provide more conservation purpose to the stocks. Much of what happens depend on abundance of the stocks. When abundance is high, unharvested surplus does not necessarily provide more conservation purpose to the stocks.

There is particular concern for the status of the pollock population on acount of very high catches that have been taking place outside the U.S. EEZ in the "donut hole" area of the Bering Sea. Catches have been reported to be about a million t per year for the past 2 years, as compared to about 1.2 million t in the Bering Sea FMP management area. Preliminary information on the inter-relationship of pollock stocks throughout the North Pacific suggest that some components of U.S. EEZ pollock are mixed with other stocks in the donut hole area.

While it is difficult to quantify the impact of pollock catches in the donut hole area on stocks in the U.S. EEZ, it is clear that fishing activities in the donut hole area would have downstream effects on U.S. EEZ stocks. These effects are being studied through a proposed multi-national research program (NWAFC 1987). While the research would take years to complete, the impact of donut hole catches would have to be incorporated in the Resource Assessment Document and estimation of ABCs for pollock each year.

Predator-Prey Interactions

The marine ecosystem is a complex web of predator-prey interations. Since the status of each component stock in the groundfish complex may change from year to year, even under the status quo alternative, predator-prey interactions are also expected to vary. Of particular concern are the predator-prey interactions:

(a) between fish species within the groundfish complex
(b) between fish and crab resources
(c) between fish and seabirds, and
(d) between fish and marine mammals

Potential impact of predator-prey relationships with seabirds and marine mammals are discussed in latter sections. Discussion of the relationships among fish and crabs are as follows.

Laevastu and Favorite 1977 evaluated mortality sources by prey age for yellowfin sole, Pacific herring, Pacific cod, and walleye pollock as prey. Although the actual magnitude of the removal at age by fish, mammals, and the fishery depends on population size of the predators and size distribution of prey in a given year, it can be generalized that fish and seabird predators consume the youngest prey while marine mammals tend to take slightly older (and larger) prey. The fishery takes the largest fish of any particular species.

Fish food habits research conducted by the NWAFC in the eastern Bering Sea provides information on which fish species utilize the same food sources and which fish species are predators of other fishes. This research also outlines the size ranges of prey consumed by fish predators. For an overview of this information and references to other studies, see Livingston et al. (1986) and Brodeur and Livingston (1988).

Since the most abundant and ecologically important species harvested are walleye pollock, Pacific cod, and yellowfin sole discussions are categorized accordingly.

Fishery on walleye pollock

Adult pollock are cannibalistic and are the major source of predation on young-of-the-year pollock. Other fish predators such as Pacific cod, Pacific halibut, Greenland turbot, arrowtooth flounder, sablefish, and flathead sole also consume young pollock.

Table 5.1 show that most removals of pollock (in terms of numbers and weight) are by adult pollock. Fishery removals are small (18% by weight, 1% by number) in comparison with internal predation mortality (48% by weight, 84% by number). Since the fishery removes large, cannibalistic pollock it would have an initial short-term effect of releasing small pollock prey to other predators or to increased survival for later recruitment to the fishery as adults.

Long-term effects on the ecosystem would occur if there is a spawner-recruit relationship for pollock whereby removal of adult pollock would reduce the available number of young pollock. This spawner-recruit relationship has been shown in the Resource Assessment Document to be best depicted by a Beverton-Holt relationship (NPFMC 1987). This relationship shows that the present spawning biomass of pollock in excess of 6.0 million t is substantially above the Bmsy spawning biomass of 4.7 million t necessary to produce high levels of recruits.

Fishery on Pacific cod

There are few major fish predators which consume Pacific cod. Occasionally, Pacific cod adults consume juvenile cod. Inshore in Bristol Bay, yellowfin sole have consumed 0-age Pacific cod. Increased fishing on Pacific cod adults would have no effect on fish predators which consume Pacific cod in the short-term. Long-term effects on fish predators would occur only if a spawner-recruit relationship exists between number of adult Pacific cod and the number of Pacific cod spawned which become available to predators. Even these long-term effects would be slight as no fish predators rely heavily on Pacific cod as a food source.

Other fish predators which consume common prey with Pacific cod and which might benefit from reduced cod populations include pollock, yellowfin sole, Pacific halibut, and cottids. Pollock and yellowfin sole consume younger prey than Pacific cod so they would not benefit much by reduced cod populations. Pacific halibut consume pollock and Tanner crab of similar sizes to those consumed by Pacific cod. Similarly, cottids consume small Tanner crab as do Pacific cod.

It is difficult to determine whether a decrease in the Pacific cod population would result in enhanced growth opportunities for its competitors due to increased food availability or whether such a decrease might actually result in increased survival rates for Pacific cod prey such as Tanner crab. While it is difficult to determine whether the above cause-effect relationships would occur, it seems intuitive that unchecked growth of Pacific cod biomass would be detrimental to Tanner crab populations.

Fishery on yellowfin sole

Main fish predators of yellowfin sole are Pacific cod and Pacific halibut. Since the fishery removes large yellowfin sole, in the

Table 5.1 Estimated removals of walleye pollock, Theragra chalcogramma, from the eastern Bering Sea by man, marine mammals, birds, and fish.

Source of Removal	Estimated Biomass Removed (mt)	Percent Biomass Removed	Estimated Numbers Removed ($x10^9$)	Percent Numbers Removed
Fishery	1,000,000[a/]	18	2.0[1/]	0.4
Marine mammals	501,000[b/]	9	3.9[2/]	0.8
Fur seals	167,000	3	2.5	0.5
Sea lions	274,000	5	1.3	0.3
Others	60,000	1	0.1	<0.1
Marine birds	272,000[b/]	5	68.0[3/]	13.8
Marine fish	3,812,000[c/]	68	419.6[4/]	85.0
Pollock	2,696,000	48	416.5	84.4
Other fish	1,116,000	20	3.1	0.6
TOTAL	5,585,000		493.5	

a/ Bakkala, R.G., V.G. Wespestad, and J.J. Traynor. 1986. Walleye pollock. In: R.G. Bakkala and L.L. Low (editors) Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1985. NOAA Tech. Memo. NMFS F/NWC-104.

b/ Kajimura, H. and C.W. Fowler. 1984. Apex predators in the walleye pollock ecosystem in the eastern Bering Sea and Aleutian Islands region. In: D.H. Ito (editor) Proceedings of the workshop on walleye pollock and its ecosystem in the eastern Bering Sea. NOAA Tech. Memo. NMFS F/NWC-62.

c/ Livingston, P.A., D.W. Dwyer, D.L. Wencker, M.S. Yang, and G.M. Lang. 1986. Trophic interactions of key fish species in the eastern Bering Sea. Int. N. Pac. Fish. Comm. Bull. 47:49-65.

1/ Numbers removed estimated from catch-at-age (CAGEAN) model results averaged from 1982-1984 in Bakkala, R.G., V.G. Wespestad, and J.J. Traynor. 1987. Walleye pollock. In: R.G. Bakkala and J.W. Balsiger (editors). Condition of groundfish resources of the eastern Bering Sea and Aleutian Islands region in 1986. NOAA Tech. Memo. NMFS F/NWC-117. (Most pollock were age three to five.)

2/ Assuming fur seals and other marine mammals consume mostly one-year old pollock and sea lions consume mostly age two pollock. Frost, K.J. and L.F. Lowry. 1986. Sizes of walleye pollock, Theragra chalcogramma, consumed by marine mammals in the Bering Sea. U.S. Fish. Bull. 84: 192-197.

3/ Assuming marine birds consume mostly age 0 pollock. Hunt, G.L. Jr., B. Burgeson, and G.A. Sanger. 1981. Feeding ecology of seabirds of the eastern Bering Sea. In: D.W. Hood and J.A. Calder (editors), The eastern Bering Sea shelf: oceanography and resources, Volume 2, p. 629-647. Univ. Wash. Press, Seattle.

4/ Walleye pollock consume mostly age 0 pollock. Dwyer, D.A., K.M. Bailey, and P.A. Livingston. 1987. Feeding habits and daily ration of walleye pollock (Theragra chalcogramma) in the eastern Bering Sea, with special reference to cannibalism. Can. J. Fish. Aquat. Sci. 44:0000-0000.
Other fish is mainly Pacific cod consuming age three pollock. Other fish category includes: yellowfin sole, flathead sole, arrowtooth flounder, Greenland turbot, and Pacific cod. Livingston, et al. 1986. (op. cit.)

short-term there would not be an impact on fish predators (which consume smaller yellowfin sole). Long-term impacts would occur only if there is a spawner-recruit relationship for yellowfin sole which would reduce the amount of subsequent young recruits available to fish predators. This has generally not been the case. In the short-term, removal of yellowfin sole could release yellowfin sole prey (benthic invertebrates) to other predators (Pacific cod, other flatfish, crab, small yellowfin sole). Whether this prey is actually utilized by other predators depends on whether food is limiting for them.

In the eastern Bering Sea, the biomass of shallow water (<40 m) benthic invertebrates is lower than in deeper shelf areas (Feder 1981). This suggests that benthic prey not consumed by large yellowfin sole in shallow areas might be consumed by small yellowfin sole and other flatfish, perhaps providing enhanced growth (and reproductive) conditions for these species.

Implications for Bycatch of Incidental Species

Even under status quo, the groundfish fishery is still evolving as DAP and JVP fisheries develop and change. While the dominant gear used is trawl gear, there are developments taking place with the technology of trawling in order to minimize bycatch of incidental species. Bycatch problems are associated with traditional fully utilized DAP fisheries (such as crabs, halibut, and salmon) and new fully utilized or low abundance species (such as herring, sablefish, and rockfishes).

Regardless of the type of bycatch problems, the Council has adopted measures to protect incidentally caught species. These protections generally:

(a) regulate non-retention of the incidental species (prohibited species catch),

(b) set PSC limits to certain amounts which triggers the closure of certain time-area strata when limits are reached, and

(c) shut down fisheries or certain gear types when certain PSC limits are reached.

Examples of some bycatch restrictions are contained in the present fishery regulations for flatfish fisheries in the eastern Bering Sea. These restrictions limit the amount of king crabs and *C. bairdi* crabs that could be taken in conjuction with flatfish fisheries in Area 511 of the eastren Bering Sea. When any limit is reached, the fishery would have to move out of the area. In addition, a bycatch limit for Pacific halibut is also in effect. All these regulations are effective through the 1988 fishery and are expected to be replaced with the bycatch amendment proposal contained elsewhere in Amendment 12. Therefore, under the status quo alternative, impact to bycatches will continue to be minimized through bycatch regulations.

Implications on Marine Debris

Along with trawling activities, lost or discarded trawl webbing and other fishing debris are introduced into the sea. The debris eventually wash up on shore and affect the esthetics and ecology of shorelines. Also, marine debris, particularly fragments of trawl webbing drifting at sea are known to entangle northern fur seals. The effect of such entanglement are addressed in the section on marine mammals below.

As stated earlier, DAP and JVP fisheries are still evolving. As such, it is difficult to accurately predict whether more trawling activities would result when compared to prior years when the fishery was dominated by foreign trawlers. Under the status quo alternative where OY is limited to 2.0 million t, it is anticipated that trawling activities would likely be lower than in prior years. The main reason is that domestic trawlers (both DAP and JVP) tend to operate for shorter periods of time than foreign trawlers that operated over a wider area and longer periods of time. As such, it is expected that less fishing time and marine debris will result.

Further, Public Law 100-220, Title IV will prohibit the discharge of all plastics, including fishing gear, as of December 30, 1988. It is expected that compliance with this newly enacted legislation will greatly reduce the input of debris.

Seabirds

As noted in Section 2.2.4, several species of seabirds in the Bering Sea/Aleutian Islands feed on juvenile groundfish (mostly pollock). These birds consume small fish prior to their recruitment to commercial fisheries and are in competition with commercial fish species for prey. This type of trophic interaction is the major potential impact of groundfish fisheries on seabirds.

Reproductive success at Bering Sea colonies, noted particularly for kittiwakes and murres, has varied considerably from year to year since first monitored in 1975 (Johnson and Baker, 1985; Byrd, in press), likely in response to the variation and interaction of biological and environmental factors such as food supply, predation, and oceanographic/ meteorologic conditions (e.g. sea temperature). For example, in 1982 both kittiwakes and murres experienced almost total reproductive failure on St. Matthew Island (Springer et al., 1983, 1984a). Few eggs were observed in nests and almost no nestlings. The cause was assumed to be an inadequate food supply since adults were not found to be capturing fish, the necessary diet for egg production and chick development (Springer et al., 1983, 1984a,b, 1985). In 1983, kittiwakes again did poorly but food availability for murres may have improved, as reflected in their increased breeding success (Springer et al., 1983, 1984a). While the effect of competition for prey and dependence on juvenile groundfish as prey is intricate, it has been suspected that survival rates of nestlings of some piscivorous seabirds may be correlated with the size of pollock year classes (Springer et al., 1986). In contrast, low abundance of juvenile pollock may benefit planktivorous seabirds, such as auklets, due to reduced competition for copepods.

Analysis of data for the Pribilof Islands (Lloyd, 1985), however, indicates that food availability rather than abundance may be responsible for variations in reproductive success. Specifically, kittiwake and murre reproduction at St. George Island showed stronger correlation to physical parameters such as sea surface temperature. A tentative explanation is that, during years of colder water temperatures, the distribution of larval and juvenile pollock is constricted to the outer shelf, thus becoming more available to birds from the breeding colonies there. During warmer years pollock are distributed more widely across the shelf and are thus less available to birds foraging from the Pribilofs. Other factors that may affect the availability rather than the abundance of seabird prey include annual variation in current patterns, wind mixing of the water column, as well as the direct affect of wind on the foraging capability of adult birds.

There is, as yet, no evidence to confirm any direct or indirect impact of commercial fisheries for pollock or other groundfish on the reproductive success or population status of seabirds in the Bering Sea/Aleutian Islands (Lensink, 1984; Sanger, in press; USFWS, 1988). In the case of pollock, the only fishery in the Bering Sea for which such interactions are suspected, commercial harvest may even increase the abundance of piscivorous seabird prey due to the cannibalistic nature of adult pollock, the effects of the commercial harvest to shift pollock age distribution to smaller fish, and a spawner-recruit relationship that indicates the environment rather than number of adults exerts more control over recruitment.

In addition to poor reproduction, kittiwakes and murres at several colonies in the eastern Bering and Chukchi seas have also undergone noticable population declines over the past decade (Troy and Baker, 1985, Murphy et al., 1986; Byrd, in press). Since for such long-lived bird species the recent years of low reproductive success would not yet be expected to result in overall population decline, there is some indication of adult mortality. However, there is to date no information linking such adult bird mortality to commercial groundfish fisheries.

While there is intuitive reason to be concerned that groundfish fisheries may impact prey availability to seabirds, if those fisheries are appropriately constrained by ABCs that protect recruitment, then other predators should not suffer adverse impact.

Marine Mammals

Types of interactions between marine mammals and commercial groundfish fisheries in the Bering Sea/Aleutian Islands have been divided into direct and indirect effects:

(a) Direct effects on marine mammals from shooting, harassment, incidental entanglement during fishing operations, and/or entanglement in lost or discarded fishing gear.

(b) Indirect effects on marine mammals caused by fisheries reducing the quantity or quality of prey species available to marine mammals.

<u>Direct effects on marine mammals</u>: Loughlin and Jones (1984) characterized and ranked direct interactions between marine mammals and groundfish fisheries. They identified problems with incidental take, catch loss, and gear damage between groundfish trawl fisheries and northern fur seals, northern sea lions, and harbor seals. There has also been great concern about the entanglement of northern fur seals in derelict net fragments from the trawl fishery (Fowler, 1987). Loughlin and Jones (1984) and Steiner (1987) further described problems with catch loss, gear damage, and harassment or killing of northern sea lions and killer whales in longline fisheries. There also have been reports of walrus caught in trawls in Bristol Bay, as part of the yellowfin sole/other flatfish fishery.

Under the Marine Mammal Protection Act of 1972 ,incidental taking of some marine mammals in the groundfish fisheries has been allowed by issuance Certificates of Inclusion to fishermen covered under a general permit. Marine mammals, particulary northern sea lions, have been caught incidentally in foreign commercial trawl fisheries in the Bering Sea and Gulf of Alaska since about 1954 when those fisheries expanded. Northern sea lions are the predominant species incidentally caught in commercial fisheries (Loughlin et al., 1983; Loughlin and Nelson, 1986). Many northern sea lions incidentally caught during fishing operations are alive when brought aboard vessels (up to 34% in 1979); however joint-venture fisheries composed of U.S. trawlers catching and selling fish to foreign processors experience nearly 100% mortality of caught sea lions (Loughlin and Nelson, 1986). During the period 1978-81 the estimated average annual take of northern sea lions by foreign vessels was 724 animals (Loughlin et al., 1983). In a walleye pollock joint-venture fishery in Shelikof Strait, Alaska, the estimated number of mortalities resulting form incidental catch ranged from 216 to 1,436 during January to April 1982 to 1984 (Loughlin and Nelson, 1986).

Information on the abundance of net fragments in both the pelagic waters of the Pacific Ocean and Bering Sea, and on beaches, as well as on the incidence of fur seal entanglement in such debris has been collected. Data for fur seal entanglement has been collected since the mid 1960's. A comparison of this information with recent trends in population levels of northern fur seals (Fowler, 1982, 1987) suggests that entanglement-induced mortality of young seals may largely account for those declines. Such a conclusion has been contested, however, by York and Kozloff (1987) since pupping rates stabilized on St. Paul Island from 1981 to 1986 even though entanglement rates had presumably remained the same; if entanglement were the source of population decline, then pupping rates on St. Paul would be expected to have continued their decline.

Entanglement of northern sea lions is less evident and appears to be insufficient to account for a substantial decline in sea lion numbers in the Aleutian Islands (Loughlin et al., 1986), however, assessment of juvenile sea lions has been difficult and inadequate to evaluate whether juvenile mortality due to entanglement is significant.

The extent of harassment and killing of northern sea lions is not well documented, although it is known that sea lions have been shot as nuisances (Merrick et al., 1987). There is also information suggesting that a substantial number of killer whales are impacted by the sablefish longline fishery (Steiner 1987), particularly near Unimak Pass and Akutan Island. There is, however, no rigorous estimate of the killer whale population nor assessment of existing harassment.

Trawl catch of walrus has been reported by the foreign observer program of NMFS, however all animals observed in 1986 and 1987 were dead, with a large proportion of them already decomposing. Trawl fisheries apparently are capturing carcasses rather than live animals (R. Nelson, NWAFC, pers. comm.). Because the population of walrus is considered healthy, the current incidental take, even if composed of some live animals, is not expected to have any adverse effect.

<u>Indirect effects on marine mammals</u>: Considering that several marine mammals rely upon groundfish for an important proportion of their diet, there is concern that commercial harvests of groundfish can impact these animals. In relation to groundfish fisheries interactions, Lowry (1984) ranked northern fur seals, northern sea lions, and harbor seals as most likely to be adversely affected, but recognized that such affects have not been documented.

Northern fur seals have suffered a decline in population, as indicated by reduced numbers of pups and large males on the Pribilof Islands, since the 1950-60s. Although some type of trophic interaction, mediated through pollock, has been suspected as a cause of this decline, evidence such as high individual growth rates suggests that food limitation is not a problem for fur seals (Fowler, 1982). In fact, Swartzman and Haar (1983) examined the extensive data base available on northern fur seals and noted that pollock comprised an even larger portion of the Pribilof fur seal diet after the commercial fishery for pollock was initiated. Given that fur seals feed mostly on small (1-2 year old) pollock (Frost and Lowry, 1986), before their recruitment to the fishery, and that the fishery acts to shift the size distribution of pollock toward smaller, younger fish, commercial harvest of pollock may actually increase the food available to, and thereby benefit, fur seals (Swartzman and Harr, 1983).

There is less information on northern sea lions. Some of the fish upon which this species depends are smaller than taken in commercial fisheries, others are not (Frost and Lowry, 1986; Merrick et al., 1987); the mean length reported by Frost and Lowry 1986) being 29.3 cm. Even less information is available on the diet of harbor seals. Their dependance on some small fish may preclude complete direct competition with the groundfish fisheries (Pitcher, 1980; Frost and Lowry, 1986), however the mean length of fish consumed reported by Frost and Lowry (1986) was 24.5 cm. and more than 50% of the fish consumed, especially by weight, are within the size range taken by commercial fisheries.

In summary, as stated by Lowry and Frost (1985), there is no conclusive evidence that fisheries in the Bering Sea/Aleutian Islands affect marine mammal populations through depletion of food supply. They go on to say that samller average sizes and younger average ages of pollock stocks in the Bering Sea caused by fishing may be benefitial to those species of pinnipeds which eat primarily small pollock. On the other hand major declines have been documented in population sizes of fur seals, sea lions and harbor seals in the Bering Sea and Gulf of Alaska. These are the species that Lowry (1984) considered most likely to be effected by commercial fisheries in that area. Until such time as the causes of these declines are conclusively identified, the possiblity that fisheries are a causative or contributing factor cannot be ruled out. Available data are not adequate to characterize the diets of these and many other marine mammal species to assess whether populations have been or will be effected by commercial groundfish fisheries.

5.1.2 Alternative 2 -- Sum of the annual estimates of ABC.

This alternative would be directly responsive to changing condition of the stocks as measured by ABCs where OY would be set equal to or lower than the sum of ABCs. Three options have been suggested to implement this alternative:

(a) the alternative as stated
(b) limit upper end of OY to 90% of sum of ABCs
(c) limit any annual increase of OY to 5% of the upper end of the range in the previous year.

The environmental impact to each of these options are not too different to the main proposal in the sense that Options B and C imposes more conservatism onto each year's setting of OY. The additional degree of conservation for the stocks is difficult to quantify and may or may not be better reduce the environmental impact of the action.

Groundfish Stocks

As stated for Alternative 1, ABC is the estimated surplus production which can be harvested each year. The harvest of surplus production should not adversely impact the well-being of groundfish populations since the fish harvested are those amounts in excess necessary to maintain the population. Each year, the Council sets TACs by species according to the status of the stocks. If these TACs are set less than or equal to ABCs, there should be no adverse impact to groundfish stocks.

Moreover, limiting each years increase of OY according to Options B and C may not necessarily provide more conservation purpose to the stocks. For some stocks, for example pollock, limiting harvests below ABC may actually lead to higher abundance of adult pollock and thus increase cannabilism on its young.

<u>Predator-Prey Interactions</u>

Any impact on predator-prey interactions are closely linked to the setting of TACs. If TACs are set generally close to ABCs as in past practices, then additional adverse impact to predator-prey relationships should not occur under this alternative and it's options. In addition, it is quantitatively difficult to distinguish any difference to predator-prey relationships under any of the three options.

Table 5.2 shows a calculation of approximate food biomass released to the ecosystem under increased fishing removals of Alternative 2. Most of the walleye pollock and Tanner crab biomass released is due to the increased fishery on Pacific cod. Most pollock consumed by cod are ages 1 to 3 and Tanner crab are ages 0 to 4. Other fish predators which consume pollock of these ages include Greenland turbot, arrowtooth flounder, and Pacific halibut. Fish predators which consume small Tanner crab are Pacific halibut, great sculpin, plain sculpin, and yellow and red Irish lords. Research has been unable to determine whether an increase in availability of young pollock or Tanner crab would result in more of these species surviving to enter the fishery or whether they would be consumed by other predators in the system, possibly providing enhanced growth opportunities for these other predators, such as seabirds and marine mammals.

Similarly, the food released by increased fishing removals of the other groundfish species in Table 5.2 could provide increased growth opportunities for pelagic and benthic fishes if food is currently limiting for any fishes in those environments. There may also be enhanced food availability for seabirds and marine mammals. However, there is not enough information to determine which ecosystem component might benefit from such an increase in available food. Unused pelagic production would eventually be transferred in part as detritus which could improve benthic production. Similarly, unused nutrients in the bottom sediments could be transferred up in the water column to pelagic components through physical mixing processes. The quantification of such

Table 5.2 Estimated biomass (1000 mt) of prey released to ecosystem under Alternatives 2 and 3 due to increased fishery removals (1000 mt), in the Bering Sea/Aleutian Islands, 1989-1990.

Species/Region		1989 ΔTAC	1989 Pollock	1989 Tanner crab	1989 Other prey	1989 TOTAL PREY	1990 ΔTAC	1990 Pollock	1990 Tanner crab	1990 Other prey	1990 TOTAL PREY
Pollock 1/	BS	0.0	0.0	0.0	0.0	0.0	30.0	16.0	trace	19.0	35.0
	AI	58.0	0.0	0.0	67.0	67.0	58.0	0.0	0.0	67.0	67.0
Pacific cod 1/		171.0	217.0	47.0	357.0	621.0	155.0	197.0	43.0	322.0	562.0
Arrowtooth flounder 1/		104.5	75.0	0.0	80.0	155.0	104.5	75.0	0.0	80.0	155.0
Other flatfish 2/		181.9	1.3	0.0	78.7	80.0	181.9	1.3	0.0	78.7	80.0
Sablefish 3/	BS	0.9	0.8	0.0	0.6	1.4	0.6	0.5	0.0	0.4	0.9
	AI	1.9	1.7	0.0	1.3	3.0	1.9	1.7	0.0	1.3	3.0
Pacific ocean perch 4/	BS	0.8	0.0	0.0	1.2	1.2	0.8	0.0	0.0	1.2	1.2
	AI	10.8	0.0	0.0	15.8	15.8	11.0	0.0	0.0	16.1	16.1
Atka mackerel 4/		0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	5.8	5.8
Squid 4/		8.0	0.0	0.0	12.6	12.6	8.0	0.0	0.0	12.6	12.6
Other species 4/		52.0	0.0	0.0	81.6	81.6	54.0	0.0	0.0	78.8	78.8
TOTAL		589.8	295.8	47.0	695.8	1038.6	609.7	291.5	43.0	682.9	1017.4

1/ Figures derived by inserting Δ TAC biomasses into Tables 8-11 of Livingston et al. (1986) and assuming most TAC removals are of pollock >40 cm, P. cod >60 cm, and arrowtooth flounder >40 cm.

2/ Assuming daily ration and percentages of pollock in diet are the same as yellowfin sole ration estimated in Livingston et al. (1986) (ave. = 0.13% body weight daily).

3/ Assuming daily ration and percentage of pollock in diet is the same as in Livingston and Dwyer (1986) (0.43% BWD and 56.1% pollock by weight in the diet).

4/ Assuming daily ration for this group is 0.4% BWD.

ecosystem processes is not advanced enough to determine what would be the impact on the Bering Sea ecosystem of releasing prey biomass.

Bycatch

Potential increases in harvests outlined in Table 4.4 indicate that most will involve fisheries for Pacific cod and other flatfish. These predominantly bottom-trawl fisheries encounter substantial bycatch of benthic species such as crab and halibut, but are unlikely to substantially affect bycatch of more pelagic species such as salmon and herring.

Under present and anticipated bycatch regulations, this alternative and it's options would not change bycatch amounts taken in the fishery. The reason is that bycatch limits are firmly set by tonnage or numbers for each prohibited species, regardless of the level of groundfish fishing. On the other hand, bycatch regulations for prohibited species are expected to change in time through the plan amendment process. Presumably, such amendments will meet the conservation criteria for the bycatch species. Therefore, no additional adverse impact can be identified to result from implementing this alternative or it's options.

Marine Debris

When the sum of ABCs fall below 2.0 million t, this alternative would result in lower levels of fishing than at status quo when OY can be set at 2.0 million t. Under this condition, fishing and trawling activities are expected to be lower than at status quo. Therefore, less marine debris may result.

When the sum of ABCs exceed 2.0 million t, however, OY may be set higher than at status quo and fishing activities would increase. As such, additional marine debris could result. This may or may not happen depending on conscious actions of fishermen. Most debris are expected to result from irresponsible dumping. In recent years, there have been public campaigns and educational programs to raise the level of conciousness about damaging effects of dumping at sea. This should result in lower incidence of dumping. Moreover, Public Law 100-220, Title IV will prohibit discharge of all plastics beginning December 30, 1988.

During fishing operations in the eastern Bering Sea, few nets are actually lost or severely ripped because most of the fishing grounds are not rocky. There may be some trouble spots that fishermen quickly learn to avoid. In the Aleutian region, the bottom is rocky and bottom trawling requires more finesse. At present, trawling activities are not intensive in the Aleutians. However, rockfishes are valuable species in the region and more trawling activities are anticipated in the future. As such more nets could be snagged resulting in portions of trawl webbing lost at sea. These would be unavoidable loss which the fishermen would take special efforts to prevent. The impact of such lost webbing is difficult to evaluate. However, full compliance with legislation prohibiting discharge of plastics and other debris should greatly reduce the input of net fragments and line into the Bering Sea/Aleutian Islands area.

Seabirds

As discussed in Chapter 4 (Table 4.4), increasing the upper limit of OY to the sum of ABCs would result in only minor potential increases in the harvest of pollock. Given that current harvests of well over 1 million mt per year do not discernibly affect seabirds in the Bering Sea/Aleutian Islands, there is no expected impact to seabirds of a possible 88,000 mt increase (30,000 in the Bering Sea, 58,000 in the Aleutian Islands). Options 2 and 3 of this alternative would prevent even these modest increases in pollock harvests and therefore would likely not affect seabirds.

As outlined in Table 5.2, increased harvest of larger fish may actually increase food available to competitors feeding on younger fish. An estimated 300,000 mt of young pollock (ages 0-3) could be released to the ecosystem by increased harvests of groundfish; compared to current estimates of pollock consumption by seabirds (Table 5.1), this could provide a substantial increase in prey for these animals.

Analyses of the roles of environment and commercial fisheries in recent declines of seabirds in the Bering Sea have been inconclusive. In one study, environmental factors indicated that murre populations should have increased, but they did not; Murphy et al. (1986) cited declines in pollock stocks since the 1970s as a possible cause for this failure. Another study, however, suggested that breeding failures have been caused by environmental control of prey distribution rather than abudance (Lloyd, 1985). It is not currently possible to distinguish the effects of the environment on seabird populations from those, if any, possibly resulting from commercial fishing activities.

Marine Mammals

As discussed in Chapter 4 (Table 4.4), increasing the upper limit of OY to the sum of ABCs would result in only minor potential increases in the harvest of pollock. Given that current harvests of well over 1 million mt per year do not discernibly affect marine mammals in the Bering Sea/Aleutian Islands, there is no expected impact to marine mammals of a possible 88,000mt increase (30,000 in the Bering Sea, 58,000 in the Aleutian Islands). Options 2 and 3 of this alternative would prevent even these modest increases in pollock harvests and therefore would not affect marine mammals.

As outlined in Table 5.2, increased harvest of larger fish may actually increase food available to competitors feeding on younger fish. An estimated 300,000 mt of young pollock (ages 0-3) could be released to the ecosystem by increased harvests of groundfish; compared to current estimates of pollock consumption by marine mammals (Table 5.1), this could provide a substantial increase in prey for these animals.

5.1.3 Alternative 3 -- Groundfish Complex MSY.

This alternative would limit OY to MSY which could be re-evaluated from time to time as more information becomes available on the stocks. At present, the sum of individual species MSYs total 3.4 million t, thus becoming the limit. Three options to this alternative have been suggested:

(a) the alternative as stated
(b) set upper end of OY to 85% of complex MSY
(c) limit any annual increase of OY to 5% of the upper end of the range in the previous year.

The environmental impact to each of these options are not too different to the main proposal in the sense that Options B and C imposes more conservatism onto each year's setting of OY. The additional degree of conservation on the stocks is difficult to quantify and may or may not be better to reduce the environmental impact of the action.

Groundfish Stocks

Under this alternative, OY can be set as high as 3.4 million t or it's option would allow a gradual increase above status quo when the OY is 2.0 million t. In past practices, the Council has set TACs close to ABCs. If this practice continues, then TACs would be set consistent to the relative status of the stocks. As such, negative impacts to groundfish stocks cannot be identified under this alternative and it's options.

If the practise of setting TACs close to ABCs is not followed, then some groundfish stocks may be harvested in disproportionate intensities, possibly forcing abundance and dynamics of stocks against natural trends. It will still be difficult to evaluate whether these practises would be detrimental to the stocks on a long term basis. In any case, the status of the stocks are evaluated each year, reported in resource assessment documents, and any adverse impacts of harvesting strategies would be pointed out to the Council for corrective actions. As such, there may be no additional negative impact associated with implementation of this alternative or it's options over status quo.

Predator-prey Interactions

The same rationale of disproportionate harvesting against natural trends discussed in the paragraph above applies for predator-prey interactions. Because corrective actions can always be taken from year to year, there may be no additional negative impact with implementation of this alternative or it's options over status quo.

Bycatch

Under present bycatch regulations, this alternative and it's options would not change bycatch amounts taken in the fishery. The reason is that bycatch limits are firmly set by tonnage or numbers for each prohibited species, regardless of the level of groundfish fishing. On the other hand, bycatch regulations for prohibited species are expected to change in time through the plan amendment process. Presumably, such amendments would not get approved unless they meet the conservation criteria for the bycatch species. Therefore, no additional adverse impact can be identified to result from implementing this alternative or it's options.

Marine Debris

Under this alternative and it's options, OY would likely be set higher than at status quo and fishing activities would increase. As such, additional marine debris could result. This may or may not happen depending on the concious actions of fishermen. Most debris are expected to result from irresponsible dumping. In recent years, there has been public campaigns and educational programs to raise the level of conciousness about damaging effects of dumping at sea. This should result in lower incidence of dumping. Moreover, Public Law 100-220, Title IV, prohibits the discharge of all plastics biginning December 30, 1988.

During fishing operations in the eastern Bering Sea, few nets are actually lost or severely ripped because most of the fishing grounds are not rocky. There may be some trouble spots that fishermen quickly learn to avoid. In the Aleutian region, the bottom are rocky and bottom trawling requires more finesse. At present, trawling activities are not intensive in the Aleutians. However, rockfishes are valuable species in the region and more trawling activities are anticipated in the future. As such more nets could be snagged resulting in portions of trawl webbing lost at sea. These would be unavoidable loss which the fishermen would take special efforts to prevent. The impact of such lost webbing is difficult to evaluate. Full compliance with recently enacted legislation should greatly reduce the input of net fragment and line into the Bering Sea/Aleutian Islands area.

Seabirds

As discussed in Chapter 4 (Table 4.4), increasing the upper limit of OY to the groundfish complex MSY would result in only minor potential increases in the harvest of pollock. Given that current harvests of well over 1 million mt per year do not discernibly affect seabirds in the Bering Sea/Aleutian Islands, there is no expected impact to seabirds of a possible 88,000 mt increase (30,000 in the Bering Sea, 58,000 in the Aleutian Islands). Options B and C of this alternative would prevent even these modest increases in pollock harvests and therefore would likely not affect seabirds.

As outlined in Table 5.2, increased harvest of larger fish may actually increase food available to competitors feeding on younger fish. An estimated 300,000 mt of young pollock (ages 0-3) could be released to the ecosystem by increased harvests of groundfish; compared to current estimates of pollock consumption by seabirds (Table 5.1), this could provide a substantial increase in prey for these animals. It is not possible, however, to reasonably predict recovery or further decline of seabird populations in the Bering Sea due to as yet unknown interactions of the environment and the distribution of prey or other factors.

Marine Mammals

As discussed in Chapter 4 (Table 4.4), increasing the upper limit of OY to the groundfish complex MSY would result in only minor potential increases in the harvest of pollock. Given that current harvests of well over 1 million mt per year do not discernibly affect marine mammals in the Bering Sea/Aleutian Islands, there is no expected impact to marine mammals of a possible 88,000mt increase (30,000 in the Bering Sea, 58,000 in the Aleutian Islands). Options B and C of this alternative would prevent even these modest increases in pollock harvests and therefore would not affect marine mammals.

As outlined in Table 5.2, increased harvest of larger fish may actually increase food available to competitors feeding on younger fish. An estimated 300,000 mt of young pollock (ages 0-3) could be released to the ecosystem by increased harvests of groundfish; compared to current estimates of pollock consumption by marine mammals (Table 5.1), this could provide a substantial increase in prey for these animals.

5.2 Socioeconomic Impacts

In the sections to follow, specific impacts are hypothesized by relying on the ABC/TAC projection scenarios presented in Chapter 1 and Chapter 4. As argued in the introduction of those scenarios, the numbers presented are the best current estimate of future trends in allowable harvest. It is then assumed that TACs are set equal to those ABCs. Clearly this overstates the total potential harvest as TACs are often set at a level less than ABC. Moreover, it is often the case that actual harvest falls short of the TAC (Table 3.5).

Second, these point estimates of future harvest levels should be viewed as a comprehensive example and not a concrete statement of actual harvest levels for the next three years. Harvests in 1989 and 1990 may well differ from these projections for, at least, two reasons. ABCs and hence, TACs, are annually determined based on current survey information and on interpretation of that information. This means that a one year projection for an ABC may well differ from a two year projection made one year earlier. There are also many other factors that are considered when establishing a species' TAC, such as the implied bycatch from that harvest, interaction of the harvest of that species with the harvest of other groundfish fisheries, the current market situation for the species, the level of risk associated with the projections of biomass, ABC, and so forth. This list of determinants is of overriding importance in establishing any year's TAC. The upper limit on OY, whether it be 2.0 million mt or 2.6 million mt, provides only a framework under which a specific TAC is determined.

Given this, it is important to note that the subsequent quantitative analysis is used to view some probable consequences of OY limits other than the current 2.0 million mt, but that the significance of an increase in the upper limit of the OY is one of process rather than amount. Raising the upper limit, above all, increases management flexibility. Council decisions on allowable harvest will depend on the particular biological, economic, and social circumstances relevant at the time of consideration.

5.2.1 Alternative 1 - Status quo

Continuation of the status quo would imply that, in 1989 and 1990, the fishery could be controlled by a set of DAP and JVP allocations as illustrated in Table 4.2. Recall that these estimates are based on projected gains in DAP capacity, current and expected JVP requests, and an assumption that the basic nature of the fishery remains unchanged from 1988. This means that species that are currently under-utilized remain under-utilized and that no major technological change in fishery harvesting or production practice is anticipated. We also assume no major disruption of markets for these groundfish, although we do attempt to discuss, in a general way, possible changes in supply and any resultant price effects.

Assuming that the current upper limit of 2.0 mmt on OY constrains the fishery from increasing total harvest, the consequences of continuing that constraint can be examined. Note that the interpretation of the processor preference amendment implies that the growth of DAP will not be constrained, at least up to the current OY limit of 2.0 mmt. Given the status quo, the projected scenarios, and the growth in DAP, it also follows that under this alternative there will be no future allocation to TALFF. The upper limit of 2.0 mmt will therefore constrain joint venture harvest with a projected allocation of 798,000 mt in 1989 and 417,000 mt in 1990 (Table 4.2).

This contraction in future joint venture harvest is not unexpected, and is, in fact, a result of the interpretation of DAP priority to allocation, not the overall harvest level. What is relevant for distinguishing among alternatives, however, is the rate of that contraction. For Alternative 1 the issue is how long might we expect joint ventures to receive allocations given continuation of the status quo. To project beyond 1990 it is necessary to project DAP into that period. There are two ways to proceed. The first is to rely on knowledgeable estimates from those in industry investing in increased DAP capacity. That, as explained in Chapter 4, has been the method of obtaining projections into 1989 and 1990.

Beyond those years statistical projections were used, relying on current expansion trends to estimate DAP capacity.

Two projection possibilities were examined: linear and exponential. The latter approach provides the better statistical fit to the data series and predicts DAP estimates for 1991 and beyond well in excess of 2.0 mmt (2.2 mmt - 1991; 2.8 mmt - 1992; 3.4 mmt - 1993). These estimates are less probable than those resulting from linear projection in that they rely on the assumption that current exponential growth will continue unabated over the next five years. The second approach, linear projection, provides the following estimate of future DAP: 2.0 mmt - 1991; 2.5 mmt - 1992; 2.9 mmt-1993. It is clear, in either case, should the 2.0 mmt upper limit on OY remain in effect, the total DAP request will exceed the available allocation of 2.0 mmt by 1991. Thus, under these projections, joint ventures will be phased out in 1991.

The cost of this phase out, relative to removing the current upper limit on OY, in terms of foregone ex-vessel revenue to the domestic fishermen who participate in joint ventures, is examined as part of the analysis under Alternative 2. The rate of the contraction of joint venture harvests off Alaska is important in more subtle ways than simple gross harvesting revenue. Continuation of the status quo will, for the alternatives under consideration, lead to the most rapid joint venture phase out, and thus, the most beneficial position for DAP in securing markets being vacated by foreign processors. It is also likely that an expected rapid phase out of joint venture may further stimulate investment in domestic processing, and may strengthen prices paid in foreign markets due to supply contractions.

At the same time adverse impacts are possible. A too rapid contraction in joint venture may bankrupt those U.S. companies owning catcher vessels should they not have the opportunity to secure contracts with U.S. processors. Also, foreign processors, contemplating a sharp reduction in U.S. supply, may go elsewhere in the world market to buy fish which, in turn, may lead to decreased demand for U.S. product. This last scenario is, of course, completely dependent on the worldwide supply situation for the various species. Lastly, the foreign nations may restrict imports, raise import duties, or erect other trade barriers to the import of U.S. product.

It is not known which, if any, of these impacts is probable or, should they all occur, whether the positive impacts outweigh the negative impacts. This is because little is known of the probability of any of these suggested scenarios. Moreover, it is simply not possible, given uncertainties in future foreign exchange rates, U.S. trade policy, and the general performance of the U.S. economy, to determine future market behavior and quantitative responses to changes in those markets both in the free trade sense and in terms of U.S. government policy.

This analysis illustrates that the difference among the various scenarios of joint venture phase out derive from the quantitative difference in response to a three year, four year, or five year phase out. Knowing the likely period of this phase out may be more important than the length of the phase out period, per se, as much of the current uncertainty will be removed. It follows that all economic agents may plan and account for these changes over a more certain time horizon, and that knowing, in 1988, what that horizon might be, better allows them to plan for 1991, 1992, and beyond. This knowledge may mitigate most of the adverse effects listed above.

5.2.2 Alternative 2 - Sum of the ABCs

Incidental Catch of Non-Groundfish Species

Independent of the current proposal to increase the upper limit of the OY is a proposal to consider replacement of the bycatch control provisions of Amendment 10 for red king crab, C. bairdi Tanner crab, and halibut, with a set of frameworked PSC limit controls. Analysis of the proposed alternatives is part of the current amendment analysis but not a part of this SEIS, and is contained in Chapter 2 of the EA/RIR/IRFA for Amendment 12. The analysis in that chapter explicitly considers the impact on bycatch of an upper limit on OY equal to the sum of the ABCs.

For the purposes of analysis in this chapter, the essential characteristic of the bycatch proposal analysis is that the adoption of either alternative to the status quo would establish limits on allowable incidental catch and that those limits do not depend on the level of the upper end of the OY range and thus, the bycatch controls would take precedence in limiting any additional bycatch which would occur under expanded harvest levels.

Revenue Impacts

Projections for TAC, DAP, JVP, and TALFF for 1989 and 1990 have been presented in Table 4.7 and the differences between those projections and those of Alternative 1 are contained in Table 4.8.

For 1989, that analysis indicates a potential increase in DAP for sablefish of 2,800 mt (relative to the status quo) and an increase in DAP for P.O.P. of 11,600 mt. At the ex-vessel level, using 1987 prices, this catch would bring in $8.5 million in additional revenue to the wholly domestic fleet (Table 5.3). Processing by U.S. processors, any secondary processing, and the wholesale/retail transaction would add further value to the product.[6]

[6] Clearly, a ton of U.S. processed product is worth more than a ton of foreign processed product to the U.S. economy because of the increased value, income and employment that results. We do not quantify that differential in the current analysis, however, as under Alternative 2 (and Alternative 3) there is no

In 1990, these revenue gains would not be quite as great due to a decline in projected Bering Sea sablefish DAP which more than offsets the value gained from an incremental allocation of 200 mt of P.O.P. in the Aleutian Islands management area. In total, revenue is projected to be $8.2 million greater than under the status quo and about $200 thousand less than in 1989.

For joint ventures the revenue increase would be about $28 million in 1989 and $50 million in 1990, assuming allocations are as indicated in Tables 4.2 and 4.3 and that 1987 prices hold into 1989 and 1990 (Table 5.3). Most of the revenue gain to joint ventures is attributable to cod, implying that the accuracy of these projections is quite sensitive to the future price of cod.

Under Alternative 2, there is also the potential of allocation to TALFF. Since fish harvested by the directed foreign fishery generate no revenue to the U.S. economy, revenues are not included in Table 5.3. However, the foreign fleet is required to pay a fee to the U.S. government for the privilege of harvesting fish in the EEZ. It is not known what these fees might be in 1989 and 1990 as they are set annually so as to result in recovery of that portion of the U.S. fishery enforcement costs equal to the share the foreign catch is to total harvest in the EEZ. If we assume that 1988 fees might be appropriate proxies for fees in 1989 and 1990, the revenue received by the U.S. government from those fees are estimated to be $43 and $30 million in 1989 and 1990, respectively (Table 5.3).

JVP Phase-out

Using projections of DAP growth presented in the section above, indicates that, under an exponential growth projection, allocations to JVP would be extended one year, relative to the status quo, into 1992. If, instead, the linear expansion path for DAP capacity is used, JVP allocations would end as of 1993.

The kinds of positive and negative impacts that may occur from the phase out of the joint ventures were described above, under the discussion of Alternative 1. These impacts would also occur under Alternative 2, although the extra year or two of existence of the joint venture may lessen transition costs (bankruptcy, market disruption, or market barriers), and may weaken the competitive position of the domestic sector (strengthening of prices, markets, incentives to invest). As above, it is not possible to predict the magnitude of any of these possible impacts.

Potential TALFF

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trade off between DAP and JVP product. Instead, all user groups experience revenue gains, and therefore, a relative evaluation of the benefits of differential allocation is unnecessary.

Table 5.3 Possible increases of ex-vessel revenue from increases in TACs and apportionments for Bering Sea/Aleutian Islands groundfish (mt), without 2.0 million mt limit to OY, 1989.

1989			DAP			JVP			Foreign	
Species/Region		Δ TAC	Δ DAP	Ex-vessel Price ($/lb.)	Δ Revenue ($1,000s)	Δ JVP	Ex-vessel Price ($/lb.)	Δ Revenue ($1,000s)	Potential TALFF	Fees ($1000s)
Pollock	BS	0	0	0.082	$0	0	0.058	$0	0	$0
	AI	58,000	0	0.080	$0	58,000	0.058	$7,418	0	$0
Pacific cod		171,000	0	0.173	$0	50,000	0.117	$12,899	121,000	$17,420
Yellowfin sole		0	0	0.092	$0	0	0.067	$0	0	$0
Greenland turbot		0	0	0.255	$0	0	0.067	$0	0	$0
Arrowtooth flounder		104,500	0	0.371	$0	0	0.067	$0	104,500	$8,683
Other flatfish		181,900	0	0.133	$0	50,000	0.067	$7,387	131,900	$10,960
Sablefish	BS	900	900	0.514	$1,020	0	0.137	$0	0	$0
	AI	1,900	1,900	0.605	$2,535	0	0.137	$0	0	$0
Pacific ocean perch	BS	800	800	0.194	$342	0	0.141	$0	0	$0
	AI	10,800	10,800	0.192	$4,572	0	0.141	$0	0	$0
Other rockfish	BS	0	0	0.226	$0	0	0.147	$0	0	$0
	AI	0	0	0.252	$0	0	0.147	$0	0	$0
Atka mackerel		0	0	0.133	$0	0	0.072	$0	0	$0
Squid		8,000	0	0.134	$0	100	?	?	7,900	$593
Other species		52,000	0	0.114	$0	6,000	?	?	46,000	$4,905
TOTAL		589,800	14,400		$8,469	164,100		$27,704	411,300	$42,562

Source: Domestic Price - PacFIN, 1987 Price, 3/16/88. Joint venture price - 1987 Price, NMFS-AKR. Foreign Fees - 1988 fees, 50 CFR Part 611.

Table 5.3 (cont.) Possible increases of ex-vessel revenue from increases in TACs and apportionments for Bering Sea/Aleutian Islands groundfish (mt), without 2.0 million mt limit to OY, 1990.

1990			DAP			JVP			Foreign	
Species/Region		Δ TAC	Δ DAP	Ex-vessel Price ($/lb.)	Δ Revenue ($1,000s)	Δ JVP	Ex-vessel Price ($/lb.)	Δ Revenue ($1000s)	Potential TALFF	Fees ($1000s)
Pollock	BS	30,000	0	0.082	$0	30,000	0.058	$3,837	0	$0
	AI	58,000	0	0.080	$0	58,000	0.058	$7,418	0	$0
Pacific cod		155,000	0	0.173	$0	105,000	0.117	$27,088	50,000	$7,199
Yellowfin sole		0	0	0.092	$0	0	0.067	$0	0	$0
Greenland turbot		0	0	0.255	$0	0	0.067	$0	0	$0
Arrowtooth flounder		104,500	0	0.371	$0	0	0.067	$0	104,500	$8,683
Other flatfish		181,900	0	0.133	$0	75,000	0.067	$11,080	106,900	$8,882
Sablefish	BS	600	600	0.514	$680	0	0.137	$0	0	$0
	AI	1,900	1,900	0.605	$2,535	0	0.137	$0	0	$0
Pacific ocean perch	BS	800	800	0.194	$342	0	0.141	$0	0	$0
	AI	11,000	11,000	0.192	$4,657	0	0.141	$0	0	$0
Other rockfish	BS	0	0	0.226	$0	0	0.147	$0	0	$0
	AI	0	0	0.252	$0	0	0.147	$0	0	$0
Atka mackerel		4,000	0	0.133	$0	4,000	0.072	$635	0	$0
Squid		8,000	0	0.134	$0	100	?	?	7,900	$593
Other species		54,000	0	0.114	$0	6,000	?	?	48,000	$5,119
TOTAL		609,700	14,300		$8,214	278,100		$50,058	317,300	$30,476

Source: Domestic Price - PacFIN, 1987 Price, 3/16/88. Joint venture price - 1987 Price, NMFS-AKR. Foreign Fees - 1988 fees, 50 CFR Part 611.

Under Alternative 2 there is potential for some 300,000-400,000 mt of TALFF. Should these allocations be made, several points should be considered beyond the already considered fee revenue. Currently, the U.S.S.R. may receive no allocation and Japan's allocation is to be reduced by 50%, due to international conflicts on whaling. It is also possible that Japan's allocation may be reduced to 0% at the beginning of next year, should they, in the opinion of the U.S., not have made efforts to reduce their take of whales.[7]

It follows, therefore, that foreign allocations may only be made to Korea, China and Poland. This means that one of the benefits to the U.S. of direct allocations of cod to Japan--support to Western Alaskans by the Japanese North Pacific Longline Association (NPLA)--may not be forthcoming.

This result is also possible should the upper limit of the OY not be increased (Alternative 1). It is difficult to precisely quantify the benefits from that support but, in the past, NPLA has contributed scientific research, joint venture support, investment capital, technology transfer, and facilitation of trade. For example, over the last several years NPLA has provided a vessel for the joint U.S./Japan cooperative longline survey. If the U.S. were to charter a replacement survey the charter fee would be about $800,000 (Gary Stauffer, pers. comm., 1988), although it is also possible that a charter arrangement whereby a U.S. vessel is allowed to sell its catch might be arranged at no cost to the U.S. government. Under either scenario, personnel and travel costs associated with staffing the cruise may total $60,000-$80,000 (Gary Stauffer, pers. comm., 1988).

Additionally, NPLA has participated in joint ventures in Norton Sound and Togiak which, over a period from 1982 to 1987, generated in excess of $12 million to the local economy, and has provided some $330,000 in secured loans to Atka and Nelson Islands (Paul MacGregor, letter dated February 26, 1988).

DAP Price Effects

An increase in TAC can result in decreased exvessel and processed product prices. Typically the decrease in price will not completely offset the increase in harvest, therefore, gross earnings from a fishery will usually increase when a TAC is increased. However decreases in prices can reduce the gross earnings of some groups of fishermen and processors and in the extreme case eliminate them from a fishery if prices are reduced below the breakeven level. For example, if the increase in a TAC

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[7] The certification of Japan for whaling is currently under negotiation by the U.S. State Department. It is possible that, as a result of those negotiations, the certification may be removed.

results in an increase in JVP harvest but no increase in DAP harvest, gross earnings of the DAH and JVP fisheries would probably increase, but due to the price effect gross earnings in the DAP fishery could decrease.

The extent of this potentially adverse effect on some fishermen and processors will depend on how responsive prices are to changes in TACs. The availability of substitutes, the size of the change in TAC compared to both current TAC and the amount of substitutes available, and the length of time over which the change is made are important factors in determining how responsive prices will be to a change in a TAC. If substitutes are readily available, if the change in TAC is relatively small in comparison to the total supply of a species and its substitutes, or if the change is over a long period of time, the price effect may be negligible.

For groundfish products such as pollock and cod that compete in very large international markets, the price is not expected to be very responsive to changes in TAC. However, it is appropriate that the issue of price responsiveness be more thoroughly researched and be considered annually when TACs are established each year.

Options under Alternative 2

Two options (B and C) which would limit the amount or rate of the increase in the upper limit of the OY range have been suggested. Option B would set the upper limit at 90% of the sum of the ABCs. It follows that under this option the benefits and costs that are quantifiable would be 90% of the amount estimated earlier. In terms of qualitative or non-quantifiable benefits the same informal rule would apply with negative and positive benefits reduced in a roughly proportional way.

Option C would only allow the upper limit of the OY to increase by 5% in any one year. For this option, assuming ABCs and TACs remain constant after 1990, the upper end of the OY would be 2.1 mmt in 1989, 2.2 in 1990, and would reach 2.6 mmt in about six years. Again, to the extent that benefits and costs are realized when the upper limit is raised, the values estimated above would be proportionally reduced.

Option C, which would allow only an annual marginal increase in the sum of the TACs, is, in a qualitative sense, not very different from Alternative 1 (status quo). Thus, the kind of non-estimable impacts discussed under that alternative would also be expected to occur under this option.

5.2.3 Alternative 3 - Groundfish Complex MSY

Given assumptions concerning ABC and the relation to TAC and the projections of those ABCs into 1989 and 1990 there is no expected increase in TAC under Alternative 3 from that expected under Alternative 2. Therefore, the quantitative impacts discussed above for Alternative 2 would also occur under this Alternative.

There are three options suggested for implementing this Alternative which are identical to those proposed for Alternative 2. It follows that, under Alternative 3, the kind of quantitative and qualitative impacts discussed above would also occur.

5.2.4 Impacts on Consumers

All else equal, an increased supply of product in the retail market will lead to a lower price paid by the consumer. However, given the size of the total U.S. retail market for seafood in proportion to the total hypothesized change in harvest levels under Alternative 2 and 3, and the fact that much of market is driven by imported product, any detectable retail price change is unlikely. Moreover, lack of knowledge regarding future demand, price and quantity of substitute product, and U.S. foreign trade relations, prevents any quantitative prediction of future price levels.

5.2.5 Distribution of Benefits and Costs; Cost/Benefit Conclusion

Adoption of Alternative 2 or 3 will increase the potential overall harvest level in Bering Sea/Aleutian Islands groundfish fisheries. To the extent that the potential is realized revenue gains will occur in the DAP and JVP sectors. Moreover, should TALFF be granted, additional fee revenue will be received by the U.S. treasury. Thus, all groups will receive some benefit.

With regard to costs, it has not been possible to quantify the magnitude of losses to the wholly domestic sector due to any possible negative price impacts, or a potential slowing of the rate of Americanization. Given the minor difference among alternatives in the projected life span of joint ventures it is unlikely that quantitative differences among alternatives will be large.

For this same reason, the cost (in the sense of transition and phase out costs) to joint venture harvesters of retaining the current 2.0 mmt cap is not, in the longer run, very different from the cost of a somewhat longer phase out.

5.3 Unavoidable Adverse Impacts

No unavoidable adverse impact has been identified for the groundfish complex and associated bycatch fisheries under any one of the three alternatives and their options.

5.4 Short-term Use vs Long-term Productivity of the Environment

Regardless of the upper limit to the OY range, management of the groundfish fishery has depended directly upon the status of the stocks and resultants estimates of ABC. Each year, the Council determines the status of the stocks, calculates their ABCs and sets TACs accordingly. In addition, the annual and periodic review process at each Council meeting of the fishery and stock situations assures sufficient checks and balances to correct any adverse impacts to the environment. Since this practice, as legislated by the MFCMA, will continue, the welfare of the short-term and long-term productivity of the environment would be maintained.

5.5 Irreversible or Irretrievable Commitment of Resources

There appear to be no irreversible or irretrievable commitment of resources contemplated under any of the alternative actions.

5.6 Mitigation Measures

Each of the alternatives share an important mitigation measure that is already in place -- established Council procedures (see Section 1.5) to annually assess the status of stocks and derive appropriate estimates of acceptable biological catch and total allowable catch based upon relevant biological and socioeconomic concerns. This procedure incorporates substantial opportunity for public comment and scientific review, and is not altered by the amendment proposals described here.

Also, there are existing Council procedures for dealing with bycatch concerns. Marine debris is the subject of international agreements (MARPOL Annex V) and new national legislation (P.L. 100-220, Title IV). Finally, potential impacts to seabirds and marine mammals will be the subject of continued study by responsible agencies and the scientific community.

Given established procedures, and the apparent lack of substantial adverse effects, any likely biological impacts will be adequately mitigated without additional restrictions incorporated into any of the alternative actions.

6.0 CONCLUSIONS

[A summary look at the consequences of the preferred alternative, to be written after such time as the Council makes a decision.]

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8.0 CHANGES TO THE FMP AND REGULATORY LANGUAGE

This portion of Amendment 12 to the Bering Sea/Aleutian Islands groundfish FMP was approved by the Council at its meeting on ____ __ - __, 1988. The amendment makes the following changes to the FMP and appropriate regulations in 50 CFR Parts 611 and 675 regarding the optimum yield (OY) range for the groundfish complex.

8.1 Changes to the FMP Text

The FMP makes several references to optimum yield. This amendment does not change the generic meaning of optimum yield, being the harvest which provides the greatest overall benefit to the nation with particular reference to food production and recreational fisheries, based upon the maximum sustainable yield as modified by relevant economic, social or biological factors. This action does, however, alter various specific aspects of the OY range as defined in the plan.

In Chapter 4, Section 4.3 entitled "Operational Definitions of Terms," page 4-3, the final paragraph under item 1 (d) would be amended to read:

> The OY of the groundfish complex is 1.4 to __ million mt to the extent that this can be harvested consistently with the management measures specified in this FMP.

In Chapter 11, Section 11.2 entitled "Optimum Yield and the Groundfish Complex," pages 11-1 and 11-2, would be amended to read:

> The optimum yield (OY) of the groundfish complex is set equal to __% of the ___ for the target species and the "other species" categories (1.4 to __ million mt) to the extent this can be harvested consistently with the management measures specified in the FMP plus the actual amount of the nonspecified species category that is taken incidentally to the harvest of target species and the "other species" category...

In Chapter 11, Section 11.3 entitled "Total Allowable Catch (TAC)," pages 11-2 and 11-3, would be amended to read:

> The TACs for each target species and for the "other species" category will be determined by the Alaska Regional Director of NMFS by the end of the preceding fishing year. The sum of these TACs, or the TAC for the groundfish complex excluding nonspecified species shall be within the OY range of 1.4 to __ million mt and is subject to the management measures prescribed in this FMP...

8.2 Changes to the Regulations

50 CFR 611 and 675 outline regulations pertaining to groundfish of the Bering Sea/Aleutian Islands.

In 50 CFR 611.93 (a), Item (3) would be amended to read:

(3) The optimum yield for the fishery regulated by this section and by 50 CFR Part 675 is a range of 1.4 to __ million mt for target species and the "other species" category in the management area to the extent this amount can be harvested consistently with this Part and 50 CFR Part 675, plus the amounts of "nonspecified species" taken incidentally to the harvest of target species and the "other species" category. For a definition of the categories of species involved in the fishery, see Table 1 of this section.

In 50 CFR 675.20 (a), Item (1) entitled "Optimum Yield" would be amended to read:

(1) Optimum yield The optimum yield (OY) for the fishery regulated by this section and by 50 CFR 611.93 is a range of 1.4 to __ million mt for target species and the "other species" category in the Bering Sea and Aleutian Islands management area, to the extent this amount can be harvested consistently with this Part and 50 CFR Part 611, plus the amounts of "nonspecified species" taken incidentally to the harvest of target species and the "other species" category. The species categories are defined in Table 1 of this section.

In 50 CFR 675.20 (a), Item (2) entitled "TAC" would be amended in part to read:

(2) TAC The Secretary, after consultation with the North Pacific Fishery Management Council (Council), will specify the total allowable catch (TAC) for each calendar year for each target species and for the "other species" category. The sum of the TACs established must be within the OY range of 1.4 to __ million mt for target species and the "other species" category...

9.0 LIST OF PREPARERS

This SEIS/RIR/IRFA was prepared by the Plan Team for Bering Sea/Aleutian Islands groundfish and staff of the North Pacific Fishery Management Council, as assisted by personnel from the Northwest and Alaska Fisheries Center and National Marine Mammal Laboratory of the National Marine Fisheries Service, and the Minerals Management Service and U.S. Fish and Wildlife Service:

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10.0 LIST OF AGENCIES, ORGANIZATIONS AND PERSONS CONSULTED

Alaska Department of Fish and Game

Alaska Factory Trawlers Association

American High Seas Fisheries Association

Greenpeace

International Pacific Halibut Commission

Minerals Management Service

National Marine Fisheries Service

University of Alaska

U. S. Fish and Wildlife Service

From the Gulf of Alaska FMP

D-4
Prop 3

4.2.1.3 Procedure for setting joint venture and foreign prohibited species catch limits of fully utilized species

The timing of actions and procedure to be taken in establishing prohibited species catch limits (PSCs) of fully utilized species is as follows:

(1) September. Following the initial determination of TACs for all managed groundfish species as described in Section 3.1, the plan team will identify those groundfish species that are fully utilized by the wholly domestic fishery. For those species, initial PSC limits will be calculated for joint venture and foreign fisheries using the best available bycatch rates obtained by NMFS observers from the respective fisheries and applying it to initial joint venture (JVP) and foreign (TALFF) TAC apportionments. Each PSC may be apportioned among the regulatory areas and districts of the Gulf of Alaska.

(2) September Council meeting. Council will review and approve preliminary PSCs and release the RAD for 30-day public review.

(3) October 1. As soon as practicable after October 1 the Secretary, after consultation with the Council, will publish a rule-related notice in the Federal Register specifying the proposed PSCs for JVP and TALFF. Public comments on the proposed PSCs will be accepted by the Secretary for 30 days after the notice is published.

(4) November. Plan Team prepares final RAD.

(5) December Council meeting. Council reviews public comments, takes public testimony and makes final decisions on annual PSC limits.

(6) By January 1 the Secretary will publish a notice of final PSC limits in the Federal Register.

(7) January 1. Annual PSC Limits take effect for the current fishing year.

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each target species and the "other species" category, and will apportion the TACs among DAP, JVP, reserves, and total allowable level of foreign fishing (TALFF).

(i) The sum of the TACs specified must be within the OY range of 116,000 to 800,000 mt for target species and the "other species" category. Initial reserves are established for pollock, Pacific cod, flounder, and "other species", which are equal to twenty percent of the TACs for these species or species groups.

(A) Assessments of the biological condition of each target species and the "other species" category. Assessments will include, where practicable, updated estimates of maximum sustainable yield (MSY), and acceptable biological catch (ABC); historical catch trends and current catch statistics; assessments of alternative harvesting strategies and related effects on component species and species groups; relevant information relating to changes in groundfish markets; and recommendations for TAC by species or species group.

(B) Socioeconomic considerations that are consistent with the goals and objectives of the fishery management plan for groundfish in the Gulf of Alaska area.

(b) Prohibited species catch limits. (1) When the Secretary determines after consultation with the Council that the TAC for any species or species group will be fully harvested in the DAP fishery, the Secretary may specify for each calendar year the prohibited species catch (PSC) limit applicable to the JVP and TALFF fisheries for that species or species group. Any PSC limit specified under this paragraph shall be provided as bycatch only, and may not exceed an amount determined to be that amount necessary to harvest target species. Species for which a PSC limit has been specified under this paragraph shall be treated in the same manner as prohibited species under paragraph (e) of this section.

(2) The annual determinations of the PSC limit for each species or species group under paragraph (b)(1) of this section may be adjusted, based upon a review of the following:

(i) Assessments of the biological condition of each PSC species. Assessments will include where practicable updated estimates of maximum sustainable yield (MSY), and acceptable biological catch (ABC); estimates of groundfish species mortality from nongroundfish fisheries, subsistence fisheries, recreational fisheries, and the difference between groundfish mortality and catch. Assessments may include information on historical catch trends and current catch statistics; assessments of alternative harvesting strategies and related effects on component species and species groups; relevant information relating to changes in groundfish markets; and recommendations for PSC limits for species or species group fully utilized by the DAP fisheries:

(ii) Socioeconomic considerations that are consistent with the goals and objectives of the FMP.

(c) Notices.

(1) Notices of harvest limits and PSC limits. As soon as practicable after October 1 of each year, the Secretary, after consultation with the Council, will publish a notice in the FEDERAL REGISTER specifying preliminary annual TAC, DAP, JVP, TALFF, reserves, and applicable PSC amounts for each target species, "other species" category, and species determined to be fully utilized by the DAP fisheries. The preliminary specifications of DAP will be the amounts harvested during the previous year plus any additional amounts the Secretary finds will be harvested by the U.S. fishing industry for delivery to U.S. processors. The preliminary specifications of JVP will be the amounts harvested during the previous year plus any additional amounts the Secretary finds will be harvested by the U.S. fishing industry for delivery to foreign processors, subject to reductions to accommodate increasing DAP. These additional amounts will reflect as accurately as possible the projected increases in U.S. processing and harvesting capacity and the extent to which U.S. processing and harvesting will occur during the coming year. Public comment on these amounts will be accepted by the Secretary for 30 days after the notice is filed for public inspection with the Office of the Federal Register. The Secretary will consider timely comments and, after consultation with the Council, specify the final PSC limits and annual TAC for each target species and the "other species" category and apportionments thereof among DAP, JVP, TALFF, and reserves. These final amounts will be published as a notice in the FEDERAL REGISTER on or about January 1 of each year. These amounts will replace the corresponding amounts for the previous year.

(2) Notices of closure. (i) If the Regional Director determines that the TAC for any target species or of the "other species" category in any regulatory area or district in Table 1 has been or will be reached, the Secretary will publish a notice in the Federal Register prohibiting directed fishing for that species, as defined at §672.2, in all or part of that area or

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district, and declaring such species in all or part of that area or district a prohibited species for purposes of paragraph (e) of this section. During the time that such notice is in effect, the operator of every vessel regulated by this Part or Part 611 must minimize the catch of that species in the area or district, or portion thereof, to which the notice applies.

(ii) If, in making a determination under paragraph (c)(2)(i) of this section, the Regional Director also determines that directed fishing for other groundfish species in the area or district, or portion thereof, to which the notice applies may lead to overfishing of the species for which the TAC has been or will be achieved, the Secretary will, by notice in the Federal Register, also prohibit or limit such directed fishing for other groundfish species in a manner, including time, area, or gear adjustments, that will prevent overfishing of the species for which the TAC has been or will be taken.

(iii) When making closures or imposing limitations under paragraphs (c)(2) (i) and (ii) of this section, the Regional Director will take into account the following considerations and may allow continued fishing with certain gear types, issuing findings relevant to these considerations:

(A) The risk of biological harm to a groundfish species for which the TAC has been reached;

(B) The risk of socioeconomic harm to authorized users of the groundfish for which the TAC has been reached; and

(C) The impact that a continued closure might have on the socioeconomic well-being of other domestic fisheries.

(iv) If the Regional Director determines that a PSC limit applicable to a directed JVP or TALFF fishery in any regulatory area or district in Table 1 has been or will be reached, the Secretary will publish a notice of closure in the Federal Register closing all further JVP or TALFF fishing in all or part of the regulatory area or district concerned.

(d) Apportionment of reserves, initial DAH, and adjustment of PSC limits -- (1) Apportionment of reserves. (i) In accordance with paragraph (d)(5) of this section and as soon as practicable after April 1, June 1, and August 1, and on such other dates as he determines necessary, the Secretary, after consultation with the Council, may reapportion to TALFF, part or all of the reserves specified in Table 1.

(ii) As soon as practicable after April 1, June 1, and August 1, and on such other dates as he determines necessary, the Secretary may apportion to DAH, in accordance with paragraph (d)(3) of this section, any amounts of any reserve that he determines to be needed to supplement DAH.

(2) Apportionment of surplus DAP to JVP and surplus DAH to TALFF. In accordance with paragraph (d)(5) of this section and as soon as practicable after April 1, June 1, and August 1, and on such other dates as he determines necessary, the Secretary will apportion to JVP any part of the DAP amounts that he determines will not be processed by U.S. processors, and may apportion to TALFF any part of the DAH amounts that he determines will not be harvested by U.S. fishermen during the remainder of the year.

(3) Allocation of increases or decreases in DAH among DAP and JVP. The Secretary may allocate any increases or decreases in DAH amounts resulting from apportionments under paragraphs (d)(1)(ii) and (d)(2) of this section among the DAP and JVP components of DAH.

(4) Adjustment of PSC limits resulting from apportionments. If the Secretary makes inseason apportionments of target species, the Secretary may proportionately increase any PSC limit amount of species fully utilized by the DAP fishery if such increase will not result in overfishing of that species. Any adjusted PSC limit may not exceed the amount determined to be necessary to harvest a target species.

(5) Standards and procedure for apportionment. -- (i) General. The Secretary, under paragraphs (d)(1) and (d)(2) of this section, may apportion to TALFF only those amounts that he determines will not be harvested by vessels of the United States during the remainder of the fishing year, and shall apportion to JVP only those amounts he determines will be harvested by vessels of the United States during the remainder of the fishing year but will not be processed by United States processors. The amount of reserve that the Regional Director determines will be harvested by vessels of the United States may, at the discretion of the Secretary, either be apportioned to DAP or JVP, or retained in the reserves as eligible for later apportionment under paragraph (d) of this section.

(ii) Factors. In determining whether or not amounts proposed to be apportioned under paragraphs (d)(1) and (d)(2) of this section will be harvested by vessels of the United States during the remainder of the fishing year, the Regional Director will

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June 15, 1988

Prepared on behalf of
Alaska Factory Trawler Association
Pacific Seafood Processors Association

June 15, 1988

Dear Council Members:

The Pacific Seafood Processors Association and the Alaska Factory Trawler Association have prepared the attached "Industry Drafted Augmentation of the Draft Supplemental Environmental Impact Statement" for the Bering Sea Optimum Yield Amendment being considered by the Council as part of the Bering Sea Amendment 12 package. We went to this extra effort out of a sense of frustration with the draft document which seems to be, if you will forgive our bluntness, a perfunctory exercise in compliance, rather than a vigorous and inquisitive analysis which is so important to get all of the facts out on the table for decision makers. The DSEIS equates to an elementary primer on the resources of the Bering Sea, but in no way reflects the reality of the fishing business which is being regulated by the Council.

Adequate presentation of the impacts of your actions is so important in this Council process where you, the Council members, are part time regulators. The Council must have staff analyses which present the situation like it is for important decisions such as this one. The Council is not getting it. We feel that the present analysis in the DSEIS amounts to a justification document. It requires the strict scrutiny by the Council and NMFS if it is to be utilized as a decision document. We feel that the information provided in our effort calls to your attention the impacts of the decision in a far better way than the staff document. We wish we could have done a better job ourselves, but as you may realize we have had only 20 calender days or so to respond.

Sincerely,

Barry D. Collier
President
Pacific Seafood Processors
Association

Edward D. Evans
Executive Director
Alaska Factory
Trawler Association

The greatness of nations is founded on abundant natural resources. The endurance of great nations depends upon how wisely they manage those resources. Nonrenewable resources--ores, metals, fossil fuels, and uranium--are finite, consumable, and will be depleted over time, even with the most erudite management; however, the renewable natural resources-forest, fisheries, and agriculture-can be managed in perpetuity within the limits of skill, knowledge, and self-restraint of the user.

Senator Warren G. Magnuson

Executive Summary

I. Management Philosophy.

The goals and objectives of fishery management should be the starting point for analysis of any significant change in management strategy for fishery resources. The language of the MFCMA and the legislative history clearly show the strong Congressional bias towards a stable, long-term conservation-oriented management of the resources and development of the domestic seafood industry. The Act was not intended to encourage a management strategy that would promote harvesting of every available fish. Furthermore, the optimum yield must be established with regard to the greatest benefit to the Nation. For that purpose, the optimum yield determinations should be calculated to promote the maximum jobs for United States citizens and encourage other contributions to the U.S. domestic economy, such as export of high-valued fishery products.

The current upper limit of optimum yield of 2.0 million mt was established by amendment number one to the BS/AI Groundfish FMP. The Council chose to manage the total groundfish complex in the BS/AI rather than by single species. The Plan Team noted that harvest levels set by the single-species management are of little value because they ignore species inter-relationships. With total groundfish production close to 2 million mt, the Plan Team also noticed evidence indicating population stress. The current plan amendment proposes to establish harvest levels on a single species basis (the sum of the species' ABC). Further, the optimum yield for the sum of the ABCs will likely be beyond 2.0 million mt, the point at which stress in the stocks are observed.

The goals and objectives of the Council when establishing the 2.0 million mt optimum yield safeguard were, in summary, (1) to create a multi-species management regime to account for various species inter-relationships within the ecosystem, (2) to provide an overall groundfish harvest level which will avoid population stress observed in a number of species at harvest levels above 2.0 million mt, (3) provide high catch per unit effort and larger average fish sizes to assist the development of the domestic industry, and (4) to reduce the risk associated with relying upon incomplete data and questionable assumptions in assessment models used to determine conditions of stocks.

The DSEIS for the proposal to increase the optimum yield range reports that the reason for the increase is simply to provide greater flexibility to utilize the groundfish resource consistent with the biological condition of the stocks. A need for this flexibility is indicated because the 2.0 million mt safeguard "has constrained the Council in recent years from setting the total sum of the TACs at a level that would allow for full utilization of surplus production." The major objective of the proposal to increase optimum yield beyond 2.0 million mt level, however, is to slow the pace of the reduction in joint venture harvesting and processing.

Under the statutory language of the MFCMA, optimum yield must be established "on the basis of the maximum sustainable yield from such fishery, as modified by any relevant economic, social or ecological factor." The current proposal merely establishes optimum yield on the basis of ABCs, which are not intended to include relevant economic, social, or ecological factors as required by the Magnuson Act. The current proposal to establish the upper end optimum yield limit equal to the sum of the annual estimates of ABC is in violation of the statutory requirement for establishment of optimum yields.

The DSEIS also fails to recognize the impact the proposed amendment would have on other management measures currently in place or in the planning stages. The bycatch control measures and effort rationalization plans that are currently under consideration would be particularly impacted.

The bycatch needs of the trawl and longline fisheries would increase with an increase in quota. Under all of the proposed bycatch management alternatives, total bycatch would be allowed to increase above the low levels currently experienced. Under all alternatives other than the status quo (no bycatch controls), the cost to the fishermen of attempting to stay under the bycatch limits would increase. The DSEIS fails to adequately analyze these impacts.

II. **Frameworking Optimum Yields Under the MFCMA.**

The amendment proposal to set the upper limit on optimum yield at the sum of the ABCs is essentially an attempt to framework this decision-making process. A management framework allows for the adjustment of management measures within the scope of the criteria established in the FMP. The adjustments are limited to those anticipated and described in the analysis accompanying the amendment establishing the framework.

This amendment proposal falls short of being an adequate framework. First, the proposal does not provide the decision-maker with adequate instructions and parameters. While the mechanical act of summing the ABCs is clear, there is unfettered discretion in setting the underlying ABCs. Second, the discussions in DSEIS demonstrate the inability to anticipate and describe the situations that are likely to occur under the proposal. Since the possible actions under the framework are limitless, it is impossible to analyze the socio-economic and biological impacts of actions likely to be made pursuant to the amendment.

The amendment would also lessen the procedural safeguards available to the public. The Council would be able to implement major changes in management policy without undergoing the scrutiny provided in the amendment process.

III. Biological Implications of an Increase in the Optimum Yield Range for the Groundfish of the Bering Sea and Aleutians.

The groundfish fishery in the BS/AI is relatively new. History demonstrates that catches in the range of 2.0 million mt were followed by declines in stock conditions. BS/AI stocks have responded to reduced catch limits and have been well-behaved under harvests in the range 1.5 - 2.0 million mt.

The optimum yield range sets the latitude for the Council's management decisions. The validity of the ABCs is germane to any decision to increase optimum yield because (1) the proposal is for change in the way the ABCs are utilized in management and because (2) there is an increased risk of overharvest.

Two concepts form the basis for calculating optimum yield: (1) single-species analysis to determine the individual ABCs and (2) species interaction to provide for ecosystem effects - "the whole is less than the sum of the parts." These concepts were one of the bases for the two-tiered management method of the current BS/AI FMP.

The Alternatives eliminate the two-tiered management system and replace it with the older concept of single species analysis. This is a fundamental change in the way ABCs are used in management. The rationale for this change is not included in the DSEIS.

There is no single "correct" ABC calculation - that is, an ABC depends upon the objectives selected. The specific objectives for each species calculation are often unstated and subsequently become implicit in the underlying assumptions of the method used. Criteria other than growth or recruitment overfishing can be used to specify or delimit ABCs - for example, stability of the stock, CPUE, size of fish or roe condition.

Information used to set ABCs is uncertain. These uncertainties arise from a number of sources, for example: (1) uncertainty arising from the mathematical properties and assumptions of the model used, (2) uncertainties arising from the adequacy of the data, (3) uncertainties in the accuracy of the data, and (4) uncertainties arising from statistical variation.

In addition, biological characteristics of groundfish populations have important implications in the setting of optimum yield and ABCs and are reflected in the uncertainty of the estimates of the ABCs and optimum yield. Important biological characteristics include: (1) homeostasis (stability), (2) variations in recruitment, (3) life history continuum - time, and (4) ecological interactions.

Another major uncertainty in calculations of optimum yield/ABC for pollock in the BS/AI management area is the relationship of the BS/AI stocks to the harvest of pollock in the international waters of the Bering Sea (the "doughnut hole" issue). In the opinion of the Northwest and Alaska Fisheries Center, the catches in the doughnut result from stocks of the BS/AI area. If this is the case, the exploitation rates for this stock in the last two years would have nearly doubled the recommended rate. And, if the assumption of current full utilization for BS/AI pollock are correct, then serious overfishing may already be occurring.

Over the past 10 years pollock have provided 72 to 83% of the total harvest from the BS/AI area. Consequently uncertainty in this one component of the resource base could have serious impact for other species of the groundfish complex.

IV. Economic Analysis.

The DAP segment of the North Pacific fisheries has been growing rapidly over the past three years. Continued growth in both at-sea and on shore processing is expected. By 1990 approximately 60 vessels will be catching and processing or processing at-sea. Investment in catcher processors, processors and on shore processing facilities at that time will be close to $900 million.

This industry provides significant employment opportunities. Current direct employment is estimated at close to 4000 jobs, including crews on catcher processors and processors, staff onshore providing administrative support for at-sea processing, and on shore processing jobs. Approximately 2000 additional jobs will be added by 1990.

Benefits to the domestic economy are substantial. A number of businesses are engaged in supporting the fishing industry. In addition, once the fish has left the harvesting and primary processing operations, significant value-added activities are conducted in the transportation, warehousing, secondary processing, packaging, labeling, distribution, wholesaling, retailing, and food service industries. The combined revenue in these sectors far exceeds those in the harvesting and processing sectors, suggesting the substantial multiplier effect that a vigorous fishing industry provides for the economy.

The employment and economic benefits of an industry that has attained full DAP are substantially greater than those derived from an industry which operates in a JV mode. Domestic revenue, exports, direct employment, investment, and the stimulative effects on the economy of a domestic industry are several orders of magnitude greater.

Any significant increase in the quantity of groundfish removed from the Bering Sea/Aleutian Islands places these benefits to the U.S. economy in serious jeopardy. Such increases may result in U.S. producers losing foreign markets which are meeting their needs with fish entering through allocations to JVP or TALFF. Where markets are not lost, significant price reductions occur. Reprocessing of JV caught fish from the U.S. EEZ in foreign countries for reimport into the U.S. provides low cost competition for U.S. producers and hurts business in the domestic markets.

V. **Conclusion.**

The proposal to increase the upper limit of the optimum yield to the sum of the annual ABCs for groundfish species in the BS/AI region may have serious and adverse impacts upon both the domestic harvesting and processing industry and on the groundfish resource. The amendment has been proposed and advocated by joint venture harvesters whose goal is to continue their method of operation for as long a period as possible. The proposal, however, is dangerous for the conservation of the resource and for development of the domestic industry - two of the primary goals of the Magnuson Act and the Nation's seafood industry. Furthermore, the amendment appears to violate the Magnuson Act's requirement that optimum yield take into consideration socio-economic factors.

I. Management Philosophy.

A. Management Goals and Objectives.

1. Magnuson Act goals and objectives.

a. Conservation of Fishery Resources.

(i) Findings, Purpose and Policies.

(ii) National Standards.

(a). National Standard One: The Prohibition of Overfishing and the Setting of Optimum Yield.

(b). National Standard Two: The Use of Scientific Information.

(c). National Standard Six: Taking into Account and Man-Made Variation

b. Development of the Domestic Seafood Industry.

(i) Optimum Yield.

(ii) Findings, Purpose and Policies.

c. Conclusion.

(2) Goals and Objectives of the BS/AI Optimum Yield.

a. 2.0 million mt Optimum Yield.

b. Goals and Objectives of Current Amendment.

(i) Intended Goals and Objectives.

(a) Flexibility.

(b) Single-Species Management.

(c) Promotion of Joint Ventures.

(ii) Other Consequences.

a. Violation of the Statutory Requirement to Consider Socio-Economic Factors When Calculating Optimum Yield.

B. Bycatch Management.

1. Alternative 1 of the Bycatch Amendment.

2. Alternative 2 of the Bycatch Amendment.

3. Alternative 3 of the Bycatch Amendment.

4. Alternative 4 of the Bycatch Amendment.

5. Conclusion.

II. Frameworking Optimum Yields Under the MFCMA.

A. NMFS Policy and Guidelines on Frameworking.

B. The Current Proposal as a Framework Procedure.

C. Effect of Proposal on Procedural Safeguards.

III. Biological Implications of an Increase in the Optimum Yield Range for Groundfish of the Bering Sea and Aleutian Islands.

A. Bering Sea Resource.

B. Proposal to Increase Optimum Yield Depend Upon the Validity of the ABC's and Change Their Use in Management.

1. Importance of ABC's in the Management Process.

2. Management Objectives Determine the Criteria For Calculating ABC's.

3. Validity of the Optimum Yield depends on the Validity of the Individual Calculations of ABC's or MSY's.

a. Quality of the Models.

b. Quality of the Data.

c. Uncertainties of the Data.

d. Uncertainties in the Statistical Variation.

4. Biological Characteristics of Populations as Related to

I. Management Philosophy.

A. Management of Goals and Objectives. The Amendment 12 proposal to the Bering Sea/Aleutian Islands ("BS/AI") Fishery Management Plan ("FMP"), which would increase the upper end of the optimum yield range beyond the current 2.0 million mt limit will have tremendous impacts upon fishery management. The goals and objectives of fishery management should be the starting point for analysis of any significant change in management strategy for fishery resources. This section will describe the objectives of fishery management as found in Magnuson Fishery Conservation and Management Act [1] (hereinafter "the MFCMA", "the Magnuson Act" or "the Act") and the North Pacific Council's BS/AI FMP.

1. Magnuson Act goals and objectives. In 1987 Congress enacted what has become known as the Magnuson Act. It was in the light of strong dissatisfaction with the status of marine fishery management during the early 1970's that Congress passed the MFCMA, notwithstanding the foreign policy objections of then President Ford and the State Department. Two significant concerns which prompted Congress to pass the MFCMA were the related determinations that foreign fishing was contributing to the depletion of certain fish species in U.S. costal waters[2] (including, from the Northeast Pacific Ocean, Yellowfin sole, Alaska Pollock, Pacific ocean perch, and Pacific halibut[3]), and that foreign fishing was impeding the development of the domestic fishing industry.[4] The Act has been called a radical departure from the legal and philosophical foundations of past United States fishery management.[5] In addition to extending jurisdiction over fishery resources out to 200 miles (as well as throughout the migratory range of anadromous species out to the exclusive economic zones of other nations and all Continental Shelf fishery resources beyond the 200-mile limit), the MFCMA created a management regime over the fishery resources within the newly created 200-mile zone and enunciated management goals and objectives.

The goals and objectives of the Magnuson Act are primarily found in the Findings, Purposes, Policies, Definitions and National Standards provisions of the Act. The legislative history of MFCMA indicated that the primary goals of the Act are cautious conservation of fishery resources and development of the domestic seafood industry. The goals and objectives of the Act, however, are necessarily broad. The Magnuson Act provides that an "optimum" yield is to be calculated for each fishery. Optimum is defined as the level which will provide the greatest overall benefit of the Nation.[6] Other statements in the Act, calling for "development of fisheries which are underutilized,"[7] "promotion of commercial and recreational fishing,"[8] "promotion of efficiency,[9] "to "minimize cost,"[10] and "fair and equitable"[11] allocations among various United States fishermen, are vague and potentially conflicting. To help promote fishing, for example, some commercial fishermen seek larger markets for their catch, whether foreign or domestic. To help industry development of underutilized species, some seafood processors want maximum access to low-cost raw materials without competition from foreign processors. Although the goals and objectives of the Magnuson Act are board, the legislative history of the Act provides greater detail of Congressional intent. These policy considerations also present considerations which fishery managers must legally make when establishing management strategies.

a. Conservation of Fishery Resources. To assure that the present and future benefits of our fishery resources are protected by fishery managers, those charged with the management of our fisheries must understand and act upon the conservation aspects of the MFCMA.

(i) Findings, Purpose and Policies. The Findings of the Act note that as a result of the inadequacy of fishery management practices, certain stocks of fish have been overfished,[12] and a national program for the conservation and management of our fishery resources is necessary to prevent overfishing, to rebuild overfished stocks and to insure conservation.[13] The Purposes section of the Act reiterates that it is the purpose of Congress in enacting the legislation to "take immediate action to conserve and manage" our fishery resources.[14]

(ii) National Standards. The heart of the MFCMA's conservation program is the seven "National Standards for Fishery Conservation and Management" found in Title II of the Act.[15] Three of the seven standards only need to be taken into account by the Council where practicable. These three standards deal with administrative and jurisdictional matters such as promotion of efficiency,[16] minimizing costs and duplication,[17] and managing stocks of fish as a unit without regard to jurisdictional boundary.[18] The remaining four standards, however, cover substantive concerns underlying Congressional intent for management of fishery resources under the Act. The Council must take them into consideration when developing fishery management plans. Standard Number One states that "[c]onservation and management measures shall prevent overfishing."[19] Standard Number Two required that "[c]onservation and management measures shall be based upon the best scientific information available."[20] Standard Number Four dictates that "[c]onservation and management shall not discriminate between residents of different States."[21] Standard Number Six requires that "[c]onservation and management measures shall take into account...variations among...fisheries, fishery resources, and catches."[22]

The first, second, and sixth standards are the most definitive statements of the goals and purposes of federal fisheries management under the Act. Especially when combined with the Findings, Purposes, and Policies section of the Act, these three standards give the MFCMA a strong conservation orientation. The Act's definition of "conservation and management measures" (a phase contained in each National Standard) gives further weight to the Congressional intent to rebuild, protect and conserve our fishery resources. Conservation and management measures are defined as all methods:

> (A) which are required to rebuild, restore or maintain...any fishery resource and the marine environment; and
> (B) which are designed to assure that
> (i) a supply of food and other products may be taken, and that recreational benefits may be obtained, on a continuing basis;
> (ii) irreversible or long-term adverse effects on fishery resources and the marine environment are avoided; and
> (iii) there will be a multiplicity of options available with respect to future uses of these resources.[23]

(a). National Standard One: The Prohibition of Overfishing and the Setting of Optimum Yield. Standard One states that "[c]onservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery,"[24] Because of direct impacts on the profits of various sectors of the seafood industry, what constitutes overfishing is subject to a variety of interpretations. It may be in some fishermen's interest, for example, to harvest the fish now, while they can, and any risk that the harvest levels may constitute overfishing are discounted. The Senate Committee on Commerce Science and Transportation report notes, however, that preventing overfishing "is the basic objective of fishery management, but still deserves clear recognition. **There should be no uncertainty that the basic goal of management is to protect the productivity of fish stocks."[25]**

(b) <u>National Standard Two: The Use of Scientific Information</u>. The second national standard dictates that "[c]onservation and management measures shall be based upon the best scientific information available.[26] This standard requires that fishery managers use the "best" information possible.[27] In setting the optimum yield, the quality of the technical information available to decision makers is critical. Fishery managers are required to use the "best" information available; however, it would appear that they owe a similar duty to recognize limitations in the available information. Other sections of the Act requiring long-term conservation-oriented management indicate that this standard requiring use of the "best" information serves only as a quality control mechanism in preparing management plans.

An example of the necessity to recognize the limitations of scientific data when developing fishery management plans was dramatically demonstrated in the king mackerel fishery of the South Atlantic and Gulf regions. Using what was considered to be the best scientific information available, the Councils and Secretary established harvest levels which overfished the resource. Before this overfishing could be detected, the stocks of king mackerel became seriously depleted. After the collapse of the valuable king mackerel fishery, a committee was formed by the National Oceanic and Atmospheric Administration (NOAA) to investigate the steps leading to the loss. The committee issued a report which recommended methods to help assure that similar overfishing did not occur in the future. The Committee recommended that the Councils, NOAA, and NMFS adopt a **"more conservation-oriented management philosophy."[28]** To accomplish this important basic change, the Committee made the following recommendation:

> It is the responsibility of the scientists to make clear to the Council the uncertainties involved in their assessments of stick status and, in cases where even conservation levels of TAC's may involve significant risks to the populations, the Councils should be clearly advised. **The current "central tendency" approach in which the scientist give their best estimate of the stock status, leads to undue optimism on the part of the Council members.** The scientists must present the downside risks clearly enough so that the Council managing the stock can make a reasonable judgement which adequately takes into account uncertainties.[29]

Clearly, the requirement that the "best" information be used does not dictate that the best estimates be unquestionably translated into the initial Allowable Biological Catches (hereinafter "ABC's"). The standard serves only as a starting point for the gathering of appropriate information. The Act's objectives of stable, long-term conservation management requires that caution and safeguards be used in transferring the "best" scientific information into initial ABC's.

(c) National Standard Six: Taking into Account Natural and Man-Made Variation. National Standard Six mandates that "[c]onservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches."[30] The Senate Commerce Committee report notes that this standard requires fishery managers to provide for a margin of safety to protect against any unexpected decline in the stocks of fish.

> There can be great uncertainty with regard to the location, size, and even the vary existence of fish stocks. There are often great peaks and valleys in annual catch statistics for many fisheries...Therefore, there must be a margin of error in the management system to provide a buffer in favor of the resource.[31]

This standard gives evidence to the Act's goal of managing fish populations on a continuing basis and again, emphasizes the Act's underlying conservation thrust. The science of fishery management is often faced with some degree of uncertainly. Thus, there are usually significant questions about any "best" estimates of acceptable harvest levels. This standard requiring that the "best" information be used, seems to require that the data used be the best that is available. For the purpose of maintaining the resource on a continuing basis, however, fishery managers must be advised of, and account for, the inherent uncertainly in the accuracy of the data and the models upon which stock assessments or appropriate harvest levels are based. Managers must provide a safeguard in favor of the resource.

b. Development of the Domestic Seafood Industry. From the initial passage of the Magnuson Act, Congress intended that the newly-created fisheries management regime be used to develop the United States seafood industry and displace foreign harvesting and processing in the 200-mile zone.[32]

(i) Optimum Yield. As noted above, National Standard One requires that each fishery management plan specify the optimum yield for the fishery. When the Magnuson Act was passed in 1976, this requirement was one of the most important of the Act's management changes. The act defines "optimum" as follows:

'optimum' with respect to the yield from a fishery, means the amount of fish-

(A) which will provide the greatest benefit to the Nation, with particular reference to food production and recreational opportunities; and

(B) which is prescribed as such [by the appropriate Council and the Secretary] on the basis of the maximum sustainable yield from such fishery, as modified by any relevant economic, social, or ecological factor.[33]

The optimum yield definition is obviously subject to differing interpretations. Exactly what is the "greatest benefit to the Nation" and what socio-economic factors should be considered by fishery managers, is not expressly articulated in the Act or its legislative history. Read in the light of the other provisions within the Act and the legislative history of various amendments in years immediately following passage of the MFCMA, however, a clearer vision of the goals intended by Congress in calling for an optimum yield comes to focus.

A overriding theme of Congressional deliberations on the national benefits of the MFCMA is the economic contributions that would accrue to the United States in terms of jobs and balance of trade contributions when the fishery resources in the exclusive economic zone were fully utilized by the domestic seafood industry. During passage of the amendments to the Act which created a preference to fishery resources for domestic operators who fully utilize the raw material (the so-called processor preference amendments), Congressman Studds clearly articulated the national benefits Congress envisioned from development of the U.S. industry.

> In particular, the passage of [this bill] should provide greatly increased benefits to our economy. It should generate not only substantial increases in fish landings but it should also generate thousands of jobs in processing plants and related activities. In addition, increased landings of fish should augment State and local taxes and otherwise aid local economics in need of new sources of revenues. Also, such increased fish landings should result in a significant reduction in the U.S. balance of payments deficit, which was approximately $2.6 billion in 1977, and increase in 12 percent over 1987.[34]

In addition to employment and balance of trade benefits achieved by full utilization, the House Report addressing the processor preference amendments noted that the overall benefits to the Nation may include the quality of life in the United Stated, which includes minimum wage, safety and anti-pollution laws.[35]

In the early 1980's, Congress became frustrated by the lack of growth in the domestic seafood industry for underutilized species of fish.[36] During passage of amendments to the Act which allowed for a forced phase-out of foreign fishing (the American Fisheries Promotion Act, or "AFPA" amendments), Congressman Breaux noted that biology alone had played too great a role in establishing optimum yield levels, and economic interest has been discounted.

> The experience of the last several years has demonstrated that the device of optimum yield has to provided adequate recognition of the national interest of the United States in improving utilization of its fisheries by its own citizens. Biological factors have played too great a role, and economic interest have not been sufficiently taken into account. This approach has tended to ignore the plain language of the FCMA in section 3(18), which defines optimum yield to include economic and other domestic considerations and to serve the overall interest of the Nation.[37]

During Senate considerations of the AFPA amendments, Senator Stevens reflected Congressional intent that the greatest benefit to the Nation includes the goal of displacing foreign fishing operations and thereby creating seafood industry jobs and improved balance of trade.

> Now the time has come for American fishermen and fish processors to extend their activities and displace foreign fishermen from our shores. Under the 200-mile bill, domestic fishermen received priority to catch stock over foreign-fishermen. When [the Magnuson Act] was passed, Senator Magnuson and I assumed that this priority would result in a phase-down of foreign activities...When the shoreside facilities in Alaska and Pacific Northwest are complete and foreign fishing activity is phased out, ten of thousands of jobs through our all the Pacific Northwest and Alaska will be created. Mr President, I would point our that we will be producing primarily an export product... What a tremendous change this could make in our balance-of-trade deficit.[38]

(ii) Findings, Purpose and Policies. Provisions of the Findings, Purpose and Policies sections also refer to the Congressional intention to develop the domestic seafood industry. The Findings of the Act state: "A national program for the development of the fisheries which underutilized or not utilized by United Stated fishermen, including bottom fish off Alaska, is necessary to assure that our citizens benefit from the employment, food supply, and revenue which would be generated thereby."[39] The Act's Purposes section translates this finding by a call "to encourage the development of fisheries which are currently underutilized or not utilized by United States fishermen, including bottom fish off Alaska..."[40] This provision of the Purpose section was amended in 1980 to clarify the specific Congressional intent that "...optimum yield determinations promote such development."[41]

c. Conclusion. Certainly the goals and objectives of the Magnuson Act are broad. The language of the Act and the legislative history, however, clearly show the strong Congressional bias towards stable, long-term conservation-oriented management of the resources and development of the domestic seafood industry. By supporting development of the U.S. industry, Congress also focused on the jobs that would be created and the overall benefits to the United States economy for our fishery resources.

The Act was not intended to encourage a management strategy that would promote harvesting of every available fish. Management of our groundfish resources in the BS/AI area has been extremely successful with the 2.0 million mt safeguard. Where there were questions regarding the health of the resources at different harvest levels, as in the case of the proposal to increase the optimum yield beyond the 2.0 million mt, the Magnuson Act requires a conservative management strategy and that fishery managers err on the side of resource protection.

Furthermore, the optimum yield must be established with regard to the greatest benefit to the Nation. For that purpose, the optimum yield determinations should be calculated to promote the maximum jobs for United States citizens and encourage other contributions to the U.S. domestic economy, such as exports of high-valued fishery products. The Draft Supplemental Environmental Impact Statement "DSEIS" on the proposal to increase the optimum yield to the sum of the individual species' ABC's in the BS/AI area notes that increasing the optimum yield will lead to lower prices which could eliminate U.S. processors from a fishery. In addition, gross earnings of DAP fisheries may decrease.[42] Given the great number of jobs, taxes, and general economic revenues that are attributed to the value-added processing of fishery resources, increasing of the optimum yield to the detriment of the domestic processing industry is in direct opposition to the intent of the Magnuson Act's goals and objectives.

2. Goals and Objectives of the BS/AI Optimum Yield. Overall groundfish harvest in the BS/AI area have varied over the years from a peak of 2.3 million mt in 1972 when fishing was unregulated (before passage of the MFCMA) to a low of 1.3 million metric tons in 1977, the first year of regulation under the Magnuson Act. Below are the groundfish harvests in the years 1969 through 1986:

1969 -- 1,236,029 metric tons
1970 -- 1,674,259 metric tons
1971 -- 2,189,444 metric tons
1972 -- 2,328,809 metric tons
1973 -- 2,098,450 metric tons

1974 -- 1,949,432 metric tons
1975 -- 1,691,735 metric tons
1976 -- 1,472,040 metric tons
1977 -- 1,254,378 metric tons
1978 -- 1,402,926 metric tons

1979 -- 1,269,144 metric tons
1980 -- 1,332,329 metric tons
1981 -- 1,365,641 metric tons
1982 -- 1,330,198 metric tons
1983 -- 1,383,243 metric tons

1984 -- 1,596,555 metric tons
1985 -- 1,763,527 metric tons
1986 -- 1,727,615 metric tons[43]

a. 2.0 Million mt Optimum Yield. The current optimum yield of 2.0 million mt in the BS/AI was established by amendment number one of the BS/AI Groundfish FMP. This amendment was submitted to the NPFMC by the BS/AI Plan Development Team in March of 1980. The Plan Team chose to manage the total groundfish complex in the BS/AI rather than by single species (as proposed in the current amendment). Therefore, a 2.0 million mt limit was established to safeguard overall harvest from the groundfish complex in the BS/AI region.

> Although MSY can be calculated for each species included in this fishery by applying single specied concepts, their values are limited value in fisheries management if they ignore species interrelationships 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 complex is more stable. 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. 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.[44]

The Plan Team noted harvest levels set by single-species management of little value because they ignore species inter-relationships. More importantly, when total groundfish production reached close to 2 million mt, the Plan Team properly noticed evidence indicating population stress.

It is troublesome to observe that the current plan amendment proposes to establish harvest levels on a species by species basis (the sum of each species' ABC) which has been characterized to be of little value because it ignores inter-relationships within the ecosystem. Further, the optimum yield for the sum of the ABC's will likely be beyond 2.0 million mt, the point at which stress in the stocks are observed. The optimum yield levels proposed by the current plan amendment would exceed the harvest levels of foreign fishermen during the time of unregulated fishing. It was these levels which lead Congress to pass the Magnuson Act because of unregulated foreign fishing's detrimental impact on United States fishery stocks.

The amendment one proposal of 1980 also indicated that is was establishing the optimum yield at a level below the maximum sustainable yield "MSY". The reason that the optimum yield was set below the MSY was to encourage development of the domestic industry. In reducing the optimum yield, the Plan Team noted that the optimum yield figure (which was initially proposed to be 1.6 million mt) "should provide high catch rates and larger average fish sizes that testimony to the Council indicates are important to the further development of the domestic commercial fishery."[45] The final adoption of amendment one also noted that the reduction of optimum yield from MSY was to lower the risk of incomplete or inaccurate scientific data when determining the condition of the stocks.[46]

The goals and objectives of the Council when establishing the 2.0 million mt optimum yield safeguard were, in summary, (1) to create a multi-species management regime to account for various species inter-relationships within the ecosystem. (2) to provide an overall ground harvest level which will avoid population stress observed in a number of species at levels above 2.0 million mt, (3) provide high catch per unit of effort and larger average fish sizes to assist the development of the domestic industry, and (4) to reduce the risk associated with replying upon incomplete date and questionable assumptions in assessments models used to determine conditions of stocks.

b. Goals and Objectives of Current Amendment.

(i) Intended Goals and Objectives. There are some goals and objectives that are clearly present within the proposal to increase the 2.0 million mt optimum yield safeguard.

(a) Flexibility. Remarkably, the DSEIS for the proposal to increase the optimum yield range reports that the reason for the increase is simply to provide greater flexibility to utilize the groundfish resource consistent with the biological condition of the stocks.[47] A need for this flexibility is indicated because the 2.0 million mt safeguard "has constrained the Council in recent years from setting the total sum of the TAC's at a level that would allow for full utilization of surplus production. This constraint has occurred in six out of the last seven years - 1982, 1983, 1984, 1985, 1987, and 1988 when ABC's exceed 2.0 million mt."[48]

The objectives of this flexibility, except for full "utilization of surplus production," is not articulated. Furthermore, additional goals and objectives of this new fishery management strategy are not described. There are, however, some intended goals and objectives that can be extrapolated from the consequences of the proposed amendment.

(b) Single-Specied Management. The multi-species management philosophy upon which we have based our current successful groundfish management in the BS/AI area is being replaced with a single-species management system. Thus, the inter-relationships of the individual species within the ecosystem will not be readily accountable for when harvest levels are established. This may provide flexibility to increase harvest levels to the sum of the ABC's when the sum is greater than 2.0 million mt; however, if the sum of the ABC's are greater than the overall ecosystem complex (as suggested by the goals and purposes of amendment one), then overfishing will occur and stress on some of the species of the groundfish is likely.

(c) Promotion of Joint Ventures. The major objective of the proposal to increase the optimum yield beyond 2.0 million mt is to slow the pace of the reduction in joint venture harvesting and processing. With the 2.0 million mt optimum yield, as the domestic processing industry develops, the amount of raw product available for joint venture fishermen decreases. The Draft Supplemental Environmental Impact Statement notes that "[t]he upper limit of 2.0 million mt will therefore constrain joint venture harvest with a projected allocation of 798,000 mt in 1989 and 417,000 mt in 1990."[49] This possible reduction in joint venture harvest has caused some joint venture fishermen to encourage an increase in the optimum yield limit. These fishermen have been the driving force behind the proposed increase.

(ii) Other Consequences. Although not necessarily goals or objectives, there are other policy considerations and fishery management consequences that flow from the increase of the optimum yield. The potential risks to the groundfish biomass, the reduced long-term stability of both conservation and economic aspects of fishery management for the short-term benefit of protection of certain fishermen, the obvious adverse impacts to development of the domestic processing industry and full utilization of the resources, and the adverse impacts on bycatch species and limited entry proposals will be discussed in detail below.

(a) Violation of the Statutory Requirement to Consider Socio-Economic Factors When Calculating Optimum Yield. There will also, however, be a fundamental change in the required two-step process for establishment of optimum yield. Currently, the optimum yield is set equal to 85% of the MSY for the BS/AI groundfish resource. The 85% number was set, in part, due to socio-economic factors. As noted above, under the statutory language of the MFCMA, optimum yield must be established "on the basis of the maximum sustainable yield from such fishery, as modified by any relevant economic, social, or ecological factor."[50] The current proposal, however, merely establishes optimum yield on the basis of ABC's, which are not intended to include relevant economic, social, or ecological factors as required by the Magnuson Act. The Council will consider social and economic concerns only when establishing the total allowable catch ("TAC") levels. Optimum yield levels, not TAC's, are statutorily required to be established on the basis of MSY as modified to socio-economic considerations. The current proposal to establish the upper end optimum yield equal to the sum of annual estimates of ABC's is in violation of the statutory requirement for establishment of optimum yields.

The most obvious demonstration of how this violates the Magnuson Act is in the rare instance where socio-economic considerations would warrant the establishment of harvest levels greater than the sum of the ABC's. Under the current system, if the sum of the ABC's were under 2.0 million mt (an overall groundfish harvest level considered safe by the BS/AI FMP) it would be possible to establish groundfish harvest at a level higher than the ABC's (up to the 2.0 million mt safeguard) if the relevant socio-economic determinations warrant such a level. Under the proposed amendment, however, if the sum of the ABC's was 1.4 million mt, the optimum yield would be 1.4 million mt regardless of any socio-economic considerations.

The options to the proposal (limiting the upper end of the optimum yield range to 90% of the sum of the ABC's and limiting the annual increase in optimum yield to 5% per year) suffer from the same lack of consideration of social and economic concerns.

B. Bycatch Management. The DSEIS incorrectly concludes that changing the method of determining the upper limit on total optimum yield, and the likely increase in total harvest that will result, is not likely to effect the amount of crab and halibut taken as bycatch.[51] In fact, if the optimum yield is increased, when the total harvest level increases the amount of bycatch would increase under all four of the bycatch management alternatives before the Council. Under all but the status quo (sunsetting of all bycatch controls), the cost to the groundfish industry of staying under the caps will increase if harvest levels increase.

1. Alternative 1 of the Bycatch Amendment. Under alternative 1, the current bycatch controls expire at the end of 1988. If this alternative is selected, the amount of crab and halibut taken as bycatch will increase if groundfish harvest levels increase. Halibut and/or crab is an unavoidable bycatch in many groundfish fisheries. If harvest levels increase, the amount of bycatch required to fully harvest the quotas will increase. Lacking management controls that close or restrict fisheries due to bycatch, there is no reason to believe that bycatch would not increase. The amount of bycatch to expect could be estimated by multiplying current bycatch rates times the groundfish TACs expected in the future.

2. Alternative 2 of the Bycatch Amendment. Under alternative 2, the current bycatch controls are extended indefinitely. Under the current controls, the following limits are placed on the fisheries:

Bairdi:	Zone 1 - 80,000; Zone 2 - 326,000
King Crab:	Zone 1 - 135,000
Halibut:	BS/AI - 828,000

The bairdi and King Crab limits apply to DAH yellowfin sole and other flatfish fisheries; if the limit is reached, the zone is closed to those fisheries. The halibut limit applies to the JV yellowfin sole and other flatfish fishery; if the limit is reached, Zone 1 is closed to that fishery.

There are no bycatch limits on crab in Zone 3. None of the limits apply to fisheries other than the yellowfin sole and other flatfish fishery. This fishery is chosen for management because it has the potential for taking the most bycatch, and thus is the most effective to manage to control bycatch.

Other trawl, longline and pot fisheries require bycatch, although to a lesser degree than the flatfish fisheries. If the harvest levels in these other fisheries are greatly increased, the bycatch can be expected to increase in a proportional manner. To estimate the anticipated bycatch, multiply the currently experienced bycatch rates in these fisheries by the TAC expected under the "sum of the ABCs" alternative.

Under this alternative, the groundfish fishery, particularly the DAP fishermen, would be expected to have increased costs as a result of attempting to harvest a greater amount of yellowfin sole and other flatfish under caps designed to accommodate lower harvest levels. Increased allocations to JV's would trigger the closure of areas to DAP operations sooner than under the 2 million mt cap. The increased costs would be the result of increased time and fuel consumption spent in searching for concentrations of flatfish where bycatch is low, increased gear modifications, and increased travel costs due to being forced to fish outside of Zones 1 and 2 for a greater period.

3. Alternative 3 of the Bycatch Amendment. This proposal sets new caps for crab bycatch based on a percentage of crab population and extends coverage to more bottom trawl fisheries. It also changes the halibut cap and extends coverage to DAP, more trawl fisheries and to the longline cod fishery.

Given an increase in harvest level, total bycatch under this system would likely be less than under the two alternatives above. Most of the fisheries that experience bycatch are covered by this system, and would be closed when the caps are reached. This is not the case under alternative 1 or 2. Under 1, no fishery would be closed; under 2, only the flatfish fisheries.

However, total bycatch under this system would be higher if harvest levels increase than if harvest levels remain under 2 million mt. Information presented to the Bycatch Committee showed that in most years, harvest of up to 2 million mt could be fully prosecuted without reaching the bycatch caps. If the harvest level were increased substantially, the caps would likely be reached each year.

Raising the cap impacts this alternative in another way. The Bycatch Committee reached its agreement with the understanding that if the harvest levels were allowed to increase substantially beyond 2 million mt, bycatch need would be reassessed and the caps would be revisited. It seems likely that a substantial increase in the harvest levels would result in an increase in the bycatch limits.

4. Alternative 4 of the Bycatch Amendment. Alternative 4 extends the current bycatch controls, progressively reducing the bycatch limits. It also increases the areas closed to trawling.

The impacts under this alternative are similar to those for alternative 2, except that the cost to the groundfish fishermen would increase as the limits decrease.

5. Conclusion. There are no assurances that a

comprehensive bycatch management system will be adopted. Even if one is adopted, raising harvest levels will assure that bycatch reaches the upper end of the allowable limits.

Increasing harvest levels without a corresponding adjustment to bycatch limits would increase the cost to the fishermen of staying within the limits, or responding to closures due to the limits.

The impacts on the bycatch species, on the crab and halibut fishermen, and on the groundfish fishermen, need to be analyzed and quantified under the above alternatives. Bycatch is perhaps the most controversial matter in fisheries management in the North Pacific. Failing to address the impact on the bycatch situation caused by this action is unacceptable.

C. Limited Entry. The Council has made it clear that it intends to have a new management regime in place for groundfish in the BS/AI region by 1990. The Council has formed an industry workgroup, the Future of Groundfish Management Committee ("FOG"), to explore methods to limit access to fishery resources. The primary motivation behind this effort is the belief that the groundfish resource is, or soon will be "overcapitalized".

FOG determined that there were five major problems with the current system of fishery management. The first problem listed is that "[a]s the industry becomes fully Americanized FOG anticipates increasing pressure to raise the TAC's"[51] The worst example of this overcapitalization is the joint venture fleet, which currently can utilize the JV quota in less then one-half of the calendar year. What we are seeing in the proposal to increase the optimum yield is the overcapitalized joint venture fleet trying to continue their method of operation despite declining quotas. This political effort, however, is little more that a prelude to the pressure that will be put on the Council in the future. If optimum yield calculations are equal to the sum of the total groundfish species ABC's, tremendous pressure will be placed upon biologists to maximize ABC calculations and upon fishery managers to allow harvest to the full extent of the ABC. As a result, the conservation safeguard of the current optimum yield will be forever lost.

Furthermore, if the Council chooses to allow the optimum yield safeguard to be eliminated, there seems little need to immediately consider limited access proposals. Any concern of overcapitalization is diminished by the fact that the current level of harvest will likely by greatly increased, thereby relieving the fishing pressure found at the current levels.

II. FRAMEWORKING OPTIMUM YIELD RANGES UNDER THE FCMA.

A. NMFS Policy and Guidelines on Frameworking.

The proposal to set the upper limit of the total optimum yield at the sum of the ABC's for groundfish species is an attempt to establish a management framework. The National Marine Fisheries Service Operational Guidelines - Fishery Management Plan Process (1983) (See Exhibit One) sets out the procedures and policy to be followed in setting up a framework procedure.

A management framework allows for the adjustment of management measures within the scope and criteria established in the FMP. The principal benefit of the framework concept is more timely fishery management. "It is not intended to circumvent the FMP amendment process that must take place when the circumstances in a fishery change substantially or when a Council adopts a different management philosophy and objectives, triggering significant changes in the management regime."[52]

Once in place, the framework procedure allows adjustments and changes to be made rapidly. However, the changes are limited to those that have been anticipated and described in the documents accompanying the amendment establishing the framework; changes which were not anticipated still require adherence to the amendment procedure. The inability to define the nature of potential problems and analyze their effects may seriously weaken the basis for subsequent management actions and render them subject to challenge.

A key to the establishment of a framework procedure is providing adequate instructions and parameters for the decision-maker.

B. The Current Proposal as a Framework Procedure.

The proposal to set the upper limit of the optimum yield at the sum of the ABCs falls short of being an adequate framework procedure as described in the Operational Guidelines in two respects.

First, the proposal does not provide adequate instructions and parameters for the decision-maker. While it is clear that there would be no discretion in mechanically setting the upper limit of the optimum yield at the sum of the ABCs, there is unfettered discretion in determining the underlying individual ABCs. This *de facto* gives the Council unlimited discretion in setting the upper optimum yield limit.

The conclusion that the Council has unlimited discretion in setting ABC is based on the following observations:

1. The current definition of ABC is vague and subject to many different interpretations. As seen in the DSEIS, the literal definition of ABC is ignored in favor of an

[40] 16 USCA 1801(b)(6)(1986)(emphasis added).

[41] Pub. L. 95-561,94 Stat. 3275, Sec. 233. Fishery Development Objectives. "Section 2(b)(6) of the Fishery Conservation and Management Act of 1976 (16 USCA 1801(b)(6)) is amended by inserting immediately before the period at the end thereof the following:",and to that end, to ensure that optimum yield determinations promite such development."(emphasis added).

[42] DRAFT SUPPLEMENT ENVIRONMENTAL IMPACT STATEMENT, April 1988, (hereinafter "DSEIS"), 146.

[43] DRAFT RESOURCE ASSESSMENT DOCUMENT FOR THE GROUNDFISH RESOURCES IN THE BERING SEA-ALEUTIAN ISLAND REGION, North Pacific Fishery Management Council Plan Team, Sept.,1987, 5 and 6.

[44] DRAFT PROPOSED AMENDMENT TO THE FMP FOR THE GROUNDFISH FISHERY OF THE BS/AI AAREA,BS/AI Groundfish Plan Development Team, March 1980, p.11-12. (hereinafter, "Amendment Number One")

[45] Amendment Number One, 1103.

[46] BS/AI Groundfish FMP Revised Amendment #1 (1982), 2.

[47] DSEIS, 4.

[48] DSEIS, 4.

[49] DSEIS, 140.

[50] 16 USCA 1801(18)(1986)(emphasis added).

[51] FOG Draft Report, 5.

[52] DSEIS 127, 134, 137, 141, 154.

[53] Operational Guidelines, 34.

[54] See DSEIS

[55] DSEIS, vi.

[56] DSEIS, vi.

[57] DSEIS, vi.

[58] See DSEIS, iii.

[59] See DSEIS 12.

[60] DSEIS, Table 1.4.

H. PHASE V: CONTINUING AND CONTINGENCY FISHERY MANAGEMENT

This phase involves two aspects of operational fishery management: (1) continuing management after the FMP (or amendment) is in place, and (2) contingency management (with or without an FMP) under the amended emergency provisions (Section 305(e)) of the Magnuson Act.

Continuing Fishery Management

The Framework Concept

The activities involved in continuing fishery management include monitoring, evaluation, adjustment, and revision. Ease of continuing management depends almost entirely on the foresight exercised in developing the FMP, and on identification of continuing research and data needs to monitor the changing conditions in the fishery. These guidelines focus on the "adjustment" features of continuing management; they summarize and slightly modify, as per Magnuson Act amendments, the informal guidelines issued by NMFS in May 1982 on framework FMPs.

Adjustment, as distinguished from revision (amendment), means the adjustment of management measures within the scope and criteria established by the FMP or amendment; it is the essence of the framework concept. While the process of amending and implementing fishery management plans and regulations has been shortened by the Magnuson Act amendments to 140 days from the time the complete package is received for formal Secretarial review (see Phase IV), it is still too long for practical management of many fisheries. The purpose of the framework concept is to make it possible to manage fisheries more responsively under conditions requiring "real time" management. It is not intended to circumvent the FMP amendment process that must take place when circumstances in the fishery change substantially or when a Council adopts a different management philosophy and objectives, triggering significant changes in the management regime.

The principal benefit of the framework concept is more timely fishery management <u>after</u> the initial FMP has been prepared and approved; it does not save any time on the initial submission. In fact, a framework (or multi-year) FMP is likely to take longer to prepare, since it must anticipate and describe situations expected to occur; establish criteria, procedures, and limits for action; allow for public comment on the range of potential actions and degree of delegated discretion; and provide all the necessary documentation to support the framework measures under other applicable law. The effort is the price that has to be paid for subsequent freedom of action. Once in place, such an FMP or amendment enables adjustments and changes that have been described to be made rapidly, conveniently, and essentially regionally. This is consistent with national standard 6, as described in the revised national standard guidelines.

The Framework Process

The principle used is to prepare FMPs and regulations that do not contain rigid numerical management measures (fixed quotas, allocations, times, areas, and so forth.) Instead, instructions are provided to the NMFS Regional Director, acting for the Secretary, as to how specified management measures will be determined or changed, with or without the assistance of the Council, as the FMP is implemented and maintained. For example, a framework FMP may describe how an RD, with the advice of the Council, may make the annual determinations of OY, or how a quota may be changed inseason, based upon current catch and effort data.

Provided the FMP contains adequate instructions, the RD is clearly implementing the FMP (a Secretarial function) rather than amending it (a Council function requiring subsequent Secretarial review). In most cases, such annual or inseason management adjustments require only rule-related notices to take effect. It should be possible to make routine inseason changes in as little as four days, although not all actions need to move this fast. Annual changes should be able to be made in one to three months, from the time that the information needed is available to the Council and/or the RD in a form that will permit informed decisions to be made. The Secretary's authority to implement management adjustments described in the regulations is delegated to the RDs, although the notices or regulations must be processed through the WO to the OFR.

<u>Contents of Framework Measures</u>

Councils should not attempt to prepare framework measures that will account for every possible contingency. This could make FMPs and their regulations excessively long and complicated. Since all regulations must meet the requirements of other applicable law upon initial submission, they must be accompanied by the appropriate analyses describing the full range of changes that may be made under continuing management, and the economic, social, and environmental effects that may arise in each case. Thus, the limitations upon the ability to define at the outset the nature of all potential problems and analyze their effects, might seriously weaken the basis for subsequent management actions and render them subject to challenge. Analyzing the effects is progressively more difficult with increasing complexity of the FMP and uncertainty of the nature and combinations of changes that may be needed. Framework plans should cover only those actions which are reasonably foreseeable and definable, and for which corrective action can be anticipated and spelled out. Action on poorly defined issues should be taken later when events enable their nature and consequences to be more clearly determined. Regular action can then be taken through the amendment process, now normally completed in 110 days, with effective action in 140 days. If the problem is serious and urgent, the emergency provision can be used, as discussed on pages 40 ff.

Each framework element describing how changes are to be made in a particular aspect of the management of a fishery should contain provisions that--

a. <u>Define the circumstances</u> that will trigger a change in management, whether it be an annual review, the arrival at a catch quota, a sudden drop in yield in the fishery, etc.

b. <u>Indicate the criteria</u> that will be considered in determining if a change is needed and for selecting a proposed response from among the options available. These criteria should include, at least, a determination that the proposed change is consistent with the FMP's objectives and with the priorities identified for the fishery.

c. Define the procedures to be used in making changes, which may include public hearings on the issues, and/or the preparation of Council recommendations to the RD for action.

d. Set limits to adjustments, if a Council considers this appropriate.

Rule-related Notice

As noted above, most annual or inseason management adjustments are implemented through a rule-related notice in the FR. A rule-related notice applies to actions that have been anticipated in an FMP and implementing regulations. The FMP and implementing regulations must specifically provide that such a management adjustment will be accomplished by a rule-related notice and specify the procedures by which it will be accomplished. Because OMB will have already reviewed and approved the regulations implementing the FMP, rule-related notices are exempt from OMB review. OMB has granted the Department this exemption on a year-by-year basis. To qualify for the exemption, a determination must be made for each management adjustment that it is, in fact, within the scope of the original framework regulations. This implies also that the consideration of the impacts made in the original RIR covers the full range of those that will occur under each of the management adjustments that may be taken under the approved framework FMP.

ROUTINE MANAGEMENT ADJUSTMENTS: Event Schedule

1. Region notifies FM1 at earliest opportunity of intended action.

2. Region prepares information memo to F and regulatory action, transmits to FM1, and identifies regional contact point for fast contingency problem-solving.

3. Day 1 : FM12 logs, tracks, reviews, and clears regulatory actions, sends to FM11, FM1, and GCF for clearance.

4. Day 3: FM12 transmits cleared regulatory action to DOC for docket number.

5. Day 4: FM12 sends regulatory action to F for signature, then files with OFR.

Regulatory Amendments

A regulatory amendment differs from a management adjustment; it does not qualify as a rule-related notice because it amends rather than implements a regulation. It amends a regulation, not an FMP. A regulatory amendment is used to clarify Council intent or to interpret broad terms contained in approved FMPs; it may be used to implement a portion of an approved FMP/amendment that was reserved and the Council now desires to implement. In these cases the regulatory amendment should be based on and refer to actual

EXHIBIT TWO

P.COD PRICES

Excerpt of SUISAN KEIZAI article dated November 30, 1987

P.cod quota from United States is now 72,225 ton including the 20,000 ton additional quota given at the end of October. This figure dramatically exceeds the last year's 51,821 ton. Among 20,000 additional quota, 14,000 ton given to Hokuten trawlers, 6,000 ton given to the longliners.

Facing the winter peak season, P Cod market was enjoying the high prices until this additional quota was given.
For an example, Longline caught sold on 10/6 were

4/6 439-435/kg (1.48 - 1.46/lbs) @ ¥135 exchange rate
7/8 466-462/kg (1.57 - 1.56/lbs)

and prices were expected to hit ¥500/kg (1.68/lbs) level.

However, after the announcement of 20,000 ton additional quota, the prices immediately started to fall and kept falling at each offload in November. On 11/2 at Shiogama,

4/6 420/kg (1.42/lbs)
7/8 460/kg (1.55/lbs)

and right now prices are

4/6 350/kg (1.18/lbs)
7/8 360/kg (1.21/lbs)

Prices are expected to fall further before the end of the year, probably to just above ¥300 ($1.01) level.

It was considered this market fall was caused partly because of the concern that the cheaper trawler caught cod will drag the prices since majority of cod was portioned to trawl sectors. However, trawl caught products also showed the same sign of starting at high with ¥400 level in October and falling to ¥290(4/6) and ¥310(7/8) of current level and are speculated to fall down to ¥270 -290 level.

This falling market is somewhat buffered due to the late products demand affected by warm wheather.
Since Hokuten trawlers were ordered to leave U.S.waters, it would be doubtful for them to fill all 20,000 ton additional quota, in which case the market might bounce back a little.

EXHIBIT 3: PRICE RELATIONSHIP BETWEEN U.S. AND KOREAN POLLOCK BLOCKS

DATE	JAN-86	FEB-86		APR-86	MAY-86	JUN-86
POLLOCK-ALASKA	.66	.66		.70	.90-.95	.90-.95
KOREAN POLLOCK						.70

DATE	JUL-86	AUG-86	SEPT-86	OCT-86	NOV-86	DEC-86
POLLOCK-ALASKA	.90-.95	.90-.95	.90-1.00	.95-1.00	1.00-1.05	1.05
KOREAN POLLOCK	.70	.70	.70	.95	.95	1.00-1.05

DATE	JAN-87	FEB-87	MAR-87	APR-87	MAY-87	JUN-87
POLLOCK-ALASKA	1.00-1.05	1.10-1.15	1.15-1.20	1.15-1.20	1.02-1.05	1.02-1.05
KOREAN POLLOCK	1.00-1.05	1.05-1.10	1.05-1.10	1.03-1.05	1.02-1.03	1.02-1

DATE	JULY-87	AUG-87	SEPT-87	OCT-87	NOV-87	DEC-87
POLLOCK-ALASKA	1.02-1.05	1.05-1.07	1.05-1.07	1.05-1.07	.98-1.03	.90-.93
KOREAN POLLOCK	1.02-1.03	1.00-1.05	1.06	1.06		

DATE	JAN-88	FEB-88	MAR-88	APR-88	MAY-88	JUNE-88
POLLOCK-ALASKA	.95	.90-.95	.95-1.00	.90-.95	.90-.95	.90-.95
KOREAN POLLOCK						.80-.85

SOURCE: Seafood Price Current, Urner Barry Publications

EXHIBIT 4

Table A20.--Monthly U.S. cold storage holdings of selected groundfish fillets, EOM, 1985-88, in thousands of pounds.

Month	Cod	Flounder	Ocean perch	Pollock	Whiting	Total*
1985						
Jan.	31,020	5,591	9,432	8,142	1,511	62,360
Feb.	25,092	5,544	6,608	6,482	1,344	49,660
Mar.	25,336	5,951	6,270	5,540	1,667	48,980
Apr.	26,186	5,956	4,901	5,604	2,206	48,660
May	32,228	5,673	4,151	5,498	1,764	52,860
Jun.	30,393	5,644	4,029	5,368	2,357	52,870
Jul.	37,186	6,166	5,058	6,363	3,072	64,380
Aug.	33,910	6,290	5,492	6,351	3,478	61,830
Sep.	35,010	7,076	6,745	6,707	3,568	68,060
Oct.	31,257	7,825	7,180	7,206	4,278	66,150
Nov.	26,913	8,656	6,831	7,575	4,742	64,060
Dec.	24,232	10,897	7,322	8,673	5,278	66,180
1986						
Jan.	17,789	7,937	4,863	6,573	5,201	49,630
Feb.	17,394	7,263	2,777	5,455	3,468	42,690
Mar.	15,475	6,365	2,159	4,397	2,892	37,930
Apr.	17,561	6,015	2,230	3,681	3,177	38,770
May	21,588	5,726	2,975	3,769	1,551	42,020
Jun.	16,085	6,872	3,848	3,394	2,156	37,820
Jul.	16,975	7,543	4,943	3,106	2,004	40,470
Aug.	14,599	8,539	6,535	3,699	2,269	41,130
Sep.	10,865	10,357	7,057	3,470	1,866	39,990
Oct.	8,799	9,982	8,538	4,301	1,674	38,940
Nov.	7,382	10,172	9,107	4,672	2,079	38,480
Dec.	10,267	9,539	9,260	5,146	1,980	42,050
1987						
Jan.	9,779	7,701	7,997	4,527	1,964	36,810
Feb.	11,797	5,968	6,436	3,862	1,864	34,050
Mar.	14,357	4,773	5,501	4,125	1,461	34,910
Apr.	18,215	4,288	4,899	5,071	3,038	41,050
May	20,407	4,403	5,881	5,724	2,208	44,460
Jun.	23,307	5,222	6,908	5,976	2,432	50,140
Jul.	24,901	6,783	7,685	6,601	3,260	56,400
Aug.	24,660	7,171	8,984	9,638	2,842	61,520
Sep.	24,300	8,142	8,201	12,271	4,227	65,210
Oct.	25,839	8,646	9,780	14,006	4,275	71,150
Nov.	27,702	9,172	10,649	16,334	4,761	77,114
Dec.	27,233	8,878	10,910	20,902	4,031	81,899
1988						
Jan.	25,667	7,636	10,067	23,731	4,286	79,361
Feb.	29,007	5,975	8,478	24,574	2,819	77,426
Mar.	31,803	5,212	7,417	21,899	2,424	75,292
Apr. p	32,831	5,206	6,667	22,924	2,236	76,612

* - Total includes other species not listed.

Source: Natl. Mar. Fish. Serv., Natl. Fish. Stat. Prog., Washington, D.C. 20235.

EXHIBIT 5

TESTIMONY OF
JAMES E. DOUGLAS, JR.
DEPUTY ASSISTANT ADMINISTRATOR FOR FISHERIES
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE AND TRANSPORTATION
AND THE
NATIONAL OCEAN POLICY STUDY

UNITED STATES SENATE

MARCH 16, 1988

Mr. Chairman and Members of the Subcommittee. My name is James E. Douglas, Jr. I am the Deputy Assistant Administrator for Fisheries of the National Oceanic and Atmospheric Administration, (NOAA) U.S. Department of Commerce. I am accompanied today by Dr. William Aron, the Director of Science and Research for Alaska.

At your request we are here to address the problems presented by foreign fishing vessels operating in the central portion of the Bering Sea -- the so-called "donut hole" -- which is beyond the 200-mile zones of the United States and the Soviet Union. Recent evidence suggests that some foreign vessels are using the "donut hole" to stage illegal fishing operations within our exclusive economic zone (EEZ). Moreover, it now appears that the amount of fishing occurring within, or falsely reported as having occurred within, the "donut hole" ultimately may affect the amount of fish that can be safely harvested by developing U.S. fisheries in our EEZ.

The Bering Sea is the world's most productive fishing ground. As the map that stands before you illustrates, the richest waters -- the shallower areas closer to shore -- lie entirely within the United States' EEZ and the Soviet economic zone. These areas within our EEZ support a wide variety of fish and shellfish resources that, I am pleased to report, are now primarily harvested by U.S. fishermen as Congress intended when it enacted the 1976 Magnuson Fishery Conservation and Management Act. In our EEZ off Alaska, the phase-out of directed foreign fishing is virtually complete.

With the Magnuson Act's success, foreign vessels have been forced to relocate their fishing activities. Some have moved to the much deeper waters of the "donut hole", which overlies part of the Aleutian Basin. Although these waters are not as productive as the shallower areas closer to shore, they are probably part of a large Bering Sea ecosystem. There seem to be times of the year when significant amounts of fish can be taken within the "donut hole". The species taken most easily is Alaska pollock when they form large spawning aggregations.

I emphasize that the donut hole fishery for pollock is new, but very rapidly expanding, with vessels from Japan, the Republic of Korea, Poland, and the People's Republic of China. Since 1980, in the absence of limits, foreign catch reports attributed to the "donut hole" have nearly doubled each year -- from only 15,000 metric tons in 1980 to nearly a million metric tons of pollock in 1986. While we cannot estimate the size of the total pollock resource in the Bering Sea ecosystem, we must view the rapidly escalating foreign effort with considerable trepidation. Since most of the Bering Sea is probably a single ecosystem, any significant level of fishing in the "donut hole" may reduce the amount of fish that can safely be taken elsewhere within that ecosystem. Thus, the United States shares a common fisheries interest with other nations in seeing that sound conservation measures are implemented for that part of the Bering Sea beyond our 200-mile limit.

Another serious concern, at least for the United States, is that some of the most productive areas of our continental shelf are quite close to the 200-mile limit. One of these areas -- Bowers Ridge -- is where as many as seven Japanese medium- sized stern trawlers were observed illegally fishing on January 13, 1988. NOAA has issued Notices of Violation and Assessment to four identified and two unidentified vessels for fishing without a permit and against two unidentified vessels for concealing their numbers. NOAA has also proposed permit sanctions against all vessels owned by the Japanese companies whose vessels were identified. We have every reason to believe that these Japanese vessels used, or intended to use, the "donut hole" as a sanctuary for evading U.S. enforcement efforts.

I am pleased to report that NOAA, in cooperation with several other agencies, is addressing both the short and the long-term consequences of the rapidly expanding foreign fisheries in the "donut hole."

First, we dispatched a NOAA P-3 Orion aircraft to Adak to assist the Coast Guard in its aerial surveillance program. During our first five flights between February 10 and 19, we detected six Polish vessels fishing very close to the boundary inside our EEZ. Those cases will be presented to the NOAA General Counsel for possible prosecution. This was only a temporary measure, however, since the NOAA aircraft has other assignments. We are, therefore, exploring increased use of military aircraft and satellite communication technology to enforce the 200-mile limit when weather and mission requirements permit.

Second, we are considering a variety of new regulations to place more restrictions on foreign fishing vessel operations withi our EEZ. Some of the vessels operating in the "donut hole" may have been supported by vessels operating in our EEZ. Present regulations do not require a permit for transfers of fish and supplies within the EEZ if the fish involved were taken beyond th EEZ. We propose to fix that by emergency regulation as soon as interagency discussions have been completed. We also plan to publish an advanced notice of proposed rulemaking (ANPR), again, soon as interagency discussions can be completed. Some of the suggestions to be addressed in the ANPR include new requirement for foreign fish processing vessels and foreign fishery support vessels to submit to in-port inspection and to carry U.S. fishery observers into the "donut hole" if they also intend to conduct operations within the EEZ which they still commonly do in joint venture. Another is to allow fishery support only if the fish are harvested within the EEZ.

Third, our researchers have begun a careful examination of the problems posed by the expanding "donut hole" fishery in order to provide better information to the North Pacific Fishery Management Council. We have several hypotheses on the relationship between pollock found in the Aleutian Basin and pollock found elsewhere in the Bering Sea. While much more data needs to be gathered, we believe the least likely scenario is that there is a separate stock of pollock in that area as has been suggested by the Japanese. Instead, it seems more likely that the fish in the "donut hole" are part of a larger population which inhabits most of the Bering Sea. There may also be a second pollock stock in the extreme western part of the Soviet economic zone. The NOAA ship MILLER FREEMAN has just completed a research cruise across the Aleutian Basin and found very little pollock in the "donut hole" and none in harvestable quantities at this time of the year.

Fourth, NOAA, the State Department and the Coast Guard will meet with Soviet fisheries officials here in Washington in late March or early April specifically to consider how to deal with the alarming expansion of third party fishing in the "donut hole." At

DEEP SEA FISHERIES, INC.

Mr. James O. Campbell, Chairman
North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, Alaska 99510

6/18/88

Dear Mr. Campbell:

What was only days ago a rumor has now materialized into a real threat to the Americanization of the North Pacific bottom fish harvest. On short notice, and not at all through the system, we have come to find out that the issue of Pacific Cod TALFF allocations to the Japanese Longliners will be cinsidered at the upcoming meetings of the NPFMC on 6/20/88. Based on the councils decision earlier in the year not to grant TALFF allocations this year, our company, Deep Sea Fisheries, Inc., has invested heavily in the harvesting and processing of Pacific Cod. Additionally we have a tremendous investment in unsold Pacific Cod inventories in Japan. Continued rumors of a Japanese Longline fleet TALFF allocation have completely flattened the Pacific Cod market and continuing indications from the NPFMC and NMFS of a reconsideration of this issue is bringing tremendous financial pressure to bear on our wholly American owned and operated company.

Although we have tried through the Council system to demonstrate the negative impact of the remotest possibility of any TALFF to the Japanese, we are beginning to feel our cries are falling on deaf ears. The Japanese Longliners have long used a strategy of enlisting the Western Alaska Natives in their cause in return for certain contributions the Japanese make to these people. The committed and tireless methods the Japanese employ have overshadowed the trememdous contributions the U.S. processing community in Alaska has made to all the coastal community of Alaska. Because we as a group have not systematically engaged a strong lobbying effort, nor hired Alaska Natives to act as spokes-people, our message is not getting through. In order for our company to contribute its utmost, we need to diversify into all fish species to protect us from the down turn of a single species such as crab in the early eighties. In order to diversify into bottom fish we need the support of the NPFMC and NMFS which we saw at the beginning of 1988. We need an end to continued market dampening threats of a Japanese Cod TALFF.

5305 Shilshole Northwest Suite 200 Seattle, Washington 98107 (206) 782-6545

President Reagan's recently imposed sanctions of NO TALFF for Japan because of continued whaling violations seem to have had no effect on the market and have not dampened the Japanese efforts to gain a TALFF at all. Do the Japanese know something which we as an industry are unaware of? In light of these sanctions we would hardly expect the council to consider the TALFF issue with its tremendous negative impact on the U.S. industry. However, the issue looms ever and ever larger with the council meeting just hours away now. It is also difficult to understand how the Japanese could be granted a TALFF when the Bering Sea 2 million MT cap includes the Pacific Cod Quotas at the cost of DAH and JVP rrequests for other species. It is clear in our minds that any reduction in U.S. harvest of Pacific Cod must be matched by an increase in Quotas to the DAH and JVP sectors who were denied full allocations at the first of the year. There just is no room under the Magnuson Act allocation process to award TALFF this year.

Any consideration of a Japanese request for a Pacific Cod TALFF would have to come outside the normal agenda system all of us are rquired to adhere to. Such a short notice possibility that the issue of a Pacific Cod TALFF to the Japanese Longliners smacks of political manipulation of the system and denies the U.S. industry its right to a fair and informed accounting of our intentions for remainder of the year. As you well know, Black Cod is virtually over for the season already, much sooner than expected. Man vessels and companies, which as little as 3-4 weeks ago thought they would harvest Black Cod through September, have already started targeting True Cod months earlier than previously forecast. Such short notice of this Pacific Cod TALFF issue gives none of us the time to adequately prepare our rebuttals and certainly denies many, many, fishermen and processors the right to representation, when we all thought this issue was settled.

Sincerely,

John Boggs

John Boggs
President

TRIDENT SEAFOODS CORPORATION

5303 Shilshole Avenue N.W. • Seattle, Washington 98107
(206) 783-3818 • Sales: (206) 783-FISH
Telex: Trident Sea 321266 • Fax: (206) 782-7195

June 20, 1988

Mr. James O. Campbell
Chairman
North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, AK 99510

Dear Jim:

We have heard word that the Japanese Longliners are again planning to try and have the North Pacific Fishery Management Council declare Pacific cod to be a TALFF species so that Japan can eventually receive an allocation of cod. Trident Seafoods has invested a large amount of our company's effort in production of headed and gutted cod for the Japanese market. We are obviously opposed to the creation of a TALFF for cod.

We cannot stress strongly enough the adverse impacts any creation of TALFF would have on the United States Seafood processing industry. The Japanese newspaper Suisan Keizai, dated November 30, 1987, reported that prices of cod in Japan fell from $1.46 a pound to $1.01 per pound after the announcement of a cod allocation from TALFF. To quote the article, "[f]acing the winter peak season, Pacific cod was enjoying the high prices until this additional quota was given." Many U.S. seafood processors have developed large inventories of Pacific cod this year. If there were a TALFF created on cod it will have a devastating impact on those who have relied upon our government not creating a TALFF in 1988. It is a situation we would not be able to tolerate, and every appropriate action must be taken to assure that the Council and the Secretary do not proceed with the Japanese Longliners' proposal.

The Japanese Longliners claim that they deserve a TALFF because of their contributions to areas of Western Alaska. We believe that the domestic processing industry makes substantially more economic contributions to the region than the Japanese. We, however, have not attempted to publicize our efforts. The U.S. industry can make even greater contributions if we become more diversified and process all species of fish so that a down-turn in one, such as king crab, will not severely impact the industry. To achieve this diversification, we must have the ability to fully utilize the cod resources of the Bering Sea.

Regardless of the contributions made by the Longliners, the Magnuson Act does not allow for those contributions to be considered when determining whether a TALFF should be created. Economic contributions by foreign companies to full development of the domestic seafood industry are relevant only in consideration of which foreign nation will receive a portion of the allocations from TALFF, not whether a TALFF should be established in the first place.

Numerous seafood processors have relied upon the Council's December determination that established no initial TALFF for 1988. The notice that the Council would be considering such a proposal at the June session is wholly inadequate. The published agenda for the Council meeting gives no indication that reapportionment to TALFF would be considered.

We have been told just today that the NPFMC may, in fact, be considering granting a TALFF so that the Japanese Longliners can receive Pacific cod. This certainly has not provided adequate notice for the industry to express our concerns. Trident has relayed the news of the rumored Longliner effort to the Pacific Seafood Processors Association so that the Association can actively oppose the proposal. Many individual companies, however, also would have gone to Anchorage to participate in the public comment portion of the meeting if they had advance notice that such an important proposal will be considered.

The Bering Sea/Aleutian Islands Fishery Management Plan (FMP) provides that before any foreign nation can harvest a TALFF for any target species, they must also have a TALFF for all bycatch species. The harvesting of Pacific cod produces bycatch of pollock, sole, rock fish, turbut, and sablefish. There is no possible calculation that would allow the Council to allocate the necessary bycatch to TALFF required before a foreign country could prosecute a Pacific cod fishery.

In addition, within the 2.0 million mt optimum yield there are Domestic Annual Harvest (DAH) request for species other than cod that were denied so that a maximum amount of Pacific cod could be allocated to the domestic industry. If the Council were to find that the 1988 DAH need for cod will be less than the Pacific cod Total Allowable Catch (TAC) then the Council should reduce the Pacific cod TAC and increase the TAC (within the 2.0 million mt safeguard) for other species which DAH has has been restricted by TAC. TALFF should not be given until the full extent of DAH request are met up to the limit of each species ABC within the optimum yield safeguard of 2.0 million mt. If the Council were to simply create a TALFF on Pacific cod, it would be giving fish to foreign fishermen to the exclusion of the domestic industry.

Although not a legal consideration on whether to establish a TALFF, the Packwood/Magnuson provision of the Magnuson Act and the Pelly Amendment to the Fishermen's Protective Act also dictate that the Japanese will not receive any allocations of TALFF this year. The Japanese have conducted whaling operations again this year in violation of the International Whaling Commission and have been duly certified under the Packwood/Magnuson provisions of the MFCMA. Such designation is also automatic certification under the Pelly amendment and the President has indicated to Congress that he will prohibit any allocations of TALFF to the Japanese because of the certification under the Pelly amendment.

The NPFMC has made historic progress towards Americanization of the fishery resources in the North Pacific. Trident has followed the Council's lead and invested heavily in the production of Pacific cod. Any creation of TALFF by the Council and the Secretary will severely harm the cod market in Japan. The domestic seafood industry will face a severe setback on our efforts to fully utilize the Pacific cod resources if a cod TALFF is created. We simply must do everything possible to make sure that such an eventuality does not happen.

Sincerely,

Charles H. Bundrant

Charles H. Bundrant, President
Trident Seafoods Corporation

REPORT OF THE NORTH PACIFIC LONGLINE ASSOCIATION OF JAPAN ON THE COOPERATIVE PROJECTS BETWEEN NPLA, WESTERN ALASKA FISHERMEN AND THE U. S. FISHING INDUSTRY FOR 1988

JUNE 22, 1988

1. NORTON SOUND SALMON JOINT VENTURE

   A. Fishing Ground: Norton Sound.

   B. Period of Operation: June 10, 1988, through August 15, 1988. (Fishing season begins June 20, at 6:00 p.m.)

   C. Project Description: Two NPL vessels will receive all species of salmon from 80 fishing vessels involving approximately 150 fishermen and their helpers. The target tonage is 500 metric tons.

2. GROUND FISH FISHERY DEVELOPMENT IN THE NELSON AND NUNIVAK ISLAND AREA.

   A. Project Partners: Qaluyaat Fishermen's Association (QFA), Kokechik Fishermen's Association (KFA), and Bering Sea Fishermen's Association (BSFA).

   B. Areas: Nelson and Nunivak Islands.

   C. Period of Operation: June 14 through July 15, 1988.

   D. Project Description: Three Japanese technicians from NPL member companies are currently in the area for technical assistance on longlining and processing methods for Pacific cod. Also included in the assistance is a loan agreement to enable the local people to expand their fishing ability by lease or purchase of a larger vessel. The size of the loan is linked to an allocation.

3. ATKA FISHERMEN'S ASSOCIATION FISHERIES DEVELOPMENT PROJECT.

   A. Project Description: NPL is providing assistance in the form of a loan guarantee to assist the Atka Fishermen's Association in the purchase of a larger vessel costing approximately $400,000. This vessel is necessary to allow the local fishermen to expand their ability to participate in the fisheries which are taking place on their local fishing grounds. Future assistance is planned in the area of fishing technology, marketing and other technical assistance.

4. SHARING OF PACIFIC COD IMPORT QUOTA.

A. Project Description: the NPL is providing U.S. processors with access to Pacific cod I.Q. for the Japanese market. Any U.S. processor who is not able to sell their fish into the Japanese market due to the lack of a cod I.Q. can contact the NPL to obtain an I.Q. free of charge. The present level of the program is 10,000 metric tons which has been sufficient to meet all of the requests of U.S. processors.

B. Future of the Program: The NPL is studying the possibility of obtaining a substantial increase in the I.Q. This increase of I.Q. is to assure that there is sufficient I.Q. for any demand of U.S. processors.

5. U.S.-JAPAN JOINT GROUNDFISH RESOURCE SURVEY CRUISE.

A. Project Description: JAMARC is sponsoring the research cruise at the request of the Northwest Alaska Fisheries Center and NMFS. JAMARC has chartered the Tomi Maru 88, an NPL vessel. The research cruise is presently being conducted.

B. Period of Operation: The cruise is to be conducted from May 17, through October 16, 1988.

— acknowledge the value of the cooperative projects with western Alaska communities.

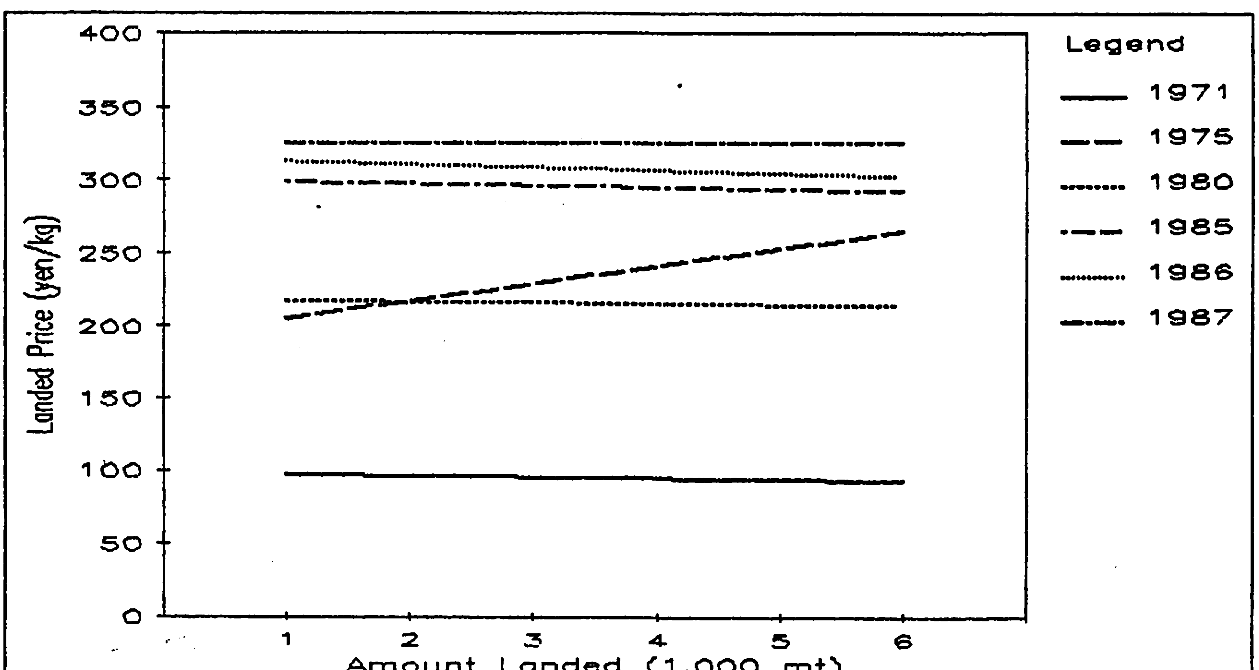
CLINT ATKINSON

The Japanese Market for Cod.

With the growth of the United States high seas fisheries in the North Pacific, a number of questions have arisen regarding the Japanese market for groundfish. The most recent problem involves that of cod and hopefully, these few comments may help clarify some of these questions.

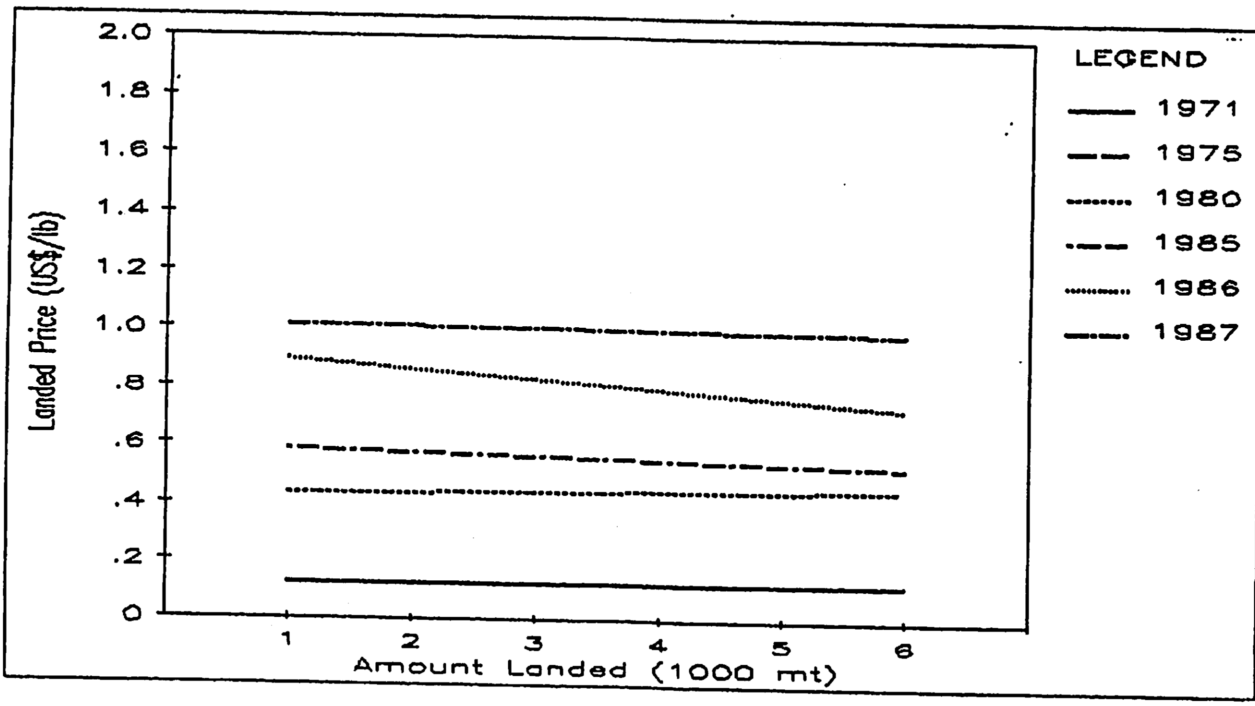
1. Japan's supply of cod. In the last two years, both the United States and Japan have expanded their fishery statistics so that it is now possible to obtain a "first" estimate of the total supply of cod being consumed in Japan. The results of the compilation of the landings, imports and exports and inventories for 1986 and 1987 is shown in Table 1, the various values converted to raw fish weight for comparison. Although some refinement of the data will be necessary, this preliminary estimate of total domestic supply of cod in Japan shows a decrease of about 12,200mt in 1987 from 1986. From these estimates, we can assume that the annual domestic supply of cod in Japan is about 115,000 to 125,000 mt per year (raw fish weight) and of this amount, only about 23,000-25,000 /yr (raw fish weight) from the United States (i.e., US JV and domestic cod products from the North Pacific).

2. Relation between landings and price. One of the problems that is attracting much attention at the present time is the relationship between the supply and the price, best measured by the record of landings at the 51 major ports in Japan. Because of the limited time, I have examined 6 years of landing/price information, plotted the data and determined the trend by least squares. The results are shown in the following chart:



Although four of the six years do show a slight increase in price with a decrease in landings, the difference is very, very small - somewhere between one tenth of a cent to 3 cents per pound per 1,000 metric ton of landings.

These same data have been converted from yen/kg to US$/lb in the following chart to see what effect changes in the rate of foreign exchange might have on the slopes of the trend lines. The most significant change ocurred in 1986 when the yen-dollar rate rapidly fell but even so, the difference is still insignificant.

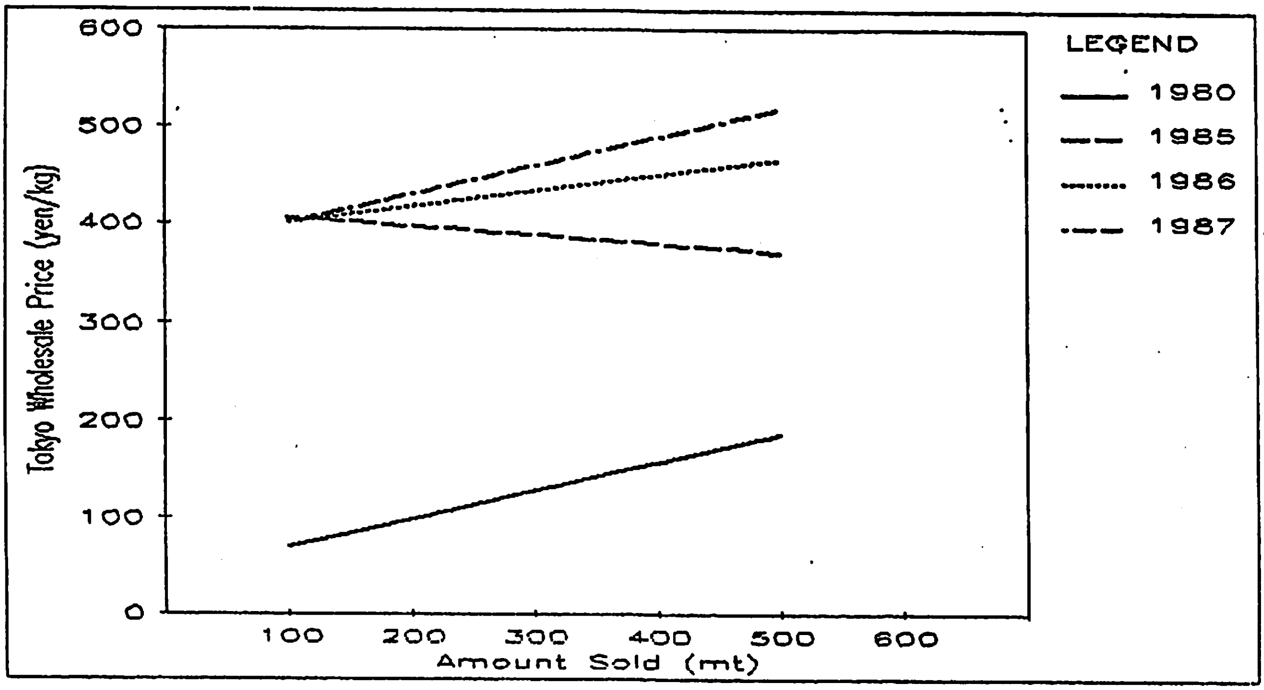


Finally, for reference, a summary of these changes in price due to decreased landings is givem below:

Year	Change in Price per 1,000 Metric Tons yen/kg	US$/lb
1971	0.7	0.001
1975	- 11.8	n/a
1980	0.8	-0.004
1985	1.2	0.010
1986	1.8	0.034
1987	0.4	0.004

From the above, it is quite clear that a decrease in the supply of cod does not result in an increase in the price of cod in Japan.

3. Relation between Tokyo wholesale market sales and price. For comparison, four years of sales/price information from the Tokyo wholesale market has also been examined. Here the picture is just the opposite. For three of the four years, the greater the amount sold, the higher the price. What happens in the consumer wholesale market, such as Tokyo, however, is that the seller will hold the product in storage until the price is right and then sell in quantity.



4. The difference in price between trawl and longline-caught cod. Information received from Japanese industry sources shows a difference in price between longline and trawl caught frozen cod. In 1986 the landed price for all frozen cod at the major ports was 307 yen/kg while the price for longline-caught cod was 325 yen/kg. Similarly, in 1987 the price for all frozen cod at major ports was 325 yen/kg while the price for longline-caught cod was 344 yen/kg. The real difference in price, however, is much greater: Since about 40 percent of the total landings of cod are taken by longline, the price received for their fish would significantly increase the total price shown for the major ports landing.

Recently, information was received from the Tokyo wholesale market that provides a more reliable schedule of prices for longline and trawl-caught frozen cod - a difference ranging from 70 to 120 yen/kg.

Longline and Trawl, January thru April, 1988.

Size*	Tokyo Wholesale Price (yen/kg) Longline	Trawl	Difference
4-6	370	300	70
7-8	380	310	70
9-10	370	290	80
11-12	350	250	100
13-15	340	250	90
16-20	295	200	95
21 or more	280	150	130

* Number of Fish per pan.

Further, as you will note in the attached page from a recent issue of Bill Atkinson's News Report (BANR), longline cod fill a very special niche in the Japanese market. They are preferred by the Japanese processors for mabuwa (a lightly salted cod) and the trawl-caught cod have scars marks that produce an inferior product. Accordingly, the mabuwa processors are very concerned about the present shortage of longline-caught cod.

4. The substatutability of Atlantic cod. In the past, some mention has been made of the substatutability of Atlantic cod for Pacific cod in the Japanese market. At the present time, very little Atlantic cod is being imported into Japan and the price is lower than that for the Pacific cod. In March 1988, the asking price for H&G Atlantic cod in the Tokyo wholesale market was 260 yen/kg but the quality was poor and the final price was only 150 to 200 yen/kg.

There are other cod-like fish that are now being taken in some quantity from the southern waters. Although of poorer quality and lower price, hoki from off New Zealand and the southern hake from Chile/Argentine are both considered to be acceptable substitutes for the Pacific cod.

June 21, 1988
Clinton E. Atkinson
Fishery Consultant and Advisor

Table 1. An Estimate of Japan's Supply of Cod (raw fish weight*, metric tons)

Item	1986	1987
Initial Inventory	30900	20600
Total Landings	100500	110000
Imports		
US JV (H&G)	11400	9900
US Domestic (fillets)	14000	13100
Korea (fillets)	7700	500
Taiwan (fillets)	500	0
USSR (H&G)	800	0
Total	34400	23500
Final Inventory	20600	26500
Total Supply	127400	115200

* Raw fish weights obtained from recovery rates of 60 percent for H&G and 28 percent for fillets; inventory a mix of product, mostly H&G, recovery rate estimated at 55 percent.

year, rather than the normal 17 kilo (37.4 lb) containers. Only pails of top grade roe are still able to get ¥5,000/kilo ($18.18/lb). Some roe stripped in Korea has appeared on the Tokyo market, but the volume is extremely limited so far.

Northern Frozen Fish

The supply of frozen northern groundfish in Japan has shifted dramatically over the past few years, as import volume rapidly grew. The change will result in an adjustment of the factors influencing the market; the traditional patterns of supply and demand in the marketplace will naturally undergo changes to meet the new sources of supply.

1. Cod --- U.S. processors shipped a total 5,959 tons of cod to Japan during 1987, compared with 296 tons shipped from Korea. Through April of this year, imports of cod from the U.S. reportedly total about 1,382 tons. The new product supply, however, has the *mabuwa* (lightly salted cod) processors in Japan concerned. Japanese longliners supplied the raw material for *mabuwa*, while the imports come mainly from trawl operations; trawl cod has net marks and the fish are frequently cut or scarred.

2. Sablefish --- About 30,000 tons of sablefish is imported by Japan each year. While there is some fluctuation, the steady supply has allowed the wholesale prices to stabilize. The main factor to influence prices will be the timing of supply. The majority of the 1987 production was received within a three month period; this year, the shipments are more evenly distributed, with prices remaining relatively stable.

3. Flatfish --- Japanese imports of flatfish through April total 42,431 tons - U.S. 37,182 tons, Korea 2,232 tons, Others 3,017 tons. Almost half of the U.S. imports (15,145 tons) were in April. The production includes almost 18,000 tons of roe-rock sole from U.S. trawl and JV operations, as well as yellowfin sole from JV operations. Imports of yellowfin sole, and other species, will continue through most of the year, from Korea, the Soviet Union and other nations. The average import value for flatfish imports from the United States through April is ¥289/kilo ($1.05/lb), compared with an average value of ¥460/kilo ($1.67/lb) for the same period last year.

Copper River Salmon Roe

About 100 to 200 cases of *sujiko* (salmon roe) from the first opening of the Copper River fishery were recently shipped to Japan; the *sujiko* was stripped in Cordova and packed in 5 kilo (11 lb) pails and wood boxes. The importer offer prices were announced shortly after their arrival on the 23rd. The sockeye-roe prices were slightly higher, and the chinook-roe slightly lower, than last year. This is largely due to the current inventories of sockeye and chinook roe, and general demand. Sales of chinook-roe dropped after the prices were increased late last year. As a result, there is still about 70 to 80 tons of last year's chinook-roe in Japanese cold stores.

FRESH *SUJIKO* PRICES

SPECIES	¥/KILO	$/LB
Sockeye-Roe		
No.1	¥ 5,400	$ 19.64
No.2	¥ 5,000	$ 18.18
No.3	¥ 4,600	$ 16.73
Chinook-Roe		
No.1	¥ 4,200	$ 15.27
No.2	¥ 3,800	$ 13.82
No.3	¥ 3,400	$ 12.36

Message taken over phone - 2:20 p.m.

TO: Chairman James Campbell and Council Members

FROM: Golovin Fishermen
KEG Fisheries

DATE: June 23, 1988

The Golovin fishermen are in full support of Japanese longliners receiving an allocation of pacific cod in the amount of 25,000 mt for August, September and October of 1988.

Reasons:

1. Our need is very great here for economic and financial reasons.

2. They have purchased all our fish for the last several years and have done an excellent job.

3. They have worked with our KEG Fisheries Board and every meeting we come away with a better understanding and more business knowledge.

4. We have another agreement with them to purchase our fish for another year. It would be greatly benefit our area to be able to count on the longliners to get our fish.

We would also like to thank Governor Cowper for being very supportive of our sales to the Japanese.

488/BG

ROCK SOLE FACTS

I. BIOLOGICAL

STATUS OF STOCKS:

Above virgin biomass and strong recrutment continues.

EXPLOITABLE BIOMASS:

1 million metric tons plus.

ALLOWABLE CATCH:

100,000 Metric tons at the conservative exploitation rate of 10 percent.

1988 CATCH:
(NMFS - June 15)

Factory trawlers - 19,600 metric tons

Joint venture - 5,800 metric tons

II. JAPANESE MARKET

(Source: Bill Atkinson and Japanese news articles)

HISTORIC MARKET SIZE

-- From the mid 1970's the total supply of rock sole with roe in Japan ranged from 5,000 to 6,000 metric tons. About half of that was sold on the Tokyo market.

-- Bill Atkinson states that the Tokyo market may be able to take only about 3,000 metric tons.

-- JV and factory trawler product appears to be going into Shiogama. Product also goes into Kushiro.

-- The 1987 import of 6,000 metric tons of roe-rock sole from DAP operations in Alaska was double the import volume in 1986.

Chris Blackburn • Director • P.O. Box 2298 • Kodiak, Alaska 99615 • **(907) 486-3033**

1988 MARKET SIZE

-- The number of buyers is increasing.

> *"The Tsukiji brokers, however, are not the only buyers of roe-rock sole. Sales on the 13th went to regular buyers - Taiyo, the Zengyoren, Aburai, SK, etc. - but also to factories that normally process fresh fish; because of the current shortage of fresh fish, the processors are using "thawed" fish for their production."* (BANR, 1/17/88)

-- The market for imported product may be increasing.

> *"With the decrease in Japaneses catches of roe-flatfish, the Japanese are looking for other sources of product."* BANR 2/5/86

> *"With the increased restrictions on Japanese directed fishing operations around the world, they are looking for new sources supply for many of the traditional fisheries products. This is especially evident in the roe-flatfish industry, where imports from both the Atlantic and Pacific are growing."* BANR 5/17/86

> *"More attention is being paid to roe-rock sole by the consumer whole-sale market dealers handling northern frozen fish, spurring sales to volume sales stores (supermarkets, department stores, etc.) and other end users. . . . And with the increased supply, the sales market for roe-rock sole has also spread throughout the country ...*
> *. . . by the May 27th bidding, even the consumer market dealers got into the action.* Article translated from Nikkan Suisan Keizai June 14, 1988.

-- Despite a tripling of imports in 1988, all product has been sold except 1,500 metric tons held back by ARC for the fall season.

ROE-ROCK SOLE PRICE

-- The price has considerable seasonal variation which seems to be supply, or anticipated supply, driven to some degree.

-- 1988 prices are at the same level as 1986 prices when the import supply was 3,000 metric tons.

-- Factory trawler product is being sold at a higher price than JV product according to the figures obtainable from Japanese articles.

-- In 1986 declining supplies from Japanese domestic operations created an active demand for product. The first load of rock sole imported by Aburai Kaeki Company had flesh that lacked firmness, needed more washing before freezing and had pale roe. Despite the flaws the product was saleable because of the demand for product.

-- It would appear that the roe-rock sole market is expanding rapidly, new buyers and new distribution channels are appearing. Any conclusions about the size of the market or a proper price are premature.

-- Factory trawler product accounted for about 80% of the product imported by Japan from U.S. waters. There is no indication the 20% imported from U.S. JV operations had any discernible effect on price.

ALASKA FACTORY TRAWLER ASSOCIATION

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SEATTLE, WASHINGTON 98199
(206) 285-5139

TELEFAX 206-285-1841
TELEX 5106012568, ALASKA TRAWL SEA

AFTA PROPOSAL FOR THE OY FRAMEWORK AMENDMENT

AFTA proposes a framework in which the Council would be able to increase the OY from year to year by 10%, but no more than 25% overall. Should the Council desire to exceed these limits a plan amendment would be necessary. This formula would apply only to species other than pollock until the issue of unregualted fishing on pollock is satisfactorily resolved. To explain this formula by example:

In 1989 the existing OY, 2 million tons less the 1.3 million tons which makes up the pollock component, could be increased by 10%. (700,000 metric tons x 110% = 770,000) the example assumes maximum increases. The 25% limit takes effect in 1991 in this example.

	Pollock Excluded	Pollock Included
Base OY	700,000	2,000,000
1989	770,000 + 1,300,000 = 2,070,000	2,200,000 (10% of previous OY)
1990	847,000 + 1,300,000 = 2,147,000	2,420,000 (10% of previous OY)
1991	875,000 + 1,300,000 = 2,175,000	2,500,000 (25% of base OY)

North Pacific
Fishing Vessel
Owners' Association

TESTIMONY RELATIVE TO AMENDMENT 12

TO THE FISHERY MANAGEMENT PLAN FOR THE GROUNDFISH

FISHERY OF THE BERING SEA/ALEUTIAN ISLANDS

Presented to the North Pacific Fishery Management Council
June 1988

This testimony is presented by Kenneth O. Larson, Director of Governmental Affairs of the North Pacific Fishing Vessel Owners' Association. The North Pacific Fishing Vessel Owners' Association (also referred to as "the association" or NPFVOA), has members involved in the crab fisheries and various aspects of the trawl fisheries. As such, the association has a direct interest in effective management of the resources of the Bering Sea/Aleutian Islands fisheries and our members will be directly impacted by decisions relating to the Amendment 12 Proposals. The following comments are directed to specific recommendations contained in the Plan Team's documents and refer to alternatives and options as presented therein.

I. Consideration of the Optimum Yield Range:

NPFVOA favors setting the OY annually at a level equal to the sum of the ABC's..

The North Pacific Fishing Vessel Owners' Association favors setting the optimum yield annually at a level equal to the sum of the Acceptable Biological Catch (ABC) figures. We realize however, that establishing the OY (as defined in the MFCMA) also involves other considerations and must be based on sound scientific figures of the ABC's.

Additionally, we recognize that large fluctuations upward in the OY from year to year may cause stress on the marketing and financing sectors of the industry. We, therefore, recommend that the increases in OY, assuming the ABC's justify a large increase, be dampened by setting a limit to any single annual increase. For example, an increase in OY from one year to the next may not exceed 15 per cent of the prior year's OY. Thus, applying this example, the current 2.0 mmt cap could be increased to 2.3 mmt the first year, to 2.645 mmt the second year and increased in 15 per cent increments thereafter so long as the increase was justified by sound scientific data. A decrease for biological and conservation reasons, however, would not be restricted to any percentages and would be dictated by the status of stocks. A more detailed examination of the limiting percentages and impacts of increases is needed.

II. Bycatch Controls:

NPFVOA favors Alternative 3--Establish a framework management procedure to control bycatch of Tanner crab, red king crab and Pacific halibut.

NPFVOA is in a somewhat unique position of having both crabbers and draggers as members. The association's membership takes the cohesive position that the interests of both gear types can be protected under Alternative 3 by setting bycatch limits in a rational manner in relation to the abundance of the bycatch species. Emphasis must be made, however, that this system can only work if the population figures are soundly based on accurate scientific data. The bycatch limits must be set at a sufficiently high level to prevent unjustifiable interference in the directed fisheries, but be narrowly set to protect those fisheries targeting on crab and halibut. If the crab populations, for example, are over estimated for purposes of setting the bycatch limits, the crab industry will likely suffer from reduced populations on which to target effort. With such considerations in mind, we recommend a cautious approach at estimating the populations and setting the resultant limits on bycatch.

The percentage figures recommended by the Bycatch Committee appear quite reasonable--1 % of the bairdi population, .75 % of the red king crab population in Zone 1 and 3900 mt of halibut mortality.

The association favors Option B because of its simplicity and the rational approach of defining target fisheries by gear type. In addition, we consider Alternative 3, Option B to provide the best system proposed for monitoring the relevant fisheries.

III. Federal Permit Requirement:

The North Pacific Fishing Vessel Owners' Association favors Alternative 2--All vessels of the United States receiving EEZ-caught fish would have to hold a Federal permit and thus would have to comply with the weekly reporting requirements.

Timely gathering of data and prompt analysis of these data are critical to proper resource management. Under the present system the treatment of vessels within the Territorial Sea and those beyond the EEZ which receive fish caught within the EEZ creates an inconsistent data gathering effort. Uniformity is needed and NPFVOA considers Alternative 2 to be an appropriate method of closing the "loophole" and providing better data reporting. In addition, the association stresses the need to minimize delays in data analysis, whether from hail weight reports or fish tickets.

IV. Non-Retainable Groundfish Catch Limits:

NPFVOA supports Alternative 2--Provide for non-retainable catch limits that are not within the OY for groundfish species.

The North Pacific Fishing Vessel Owners' Association is concerned with any system which results in waste of resources. Potential over-harvest under the present system and the level of waste from unlimited discards concerns the membership. We, therefore, favor a system that reduces waste while effectively minimizing the potential of overfishing of valuable resources. Under Alternative 2, we believe, there exists a higher probability that high yields of groundfish can be maintained and that waste of resources be reduced without having significant negative impacts on any particular segment of the industry.

Until such time as a "new" structure is in place, the association recommends consideration of the following. Under present language of the "single species rule," the 20 per cent retained bycatch is effective "at any time." We consider a better approach is to allow a period of time (a week for example) before the 20 per cent is calculated. This will allow the fisherman time to alter his fishing to reduce the bycatch and minimize waste resulting from the present need for immediate discard of bycatch. In addition, (whether under the present system or Amendment 12) the association looks favorably on a system of retention which would allow some possession of incidentally caught high-value prohibited species.

V. Resource Assessment Document Deadline:

NPFVOA supports Alternative 2--Remove the July 1 RAD deadline.

The present July 1 deadline is simply not working. A better approach, we believe, is to eliminate the July 1 requirement and re-align the RAD deadline to more closely fit with the trawl fleet schedule and the realistic time frame for document review. We suggest also that the Council change its September meeting date to mid-October and that the RAD be presented and reviewed during an October meeting.

VI. Roe-Bearing Rock Sole/JVP Prohibition:

NPFVOA favors maintaining the status quo with increased enforcement and reporting requirements in order to generate a more complete data base upon which decisions may be made.

The association considers the roe-bearing rock sole to be a valuable resource. A decision at this time whether to support the JVP prohibition (or restrictions) appears premature. Rather, we desire to maintain the status quo for the next year to allow time to generate and analyze data on the rock sole harvests. As stated by the Plan Team, this directed fishery is quite new. Impacts of any alternative may impose unnecessary restraints if not based on sound scientific data. Thus, mandatory reporting of the rock sole as a separate species and increased enforcement of these reporting requirements are recommended for both the JVP and DAP fisheries. After attaining accurate, complete "year-end catch statistics," we can then make a proper decision based on supportable data analysis.

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The North Pacific Fishing Vessel Owners' Association is committed to support of the Council process and desires to work closely with fisheries management to attain the highest benefits for the industry while maintaining healthy resource stocks.

GREENPEACE U.S.A.

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GREENPEACE TESTIMONY BEFORE THE NORTH PACIFIC FISHERY MANAGEMENT COUNCIL ON THE PROPOSALS UNDER AMENDMENT 12 TO THE FISHERY MANAGEMENT PLAN FOR THE GROUNDFISH FISHERY OF THE BERING SEA/ALEUTIAN ISLANDS

June 22, 1988

Presented by:

Cindy Lowry, Alaska Field Representative

Alan Reichman, North Pacific Ocean Ecology Coordinator

GREENPEACE TESTIMONY TO THE NORTH PACIFIC FISHERY MANAGEMENT COUNCIL

By Cindy Lowry

Good afternoon, my name is Cindy Lowry and I am the Alaska Field Representative for Greenpeace, an international environmental organization with over 800,000 supporters in the United States, including 1,800 in Alaska. I appreciate this opportunity to provide testimony on the proposals under Amendment 12 concerning the Fisheries Management Plan for the Bering Sea/Aleutian Islands area.

Joining me today from Seattle is Alan Reichman, Greenpeace's North Pacific ocean ecology coordinator. Greenpeace has provided detailed comments on the Draft EIS on the proposal to increase the upper limit of the optimum yield range for groundfish. We wish to summarize our comments, and provide our position on other FMP amendment proposals of environmental importance.

The decision concerning whether to approve and implement an increase of the upper end of the OY range above the current 2.0 million metric ton status quo -- and increase commercial fishing -- will be crucial to the viability of the environment of the region in the future. Therefore, it was hoped that the Draft SEIS would provide complete, accurate biological and socioeconomic information, and balanced, detailed analyses of potential consequences under the three management alternatives in order to allow for prudent decision-making.

Unfortunately, however, the information provided in the Draft SEIS, as we illustrate in our comments, is woefully incomplete, the analyses are flawed, and the presentation is biased towards favoring the two alternatives (2 and 3) that would allow increased fishing.

The Draft SEIS clearly does not comply with the required standards of the National Environmental Policy Act (NEPA) for environmental impact statements.

There are several signals that the Bering Sea/Aleutian Islands marine ecosystem is under stress. Marine mammal species such as northern sea lions, northern fur seals, and harbor seals are experiencing dangerous population declines. Seabird species have experienced reproductive failure in certain areas. Stocks of Pacific ocean perch, Atka mackeral, and king crab have not recovered from severe depressions. Greenland turbot stocks have declined since initiation of management under the NPFMC and currently are severly reduced. Extensive unregulated trawling by foreign nations is occurring in the Donut Hole. The overcapitalization of the American groundfish fisheries could prompt socioeconomic pressures that could cause overharvesting of fish species. Biologists and managers are being provided with less data on which to make biological assessments, and to base management decisions, as a result of the increasing percentage of DAP harvesting and the lack of a mandatory domestic observer program.

Furthermore, an increase in fishing activity would cause an increase in incidental mortality of marine mammals, especially northern sea lions, during active trawling operations. The National Marine Fisheries service recently designated northern fur seals as depleted under the Marine Mammal Protection Act, and is now reviewing the status of northern sea lions as a result of its population decline.

Therefore, it is critical that caution be exercised in the setting of harvest levels. As a result, we support Alternative 1 to maintain the 2 million mt upper limit of the OY range. The status quo provides a safety buffer given the uncertainties and inadequacies of current knowledge about the environment, and socioeconomic uncertainties caused by overcapitalization.

In regards to other proposals under Amendment 12, Greenpeace supports the following alternatives. For (a) "bycatch controls," we support Alternative 4. For (b) "federal permit requirements" we support Alternative 2. For (c) "non-retainable groundfish catch limits," we support Alternative 2.

Thank you. My colleague will now take the stand.

By Alan Reichman

Thank you Mr. Chairman, members of the Council. With due respect to the Council and NMFS staff members assigned to prepare the document, the Draft SEIS clearly does not meet the criteria that NEPA sets for environmental impact statements. Obviously, the preperation of the Draft SEIS was rushed in an effort to meet the requirements of the Council's groundfish plan amendment cycle. However, the OY range upper limit decision is too important a matter to rush and make a charade of the NEPA process.

There are numerous inaccuracies in the document, and review and discussion of several key issues which must be considered to understand potential consequences of allowing increased fishing is not included. These neglected issues include the following:

- Observer coverage. There is no consideration as to whether a mandatory observer program would be necessary for effective management under the scenarios posed by the three alternatives.

- Discard Catch and Bleeding. The Draft SEIS neglects to provide information on the numerous reports of trawlers bleeding off tons of excess pollock and other groundfish during deliveries to processing vessels. There is no consideration of the possibility that such discard catch could increase under Alternatives 2 and 3.

- Environmental pollution resulting from fish processing wastes is totally ignored.

- Bycatch is only discussed with regard to species currently classified as prohibited. There is no consideration that the regulations which are viewed to negate any potential problems with an OY increase will be impossible to implement without mandatory observer coverage.

- The implications of illegal foreign trawling in the U.S. FCZ is not discussed. Management implications under the alternatives that would result due to foreign fishing in the Donut Hole are also not considered.

- The benthic environment is not adequately considered. This issue is only discussed with relation to crab species. The impacts of deep water trawling on the ocean bottom is entirely ignored. This flaw is highly significant in light of the fact that much of the increased fishing under Alternatives 2 and 3 would be for species such as Pacific cod, arrowtooth flounder, and other flatfish: all species harvested by bottom trawling.

- The effects of overcapitalization, and its implications for management regimes under the three alternatives, are not reviewed. Consideration of the possibility that economic pressures due to overcapitalization could stimulate political pressure against a conservative management approach is neglected.

My time to testify is too limited to go into detail on the numerous inaccuracies in the document, and all the analyses where the best case scenario is accepted while "middle-ground" and worst-case scenarios are totally avoided during review of the consequences under the alternatives. I will, however, provide three examples, and trust that our detailed comments submission will be closely read.

The document reports that, under Alternatives 2 and 3, increases in walleye pollock TAC would be insignificant. However, a lifting of the cap would actually result in increases of pollock TAC by 88,000 metric tons in 1990, and possibly more in the future. This would be greater than that for Pacific cod, and would be highly significant. This could have substantial adverse impact on marine mammals such as northern sea lions, seabirds, and the marine debris problem.

In regards to potential impacts on the rapidly declining northern sea lion population, and other marine mammal species, the discussion fails to consider that under a number of scenarios under Alternatives 2 and 3, adverse impacts could increase substantially due to incidental mortality in trawl gear; shooting, entanglement in marine debris, and prey deprivation. The marine ecosystem is far too complex to simply conclude that increased pollock catch would result in increased juvenile pollock for consumption by other species. For example, there is ample evidence that northern sea lions depend upon pollock at ages harvested by the trawl fisheries as a major food source. In general, information on and review of potential consequences that could result under the alternatives for several marine mammal species is either entirely ignored or incomplete. These species include harbor seals, ribbon seals, spotted seals, killer whales, other small cetaceans, and great whale species.

Concerning marine debris, the Draft SEIS's premise that compliance with MARPOL Annex V will "greatly reduce" the input of ship-borne debris into the marine environment is seriously flawed. The law will be extremely difficult to enforce, especially in light of budgetary limitations facing the Coast Guard. Moreover, Alaskan ports, such as Dutch Harbor and Kodiak, do not have adequate reception facilities for proper disposal of debris from vessels. As a result, the document should have included scenarios where debris generation increases with increased trawling activity.

In summary, the Draft SEIS does not meet the criteria NEPA requires for environmental impact statements. It requires considerable revision and additional as well as broader analyses before it can be considered as a scientifically valid, useful, informative, and balanced document for use in policy making.

In this era of uncertainty for the ecology of the Bering Sea and Aleutian Islands area, it is necessary for caution to be exercised. In light of the information available, the 2 million metric ton OY upper limit should be maintained as a needed safety buffer.

AGENDA D-4
SUPPLEMENTAL

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest and Alaska Fisheries Center
Resource Ecology and Fisheries
Management Division
7600 Sand Point Way Northeast
BIN C15700, Building 4
Seattle, Washington 98115-0070

June 15, 1988 F/NWC2:RN:5.19

cc: TS

Dr. Clarence Pautzke
Executive Director
North Pacific Fishery Management Council
605 West 4th Ave., P.O. Box 103136
Anchorage, AK 99501

Dear Clarence,

Terry Smith requested that we prepare a preliminary summary of data available from the 1988 joint venture rock sole fishery conducted in the Bering Sea. The attached summary provides that information and includes an estimate of the catch of rock sole taken in the fishery and a summary of other observations reported by the observers. We will be able to provide additional information, if it is requested, in the fall when we have completed the editing of all the data collected during the first quarter of this year.

Sincerely,

Richard Marasco
Division Director

Enclosures

PRELIMINARY SUMMARY OF 1988 JOINT VENTURE ROCK SOLE FISHERY IN THE EASTERN BERING SEA

A winter joint venture fishery targeting on rock sole was conducted for the first time in the eastern Bering Sea in 1988. During previous years, rock sole were primarily taken as an important secondary species in the yellowfin sole fishery. This preliminary summary will only deal with catches of rock sole taken during the target fishery for rock sole and not with the catches taken in the yellowfin sole target fishery in 1988. The catch of rock sole is currently managed as part of the group of other species of sole and flounders in the Bering Sea defined as the "other flatfish" group. As a result, catch statistics are not directly available from the rock sole fishery but have to be derived by applying the data on catch composition of the flatfish catch gathered by U.S. fisheries observers to the catches of the "other flatfish" group taken during the period that the joint venture rock sole fishery was conducted.

The data gathered by U.S. fisheries observers indicated that the rock sole fishery in 1988 was conducted from the first week of January through the end of February. During this period of time, the catch of the "other flatfish" group taken by the vessels identified as participating in this fishery was estimated to be 5,925.5 metric tons (t). We were able to identify ten foreign vessels which participated in the rock sole fishery. Some of these vessels participated in the rock sole fishery for only short periods of time (several days up to two weeks) while others participated throughout most of the period of operation of the fishery.

The data collected by observers on the species composition of the "other flatfish" catch showed that rock sole composed 96.7% of the catch in January and 93% of the catch in February. By applying these percentages to the estimated catches of "other flatfish" taken in the rock sole fishery during January and February, it is estimated that 5,825 t of rock sole were taken by the joint venture fishery targeting on rock sole in 1988. The observer data indicated that on the average, rock sole composed 44% of the total groundfish catch of vessels targeting on rock sole over the January through February period. Data on the sex and length composition of the catch showed that female rock sole averaging 34 cm in total length accounted for 41% of the catch (in numbers of fish) while male rock sole averaged 28 cm in total length and accounted for the remaining 59% of the rock sole catch.

Observers reported that the products produced from rock sole during January and February included headed and gutted female rock sole with the roe intact while male rock sole were either headed and gutted or frozen whole. Observer reports indicated that rock sole were observered in spawning condition in late February and throughout March and as a result roe was no longer retained after late February. A number of factors were cited by the vessel operators as responsible for the termination of the target fishery for rock sole in late February. Those factors were the deterioration in the quality of the roe as the fish reached spawning condition and the difficulty in limiting the bycatch of pollock to less than 20% of the catch on a consistent basis as a result of the earlier closure of the pollock fishery. There may be other factors as well, which were not made known to the observers by the operators of the vessels.

These data represent a preliminary summary of data available from the 1988 fishery. More detailed information will be available early this fall when editing of the data from the joint venture fishery conducted during the first quarter of 1988 is completed.