GOA AMENDMENT 16 SUMMARY

Establish a minimum size limit for sablefish.

Alternative 1: Do nothing (i.e., no minimum size limits).

Alternative 2: Establish a single minimum size limit for all gear (include consideration of a 22-inch limit).

Alternative 3: Establish a minimum size limit for fixed gear only (i.e., hook-and-longline and pots).

DAP priority within 100 miles of Unalaska Island.

Alternative 1: Do nothing (i.e., no area restrictions on foreign processors receiving fish from U.S. fishermen).

Alternative 2: Establish year-round area closures. Two sub-alternatives consider square approximation of a 100-mile circle centered on Unalaska Island.

Alternative 3: Establish seasonal area closures. Two sub-alternatives consider January through June closures of the 100-mile zones and the entire Bering Sea.

Alternative 4: Establish a fee structure for foreign processors who receive joint venture fish.

Revise the definition of prohibited species.

Alternative 1: Do nothing.

Alternative 2: Clarify, but not substantially alter, definition.

Improve catch recording requirements.

Alternative 1: Do nothing.

Alternative 2: Require fishing and transfer logbooks for all DAP vessels.

Alternative 3: Require the logbooks only from DAP catcher/processors and mothership/processors.

Fishing season framework.

Alternative 1: Do nothing (i.e., the setting of seasons will require a plan amendment).

Alternative 2: Establish a fishing season framework to allow the annual setting of seasons, using a more efficient notice procedure.

Expand the existing halibut PSC framework to include all traditional "prohibited species" (i.e., halibut, salmon, king and Tanner crabs).

Alternative 1: Do nothing (i.e., no bycatch limit other than for halibut can be placed on the groundfish fishery; no authority to set PSC limits on foreign fisheries; when halibut PSC limit is reached, just bottom trawl fisheries close).

Alternative 2: Establish a framework measure to control bycatches of all prohibited species. Will provide authority to set PSC limits for all traditional prohibited species on all domestic and foreign groundfish fisheries.

Update Gulf of Alaska FMP descriptive sections, reorganize chapters, and incorporate Council policy as directed.

Alternative 1: Do nothing (i.e., existing plan would remain out of date and difficult to use).

Alternative 2: Update FMP, reorganize chapters, and incorporate Council policy as directed. This alternative address includes several administrative changes, a description of rockfish management strategies, a revised list of target species, and clarification of legal gear.

M E M O R A N D U M

TO: Council, SSC, and AP members

FROM: Jim H. Branson
Executive Director

DATE: March 12, 1987

SUBJECT: Gulf of Alaska Groundfish Fishery Management Plan

ACTION REQUIRED

(1) Review 1987 pollock apportionments to DAP, JVP, and TALFF.

(2) Review and approve Amendment 16 for public review.

BACKGROUND

1987 Pollock Apportionments

The Council has been asked to review the 1987 pollock apportionment in the Western/Central Regulatory Area to DAP, JVP, and TALFF. In December, the Council set the pollock target quota at 84,000 mt apportioned as follows: DAP = 83,700 mt; JVP = 300 mt; and TALFF = 0 mt. The decision was based primarily on the NMFS industry survey conducted in November and testimony at the December meeting. It was recognized at the time that the survey results were not entirely reliable and that a reapportionment might be necessary later. The NMFS Regional Director has the authority through the FMP to reapportion fish among the various users as necessary. Bob McVey discussed this with the Council in January, suggesting that at least 10,000 mt of the earlier estimate for pollock DAP in the Central/Western area was redundant to actual need and the DAP estimate used at the December meeting should be re-evaluated.

The Council expressed some concern about the timing of any change but ultimately left the matter in Bob's hands.

Subsequent re-evaluation of the DAP requirements by Regional staff indicated there was as much as 21,900 mt available for other than DAP uses from the target quota of 84,000 mt. The Regional Director has recommended that amount, plus an appropriate reserve, be transferred from DAP to JVP (21,900 mt) with the reserve to be held for either category as needed (20% of TQ = 16,800 mt).

That action stirred up so much controversy that Under Secretary Calio has asked the Council to review the situation and provide its position on 1987 specifications for Gulf pollock [item D-2(a)].

This is the initial specification of DAP, not a reapportionment. Publication of all Gulf 1987 quotas and apportionments is pending until this decision is made.

Amendment 16

The Council reviewed amendment proposals in January and selected eight for further development and analysis. The plan team has incorporated seven of them into an Amendment 16 package that includes an Environmental Assessment (EA) and draft Regulatory Impact Review (RIR). The eighth proposal, for effort management in the sablefish fishery, will be treated as a separate amendment to be developed primarily by the affected industry (see Executive Director's Report for details).

Initial Council review of the Amendment 16 package and approval for public review is scheduled for this meeting. The package consists of a summary document and a combined EA/RIR. The summary document is provided in your notebooks as item D-2(b). The draft EA/RIR was sent to you last week in a special mailing. The amendment package contains the presentation of amendment topics and an environmental and economic analysis of the alternatives.

A 30-day public comment period is scheduled to begin on or about April 4 and end about May 4. The Council will review public comments and take final action on the amendment during its May 18-22 meeting. The amendment should be implemented by November 1987.

UNITED STATES DEPARTMENT OF COMMERCE
The Under Secretary
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

MAR 3 1987

ACTION	ROUTE TO	ANNUAL
	Exec. Dir.	3
	Deputy Dir.	
	Admin. Off.	
LC: SD	Exec. Sec.	
	Staff Asst. 1	
	Staff Asst. 2	
	Staff Asst. 3	
	[illegible]	
	Secy/Dpty.	
	Secy. Typist	

Mr. James O. Campbell
Chairman, North Pacific
Fishery Management Council
411 West Fourth Avenue
Anchorage, Alaska 99510

Dear Jim,

I have been advised of the problems relating to the allocation of Gulf of Alaska pollock between domestic and foreign processors. Bill Evans informed me that you, Jim Branson and Dick Roe discussed this issue at the recent Council Chairmen's meeting in La Parguera, Puerto Rico.

Based on the discussions at the December and January Council meetings and on the new information developed by Bob McVey, we should not proceed with a decision on the final initial specifications without a clear statement of the Council's recommendations. Will the Council please review the situation with Bob at or before the March meeting and to provide its position on 1987 specifications for Gulf pollock?

Sincerely,

Tony

Anthony J. Calio

THE ADMINISTRATOR

ALASKAN JOINT VENTURE FISHERIES, INC.
310 "K" Street
Suite 310
Anchorage, Alaska 99501
(907) 276-5342
Telex: 332471 APANC
Fax: (907) 258-0155

February 20, 1987

Dr. Robert McVey
Director, Alaska Region
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

Dear Bob:

We are writing in regard to the potential allocation by NMFS of 22,000 metric tons of pollock for JVP in the Gulf of Alaska. It is our understanding that this recommendation is strongly disliked by some domestic processors who feel that their processing efforts will be infringed upon by minimal joint venture harvesting effort by American fishermen in the Gulf. As the only company managing joint venture operations from Alaska, Alaskan Joint Venture Fisheries, Inc. fully supports the allocation so American fishermen are able to harvest a small amount of pollock that otherwise would probably not be utilized by the domestic processing sector.

In 1987, Alaskan Joint Venture Fisheries, Inc. has contracted with their foreign partners for sales of approximately 200,000 metric tons of bottomfish; 90% is pollock. Twelve U.S. catcher boats are contracted to harvest and deliver this fish to Korean and Chinese processors providing them and their crews with steady, and hopefully, year-round markets. To date, we have sold more than 40,000 metric tons of pollock in the Bering Sea providing an average gross revenue of approximately $500,000 per catcher boat. If we are able to harvest and process our 200,000 metric tons, each catcher boat should average approximately 2.5 million dollars of gross income.

As illustrated by the enclosed graph, actual DAP performance in the Gulf for 1986 was only 15% of their pre-season estimates. It was a great boost to fishing effort when approximately 10,000 metric tons were reallocated from DAP to JVP in the Western/Central Gulf after September 1, 1986. By that late in the year, it was clear that domestic processing did not have the capacity they intended to have when the 1986 requests were made.

I am not undervaluing the importance of Americanizing both the harvesting and processing sectors of the bottomfish fishery; it must be realized, however, that there are at least 60-70 American catcher boats valued at 2-4 million dollars each who could be tied up at the dock by the latter part of 1987 because of a lack of pollock for joint ventures. A few of these boats will be employed by domestic shore based plants or off shore operations. Are not the remaining fishermen with their substantial investments also an integral part of the Americanization process? What happens to them?

It is our hope that NMFS will be allowed to rely upon foresight and assist our industry in convincing the North Pacific Council that those who we know will take the fish shall be able to - and those are joint ventures in 1987.

As it reads in the Magnuson Act:

> "If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and C) carried out in such a manner that no particular individual, corporation or other entity acquires an excessive share of such privileges."

Today there is almost no other operation as efficient in their harvesting and processing capacity as joint ventures. In time, and more rapidly than some may think, domestic harvesting and processing will also be economically efficient; however, while we wait we cannot discriminate between one domestic user and another.

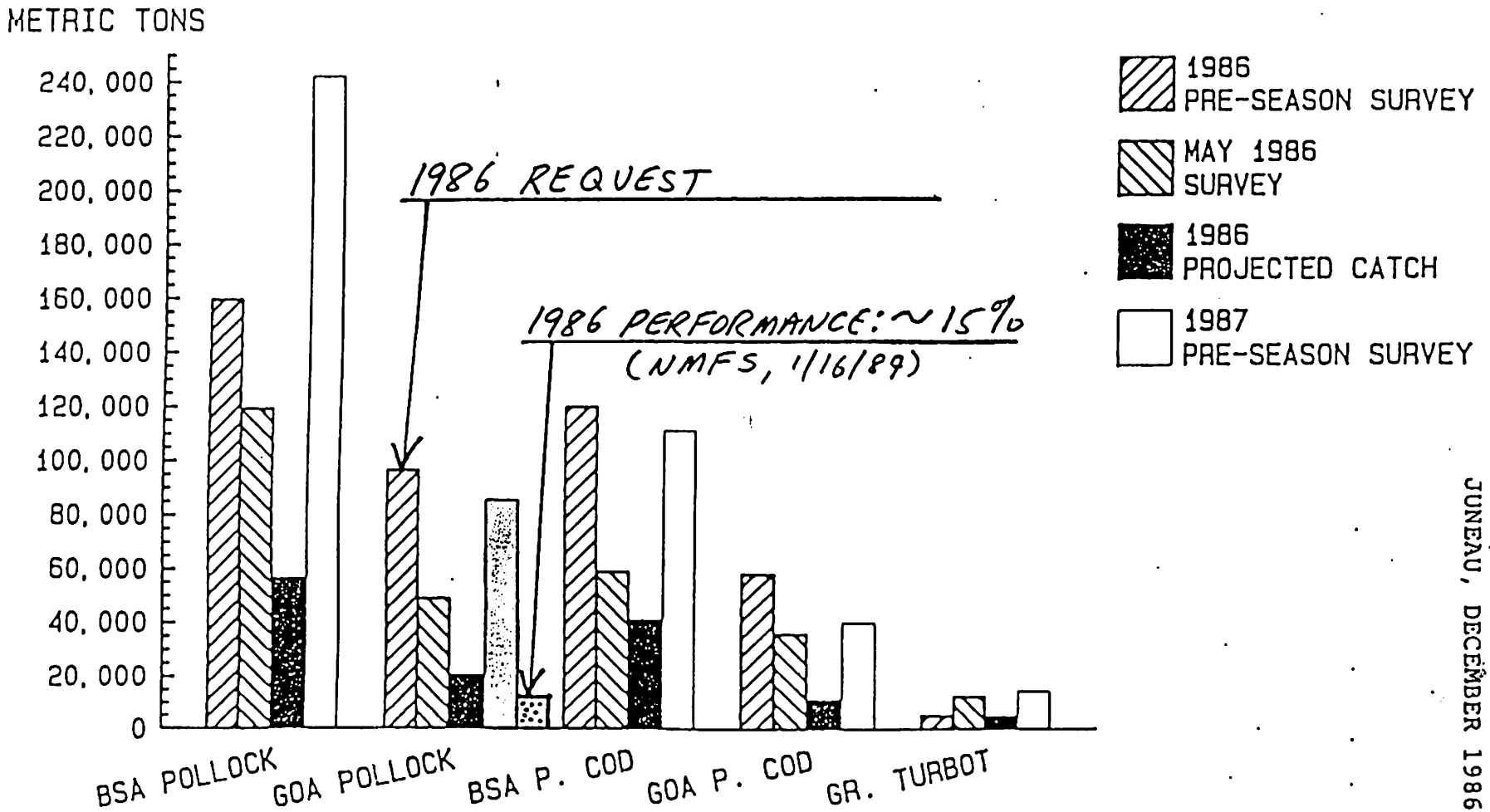
Sincerely,

Annie Burnham
President

Enclosure

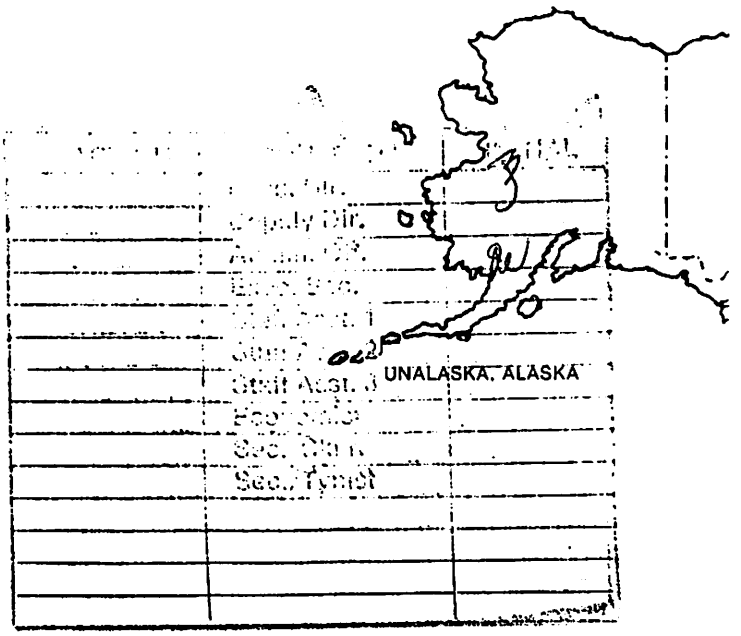
cc: Senator Ted Stevens
Senator Frank Murkowski
Congressman Don Young
Anthony J. Calio, NOAA
Jim Branson, NPFMC
Jim Campbell, NPFMC
William Evans, NMFS
Governor Steve Cowper

DOMESTIC ANNUAL PROCESSING
NMFS SURVEY RESULTS AND DAP CATCHES



AGENDA ITEM E-5
NMFS, ALASKA REGION
JUNEAU, DECEMBER 1986

CITY OF UNALASKA
P.O. BOX 89
UNALASKA, ALASKA 99685
(907) 581-1251
"Capital of the Aleutians"



MAR - 9 1987

March 3, 1987

James Campbell
c/o NPFMC
P.O. Box 103136
Anchorage, AK 99510

Dear Mr. Campbell:

We were shocked to hear that the NMFS Alaska Regional Director recently recommended overturning the Council's decision to reserve the pollock resource in Shelikoff Strait for the domestic industry. We are requesting an explanation and documentation of how the Regional Director came to his decision. We attended the last Council meeting and clearly heard him say that the Regional office would take no action until new data could be presented to the Council at the March 16 meeting.

In addition, we cannot explain why the Regional Director is one of the leading opponents of our proposal for a 100 mile Domestic Fisheries Zone around Dutch Harbor. We would expect that NMFS would provide a leadership role or at least remain neutral towards efforts to Americanize the fisheries within the FCZ. There are enough enemies of Americanization already.

I refer you to the attached letter which clearly spells out the plan of a new organization, the American High Seas Fisheries Association (AHSFA) to thwart the intent of the Magnuson Act to realize full domestic utilization of the fishery resources including processing and transportation.

In that letter we finally see a forthright statement of some of the Joint Venture operator's goal of "preservation of this method of selling our harvest." The letter strips away their pretensions of claiming that Joint Ventures are a transitional phase in the Americanization process. They want to stop this process dead in its tracks at the point where they are cut in but everyone else is cut out. And they are proposing to assess themselves $15,000.00 per boat to accomplish this.

Two of the main targets they list are the 100 mile domestic zone around Dutch harbor and reopening the Gulf of Alaska (including Shelikoff Strait) to Joint Ventures. If they can't attain their goals through defeating these proposals they will seek to accomplish them through reflagging foreign processing vessels. They state: "Without the Tenyo Maru where are we? Do we care what flag flies over the stern? Or Who owns her?"

They may not care, but we do. It is the livelihood of our coastal communities and many other Americans entitled to benefit from the fishery resources in the FCZ.

It is interesting to note that on page 2 they discuss whether they should use their Association to increase tonnages allocated to the Japanese at the expense of other countries, or to join forces with the Koreans against the Americans. The author recommends the latter.

Perhaps their most dangerous goal is the increase of total allowable catch from 2.0 million metric tons to 2.4 million metric tons to 2.4 million metric tons a year. At a time when fishermen are already expressing concern about overcapitalization of the fleet and over-exploitation of the resource, this policy could be disastrous. This idea was introduced at the last council meeting by the NMFS Alaska Regional Director. Have we learned nothing from the destruction of the fish stocks in the Gulf of Mexico and the Atlantic Ocean?

And for what? So that there can be an "increase of Pollock tonnage available for Joint Venture operations.?" What national policy could possibly be served by such a move? Not only are we losing the value of the fish to American industry by giving it to the foreign processors, but many of these fish are then imported back into the U.S. adding to our massive trade deficit, which last year in fisheries products amounted to $5.6 billion, up 14% from the year before.

This is a true moment in history which will affect our future for many years to come. Any assistance you could give to our proposals before the Council to Americanize the fishing/processing industry in the FCZ, would be very important at this time.

I hope you do not feel I have spoken too strongly in this letter. We are very concerned about the situation we see developing and it is our responsibility to safeguard the future prosperity of our communities.

Sincerely,

Paul Fuhs

Paul Fuhs
Mayor of Unalaska/Dutch Harbor
President, Southwest Alaska Municipal Conference

cc: NPFMC Members
Dr. Tony Callio
Senator Ernest Hollings
Senator Ted Stevens
Senator Frank Murkowski
Representative Don Young
Governor Steve Cowper

WESTWARD TRAWLERS, INC.

715 N.E. Northlake Way Seattle, Washington 98105 phone: 206-547-6840

16 February 1987

To: All Westward catcher-boats & their owners

From: Hugh Reilly

Re: American High Seas Fisheries Association

Enclosed you will each find copies of organizational papers and membership application for the American High Seas Fisheries Association—which is presently in formation.

The Association was conceived late last year, principally by a number of the boats fishing in the Nissui venture. The purpose is stated in the Articles of Incorporation (Article III):

> " . . . promotion of the interests of owners and operators of commercial fishing vessels that deliver fish at sea in the North Pacific Ocean and Bering Sea."

You have all doubtless gotten wind of this effort, either in Seattle recently or on the fishing grounds. A careful review of the enclosures will be somewhat illuminating; for example, in the BYLAWS:

> Article I - Members
>
> 1.1 Qualifications. Membership in the association is limited to persons who are actively engaged as vessel owners or vessel operators and who receive 75% of their revenues from deliveries of fish to Japanese processors at sea in the North Pacific Ocean and the Bering Sea.
>
> Article II - Assessments.
>
> 2.1 Assessments. The Board of Directors shall levy assessments to be charged against each member to provide necessary operating capital for the association. An annual assessment of $1.00 per metric ton of groundfish delivered by each vessel, up to a maximum of $15,000 per vessel, shall be levied againse each member.

Frank Bohannon, Wilhelm Jensen and others in the Nissui fleet can give you background on what has led to the formation of the organization; and they can give you their ideas on what the Association should try to accomplish, and perhaps how it should go about it.

. . . cont'd

cable: Westward Seattle

tlx: 326048

But it will ultimately be up to the membership and their Board of Directors to direct the Association. That process will begin at the organizational meeting of the Association in Seattle on March 9th (see enclosed Notice).

From our point of view, the Association is an unfortunate necessity for those of us (Owners, Captains, & crews) who derive our living from these joint fishing operations with the Japanese. As a group, we have a significant financial stake in the preservation of this method of selling our harvest, but our opponents are numerous . . . and increasingly effective. We now need to put up a fight to defend our interests, and it takes unity and money to win fights in fisheries politics.

Principal issues facing the membership and its Board of Directors in March will be organizational and philosophical in nature:

1) Should AHSFA work in concert with ventures with other countries (i.e. Korea) to preserve and extend the lifespan of ventures with both countries?

OR

2) Should AHSFA work to expand the tonnage of 'Japanese' boats by reducing the tonnage of other nations?

3) Should AHSFA pursue a 'high-visibility' role in the political arena (like NPFVOA, PSPA, AFTA, Alaska Draggers (ADA), etc.)?

OR

4) Should AHSFA keep overhead, staff, and "imagery" costs at a minimum, using it's substantial funds (at $15,000/boat we are talking some serious money!), atleast initially, to get things accomplished using task-specific staff (probably part-time), working with and through existing organizations (i.e. NPFVOA, ADA, JFA, etc.), scientific specialists (consultants), public relations firms, and political professionials (i.e. lawyers/lobbyists)?

Personally, I favor alternatives 1) and 4); ultimately, these questions are for the membership/Board to decide. And I would like to see development of a similar association of 'Korean' boats——with which AHSFA can collaborate on funding common needs and influencing common issues.

Some of the key issues that face our particular segement of the trawl industry, and which <u>must</u> be strongly and clearly addressed during 1987 are:

. . . cont'd

I. The 100 mile closure proposed around Dutch Harbor

II. Pollock roe-stripping operations (both Korean & Japanese)

III. Reopening the Gulf of Alaska to J/V's

IV. Reflagging of foreign processors (without the TENYO MARU, where are we? Do we care what flag flies over the stern? or who owns her?

V. The possible increase of Bering Sea/Aleutians total allowable harvest (all species) from 2.0 million tons to 2.4 million tons . . . and with that, increase of Pollock tonnage available for J/V operations.

Again, we see the Association as an unfortunate necessity, one that will require considerable commitment of our monies, our time, and our influence. We encourage all of you to give membership in the Association the most serious consideration.

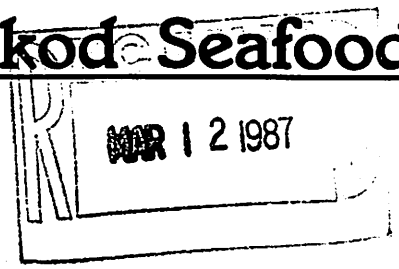
Reprentitives from each of the Westward catcher-boats should be coming home the end of the month and should be prepared to deal with this Association matter in behalf of everyone involved with each vessel.

We hope that everyone will be supporting the Association and will be represented at the organizational meeting on March 9th in Seattle. See the first four pages of the enclosed——which need to be filled out for membership.

copies to:

		also to:
CALIFORNIA HORIZON		
HALF MOON BAY		
SUNSET BAY		
MARGARET LYN	-	Dave Harville
HAZEL LORRAINE I	-	Bob Dooley
SHARON LORRAINE		
VIKING	-	Bill Lock
SEAWOLF	-	Terry Cosgrove
OCEAN DYNASTY	-	" "
WESTWARD I		
GREAT PACIFIC	-	Trefon Angasan
VAERDAL	-	Phil Werdal
		Steve Huddleston

Alkod Seafood, Inc.



ACTION	ROUTE TO	INITIAL
	Exec. Dir.	
	Deputy Dir.	
	Secretary	
	Staff Asst. 1	
	Staff Asst. 2	
	Staff Asst. 3	
	Economist	
	Secretary	
	Sec./Typist	

March 11, 1987

TO: North Pacific Fisheries Management Council

RE: J/V Shelikof Strait

Dear Sirs;

As a representitive of Alkod Seafoods, Inc. in Kodiak, Alaska, I would like to propose a Joint-Venture: shore plant operation in Shelikof Strait for Pollock utilizing a tender.

We are a new bottomfish plant that started operation about February 15, 1987. Since most of the draggers from Kodiak are either J/V fishing or fishing for other plants in Kodiak, there is a shortage of drag boats in Kodiak. One other plant in Kodiak has just opened and they have only one vessel fishing for them. They also are short of product.

At this time, the Pollock roe season in Shelikof Strait is about to peak. As I see it, the shore based plants in Kodiak are not going to be able to process anywhere near the Shelikof quota.

The vessels now fishing in Kodiak have a capacity of around 55,000 tons per year. I would like our plant to be able to work with a J/V in Shelikof Strait, with a 10,000 ton allotment; 5,000 for us and other shore-side plants, and 5,000 for the J/V. The tender operation for shore based plants would get first priority in catch from catcher boats.

We have the support of the Alaska Dragger's Assoc. and the N.P.V.O.A. (National Pacific Vessel Owner Assoc.). Your help and consideration in this matter would be greatly appreciated.

Sincerely,

Jim Baglien

Jim Baglien
Plant Manager

Seattle Address: P.O. Box C900927 • 1800 W. Emerson Pl. • Seattle, Washington 98109 • Phone: 206-284-2903, Ext. 59
Kodiak Address: P.O. Box 648 • 103 Marine Way • Kodiak, Alaska 99615
Phone: 907-486-3373 • 907-486-3883 • Fax: 907-486-8282

D R A F T

ENVIRONMENTAL ASSESSMENT/REGULATORY IMPACT REVIEW/ INITIAL REGULATORY FLEXIBILITY ANALYSIS OF AMENDMENT 16 TO THE FISHERY MANAGEMENT PLAN FOR GROUNDFISH OF THE GULF OF ALASKA

PREPARED BY THE PLAN TEAM FOR THE
GROUNDFISH FISHERY OF THE GULF OF ALASKA
AND THE STAFF OF THE
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL

MARCH 11, 1987

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1.0 INTRODUCTION

The domestic and foreign groundfish fishery in the fishery conservation zone (3-200 miles offshore) of the Gulf of Alaska is managed under the Fishery Management Plan for Groundfish of the Gulf of Alaska (FMP). The FMP was developed by the North Pacific Fishery Management Council (Council) under the Magnuson Fishery Conservation and Management Act (Magnuson Act). It was approved by the Assistant Administrator for Fisheries, NOAA, (Assistant Administrator) and implemented December 1, 1978 (43 FR 52709, November 14, 1978). Amendments 1-11 and 13-15 to the FMP have been approved by the Assistant Administrator. Amendment 12 was adopted initially by the Council at its July and December, 1982 meetings but was later rescinded by the Council at its September, 1984 meeting without having been submitted formally for Secretarial review.

At its March 18-20, 1987, meeting, the Council reviewed the status of the FMP and certain problems that have been identified, either through experience gained from nine years of fishery management or through situations unforeseen as the domestic fishery has developed. It received recommendations from the PT, the Advisory Panel (AP), and the Scientific and Statistical Committee (SSC) on alternative management measures that could be adopted, as Amendment 16 to the FMP, to resolve the problems. The Council adopted an Amendment 16 "public hearing" package for consideration by the public, the fishing industry, and management agencies that analyzes the biological, ecological, and socioeconomic effects of these management measures.

1.1 List of the Management Measures

The Council is considering seven management measures needed to resolve problems in the current management regime. These management measures are:

(1) Establish a minimum size limit for sablefish
(2) Establish DAP priority within 100 miles of Unalaska Island
(3) Revise the definition of prohibited species
(4) Implement improved catch recording requirements
(5) Implement framework procedures for setting fish seasons
(6) Establish a framework procedure for managing prohibited species
(7) Update GOA FMP description sections, reorganize chapters, and incorporate Council policy as directed

1.2 Purpose of the Public Hearing Package

1.2.1 Environmental Assessment

One part of the package is the environmental assessment (EA) that is required by the National Oceanic and Atmospheric Administration in compliance with the National Environmental Policy Act of 1969. The purpose of the EA is to analyze the impacts of major Federal actions on the quality of human environment. It serves as a means of determining if significant environmental impacts could result from a proposed action. If the action is determined not to be significant, the EA and resulting finding of no significant impact (FONSI) would be the final environmental documents required by NEPA. An EIS must be prepared if the proposed action may be reasonably expected: (1) to jeopardize the productive capability of the target resource species or any

related stocks that may be affected by the action; (2) to allow substantial damage to the ocean and coastal habitats; (3) to have a substantial adverse impact on public health or safety; (4) to affect adversely an endangered or threatened species or a marine mammal population; or (5) 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. Following the end of the public review period the Council could determine that Amendment 16 will have significant impacts on the human environment, and proceed directly with preparation of an EIS required by NEPA. This EA is prepared to analyze the possible impacts of management measures and their alternatives that are contained in Amendment 16.

Certain management measures are expected to have some impact on the environment. Such measures are those directed at harvests of stocks and may occur either directly from the actual harvests (e.g. removals of fish from the ecosystem) or indirectly as a result of harvest operations, (e.g. effects of bottom trawling on the benthos (animals and plants living on, or in, the bottom substrate). Environmental impacts of management measures may be beneficial when they accomplish their intended effects (e.g. prevention of overharvesting stocks as a result of quota management). Conversely, of course, such impacts may be harmful when management measures do not accomplish their intended effects (e.g. overharvesting occurs when quotas are incorrectly specified. The extent of the harm is dependent on the amount of risk of overfishing that has occurred. For purposes of this EA, the term "overfishing" is that, which is described in the "Guidelines to Fishery Management Plans" (48 FR 7402, February 18, 1983). It is a level of fishing mortality that jeopardizes the capacity of a stock(s) to recover to a level at which it can produce maximum biological yield or economic value on a long-term basis under prevailing biological and environmental conditions. Environmental impacts that may occur as a result of fishery management practices are categorized as changes in predator-prey relations among invertebrates and vertebrates, including marine mammals and birds, physical changes as a direct result of on-bottom fishing practices, and nutrient changes due to processing and dumping of fish wastes. If more or less groundfish biomass is removed from the ecosystem, then oscillations occur in the ecosystem until equilibrium is again achieved.

1.2.2 Regulatory Impact Review

Another part of the package is the Regulatory Impact Review (RIR) that is required by NMFS for all regulatory actions or for significant DOC/NOAA policy changes that are of public interest. The RIR (1) provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action; (2) 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; and (3) 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 way.

The RIR also serves as the basis for determining whether any proposed regulations are major under criteria provided in Executive Order 12291 (E.O. 12291) and whether or not proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with

Regulatory Flexibility Act (P.L. 96-354, 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. This Act requires that if regulatory and recordkeeping requirements are not burdensome, then the head of an agency must certify that the requirement, if promulgated, will not have a significant effect on a substantial number of small entities.

This RIR analyzes the impacts that Amendment 16 alternatives would have on the Gulf of Alaska groundfish fisheries. It also provides a description of and an estimate of the number of vessels (small entities) to which regulations implementing Amendment 16 would apply.

1.3 Description of Entities

A total of 934 vessels may fish groundfish in the Bering Sea and Gulf of Alaska in 1987 (Table 1.1). This number is based on 1987 Federal groundfish permits that have been issued to domestic vessels as of March 1, 1987. This number includes vessels that will engage in only in harvesting operations (catcher vessels), vessels that will both harvest and process their catches (catcher/processor vessels), vessels that will only process fish (mothership/processor vessels), and support vessels that will engage in transporting fishermen, fuel, groceries, and other supplies.

Table 1.1 Numbers of groundfish vessels Federally permitted to fish off Alaska in 1987 that are less than 5 net tons and 5 net tons or larger.

	Number of Occurrences	
	Less than 5 net tons	Over 5 net tons
HARVESTING ONLY	71	676
HARVESTING/PROCESSING	20	151
PROCESSING ONLY		1
SUPPORT ONLY		15
Total vessels	91	843

Of this 934 total, 843 vessels (90%) are 5 net tons or larger. Ninety-one vessels (10%) are less than 5 net tons. This analysis is limited to discussion of the larger vessels, i.e., those that are 5 net tons or larger. They are located Seattle, Sitka, Kodiak, and Dutch Harbor, and other non-Alaska and Alaska ports. Most of the vessel numbers of vessels by processing mode are shown in Table 1.2. The numbers of vessels that come from the Seattle area is 222 vessels; the number from Alaska is 393; and the number from other areas is 128.

Table 1.2 Numbers of groundfish vessels Federally permitted to fish off Alaska in 1987 from the Seattle area, Alaska, and other areas.

Mode	Number		
	Seattle Area	Alaska	Other Areas
HARVESTING ONLY	153	411	112
HARVESTING/PROCESSING	54	81	16
PROCESSING ONLY	1		
SUPPORT ONLY	14	1	
Total	222	393	128

Net tonnages of catcher vessels (harvesting only) and catcher/processor vessels (harvesting/processing) varies widely. The total net tonnage of the catcher vessels is 32,449 net tons, and the total net tonnage of the catcher/processor vessels is 12,502 net tons.

Vessels involved in harvesting only (catcher vessels) employ three types of gear: hook-and-line (longline), trawls, or pots (Table 1.3). By far, the largest number of vessels use hook-and-line gear.

Table 1.3 Numbers and statistics of groundfish vessels that are Federally permitted to fish off Alaska.

	Number	Average Net Tons	Average Length (ft)
HOOK-AND-LINE	650	32	49
POTS	12	95	95
POWER TROLL	1	15	45
TRAWL	141	145	106
TRAWL/H&L	16	81	65
TRAWL/POT	1	135	123

Most of the catcher vessels are hook-and-line vessels, which number 650. They are mostly the smallest vessels fishing groundfish, having average net tonnage capacities equal to 32 net tons and average lengths of 49 feet. In 1987, their combined net tonnage is trawl vessels number 141. Pot vessels number 12. They have average net tonnage capacities of 95 net tons. Their average length is 95 feet, tonnage is 95 net tons. Other combinations of catcher vessels exist. Sixteen trawl vessels are also equipped with hook-and-line gear and one trawl vessel also fishes with pots. One vessel using power troll gear is permitted to fish groundfish. The total net tonnage of hook-and-line vessels is 21,357 net tons; the total net tonnage of vessels using trawl gear is 22,009 net tons.

2.0 ESTABLISH A MINIMUM SIZE LIMIT FOR SABLEFISH

[THIS CHAPTER AND ANALYSIS WAS NOT COMPLETED BY THE TIME OF THIS MAILING. WORK IS CONTINUING. IT WILL EITHER BE SENT TO YOU DIRECTLY FROM THE CENTER WHEN READY, OR BROUGHT TO THE MEETING.]

3.0 ESTABLISH DAP PRIORITY WITHIN 100 MILES OF UNALASKA ISLAND

[THIS CHAPTER IS IDENTICAL TO CHAPTER 3.0 IN THE BERING SEA/ALEUTIAN ISLANDS AMENDMENT 11 EA/RIR DOCUMENT. PLEASE REFER TO THAT DOCUMENT FOR DISCUSSION AND ANALYSIS OF ALTERNATIVES.]

4.0 REVISE THE DEFINITION OF PROHIBITED SPECIES

4.1 Description of and Need for the Action

Prohibited species are not specifically defined in the current groundfish FMP for the Gulf of Alaska (GOA). Instead, the GOA groundfish FMP relies on the term "unallocated species." Section 6.4.1 defines unallocated species as "those species and species groups which must be immediately returned to the sea by vessels operating in the groundfish fishery." One problem with this definition is that it does not clearly specify these species as prohibited and issue a warning that they are to be avoided if possible. Instead, it relies on the implication that there is no allocation for these (unnamed) species so, if caught, they cannot be retained.

Another problem is that the "unallocated species" definition is not consistent with references to prohibited species elsewhere in the GOA groundfish FMP and its implementing regulations. Under section 8.3.1.1(C), prohibited species restrictions are specified simply as "in accordance with existing state and federal statutes." Separate prohibited species restrictions are specified for foreign fisheries under FMP section 8.3.2.1(B). These restrictions are more explicit about avoiding and not retaining six species groups. However, there is no explicit language that identifies unallocated species as prohibited species. It is possible to misconstrue unallocated and prohibited species as different categories of species.

A third problem is the reliance on "other applicable law" to define which species are prohibited. This presents a potential enforcement problem. For example, it may be impossible to penalize a groundfish fishermen found to be retaining incidentally caught king crab from the GOA. First, king crabs are explicitly excluded from the listing of prohibited species in the regulation (§672.20(e)(1)(i), (ii) and (iii)). Second, since there are no existing Federal regulations restricting the catch of king crabs in the GOA, the culpable vessel would have to be registered in the State of Alaska for state restrictions on king crab catches to apply. If the culpable vessel were not registered in the State of Alaska, then there would be no other existing state or federal "statutes" or regulations that would be violated with respect to retention of king crab.

In summary, the GOA groundfish FMP has flawed definitions of prohibited species. As a result, regulations implementing this FMP, pertaining to prohibited species, suffer from confusing and imprecise language that may not be legally enforceable against every vessel fishing for groundfish in the EEZ off Alaska. This is especially true for Tanner and king crab species since anticipated FMPs for these species are not now in effect. This problem extends also to other non-groundfish species for which other applicable law does not exist.

4.2 Alternatives Including the Action

4.2.1 Alternative 1: Do nothing - status quo.

Under this alternative, no changes would be made to the FMP definitions of prohibited species or to the respective implementing regulations.

4.2.2 Alternative 2: Revise the definition of prohibited species.

Under this alternative, the prohibited species definitions in the FMP would be changed to list those species or species groups which must be avoided while fishing for groundfish and, if caught incidentally, must be immediately returned to the sea with minimum injury. Listed species will include the "traditional" species of salmon, halibut, king and Tanner crabs plus other non-groundfish species. Retention of any of these species would not be allowed unless authorized by other applicable Federal law. This would allow, for example, a groundfish fishermen the option of retaining halibut caught during a bona fide open season for halibut. In addition, the definitions would provide for treating groundfish for which the TAC or TQ has been fully harvested in the same manner as prohibited species. Changes appropriately reflecting these new definitions would be made in the respective regulations implementing each FMP. Specific FMP and regulatory language for this alternative is given under parts below.

4.3 Biological and Physical Impacts

Pacific halibut, salmonids, king and Tanner crabs are often referred to as the "traditional" prohibited species because of preexisting state restrictions on taking these species outside of bona fide fisheries for them. In addition, the traditional fisheries off Alaska have largely involved these species. The Council clearly indicates in both of its groundfish FMPs its intent to protect these traditional fisheries while fostering the growth of the domestic groundfishing industry. Hence, there is a general common understanding of what species are prohibited and must not be retained if caught while fishing for groundfish.

Neither alternative would change this common understanding of prohibited species. The expected biological and physical impacts of implementing either alternative, therefore would be nil. No substantive change is expected in the behavior of the groundfish fishery under either alternative. Therefore, the amount and kind of fishing mortality imposed on groundfish and non-groundfish species will likely remain unchanged. Likewise, no significant change in the perturbations on the physical environment from fishing activity is expected under either alternative.

To the extent that enforcement of prohibited species restrictions is enhanced under Alternative 2, however, domestic groundfish fishermen may improve their ability to avoid catches of prohibited species. As such, Alternative 2 may provide for a marginal decrease in the mortality rate of prohibited species. In addition, there may be an associated decreased perturbation of the physical environment important to prohibited species due to decreased activity of fishing gear in areas of prohibited species abundance. The extent to which these improvements in the environment of prohibited species may occur is speculative at best and impossible to measure against the normal variability of factors affecting marine life in the epibenthos and water column.

4.4 Socioeconomic Impacts

Because Alternative 2, as compared to the status quo, would not significantly affect the common understanding of prohibited species, no significant change in the behavior of groundfish fishermen is expected under Alternative 2.

Hence, this alternative would not significantly affect the amount of groundfish harvested, the location timing of the fishery, nor the choice of fishing gear used. Instead, the intended and expected effect is an improvement in the ability to enforce the Council's existing and basic policy on prohibited species. Any economic impacts on the groundfish fishery from implementation of Alternative 2, therefore, would stem from an increased probability of imposing penalties for violating prohibited species regulations.

Assuming that penalties for violating prohibited species regulations has the effect of increasing conformance within the groundfish fishery, economic benefits under Alternative 2 would accrue to the legitimate users of the prohibited species, i.e. the salmon, crab and halibut fisheries, since more of these species would remain unmolested by the groundfish fishery. Whether implementation of Alternative 2 would lead to any real increases in catches in the salmon, crab and halibut fisheries is debatable and would depend on a substantial decrease in the actual number of prohibited species intercepted by the groundfish fishery. Calculating these benefits would require information on the number, size and species of prohibited species that would not be intercepted due to the threat of punitive legal action under Alternative 2 and the assumption that those species not intercepted would ultimately be caught by legal fisheries. Such information is not available.

Another potential benefit from implementing Alternative 2 is the increased potential of successfully prosecuting groundfish fishermen who violate prohibited species regulations. This benefit cannot be characterized in monetary terms unless the information described above is available and the attendant assumptions are correct. Otherwise, this benefit may be viewed more as a cost to society in terms of increased litigation and a cost to fishermen violators who would have otherwise (under the status quo) been treated with impunity.

In summary, marginal economic benefits of Alternative 2 in terms of decreased interceptions of prohibited species by the groundfish fishery are speculative at best in qualitative terms and cannot be quantitatively estimated. The principle benefit of Alternative 2, however, is the improved ability to enforce the prohibited species regulations against all vessels fishing for groundfish in the EEZ off Alaska. If it is assumed that this improved enforcement capability will result in increased conformance within the groundfish fleet, then the added administrative costs of prosecuting prohibited species violations are outweighed (in qualitative terms) by the the assumed benefit of increased avoidance of prohibited species by the groundfish fishery.

5.0 IMPROVE CATCH RECORDING REQUIREMENTS

5.1 Description of and Need for the Action

Current Federal regulations do not provide adequate authority to collect information from DAP fishermen that is necessary to account for all groundfish removals in the commercial fishery. They do not provide authority to verify at-sea the amounts of groundfish harvested and retained by U.S. catcher/processor and mothership/processor vessels. Nor do they provide adequate authority to collect information on amounts of groundfish discarded at sea or levels of effort required to catch groundfish. This information is necessary for analysis by NMFS scientists to account for total removals of groundfish by DAP fishermen and the work required to achieve those removals. These data are necessary to determine the condition of groundfish stocks. Verification of catches from U.S. catcher/processor and mothership/processor vessels is becoming especially necessary in view of the large amounts of groundfish being caught and processed by these vessels now that U.S. fisheries are replacing the once dominant foreign fleet.

Reporting requirements of foreign vessels, which dominated the groundfish fishery for the past two decades, have been in place since 1977. In recent years, the DAP fishery has emerged and the groundfish catch by U.S. vessels has overtaken the foreign fishery for the first time in 1986. The groundfish catch by U.S. fishermen has grown from about 8,600 metric tons in 1979 to over 1.4 million metric tons in 1986. Although large domestic offshore trawlers fishing in joint ventures with foreign processors are responsible for the majority of this increase, new U.S. catcher/processor and mothership/processor vessels are contributing to a rapidly growing wholly U.S. catching and processing (DAP) industry.

Ability to verify the amounts of groundfish being caught by catcher/processor and mothership/processor vessels at-sea is inadequate, which reduce the effectiveness of Federal management and enforcement of the groundfish fisheries. For example, significant amounts of groundfish may be on board a vessel in processed form, which may be misspecified in currently required weekly catch reports. Or, amounts of groundfish may be on board a vessel, which are grossly in excess of amounts reported. New U.S. business ventures are being founded that result in transfer of processed fish to foreign vessels or to U.S. cargo vessels for transhipment to U.S. ports or other countries. No means are in place to verify amounts of fish caught or amounts of fish products transferred.

The National Marine Fisheries Service proposes new record keeping requirements that that will allow for better at-sea verification of the groundfish being caught, the amount of effort required to catch groundfish, amounts of fish received by processing vessels, and fish products transferred, both in terms of species and tonnages. The record keeping requirements involve the following types of logbooks: Fishing Logbook and a Transfer Logbook.

The Fishing Logbook will include four sections:

(a) Effort Log
(b) Discard Log
(c) Daily Cumulative Product Log

The Fishing Logbook must be maintained on a trip-by-trip basis aboard DAP vessels while fishing in the EEZ off Alaska. The daily and cumulative amounts of product for each species and product type must be maintained to the nearest hundredth of a metric ton (0.01 mt = about 20 pounds) for each trip. The quantity of each fish product that is offloaded must be recorded by species , resulting in the cumulative net balance of cargo aboard the vessel. The respective purposes of the Effort Log and Discard Log in the Fishing Logbook are to provide scientists information on catches per units of effort, which is used to estimate the condition of the resource, and more complete information on total groundfish removals. The purpose of the Cumulative Product Log is to allow a federal fisheries officer to compare the cumulative amounts of fish that have been logged with the amounts of processed product that a vessel has on board.

The Transfer Log will require the date, location, quantities offloaded, name of transport vessel, and port of destination. The purpose of the Daily Transfer Log is to allow a federal fisheries officer to compare the cumulative amounts of processed fish that have been logged and transferred with the amounts of processed product that a vessel has on board.

Information obtained from effort and discard logs will be integrated into a database for fisheries analyses. A program will be established that will require the submission of logbooks on a periodic basis specified by regulations to the National Marine Fishery Service.

5.2 Alternatives Including the Action

Three alternatives are considered, including doing nothing, i.e., the status quo. Alternatives 2 and 3 are directed at vessels that are 5 net tons or larger.

5.2.1 Alternative 1: Do nothing - status quo. Do not require the Fishing Logbook and the Transfer Logbook.

5.2.2 Alternative 2: Apply new catch recording requirements on DAP vessels. Catch recording will require a Fishing Logbook and a Transfer Logbook as follows:

Catcher boats - maintain the Effort Log part of the Fishing Logbook; maintain the Discard Log part of the Fishing Logbook, unless delivering to a catcher/processor or mothership/ processor vessel.

Catcher/processors & mothership processors - maintain the Fishing Logbook and Transfer Logbook.

5.2.3 Alternative 3: Apply new catch recording requirements to catcher/ processor and mothership/processor vessels. Catch recording will require a Fishing Logbook and a Transfer Logbook.

Catcher/processors & mothership processors - maintain the Fishing Logbook and Transfer Logbook. The Fishing Logbook will require an Effort Log, a Discard Log, and a Daily Accumulative Product Log.

5.3 Biological and Physical Impacts

5.3.1 Alternative 1: Do nothing - status quo.

This alternative is the least favorable of the alternatives, because it would do the least for accounting for amounts of groundfish that are removed from the ecosystem. Improved accounting of amounts of groundfish that are removed from the ecosystem is necessary to lessen the risk of overharvesting the groundfish stocks. Under Alternative 1, environmental impacts that might occur as a result of overharvesting groundfish stocks are categorized as changes in predator-prey relations among invertebrates and vertebrates, including marine mammals and birds, physical changes as a direct result of on-bottom fishing practices, and nutrient changes due to processing and dumping of fish wastes.

Harvests of groundfish remove predator species that would otherwise have consumed other marine life. All of the groundfish species are predators. Sablefish is a good example of a groundfish predator. Sablefish consume small pollock, herring, and capelin during the day and deep sea fish, including grenadiers (family Macrouridae) and viperfish (family Chauliodontidae), and bottom dwelling invertebrates during night. Other fish in their diet include Pacific cod, sculpins, small flounders, rockfish, and small sablefish. Whatever amounts of these prey species would have been consumed by predator sablefish had they not been caught, will now be available to other predators.

Harvesting less sablefish results in more sablefish fish being left in the ecosystem to consume more prey. More sablefish would also provide more biomass for other predators (including marine mammals and birds) in the system. Less fish offal (fish waste material) would be discharged into the system by floating and/or shorebased processors. Less nutrients from fish waste material would be available for animal life that otherwise would have consumed it. Harvesting more sablefish would result in less fish being left in the ecosystem; thus, fewer prey species would be consumed by sablefish, and less sablefish biomass would be available for other predators. More nutrients from fish waste material would be discharged by floating and/or shorebased processors. More nutrients from fish waste material would be available for animal life that feeds on such material.

Other naturally occurring factors, however, such as (1) subtle physical changes in ocean chemistry, temperature, and weather conditions, and (2) biological changes in animal populations as a result of physical changes, disease, and intra- and inter-specific competition, could well mask the direct effects of any management practice.

5.3.2 Alternative 2: Apply new catch recording requirements on DAP vessels. Catch recording will require a Fishing Logbook and a Transfer Logbook.

This alternative is superior to the others considered, because it would provide data needed for determining the status of stocks through collection of information on effort and discards. It would promote enforcement of catch reporting through collection of information on amounts of groundfish that have been offloaded, thereby promoting credible information on total fish removals.

Therefore, Alternative 2 would best prevent overharvesting fish stocks and thus reduce the risk of overfishing.

5.3.3 Alternative 3: Apply new catch recording requirements to catcher/processor and mothership/processor vessels only. Catch recording will require a Fishing Logbook and a Transfer Logbook.

This alternative would provide lesser amounts of data needed for determining the status of stocks, because it would only apply to catcher/processor and mothership/processor vessels and not to vessels that just catch groundfish. To the extent that fisheries may be mismanaged as a result of insufficient data with possible overharvesting as a result, Alternative 3 is inferior to Alternative 2.

5.4 Socioeconomic Impacts

Under Alternative 1 (status quo), no changes in reporting costs incurred by fishermen or floating processors would occur. No additional administrative, enforcement, or information costs would occur. However, the need for credible information on total groundfish removals would still exist. Other means, such as increased agency vessel research time would be sought, but in view of recent budget constraints, not obtained.

Under Alternative 2, costs that would be incurred by fishermen are those that are associated with completing the Fishing Logbook and Transfer Logbook. Again, this requirement is only for vessels that are 5 net tons or larger. Based on the NMFS database on groundfish permits issued for 1987, there are 676 catcher vessels and 151 catcher/processor vessels, which is a total of 827 vessels that would complete the effort part of the Fishing Log. There is one mothership/processor vessel, which, with the catcher vessels and catcher/processor vessels, results in 828 vessels that would complete the discard log part of the Fishing Log; 152 catcher/processor and mothership/processor vessels would complete the Transfer Logbook if each were to transfer processed product to a cargo vessels.

Costs to respondents (vessels operators or owners) of complying with this information collection requirement are those resulting from having to fill out the logbooks. These costs are derived by estimating the total fleet vessel-days during a year for which records might be required, mulitplying vessel-days by the number of minutes each respondent might spend in filling out a log, and then dividing by 60 minutes to obtain the total number of hours per year that might be spent by DAP fishermen as a result of maintaining these logbooks. NMFS estimates that an average of about 15 minutes and 30 minutes per day would be required for catcher vessels and catcher/processor vessels, respectively, to complete the Effort Log. About 10 minutes per day would be required to complete the Discard Log. About 30 minutes per day would be required to complete the Product Log. About 10 minutes per day would be required to complete the Transfer Logbook. Costs across the fleet to comply with these new requirements are estimated as follows:

Effort log - If catcher vessels spend about 20 days each month for three months, then 676 catcher vessels were to spend 40,560 vessel-days. Completing effort logs, at 15 minutes per log per day would require 10,140 hours per year. If catcher/processor vessels spend 20 days each for six months, then

151 catcher/processor vessels will spend 18,120 vessels-days per year. Completing effort logs by this class of vessels at 30 minutes per log would require 9,060 hours per year. Thus, the total costs on DAP vessels to complete the effort log is about 19,200 hours per year.

Discard log - If 152 vessels that process their catch were to spend 20 days each for six months, then these vessels would spend 18,240 vessel-days per year. Completing discard logs by this class of vessels at 10 minutes per log per day would require 1,824 hours per year. Thus, the total costs on DAP vessels to complete the discard log is about 3,040 hours per year.

Product log - If 152 vessels that process catch were to complete the product log per 20 days for each of six months, then these vessels would also spend 18,240 vessels-days per year.

Transfer Logbook - If 152 vessels that process catch were to transfer that catch at the rate of once every two weeks (bi-monthly) for six months, then these vessels would make a total of 1,824 transfers. Completing transfer logs at 10 minutes per log would require 304 hours.

The amount of time to complete these logbooks is not necessarily an added cost to fishermen. The respondents likely keep these records anyway. Alternative 2 may actually provide a benefit to fishermen by supplying the logbooks that they would use.

Under Alternative 2, certain costs would be incurred by resource agencies in administering and enforcing the data collection program. NMFS estimates that the amount of time to board and inspect a catcher vessel and/or catcher/processor and mothership/processor vessels, including their logbooks is about one hour and two hours, respectively. If 5% of the 676 vessels were boarded and inspected, about 34 hours would be required to inspect 34 vessels. If 50% of the 152 catcher/processor and mothership/processor vessels were boarded and inspected, then about 152 hours would also be required to inspect 74 vessels. Costs are those included in utilizing support platforms, e.g. U.S. Coast Guard vessels. No additional costs, however, are borne by agencies. Enforcement personnel are already hired to support the conservation and management roles of the National Marine Fisheries Service. U.S. Coast Guard vessels are in place to carry out search-and-rescue missions off Alaska.

Depending on the type of program instituted for obtaining and analyzing logbook information, certain costs would also be incurred by the National Marine Fisheries Service. These costs would be those associated with those analyses. However, such programs would likely be less expensive than establishing a program to gather and analyze data on the status of groundfish stocks. The relative value of data from commercial fisheries compared to that obtained from NMFS programs would depend on the types of programs that were established.

Under Alternative 3, costs that would be incurred by catcher/processor and mothership/processor vessels are those that are associated with completing the Fishing Logbook and Transfer Logbook. Based on the NMFS database on groundfish permits issued for 1987, there are 151 catcher/processor vessels and one mothership/processor vessel, or 152 vessels that could complete the logbooks. Costs to respondents of complying with this information collection

requirement are summarized above under alternative 2. Costs for the catcher/processor and mothership/processor fleet to comply with these new requirements are estimated as follows:

Effort log - If catcher/processor vessels were to spend 20 days each for six months, then 151 catcher/processor vessels would spend 18,120 vessels-days per year. Completing effort logs by this class of vessels at 30 minutes per log would require 9,060 hours per year.

Discard and product logs and Transfer logbook - Costs are the same as under Alternative 2.

Under Alternative 3, certain costs would be incurred by resource agencies in administering and enforcing the data collection program. NMFS estimates that the amount of time to board and inspect catcher/processor and mothership/processor vessels, including their logbooks is about two hours. If 50% of the 152 catcher/processor and mothership/processor vessels were boarded and inspected, then about 152 hours would be required to inspect 74 vessels. Costs are those included in utilizing support platforms, e.g. U.S. Coast Guard vessels. No additional costs, however, are borne by agencies. Enforcement personnel are already hired to support the conservation and management roles of the National Marine Fisheries Service. U.S. Coast Guard vessels are in place to carry out search-and-rescue missions off Alaska. As discussed for Alternative 2, certain costs associated with analyses of data from logbooks also be incurred by the National Marine Fisheries Service, and the relative value of data from commercial fisheries compared to that obtained from NMFS programs would depend on the types of programs that were established.

6.0 FISHING SEASON FRAMEWORK

6.1 Description of and Need for the Action

Fishing season(s) is defined as the period when harvesting a fishery resource is permitted. Fishing seasons will usually be within a calendar year for statistical purposes. However, it is recognized that there may be occasions where the management of fisheries require seasons which extend into the next calendar year. Currently, fishing season opening and closing dates are specified in the plan and require a plan amendment to change. This procedure had been satisfactory for management since the season matched the calendar year and there were few reasons for fisheries to be scheduled for a particular time. However, in 1985 the fishing industry requested and the Council approved an April 1 opening for the sablefish pot and hook and longline fisheries primarily for weather and vessel safety reasons. Because of the lengthy plan amendment process, this season was not put into effect until 1986. In that same year, fishermen participating in the Shelikof Strait pollock roe fishery were disappointed with the product quality and yield. Due to a small quota and intense competition, fishermen were reluctant to wait for the optimal time to conduct their fishery. A request from the industry for a specified pollock roe season is likely. Also beginning in 1986, the Council initiated an exploratory pollock fishery to take place outside Shelikof Strait during a specified time period. This "special season" has been implemented by placing conditions on joint venture permits. There has also been informal discussion of managing the sablefish fishery in a similar fashion as the halibut fishery, where a series of short seasons are used to spread the catch. A series of seasons would also help prevent exceeding existing processing capacity, and provide time to calculate sablefish catch-to-date statistics. Given these examples and anticipating that the Council will be faced with an increasing number of season requests, a framework procedure is believed desirable to enable the Council to efficiently respond to season proposals.

6.2 Alternatives Including the Action

6.2.1 Alternative 1: Do nothing - status quo.

Retention of the status quo would continue the problems and weaknesses of the plan as described in the above description of need. The plan specifies the groundfish fishing season as beginning on January 1 and ending on December 31 unless closed following the attainment of the OY for all groundfish fisheries except sablefish. For sablefish, the pot and hook and longline fishery begins on April 1. Sablefish fishing using trawl gear begins on January 1. Adjustment of these dates prior to the season requires a plan amendment that may take 11 months or longer to implement.

6.2.2 Alternative 2: Establish a framework procedure for the annual setting of fishing seasons for any of the managed groundfish species (Date specific only).

A framework procedure has been developed that would allow the Council to adjust fishing seasons on an annual basis following a review of public proposals. Proposals received by the Council will be evaluated based on their achievement of biological and socioeconomic criteria prior to the year that

they would go into effect. Some of the criteria or factors the Council may consider in recommending fishing seasons are:

- Biological risks: Spawning periods, migration, and other information, thereby, minimizing the biological risk to the groundfish resource.

- Product quality: Producing the highest quality product to the consumer.

- Safety: Seasons scheduled to avoid severe weather conditions, and therefore, minimize loss of men, vessels, fishing time, and equipment.

- Cost: Costs of industry operations are affected by the timing of seasons.

- Other fisheries: That will be making demands on the same harvesting, processing, and transportation systems needed in the groundfish fishery.

- Coordinated season timing: The need to spread fishing effort, minimize gear conflicts, and allow participation by all elements of the groundfish fleet.

- Enforcement and management costs: The costs of enforcement and management as affected by the timing and area of different groundfish seasons and as affected by seasons for other resources.

Following a review of the fishing season proposals, the Council may approve or disapprove one or more proposals depending on whether the proposed season change provides significant advantages over the designated fishing season it is intended to replace. Approved season dates will be specified by regulation and implemented by a rule-related notice procedure. Different seasons may be established for wholly domestic, joint venture, and foreign fisheries or for subdivisions of these fisheries.

6.4 Biological and Physical Impacts

Under the status quo alternative seasons can be set by plan amendment only, a process that can take about a year unless the change is made by emergency regulation under Section 305(e) of the MFCMA, in which case about four months is needed. Hence, the problem is administrative. Assuming that the same amount of groundfish would be harvested under the current seasons as under seasons modified by plan amendment, emergency rule, or by the framework procedure, no significant impacts on groundfish stocks or the environment should occur. Under the status quo some stocks could be underharvested because established seasons were too short to provide adequate time to harvest the available resource. A framework procedure for setting fishing seasons by an administratively efficient mechanism is superior to the status quo.

6.5 Socioeconomic Impacts

Fishery costs and benefits

The principal advantage for this framework measure is to provide administrative flexibility in establishing fishing seasons. The difference between Alternatives 1 and 2 is the length of time it takes to implement approved

season dates. Under the status quo, a plan amendment may take as long as 11 months to develop and implement. Alternative 2 would allow for implementation within 4 months. The framework gives latitude to decision makers in responding to changing resource or market conditions.

Except for the sablefish and pollock roe fisheries, there is not an immediate need for the flexibility to change seasons in the Gulf of Alaska. As effort has increased in the sablefish fishery, seasons have become extremely short, especially in the Eastern Gulf. The increased effort and short season has led to considerable problems in processing and transporting the catch, maintaining high product quality, and preventing the overharvest of quotas. However, if other groundfish fisheries follow this pattern (for example pollock and cod) large amounts of fish could be landed in a short period of time and stress the processing sector even further. The ability to change the timing of the season in a efficient manner in response to rapidly increasing effort is an advantage that Alternative 2 possesses over the status quo. This could take the form of brief serial openings spread throughout the year. A similar rationale is used in managing the Pacific halibut fishery. In the pollock roe fishery, separate joint venture seasons have been required to allow domestic harvesters and processors to take more fish in Shelikof Strait and encourage joint venture exploration for other pollock concentrations elsewhere, thus utilizing both capital and fisheries resources more effectively.

Other advantages become clear upon review of the framework criteria used in evaluating season date proposals. For example, if new biological information were to arise that suggested a sensitive time period for reproduction, the Council could schedule a fishing season (citing the biological risk factor) around this period so that commercial fishing would not interfere with reproduction. Similarly, the timing of seasons can alter product quality. A determinant of product quality is the ability to take proper care of the fish once landed. This is a function, among other things, of the volume of landings processed at that time. If effort increases to the point that many species are landed during a short period of time, processors may not be able to maintain a high quality product (a problem experienced in the halibut and sablefish fisheries) and both economic inefficiency and resource wastage may occur. Seasons could be set via framework (citing the product quality and season coordination criteria) so as to distribute landings more evenly throughout the year. This would tend to more optimally employ processing capacity and enhance the quality and availability of product to the consumer. Since the framework is a preseason tool, data from previous years would need to be used in setting the season dates.

Costs of industry operations are affected by the timing of seasons. Operating during periods of bad weather increases costs due to down time and injury, lost gear, and increased insurance premiums. Scheduling seasons with weather and costs as factors is desirable. Variations in demand for seafood products can fluctuate during the year due to seasonal, cultural and religious influences in markets. Scheduling seasons to more precisely meet expected market requirements could benefit harvesters, processors, and consumers.

Reporting costs

The framework alternative would not alter the reporting costs of the harvesting and processing sectors.

Administrative, enforcement and information costs and benefits

The adoption of Alternative 2 would lower management costs by eliminating the need for plan amendments to change season dates. Given that Council and NMFS staff costs will be reduced under Alternative 2, it is estimated that the savings will be approximately $10,000 to $20,000 per season adjustment. This figure was derived by calculating staff time required to prepare and implement a plan amendment, as compared to the development and analysis of season adjustment using the notice procedure described in the above framework. There would be no change from the status quo with regard to enforcement and reporting costs.

Impacts on consumers

If effort were to increase to the point where product quality diminishes, timely changes in the fishery dates may provide the consumer with a higher quality product.

Redistribution of costs and benefits

This measure is simply one of regulatory efficiency. These benefits would be shared by all participants in the fishery.

Certain aspects of Alternative 2, such as adjusting openings to account for severe weather conditions, could result in some redistribution of revenues from the larger, more seaworthy vessels that can effectively operate in heavy seas, to the smaller vessel fleet which would have otherwise been excluded from participation by virtue of weather. However, all operators should benefit from reduced risk and strain on vessels, gear and crews, under these circumstances. More efficient management should free policy makers and research personnel for assignment to higher priority management issues.

Benefit-Cost conclusion

One of the major criticisms of current fishery management policy making is that managers are often in a reactive mode, forced to react to one crisis after another and not anticipate potential problems in the fisheries. This imposes significant costs on fishermen, processors, consumers, and the American public. Alternative 2 is in preparation for large influxes of effort in the groundfish fisheries, which can only increase the burden on the resource and all those who use and/or are responsible for management of it. This has already occurred in the sablefish fishery. Fisheries that currently possess large amounts of effort and confront excess harvesting capacity and processing capacity constraints, such as crab and halibut fisheries, have this type of flexibility in setting seasons.

The majority of benefits of Alternative 2 would be from increased efficiency in setting seasons which would allow for increased benefits ranging from higher product quality, more efficient use of harvesting and processing capital, and greater product availability for the consumer, to reduced physical and economic risk, less wastage of the resource, and diminished operating costs for the industry. The removal of the need for plan amendment

will also decrease administrative costs. While regulations would be the same as under the plan amendment process, they would be less expensive to implement, thus reducing the burden on the taxpayer.

The only perceived costs associated with the proposed amendment might involve some minor redistribution of total catch, and therefore gross revenues, among the large and small vessel segments of the harvesting sector. The magnitude of this redistribution cannot be quantified a priori. However, these costs, if they in fact materialize, would most probably be insignificant when compared with the benefits accruing from adoption of Alternative 2.

7.0 ESTABLISH A FRAMEWORK MANAGEMENT MEASURE TO CONTROL BYCATCHES OF ALL PROHIBITED SPECIES

7.1 Description of and Need for the Action

Trawl, hook-and-longline, and pot fisheries are basically non-selective harvesting technologies; i.e. the species composition of the catch is diverse, including targeted species and unavoidable bycatch species.[1/] Historically, the major bycatch concern addressed by the Council has been the bycatch of halibut, salmon, and crab with the emphasis on halibut. Retention of these high valued species is prohibited in all commercial groundfish fisheries. King and Tanner crab, and salmon fisheries are managed under FMPs while the halibut fishery is managed under the North Pacific Halibut Act.

Through 1985, gear restrictions, time/area closures, halibut bycatch limits for domestic vessels, and reduced OYs for Pacific cod and flounders were used to limit bycatch, particularly that of halibut. These measures were implemented by permit conditions, emergency rules, and plan amendments. Amendment 14, approved by the Secretary in November 1985, established a framework procedure for setting and adjusting prohibited species catch limits (PSCs) to control the bycatch of halibut in all commercial groundfish fisheries without requiring a formal amendment. This measure authorizes the Council to make an annual determination of the need and scope of the regulation. It also provides an approved procedure of implementing the PSCs in a timely manner.

Although the regulations that implemented this framework excluded foreign fisheries, and lack of an adequate observer program for wholly domestic fisheries reduces the effectiveness of the controls, the framework in general does appear to provide an efficient mechanism for setting and adjusting measures to control halibut bycatch in response to changing conditions in the fisheries.

This framework needs to be expanded to include all traditional "prohibited species" and have regulations rewritten to allow the setting of PSCs on foreign and domestic fisheries, with limits specified by gear, time, and area if necessary. Recently managers have also discovered that bycatch rates and associated bycatch mortality can vary more than expected. The current regulations prohibit further fishing with bottom trawl gear when PSC limits are reached. However, other gear(s) may also contribute to the bycatch with no specific control. Another problem became apparent in 1984 and again in 1986, when large bycatches of salmon were caught incidentally by joint venture trawl operations targeting on pollock in the Central Gulf area.

Bycatches of salmon, a traditional prohibited species, unaffected by Amendment 14, could have an adverse impact on salmon stocks, the fisheries they support, and current management efforts to rebuild this resource if continued to remain unchecked. Also in 1986, the Council adopted a three year bottom trawl time/area closure scheme around Kodiak Island for purposes of

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1/ For purposes of this section, the term bycatch or incidental catch is defined as the incidental capture of non-targeted species.

protecting king crab stocks. It is believed that protecting areas of high crab concentrations and better management of king and Tanner crab bycatch may lead to positive benefits in terms of rebuilding these resources.

7.2 Alternatives Including the Proposed Action

7.2.1 Alternative 1: Do nothing - status quo.

Adoption of this alternative would continue the problems described in the statement of need. Incidental catch of salmon or king and Tanner crab would have to be addressed by voluntary, emergency or amendment procedures. This alternative would not assure a timely response to a salmon or crab bycatch problem. Bycatches, if allowed to occur unchecked could lead to significant biological and socioeconomic impacts.

Under the status quo, only halibut bycatch will be controlled by the plan. The plan's framework procedure has been successfully used for two years in determining the appropriate halibut PSC limits for the groundfish fishery. Weaknesses in the original framework which have been described above (lack of controls over foreign bycatch, limitations with respect to gear, and inability to efficiently control salmon and crab bycatch), would continue. The advantages of the framework with regard to halibut bycatch would also continue.

The framework measure and implementing regulations describe how this management tool operates. An example of the framework measure is provided below:

The bycatch framework procedure formally begins in September of each year. This is the time when the Council annually reviews the preliminary results of the groundfish surveys, catch-to-date statistics, and initial Resource Assessment Document(RAD) prepared by the plan team. This is also the time that the Council, based on the above information, determines initial quotas and its estimated apportionment to domestic (DAP), joint venture (JVP), and foreign (TALFF) users for the upcoming year. These initial figures are then released for a minimum 45-day public review. Final decisions on the next year's quotas and apportionment figures are made in early December following public comment, finalization of the RAD, updated survey and catch figures, and a NMFS survey of the fishing industry to learn what their plans and requirements will be in terms of the resource. Final decisions on groundfish quotas and apportionments are then implemented using a rule-related notice procedure.

The RAD published in September and later finalized prior to the December Council meeting, contains chapters on the status of groundfish stocks, plan team recommendations on acceptable biological catch levels, and bycatch information for use in the framework. Specifically, it contains the following information for use with the bycatch framework:

(a) Estimated change in biomass and stock condition of each bycatch species.
(b) Potential impact on bycatch species stocks.
(c) Potential impacts on target fisheries for the bycatch species.

(d) Estimated bycatch in years prior to that for which PSCs are being set.
(e) Expected change in target groundfish catch.
(f) Estimated change in target groundfish biomass.
(g) Methods available to reduce bycatch.
(h) The cost of reducing bycatch.
(i) Other biological and socioeconomic factors that affect the appropriateness of specific bycatch measures in terms of FMP objectives. The RAD also provides bycatch rate information and bycatch mortality information as shown in Tables 7.1 and 7.2, respectively.

This information is used by the Council during its September meeting to estimate halibut bycatch and mortality and to determine an acceptable bycatch mortality goal. The estimates are calculated following the initial determination of groundfish quotas and apportionments to the three user groups. The bycatch data is applied to the specified apportionment figure along with estimated gear shares and species mix in the target fishery. The resulting estimate of halibut bycatch and mortality is made a part of the quota review package that is submitted for a 45-day public review.

In December, following public review, a final RAD is presented to the Council with the team's final recommendations on bycatch and mortality rates. Following Council review of the RAD and the setting of quotas and apportionments, the Council uses this and other relevant information in estimating halibut bycatch and its effect on the halibut resource and directed fishery. The Council may make adjustments to the quotas or apportionments to produce a bycatch result within acceptable limits. For the 1987 groundfish fishery, the Council discovered that following its setting of quotas and apportionments, few additional adjustments were necessary since the estimated halibut bycatch resulting from the groundfish fishery was found to be within acceptable limits. The estimates of halibut bycatch (DAP bycatch = 3,000 mt; JVP bycatch = 47 mt) were therefore used as the 1987 PSCs.

7.2.2 Alternative 2: Expand the existing halibut bycatch framework to include salmon and crab. Revise regulations to allow full use of the framework with regard to gear and area or parts thereof.

Since the halibut bycatch control framework was approved by the Council, the need for a similar framework for other species has been demonstrated by actions the Council has taken to control bycatch of king crab near Kodiak Island and by the concern over salmon bycatch in trawl fisheries. Measures to control the bycatch of traditional prohibited species other than halibut can only be established and adjusted through the emergency rule and amendment processes. In 1984 the incidental catch of salmon in the joint venture pollock fishery was exceptionally high. Under current management, salmon are defined as a prohibited species, and therefore discarded when caught, but no ceiling on the bycatch exists. To implement a bycatch ceiling the Council was faced with either amending the FMP, adopting emergency regulations, or accepting voluntary agreements from the industry. The Council chose the voluntary agreement approach. However, salmon bycatch in the pollock fishery again surfaced as a problem in 1986 and will likely continue as an issue whenever trawling for pollock occurs. Also in 1986, the Council identified several areas around Kodiak Island for closure to bottom trawling. The

Table 7.1 Projected 1987 halibut bycatch rates as estimated from historical joint venture and foreign fishing operations.

Gear Type		Area		
		Western	Central	Eastern
Bottom trawl				
	DAP	2.53%	2.53%	2.53%
	JVP	2.53%	2.53%	2.53%
	TALFF	2.53%	2.53%	2.53%
Mid-water trawl				
	DAP	0.06%	0.06%	0.06%
	JVP	0.06%	0.06%	0.06%
	TALFF	0.06%	0.06%	0.06%
Cod longline				
	DAP	5.23%	9.15%	9.15%
	JVP	5.23%	9.15%	9.15%
	TALFF	1.49%	4.97%	4.97%
Sablefish longline				
	DAP	1.20%	1.20%	1.20%

Source: NMFS Foreign Observer Program

Table 7.2 Halibut mortality rates used in 1987 estimation of mortality.

User	Gear Type	
	Trawl	Longline
DAP	50%	25%
JVP	100%	25%
TALFF	100%	25%

Source: International Pacific Halibut Commission

purpose of this temporary measure was to protect king crab which are in poor condition. A plan amendment and an emergency rule were used to implement the closure scheme. Had an expanded bycatch framework existed in the FMP the Council could have addressed both the salmon and crab problems by setting bycatch limits on groundfish operations by regulatory area, or parts thereof. Given the likelihood that bycatch limits will again be necessary to control the incidental catch of salmon and crab in the groundfish fisheries, and that a domestic observer program will likely be initiated in the near future, the expanded framework is believed extremely useful for management of these resources.

This alternative authorizes the use of PSC limits to control the bycatch of halibut, salmon, and king and Tanner crab in the groundfish fisheries of the Gulf of Alaska. The same procedure for setting limits as currently followed for halibut alone will be used. PSC limits may be specified by fishery, gear, time, regulatory area, or parts thereof. Separate PSCs will be specified for the domestic fishery, joint venture fishery and foreign fishery. A PSC may be defined in terms of bycatch weight, numbers of individuals, or potential value, and each may measure catch or estimated mortality.

A PSC limit may be set for a single species or species category; may be set equal to zero for an area and time period to create a time/area closure; or may be set equal to zero for a specific gear type to restrict the use of that gear. Short-term restrictions may be implemented by the framework, but long-term or permanent closures are to be implemented by plan amendment. Bycatch measures will be determined annually, if necessary, by the Regional Director of NMFS-AK in consultation with the Council. Prior to the Regional Director's determination, the Council will make recommendations to him for each fishery and area based on the best available information concerning the affected stocks and fisheries. The Regional Director will make these recommendations and supporting information available to the public for comment. If the Council does not make recommendations by December 15, the bycatch measures already established shall automatically constitute the Council's recommendations to the Regional Director.

By the end of the preceding fishing year, the Regional Director will determine:

(a) The areas, or parts there of, and species for which PSCs will be established.
(b) The number of PSCs per area, fishery, and gear.
(c) The level of each PSC.
(d) The time period for each PSC.
(e) Whether PSCs will be allocated to individual operation.
(f) The methods of allocation to be used.
(g) The types of gear or modes of operation to be prohibited once a (or its) PSC limit is reached.

The Regional Director may change the bycatch measures during the year for which they were set if, as new information becomes available, it is apparent to him that his initial determination has become inappropriate with respect to meeting FMP objectives. The Council may recommend such inseason changes based on new information.

The Council's recommendations on bycatch measures will be based on the following criteria:

(a) Estimated change in biomass and stock condition of each bycatch species.
(b) Potential impact on bycatch species stocks.
(c) Potential impacts on target fisheries for the bycatch species.
(d) Estimated bycatch in years prior to that for which PSCs are being set.
(e) Expected change in target groundfish catch.
(f) Estimated change in target groundfish biomass.
(g) Methods available to reduce bycatch.
(h) The cost of reducing bycatch.
(i) Other biological and socioeconomic factors that affect the appropriateness of specific bycatch measures in terms of FMP objectives.

The Regional Director, after consulting with the Council, will implement the bycatch measures by the most expeditious procedures available.

7.4 Environmental Impacts of the Alternatives

7.4.1 Alternative 1: Do nothing - status quo.

The FMP and implementing regulations provide management measures to control the bycatch of Pacific halibut in domestic and joint venture fisheries only. Under the status quo alternative, bycatches of Pacific halibut in foreign fisheries and bycatches of Pacific salmon, Tanner crab, and king crab (species important in other U.S. fisheries) in domestic, joint venture, and foreign fisheries are not limited. Without actual limits on such prohibited species catches in the groundfish fishery, overharvesting can occur.

7.4.2 Alternative 2: Expand the existing halibut bycatch framework to include salmon and crab. Revise regulations to allow full use of the framework with regard to gear and area or parts thereof.

Under Alternative 2, the framework measure currently in place for controlling the bycatch of Pacific halibut would be broadened to include Pacific halibut in foreign fisheries, and salmon, Tanner crab, king crab in all fisheries. This alternative also includes a revision to the existing regulations to reflect the expansion of the framework to other species, and to allow full implementation of the existing framework with regard to specification of bycatch limits [i.e. by user group (DAP, JVP, TALFF), all gear types, time period, and all areas or parts thereof]. Management of the bycatches of the above species under this alternative would be superior to the status quo alternative because the amount of incidental harvest could be controlled. Another advantage is that adjustments to bycatch measures in response to changes in stock condition or changes in the fishery itself, could be implemented in a timely manner. The impacts of this alternative on the biological and physical environment is difficult to quantify due to lack of information. The impacts are related to changes resulting from the incidental catch of different numbers of salmon, king and Tanner crab, and other organisms and from perturbations of the benthos caused by the use of commercial fishing gear.

Salmon are important components in the ecosystem. As juveniles, salmon prey on small crustaceans and small fish. As salmon mature, its common food include herring, sand lance, pilchard, rockfish and euphausiids when abundant. A reduction in the number of salmon as a result of groundfish fishing could have an effect on the predator/prey relationship that exists between salmon and these other forms of marine life.

The trawl fisheries in the Gulf of Alaska catch all five species of Pacific salmon that come from the fresh waters of North America: chinook, chum, pink, sockeye and coho. Chinook are, by far, caught in the greatest numbers (usually about 90% of the catch by number). Chums are a distant second (usually about 10% of the catch). Pinks, sockeye, and coho are caught only rarely. Table 7.3 shows the catch of each species by the joint venture and directed foreign fisheries during 1984 and 1985. Unfortunately we don't know which salmon stocks are impacted by trawl fisheries.

Most of the salmon stocks likely to be caught in the Gulf of Alaska trawl fisheries are in good shape now, but the status for many is unknown, particularly the wild stocks. Under a rebuilding provision of the Pacific Salmon Treaty, many wild stocks of chinook salmon in Southeast Alaska, British Columbia, Washington, and the Columbia River are being returned to desired levels of abundance. But some stocks are still behind schedule, for example those from the Alsek River in Southeast Alaska and those from the Strait of Georgia in British Columbia. The rebuilding goals are to be met by 1998. Almost all Alaskan salmon stocks have been and are being harvested at acceptable biological levels, and any additional significant catch by the trawl fishery will reduce the allowable catch by the salmon fisheries.

King and Tanner crab feed on invertebrates and detritus and are both at extremely low levels of abundance. The outlook for near term improvement in the Kodiak king crab stock is poor. The small population of crab is concentrated in very small areas compared to their historical range. The population is very old when compared to the historical size structure and possesses few immature or young crab. Natural mortality rates on the existing stock will probably remain higher than normal because of high abundance of fish predators and the old age of the stock. Recent studies also indicate that molting crab constitute a frequent part of the diet of cod and sculpin which could be an important contributor to natural mortality. The legal population is projected to decline with weight losses from natural mortality exceeding weight gains from recruitment. The female population should show similar declines with reduced overall reproductive capability. Without recruitment of juvenile animals in the near future, the reproductive power of the stock for generating future generations of king crab, may decline to such levels that multiple generations of crab may be necessary before recovery occurs. These observations and concerns associated with the Kodiak stock are also seen in the Prince William Sound and Alaska Peninsula areas. Given the poor condition of these king crab stocks, commercial fisheries have either been severely curtailed or ended to promote rebuilding.

The Tanner crab stocks of the Gulf of Alaska are currently considered in stable condition although some areas show stocks either declining or depressed. While bycatch of Tanner crab in Gulf groundfish fisheries is not currently an issue, it could be if this resource follows the declining trend of king crab and if groundfish trawl fisheries continue to expand. In the

Table 7.3 Estimated catch of salmon by foreign and joint venture trawlers in the Gulf of Alaska during 1984 and 1985. (Estimated catch is in numbers of salmon.)

	Chinook	Chum	Coho	Sockeye	Pink	Total
1984						
Foreign Directed	11,102	718	102	58	22	12,001
Joint Venture	63,251	524	51	19	+	63,845
TOTALS	74,353	1,241	153	77	22	75,846
1985						
Foreign Directed	349	9	7	0	0	365
Joint Venture	13,645	66	22	4	0	13,737
TOTALS	13,994	75	29	4	0	14,102

Source: J. Berger, J. Wall, and R. Nelson, Jr., 1985 and 1986. Summary of U.S. Observer Sampling of Foreign and Joint Venture Fisheries in the Northeast Pacific Ocean and Eastern Bering Sea. Northwest and Alaska Fisheires Center, National Marine Fisheries Service, Seattle, Washington.

Bering Sea, the Tanner crab resource (C. bairdi) declined several years after the king resource reached historic low levels. A similar lag period may occur in the Gulf.

With Alternative 2, a degree of control over the environmental impacts associated with bycatches of salmon and crab would exist that doesn't occur under the status quo.

7.5 Socioeconomic Impacts

Description and estimate of the number of small entities affected

Alternative 2 if approved will extend the bycatch framework to all harvesters of the groundfish resource. Under the current halibut framework, PSC limits can be specified for domestic and joint venture fisheries only. When PSC limits are reached, continued use of bottom trawl gear is prohibited. The original intent of the framework (described in the FMP but not implemented in the regulations) was to control halibut bycatch of all gear and all groundfish fisheries. The expanded framework will allow PSC limits of halibut, salmon, king crab, and Tanner crab to be set for each gear type so that the bycatch associated with one form of gear won't prohibit the use of other legal gear. As was described in the introduction, the number of small entities affected by the measure would consist of all registered fishing vessels, currently estimated at 934 vessels.

Fishery costs and benefits

The 1987 halibut PSCs are not expected to have a significant economic impact on the fishing fleet since current information suggests that all directed quotas will have to be attained for the bycatch PSC to be exceeded, assuming the bycatch rate assumptions hold true. Should fishermen choose to fish in new areas or with less effort to avoid halibut, the PSC limit may become an influencing constraint on the fishery. There is, of course, no means of assessing this potentiality a priori.

The costs and benefits associated with the implementation of salmon or king or Tanner crab PSC limits are difficult to estimate ex ante. Some work has been done, however, to establish an analytical methodology by which these economic impacts may be approximated. Marasco and Terry (1981) demonstrated that an organism destroyed as part of the bycatch in a groundfish fishery, which would have otherwise survived to enter the directed fishery for that species, represents a quantifiable future income loss. Queirolo (1986) extended this methodology to show that, had that individual organism, lost to bycatch, survived to reproduce, it would have contributed future wealth in the form of a benefit stream from successive generations of its offspring. A portion of which in their turn would have entered the directed fisheries or contributed to future reproductive cycles.

The potential physical and economic impacts of bycatch interceptions of economically important and fully utilized species, as approximated via this methodology, vary by species. For example, Pacific halibut stocks are currently at record high levels of abundance, and the predicted halibut bycatch mortality, attributed to the groundfish fishery, is well within the acceptable limits, established by the Council. Therefore, the impacts

associated with halibut bycatch interceptions in the groundfish fishery would be relatively small. On the other hand, continued bycatch losses of king and Tanner crabs, and some species of salmon, e.g. chinooks, could result in relatively large impacts on directed domestic crab and salmon fisheries. Furthermore, should the PSCs become a constraint on groundfish fishing operations, significant additional losses to domestic harvesters, processors, and consumers could accrue as a result of foregone groundfish harvests due to premature closures brought on by attainment of PSC limits.

The determining factors governing the establishment of the respective PSC limits are: (1) the level of bycatch mortality that is considered acceptable to the Council, given the stock status of the bycatch species, (2) the condition of the directed fishery that the bycatch species supports, and (3) the condition of the groundfish fishery itself. After careful weighing of these considerations, an acceptable bycatch goal can be used in determining what the appropriate PSC should be and whether or not the PSC will constrain the directed groundfish fishery. In determining the mortality goal, the Council must make the determination that the costs associated with the bycatch are outweighed by the benefits of the groundfish harvest that the mortality goal would permit. To help estimate potential bycatch mortality goals for salmon, king crab, and Tanner crab, a review of historical incidental catches is required. Since little information is available on the incidental catches that occur in the domestic fishery, this analysis will focus primarily on the joint venture fishery, where more detailed information exists.

Over the period 1977 through 1984, the actual size of the salmon bycatch in the Gulf of Alaska foreign and joint venture fisheries varied substantially. Table 7.4 shows that the catches ranged from a low of 5,272 fish in 1977, to over 71,200 fish in 1984. These bycatches did not necessarily follow with a corresponding increase in groundfish catch, rather, they are more of a reflection of the target species being harvested (pollock), the time of year the fishing occurred, and the type of gear (trawl) used. A closer examination of NMFS foreign observer data shows that most of the salmon bycatch occurs during the last quarter of the year, by vessels targeting on pollock using mid-water trawl gear (Table 7.5).

Since 1978, the estimated quantities of commercially important crab species caught incidentally by foreign and joint venture fleets in the Gulf of Alaska have ranged from 721 pounds of red king crab in 1986 to 292,000 pounds in 1978, and from 13,500 pounds of Tanner crab in 1986 to 79,000 pounds in 1981 (Tables 7.6 and 7.7). Recent declines in incidental catches of crabs is reflection of reduced crab abundance and emergency management measures to minimize crab bycatch. From the above data, it is clear that incidental catches fall within a wide historical range. Examining joint venture bycatches of salmon, king crab, and Tanner crab over the last four years, will produce an average bycatch of 26,000 salmon, 3,700 king crab, and 56,500 Tanner crab. While not supporting these figures at the present time as "acceptable bycatch goals", these figures will be used as maximum levels to analyze the economic impacts of these incidental harvests on the directed and bycatch fisheries.[1/]

1/ This period was selected since it most accurately reflects current fishery trends with limited bycatch controls (i.e. increasing domestic harvest).

Table 7.4 The estimated incidental catch (numbers and metric tons) of Pacific salmon in the foreign and joint venture groundfish fisheries in the Gulf of Alaska, 1977-86.[1/]

Year	Foreign Vessel Catch (No.)	Foreign Vessel Catch (t)	Joint Venture Catch (No.)	Joint Venture Catch (t)	Total (No.)	Total (t)
1977	5,272	19.30	NF	NF	5,272	19.30
1978	45,603	131.27	2/	2/	45,603	131.27
1979	20,410	68.69	1,050	2.31	21,460	71.00
1980	35,901	106.90	168	1.07	36,069	107.97
1981	30,860	95.89	0	0.00	30,860	95.89
1982	5,556	18.89	1,411	2.77	6,967	21.66
1983	9,621	31.76	4,263	11.98	13,874	43.74
1984	12,001	36.13	63,845	168.97	75,846	205.10
1985	400	1.60	15,600	50.00	16,000	51.60
1986	0	0.00	20,300	3/	20,300[4/]	3/

1/ Estimates for years 1977-83 are from Berger et al., 1984.
2/ No estimates of incidental catch were made of the limited joint venture fishery in 1978.
3/ No weights were taken.
4/ Preliminary

Source: National Marine Fisheries Service Observer Program, NWAFC, Seattle.

Table 7.5 Gulf of Alaska joint venture groundfish catch, salmon bycatch, and its proportion of total catch, September-December, 1983-86.[1/]

Year	Month	Groundfish Catch (mt)	Percent of Total	Salmon Bycatch (Nos.)	Salmon Bycatch (mt)	Percent of Total
1983	Sep	1,500	0.01	100	0.4	0.02
	Oct	900	0.01	100	0.3	0.02
	Nov	1,400	0.01	400	1.8	0.04
	Dec	3,100	0.02	1,400	4.1	0.33
			0.05			0.41
1984	Sep	7,000	0.03	1,700	4.0	0.03
	Oct	16,500	0.07	16,500	45.6	0.28
	Nov	5,200	0.02	20,300	52.2	0.35
	Dec	2,600	0.01	11,000	29.3	0.19
			0.13			0.85
1985	Sep	2,000	0.01	100	0.3	0.01
	Oct	14,300	0.06	700	1.9	0.04
	Nov	4,900	0.02	8,900	26.9	0.56
	Dec	600	0.005	1,800	7.0	0.11
			0.095			0.72
1986	Sep	500	0.01	100	2/	0.005
	Oct	4,600	0.07	8,800	2/	0.43
	Nov	2,300	0.03	7,900	2/	0.39
	Dec	1,400	0.02	200	2/	0.01
			0.13			0.835

Source: National Marine Fisheries Service Foreign Observer Program

1/ Preliminary
2/ Weights not taken.

Table 7.6 Estimated incidental catch (numbers and metric tons) of king crab in the foreign and joint venture groundfish fisheries in the Gulf of Alaska, 1978-1986.[1/]

Year	Foreign		Joint Venture		Total	
	(Nos.)	(t)	(Nos.)	(t)	(Nos.)	(t)
1978	93,875	135.31	2/	2/	93,875	135.31
1979	24,094	40.30	466	0.83	24,560	41.13
1980	6,395	8.95	6,285	13.03	12,680	21.98
1981	6,619	8.01	0	0.00	6,619	8.01
1982	3,464	5.60	11	0.03	3,475	5.63
1983	2,124	3.00	4,454	15.01	6,578	18.01
1984	1,465	4.89	5,482	20.15	6,947	25.04
1985	10	0.01	2,427	7.69	2,437	7.70
1986	100	0.10	2,300	3/	2,400	3/

1/ Estimates for 1978-84 are from Berger et al., 1985.

2/ No estimates of incidental catch were made of the limited joint venture fishery in 1978.

3/ Weights were not taken.

Table 7.7 Estimated incidental catch (numbers and metric tons) of Tanner crab in the foreign and joint venture groundfish fisheries in the Gulf of Alaska, 1978-1986.[1/]

Year	Foreign		Joint Venture		Total	
	(Nos.)	(t)	(Nos.)	(t)	(Nos.)	(t)
1978	23,969	14.16	2/	2/	23,969	14.16
1979	16,992	11.30	626	0.25	17,618	11.55
1980	27,844	16.62	58,022	14.43	85,866	31.05
1981	96,662	70.19	0	0.00	9,662	70.19
1982	63,293	35.33	364	0.17	63,657	35.50
1983	30,609	22.42	102,840	54.87	133,449	77.29
1984	8,885	5.69	41,663	27.36	50,548	33.05
1985	509	0.28	64,640	16.61	65,149	16.89
1986	1,300	0.90	16,900	3/	18,200	3/

1/ Estimates for 1978-84 are from Berger et al., 1985.

2/ No estimates of incidental catch were made of the limited joint venture fishery in 1978.

3/ Weights were not taken.

As Queirolo (1986) points out, "The process of evaluating the economic loss to directed salmon fishermen associated with bycatch mortality of salmon in the Gulf of Alaska groundfish fishery is relatively complex. This is principally true because the Gulf serves as a rearing habitat for salmon originating from river systems throughout Alaska, British Columbia, Washington, and Oregon. Therefore, losses of salmon in the Gulf necessarily accrue to different directed fisheries, and at different times, in proportion to the contribution each region makes to the pool of immature salmon found in the Gulf of Alaska."

All five Pacific salmon species are taken incidentally in the groundfish fisheries in the Gulf. However, by far the most numerous are chinook (Oncorhynchus tschawytscha) and chum (O. keta), accounting on average for roughly 89% and 10%, respectively. Specifically, it has been assumed that the contribution of chinook stocks to incidental catch, by area of origin, is proportional to the origin composition obtained from scale pattern analysis and coded wire tagged salmon from Gulf of Alaska trawl fishery. Chum salmon taken incidentally were all assumed to originate in the central Alaska region.

Chinook bycatches are, on average, one and one-half to three years away from maturity, depending upon stock, and therefore a similar period away from recruitment into either directed fisheries or spawning biomass. Chum salmon are believed to be in their last "ocean year" when encountered in the groundfish fishery and therefore would have entered the directed fishery or spawning biomass in the same year they were intercepted.

Queirolo (1986) developed an empirical model that estimated the economic loss to the directed salmon fishery and the resource's spawning potential attributed to bycatches of salmon in the Gulf groundfish fishery. The model incorporates several assumptions regarding region of origin, the proportion of hatchery production, weighted exvessel prices by gear type and by region, and the different rates of maturity that exist within Alaskan stocks, and between Alaskan stocks and fish from British Columbia, Washington, Oregon, and northern California. Results from the 1986 study indicate that the discounted present economic loss associated with the incidental catch of salmon, in the assumed species and stock proportions, in any one year ranged from $18.37/fish to $62.05/fish, depending on discount rate employed. This loss accrues not only to the next most recent directed salmon fishery that the fish could have recruited to, had it not been lost to trawl bycatch, but also the economic loss associated with the reproductive potential foregone of salmon which would have contributed, through successive generations, to future salmon fisheries.

Applying this range to the four-year average bycatch would lead to a potential discounted present value loss to the directed salmon fisheries of $477,600 to $1.6 million per year, depending again upon the social rate of time preference used. These estimates likely understate the actual losses associated with salmon bycatches, because they are limited to a commercial exvessel approximation of the value of all users, i.e. recreational, subsistence/personal use, treaty Indian use, etc. There are, of course, other impacts that arise from these interceptions. These include, among others, distributional questions, community impacts, impacts on both public and private investments in salmon enhancement and rehabilitation programs, and costs imposed on intermediate and final users (consumers) of commercially harvested salmon. Data limitations

preclude a comprehensive empirical accounting of the total loss, however, the value obtained through the application of this methodology can, the author argues, reasonably be regarded as a "minimum" cost estimate.

The above discussion describes the estimated average annual "minimum" cost, in present value terms, associated with the bycatch loss in the joint venture groundfish trawl fishery in the Gulf. The next aspect to consider in this analysis is the economic benefit of the salmon bycatch accruing to the groundfish fishery. As noted previously, the majority of the salmon bycatch occurs during the last quarter of the year ranging from 41% to 85% of the total catch by the groundfish fishery (Table 7.5). The average salmon bycatch during this period has been approximately 20,000 fish, with an estimated discounted present value loss to the directed salmon fishery of $367,000 to $1.2 million. During this same time period, the groundfish catch which consists primarily of pollock, averaged 17,200 mt with an estimated exvessel value of $1.6 million. The immediate benefits to groundfish fishermen of allowing a salmon bycatch in the fall months is the opportunity to harvest groundfish of significant value. This is not to say, however, that to harvest 17,000 mt of groundfish requires a salmon bycatch of 20,000 fish. On the contrary, a large groundfish harvest may still be attainable with reduced incidental catch of salmon if fishermen chose to harvest their groundfish in a different area, or at a different time, or using different gear or techniques. This is apparent by the fact that on average, over 95% of the joint venture groundfish catch is taken during the first eight months of the year.

A salmon PSC limit could be used as an incentive to maximize groundfish harvests, while reducing the groundfish fishery's impact on the directed salmon fishery. Such a technique has been used in the foreign groundfish fishery in the Bering Sea since 1983 with foreign fleets proving that they are capable of harvesting their groundfish allocation while operating at or below established PSC limits. The modification to recent fishery patterns resulting from a PSC incentive would likely increase the groundfish fishermen's harvesting costs (assuming the status quo harvesting strategy represents the efficient optimum) and reduce salmon bycatches. However, there is some uncertainty over how much a reduction can be achieved given that a change in fishing patterns may still result in salmon bycatches. Any significant reduction though, would be a benefit to the salmon fishery. Unfortunately, due to lack of data, the costs and benefits associated with a change in fishing patterns cannot be quantified at this time.

Analyzing the costs and benefits of PSC limit controls on the Gulf of Alaska king and Tanner crab fisheries is more difficult still, given uncertainties about crab life histories, migratory and reproductive patterns, and lack of socioeconomic research on the fisheries utilizing these species.

Tables 7.8 and 7.9 present data on the U.S. directed fisheries on king and Tanner crab in the Gulf of Alaska. As can be seen from the statistics of the directed crab fisheries, both king crab and Tanner crab fisheries are suffering a period of decline. Catches of king crab have been significantly reduced since 1983 in an effort to rebuild this resource. In the Gulf of Alaska, the major area of historical king crab abundance has been in the Kodiak Island and westward areas. Due to poor stock condition, there has been no directed king crab fishery in these areas since 1983. The economic impact of incidental king crab catch by the groundfish fishery during this period of

Table 7.8 Exvessel prices, landings, and values of domestic king crab catch in the Gulf of Alaska, 1978-1984.

	1978	1979	1980	1981	1982	1983	1984
Exvessel price ($/lb)	1.65	1.26	1.13	1.96	3.75	3.30	2.43
Landings (1000 lbs)	16,900	21,500	27,300	28,400	14,400	607	362
Value ($1000)	27,900	27,100	30,900	55,700	54,000	20,031	880

Table 7.9 Exvessel prices, landings, and values of domestic Tanner crab catch in the Gulf of Alaska, 1978-1984.

	1978	1979	1980	1981	1982	1983	1984
Exvessel price ($/lb)	0.49	0.67	0.70	0.79	1.65	1.24	1.18
Landings (1000 lbs)	58,900	55,400	44,500	26,700	27,800	30,079	22,010
Value ($1000)	28,900	34,100	31,200	21,100	45,900	37,298	25,972

Sources: Kodiak prices, from Commercial Fisheries Entry Commission unpublished data, and annual Alaska Catch and Production Statistical Leaflets.

rebuilding, while not amenable to quantification due to data limitations, could be very substantial. As the size of the reproductive population declines, the loss of each additional animal increases in potential importance from the standpoint of rebuilding the resource. Considering the fact that no directed fishery has been permitted on these stocks, because of their depleted conditions, the value of retaining a crab in the reproductive population must be greater than its value in the directed fishery, in the opinion of resource management scientists.

Tanner crab catches have also declined as a result of reduced abundance, but not as dramatically as in the king crab fishery.

In 1983 the Council's Prohibited Species Workgroup presented a report that included an analysis of the economic impacts associated with crab bycatch in the foreign and joint venture fisheries conducted during 1978-1982. The workgroup estimated the average weight of incidentally caught king and Tanner crab, and the corresponding time required to grow from time of capture to recruitable size. They also estimated exvessel loss of the bycatch to future crab fisheries. In the workgroup's analysis it was assumed that elimination of incidental catch mortality would increase directed harvest without a short run increase in entry or effort. Moreover, fishermen that do participate in the fishery are assumed to have no short run alternatives, and hence, zero opportunity cost. These assumptions permitted treating lost gross exvessel revenue as the cost of incidental catch.

Tables 7.10 and 7.11 display estimates of the nominal lost revenue due attributable to incidental catch mortality of red king crab and bairdi Tanner crab.

As in the example of using a 0% discount rate, the practice of assuming the worst case whenever it was impossible to construct a reliable point estimate was followed throughout this analysis. This means that the figures presented for lost revenues due to foreign and joint venture bycatch mortality are probably overestimates.

The largest estimated impact of foreign and joint venture incidental catch of king crab during this period occurred in 1978, when foregone gross revenue amounted to $717,000. Lost revenue in the directed crab fisheries declined rapidly to only $5,000 in 1981, before rising slightly in 1982 to $29,000. This compares with a five-year average gross revenue to the commercial king crab fishery of about $45 million during this same timer period.

Foregone gross revenues in the Tanner crab fishery attributable to foreign and joint venture bycatch ranged from $17,000 in 1979 to $186,000 in 1981. This compares with the five-year average gross revenue to the commercial fishery of $39 million.

Based on the above analysis, the workgroup's conclusion was that in comparison to the the value of the directed fishery, the value of the lost crab to the groundfish fishery was insignificant. While that may have been justified, based upon fishery and resource conditions prevailing prior to 1983, with the directed fishery currently either closed or severely restricted, the value of each king crab incidentally caught in the groundfish fishery is probably very significant.

Table 7.10 Estimated loss in future real gross exvessel revenue to the domestic king crab fishery due to red king crab incidental catch mortality in Gulf of Alaska foreign and joint venture fisheries in each year, 1978-1982.

(1000 1982 $)

Fishery	1978	1979	1980	1981	1982
Foreign Trawl	715	190	8	2	25
Foreign Longline	2	4	4	3	4
Foreign Total	717	194	12	5	29
Joint Venture	0	5	106	0	0
Total	717	199	118	5	29

Table 7.11 Estimated loss in future real gross exvessel revenue to the domestic Tanner crab fishery due to bairdi Tanner crab incidental catch mortality in Gulf of Alaska foreign and joint venture fisheries in each year, 1978-1982.

(1000 1982 $)

Fishery	1978	1979	1980	1981	1982
Foreign Trawl	24	13	28	32	59
Foreign Longline	2	3	5	31	17
Foreign Total	26	16	33	63	76
Joint Venture	0	1	153	0	1
Total	26	17	186	63	77

As mentioned previously, emergency management measures have been implemented to restrict the incidental catch of king crab and to a lesser degree, Tanner crab in an effort to promote the rebuilding of these economically important species. Recognizing the value of crab in terms of maximizing the reproductive potential of the depleted stocks, some management compromise short of prohibiting all groundfish fishing is needed. Implementation of the framework described under Alternative 2, would authorize the use of PSC limits as a method of controlling king and Tanner crab bycatch while assuring the fullest possible opportunity for the utilization of the available groundfish resource. PSCs could be specified for entire regulatory areas or subparts within an area to afford the degree of crab protection necessary.

Examination of crab bycatch trends in the joint venture fisheries indicate that as with salmon, a significant proportion of the total king and Tanner crab incidental catch occurs in the last months of the year (Table 7.12). Setting a PSC limit below the four-year average catches of 3,700 king crab and 56,500 Tanner crab would likely require a modification to current trawl fishing patterns. As with salmon, a reduction in crab bycatch would be a benefit to the directed crab fishery but at a cost to groundfish fishermen. The magnitude, distribution, and duration of these potential costs will depend upon the operational flexibility available to the groundfish vessel operator. They cannot be estimated, given information currently available.

The above discussion focused primarily on the joint venture groundfish fishery (JVP) because this fishery has been a predominate user group in the Gulf. The JVP fishery is believed to be the best source of information on current harvesting and bycatch trends in the wholly domestic fishery (DAP) as well. Table 7.13 provides information on DAP groundfish catches during the period 1978 to 1986. Clearly DAP catches have grown and with joint ventures, have displaced the foreign groundfish fishery, heretofore available from observer coverage of this fleet. Accompanying the exit of the foreign fishery is a loss in observer information. Because no equivalent observer program exists with regard to the DAP fishery, the extent of halibut, salmon and crab bycatch that occurs in the domestic fishery is not known. The analysis using joint venture data suggests that the bycatch is significant in that fishery. In combination with bycatch that must certainly occur in the DAP fishery, these losses may lead to substantial conservation impacts on the incidentally caught resources and economic impacts on the fisheries that they support. Enforcement of the provisions of Alternative 2 in terms of monitoring and management will be difficult without an effective at-sea data gathering program. Efforts are currently being made at both the governmental and industry levels to develop and implement such a program.

Reporting costs

Alternative 2 would not increase the reporting burden on fishermen or processors. The bycatch framework will be enforced using at-sea enforcement, not through catch reporting. Therefore, relative to the status quo, the amendment should not change the reporting costs of any participant in the fishery. PSC limits will be specified using bycatch rate information obtained from U.S. observers on board joint venture processors. These data will be applied to all domestic fisheries by gear type where applicable. Should more

Table 7.12 Gulf of Alaska joint venture king crab bycatch and Tanner crab bycatch and its proportion of total catch, September through December, 1983-86.[1/]

Year	Month	King Crab Bycatch (no.)	King Crab Bycatch (mt)	Percent of Total	Tanner Crab Bycatch (no.)	Tanner Crab Bycatch (mt)	Percent of Total
1983	Sep	1,500	3.7	0.33	25,600	13.7	0.25
	Oct	100	0.2	0.02	4,100	2.0	0.04
	Nov	1,200	6.0	0.27	1,200	0.5	0.01
	Dec	500	2.2	0.11	37,200	18.8	0.36
				0.73			0.66
1984	Sep	1,300	3.5	0.25	2,700	2.5	0.07
	Oct	700	3.7	0.13	4,200	3.4	0.11
	Nov	200	0.4	0.04	3,500	3.4	0.09
	Dec	100	0.2	0.02	2,100	1.4	0.05
				0.44			0.32
1985	Sep	200	0.4	0.09	1,900	0.7	0.03
	Oct	800	2.3	0.36	25,600	11.9	0.42
	Nov	200	0.6	0.09	4,400	2.5	0.07
	Dec	<100	<0.1	0.04	1,400	2.3	0.02
				0.58			0.54
1986	Sep	<100	2/		<100	2/	
	Oct	<100	2/		10,300	2/	
	Nov	0	2/		4,600	2/	
	Dec	<100	2/		1,000	2/	

Source: National Marine Fisheries Service Foreign Observer Program

1/ Preliminary
2/ Weights not taken

Table 7.13 Gulf of Alaska wholly-domestic groundfish catch, 1978-86.

Year	Catch (mt)
1978	5,366
1979	6,089
1980	5,661
1981	3,669
1982	8,796
1983	7,230
1984	12,011
1985	23,417
1986	44,338[1/]

Source: ADF&G Annual Reports and PacFIN Data Network

1/ Preliminary

appropriate data be available from other sources, including voluntary reporting by the domestic fleet, this information will be used in calculating bycatch requirements in the domestic and joint venture fisheries. Foreign fishery PSC limits will be based on U.S. observer information gathered from these fisheries.

Administrative, enforcement, and information costs and benefits

Alternative 2 authorizes the specification of PSC limits to control bycatch of all the traditional "prohibited species" in the Gulf of Alaska groundfish fishery. As a result, it is expected that administrative, enforcement, and information costs to the U.S. will increase. However, while these increased costs are difficult to quantify, it is anticipated that they will be relatively small when compared to the economic benefits derived from improved management of the groundfish fishery and its effect on other fishery resources in the region.

Impact on consumers

The impact on consumers is expected to be minimal as a result of this framework amendment. Currently the groundfish fishery operates well within acceptable bycatch limits for halibut. Time/area closures (i.e. PSC = 0) for the protection of king crab around Kodiak Island have little impact on current bottom trawl fishing operations. Trawl catches in these areas is such a small percentage of the Gulf total that consumer prices should not be affected, in a perceptual way, by the closures. If the closures contribute to the return of healthy king crab stocks, as they are expected to, there would be an increase in benefits to consumers who purchase king crab, if a lower price and/or greater availability resulted.

If the groundfish fishery expands to the point where PSC limits influence fishing operations, increased costs associated with the changed fishing operations may lead to higher prices for groundfish and/or reduced product availability. At the same time there could be increased availability of halibut, salmon, king and Tanner crab to the consumer level.

Redistribution of costs and benefits

The costs of the proposed bycatch limit framework are borne by all groundfish harvesters and processors to the extent that costs actually materialize. Fishing operations may have to modify their methods to harvest, or location, in order to comply with PSC limits.

There may also be increases in enforcement costs associated with adoption of the amendment. However, given that under existing regulations halibut bycatch limits are to be enforced anyway, the additional enforcement burden caused by the inclusion of salmon and crab should be minimal.

Benefits will accrue to the harvesters of salmon, king crab, and Tanner crab should control of incidental catch of these species in the groundfish fishery lead to increased catches in the directed fisheries.

Benefit-Cost conclusion

The extent to which attributable costs, as measured by foregone groundfish harvests due to the issuance of PSC limits, will accrue, depends on whether the effort can be redistributed, and whether harvest levels can be maintained in other areas. There will be impacts on the groundfish fishery in terms of increased operating costs and/or reduced catches if current fishery patterns are optimal. There are also costs to the directed salmon and crab fisheries if the bycatch of these species continue without any controls. Neither set of costs can be accurately estimated given available information. However, the ongoing analysis does suggest the PSC savings could be significant.

The benefits of the expanded bycatch framework depend upon the level of salmon and king and Tanner crab associated with the redistributed groundfish fishing effort. It also depends on the crab stocks' ability to reproduce give the protection the PSCs afford.

8.0 UPDATE GOA FMP DESCRIPTIVE SECTIONS, REORGANIZE CHAPTERS, AND INCORPORATE COUNCIL POLICY AS DIRECTED

8.1 Description of and Need for this Action

The Gulf of Alaska Groundfish FMP was implemented in 1978 and was the first management plan approved under the MFCMA. At the time of its development, preparers had little knowledge as to how a plan should be organized and the type of descriptive material and management measures it should contain. In the ten years of fisheries management under the Magnuson Act managers have identified the plan's strengths and weaknesses, and have learned that routine management actions are most efficiently handled through framework measures. Since 1978, the Gulf FMP has been amended 13 times (one amendment pending) to incorporate new framework management measures, revise conventional measures, and make administrative improvements. Little effort has been spent in updating the descriptive sections of the plan or to make improvements to the plan's format. For this reason, the Gulf FMP is terribly out of date, difficult for managers and the public to read and use, and as a result has lost some of its effectiveness as a management tool. This amendment completely updates the descriptive sections of the plan (i.e. description of groundfish life histories, stock status, characteristics of the fishery, etc.) to reflect current knowledge. The plan will be reorganized to make the document easier to read and use and to update in the future. Technical revisions to the text and regulations to reflect Council policy with regard to gear restrictions, experimental fisheries, and working definitions will be incorporated and fully analyzed where necessary. And finally, a respecification of target species with an accompanying description of rockfish assemblage management will be provided.

8.2 Alternatives Including the Action

8.2.1 Alternative 1: Do nothing - status quo.

Adoption of this alternative would leave the FMP's descriptive sections unchanged. It would also leave unaddressed the other problems discussed in the above statement of need. Management of rockfish using the assemblage approach would be more difficult to implement since a formal description of the concept would be absent from the FMP. Council policy with regard to legal gear and experimental fisheries would be difficult to enforce.

8.2.2 Alternative 2: Update the descriptive sections, reorganize the chapters, and incorporate Council policy into the FMP as directed.

Approval of this alternative would address fully the problems described above. Most of the amendment focuses on the descriptive sections of the plan. Since these sections are only descriptive, no implementing regulations or accompanying regulatory analysis is necessary. Specific changes to the FMP text are described in the Changes to the FMP document. This amendment does however, make several technical changes to the plan with some requiring regulatory revisions. These few technical changes are described below:

(a) Target Species - defined as those species or species category that support either a single species or mixed species target fishery. Current list and proposed list are shown in Table 8.1.

Table 8.1 Groundfish species or species categories managed by this plan.

Current Target Species	Proposed Target Species
Pollock	Pollock
Pacific cod	Pacific cod
Flounders	Flounders
Pacific ocean perch	Rockfish
Other rockfish	- slope assemblage
Thornyhead rockfish	- shelf demersal assemblage
Sablefish	- shelf pelagic assemblage
Atka mackerel	- thornyhead rockfish
Squid	Sablefish
Other species	Other species
- sculpins	- Atka mackerel
- sharks	- squid
- skates	- sculpins
- eulachon	- sharks
- smelts	- skates
- capelin	- eulachon
- octopus	- smelts
	- capelin
	- octopus

Adoption of this alternative eliminates the POP complex and Other Rockfish category by replacing it with a new category called Rockfish. This general category is composed of the three rockfish assemblages currently specified in the plan. All three assemblages occur in abundance in the Southeast Outside District (east of 140°W. long.). The abundance and species diversity of the shelf pelagic and shelf demersal assemblages declines to the west. Given current knowledge on the rockfish resource, it is likely, that for this reason, the Council will manage all assemblages together as a general group west of 140°W. long. (in the Western and Central Areas separately or combined). In the Southeast Outside District, the Council may choose to manage rockfish together or by assemblage. Thornyhead rockfish will be included in the new Rockfish category and managed as a single :species if necessary. The category Atka mackerel will be placed in the Other Species category.

(b) Drop the term Target Quota (TQ) and replace it with Total Allowable Catch (TAC). The definition would remain unchanged. This term represents the harvest quota for a species or species group. Making this adjustment would bring this term into conformity with that currently used in the Bering Sea/Aleutian Islands Groundfish FMP.

(c) Revise the definition for acceptable biological catch (ABC) to bring it into conformity with the definition used by the Scientific and Statistical Committee and the Pacific Fishery Management Council.

The current definition reads as follows:

> ABC is a seasonally determined catch that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitments. The Council can set the ABCs for individual species anywhere between zero and the maximum possible removal based on the best scientific information presented by the Plan Team and/or Scientific and Statistical Committee. The ABC may be modified to incorporate safety factors and risk assessment due to uncertainty. Lacking other biological justification, the ABC is defined as the maximum sustainable yield exploitation rate multiplied by the size of the biomass for the relevant time period. The ABC is defined as zero when the stock is at or below its threshold.

This alternative would replace the existing definition with the following revised definition:

> ABC is a seasonally determined catch or range of catches that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitments. Given suitable biological data and justification by the Plan Team and/or Scientific and Statistical Committee, ABC may be set anywhere between zero and the current biomass less the threshold value. The ABC may be modified to incorporate safety factors and risk assessment due to uncertainty. Lacking other biological justification, the ABC is defined as the maximum sustainable yield exploitation rate multiplied by the size of the biomass for the relevant time period. The ABC is defined as zero when the stock is at or below its threshold.

(d) Specification of legal gear. This amendment will incorporate Council policy with regard to authorized gear in the groundfish fisheries. The following statement will be added to the existing gear restrictions section:

This plan authorizes the use of trawls, pot and longline, and hook and longline as legal gear for the commercial harvest of groundfish. (Further area restrictions apply and are described already in the plan; i.e. sablefish). All other gear is prohibited. However, possession of an NMFS experimental fishery permit authorizes the use of experimental gear on a limited basis. Annual application for use of experimental gear must be made to the Regional Director, Alaska Region, NMFS, and contain the following elements: Personal name, vessel name, valid federal fishing permit, description of gear type, description of experiment, description of vessel, description of species to be harvested and the amounts necessary to conduct the experiment. Upon completion of the experiment a written report is to be made available to NMFS for public distribution.

Adoption of this policy will bring the Gulf FMP into conformity with the Pacific Fishery Management Council's West Coast Groundfish FMP and other FMP's around the country.

(e) Discontinue the use of a species-specific reserve from the plan. A 20% reserve has been a part of the Gulf groundfish FMP since its inception. The reserve is a calculated portion of a species specific quota and was intended to provide a source for additional domestic, joint venture, and foreign allocation during the year if needed. With recent amendments to the MFCMA and the FMP, a species specific reserve is no longer a useful tool for fisheries management. The Secretary now has the authority to adjust the initial allocations and transfer amounts of fish between the various users without requiring that such adjustments come from a reserve account. For 1987, the Council did not use the reserve provision since the groundfish fisheries where almost entirely domestic. NMFS however, had to calculate reserves since the procedure is still required in the plan. Since there is no longer a need to hold back fish when making initial allocations, and since the Secretary can make adjustments inseason without a reserve, this technical amendment deletes this requirement from the FMP.

8.4 Environmental Impacts of the Amendment Proposals and their Alternatives

Environmental impacts on the quality of the human environment are categorized as physical, biological, and socioeconomic. The socioeconomic analysis is presented under the Initial Regulatory Impact Review/Initial Regulatory Flexibility Analysis prepared for Amendment 16. The remaining physical and biological impacts are discussed below:

8.4.1 Alternative 1: Do nothing - status quo.

Adoption of this option would continue the existing problems with rockfish management as discussed in the statement of need. The status quo would continue the incidental mortality associated with bycatches of rockfish and when combined with outdated quota methodology could lead to overharvests of some rockfish species to the detriment of the resource. In the event that

overfishing occurs, fewer numbers of rockfish would be in the ecosystem. The predator-prey relationship would be disturbed in that fewer prey species would be consumed by rockfish remaining in the system, and fewer rockfish species would be consumed by marine life that preys on them. When a quota for a rockfish assemblage has been reached and a fishing closure has been implemented, rockfish species in that assemblage must be treated as a prohibited species and discarded at sea under the existing management regime. Rockfish species discarded at sea are dead and would be consumed by various marine life or they would decompose and contribute to the background nutrient load in the system. These impacts are difficult to quantify but are considered insignificant when compared to naturally occurring perturbations that occur in the environment.

Under the status quo, confusion within management and the fishing industry with regard to terminology would continue. In addition, the status quo would allow unregulated use of any gear or method of harvesting groundfish (with the exception of the sablefish fishery where specific gear regulations already exist). Continuation of this policy could lead to gear conflicts, habitat degradation, and increased marine debris.

8.4.2 Alternative 2: Update the descriptive sections, reorganize the chapters, and incorporate Council policy into the FMP as directed.

(a) Replace the POP Complex and Other Rockfish, with the new management category "Rockfish", subdivided into the three assemblages and thornyhead rockfish where necessary. Atka mackerel are to be placed in the Other Species category.

Over 40 species of rockfish of the genera Sebastes and Sebastolobus are found in the Gulf of Alaska. Species diversity is highest in the eastern Gulf and declines to the west. Rockfish are currently managed in three groups with separate quota strategies: the Pacific ocean perch complex, Other Rockfish, and Thornyhead rockfish. Since plan implementation in 1978, Pacific ocean perch (S. alutus) has been managed either separately or included in the red rockfish group commonly known as the POP complex. The POP complex was isolated from the other rockfish found in the Gulf of Alaska because it was the predominant species harvested by foreign fleets prior to the MFCMA and has been at a very low level of abundance. The POP quota is based on survey estimates of current biomass, catch at age analysis, and estimated recruitment. All other Sebastes rockfish are placed in the general category and as with the Thornyhead rockfish category, are managed using Gulfwide quotas based on historical estimates of these species in the foreign POP fishery. Given the results of recent rockfish surveys and that the character of the fishery has completely changed (now fully domestic), the plan team believes the setting of quotas using historical data is no longer appropriate and attempts should be made to set area specific harvest limits using more current information.

In 1985 the plan was amended to introduce three rockfish categories: The slope, shelf pelagic, and shelf demersal assemblages (Table 8.2). Research has shown that all rockfish inhabit one of these three habitats. The shelf demersal assemblage consists of non-schooling species that occur in the shallower waters of the continental shelf very close to the bottom and are currently harvested primarily with longline gear. The shelf pelagic rockfish

Table 8.2 Gulf of Alaska rockfish assemblages.

Slope Assemblage

Pacific ocean perch (S. alutus)
Northern rockfish (S. polyspinus)
Rougheye rockfish (S. aleutianus)
Shortraker rockfish (S. borealis)
Sharpchin rockfish (S. zacentrus)
Red banded rockfish (S. babcocki)
Rosethorn rockfish (S. helvomaculatus)
Darkblotch rockfish (S. crameri)
Redstripe rockfish (S. proriger)
Splitnose rockfish (S. diploproa)
Harlequin rockfish (S. variegatus)
Aurora rockfish (S. aurora)

Shelf Demersal Assemblage

Yelloweye rockfish (S. ruberrimus)
Quillback rockfish (S. maliger)
Canary rockfish (S. pinniger)
China rockfish (S. nebulosus)
Tiger rockfish (S. nigrochinctus)
Rosethorn rockfish (S. helvomaculatus)
Silvergray rockfish (S. brevispinus)
Copper rockfish (S. auorinus)

Shelf Pelagic Assemblage

Black rockfish (S. melanops)
Dusky rockfish (S. ciliatus)
Yellowtail rockfish (S. flavidus)
Widow rockfish (S. entomelas)
Boccacio (S. paucispinus)
Blue rockfish (S. mystinus)

assemblage consists of schooling species which occur near or off-bottom and frequently concentrate around prominent geological features. While there is little targeted effort on this assemblage at this time, off-bottom trawls and jig gear can be used to harvest these species. The slope assemblage occurs in the deeper waters of the continental shelf and the steep slopes along the shelf edge and consists of primarily bottom oriented species which can be harvested with bottom trawls or longlines.

Fisheries targeting on one or more species in a particular assemblage, almost always incidentally harvest other rockfish of that assemblage. For example, when trawling for POP, other slope rockfish are also captured. Or, when longlining for yelloweye rockfish, other shelf demersal rockfish are harvested. A management problem exists when the quota for POP is achieved prior to the other rockfish quotas being taken (or vice versa). Fishermen couldn't fish for their target without incidentally harvesting the closed species. The Council believes that this is improper management of the resource and directed the plan team to develop a comprehensive management strategy for rockfish. In 1985, Amendment 14 introduced the rockfish assemblages based on observed habitat. In 1986, Amendment 15 implemented a harvest quota framework procedure that allows the Council to specify quotas for each target species category. This amendment, Amendment 16, will revise the target species list so that beginning in 1987, the Council can specify harvest quotas for one rockfish category or by rockfish assemblage if desired (Table 8.1).

Thornyhead rockfish (Sebastolobus sp.) will be included in the Rockfish management category. This species group are incidentally caught in trawl and longline groundfish fisheries targeting at other species. Thornyhead rockfish are commonly found in groundfish fisheries targeting on flounder and the slope rockfish assemblage. However, recognizing that the flesh of thornyheads is highly regarded by commercial fishermen, this species may be managed as part of an assemblage or separately if considered necessary.

Atka mackerel (Pleurogrammus monopterygius) are distributed throughout the Gulf of Alaska, but are primarily found in the westward region. They were first encountered by foreign fisheries and research surveys in the early 1970s. Foreign fleets have historically been the primary harvesters of this resource, although U.S. catches increased as joint venture fisheries developed. By 1978 this resource began a declining trend and returned to trace levels in 1985. Since this resource is no longer a significant part of the commercial catch, it is appropriate to move the Atka mackerel category into the Other Species category for purposes of management. Should at sometime in the future this species return to its high levels of the mid-1970s, it can once again be managed separately.

Squid (Berryteuthis sp. and Gonatus sp.) are distributed throughout the Gulf and are encountered incidentally by the groundfish fisheries targeting on other species. Catches of squid have historically been low (averaging 428 mt) and estimates of biomass are difficult to estimate. For this reason, squid are also being moved to the other species category for purposes of management. Should in the future squid become a primary target species, it can again be managed separately.

Adoption of this amendment will will lead to more effective utilization of the rockfish resource and reduce the probability of overfishing. The biological and physical impacts of the rockfish fishery are not fully understood. Trophic interaction of rockfish with other species and dependence of other species for rockfish for food are just beginning to be explored. Perhaps the greatest potential risk is the impact of overharvest on the rockfish stocks themselves. This alternative is designed to reduce the probability of overfishing rockfish by managing the resource using the assemblage approach. To the extent that reducing the risk of overharvesting local rockfish stocks, would make this alternative superior to the status quo. The predator-prey relationship in the food web would be less disturbed as a result of reduced fishery-related disturbances, because the numbers of rockfish remaining in the system would be closer to an equilibrium with those removed by fishing activities. Other living marine species would be preyed on by rockfish remaining in the system, which in turn would be preyed on by other predators. These impacts are difficult to quantify but are considered insignificant when compared to naturally occurring perturbations that occur in the environment.

On-bottom trawl gear may result in some short term damage to the benthic environment. The long-term effect is likely to be a function of the type of gear, the duration of the effort and the area fished. Data is not currently available that would allow potential impacts to be quantified. Longline gear is set and retrieved vertically through the water column rather than dragged across the bottom and therefore impacts on the environment are thought to be insignificant. Both gear types catch and kill other non-target species to varying degrees, but accurate data is not available. However, in comparison with the existing rockfish fishery and its management, this amendment will not produce any measurable negative impacts on the environment.

(b) Drop the term Target Quota (TQ) and replace it with Total Allowable Catch (TAC). The definition would remain unchanged. This term represents the harvest quota for a species or species group. Making this adjustment would bring this term into conformity with that currently used in the Bering Sea/ Aleutian Islands Groundfish FMP.

This amendment addresses an administrative correction and will have no effect on the environment. Currently the Gulf FMP specifies that a TQ will be set for every target species or species group. This quota is used to manage the fishery and when it is reached, is used to justify the closure of the fishery. In the Bering Sea/Aleutian Islands Groundfish FMP, the term TAC is used to represent the quota. It is used in the same way as TQ. Since the Bering Sea term has been in use for over five years, and TQ for only one year, changing the Gulf FMP to mirror that of the Bering Sea/Aleutian Islands will help standardize both groundfish plans and eliminate confusion with the terminology.

(c) Revise the definition for acceptable biological catch (ABC) to bring it into conformity with the definition used by the Scientific and Statistical Committee and the Pacific Fishery Management Council.

This amendment addresses an administrative correction and will have no effect on the environment. Both the Gulf FMP and the Bering Sea/Aleutian Islands Groundfish FMPs define a term ABC for use as a biological reference point when making management decisions. Recently the North Pacific Council's Scientific

and Statistical Committee have revised the definition of ABC for purposes of clarification. This amendment revises the existing definition to conform with the current interpretation of ABC and with other groundfish FMPs.

Although the proposed change to the ABC definition will not cause direct impact on the environment, it will require, in order to determine upper and lower bounds to ABC, scientists to identify a population size which represents the undefined term "threshold". This requirement is likely to consume considerable resources as the scientific staff struggles to develop a theoretical model or empirical data to identify threshold population levels for the managed groundfish stocks.

(d) Specification of legal gear. This amendment will incorporate Council policy with regard to authorized gear in the groundfish fisheries.

Approval of this technical change will provide a measure of control over what gear is and might be used in harvesting groundfish in the Gulf of Alaska. Currently, three gear types are used in this fishery: trawl, hook and longline, and pot and longline. This amendment to the FMP does not effect the status of these gear types other than more clearly acknowledging the gear as legal gear. Should a new form of gear wish to be used, this amendment provides the opportunity to test the gear following the rules of experimental fishing. If the results from the experiment suggest that the new gear be authorized as legal gear, a plan amendment using the results from the experiment could be developed.

In comparison with the status quo, adoption of this amendment will have no environmental impacts over the short term since none of the gear currently used in this fishery will be prohibited. Over the long term significant benefits to the environment may accrue as a result of management control over new gear used in this fishery. These benefits may take the form of reduced gear conflicts with other legal gear, the reduction of lost gear and ghost fishing, prevention of habitat degradation, and reduced marine debris.

(e) Discontinue the use of a species-specific reserve from the plan.

This amendment eliminates a procedural step in the administering of harvest quotas and will have no effect on the environment. As described in the statement of need, a species-specific reserve account is no longer necessary given recent amendments to the FMP and the MFCMA. In season reapportionment of harvest quotas are authorized without requiring a reserve account. This amendment eliminates a procedural step that is no longer of use to managers of this resource.

12.5 Socioeconomic Impacts

Fishery costs and benefits

There would be no increase or decrease in economic benefits or costs to the fishery sectors in the immediate future if Alternative 2 is chosen over the status quo. With regard to the rockfish fishery, Table 8.3 shows the quotas and catches for 1984-86.

Table 8.3 Quotas and catches of Pacific ocean perch complex and other rockfish (mt)

	Pacific Ocean Perch				Other Rockfish			
	Western		Central		Eastern		Gulfwide	
	Quota	Catch	Quota	Catch	Quota	Catch	Quota	Catch
1984	2,700	116	7,900	19	875	289	7,600	4,806
1985	1,302	848	3,906	53	875	148	5,000	1,725
1986	1,316	618	1,511	391	875	1,840	5,000	2,962

These figures indicate that in general the catches are considerably lower than the quotas with the exception of the Eastern area where the POP quota was surpassed in 1986. Management of this fishery by the assemblage approach will have no real effect in the Western and Central areas in the near term. However, in the Eastern Regulatory Area, improved management of the resource will have immediate effects. For example, assume that the POP complex fishery is closed because its quotas had been reached (as in 1986). If the Other rockfish category is left open, directed fishing on certain species within this category could result in large bycatches of members of the POP complex since some members of the complex and the Other rockfish category are found together. This bycatch could be especially harmful considering the extremely high mortality suffered by rockfish when caught and would severely undermine the Council's attempts to rebuild this resource to a level that will support a sustainable economic fishery. Therefore, Alternative 1 provides an important economic benefit by reducing the chance of overfishing a segment of the rockfish complex.

Clarification of legal gear may impose some future costs if fishermen choose to experiment will new gear technology. Meeting the requirements for obtaining permits, providing an experimental design, and supplying a final report will impose costs that would not have been required under the status quo. However, these costs are probably insignificant when compared to the costs of designing and experimenting with new gear.

The other technical and administrative aspects of Alternative 2 will have no significant socioeconomic impact since the amendment only addresses administrative problems, descriptive inconsistencies, and terminology. As a result of an updated FMP, an and improved management, positive benefits will be shared by all who participate in the groundfish fishery.

Reporting costs

The proposed alternative to the status quo would not increase the reporting burden on fishermen and processors. Under current regulations, fishermen are required to complete a fish ticket upon landing their catch. The fish ticket lists the target species by name and fishermen are required to report their landing of each of the target species (or species category). Approval of Alternative 2 will not effect this requirement.

The identification and sorting of rockfish would be much simpler under Alternative 2 should the catches exceed the quota for a certain assemblage. With this alternative, one would not need to pay as close attention to what actual species comprise the catch since fishermen fishing out of an assemblage know that where one of the species is legal, the entire catch should be.

Administrative, enforcement, and information costs and benefits

Adoption of Alternative 2 will reduce administrative costs, improve enforcement capability, and provide more reliable catch information. Administrative costs will be reduced because managers will no longer be required to calculate and publish groundfish reserve amounts each year. However, the savings will be relatively small. Enforcement capability will be improved as a result of more logical species management for rockfish, making enforcement of quotas easier; and that legal gear will be clearly specified in the regulations,

preventing an intended or inadvertent circumnavigation of the regulations. Catch information will become more reliable since the rockfish assemblage categories also follow the species grouping used by domestic processors. Catch statistics, generated from fish ticket filled out by fishermen or processors will therefore be more reliable when compared to the current procedure of attempting to identify individual species and assigning the data to either the Pacific ocean perch complex or Other Rockfish category. Costs of management staff attempting to sort out rockfish data will be reduced as a result of this amendment.

Impact on consumers

This alternative would not effect the quality or the price of the product to the consumer.

Redistribution of costs and benefits

The benefits of this amendment primarily take the form of more efficient management, which all user groups share equally. Revising the rockfish category so that each category reflects the assemblage from which the species was caught, the standardization of quota terminology, the clarification of legal gear, and the elimination of outdated administrative reserve calculations, will lead to improved fisheries management.

Benefit-Cost conclusion

Beyond the efficiency of management by categorizing rockfish by assemblage and eliminating non-species specific reserve, enforcement costs savings should be realized by adoption of Alternative 2. Enforcement of rockfish quotas and legal gear regulations should be improved. Benefits of having an updated FMP will be realized with Alternative 2 and shared by both management and the public alike.

9.0 EFFECTS ON ENDANGERED SPECIES AND ON THE ALASKA COASTAL ZONE

None of the alternatives would constitute actions that "may affect" endangered species or their habitat within the meaning of the regulations implementing Section 7 of the Endangered Species Act of 1973. Thus, consultation procedures under Section 7 on the final actions and their alternatives will not be necessary.

Also, for the reasons discussed above, each of the alternatives would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Zone Management Program within the meaning of Section 307(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

10.0 FINDINGS OF NO SIGNIFICANT ENVIRONMENTAL IMPACT

For the reasons discussed above, neither implementation of the status quo nor any of the reasonable alternatives to that action would significantly affect the quality of the human environment, and the preparation of an environmental impact statement on the final action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

_____

Date

11.0 COORDINATION WITH OTHERS

The Gulf of Alaska Groundfish Plan Team consulted extensively with representatives of the Alaska Department of Fish and Game, National Marine Fisheries Service, members of the Scientific and Statistical Committee and Advisory Panel of the Council, and members of the academic and industrial community. Lew Queirolo, Regional Economist, NMFS, and Grant Thompson, Northwest and Alaska Fishery Center, provided professional input and advise.

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2.0 Amendment Proposal 6: Minimum size limit for sablefish (GOA and BS/AI).

2.1 Description of the Problem (and Need for the Action).

The sablefish resource has several characteristics that suggest that it may be possible to increase its yield by imposing a minimum retention size for sablefish taken in commercial fisheries off Alaska. These characteristics include the following: 1) sablefish are first available to the fishery at age 1 with an average length and weight of 30 cm and 0.25 kg when they are sexually immature equal to zero; 2) 50% of female sablefish are sexually mature at 65 cm, the corresponding age and weight are 5.7 years and 3.16 kg, males at this age are 57 cm and weigh 2.10 kg; 3) the exvessel price of sablefish is size dependent with the price per pound of the largest size category equal to almost three times that of the smallest size category (see Table 2.1). These characteristics have led to the imposition of minimum size limits for sablefish off California, Oregon, Washington, and the west coast of Canada. They have also led to a request by some fishermen for a similar size limit for sablefish taken in the EEZ off Alaska.

The Pacific Fishery Management Council (PFMC) size limit is 22 inches total length. However, trawlers and fixed gear vessels, respectively, are allowed to land up to 5,000 pounds and 100 pounds of fish less than 22 inches per trip. Retention of small amounts of fish under the 22 inch limit caught incidentally while targeting on larger sablefish or other groundfish species is permitted because the Pacific Council wanted to avoid the waste of a valuable catch that would suffer high discard mortality if it were not retained. The rationale for the PFMC size limit focused on the notion that continued catches of immature sablefish could limit the reproductive potential of the stock.

The Canadian size limit is 55 cm fork length and there is no provision for the retention of smaller fish. This limit resulted from three areas of concern: 1) to protect juvenile sablefish from harvest, 2) to maximize yield per recruit, and 3) to prevent recruitment overfishing.

The effects of a minimum size limit on potential long-term yield depend on the interactions of growth, natural mortality, rates of exploitation, availability of fish to specific gear, discard mortality, exvessel prices by size category, recruitment, and fishing costs. The discussion of the effects of minimum size regulations presented in this report are based on a yield per recruit model that accounts for these interactions.

A yield per recruit model can provide insights concerning the effects of a minimum size limit on average or over a long period of time. However, it is not well suited to evaluate the shortterm effects of a size limit for a species such as sablefish that is subject to large fluctuations in recruitment. Therefore, it must be emphasized that the results of the model are useful in determining the effects of minimum size regulations that would be in effect for a number of years and not subject to frequent revisions.

2.2 Alternatives (Including the Action)

Three general types of alternative are considered. They are as follows:

2.2.1 Alternative 1 Do nothing - Status quo (i.e., no minimum size regulations)

2.2.2 Alternative 2 Establish a single minimum size limit for all gear (including a limit of 22 inches)

2.2.3 Alternative 3 Establish a minimum size limit for fixed gear only (i.e., longline and pots) (including a limit of 22 inches).

2.3 Description of the Sablefish Fishery

Because sablefish is a fully utilized species off Alaska, only DAP (i.e., fully domestic) fisheries can target on sablefish. Sablefish are taken as both target catch and bycatch by trawlers and as target catch by longline and pot vessels. In 1986 sablefish accounted for 89%, 93%, and 4% of the total DAP groundfish catch (excluding halibut) of longline, pot, and trawl vessels, respectively off Alaska. For only those groundfish landings (i.e., trips) that included sablefish, sablefish accounted for 98%, 98%, and 36% of the catch for longline, pot, and trawl vessels, respectively, in the Gulf of Alaska. The corresponding values for the Bering Sea are 93%, 99%, and 13%. For individual trawl vessels, the percentage ranged from less than 1% to over 90%.

In the Gulf of Alaska the allocation of the sablefish quota for each regulatory area was established by Amendment 14. There are no gear allocations in the Bering Sea Aleutian Islands FMP.

In 1986, 444 longline vessels, 15 pot vessels, and 30 trawl vessels participated in the DAP sablefish fishery in the EEZ off Alaska. The corresponding numbers for the Gulf of Alaska are 440, 14, and 21, respectively. For the Bering Sea and Aleutians, the numbers of vessels were 49, 6, and 13. From this it is clear that most of the longline and pot vessels that fished in the Bering Sea also fished in the Gulf. This is not true for trawl vessels.

Despite the large fleet sizes, catches were heavily concentrated among relatively small numbers of vessels. The high level of concentration of catch is demonstrated by the percentage of each fleet's total sablefish catch that was taken by the top 10% of the vessels in terms of catch per vessel. The percentages were 45% and 34% for the Gulf and Bering Sea longline fisheries. The percentages tended to be higher for the other fleets. However, due to the smaller number of vessels in these fleets and State of Alaska confidentiality restrictions, the percentages cannot be reported for the other fleets.

The physical and operational characteristics of these vessels are summarized in Table 2.2. Catch data by region, month, and gear are provided in an appendix.

2.4 Impacts of the Alternatives on the Sablefish Fishery

A sablefish bioeconomic model (Fujioka, McDevitt, and Terry, 1987) was developed at the Northwest and Alaska Fisheries Center as a tool to assist the Council focus the debate concerning the effects of a minimum size limit. The results of the model are presented below. The results are preliminary for two reasons. First, there has not been sufficient time to include complete economic data for all the fleets. Second, the parameters and functions used in the model are thought to provide a reasonable representation of the sablefish fishery, but more complex assumptions could be incorporated into the analysis.

The model was used to estimate the effects of seven minimum sizes ranging from 37 cm to 61 cm fork length in increments of 4 cm. The lowest minimum size considered provides a good approximation of the results of the status quo, that is, no minimum size limit because relatively few fish are taken at or below 37 cm. The second to the largest size considered, 57 cm fork length, is approximately the length of a sablefish that weigh 3 pounds dressed, assuming a round weight to dressed weight recovery rate of 67%. The Council was asked to consider a size limit that would prohibit retention of fish below this weight. The evaluation of the alternatives will be in terms of comparisons between the status quo and each of the other alternatives.

The model estimates equilibrium yield as a function of the instantaneous rate of fishing mortality in the fixed gear fishery (F) for each of seven size limits. Yield is defined in terms of weight, exvessel revenue, and exvessel profit. Exvessel revenue equals the quantity of fish landed (in pounds) times the average exvessel price per pound. Exvessel profit equals exvessel revenue minus harvesting costs. Hereafter, when the terms revenue, profit, or price is used, it is implicitly modified by the term exvessel.

The model also estimates the reproductive potential of the stock in terms of the egg production potential as a function of F for each size limit.

The F for the trawl fishery was set such that the ratio of fixed gear catch to trawl catch was approximately 6.2 for each fixed gear F and for each size limit. This is the ratio of fixed gear to trawl gear quotas for the Gulf of Alaska in 1987. Therefore throughout the discussion of the model, F refers to the fixed gear instantaneous rate of fishing mortality for the part of the biomass that is available to the fishery; and there is an associated fishing mortality rate for trawl gear that maintains a constant ratio between fixed and trawl gear catches. The trawl Fs for each fixed gear F and for each size limit are presented in Tables 2.3 and 2.4, respectively, for the alternatives in which a size limit applies to all gear or to only fixed gear. Although the results of the model are specifically for the Gulf of Alaska, the implications of the model are assumed valid for the Bering Sea and Aleutian Islands Area.

2.4.1 Comparison of Alternative 1 (No Minimum Size) and Alternative 2 (Establishing a Minimum Size for All Gear)

Biological Yield

When the same size limit was applied to all gear, equilibrium yield as a function of F was higher with no size limit (i.e., for the smallest size

limit modeled which was 37 cm) than for any size limit considered for all Fs below 0.40 (see Table 2.5). This result indicates that, for Fs between 0.01 and 0.40, the potential increase in equilibrium yield that could be obtained with a size limit is more than offset by discard and natural mortalities.

Exvessel Revenue

The exvessel prices used in the model are based on fish ticket data for 1986. For the longline iceboat fishery, a large percentage of the sablefish fish tickets include both catch and revenue (i.e., exvessel value) by size. Therefore, the longline exvessel prices obtained from fish tickets are thought to provide good estimates of the average 1986 prices for longline iceboats. The percentages of sablefish that are both sized and priced on fish tickets for the other types of vessels are quite low and may not be representative of 1986 prices. This problem is most acute for the catcher/processors of all three gear types, since they usually do not report catch and value by size. Therefore, the prices used in the model tend to reflect those of shore based vessels and not catcher/processors.

The maximum equilibrium revenue occurs with a size limit of 53 cm (see Table 2.6). The maximum revenue with a size limit of 53 cm occurs with a fixed gear F of 0.150 and is less than 0.2% greater than the maximum revenue that occurs with no size limit at an F of 0.125. This suggests that increased revenue per fish is not quite offset by the increased discard and natural mortalities associated with a size limit of 53 cm. However, the small increase in maximum revenue is attained with a 20% increase in the fixed gear F and a corresponding increase in fishing effort and cost. For Fs below 0.3, equilibrium revenue was greater with no size limit than with the 57 cm limit the Council was asked to consider.

Exvessel Profit

The next evaluation of size limits is in terms of equilibrium profit. The following comments on the concept of equilibrium profit and the limits of the cost information currently included in the model are a necessary introduction to that evaluation.

As noted above, the associated concepts of yield per recruit and equilibrium yield are long term concepts. Therefore, when equilibrium profits are discussed, we are assuming that the period in question is long enough to permit vessels to either enter or exit the fishery. This means that the assumption concerning any restrictions on entry should be explicit. If it is assumed that there are no restrictions on entry, entry or exit will occur until economic profit is zero, that is until just the normal rate of return is being earned in the fishery. Therefore, in the absence of restrictions on entry, the equilibrium profit will be zero for each size limit and for any F. With the qualification that for some Fs, a commercial fishery would not be economically viable and would not occur.

The equilibrium profits provide little useful information with such an assumption. The alternative is to consider the equilibrium profit that would be attainable if there were adequate restrictions on entry. The estimates of equilibrium profit used in the evaluation of size limits in this report are of this latter type. That is, they describe the potential long-term profit

associated with different size limits and Fs. This assumption is incorporated into the model by holding the number of trips per vessel constant at six per year. If this restriction was not made, an excessive number of vessels would enter the fishery and the number of trips per vessel per year would be reduced until economic profit is forced to zero.

In estimating harvesting cost and profit, crew costs per trip were held constant at the estimated 1986 level. This was done so that changes in payments to crews per trip that result from changes in size limits and Fs are included as changes in the profit of the vessel owner and crew. Otherwise these benefits or costs to crew members would not be accounted for.

At this time the model utilizes very limited harvesting cost information. Harvesting cost for the fixed gear fleet is estimated based on detailed 1986 cost and operating characteristics data for one longline iceboat and partial information for a similar vessel. Information for other types of fixed gear vessels and trawl vessels will be used as it becomes available. The trawl fleet was excluded from the estimates of potential profit, because there was not adequate time to model the complexities of this fleet. Because, the model does not include trawl cost information, the estimates of equilibrium profit are for the fixed gear fishery only. The probable effects of both of these limitations are discussed in a later section that qualifies the model's results. The lack of more complete cost and price data is a function of the time that has been available to collect them, it is not due to any reluctance on the part of the industry to provide them.

The maximum potential profit occurs with a size limit of 45 cm and an F of 0.015 to 0.020 (see Table 2.7. The difference between maximum profit with a 45 cm limit and no limit was $500,000 for the entire fixed gear fleet. Most other size limits, including one of 57 cm, resulted in lower profits than no limit for Fs between 0.01 and 0.15. However, the maximum profits for different size limits from none to one of 57 cm did not differ by more than $1.2 million.

An important implication of these results is that due to the apparent cost per unit of effort, the economically relevant portion of all of the equilibrium curves is probably bounded on the upper end by Fs that do not greatly exceed the estimated 1986 Gulf of Alaska fixed gear F of 0.023. Therefore, the Fs of approximately 0.125 to 0.175 at which the equilibrium yield and revenue curves peak are beyond the relevant range. If this is correct the evaluation of size limits in terms of yield or revenue should be at relatively low Fs, not at the Fs that maximize yield and revenue. Tables 2.8 and 2.9 present estimates of how rapidly the profitability of the fishery decreases in terms of total profits for the fixed gear fleet and in terms of both catch and revenue per trip. The latter two estimates of the decline in profitability as F increases are not dependent on the cost assumption used in the model.

To test both the sensitivity of the ranking of the size limits in terms of maximum potential profit for the fixed gear fleet and the sensitivity of the economically relevant range of Fs to the estimate of cost per unit of effort used in the model, equilibrium profit was estimated for cost per unit of effort ranging from 25% to 150% of the initial estimate. The resulting estimates are presented in Table 2.10.

A change in the cost estimate used can affect the ranking of size limits in terms of maximum potential profit by changing the F(s) at which the equilibrium

profit curves peak. As the cost estimate increases, the F that maximize profit for each size limit decrease. The result that a limit of 45 cm maximizes profit was not affected by increasing cost per unit of effort by as much as 50% or by decreasing it by 25%. However, when cost per unit of effort was decreased by 50% or 75%, maximum potential profit for the fixed gear fleet was highest with no size limit.

With respect to the sensitivity of the relevant range of Fs, it was found that even with a 75% reduction in cost per unit of effort, the F that maximizes potential economic profit in the fixed gear fishery was 0.075. However, with costs reduced by that amount, potential profit was greater than zero for Fs as high as 0.2. The Fs at which potential profit equals zero for other cost estimates were as follows: 50% cost decrease F of 0.1, 25% decrease F of 0.05, no change in cost F of 0.025, 25% increase F of 0.015, and 50% increase F of less than 0.01.

Reproductive Potential and Biomass

The model indicates that the reproductive potential of a sablefish resource declines rapidly as F increases, but that it is relatively insensitive to the minimum size for a given F between 0.01 and 0.15. As F increases, the relative differences in reproductive potential for the different size limits increases. At an F of 0.15, the reproductive potential is 8% higher with a minimum size of 61 cm than with a limit of 37 cm. At an F of 0.025, which is about equal to the 1986 F, the corresponding difference is 0.5% (see Table 2.11). Therefore, it appears that the size limit has a sufficiently small effect on the reproductive potential of sablefish ,at the Fs for which the fixed gear fishery appears to be economically viable, that it is appropriate to base the evaluation of the alternatives on the results of the yield per recruit model without adjustments for differences in reproductive potential.

The level of biomass is another measure of the effect of a size limit. Estimates of biomass in terms of an index are presented in Table 2.12 for the various Fs and size limits considered. Equilibrium biomass was found to be similar to the reproductive potential in that it was much more sensitive to F than to the size limit and that the relative sensitivity to a size limit increased with an increase in F. With Fs of 0.025 or 0.150, the biomass was increased by a maximum of 1.7% or 13.1%, respectively, by going from no size limit to that which maximized biomass. For both Fs that limit was 57 cm.

Summary

To summarize, these results suggest that when a size limit is applied to all gear types: 1) maximum equilibrium yield would be decreased; 2) maximum equilibrium revenue would be increased with a 53 cm limit by less than 0.2% but require a 20% increase in F, and would be decreased by any other size limit in comparison to no limit; 3) maximum potential equilibrium profit for the fixed gear fleet would be increased with a 45 cm size limit by $500,000; and 4) neither reproductive potential nor biomass would be reduced by more than 10% by the absence of a size limit with an F of 0.1 and the effect would be less than 2% for an F of 0.025 which exceeds the estimated 1986 F of 0.023.

Comparison with Earlier Results

These results differ greatly with those of Francis (1985) that were prepared for the PFMC after the size limit had been established. The differences are explained by three factors. The current NWAFC model accounts for discard mortality of fish below the size limit. Specifically, the model assumes that discard mortality is 35% in the fixed gear fishery and 100% in the trawl fishery. Francis assumed 0 discard mortality. The second factor is the gear selectivity function used in each model. The models are naturally quite sensitive to what is assumed about the proportion of each size group that is available to a specific type of gear. Although it is difficult to estimate gear selectivity coefficients, it is believed that those used in the NWAFC model represent the best available information. The third factor is the large difference in the gear allocation assumed. The NWAFC model assumes a 6.2 ratio of fixed gear to trawl catch, this reflects the gear allocation implemented under Amendment 14 to the GOA groundfish FMP. The analysis done for the PFMC assumes a ratio of 1 and estimates the effect of going from no size limit and a ratio of 1 to a limit of 22 inches and a fixed gear only fishery.

The difference in assumptions concerning discard mortality are based on different assumptions concerning how each fleet will react to a specific size limit. In the research for the PMFC, it was assumed that if fishermen cannot retain fish of a given size, they will change their fishing strategies in such a way that such fish will no longer be caught. With the NWAFC model, the assumption is that fishing strategies will not change and the fish below the size limit will continue to be caught and discarded. Although neither assumption is expected to be strictly met, there are reasons to believe that the latter assumption is more appropriate at least for the sablefish fishery off Alaska.

A large part of the sablefish landings caught by trawl vessels in the future will be taken as bycatch as the trawl fleet continues to increase its catch of other species. The fishing strategies associated with this trawl effort would probably not be significantly affected by sablefish size limits. The vessels that target on sablefish already have a strong price incentive to target on larger sablefish, and as noted above much of the sablefish catch is taken by a group of very productive vessels that are quite likely to respond to such an incentive. Therefore, fishing strategies and the resulting catch of small fish may not be significantly altered by a size limit. Note that at Fs close to the current level, the effect of this assumption is small.

To the extent that fishing strategies would change and reduce the catch of small fish, the results of the NWAFC model tend to understate the benefits of a size limit. If for example, fishermen are currently targeting on small fish, a size limit would necessarily alter their fishing strategy and the benefits of a size limit would be greater than estimated above. Certainly if it is determined during the Council's discussion of size limits that such targeting does occur and takes significant amounts of sablefish, the model could be modified to account for such fishing strategies.

Estimates of the 1986 size composition by gear are presented in Table 2.13. These estimates are based on fish ticket data. As noted above, the percentage

of sablefish that are sized on fish tickets varies greatly by gear and type of operation. The percentages sized were as follows: longline 68%, pot 13%, and trawl 12%. Although these limited data indicate that sablefish less than 57 cm accounted for 62% of the trawl catch by weight, these data do not indicate the proportion of fish under 57 cm that were taken as target catch as opposed to bycatch. Because a low percentage of sablefish are sized for the trawl fleet and because much of the sized sablefish are probably for shore based trawlers and not from catcher/processors, the size composition estimates for the trawl fleet may not reflect the actual size composition.

Qualifications Concerning the Estimated Effects of Size Limits

It is necessary to qualify the results discussed above by indicating that they are preliminary. As the model is reviewed by the industry and others, it will be improved.

The economic sections of the model will be improved as more complete cost, price, and operating characteristic information are obtained. The current model only contains cost information for one type of longline iceboat. Therefore, the fishing cost for the fixed gear fishery does not account for the differences in fishing cost of the many different type of vessels in the fixed gear fleet. The model does not include fishing cost for the trawl fleet. Model deficiencies due to limited cost information do not bias the inferences with respect to size limits applied to all gear, because the relative positions of the equilibrium profit curves for the different sizes considered are not affected by even very large changes in the cost of a unit of effort. That is, cost per unit of effort was varied from 75% to 150% of the initial estimate without affecting the relative position (i.e., the ranking) of the equilibrium profit yield curves. Only when cost per unit of effort was reduced by 50% or 75% did the ranking change in favor of no size limit.

A potentially more critical deficiency is the lack of trawl fleet harvesting costs in the model. By excluding both trawl revenue and cost in estimating profit, the model tends to overstate the benefits of a size limit. This is true whether the trawl fleet takes sablefish as target catch or bycatch. If it is taken as bycatch, a size limit will tend to reduce trawl revenue but not affect costs. Therefore, the probable decrease in trawl profits associated with a size limit is not currently accounted for by the model. If the trawl fleet targets on sablefish, a size limit would tend to result in a larger increase in cost than revenue because the trawl Fs associated with a given fixed gear F increases significantly when a size limit is imposed. It is possible that this bias led to the result that a 45 cm limit would increase potential profits . However, it appears that the lack of complete information concerning the fleets does not limit the usefulness of the model in determining that there would probably not be a significant increase in potential profits with a size limit applied to all gear. Even with the trawl related bias in favor of a limit, the estimated increase in potential profits was small.

The model will tend to understate the benefits of a size limit, if a size limit results in a decrease in the proportion of catch taken by trawlers. However, as noted above, the potential expansion of trawl effort targeted on other groundfish species may assure that the trawlers' share of the quotas will be taken.

The model does not allow prices to respond to changes in sablefish catch. That is, prices by size category were assumed constant. Based on the lack of success of prior attempts to estimate price response relationship, it was decide that such an exercise was beyond the scope of the current modeling project. By not including such a relationship, the difference in the heights of the equilibrium revenue and profit curves for different size limits is overstated. However, their ranking should not be affected if the prices for all size categories change proportionally. Note that although the end of season Seattle prices submitted by the Fishing Vessel Owners' Association with their request that a size limit be considered were not used in the model, the relative differences in prices among size categories for the prices that were used were similar. It is be possible to estimate the effects of a size limit for any given set of prices or other parameters that with the industry's cooperation are determined to be appropriate.

2.4.2 Comparison of Alternative 1 (No Minimum Size) and Alternative 3 (Establishing a Minimum Size for Fixed Gear Only)

Biological Yield

Equilibrium yield would not be increased by a size limit that applied to fixed gear only (see Table 2.14). This result indicates that, for Fs between 0.01 and 0.40, the potential increase in equilibrium yield that could be obtained with a size limit is offset by discard and natural mortalities.

Exvessel Revenue

The maximum equilibrium revenue occurs with a size limit of 53 cm and an F of 0.150 to 0.175 (see Table 2.15). The equilibrium revenue with a size limit of 53 cm and a fixed gear F of 0.150 is 8.8% greater than the maximum revenue that occurs with no size limit at an F of 0.125. This suggests that increased revenue per fish is not offset by the increased discard and natural mortalities associated with a size limit of 53 cm. However, the 8.8% increase in maximum revenue is attained with a 20% increase in the fixed gear F and a corresponding increase in fishing effort and cost. For Fs at or above 0.05, equilibrium revenue was greater with the 57 cm limit the Council was asked to consider than with no limit. The percentage increase in maximum revenue was smaller and the result with respect to a 57 cm limit was different when the limit applied to all gear.

Exvessel Profit

The maximum potential profit occurs with a size limit of 45 cm and an F of 0.015 (see Table 2.16. The difference between maximum profit with a 45 cm limit and no limit was $1 million for the entire fixed gear fleet. Most other size limits, including one of 57 cm, resulted in lower profits than no limit for Fs between 0.01 and 0.025. For Fs above 0.025, profit was less than zero, (i.e., there were losses) but the losses were smaller with a 57 cm limit than with no limit. Each of these results is more supportive of a size limit than the corresponding results when the limit applied to all gear.

As noted earlier, an important implication of these results is that due to the apparent cost per unit of effort, the economically relevant portion of all of the equilibrium curves is probably bounded on the upper end by Fs that do not greatly exceed the estimated 1986 Gulf of Alaska fixed gear F of 0.023. Therefore, the Fs of approximately 0.15 to 0.20 at which the equilibrium yield and revenue curves peak are beyond the relevant range. If this is correct the evaluation of size limits in terms of yield or revenue should be at relatively low Fs, not at the Fs that maximize yield and revenue. Tables 2.17 and 2.18 present estimates of how rapidly the profitability of the fishery decreases in terms of total profits for the fixed gear fleet and in terms of both catch and revenue per trip. The latter two estimates of the decline in profitability as F increases are not dependent on the cost assumption used in the model.

The test of the sensitivity of the ranking of the size limits in terms of maximum potential profit for the fixed gear fleet to changes in the cost

per unit of effort showed that the profit maximizing limit of 45 cm was not affected by increasing cost per unit of effort by as much as 50% or by decreasing it by 25% (see Table 2.19). However, when cost per unit of effort was decreased by 50% or 75%, maximum potential profit for the fixed gear fleet was highest with a 53 cm size limit. This did not occur when the limit applied to all gear.

With respect to the sensitivity of the relevant range of Fs, it was found that even with a 75% reduction in cost per unit of effort, the F that maximizes potential economic profit in the fixed gear fishery was 0.075. However, with costs reduced by that amount, potential profit was greater than zero for Fs as high as 0.2. The Fs at which potential profit equals zero for other cost estimates were as follows: 50% cost decrease F of 0.1, 25% decrease F of 0.05, no change in cost F of 0.025, 25% increase F of 0.015, and 50% increase F of less than 0.01. These results are identical to those when the limit applied to all gear.

Reproductive Potential and Biomass

The model indicates that the reproductive potential of a sablefish resource declines rapidly as F increases, but that it is less sensitive to the size limit for a given F. As F increases, the relative differences in reproductive potential for the different size limits increases. At an F of 0.15, the reproductive potential is 37% higher with a minimum size of 61 cm than with a limit of 37 cm. At an F of 0.025, which is about equal to the 1986 F, the corresponding difference is 5.7% (see Table 2.20). Note that the reproductive potential was less sensitive to a size limit when the limit applied to all gear. This may change the previous conclusion that it is appropriate to base the evaluation of the alternatives on the results of the yield per recruit model without adjustments for differences in reproductive potential. But at Fs below 0.15, the conclusion does not change.

The level of biomass is another measure of the effect of a size limit. Estimates of biomass in terms of an index are presented in Table 2.21 for the various Fs and size limits considered. Equilibrium biomass was found to be similar to the reproductive potential in that it was much more sensitive to F than to the size limit and that the relative sensitivity to a size limit increased with an increase in F. With Fs of 0.025 or 0.150, the biomass was increased by a maximum of 6% or 39%, respectively, by going from no size limit to that which maximized biomass. For both Fs that limit was 61 cm. As with reproductive potential, biomass is considerably more responsive to a change in the size limit when the limit applies to fixed gear only.

Summary

To summarize, these results suggest that when a size limit is applied to fixed gear only: 1) maximum equilibrium yield would not benefit from a size limit; 2) maximum equilibrium revenue would increase with a 53 cm limit by 8.8% but require a 20% increase in F, but would not decrease with any other size limit in comparison to no limit; 3) maximum potential equilibrium profit for the fixed gear fleet would be increased with a 45 cm size limit by $1 million; and 4) both reproductive potential and biomass are more

responsive to a change in the size limit when the limit applies only to fixed gear, but at Fs near the current level it is not necessary to consider the effect of a size limit on both variables.

The differences in the estimated effects of a size limit depending on whether the limit applies to all gear or just fixed gear can be explained by the differences in the trawl Fs with the two alternatives. Remember that in both cases the trawl F is adjusted so that, for a given fixed gear F and size limit, the fixed gear catch to trawl gear catch ratio is maintained at 6.2. This requires an increase in the trawl F as the size limit is increased if the limit also applies to trawlers. But since the trawl discard mortality rate is assumed to be 100%, the increase in trawl F tended to result in a disproportionately large increase in mortality. Conversely, when the size limit applied only to fixed gear, an increase in the size limit resulted in a decrease in the trawl F. The corresponding fixed and trawl gear Fs for each size limit are given in the previously mentioned Tables 2.3 and 2.4 for the cases in which the size limit applies to all gear or only to fixed gear, respectively.

Qualifications Concerning the Estimated Effects of Size Limits

When a size limit applies only to fixed gear, the qualifications concerning the model's implications for size limits change. The lack of trawl costs in the model now results in a bias in favor of no size limit. The reason for this is that when the limit applies only to fixed gear, trawl revenue for a given fixed gear F is relatively constant but the trawl F and cost decrease as the size limit increases. Therefore, for a given fixed gear F, the potential profit for the trawl fleet increases as the size limit increases. This increase in profits is not accounted for by the model.

When the size limit applies to fixed gear only, the bias associated with not including the trawl fleet in the estimates of potential profit and the bias of assuming that fishermen will not change their fishing strategies if a limit is implemented both tend to have the model understate the net benefits of a size limit. Therefore, the model's conclusion that a size limit would be beneficial to the fisheries, is not the result of these biases.

2.5 Environmental Assessment

Alternative 2: Establish a single minimum size limit for all gears.

Possible environmental impacts which could result from the imposition of minimum size limits on all gear types which harvest sablefish are expected to be minimal. These impacts may fall into several categories:

i. Physical damage to the ocean floor from increased fishing effort is not expected to be measurable. If most sablefish harvested by the trawl fleet would be taken as bycatch while the trawlers are targeting on other species, there would be little increase in trawl effort above current levels. If sablefish are caught in directed trawl fisheries and a minimum size limit is imposed on them, they would likely change their operations to target as much as possible on the legal sized fish. This could result in some increase in effort. In the worst case, if trawlers do target on sablefish and do not change their fishing patterns with imposition of a minimum size limit, a relatively large increase in effort is possible. There is little reason to believe, however, that trawls do any significant damage to the benthic communities (see Natural Resource Consultants 1984, for a summary of ecological impacts of trawling). There is no evidence of physical damage from longline fishing effort.

ii. Change in sablefish biomass due to size limits imposed on the fisheries is not expected to be significant. Results from the model are summarized in section 2.4.1 above. The model indicates that biomass decreases rapidly with increasing F, but that for values of F less than .15 biomass was relatively insensitive to size limits (see Table 2.12).

iii. Relative reproductive potential of the sablefish stock as measured by total fecundity is not expected to change significantly with the imposition of size limits. Results from the model are summarized in section 2.4.1 above. The model indicates that egg production decreases rapidly with increasing F, but that for values of F less than .15 egg production was relatively insensitive to size limits (see Table 2.11).

iv. The imposition of minimum size limits on the fishing fleets will change the size structure of the sablefish population, but the change is expected to be minimal. As fishing mortality is increased on larger sizes and decreased on smaller sizes, the population size structure will shift slightly towards smaller fish. The effect on predator-prey relations precipitated by the minor changes in size distribution which could result from this alternative are expected to be undetectable.

Alternative 3: Establish a minimum size limit for fixed gear only.

Possible environmental impacts which could result from imposing a minimum size limit on fixed gear only are expected to be minimal. Impacts of alternative 3 relative to the status quo (alternative 1) are likely to be less than the impacts of alternative 2 relative to the status quo for all categories outlined above.

Natural Resource Consultants. 1984. Development of large-scale trawling in the Gulf Of Alaska and Bering Sea and its economic and ecological impacts. Processed Report. NRC, 4055 21st Ave. W., Seattle, WA 98199. 195p.

2.6 Regulatory Impact Review

The discussion of the effects of size limits in sections 2.4.1 and 2.4.2 of this report is the basis for many of the following statements concerning impacts.

2.6.1 Reporting Costs

Reporting costs do not differ among the three alternatives.

2.6.2 Administrative and Enforcement Costs

There will be additional administrative costs associated with establishing and implementing a size limit. These costs will be comparable to most any other change in the FMP. That is, a change requires that the Council and NMFS spend time and other resources approving and implementing a change. Other than these setup costs, the additional administrative costs should be minimal.

Both alternatives 2 and 3 would result in increased enforcement responsibilities but probably not increased expenditures on enforcement. This means that enforcement resources would have to be reallocated to some extent. A size limit would no doubt be enforced by the same method and at the same time other regulations are enforced.

Enforcement of a size limit is probably simplest if it can be in terms of a processor being in possesion of fish below the limit. For this type of enforcement to be possible, there cannot be any exceptions to the size limit or any size limit differentials by gear or area. The Pacific Council did make an exception for relatively small amounts of incidentally caught sablefish below the size limit. This suggests that the problem of not being able to enforce the limit in terms of possesion by processors was not considered to be a major problem. Therefore, enforcement is at the vessel level or at the point of sale. With this type of enforcement, exceptions and size differential by gear do not present a major problem. Size differentials by area do present a problem.

With a size differential by area, enforcement at sea may be necessary. Therefore, enforcement difficulty and perhaps cost would by higher if the same size limit did not apply to both the Gulf of Alaska and the Bering Sea.

The experience of the Pacific Council limit has demonstrated that there will be additional enforcement resources used in terms of setup costs. For example, it took some time and effort to determine the appropriate conversions to use in going from a limit stated in total length to a limit by length or weight for dressed or more fully processed fish. Their experience suggests two things: 1) enforcement meeds to be lenient while the conversions are being sorted out, and 2) reasonable conversion factors can be agreed upon.

A size limit would by more difficult to enforce for catcher/processors as are other regulations. But the enforcement of a size limit could occur as other regulations are enforced. That is, it is unlikely that the enforcement efforts targeting on catcher/processors would be increased.

The enforcement responsibilities and potential costs would be lower with alternative 3 than with alternative 2 because fewer vessels would be envolved.

2.6.3 Impact on Consumers

Neither of the alternatives to the status quo would have a measurable impact on consumers. A size limit would decrease the supply of small fish and increase the supply of larger fish. For all practical purposes the impact on consumers would by zero because: 1) much of the sablefish catch is exported, 2) there are many substitutes for sablefish for most consumers, and 3) sablefish account for an insignificant part of consumers' budgets.

2.6.4 Redistribution of Costs and Benefits

Compared to the status quo, alternative 2 would tend to redistribute benefits from the trawl fleet to the fixed gear fleet. The benefit to the fixed gear fleet was estimated to be $500,000, if access to the fishery is limited. The cost to the trawl fleet was not quantified, but could exceed the benefit to the fixed gear fleet.

Compared to the status quo, alternative 3 was estimated to provide benbfits to both fleets. With the benefits to the fixed gear fleet being greater than with alternative 2. The net benefits to the fleets with alternative 3 are more likely to exceed the increased administrative and enforcement costs than with alternative 2.

Table 2.1 -- Sablefish lengths, weights, and price by age and sex.

Females

					Longline fishery		Trawl fishery	
Age	cm	inches	kg	pounds	$/lb.	$/fish	$/lb.	$/fish
0.5	22.1	9.3	0.1	0.1	0.00	0.00	0.00	0.00
1.0	29.0	12.1	0.2	0.3	0.00	0.00	0.00	0.00
1.5	35.1	14.5	0.4	0.6	0.00	0.00	0.00	0.00
2.0	40.6	16.7	0.7	1.0	0.45	0.45	0.12	0.12
2.5	45.3	18.6	1.0	1.5	0.45	0.65	0.12	0.17
3.0	49.6	20.3	1.3	1.9	0.45	0.87	0.12	0.23
3.5	53.3	21.7	1.7	2.4	0.64	1.57	0.49	1.20
4.0	56.6	23.0	2.0	3.0	0.64	1.90	0.49	1.46
4.5	59.5	24.2	2.4	3.5	0.76	2.65	0.67	2.34
5.0	62.1	25.2	2.7	4.0	1.03	4.11	0.88	3.52
5.5	64.3	26.1	3.0	4.5	1.03	4.62	0.88	3.95
6.0	66.3	26.9	3.4	4.9	1.03	5.10	0.88	4.36
6.5	68.1	27.6	3.6	5.4	1.27	6.83	0.94	5.06
7.0	69.6	28.2	3.9	5.8	1.27	7.35	0.94	5.45
8.0	72.2	29.3	4.4	6.5	1.27	8.27	0.94	6.13
9.0	74.3	30.1	4.8	7.1	1.28	9.15	0.99	7.02
10.0	75.8	30.7	5.2	7.6	1.28	9.79	0.99	7.51
11.0	77.1	31.2	5.4	8.0	1.28	10.31	0.99	7.91
12.0	78.0	31.6	5.7	8.4	1.28	10.73	0.99	8.23
13.0	78.8	31.9	5.8	8.6	1.28	11.06	0.99	8.49
14.0	79.3	32.1	6.0	8.8	1.28	11.33	0.99	8.69
15.0	79.8	32.3	6.1	9.0	1.28	11.54	0.99	8.85
16.0	80.1	32.4	6.2	9.1	1.28	11.70	0.99	8.98
17.0	80.4	32.5	6.2	9.2	1.28	11.83	0.99	9.08
18.0	80.6	32.6	6.3	9.3	1.28	11.93	0.99	9.16
19.0	80.8	32.7	6.3	9.4	1.28	12.01	0.99	9.22
20.0	80.9	32.7	6.4	9.4	1.28	12.08	0.99	9.27

Table 2.1 -- Continued.

Males

Age	cm	inches	kg	pounds	Longline fishery $/lb.	Longline fishery $/fish	Trawl fishery $/lb.	Trawl fishery $/fish
0.5	24.4	10.3	0.1	0.2	0.00	0.00	0.00	0.00
1.0	30.1	12.5	0.3	0.4	0.00	0.00	0.00	0.00
1.5	35.0	14.5	0.4	0.6	0.00	0.00	0.00	0.00
2.0	39.3	16.2	0.6	0.9	0.00	0.00	0.00	0.00
2.5	43.0	17.7	0.8	1.2	0.45	0.55	0.12	0.15
3.0	46.2	18.9	1.0	1.5	0.45	0.69	0.12	0.18
3.5	49.0	20.0	1.3	1.9	0.45	0.84	0.12	0.22
4.0	51.4	21.0	1.5	2.2	0.64	1.40	0.49	1.07
4.5	53.4	21.8	1.7	2.5	0.64	1.59	0.49	1.22
5.0	55.2	22.5	1.9	2.8	0.64	1.77	0.49	1.36
5.5	56.8	23.1	2.0	3.0	0.76	2.29	0.67	2.02
6.0	58.1	23.7	2.2	3.2	0.76	2.47	0.67	2.18
6.5	59.3	24.1	2.3	3.5	0.76	2.63	0.67	2.32
7.0	60.3	24.5	2.5	3.6	0.76	2.78	0.67	2.45
8.0	61.9	25.2	2.7	4.0	0.76	3.03	0.67	2.67
9.0	63.1	25.6	2.9	4.2	1.03	4.36	0.88	3.73
10.0	64.0	26.0	3.0	4.4	1.03	4.56	0.88	3.90
11.0	64.7	26.3	3.1	4.6	1.03	4.72	0.88	4.04
12.0	65.2	26.5	3.2	4.7	1.03	4.84	0.88	4.14
13.0	65.6	26.6	3.2	4.8	1.03	4.93	0.88	4.22
14.0	65.9	26.7	3.3	4.9	1.03	5.00	0.88	4.28
15.0	66.1	26.8	3.3	4.9	1.03	5.05	0.88	4.32
16.0	66.2	26.9	3.3	4.9	1.03	5.09	0.88	4.36
17.0	66.3	26.9	3.4	5.0	1.27	6.31	0.94	4.68
18.0	66.4	27.0	3.4	5.0	1.27	6.34	0.94	4.70
19.0	66.5	27.0	3.4	5.0	1.27	6.36	0.94	4.71
20.0	66.6	27.0	3.4	5.0	1.27	6.37	0.94	4.72

Fork length in cm
Total length in inches
Round weight in kg
Dressed weight in pounds (67% recovery rate)
Exvessel prices per pound dressed and per fish

Table 2.2 -- Summary statistics for different sectors of the sablefish fleets, EEZ of Alaska, 1986

All longline iceboats

NUMBER OF OBSERVATIONS : 424

		MEAN	STANDARD DEVIATION
SABLBS	.	74075.7	109710.
ALLGFLBS	.	76031.8	112313.
TRIPS	.	2.93396	2.04798
SABLBST	.	19439.2	19424.8
SABGF	.	96.4656	11.1123
LENGTH	.	50.1604	14.8548
NETTONS	.	32.3868	27.5706
HP	.	278.101	457.414

Top 50% of longline iceboats

NUMBER OF OBSERVATIONS : 212

		MEAN	STANDARD DEVIATION
SABLBS	.	137064.	126825.
ALLGFLBS	.	140161.	130102.
TRIPS	.	4.17453	2.15132
SABLBST	.	32253.8	19963.3
SABGF	.	98.0625	4.95009
LENGTH	.	56.2406	13.8548
NETTONS	.	42.6368	29.0800
HP	.	304.679	181.916

Top 20% of longline iceboats

NUMBER OF OBSERVATIONS : 86

		MEAN	STANDARD DEVIATION
SABLBS	.	244685.	139100.
ALLGFLBS	.	250405.	142884.
TRIPS	.	5.61628	2.19716
SABLBST	.	46232.1	21772.3
SABGF	.	97.7616	4.54626
LENGTH	.	58.7209	11.4303
NETTONS	.	42.2093	24.4267
HP	.	293.686	164.548

Table 2.2 -- Continued.

All longine freezer boats

NUMBER OF OBSERVATIONS : 12

		MEAN	STANDARD DEVIATION
SABLBS	.	186032.	310822.
ALLGFLBS	.	189254.	317359.
TRIPS	.	3.41667	2.60971
SABLBST	.	40817.6	60293.8
SABGF	.	98.3771	1.97291
LENGTH	.	71.8333	26.7916
NETTONS	.	94.4167	78.2031
HP	.	457.500	321.704

Top 50% of longline freezer boats

NUMBER OF OBSERVATIONS : 6

		MEAN	STANDARD DEVIATION
SABLBS	.	353169.	381369.
ALLGFLBS	.	359306.	390018.
TRIPS	.	4.66667	3.20416
SABLBST	.	71224.7	75665.1
SABGF	.	98.2687	2.37062
LENGTH	.	83.5000	29.0775
NETTONS	.	135.333	85.5796
HP	.	619.167	349.334

All pot iceboats

NUMBER OF OBSERVATIONS : 10

		MEAN	STANDARD DEVIATION
SABLBS	.	140640.	224687.
ALLGFLBS	.	142509.	230136.
TRIPS	.	5.50000	5.44161
SABLBST	.	47928.2	114074.
SABGF	.	99.7271	0.749816
LENGTH	.	79.0000	15.8325
NETTONS	.	101.500	40.6373
HP	.	596.500	277.279

Table 2.2. -- Continued.

Top 50% of pot iceboats

NUMBER OF OBSERVATIONS : 5

		MEAN	STANDARD DEVIATION
SABLBS	.	259420.	279470.
ALLGFLBS	.	263157.	287334.
TRIPS	.	8.00000	7.10634
SABLBST	.	88429.0	158603.
SABGF	.	99.4632	1.04426
LENGTH	.	89.2000	10.3779
NETTONS	.	123.800	37.2250
HP	.	781.000	283.293

All pot freezer boats

NUMBER OF OBSERVATIONS : 5

		MEAN	STANDARD DEVIATION
SABLBS	.	810645.	780157.
ALLGFLBS	.	824535.	768558.
TRIPS	.	3.80000	3.27109
SABLBST	.	183023.	192731.
SABGF	.	87.1783	27.5268
LENGTH	.	131.200	47.8195
NETTONS	.	253.600	312.828
HP	.	976.000	330.726

All trawler catcher boats

NUMBER OF OBSERVATIONS : 11

		MEAN	STANDARD DEVIATION
SABLBS	.	5739.91	5052.35
ALLGFLBS	.	145999.	232467.
TRIPS	.	1.63636	0.809040
SABLBST	.	3773.30	3924.01
SABGF	.	40.7946	43.4339
LENGTH	.	81.1818	19.2500
NETTONS	.	96.4545	44.3291
HP	.	619.545	275.331

Table 2.2 -- Continued.

Top 45% of trawler catcher boats

NUMBER OF OBSERVATIONS : 5

		MEAN	STANDARD DEVIATION
SABLBS	.	10287.4	3565.53
ALLGFLBS	.	169598.	240528.
TRIPS	.	2.00000	0.707107
SABLBST	.	6294.33	4483.06
SABGF	.	32.0375	39.4028
LENGTH	.	73.8000	15.4499
NETTONS	.	95.2000	42.3757
HP	.	554.000	284.306

All factory trawlers

NUMBER OF OBSERVATIONS : 19

		MEAN	STANDARD DEVIATION
SABLBS	.	377251.	530657.
ALLGFLBS	.	.162445E+07	.248886E+07
TRIPS	.	3.31579	1.94515
SABLBST	.	105262.	158651.
SABGF	.	44.6726	33.3117
LENGTH	.	133.000	58.0900
NETTONS	.	184.263	185.804
HP	.	1438.16	953.186

Top 47% of factory trawlers

NUMBER OF OBSERVATIONS : 9

		MEAN	STANDARD DEVIATION
SABLBS	.	467519.	564015.
ALLGFLBS	.	.272460E+07	.317941E+07
TRIPS	.	3.44444	2.06828
SABLBST	.	106567.	78679.0
SABGF	.	23.1575	16.9505
LENGTH	.	166.778	53.3263
NETTONS	.	228.889	239.879
HP	.	1973.33	603.656

SABLBS	Pounds of sablefish, round weight
ALLGFLBS	Pounds of all groundfish, round weight
TRIPS	Number of trips in which sablefish was reported
SABGF	100 * SABLBS/GFLBS
LENGTH	Vessel length
NETTONS	Vessel net tons
HP	Vessel horsepower

Table 2.3 -- Trawl Fs that maintain the fixed gear to trawl gear catch ratio at 6.2 for various fixed gear Fs and size limits that apply to all gear.

Fixed gear F	Size limits in centimeters 37	41	45	49	53	57	61
0.020	0.0087	0.0097	0.0103	0.0110	0.0120	0.0122	0.0159
0.021	0.0089	0.0104	0.0109	0.0115	0.0123	0.0125	0.0167
0.022	0.0092	0.0106	0.0113	0.0124	0.0126	0.0132	0.0174
0.023	0.0097	0.0109	0.0118	0.0127	0.0133	0.0157	0.0182
0.024	0.0101	0.0115	0.0123	0.0130	0.0139	0.0143	0.0189
0.025	0.0105	0.0119	0.0127	0.0134	0.0144	0.0148	0.0200
0.050	0.0189	0.0219	0.0233	0.0248	0.0263	0.0264	0.0375
0.075	0.0257	0.0300	0.0317	0.0330	0.0367	0.0370	0.0510
0.100	0.0316	0.0376	0.0399	0.0424	0.0387	0.0457	0.0650
0.125	0.0370	0.0440	0.0470	0.0502	0.0450	0.0570	0.0770
0.150	0.0413	0.0500	0.0523	0.0564	0.0509	0.0640	0.0870
0.175	0.0533	0.0560	0.0594	0.0620	0.0559	0.0700	0.0980
0.200	0.0585	0.0633	0.0634	0.0682	0.0622	0.0770	0.1060
0.225	0.0627	0.0660	0.0690	0.0690	0.0660	0.0815	0.1160
0.250	0.0686	0.0706	0.0742	0.0774	0.0695	0.0879	0.1210
0.300	0.0783	0.0803	0.0852	0.0718	0.0780	0.1002	0.1380
0.350	0.0878	0.0950	0.0937	0.0751	0.0854	0.1109	0.1520
0.400	0.0968	0.0968	0.0930	0.0816	0.0989	0.1108	0.1640
0.450	0.1293	0.1040	0.0836	0.0940	0.1090	0.1169	0.1790

Table 2.4 -- Trawl Fs that maintain the fixed gear to trawl gear catch ratio of 6.2 for various fixed gear Fs and size limits that apply to fixed gear only.

Fixed gear F	Size limits in centimeters 37	41	45	49	53	57	61
0.010	0.0044563	0.0044294	0.0043782	0.0042861	0.0041431	0.0039354	0.0036132
0.015	0.0065167	0.0064764	0.0063951	0.0062539	0.0060360	0.0057236	0.0052372
0.020	0.0083906	0.0083403	0.0082291	0.0081144	0.0078200	0.0074030	0.0067515
0.025	0.0102385	0.0101765	0.0100310	0.0097849	0.0094199	0.0088926	0.0080782
0.050	0.0182924	0.0181729	0.0178222	0.0172762	0.0165214	0.0154629	0.0138228
0.075	0.0249082	0.0246758	0.0240357	0.0231381	0.0219856	0.0202732	0.0180209
0.100	0.0304976	0.0301029	0.0291418	0.0279043	0.0262133	0.0241134	0.0211278
0.125	0.0351727	0.0346142	0.0332846	0.0317974	0.0295791	0.0270903	0.0234451
0.150	0.0392769	0.0384458	0.0367223	0.0348368	0.0323250	0.0294645	0.0251412
0.175	0.0429909	0.0421114	0.0396378	0.0377996	0.0346637	0.0310047	0.0266137
0.200	0.0464233	0.0453506	0.0429381	0.0402475	0.0371686	0.0324989	0.0277864
0.300	0.0580100	0.0563531	0.0517151	0.0477540	0.0431173	0.0373137	0.0296727
0.400	0.0679558	0.0656892	0.0588902	0.0516882	0.0448991	0.0379058	0.0307772

Table 2.5 -- Estimated equilibrium yield as a function of fixed gear F and a size limit applied to all gear (1,000 metric tons).

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	9.3	9.3	9.1	9.0	8.7	8.3	7.5
0.015	13.1	13.1	12.9	12.5	12.2	11.6	10.5
0.020	16.6	16.3	16.1	15.8	15.3	14.5	13.1
0.025	19.5	19.2	19.0	18.6	18.0	17.1	15.3
0.050	30.0	29.5	29.0	28.4	27.3	25.9	22.4
0.075	35.9	35.1	34.5	33.6	32.2	30.6	25.8
0.100	39.3	38.1	37.4	36.4	36.0	33.0	27.0
0.125	41.1	39.7	38.9	38.0	37.4	33.5	27.2
0.150	42.1	40.3	39.5	38.5	38.1	33.8	26.8
0.175	41.1	40.3	39.4	38.6	38.2	33.2	25.9
0.200	41.0	40.1	39.4	38.4	37.9	32.8	25.1
0.300	38.7	38.2	36.1	37.8	35.5	29.1	21.4
0.400	36.1	32.9	34.5	34.1	32.0	27.8	17.8

Table 2.6 -- Estimated equilibrium revenue as a function of fixed gear F and a size limit applied to all gear ($ millions).

F		Size limits in centimeters 37	41	45	49	53	57	61
0.010	All gear	14.0	14.0	14.4	13.7	13.6	13.5	12.7
	Fixed gear	12.8	12.7	13.1	12.4	12.4	12.1	11.4
	Trawl gear	1.3	1.3	1.3	1.3	1.2	1.4	1.3
0.015	All gear	19.4	19.7	20.0	19.1	19.2	18.9	17.7
	Fixed gear	17.7	17.5	18.2	17.5	17.3	17.0	15.9
	Trawl gear	1.8	2.1	1.7	1.7	1.9	1.9	1.8
0.020	All gear	24.3	24.5	25.0	23.9	24.0	23.5	21.8
	Fixed gear	22.1	21.9	22.8	21.8	21.6	21.0	19.6
	Trawl gear	2.3	2.6	2.2	2.2	2.4	2.5	2.3
0.025	All gear	28.6	28.7	29.3	28.1	28.1	27.5	25.5
	Fixed gear	25.9	25.7	26.8	25.6	25.4	24.7	22.8
	Trawl gear	2.6	3.0	2.6	2.5	2.7	2.9	2.7
0.050	All gear	42.7	42.9	42.0	41.8	42.1	41.3	37.1
	Fixed gear	38.8	38.3	38.2	38.1	38.1	37.2	33.3
	Trawl gear	3.9	4.6	3.8	3.7	4.0	4.1	3.9
0.075	All gear	51.1	50.0	48.6	48.6	48.9	47.9	42.6
	Fixed gear	46.6	44.7	44.4	44.6	44.3	43.1	38.4
	Trawl gear	4.5	5.3	4.2	4.1	4.6	4.8	4.2
0.100	All gear	53.7	53.1	52.1	51.4	53.1	50.5	44.3
	Fixed gear	48.8	47.3	47.7	47.0	48.8	45.4	39.9
	Trawl gear	4.8	5.8	4.5	4.4	4.3	5.1	4.4
0.125	All gear	54.7	54.0	52.9	52.2	54.6	51.0	44.3
	Fixed gear	49.7	48.0	48.4	47.8	50.2	45.6	39.9
	Trawl gear	5.0	5.9	4.5	4.4	4.4	5.5	4.4
0.150	All gear	54.5	52.5	52.6	51.9	54.8	50.9	43.6
	Fixed gear	49.5	47.7	48.3	47.6	50.4	45.5	39.3
	Trawl gear	5.0	4.8	4.3	4.3	4.4	5.4	4.3
0.175	All gear	51.4	51.4	51.4	51.1	54.4	50.0	42.0
	Fixed gear	45.8	46.7	47.1	46.9	50.1	44.9	37.9
	Trawl gear	5.6	4.7	4.3	4.2	4.3	5.1	4.1
0.200	All gear	49.9	49.7	50.2	49.6	53.2	48.7	40.1
	Fixed gear	44.4	45.0	46.2	45.6	48.9	43.6	36.2
	Trawl gear	5.5	4.7	4.0	4.0	4.3	5.1	3.9
0.300	All gear	42.6	43.3	43.2	45.5	47.1	42.6	34.4
	Fixed gear	37.7	39.5	39.8	42.5	43.3	38.1	30.7
	Trawl gear	4.9	3.8	3.4	2.9	3.8	4.5	3.7
0.400	All gear	36.3	38.5	36.3	38.0	42.3	37.6	26.1
	Fixed gear	31.9	35.4	33.7	36.4	37.7	33.8	23.0
	Trawl gear	4.4	3.1	2.6	1.6	4.6	3.8	3.1

Table 2.7 -- Estimated potential equilibrium profit for the fixed gear fleet as a function of fixed gear F and a size limit applied to all gear ($ million).

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	3.5	3.5	3.9	3.2	3.2	2.9	2.1
0.015	3.9	3.7	4.4	3.7	3.5	3.2	2.1
0.020	3.7	3.5	4.4	3.4	3.2	2.6	1.2
0.025	3.0	2.8	3.8	2.6	2.5	1.8	-0.1
0.050	-6.4	-6.9	-7.1	-7.1	-7.2	-8.1	-12.0
0.075	-20.5	-22.4	-22.7	-22.5	-22.8	-24.0	-28.7
0.100	-39.6	-41.1	-40.7	-41.4	-39.6	-43.0	-48.5
0.125	-59.5	-61.1	-60.8	-61.4	-59.0	-63.6	-69.2
0.150	-79.9	-81.8	-81.1	-81.8	-79.1	-84.0	-90.1
0.175	-103.4	-102.6	-102.1	-102.3	-99.1	-104.3	-111.3
0.200	-124.2	-123.5	-122.4	-122.9	-119.6	-124.9	-132.4
0.300	-203.5	-201.7	-201.4	-198.7	-197.9	-203.1	-210.5
0.400	-275.2	-271.7	-273.4	-270.7	-269.4	-273.3	-284.1

Table 2.8 -- Estimated equilibrium landings, revenue, cost, and profit for the fixed gear fleet as a function of fixed gear F and a size limit applied to all gear (catch in 1,000 metric tons and $ in millions).

		Size limits in centimeters						
F		37	41	45	49	53	57	61
0.010	Catch	8.0	8.0	7.9	7.7	7.5	7.1	6.5
	Revenue	12.8	12.7	13.1	12.4	12.4	12.1	11.4
	Total cost	9.2	9.2	9.2	9.2	9.2	9.2	9.2
	Profit	3.5	3.5	3.9	3.2	3.2	2.9	2.1
0.015	Catch	11.3	11.2	11.1	10.9	10.5	10.0	9.1
	Revenue	17.7	17.5	18.2	17.5	17.3	17.0	15.9
	Total cost	13.8	13.8	13.8	13.8	13.8	13.8	13.8
	Profit	3.9	3.7	4.4	3.7	3.5	3.2	2.1
0.020	Catch	14.2	14.1	13.9	13.6	13.2	12.5	11.3
	Revenue	22.1	21.9	22.8	21.8	21.6	21.0	19.6
	Total cost	18.4	18.4	18.4	18.4	18.4	18.4	18.4
	Profit	3.7	3.5	4.4	3.4	3.2	2.6	1.2
0.025	Catch	16.8	16.6	16.4	16.1	15.5	14.7	13.2
	Revenue	25.9	25.7	26.8	25.6	25.4	24.7	22.8
	Total cost	22.9	22.9	22.9	22.9	22.9	22.9	22.9
	Profit	3.0	2.8	3.8	2.6	2.5	1.8	-0.1
0.050	Catch	25.8	25.4	25.0	24.4	23.5	22.4	19.3
	Revenue	38.8	38.3	38.2	38.1	38.1	37.2	33.3
	Total cost	45.3	45.3	45.3	45.3	45.3	45.3	45.3
	Profit	-6.4	-6.9	-7.1	-7.1	-7.2	-8.1	-12.0
0.075	Catch	31.0	30.2	29.8	29.1	27.8	26.3	22.2
	Revenue	46.6	44.7	44.4	44.6	44.3	43.1	38.4
	Total cost	67.1	67.1	67.1	67.1	67.1	67.1	67.1
	Profit	-20.5	-22.4	-22.7	-22.5	-22.8	-24.0	-28.7
0.100	Catch	33.8	32.8	32.3	31.4	31.0	28.4	23.3
	Revenue	48.8	47.3	47.7	47.0	48.8	45.4	39.9
	Total cost	88.4	88.4	88.4	88.4	88.4	88.4	88.4
	Profit	-39.6	-41.1	-40.7	-41.4	-39.6	-43.0	-48.5
0.125	Catch	35.4	34.2	33.5	32.7	32.3	28.8	23.4
	Revenue	49.7	48.0	48.4	47.8	50.2	45.6	39.9
	Total cost	109.2	109.2	109.2	109.2	109.2	109.2	109.2
	Profit	-59.5	-61.1	-60.8	-61.4	-59.0	-63.6	-69.2
0.150	Catch	36.3	34.8	34.1	33.2	32.8	29.1	23.1
	Revenue	49.5	47.7	48.3	47.6	50.4	45.5	39.3
	Total cost	129.4	129.4	129.4	129.4	129.4	129.4	129.4
	Profit	-79.9	-81.8	-81.1	-81.8	-79.1	-84.0	-90.1

Table 2.8 -- Continued.

0.175	Catch	35.4	34.7	33.9	33.4	32.9	28.6	22.3
	Revenue	45.8	46.7	47.1	46.9	50.1	44.9	37.9
	Total cost	149.2	149.2	149.2	149.2	149.2	149.2	149.2
	Profit	-103.4	-102.6	-102.1	-102.3	-99.1	-104.3	-111.3
0.200	Catch	35.3	34.4	34.0	33.1	32.5	28.3	21.7
	Revenue	44.4	45.0	46.2	45.6	48.9	43.6	36.2
	Total cost	168.5	168.5	168.5	168.5	168.5	168.5	168.5
	Profit	-124.2	-123.5	-122.4	-122.9	-119.6	-124.9	-132.4
0.300	Catch	33.3	32.9	31.1	32.5	30.6	25.0	18.5
	Revenue	37.7	39.5	39.8	42.5	43.3	38.1	30.7
	Total cost	241.2	241.2	241.2	241.2	241.2	241.2	241.2
	Profit	-203.5	-201.7	-201.4	-198.7	-197.9	-203.1	-210.5
0.400	Catch	31.1	28.3	29.7	29.4	27.4	24.0	15.4
	Revenue	31.9	35.4	33.7	36.4	37.7	33.8	23.0
	Total cost	307.1	307.1	307.1	307.1	307.1	307.1	307.1
	Profit	-275.2	-271.7	-273.4	-270.7	-269.4	-273.3	-284.1

Table 2.9 -- Estimated equilibrium number of vessels, catch per trip, and revenue per trip for the fixed gear fleet as a function of fixed gear F and a size limit applied to all gear (catch in 1,000 lbs. dressed and revenue in $1,000).

		Size limits in centimeters						
F		37	41	45	49	53	57	61
0.010	Vessels	30.9	30.9	30.9	30.9	30.9	30.9	30.9
	Pounds/trip	63.9	63.6	62.7	61.5	59.8	56.6	51.8
	Revenue/trip	68.7	68.5	70.7	67.0	66.8	65.3	61.3
0.015	Vessels	46.3	46.3	46.3	46.3	46.3	46.3	46.3
	Pounds/trip	60.2	59.6	59.0	58.0	55.9	53.2	48.3
	Revenue/trip	63.6	63.1	65.6	62.9	62.2	61.2	57.2
0.020	Vessels	61.6	61.6	61.6	61.6	61.6	61.6	61.6
	Pounds/trip	56.8	56.3	55.6	54.5	52.6	50.0	45.2
	Revenue/trip	59.7	59.3	61.7	58.9	58.5	56.9	53.0
0.025	Vessels	76.8	76.8	76.8	76.8	76.8	76.8	76.8
	Pounds/trip	53.8	53.2	52.6	51.5	49.7	47.2	42.2
	Revenue/trip	56.3	55.8	58.1	55.5	55.1	53.6	49.5
0.050	Vessels	151.7	151.7	151.7	151.7	151.7	151.7	151.7
	Pounds/trip	41.9	41.2	40.6	39.6	38.2	36.3	31.3
	Revenue/trip	42.7	42.1	42.0	41.9	41.8	40.9	36.6
0.075	Vessels	224.8	224.8	224.8	224.8	224.8	224.8	224.8
	Pounds/trip	33.9	33.1	32.6	31.9	30.4	28.8	24.4
	Revenue/trip	34.6	33.1	32.9	33.0	32.9	32.0	28.4
0.100	Vessels	296.1	296.1	296.1	296.1	296.1	296.1	296.1
	Pounds/trip	28.1	27.3	26.8	26.1	25.8	23.6	19.4
	Revenue/trip	27.5	26.6	26.8	26.5	27.5	25.6	22.4
0.125	Vessels	365.7	365.7	365.7	365.7	365.7	365.7	365.7
	Pounds/trip	23.8	23.0	22.5	22.0	21.7	19.4	15.7
	Revenue/trip	22.6	21.9	22.1	21.8	22.9	20.8	18.2
0.150	Vessels	433.7	433.7	433.7	433.7	433.7	433.7	433.7
	Pounds/trip	20.6	19.7	19.4	18.8	18.6	16.5	13.1
	Revenue/trip	19.0	18.3	18.6	18.3	19.4	17.5	15.1
0.175	Vessels	499.9	499.9	499.9	499.9	499.9	499.9	499.9
	Pounds/trip	17.4	17.1	16.7	16.4	16.2	14.1	11.0
	Revenue/trip	15.3	15.6	15.7	15.6	16.7	15.0	12.6

Table 2.9 -- Continued.

0.200	Vessels	564.6	564.6	564.6	564.6	564.6	564.6	564.6
	Pounds/trip	15.4	15.0	14.8	14.4	14.2	12.3	9.5
	Revenue/trip	13.1	13.3	13.6	13.5	14.4	12.9	10.7
0.300	Vessels	808.1	808.1	808.1	808.1	808.1	808.1	808.1
	Pounds/trip	10.1	10.0	9.5	9.9	9.3	7.6	5.6
	Revenue/trip	7.8	8.1	8.2	8.8	8.9	7.9	6.3
0.400	Vessels	1028.8	1028.8	1028.8	1028.8	1028.8	1028.8	1028.8
	Pounds/trip	7.4	6.8	7.1	7.0	6.6	5.7	3.7
	Revenue/trip	5.2	5.7	5.5	5.9	6.1	5.5	3.7

Table 2.10 -- Estimated potential equilibrium profit for the fixed gear fleet as a function of fixed gear F and a size limit applied to all gear for different estimates of cost per unit of effort ($ millions).

Cost reduced by 75%

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	10.4	10.4	10.8	10.1	10.1	9.8	9.1
0.015	14.2	14.1	14.8	14.0	13.8	13.5	12.4
0.020	17.5	17.3	18.2	17.2	17.0	16.4	15.0
0.025	20.2	20.0	21.0	19.8	19.7	18.9	17.1
0.050	27.5	27.0	26.9	26.8	26.8	25.9	22.0
0.075	29.8	27.9	27.6	27.8	27.5	26.4	21.6
0.100	26.7	25.2	25.6	24.9	26.7	23.3	17.8
0.125	22.4	20.7	21.1	20.5	22.9	18.3	12.6
0.150	17.1	15.3	16.0	15.3	18.0	13.1	7.0
0.175	8.5	9.3	9.8	9.6	12.8	7.6	0.6
0.200	2.2	2.9	4.0	3.5	6.8	1.5	-6.0
0.300	-22.6	-20.8	-20.5	-17.8	-17.0	-22.2	-29.6
0.400	-44.8	-41.4	-43.1	-40.4	-39.1	-43.0	-53.8

Cost reduced by 50%

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	8.1	8.1	8.5	7.8	7.8	7.5	6.8
0.015	10.8	10.6	11.3	10.6	10.4	10.1	9.0
0.020	12.9	12.7	13.6	12.6	12.4	11.8	10.4
0.025	14.5	14.3	15.3	14.1	13.9	13.2	11.4
0.050	16.2	15.7	15.6	15.5	15.4	14.6	10.6
0.075	13.1	11.1	10.8	11.0	10.8	9.6	4.8
0.100	4.6	3.1	3.5	2.8	4.6	1.2	-4.3
0.125	-4.9	-6.5	-6.2	-6.8	-4.4	-9.0	-14.7
0.150	-15.2	-17.0	-16.4	-17.1	-14.4	-19.2	-25.4
0.175	-28.8	-28.0	-27.5	-27.7	-24.5	-29.7	-36.7
0.200	-39.9	-39.3	-38.1	-38.7	-35.3	-40.6	-48.1
0.300	-82.9	-81.1	-80.8	-78.1	-77.3	-82.5	-89.9
0.400	-121.6	-118.2	-119.9	-117.1	-115.9	-119.7	-130.5

Table 2.10 -- Continued.

Cost reduced by 25%

F	Size limits in centimeters 37	41	45	49	53	57	61
0.010	5.8	5.8	6.2	5.5	5.5	5.2	4.5
0.015	7.3	7.2	7.9	7.1	6.9	6.6	5.5
0.020	8.3	8.1	9.0	8.0	7.8	7.2	5.8
0.025	8.8	8.5	9.6	8.4	8.2	7.5	5.6
0.050	4.9	4.4	4.3	4.2	4.1	3.2	-0.7
0.075	-3.7	-5.6	-6.0	-5.8	-6.0	-7.2	-12.0
0.100	-17.5	-19.0	-18.6	-19.3	-17.5	-20.9	-26.4
0.125	-32.2	-33.8	-33.5	-34.1	-31.7	-36.3	-42.0
0.150	-47.6	-49.4	-48.8	-49.5	-46.7	-51.6	-57.8
0.175	-66.1	-65.3	-64.8	-65.0	-61.8	-67.0	-74.0
0.200	-82.1	-81.4	-80.2	-80.8	-77.5	-82.8	-90.2
0.300	-143.2	-141.4	-141.1	-138.4	-137.6	-142.8	-150.2
0.400	-198.4	-194.9	-196.6	-193.9	-192.6	-196.5	-207.3

Cost increased by 25%

F	Size limits in centimeters 37	41	45	49	53	57	61
0.010	1.2	1.2	1.6	0.9	0.9	0.6	-0.2
0.015	0.4	0.3	1.0	0.2	0.0	-0.3	-1.4
0.020	-0.9	-1.1	-0.2	-1.2	-1.4	-2.0	-3.4
0.025	-2.7	-2.9	-1.9	-3.1	-3.3	-4.0	-5.8
0.050	-17.8	-18.3	-18.4	-18.5	-18.5	-19.4	-23.3
0.075	-37.3	-39.2	-39.5	-39.3	-39.6	-40.7	-45.5
0.100	-61.7	-63.2	-62.8	-63.5	-61.7	-65.1	-70.6
0.125	-86.8	-88.4	-88.0	-88.7	-86.3	-90.9	-96.5
0.150	-112.3	-114.1	-113.5	-114.2	-111.4	-116.3	-122.5
0.175	-140.7	-139.9	-139.4	-139.6	-136.4	-141.6	-148.6
0.200	-166.3	-165.7	-164.5	-165.1	-161.7	-167.0	-174.5
0.300	-263.8	-262.0	-261.7	-259.0	-258.2	-263.4	-270.8
0.400	-351.9	-348.5	-350.2	-347.5	-346.2	-350.0	-360.9

Table 2.10 -- Continued.

Cost increased by 50%

F	Size limits in centimeters 37	41	45	49	53	57	61
0.010	-1.1	-1.1	-0.7	-1.4	-1.5	-1.7	-2.5
0.015	-3.1	-3.2	-2.5	-3.3	-3.4	-3.7	-4.8
0.020	-5.5	-5.6	-4.8	-5.8	-6.0	-6.6	-8.0
0.025	-8.4	-8.7	-7.6	-8.8	-9.0	-9.7	-11.6
0.050	-29.1	-29.6	-29.7	-29.8	-29.8	-30.7	-34.6
0.075	-54.0	-56.0	-56.3	-56.1	-56.3	-57.5	-62.3
0.100	-83.8	-85.3	-84.9	-85.6	-83.8	-87.2	-92.7
0.125	-114.1	-115.7	-115.3	-116.0	-113.6	-118.2	-123.8
0.150	-144.7	-146.5	-145.8	-146.5	-143.8	-148.7	-154.9
0.175	-178.0	-177.2	-176.7	-177.0	-173.7	-179.0	-186.0
0.200	-208.5	-207.8	-206.6	-207.2	-203.9	-209.2	-216.6
0.300	-324.1	-322.3	-322.0	-319.3	-318.5	-323.7	-331.1
0.400	-428.7	-425.3	-427.0	-424.2	-422.9	-426.8	-437.6

Table 2.11 -- Estimated equilibrium reproductive potential index as a function of fixed gear F and a size limit applied to all gear.

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	100.0	100.1	100.0	100.1	100.7	100.6	100.3
0.015	93.2	92.8	93.1	93.5	93.5	93.9	93.5
0.020	86.8	86.6	86.8	87.1	87.3	87.9	87.3
0.025	81.1	80.9	81.1	81.4	81.7	82.4	81.5
0.050	58.9	58.5	58.8	59.3	59.9	61.0	59.6
0.075	44.1	43.7	44.1	44.8	45.1	46.5	45.4
0.100	33.8	33.3	33.7	34.3	36.0	36.6	35.1
0.125	26.3	26.0	26.2	26.8	28.7	28.9	27.8
0.150	20.9	20.4	20.9	21.2	22.9	23.5	22.5
0.175	16.3	16.2	16.7	17.3	19.0	19.6	18.4
0.200	13.2	12.9	13.4	14.2	15.4	16.1	15.4
0.300	7.0	7.1	7.6	8.5	9.3	9.5	10.0
0.400	3.0	3.1	3.5	5.3	4.6	5.1	6.9

Index is 100 for F of 0.01 and 37 cm.

Table 2.12 -- Estimated equilibrium biomass index as a function of fixed gear F and a size limit applied to all gear.

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	100.0	100.1	99.9	100.1	100.6	100.6	100.3
0.015	94.2	93.8	94.2	94.5	94.4	95.0	94.5
0.020	88.8	88.6	88.8	89.0	89.1	90.0	89.3
0.025	84.0	83.0	83.2	84.2	84.5	85.4	84.4
0.050	64.6	64.0	64.4	65.0	65.7	67.1	65.3
0.075	51.9	51.4	51.9	52.8	53.5	55.0	53.6
0.100	42.9	42.3	42.8	43.7	46.2	46.7	45.0
0.125	36.3	35.7	36.5	37.2	39.9	40.0	38.9
0.150	31.2	30.7	31.6	32.3	35.0	35.3	34.3
0.175	26.6	26.7	27.5	28.6	31.3	31.6	30.3
0.200	23.3	23.3	24.6	25.5	28.1	28.5	27.6
0.300	15.4	15.8	16.6	18.8	20.3	20.7	20.1
0.400	11.5	11.8	12.9	14.8	15.8	16.9	16.2

Index is 100 for F of 0.01 and 37 cm.

Table 2.13.--1986 Gulf of Alaska catch composition by market size categories and year.

Size (lbs,dressed)	Size (kg,round)	Length (cm)	Longline landings (cummulative percent)	Pot landings (cummulative percent)	Trawl landings (cummulative percent)
1	0.677	40.4	1.2	3.4	45.8
2	1.354	50.1	10.7	25.2	62.1
3	2.031	56.8	37.2	57.9	85.9
4	2.708	62.1	63.5	80.9	96.1
5	3.385	66.5	92.2	95.3	99.5
7	4.739	73.8	99.6	100.0	100.0
8	5.416	86.9	100.0		

Table 2.14 -- Estimated equilibrium yield as a function of fixed gear F and a size limit applied to fixed gear only (1,000 metric tons).

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	9.3	9.3	9.2	9.0	8.8	8.4	7.8
0.015	13.1	13.1	13.0	12.8	12.4	11.8	11.0
0.020	16.5	16.5	16.3	16.1	15.6	14.9	13.8
0.025	19.5	19.4	19.3	19.0	18.5	17.7	16.4
0.050	30.0	30.0	29.8	29.5	28.8	27.6	25.6
0.075	36.1	36.0	35.8	35.5	34.7	33.3	31.0
0.100	39.5	39.4	39.3	39.0	38.3	36.9	34.1
0.125	41.4	41.3	41.3	41.2	40.3	38.8	35.9
0.150	42.4	42.2	42.2	42.3	41.6	40.0	36.8
0.175	42.8	42.6	42.6	42.7	42.1	40.2	37.3
0.200	42.9	42.6	42.7	43.0	42.2	40.4	37.3
0.300	41.2	41.3	40.7	41.4	41.1	39.7	35.4
0.400	39.2	39.5	38.5	37.8	37.7	37.8	33.4

Table 2.15 -- Estimated equilibrium revenue as a function of fixed gear F and a size limit applied to fixed gear only ($ millions).

F		Size limits in centimeters 37	41	45	49	53	57	61
0.010	All gear	14.1	14.1	14.6	13.9	13.8	13.5	12.8
	Fixed gear	12.8	12.7	13.2	12.5	12.5	12.3	11.7
	Trawl gear	1.4	1.4	1.4	1.3	1.3	1.2	1.2
0.015	All gear	19.6	19.6	20.6	19.5	19.4	19.1	18.1
	Fixed gear	17.7	17.6	18.7	17.6	17.6	17.3	16.5
	Trawl gear	1.9	1.9	1.9	1.9	1.8	1.8	1.6
0.020	All gear	24.5	24.5	25.4	24.5	24.4	23.8	22.6
	Fixed gear	22.1	22.1	23.0	22.1	22.1	21.6	20.6
	Trawl gear	2.4	2.4	2.4	2.4	2.3	2.2	2.0
0.025	All gear	28.8	28.8	29.9	28.8	28.8	28.1	26.8
	Fixed gear	26.0	25.9	27.1	26.0	26.1	25.5	24.4
	Trawl gear	2.8	2.8	2.8	2.7	2.7	2.6	2.4
0.050	All gear	43.2	43.3	43.5	43.8	44.2	43.4	41.7
	Fixed gear	39.0	39.1	39.3	39.6	40.1	39.4	38.0
	Trawl gear	4.2	4.2	4.2	4.2	4.1	4.0	3.7
0.075	All gear	51.8	50.6	51.0	51.7	52.6	51.8	50.1
	Fixed gear	46.8	45.6	46.1	46.8	47.7	47.0	45.7
	Trawl gear	5.0	5.0	4.9	4.9	4.9	4.7	4.4
0.100	All gear	54.4	54.3	54.6	55.7	57.2	56.5	54.9
	Fixed gear	49.1	49.0	49.3	50.4	51.9	51.3	50.1
	Trawl gear	5.3	5.3	5.3	5.3	5.3	5.2	4.8
0.125	All gear	54.7	54.7	56.1	56.7	58.6	58.4	57.5
	Fixed gear	50.1	50.1	51.6	52.0	54.1	52.9	52.6
	Trawl gear	4.6	4.6	4.6	4.6	4.6	5.4	5.0
0.150	All gear	54.5	54.7	56.3	57.1	59.5	58.5	58.9
	Fixed gear	49.9	50.1	51.8	52.5	55.0	53.9	53.8
	Trawl gear	4.6	4.5	4.5	4.6	4.6	4.5	5.0
0.175	All gear	52.3	53.9	55.8	56.8	59.6	58.7	58.5
	Fixed gear	47.9	49.5	51.3	52.2	55.1	54.2	54.2
	Trawl gear	4.5	4.4	4.4	4.5	4.5	4.5	4.3
0.200	All gear	50.9	52.7	54.7	55.9	59.3	58.4	58.5
	Fixed gear	46.6	48.4	50.3	51.5	54.8	54.0	54.2
	Trawl gear	4.3	4.3	4.4	4.5	4.5	4.4	4.2
0.300	All gear	44.1	47.2	49.0	51.1	54.1	54.8	54.7
	Fixed gear	40.6	43.1	45.4	46.9	50.2	50.7	50.9
	Trawl gear	3.5	4.1	3.6	4.3	3.9	4.1	3.8
0.400	All gear	38.7	42.8	41.7	44.5	49.8	50.0	46.0
	Fixed gear	35.1	39.2	38.0	40.7	46.0	46.5	42.6
	Trawl gear	3.6	3.7	3.7	3.8	3.9	3.5	3.4

Table 2.16 -- Estimated potential equilibrium profit for the fixed gear fleet as a function of fixed gear F and a size limit applied to fixed gear only ($ million).

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	3.5	3.5	4.0	3.3	3.2	3.0	2.4
0.015	3.9	3.8	4.9	3.8	3.8	3.5	2.7
0.020	3.7	3.7	4.7	3.7	3.7	3.2	2.2
0.025	3.1	3.0	4.2	3.1	3.2	2.6	1.5
0.050	-6.3	-6.2	-6.0	-5.7	-5.2	-5.9	-7.3
0.075	-20.3	-21.5	-21.0	-20.3	-19.4	-20.1	-21.4
0.100	-39.3	-39.4	-39.1	-38.0	-36.5	-37.1	-38.2
0.125	-59.1	-59.1	-57.6	-57.1	-55.1	-56.2	-56.6
0.150	-79.5	-79.3	-77.7	-76.9	-74.5	-75.5	-75.6
0.175	-101.4	-99.8	-97.9	-97.0	-94.1	-95.0	-95.0
0.200	-121.9	-120.1	-118.2	-117.0	-113.8	-114.6	-114.3
0.300	-200.6	-198.1	-195.8	-194.3	-191.0	-190.5	-190.3
0.400	-272.0	-267.9	-269.1	-266.4	-261.1	-260.6	-264.5

Table 2.17 -- Estimated equilibrium landings, revenue, cost, and profit for the fixed gear fleet as a function of fixed gear F and a size limit applied to fixed gear only (catch in 1,000 metric tons and $ in millions).

		Size limits in centimeters						
F		37	41	45	49	53	57	61
0.010	Catch	8.0	8.0	7.9	7.8	7.6	7.2	6.7
	Revenue	12.8	12.7	13.2	12.5	12.5	12.3	11.7
	Total cost	9.2	9.2	9.2	9.2	9.2	9.2	9.2
	Profit	3.5	3.5	4.0	3.3	3.2	3.0	2.4
0.015	Catch	11.3	11.3	11.2	11.0	10.7	10.2	9.5
	Revenue	17.7	17.6	18.7	17.6	17.6	17.3	16.5
	Total cost	13.8	13.8	13.8	13.8	13.8	13.8	13.8
	Profit	3.9	3.8	4.9	3.8	3.8	3.5	2.7
0.020	Catch	14.2	14.2	14.1	13.8	13.5	12.9	11.9
	Revenue	22.1	22.1	23.0	22.1	22.1	21.6	20.6
	Total cost	18.4	18.4	18.4	18.4	18.4	18.4	18.4
	Profit	3.7	3.7	4.7	3.7	3.7	3.2	2.2
0.025	Catch	16.8	16.7	16.6	16.4	15.9	15.2	14.1
	Revenue	26.0	25.9	27.1	26.0	26.1	25.5	24.4
	Total cost	22.9	22.9	22.9	22.9	22.9	22.9	22.9
	Profit	3.1	3.0	4.2	3.1	3.2	2.6	1.5
0.050	Catch	25.9	25.8	25.7	25.4	24.8	23.7	22.0
	Revenue	39.0	39.1	39.3	39.6	40.1	39.4	38.0
	Total cost	45.3	45.3	45.3	45.3	45.3	45.3	45.3
	Profit	-6.3	-6.2	-6.0	-5.7	-5.2	-5.9	-7.3
0.075	Catch	31.1	31.0	30.9	30.5	29.9	28.7	26.7
	Revenue	46.8	45.6	46.1	46.8	47.7	47.0	45.7
	Total cost	67.1	67.1	67.1	67.1	67.1	67.1	67.1
	Profit	-20.3	-21.5	-21.0	-20.3	-19.4	-20.1	-21.4
0.100	Catch	34.0	33.9	33.9	33.6	33.0	31.8	29.4
	Revenue	49.1	49.0	49.3	50.4	51.9	51.3	50.1
	Total cost	88.4	88.4	88.4	88.4	88.4	88.4	88.4
	Profit	-39.3	-39.4	-39.1	-38.0	-36.5	-37.1	-38.2
0.125	Catch	35.7	35.6	35.5	35.5	34.8	33.4	30.9
	Revenue	50.1	50.1	51.6	52.0	54.1	52.9	52.6
	Total cost	109.2	109.2	109.2	109.2	109.2	109.2	109.2
	Profit	-59.1	-59.1	-57.6	-57.1	-55.1	-56.2	-56.6
0.150	Catch	36.5	36.4	36.4	36.4	35.8	34.5	31.7
	Revenue	49.9	50.1	51.8	52.5	55.0	53.9	53.8
	Total cost	129.4	129.4	129.4	129.4	129.4	129.4	129.4
	Profit	-79.5	-79.3	-77.7	-76.9	-74.5	-75.5	-75.6

Table 2.17 -- Continued.

0.175	Catch	36.8	36.7	36.7	36.8	36.3	34.6	32.1
	Revenue	47.9	49.5	51.3	52.2	55.1	54.2	54.2
	Total cost	149.2	149.2	149.2	149.2	149.2	149.2	149.2
	Profit	-101.4	-99.8	-97.9	-97.0	-94.1	-95.0	-95.0
0.200	Catch	36.9	36.7	36.8	37.0	36.4	34.8	32.1
	Revenue	46.6	48.4	50.3	51.5	54.8	54.0	54.2
	Total cost	168.5	168.5	168.5	168.5	168.5	168.5	168.5
	Profit	-121.9	-120.1	-118.2	-117.0	-113.8	-114.6	-114.3
0.300	Catch	35.5	35.6	35.1	35.7	35.4	34.2	30.5
	Revenue	40.6	43.1	45.4	46.9	50.2	50.7	50.9
	Total cost	241.2	241.2	241.2	241.2	241.2	241.2	241.2
	Profit	-200.6	-198.1	-195.8	-194.3	-191.0	-190.5	-190.3
0.400	Catch	33.7	34.0	33.1	32.6	32.4	32.8	28.8
	Revenue	35.1	39.2	38.0	40.7	46.0	46.5	42.6
	Total cost	307.1	307.1	307.1	307.1	307.1	307.1	307.1
	Profit	-272.0	-267.9	-269.1	-266.4	-261.1	-260.6	-264.5

Table 2.18 -- Estimated equilibrium number of vessels, catch per trip, and revenue per trip for the fixed gear fleet as a function of fixed gear F and a size limit applied to fixed gear only (catch in 1,000 lbs. dressed and revenue in $1,000).

		Size limits in centimeters						
F		37	41	45	49	53	57	61
0.010	Vessels	30.9	30.9	30.9	30.9	30.9	30.9	30.9
	Pounds/trip	63.9	63.6	63.0	61.9	60.2	57.4	53.1
	Revenue/trip	68.7	68.5	71.1	67.5	67.2	66.2	62.9
0.015	Vessels	46.3	46.3	46.3	46.3	46.3	46.3	46.3
	Pounds/trip	60.2	60.0	59.5	58.5	56.8	54.3	50.3
	Revenue/trip	63.6	63.5	67.3	63.5	63.3	62.4	59.5
0.020	Vessels	61.6	61.6	61.6	61.6	61.6	61.6	61.6
	Pounds/trip	56.9	56.7	56.3	55.3	53.8	51.4	47.6
	Revenue/trip	59.8	59.8	62.4	59.8	59.8	58.4	55.8
0.025	Vessels	76.8	76.8	76.8	76.8	76.8	76.8	76.8
	Pounds/trip	53.9	53.7	53.3	52.5	51.1	48.8	45.3
	Revenue/trip	56.4	56.3	58.9	56.5	56.6	55.3	52.9
0.050	Vessels	151.7	151.7	151.7	151.7	151.7	151.7	151.7
	Pounds/trip	42.0	41.9	41.7	41.2	40.2	38.5	35.7
	Revenue/trip	42.8	42.9	43.2	43.5	44.0	43.3	41.7
0.075	Vessels	224.8	224.8	224.8	224.8	224.8	224.8	224.8
	Pounds/trip	34.0	33.9	33.8	33.4	32.7	31.5	29.2
	Revenue/trip	34.7	33.8	34.2	34.7	35.4	34.9	33.9
0.100	Vessels	296.1	296.1	296.1	296.1	296.1	296.1	296.1
	Pounds/trip	28.3	28.2	28.2	27.9	27.4	26.4	24.4
	Revenue/trip	27.6	27.6	27.7	28.4	29.2	28.9	28.2
0.125	Vessels	365.7	365.7	365.7	365.7	365.7	365.7	365.7
	Pounds/trip	24.0	24.0	23.9	23.9	23.4	22.5	20.8
	Revenue/trip	22.8	22.8	23.5	23.7	24.6	24.1	24.0
0.150	Vessels	433.7	433.7	433.7	433.7	433.7	433.7	433.7
	Pounds/trip	20.7	20.7	20.6	20.7	20.3	19.6	18.0
	Revenue/trip	19.2	19.3	19.9	20.2	21.1	20.7	20.7
0.175	Vessels	499.9	499.9	499.9	499.9	499.9	499.9	499.9
	Pounds/trip	18.1	18.1	18.1	18.1	17.9	17.1	15.8
	Revenue/trip	16.0	16.5	17.1	17.4	18.4	18.1	18.1
0.200	Vessels	564.6	564.6	564.6	564.6	564.6	564.6	564.6
	Pounds/trip	16.1	16.0	16.0	16.1	15.9	15.2	14.0
	Revenue/trip	13.8	14.3	14.9	15.2	16.2	15.9	16.0

Table 2.18 -- Continued.

0.300	Vessels	808.1	808.1	808.1	808.1	808.1	808.1	808.1
	Pounds/trip	10.8	10.8	10.7	10.9	10.8	10.4	9.3
	Revenue/trip	8.4	8.9	9.4	9.7	10.4	10.5	10.5
0.400	Vessels	1028.8	1028.8	1028.8	1028.8	1028.8	1028.8	1028.8
	Pounds/trip	8.1	8.1	7.9	7.8	7.8	7.8	6.9
	Revenue/trip	5.7	6.3	6.2	6.6	7.4	7.5	6.9

Table 2.19 -- Estimated potential equilibrium profit for the fixed gear fleet as a function of fixed gear F and a size limit applied to fixed year only for different estimates of cost per unit of effort ($ millions).

Cost reduced by 75%

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	10.5	10.4	10.9	10.2	10.2	10.0	9.4
0.015	14.2	14.2	15.2	14.2	14.1	13.9	13.1
0.020	17.5	17.5	18.5	17.5	17.5	17.0	16.0
0.025	20.3	20.2	21.4	20.3	20.3	19.8	18.7
0.050	27.6	27.7	28.0	28.3	28.8	28.1	26.7
0.075	30.0	28.9	29.3	30.0	31.0	30.3	28.9
0.100	27.0	26.9	27.2	28.3	29.8	29.2	28.0
0.125	22.8	22.8	24.3	24.7	26.8	25.6	25.3
0.150	17.6	17.8	19.4	20.2	22.6	21.6	21.5
0.175	10.6	12.2	14.0	14.9	17.8	16.9	16.9
0.200	4.5	6.3	8.2	9.4	12.7	11.8	12.1
0.300	-19.7	-17.2	-14.9	-13.4	-10.1	-9.6	-9.4
0.400	-41.7	-37.6	-38.8	-36.1	-30.8	-30.3	-34.2

Cost reduced by 50%

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	8.1	8.1	8.6	7.9	7.9	7.7	7.1
0.015	10.8	10.7	11.8	10.7	10.7	10.4	9.6
0.020	12.9	12.9	13.9	12.9	12.9	12.4	11.4
0.025	14.5	14.5	15.7	14.6	14.6	14.0	12.9
0.050	16.3	16.4	16.7	17.0	17.4	16.8	15.4
0.075	13.2	12.1	12.5	13.2	14.2	13.5	12.2
0.100	4.9	4.8	5.1	6.2	7.7	7.1	5.9
0.125	-4.5	-4.5	-3.0	-2.5	-0.5	-1.7	-2.0
0.150	-14.8	-14.6	-12.9	-12.2	-9.8	-10.8	-10.9
0.175	-26.7	-25.2	-23.3	-22.4	-19.5	-20.4	-20.4
0.200	-37.6	-35.8	-33.9	-32.8	-29.5	-30.3	-30.1
0.300	-80.0	-77.5	-75.2	-73.7	-70.4	-69.9	-69.7
0.400	-118.4	-114.4	-115.5	-112.8	-107.6	-107.1	-110.9

Table 2.19 -- Continued.

Cost reduced by 25%

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	5.8	5.8	6.3	5.6	5.5	5.4	4.7
0.015	7.3	7.3	8.3	7.3	7.2	7.0	6.1
0.020	8.3	8.3	9.3	8.3	8.3	7.8	6.8
0.025	8.8	8.8	10.0	8.9	8.9	8.3	7.2
0.050	5.0	5.1	5.3	5.7	6.1	5.5	4.0
0.075	-3.5	-4.7	-4.3	-3.5	-2.6	-3.3	-4.6
0.100	-17.2	-17.3	-17.0	-15.9	-14.4	-15.0	-16.2
0.125	-31.8	-31.8	-30.3	-29.8	-27.8	-29.0	-29.3
0.150	-47.1	-46.9	-45.3	-44.6	-42.1	-43.2	-43.3
0.175	-64.1	-62.5	-60.6	-59.7	-56.8	-57.7	-57.7
0.200	-79.8	-78.0	-76.1	-74.9	-71.6	-72.4	-72.2
0.300	-140.3	-137.8	-135.5	-134.0	-130.7	-130.2	-130.0
0.400	-195.2	-191.2	-192.3	-189.6	-184.3	-183.9	-187.7

Cost increased by 25%

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	1.2	1.2	1.6	1.0	0.9	0.7	0.1
0.015	0.4	0.4	1.4	0.4	0.3	0.1	-0.8
0.020	-0.9	-0.9	0.1	-0.9	-0.9	-1.4	-2.4
0.025	-2.7	-2.7	-1.5	-2.6	-2.6	-3.2	-4.3
0.050	-17.6	-17.5	-17.3	-17.0	-16.5	-17.2	-18.6
0.075	-37.1	-38.2	-37.8	-37.1	-36.1	-36.8	-38.2
0.100	-61.4	-61.5	-61.2	-60.1	-58.6	-59.2	-60.3
0.125	-86.4	-86.4	-84.9	-84.4	-82.4	-83.5	-83.9
0.150	-111.9	-111.7	-110.0	-109.3	-106.8	-107.9	-108.0
0.175	-138.7	-137.1	-135.2	-134.3	-131.4	-132.3	-132.3
0.200	-164.1	-162.2	-160.3	-159.2	-155.9	-156.7	-156.5
0.300	-260.9	-258.4	-256.1	-254.6	-251.3	-250.8	-250.6
0.400	-348.7	-344.7	-345.9	-343.2	-337.9	-337.4	-341.3

Table 2.19 -- Continued.

Cost increased by 50%

F	Size limits in centimeters 37	41	45	49	53	57	61
0.010	-1.1	-1.1	-0.7	-1.3	-1.4	-1.6	-2.2
0.015	-3.1	-3.1	-2.0	-3.1	-3.1	-3.4	-4.2
0.020	-5.5	-5.5	-4.5	-5.5	-5.5	-6.0	-7.0
0.025	-8.4	-8.4	-7.2	-8.3	-8.3	-8.9	-10.0
0.050	-29.0	-28.9	-28.6	-28.3	-27.8	-28.5	-29.9
0.075	-53.9	-55.0	-54.6	-53.9	-52.9	-53.6	-54.9
0.100	-83.5	-83.6	-83.3	-82.2	-80.7	-81.3	-82.4
0.125	-113.7	-113.7	-112.2	-111.7	-109.7	-110.8	-111.2
0.150	-144.2	-144.0	-142.4	-141.6	-139.2	-140.3	-140.3
0.175	-176.0	-174.4	-172.5	-171.6	-168.7	-169.6	-169.6
0.200	-206.2	-204.4	-202.5	-201.3	-198.0	-198.8	-198.6
0.300	-321.2	-318.7	-316.4	-314.9	-311.6	-311.1	-310.9
0.400	-425.5	-421.5	-422.6	-419.9	-414.7	-414.2	-418.0

Table 2.20 -- Estimated equilibrium reproductive potential index as a function of fixed gear F and a size limit applied to fixed gear only.

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	100.0	100.1	100.4	100.7	101.1	101.6	102.2
0.015	93.1	93.3	93.7	94.2	94.7	95.4	96.2
0.020	86.9	87.1	87.6	88.1	88.8	89.7	90.8
0.025	81.2	81.5	82.0	82.7	83.5	84.5	85.8
0.050	59.1	59.4	60.2	61.2	62.4	63.9	65.9
0.075	44.2	44.7	45.5	46.7	48.0	49.9	52.3
0.100	33.9	34.4	35.3	36.5	37.9	40.0	42.3
0.125	26.5	27.0	27.8	29.0	30.6	32.7	34.8
0.150	21.1	21.4	22.3	23.1	24.8	27.0	29.0
0.175	17.0	17.2	18.1	18.9	20.8	23.0	24.7
0.200	13.8	13.9	14.8	15.9	17.1	19.4	21.2
0.300	7.5	7.8	8.7	9.3	10.6	12.1	15.2
0.400	3.4	3.5	4.0	6.0	5.7	6.9	11.5

The index is 100 for F of 0.01 and 37 cm.

Table 2.21 -- Estimated equilibrium biomass index as a function of fixed gear F and a size limit applied to fixed gear only.

	Size limits in centimeters						
F	37	41	45	49	53	57	61
0.010	100.0	100.1	100.5	100.8	101.2	101.9	102.6
0.015	94.2	94.4	94.8	95.3	95.9	96.8	97.9
0.020	88.9	89.2	89.8	90.3	91.1	92.2	93.6
0.025	84.1	83.7	84.3	85.8	86.7	88.0	89.7
0.050	64.7	65.2	66.1	67.3	68.8	70.7	73.1
0.075	52.1	52.6	53.7	55.2	57.0	59.3	62.2
0.100	43.1	43.6	44.8	46.5	48.6	51.1	54.3
0.125	36.5	37.0	38.3	40.1	42.4	44.9	48.3
0.150	31.4	31.9	33.5	35.1	37.6	40.1	43.7
0.175	27.6	28.0	29.6	31.2	33.8	36.3	40.0
0.200	24.3	24.8	26.4	28.1	30.7	33.4	37.0
0.300	16.4	16.9	18.3	20.1	22.6	25.3	29.0
0.400	12.2	12.8	14.1	16.0	18.4	21.1	24.4

The index is 100 for F of 0.01 and 37 cm,

Table 2.a.1 -- Sablefish catch off Alaska for all gear, 1981-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP	778	825	1172	10157	5640	1910	1066	1542	2509	448	292	194	26534
	JVP		1	1	TR	31	39	31	59	172	121	21	TR	476
	FOREIGN		1	TR	TR	2	1	10	10	10	18	30	25	108
	TOTAL	778	827	1173	10158	5674	1950	1108	1612	2691	588	342	219	27118
1985	DAP	236	556	1310	2653	3492	1911	1247	724	763	1307	108	432	14741
	JVP	TR	1	3	12	33	20	38	23	43	132	22	10	335
	FOREIGN	1	6	8	6	15	19	9	6	36	73	72	99	351
	TOTAL	238	563	1321	2671	3540	1950	1295	753	842	1512	202	540	15427
1984	DAP	67	89	229	587	1070	1802	1657	1659	1727	216	436	394	9930
	JVP	46	8	1	11	54	86	271	111	102	132	26	8	876
	FOREIGN	111	69	115	214	73	132	55	279	211	781	529	459	3029
	TOTAL	224	165	345	812	1197	2020	1984	2049	2039	1149	991	861	13836
1983	DAP	8	40	181	366	670	627	363	498	466	447	17	168	3852
	JVP	TR	1	3	8	18	26	118	64	39	24	46	42	389
	FOREIGN	71	175	231	306	697	696	593	406	631	1014	1284	2039	8144
	TOTAL	79	216	415	681	1385	1349	1075	969	1135	1486	1346	2249	12385
1982	DAP	2	9	179	102	162	457	620	505	682	99	43	226	3085
	JVP	1	TR	TR	1	9	15	47	27	22	1	1		124
	FOREIGN	34	60	177	425	598	869	637	461	1144	1450	1903	1726	9484
	TOTAL	37	70	356	527	770	1341	1303	992	1848	1550	1947	1953	12694
1981	DAP	7	40	15	106	438	67	218	280	418	228	58	68	1942
	JVP				TR	145	17	7	1	8	2			180
	FOREIGN	229	164	331	535	543	730	585	708	1215	1942	2047	1902	10931
	TOTAL	236	204	346	641	1126	813	810	989	1642	2172	2105	1970	13054

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	729.3	904.3	1353.6	13426.4	7419.4	2124.4	845.2	1050.2	2668.7				30521.4
	AKR			22.7	157.3	152.4	225.1	330.4	874.5	964.9	774.5	405.0	198.3	4105.0
	WDF					2.8	4.4		7.1	683.5		141.6	9.2	848.6
	DAP	729.3	904.3	1376.3	13583.7	7574.5	2353.9	1175.6	1931.7	4317.1	774.5	546.6	207.5	35475.0
1985	ADFG	238.4	745.1	1636.5	3471.7	4954.2	2642.6	1451.9	790.0	1003.4	1771.9	19.6	477.7	19203.0
	WDF					0.7	1.0				101.4	84.9	6.9	194.7
	DAP	238.4	745.1	1636.5	3471.7	4955.0	2643.6	1451.9	790.0	1003.4	1873.3	104.4	484.6	19397.8
1984	ADFG	45.7	61.1	163.2	376.6	797.4	1070.2	1343.0	1158.4	1324.4	178.1	235.4	80.1	6833.7
	WDF				62.1			97.2	6.5	0.1			78.8	244.8
	DAP	45.7	61.1	163.2	438.7	797.4	1070.2	1440.3	1164.8	1324.6	178.1	235.4	159.0	7078.5
1983	WDF				15.9	0.7			1.0		23.0		114.7	155.4
1982	WDF			137.1		0.0	11.2		42.6	47.2			188.5	426.7
1981	WDF			4.7		66.7	0.7		150.3				110.9	333.3

Table 2.a.1 -- (con't)

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	0.425	0.497	0.532	0.607	0.612	0.579	0.509	0.596	0.754				0.599
	AKR			0.555	0.548	0.483	0.419	0.479	0.535	0.625	0.784	0.807	0.496	0.592
	WDF					1.273	1.138		1.157	1.526		1.000	0.339	1.350
	DAP	0.425	0.497	0.533	0.607	0.609	0.559	0.500	0.568	0.780	0.784	0.850	0.486	0.606
1985	ADFG	0.458	0.608	0.567	0.594	0.644	0.627	0.528	0.495	0.596	0.634	0.545	0.511	0.597
	WDF					1.050	1.200				1.157	0.418	0.394	0.629
	DAP	0.458	0.608	0.567	0.594	0.644	0.627	0.528	0.495	0.596	0.650	0.437	0.509	0.597
1984	ADFG	0.312	0.313	0.323	0.318	0.338	0.269	0.381	0.317	0.348	0.374	0.245	0.217	0.323
	WDF				0.579			0.751	0.826	0.150			0.158	0.329
	DAP	0.312	0.313	0.323	0.339	0.338	0.269	0.394	0.319	0.348	0.374	0.245	0.183	0.323
1983	WDF				0.677	0.372			0.223		0.591		0.325	0.369
1982	WDF			0.830		0.370	0.661		0.587	0.826			0.594	0.678
1981	WDF			0.795		0.800	0.550		0.695				0.807	0.750

All numbers are preliminary
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All data from Pacfin data base

Table 2.a.2 -- Sablefish catch for Bering Sea/Aleutian Islands region, all gear, 1981-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP	465	441	1043	307	216	486	698	1045	396	310	200	177	5786
	JVP			1	TR	31	39	31	54	141	116	17	TR	431
	FOREIGN			TR	TR	2	1	10	10	10	18	30	25	107
	TOTAL	465	441	1044	308	250	527	740	1109	548	444	247	203	6324
1985	DAP	2			1	TR	250	1203	628	342	416	102	432	3375
	JVP			1	11	27	16	21	19	5	9	1		110
	FOREIGN	1	5	TR	6	15	19	9	6	15	67	68	99	312
	TOTAL	3	5	1	19	42	285	1233	653	362	492	171	530	3796
1984	DAP				8	16	11	7	164	200	23	347	278	1055
	JVP	TR			TR	2	46	232	47	18	2			348
	FOREIGN	19	22	96	169	29	91	29	205	154	284	365	459	1923
	TOTAL	19	22	96	177	48	149	269	416	372	308	712	737	3326
1983	DAP	TR				1			2			15	72	90
	JVP				5	11	22	22	48	6				114
	FOREIGN	26	110	114	122	250	228	303	270	393	363	348	652	3178
	TOTAL	26	110	114	127	262	250	325	320	398	363	363	724	3382
1982	DAP							16	23	1	56	14	64	176
	JVP				1	9	15	47	27	22	1	1		123
	FOREIGN	27	50	101	130	166	285	462	279	608	532	620	579	3839
	TOTAL	27	50	101	131	175	300	525	329	631	589	635	643	4137
1981	DAP												2	2
	JVP					145	17	7	1	8	2			180
	FOREIGN	121	82	177	229	252	344	242	117	191	285	316	600	2955
	TOTAL	121	82	177	229	397	360	249	117	200	288	316	602	3137

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	451.8	460.1	1236.0	231.1	165.8	473.8	610.7	982.5	34.1				4645.9
	AKR			19.1		46.4	79.1	132.5	556.3	642.8	527.2	318.5	195.7	2517.6
	DAP	451.8	460.1	1255.2	231.1	212.2	552.8	743.2	1538.8	676.9	527.2	318.5	195.7	7163.5
1985	ADFG	0.6			1.0	0.0	341.8	1390.4	646.0	362.9	383.2	12.1	477.7	3615.6
	WDF											84.9	6.9	91.7
	DAP	0.6			1.0	0.0	341.8	1390.4	646.0	362.9	383.2	97.0	484.6	3707.3
1984	ADFG				1.3	5.8	4.0	4.7	57.7	71.8	8.1	132.3	20.3	305.8
	WDF				1.7								78.8	80.5
	DAP				2.9	5.8	4.0	4.7	57.7	71.8	8.1	132.3	99.1	386.3
1983	WDF					0.7			1.0				24.2	25.9
1982	WDF												27.6	27.6
1981	WDF												0.4	0.4

Table 2.a.2 -- (con't)

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	0.441	0.473	0.546	0.341	0.461	0.541	0.470	0.593	0.300				0.502
	AKR			0.556		0.394	0.403	0.556	0.862	0.846	0.771	0.724	0.500	0.718
	DAP	0.441	0.473	0.546	0.341	0.445	0.515	0.483	0.668	0.775	0.771	0.724	0.500	0.562
1985	ADFG	0.157			0.536	0.390	0.621	0.524	0.466	0.481	0.418	0.545	0.511	0.501
	WDF											0.418	0.394	0.416
	DAP	0.157			0.536	0.390	0.621	0.524	0.466	0.481	0.418	0.430	0.509	0.498
1984	ADFG				0.160	0.160	0.160	0.284	0.160	0.163	0.162	0.173	0.177	0.168
	WDF				0.160								0.158	0.158
	DAP				0.160	0.160	0.160	0.284	0.160	0.163	0.162	0.173	0.161	0.166
1983	WDF					0.372			0.223				0.154	0.159
1982	WDF												0.223	0.223
1981	WDF												0.100	0.100

All numbers are preliminary
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All data from Pacfin data base

Table 2.a.3 -- Sablefish catch for Gulf of Alaska region, all gear, 1981-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP	313	384	128	9850	5424	1423	368	498	2113	138	92	16	20748
	JVP		1	TR			TR		5	30	5	3	TR	45
	FOREIGN		1	TR	TR	TR								1
	TOTAL	313	386	129	9850	5424	1423	368	503	2143	143	95	16	20794
1985	DAP	235	556	1310	2652	3492	1662	44	96	421	892	6		11366
	JVP	TR	1	2	TR	5	4	17	4	38	123	21	10	226
	FOREIGN		1	8	TR				TR	21	5	4		38
	TOTAL	235	557	1320	2652	3498	1666	61	100	480	1020	31	10	11630
1984	DAP	67	89	229	578	1053	1790	1650	1495	1526	193	89	115	8875
	JVP	46	8	1	11	52	40	39	64	84	150	26	8	528
	FOREIGN	92	46	18	46	44	41	26	74	57	497	164	1	1107
	TOTAL	205	143	248	634	1149	1871	1715	1633	1668	840	279	124	10510
1983	DAP	8	40	181	366	669	627	363	496	466	447	2	96	3761
	JVP	TR	1	3	3	7	4	96	16	33	24	46	42	275
	FOREIGN	45	65	118	184	447	468	290	137	238	651	936	1387	4966
	TOTAL	53	105	301	553	1123	1100	749	649	736	1123	983	1525	9002
1982	DAP	2	9	179	102	162	457	604	481	681	43	28	162	2910
	JVP	1	TR	TR		TR								1
	FOREIGN	7	10	76	295	433	584	175	182	536	918	1283	1147	5646
	TOTAL	9	19	255	397	594	1041	778	663	1217	961	1311	1309	8557
1981	DAP	7	40	15	106	438	67	218	280	418	228	58	66	1940
	JVP				TR									TR
	FOREIGN	109	82	154	306	291	386	343	591	1024	1656	1731	1303	7976
	TOTAL	116	122	169	412	729	453	561	872	1442	1884	1789	1368	9917

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	277.5	444.1	117.6	13195.3	7253.6	1650.7	234.5	67.7	2634.6				25873.5
	AKR			3.6	157.3	105.9	146.0	197.9	318.2	322.1	247.3	86.5	2.5	1587.4
	WDF					2.8	4.4		7.1	683.5		141.6	9.2	848.6
	DAP	277.5	444.1	121.1	13352.6	7362.3	1801.1	432.4	392.9	3640.3	247.3	228.1	11.7	28311.5
1985	ADFG	237.8	745.1	1636.5	3470.8	4954.2	2300.8	61.5	144.1	640.5	1388.8	7.5		15387.4
	WDF					0.7	1.0				101.4			103.0
	DAP	237.8	745.1	1636.5	3470.8	4954.9	2301.8	61.5	144.1	640.5	1490.1	7.5		15690.4
1984	ADFG	45.7	61.1	163.2	375.4	791.7	1066.2	1338.3	1100.7	1252.6	170.1	103.1	59.9	6528.0
	WDF				60.4			97.2	6.5	0.1				164.3
	DAP	45.7	61.1	163.2	435.8	791.7	1066.2	1435.6	1107.2	1252.8	170.1	103.1	59.9	6692.2
1983	WDF				15.9						23.0		90.5	129.4
1982	WDF			137.1		0.0	11.2		42.6	47.2			160.9	399.1
1981	WDF			4.7		66.7	0.7		150.3				110.4	332.8

Table 2.a.3 -- (con't)

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	0.402	0.525	0.425	0.616	0.617	0.591	0.649	0.658	0.769				0.621
	AKR			0.548	0.548	0.535	0.429	0.439	0.322	0.412	0.813	1.400	0.311	0.463
	WDF					1.273	1.138		1.157	1.526		1.000	0.339	1.350
	DAP	0.402	0.525	0.428	0.615	0.616	0.574	0.532	0.358	0.782	0.813	1.121	0.333	0.619
1985	ADFG	0.460	0.608	0.567	0.594	0.644	0.628	0.635	0.681	0.689	0.740	0.545		0.624
	WDF					1.050	1.200				1.157			1.136
	DAP	0.460	0.608	0.567	0.594	0.644	0.628	0.635	0.681	0.689	0.758	0.545		0.626
1984	ADFG	0.312	0.313	0.323	0.319	0.341	0.270	0.382	0.335	0.372	0.399	0.525	0.235	0.338
	WDF				0.624			0.751	0.826	0.150				0.699
	DAP	0.312	0.313	0.323	0.342	0.341	0.270	0.395	0.336	0.372	0.399	0.525	0.235	0.342
1983	WDF				0.677						0.591		0.463	0.502
1982	WDF			0.830		0.370	0.661		0.587	0.826			0.830	0.789
1981	WDF			0.795		0.800	0.550		0.695				0.830	0.757

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All data from Pacfin data base

Table 2.4 -- Sablefish catch off Alaska, trawl gear, 1984-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP	565	475	147	1159	504	331	352	513	475	167	86	171	4946
	JVP		1	1	TR	31	39	31	54	172	121	21	TR	471
	FOREIGN			TR	TR	TR	1	10	10	10	11	13	TR	55
	TOTAL	565	476	148	1160	535	371	394	577	657	298	120	171	5472
1985	DAP	84		65	96	149	5	20	3	46	10	16	122	616
	JVP	TR	1	3	12	33	20	38	23	43	132	22	10	335
	FOREIGN	TR	TR	TR	2	4	14	9	5	35	58	27	4	158
	TOTAL	84	1	67	110	186	39	67	31	123	200	65	136	1109
1984	DAP	4	1		8	20	11	21	170	203	19	340	332	1130
	JVP	46	8	1	11	54	86	271	111	102	152	26	8	876
	FOREIGN	1	TR	TR	TR	1	42	51	183	135	334	207	18	972
	TOTAL	51	9	1	19	76	139	344	465	439	504	573	358	2978

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	496.5	522.9	119.3	1009.7	369.7	76.6	103.1	23.7	34.1				2755.6
	AKR					68.1	191.5	176.3	322.7	328.8	149.6	73.2	139.5	1449.6
	WDF												9.2	9.2
	DAP	496.5	522.9	119.3	1009.7	437.8	268.1	279.4	346.4	362.9	149.6	73.2	148.7	4214.3
1985	ADFG	30.7		22.3	109.6	191.2	4.7	4.9	2.0	39.5	8.5	19.6	99.5	532.5
	WDF												6.9	6.9
	DAP	30.7		22.3	109.6	191.2	4.7	4.9	2.0	39.5	8.5	19.6	106.3	539.3
1984	ADFG	1.5	0.2		1.3	7.5	4.0	7.1	59.7	71.4	7.4	120.5	36.7	317.3
	WDF				1.7					0.1			78.8	80.6
	DAP	1.5	0.2		2.9	7.5	4.0	7.1	59.7	71.5	7.4	120.5	115.6	397.9

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	0.399	0.499	0.367	0.395	0.394	0.315	0.305	0.302	0.300				0.400
	AKR					0.394	0.394	0.403	0.306	0.352	0.407	0.386	0.399	0.363
	WDF												0.339	0.339
	DAP	0.399	0.499	0.367	0.395	0.394	0.367	0.360	0.306	0.347	0.407	0.386	0.395	0.386
1985	ADFG	0.166		0.157	0.515	0.584	0.390	0.110	0.289	0.392	0.394	0.545	0.394	0.397
	WDF												0.394	0.394
	DAP	0.166		0.157	0.515	0.584	0.390	0.110	0.289	0.392	0.394	0.545	0.394	0.397
1984	ADFG	0.199	0.065		0.160	0.166	0.159	0.150	0.159	0.160	0.180	0.161	0.158	0.160
	WDF				0.160					0.150			0.158	0.158
	DAP	0.199	0.065		0.160	0.166	0.159	0.150	0.159	0.160	0.180	0.161	0.158	0.160

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All data from Pacfin data base

Table 2.a.5 -- Sablefish catch for Bering Sea/Aleutian Islands, trawl gear, 1984-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP	252	95	44	283	157	182	172	51	153	92	86	155	1722
	JVP			1	TR	31	39	31	54	141	116	17	TR	431
	FOREIGN			TR	TR	TR	1	10	10	10	11	13	TR	55
	TOTAL	252	95	44	283	189	222	214	115	304	219	117	155	2208
1985	DAP	2				TR		19	1	46	10	10	122	210
	JVP			1	11	27	16	21	19	5	9	1		110
	FOREIGN	TR	TR	TR	2	4	14	9	5	14	53	23	4	128
	TOTAL	2	TR	1	14	32	30	49	25	64	72	34	126	448
1984	DAP				8	16	11	6	164	199	15	336	272	1027
	JVP	TR			TR	2	46	232	47	18	2			348
	FOREIGN	1	TR	TR	TR	1	30	25	122	94	128	183	17	600
	TOTAL	1	TR	TR	9	20	88	264	332	310	145	519	289	1976

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	219.0	82.4	28.9	200.8	90.4	65.5	103.1	11.2	34.1				835.6
	AKR					46.4	72.9	13.6	18.9	108.3	98.6	73.2	137.0	568.9
	DAP	219.0	82.4	28.9	200.8	136.8	138.4	116.7	30.1	142.4	98.6	73.2	137.0	1404.5
1985	ADFG	0.6				0.0		4.2	0.8	39.4	8.5	12.1	99.5	165.2
	WDF												6.9	6.9
	DAP	0.6				0.0		4.2	0.8	39.4	8.5	12.1	106.3	172.1
1984	ADFG				1.3	5.8	4.0	2.1	57.7	70.1	5.2	118.6	15.9	280.5
	WDF				1.7								78.8	80.5
	DAP				2.9	5.8	4.0	2.1	57.7	70.1	5.2	118.6	94.7	361.0

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	0.394	0.394	0.300	0.322	0.394	0.304	0.305	0.305	0.300				0.346
	AKR					0.394	0.393	0.326	0.252	0.484	0.484	0.386	0.401	0.413
	DAP	0.394	0.394	0.300	0.322	0.394	0.345	0.307	0.269	0.422	0.484	0.386	0.401	0.370
1985	ADFG	0.157				0.390		0.100	0.285	0.392	0.394	0.545	0.394	0.371
	WDF												0.394	0.394
	DAP	0.157				0.390		0.100	0.285	0.392	0.394	0.545	0.394	0.372
1984	ADFG				0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.159	0.160
	WDF				0.160								0.158	0.158
	DAP				0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.158	0.159

All numbers are preliminary
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TR = landed catch less than 0.5 metric tons
All data from Pacfin data base

Table 2.a.6 -- Sablefish catch for Gulf of Alaska, trawl gear, 1984-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP	313	380	104	877	346	149	180	463	322	74		16	3224
	JVP		1	TR			TR			30	5	3	TR	40
	TOTAL	313	381	104	877	346	149	180	463	352	80	3	16	3264
1985	DAP	82		65	96	149	5	1	2	TR		6		406
	JVP	TR	1	2	TR	5	4	17	4	38	123	21	10	226
	FOREIGN								TR	21	5	4		30
	TOTAL	82	1	66	97	154	9	19	6	59	128	31	10	662
1984	DAP	4	1			4	TR	15	7	4	4	3	60	102
	JVP	46	8	1	11	52	40	39	64	84	150	26	8	528
	FOREIGN						12	26	62	41	206	24	1	371
	TOTAL	50	9	1	11	56	52	80	132	129	359	54	69	1002

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	277.5	440.4	90.3	808.9	279.3	11.0		12.5					1920.0
	AKR					21.7	118.6	162.6	303.7	220.5	50.9		2.5	880.6
	WDF												9.2	9.2
	DAP	277.5	440.4	90.3	808.9	301.0	129.7	162.6	316.2	220.5	50.9		11.7	2809.8
1985	ADFG	30.2		22.3	109.6	191.2	4.7	0.6	1.2	0.0		7.5		367.3
	DAP	30.2		22.3	109.6	191.2	4.7	0.6	1.2	0.0		7.5		367.3
1984	ADFG	1.5	0.2			1.7	0.0	5.0	2.1	1.3	2.3	1.9	20.8	36.7
	WDF									0.1				0.1
	DAP	1.5	0.2			1.7	0.0	5.0	2.1	1.4	2.3	1.9	20.8	36.9

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	0.402	0.525	0.395	0.419	0.394	0.394		0.300					0.430
	AKR					0.394	0.394	0.411	0.311	0.311	0.311		0.311	0.337
	WDF												0.339	0.339
	DAP	0.402	0.525	0.395	0.419	0.394	0.394	0.411	0.310	0.311	0.311		0.333	0.395
1985	ADFG	0.167		0.157	0.515	0.584	0.390	0.271	0.292	0.333		0.545		0.410
	DAP	0.167		0.157	0.515	0.584	0.390	0.271	0.292	0.333		0.545		0.410
1984	ADFG	0.199	0.065			0.192	0.064	0.147	0.144	0.160	0.254	0.267	0.157	0.164
	WDF									0.150				0.150
	DAP	0.199	0.065			0.192	0.064	0.147	0.144	0.159	0.254	0.267	0.157	0.164

All numbers are preliminary
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TR = landed catch less than 0.5 metric tons
All data from Pacfin data base

Table 2.a.7 -- Sablefish catch off Alaska, pot gear, 1984-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP	74	86	514	657	642	437	199	338	169	130	87	23	3356
	TOTAL	74	86	514	657	642	437	199	338	169	130	87	23	3356
1985	DAP		84	102	356	424	585	448	121	131	360		309	2922
	TOTAL		84	102	356	424	585	448	121	131	360		309	2922
1984	DAP		6	47	24		35	77		30	98	TR		277
	TOTAL		6	47	24		35	77		30	98	TR		277

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	86.3	89.7	607.3	696.3	784.8	603.2	195.9	282.6					3346.1
	AKR			22.7	157.3	84.2	33.6	107.6	412.2	454.9	367.8	239.3	58.8	1938.4
	DAP	86.3	89.7	630.0	853.6	869.0	636.8	303.5	694.8	454.9	367.8	239.3	58.8	5284.5
1985	ADFG		141.0	197.5	463.6	548.5	720.5	482.8	118.0	128.4	332.9		378.3	3511.4
	DAP		141.0	197.5	463.6	548.5	720.5	482.8	118.0	128.4	332.9		378.3	3511.4
1984	ADFG		3.6	29.6	12.4		57.0	146.7		13.0	49.1	0.3		311.6
	WDF				6.3									6.3
	DAP		3.6	29.6	18.7		57.0	146.7		13.0	49.1	0.3		317.8

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	0.532	0.475	0.556	0.599	0.616	0.660	0.661	0.713					0.610
	AKR			0.555	0.548	0.590	0.667	0.753	1.181	1.218	1.285	1.247	1.174	1.012
	DAP	0.532	0.475	0.556	0.589	0.614	0.661	0.691	0.932	1.218	1.285	1.247	1.174	0.714
1985	ADFG		0.757	0.878	0.591	0.586	0.559	0.488	0.442	0.443	0.419		0.554	0.545
	DAP		0.757	0.878	0.591	0.586	0.559	0.488	0.442	0.443	0.419		0.554	0.545
1984	ADFG		0.288	0.288	0.333		0.734	0.860		0.199	0.381	0.465		0.523
	WDF				0.380									0.380
	DAP		0.288	0.288	0.348		0.734	0.860		0.199	0.381	0.465		0.520

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All data from Pacfin data base

Table 2.a.9 -- Sablefish catch for Gulf of Alaska, pot gear, 1984-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP		4	22	657	636	383	151	24	33	64	28		2001
	TOTAL		4	22	657	636	383	151	24	33	64	28		2001
1985	DAP		84	102	356	424	493	1	4	TR				1466
	TOTAL		84	102	356	424	493	1	4	TR				1466
1984	DAP		6	47	24		35	77		30	58			277
	TOTAL		6	47	24		35	77		30	58			277

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG		3.7	23.4	696.3	776.2	538.0	186.0	45.4					2269.0
	AKR			3.6	157.3	84.2	27.4	35.3	14.5	101.7	196.4	86.5		706.8
	DAP		3.7	27.0	853.6	860.5	565.3	221.3	59.9	101.7	196.4	86.5		2975.8
1985	ADFG		141.0	197.5	463.6	548.5	605.7	1.4	4.2	0.1				1962.0
	DAP		141.0	197.5	463.6	548.5	605.7	1.4	4.2	0.1				1962.0
1984	ADFG		3.6	29.6	12.4		57.0	146.7		13.0	49.1			311.2
	WDF				6.3									6.3
	DAP		3.6	29.6	18.7		57.0	146.7		13.0	49.1			317.5

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG		0.475	0.556	0.599	0.617	0.669	0.669	1.082					0.631
	AKR			0.548	0.548	0.590	0.692	0.644	1.400	1.400	1.400	1.400		0.866
	DAP		0.475	0.555	0.589	0.614	0.670	0.665	1.145	1.400	1.400	1.400		0.675
1985	ADFG		0.757	0.878	0.591	0.586	0.557	0.535	0.457	0.672				0.607
	DAP		0.757	0.878	0.591	0.586	0.557	0.535	0.457	0.672				0.607
1984	ADFG		0.288	0.288	0.333		0.734	0.860		0.199	0.381			0.524
	WDF				0.380									0.380
	DAP		0.288	0.288	0.348		0.734	0.860		0.199	0.381			0.520

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All data from Pacfin data base

Table 2.a.10 -- Sablefish catch off Alaska, hook&line. gear, 1984-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP	139	264	511	8341	4494	1142	515	691	1865	152	119		18232
	JVP								5					5
	FOREIGN		1	TR	TR	2			TR	TR	8	16	25	53
	TOTAL	139	265	511	8341	4496	1142	515	696	1865	160	135	25	18290
1985	DAP	152	471	1144	2201	2914	1272	778	600	586	937	92		11147
	FOREIGN	1	6	8	4	10	5	1	2	1	15	45	95	193
	TOTAL	154	477	1152	2205	2924	1277	779	601	588	951	137	95	11340
1984	DAP	63	82	182	554	1045	1732	1546	1486	1494	124	96	57	8461
	FOREIGN	110	69	115	214	72	91	4	96	76	447	322	442	2057
	TOTAL	173	151	297	768	1117	1823	1550	1582	1570	572	418	499	10519

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	146.5	291.7	627.0	11720.4	6264.9	1444.6	546.2	743.8	2634.6				24419.8
	AKR			0.0				46.6	139.7	181.2	257.1	92.4		717.0
	WDF					2.8	4.4		7.1	683.5		141.6		839.4
	DAP	146.5	291.7	627.0	11720.4	6267.7	1449.0	592.8	890.5	3499.4	257.1	234.0		25976.2
1985	ADFG	207.6	604.1	1416.7	2898.5	4207.6	1858.9	964.2	670.0	835.5	1430.5			15093.8
	WDF					0.7	1.0				101.4	84.9		187.9
	DAP	207.6	604.1	1416.7	2898.5	4208.3	1859.9	964.2	670.0	835.5	1531.8	84.9		15281.7
1984	ADFG	44.2	57.4	133.6	362.9	784.8	984.6	1175.5	1095.8	1240.1	116.3	114.5	41.7	6151.4
	WDF				54.2			97.2	6.5					157.9
	DAP	44.2	57.4	133.6	417.1	784.8	984.6	1272.7	1102.3	1240.1	116.3	114.5	41.7	6309.3

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	0.476	0.501	0.557	0.637	0.632	0.575	0.532	0.579	0.769				0.633
	AKR			0.010				0.429	0.604	0.769	0.769	0.769		0.696
	WDF					1.273	1.138		1.157	1.526		1.000		1.395
	DAP	0.476	0.501	0.557	0.637	0.633	0.576	0.522	0.585	0.851	0.769	0.894		0.646
1985	ADFG	0.618	0.581	0.562	0.597	0.655	0.663	0.562	0.507	0.646	0.723			0.622
	WDF					1.050	1.200				1.157	0.418		0.643
	DAP	0.618	0.581	0.562	0.597	0.655	0.663	0.562	0.507	0.646	0.742	0.418		0.622
1984	ADFG	0.318	0.318	0.332	0.318	0.341	0.258	0.359	0.335	0.376	0.424	0.541	0.330	0.334
	WDF				0.674			0.751	0.826					0.725
	DAP	0.318	0.318	0.332	0.342	0.341	0.258	0.373	0.336	0.376	0.424	0.541	0.330	0.338

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Table 2.a.11 -- Sablefish catch for Bering Sea/Aleutian Islands, hook&line gear, 1984-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP	139	264	508	25	52	250	477	679	107	152	55		2709
	FOREIGN				TR	2			TR	TR	8	16	25	52
	TOTAL	139	264	508	25	54	250	477	679	107	160	71	25	2761
1985	DAP				1		159	737	510	165	45	92		1708
	FOREIGN	1	5	TR	4	10	5	1	2	1	15	45	95	184
	TOTAL	1	5	TR	5	10	163	737	511	166	60	137	95	1892
1984	DAP							1		1		10	2	15
	FOREIGN	18	22	96	169	28	61	4	83	60	156	182	442	1322
	TOTAL	18	22	96	169	28	61	6	83	61	156	193	444	1337

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	146.5	291.7	623.3	30.3	66.8	342.9	497.7	734.1					2733.3
	AKR							46.6	139.7	181.2	257.1	92.4		717.0
	DAP	146.5	291.7	623.3	30.3	66.8	342.9	544.3	873.8	181.2	257.1	92.4		3450.4
1985	ADFG				1.0		226.9	904.8	531.4	195.1	41.7			1901.0
	WDF											84.9		84.9
	DAP				1.0		226.9	904.8	531.4	195.1	41.7	84.9		1985.8
1984	ADFG							2.6		1.7		13.3	2.6	20.2
	DAP							2.6		1.7		13.3	2.6	20.2

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG	0.476	0.501	0.556	0.560	0.580	0.621	0.527	0.580					0.553
	AKR			0.000				0.429	0.604	0.769	0.769	0.769		0.696
	DAP	0.476	0.501	0.556	0.560	0.580	0.621	0.517	0.583	0.769	0.769	0.769		0.578
1985	ADFG				0.536		0.649	0.557	0.473	0.537	0.418			0.534
	WDF											0.418		0.418
	DAP				0.536		0.649	0.557	0.473	0.537	0.418	0.418		0.527
1984	ADFG							0.796		0.591		0.591	0.591	0.611
	DAP							0.796		0.591		0.591	0.591	0.611

All numbers are preliminary
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All data from Pacfin data base

Table 2.a.12 -- Sablefish catch for Gulf of Alaska, hook&line gear, 1984-1986

LANDED CATCH (MTONS)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	DAP			3	8316	4442	891	38	11	1758		64		15523
	JVP								5					5
	FOREIGN		1	TR	TR	TR								1
	TOTAL		1	3	8316	4442	891	38	17	1758		64		15529
1985	DAP	152	471	1144	2200	2914	1113	42	90	421	892			9439
	FOREIGN		1	8	TR									9
	TOTAL	152	472	1151	2200	2914	1113	42	90	421	892			9448
1984	DAP	63	82	182	554	1045	1732	1544	1486	1493	124	86	55	8446
	FOREIGN	92	46	18	46	44	29		13	16	291	139		735
	TOTAL	155	128	201	600	1089	1761	1544	1498	1509	416	225	55	9181

$-VALUE ($1000)		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG			3.8	11690.1	6198.1	1101.7	48.5	9.7	2634.6				21686.5
	WDF					2.8	4.4		7.1	683.5		141.6		839.4
	DAP			3.8	11690.1	6200.8	1106.1	48.5	16.8	3318.1		141.6		22525.8
1985	ADFG	207.6	604.1	1416.7	2897.6	4207.6	1632.0	59.4	138.6	640.4	1388.8			13192.8
	WDF					0.7	1.0				101.4			103.0
	DAP	207.6	604.1	1416.7	2897.6	4208.3	1632.9	59.4	138.6	640.4	1490.1			13295.8
1984	ADFG	44.2	57.4	133.6	362.9	784.8	984.6	1173.0	1095.8	1238.4	116.3	101.2	39.1	6131.2
	WDF				54.2			97.2	6.5					157.9
	DAP	44.2	57.4	133.6	417.1	784.8	984.6	1270.2	1102.3	1238.4	116.3	101.2	39.1	6289.1

PRICE PER POUND		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1986	ADFG			0.664	0.638	0.633	0.562	0.583	0.508	0.769				0.645
	WDF					1.273	1.138		1.157	1.526		1.000		1.395
	DAP			0.664	0.638	0.633	0.563	0.583	0.665	0.856		1.000		0.658
1985	ADFG	0.618	0.581	0.562	0.597	0.655	0.665	0.647	0.699	0.689	0.740			0.637
	WDF					1.050	1.200				1.157			1.156
	DAP	0.618	0.581	0.562	0.597	0.655	0.665	0.647	0.699	0.689	0.758			0.639
1984	ADFG	0.318	0.318	0.332	0.318	0.341	0.258	0.358	0.335	0.376	0.424	0.535	0.321	0.333
	WDF				0.674			0.791	0.826					0.725
	DAP	0.318	0.318	0.332	0.342	0.341	0.258	0.373	0.336	0.376	0.424	0.535	0.321	0.338

All numbers are preliminary
This report includes only data for North Pacific Council areas
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All data from Pacfin data base

SCIENTIFIC AND STATISTICAL COMMITTEE (SSC) DEFINITIONS

Overfishing[1/] is a level of fishing mortality that jeopardizes the capacity of stock(s) to maintain or recover to a level at which it can produce maximum biological yield on a long-term basis under prevailing biological and environmental conditions. (NOTE: This definition differs slightly from that found in the Guidelines for Fishery Management, 50 CFR, Part 602, p. 27228.)

1/ Overfishing is the applications of exploitation rates that drive the stock below its threshold. Exceeding acceptable biological catch need not result in overfishing, unless the excess is taken over sufficient time to reduce the population below the threshold.

Threshold

The minimum size of a stock that allows sufficient recruitment so that the stock can eventually reach a level that produces MSY.

Implicit in this definition are rebuilding schedules. They have not been explicitly specified since the selection of a schedule is a part of the OY determination process. Interest instead is on the identification of a stock level below which the ability to rebuild is uncertain. The estimate given should reflect use of the best scientific information available. Whenever possible, upper and lower bounds should be given for the estimate.

PRELIMINARY RESULTS OF A BIOECONOMIC YIELD PER RECRUIT ANALYSIS OF THE SABLEFISH FISHERY IN THE NORTHEASTERN PACIFIC

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ABSTRACT

A modified yield per recruit model as presented in Funk and Bracken (1983) was used to explore the trends in yield, reproductive potential, and economic value when minimum size limits are applied to the sablefish fishery. This model includes hooking mortality on the discarded fish below the minimum size, gear specific selectivities, and sex specific growth functions. Changes in the reproductive potential of the stock when minimum size limits are applied were estimated by an eggs per recruit model. The gross exvessel value of the yield is also calculated.

The ratio of the fixed to trawl gear catch quotas for the 1987 Gulf of Alaska sablefish fishery is 6.2. The model computes separate yields for the longline and trawl fisheries in this ratio to represent the current fishery in the Gulf.

When minimum size limits are applied to both gear types equilibrium yields decrease with increasing size limits. The egg production index increases very slowly with increasing size limits. The gross exvessel value of the yield reaches a maximum with a size limit of 53 cm. This maximum value is only about 0.2% greater than the maximum value obtained with no size limit. Achieving this increase would require a 20% increase in the instantaneous fixed gear fishing mortality (F), and a corresponding increase in fishing cost.

Applying minimum size limits to the longline gear only rather than to both gear types results in slightly increased benefits. The yield shows small increases with a minimum size limit when F is greater than 0.15. The egg production index increases slowly with increasing size limits. The maximum gross exvessel value is obtained with a size limit of 53 cm at F=0.175. This represents a 9% increase over the maximum value obtained with no size limit.

The preliminary results of this study show that factors such as discard mortality and availability have the potential to negate the benefits that may be attributed to a minimum size limit.

Minimum size limits have been proposed for the sablefish fisheries in the Gulf of Alaska and the Bering Sea, with the intended objective of increasing yield. To help evaluate the potential of achieving this goal,a modified yield per recruit model as presented in Funk and Bracken (1983) was used to explore the trends in yield, reproductive potential, and economic value when minimum size limits are applied to the sablefish fishery. The yield per recruit model is based on the following assumptions:

1) Recruitment is constant from year to year, therefore recruitment is independent of stock size.
2) The instantaneous rate of natural mortality (M) is constant.

If the initial size of each year class is assumed constant from year to year, then the yield in any one year from all year classes equals the yield from one cohort over its fishable lifespan. The yield in weight of a cohort over its fishable lifespan is defined as:

$$Y = F \int_{t_c}^{t_\lambda} N(t) * S(t) * W(t) * dt$$

where: Y = yield in weight
t_c = age of first retention in the catch
t_λ = maximum fishable age

$N(t)$ is the numbers of fish present at age t, $S(t)$ is the gear selectivity function which varies by age and gear. This function also takes into account the availability of fish at different ages. $W(t)$ is the average weight of an individual at age t.

The survival model is:

$$N(t) = N(t_r) * \exp-(F(H,S)+M) * (t - t_r))$$

where $N(t)$ is the number of fish at age t , $N(t_r)$ is number at time of recruitment, $F(H,S)$ is the instantaneous rate of fishing mortality as a function of the discard mortality rate on discarded fish and $S(t)$:

$$F(H,S)=-\ln(1-H(1-\exp(-S(t)*F)))$$

where: $H = 1.0$ when $t > tc$

The age of recruitment to the fishery is 1 year, and the instantaneous rate of natural mortality is assumed to be 0.112 (Funk and Bracken, 1983). The maximum fishable age is assumed to be 37 years.

An allometric growth function is used with $W(t)=a * (l_t)^b$ where l_t is the length at age t. Length at age is calculated with the von Bertalanffy growth equation $l_t = L\ (1-\exp(-k(t-t_0)))$.

Separate male and female growth parameters are used in the model:

	Males	Females
a	$4.457*10^{-6}$	$4.484*10^{-6}$
b	3.2266	3.2243
L_∞	66.7	81.4
k	0.290	0.249
t_0	-1.07	-0.77

Changes in the reproductive potential of the stock when minimum size limits are applied, were estimated by an eggs per recruit model which computes egg production of the equilibrium population:

$$E = \int_{t_r}^{t_\lambda} N(t) * EGGS(t) * RMAT(t) * dt$$

where E is the egg production index, EGGS(t) is a function which computes fecundity at age of mature females. The fecundity equation used was $F = 0.2349*(l_t)**3.88$ from Bracken and Eastwood (1984). The proportion of mature females was calculated by the equation: $RMAT = 1/(1 + \exp(-.40*(l_t - 65.0))$. Figures 1 and 2, respectively, show the fecundity and proportion of mature females at length.

The yield in gross exvessel value of a cohort over its fishable lifespan is defined as:

$$V = \int_{t_r}^{t_\lambda} Y(t) * P(t) * dt$$

where P(t) is the exvessel price per metric ton of yield in weight for fish at age t. Separate step functions describe the relationship between weight and exvessel price for the longline and trawl fisheries.

Weight (kg, round wt.)	Price ($/kg) longline	trawl
<0.675	0	0
<1.346	0.661	0.176
<2.024	0.948	0.728
<2.704	1.124	0.992
<3.363	1.521	1.301
<4.730	1.874	1.389
≥4.730	1.896	1.455

Yield in net exvessel value which is exvessel profit, was also calculated and is the difference between value and total harvesting cost (TC). TC is the sum of total variable cost (TVC) and total fixed cost (TFC); where TVC is dependent on the level of effort which is measured in terms of the number of trips, and TFC is dependent on the number of boats in the fishery. Specifically,

$TVC_F = (E_t/E86) * VCT * T86$ where $E=F/(F+M)[1-\exp(-F-M)]$
and
$TFC_F = FCB86 * B_F$

where VCT is total variable cost per trip, T86 is the number of trips in 1986, FCB86 is fixed cost per boat in 1986, and B_F is the number of boats in the fishery. The number of trips per boats is a parameter of the model. Based on limited cost and operating characteristics information for a "typical" longline iceboat for 1986, the cost model parameter values are as follows:

1986 catch/trip = 50,000 pounds dressed
1986 exvessel value/trip = $50,000
trips/boat = 6
VCT = $43,800
FCB86 = $35,900
F86 = 0.0233
T86 = 452

Insurance and maintenance costs that are related to the use of a vessel were included in VCT. Costs that are not related to use are included in FCB. The cost of labor is included in VCT and is set equal to the total crewshare payment of $29,250 per $50,000 trip in 1986. By holding the cost of labor per trip constant, changes in payments to crews in response to changes in F and the size limit are accounted for as benefits or costs of such changes. That is, it is assumed that the opportunity cost of labor per trip is equal to the 1986 crew payment per trip. This probably overstates the actual opportunity cost of labor, because 1986 was a very good year in terms of crew payments per trip.

At this time, the model does not include trawl fleet costs; therefore, the estimates of net value are for the fixed gear fleets only. That is, neither revenue nor costs for the trawl fleet are included in the estimates of net value yield. Such an exclusion tends to results in a bias in favor of a size limit if that limit is for all gears.

Version 1.

Four versions of the model were used to explore the yield, egg production, and value trends. The simplest version of the model has no discard mortality (all discarded fish survive), and a simple logistic selectivity curve which sets the length at which 50% selectivity occurs (L(50)) at 40 cm length (Figure 3). The equilibrium yield curves for minimum retention sizes of 37-61 cm are shown in Figure 4. The model produces similar yields at each size limit for fishing mortalities less than .175. At higher fishing mortalities, yields increase with increasing minimum retention size up to 57 cm and then decrease at 61 cm. The gross exvessel value begins to increase with minimum retention size at F=.10 and does not decrease for a size limit of 61 cm. Egg potential increases with minimum retention size at F=.05. The

egg potential index with no minimum size limit at F=.20 is approximately the same as the index at a minimum size limit of 57 cm. at F=.30. This would allow F to be increased from .20 without a minimum size limit to .30 with a 57 cm. minimum size limit without decreasing reproductive potential, resulting in a 14% increase in yield. Increasing minimum size limit to 57 cm with F remaining at .20 results in only a 10% increase in yield. The maximum increase (21%) in yield from a minimum size limit is at F=.45, but reproductive potential decreases by 48%.

Version 2.

Discard mortality was then increased to 35%. The equilibrium yields are shown in Figure 5. Size limits of 37-53 cm have similar yields over longline fishing mortalities of 0.025-0.50. This version of the model shows decreased yield for size limits of 57 and 61 cm. The gross exvessel value increases slightly with increasing retention size for F of .25-.50. The egg potential index increases slowly with increasing minimum retention size.

Version 3.

A third version of the model was applied with no discard mortality, and the L(50) was changed to 54 cm. The equilibrium yields are shown in Figure 6. As would be expected, yield, gross exvessel value, and egg potential do not change with minimum retention sizes less than L(50). For minimum retention sizes greater than L(50) for F > .20, yield will decrease, while egg potential increases. Similar yields are produced for size limits of 37-61 cm over fishing mortalities of 0.025-0.50. The size limits used in the model did not effect yield when mortality is very low and the gear is not selective for the smaller size fish.

Version 4.

The ratio of the fixed to trawl gear catch quotas for the 1987 Gulf of Alaska sablefish fishery is 6.22. The model computes separate yields for the longline and trawl fisheries, and is capable of approximating the catch ratio of 6.22 to represent the current fishery. The selectivity function, the discard mortality, and the instantaneous fishing mortality rates are gear specific.

This version of the model is designed to represent the current fishery in the Gulf of Alaska. For each longline fishing mortality, the corresponding trawl mortality will produce yields from the longline and trawl fishery in the ratio of 6.22. Discard mortality is set at 35% for the longline fishery and 100% for the trawl fishery. L(50) for the longline gear is set at 40 cm length. The L(50) for the trawl gear is set at 35 cm as selectivity increases to 100% at 50 cm. L(50) is then set at 65

cm to reflect the decreased vulnerability of larger sablefish to trawl gear (Figure 7).

The equilibrium yield, egg production, and value trends over longline fishing mortalities are presented in Figures 8-10, respectively. Yields for size limits of 37-53 cm decrease slowly over longline fishing mortalities of 0.025-0.45 (Figure 8). Yields for size limits of 57 and 61 cm are considerably lower than those of the smaller size limits (37-53 cm). Maximum yield for the size limits examined occurs at a longline fishing mortality of 0.15. Potential egg production of the standing stock increases slowly with the application of size limits of 37-61 cm (Figure 9). This increase is very slight compared to the range of egg potential from F=.025-.15. The value of the yield over fishing mortalities of 0.025-0.15 is similar for size limits of 37-53 cm (Figure 10). The maximum values for the size limits examined occurs at longline fishing mortalities of 0.125-0.15. The overall maximum value of the yield is obtained with a size limit of 53 cm. This maximum value is less than 0.2% greater than the maximum value obtained with no size limit. Achieving this increase would require a 20% increase in the fixed gear F and a corresponding increase in cost. The results of this model, indicate no increased benefit in yield with the size limits examined (37-61 cm).

Version 5.

The Version 5 model is modified from Version 4 so that the minimum size limit is applied to the longline fishery only. Yield decreases slowly with increasing minimum retention sizes for F=.025-.15 (Figure 11). for F > 0.15, the yield increases for size limits of 37-49 cm, and then decreases for size limits of 53-61 cm. The maximum yield at each size limit occurs at F=0.20. The overall maximum yield occurs with a size limit of 49 cm. This maximum is only 0.3% greater than the maximum yield obtained with no size limit. Egg production potential increases slowly with increasing size limits (Figure 12). Gross exvessel value increases slowly with minimum size limits up to 53 cm at ranges of F from .025-.225 (Figure 13). For F > 0.225, the gross exvessel value increases with size limits up to 57 cm. The maximum values occur at F=.125-.175 for the size limits examined. The overall maximum value is obtained with a size limit of 53 cm at F=0.175. This is a 9% increase over the maximum value obtained with no size limit which occurs at F=0.125.

The results presented here are preliminary. Although the parameters and functions used in the model are thought to be a reasonable way to depict the nature of the sablefish fishery, they may not. More complex assumptions about the behavior of the fishery can be incorporated and used in the evaluation of minimum size limits.

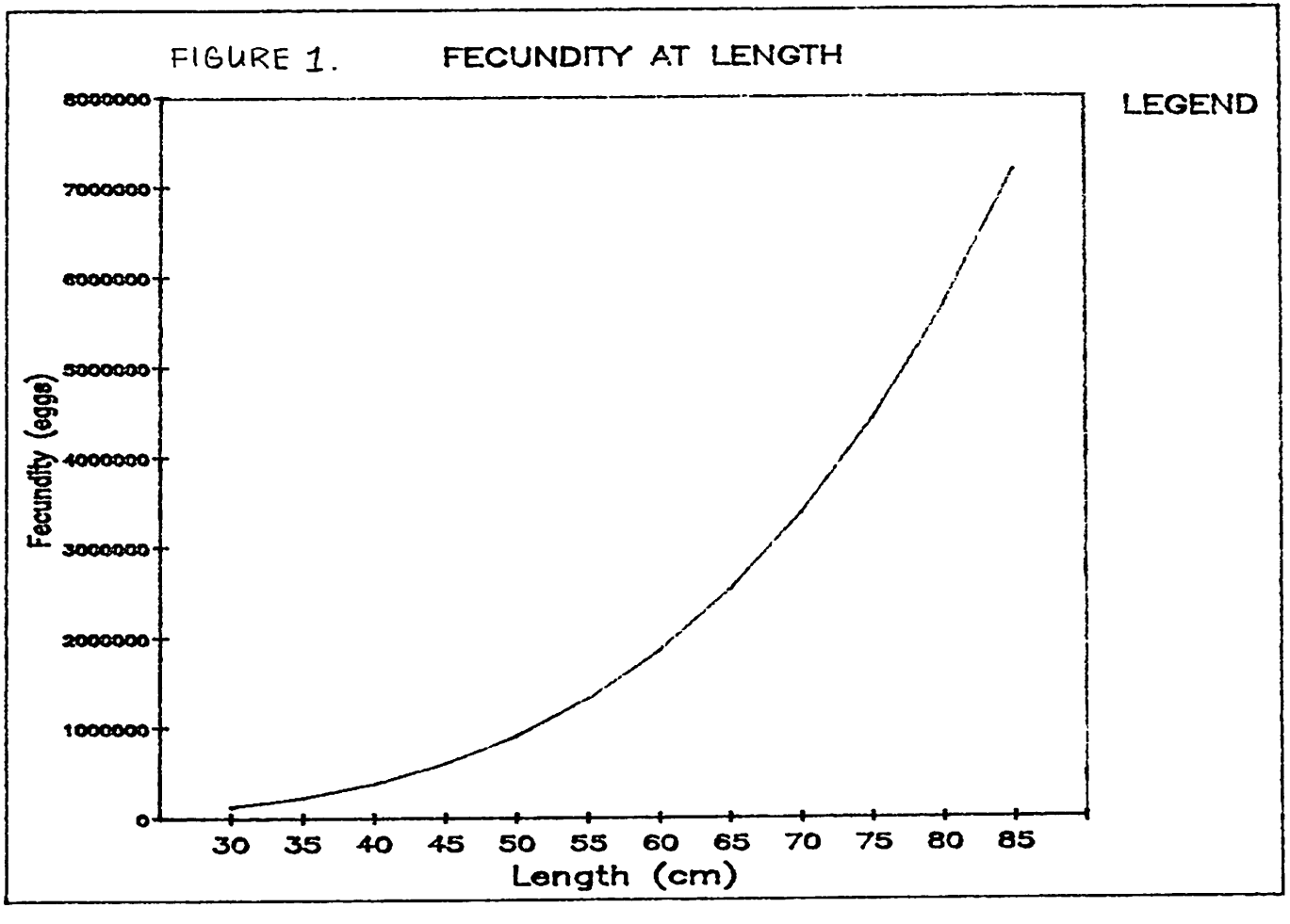
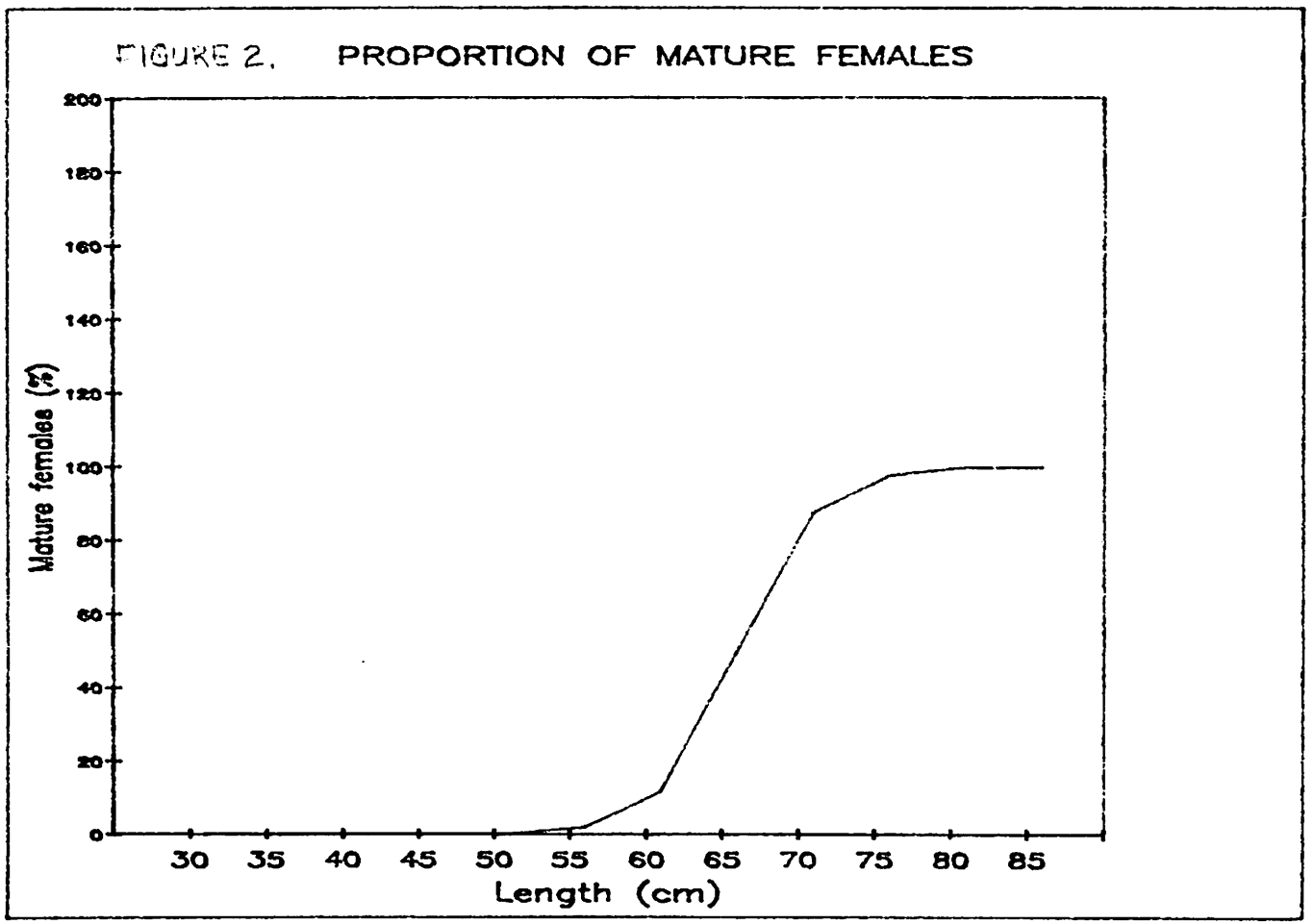


FIGURE 1. FECUNDITY AT LENGTH
LEGEND
Fecundity (eggs)
8000000
7000000
6000000
5000000
4000000
3000000
2000000
1000000
0
30 35 40 45 50 55 60 65 70 75 80 85
Length (cm)

FIGURE 2. PROPORTION OF MATURE FEMALES



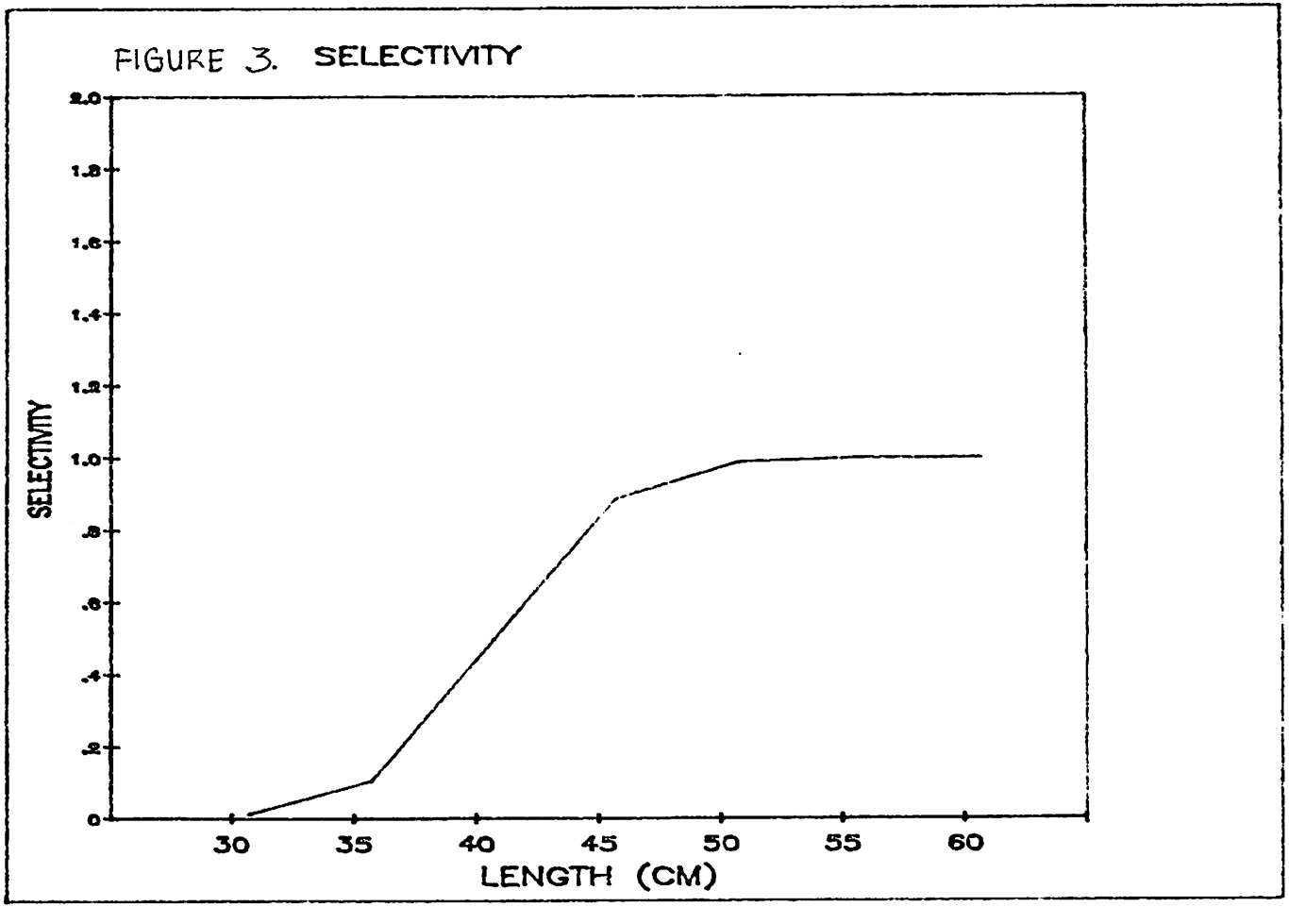


FIGURE 3. SELECTIVITY
SELECTIVITY
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
30
35
40
45
50
55
60
LENGTH (CM)

FIGURE 4. VERSION 1 EQUILIBRIUM YIELDS

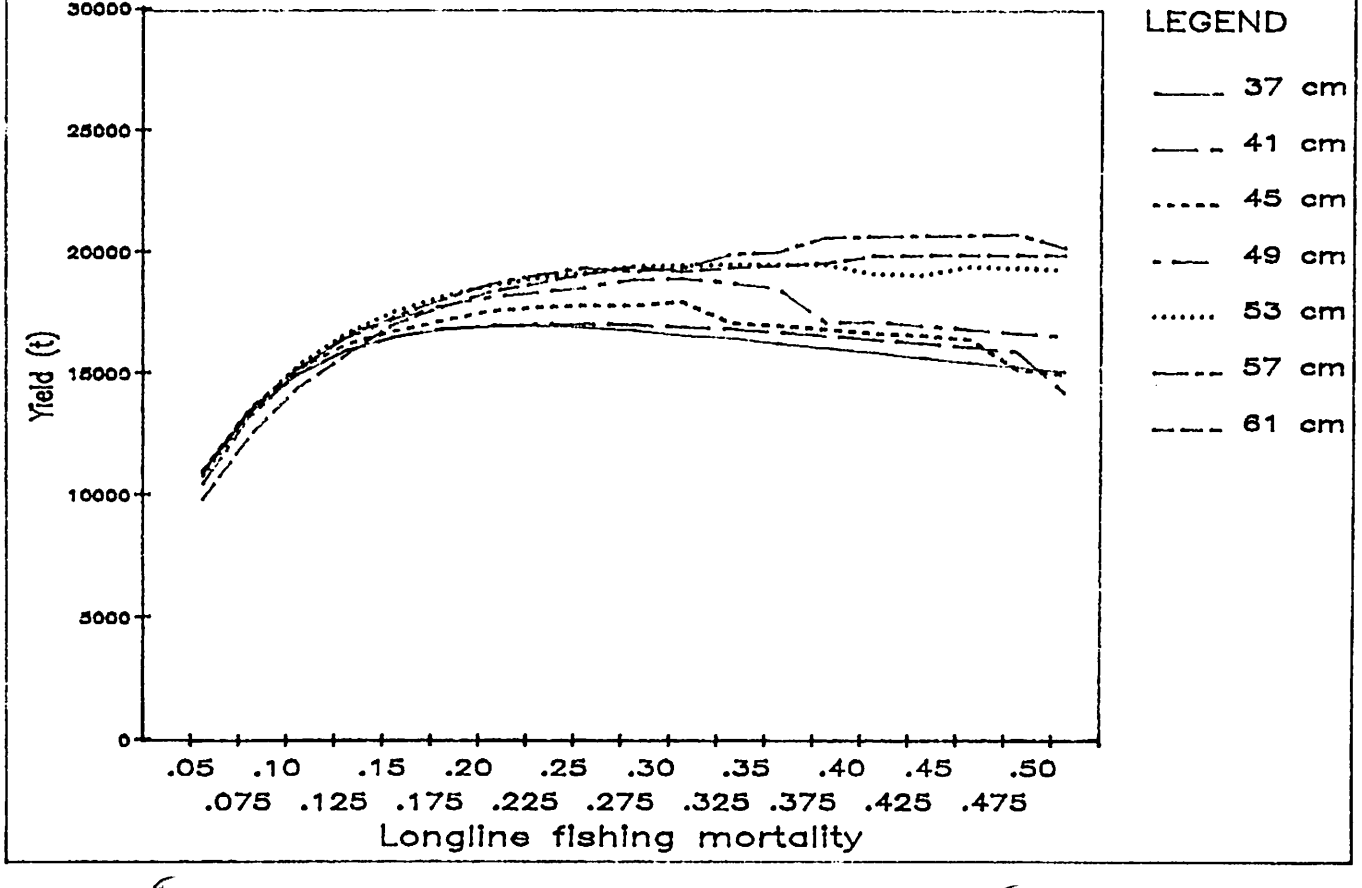


FIGURE 5. VERSION 2 EQUILIBRIUM YIELDS

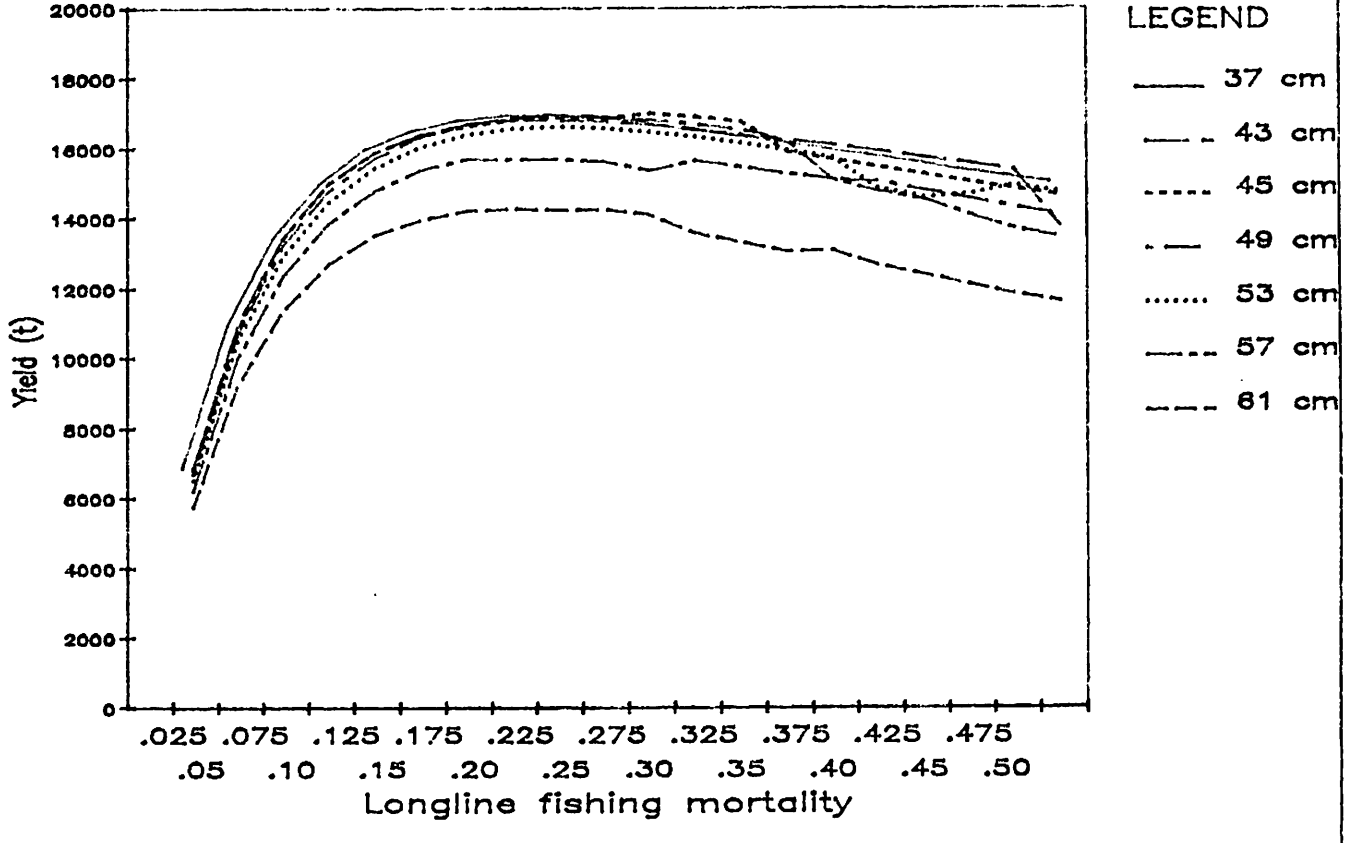


FIGURE 6. VERSION 3 EQUILIBRIUM YIELDS

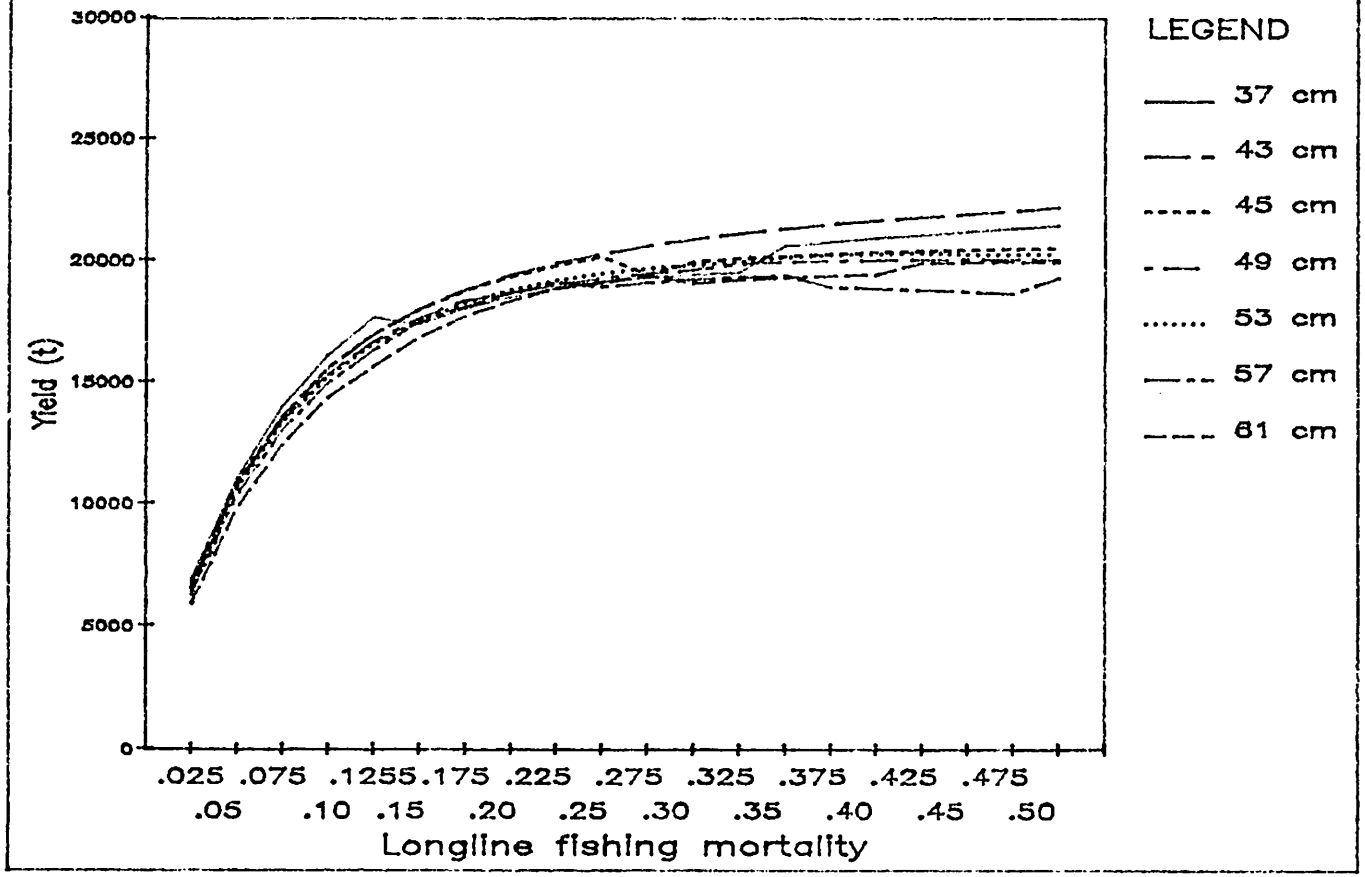


FIGURE 7. SELECTIVITY OF THE TRAWL GEAR

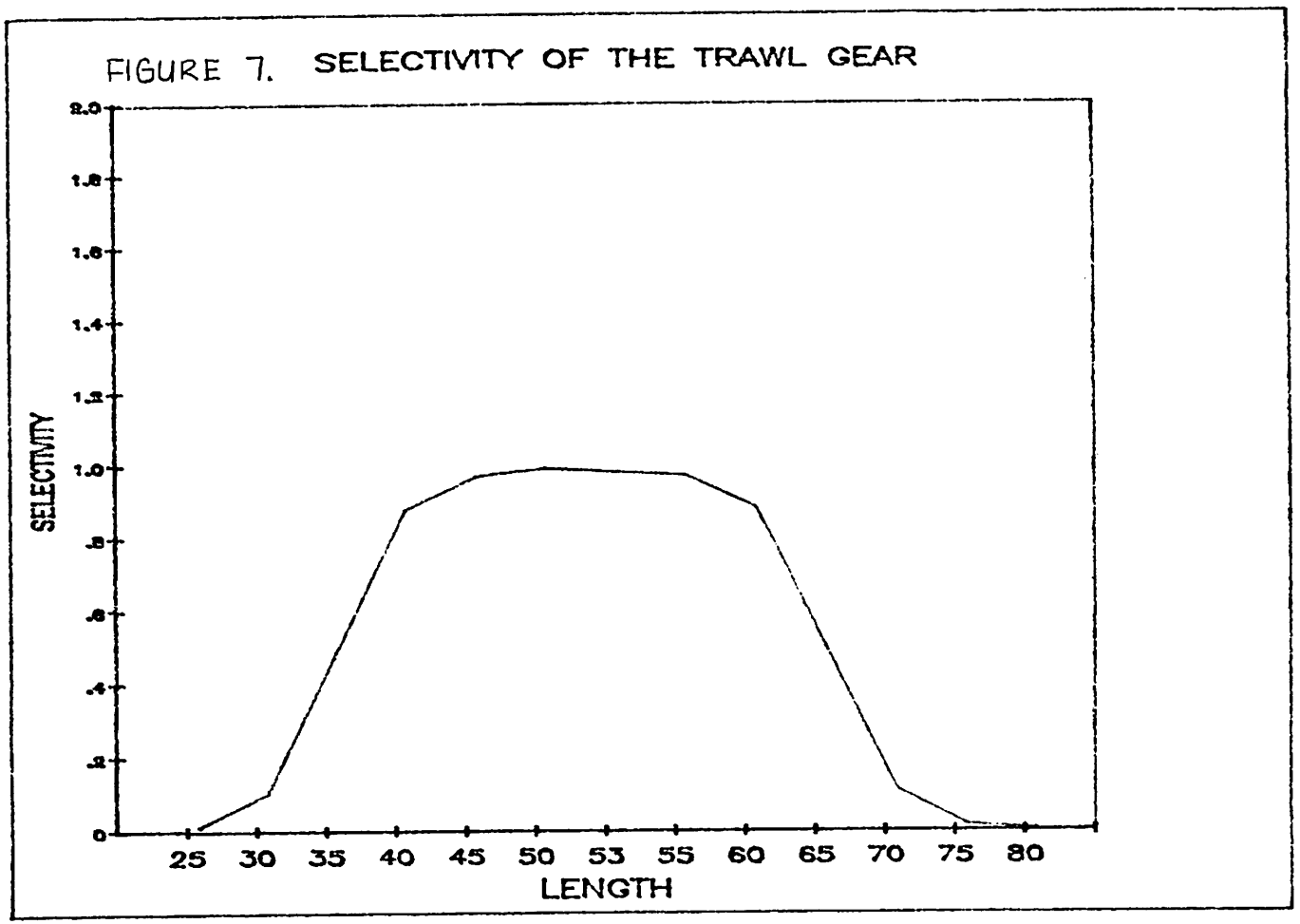


FIGURE 8. VERSION 4 EQUILIBRIUM YIELDS

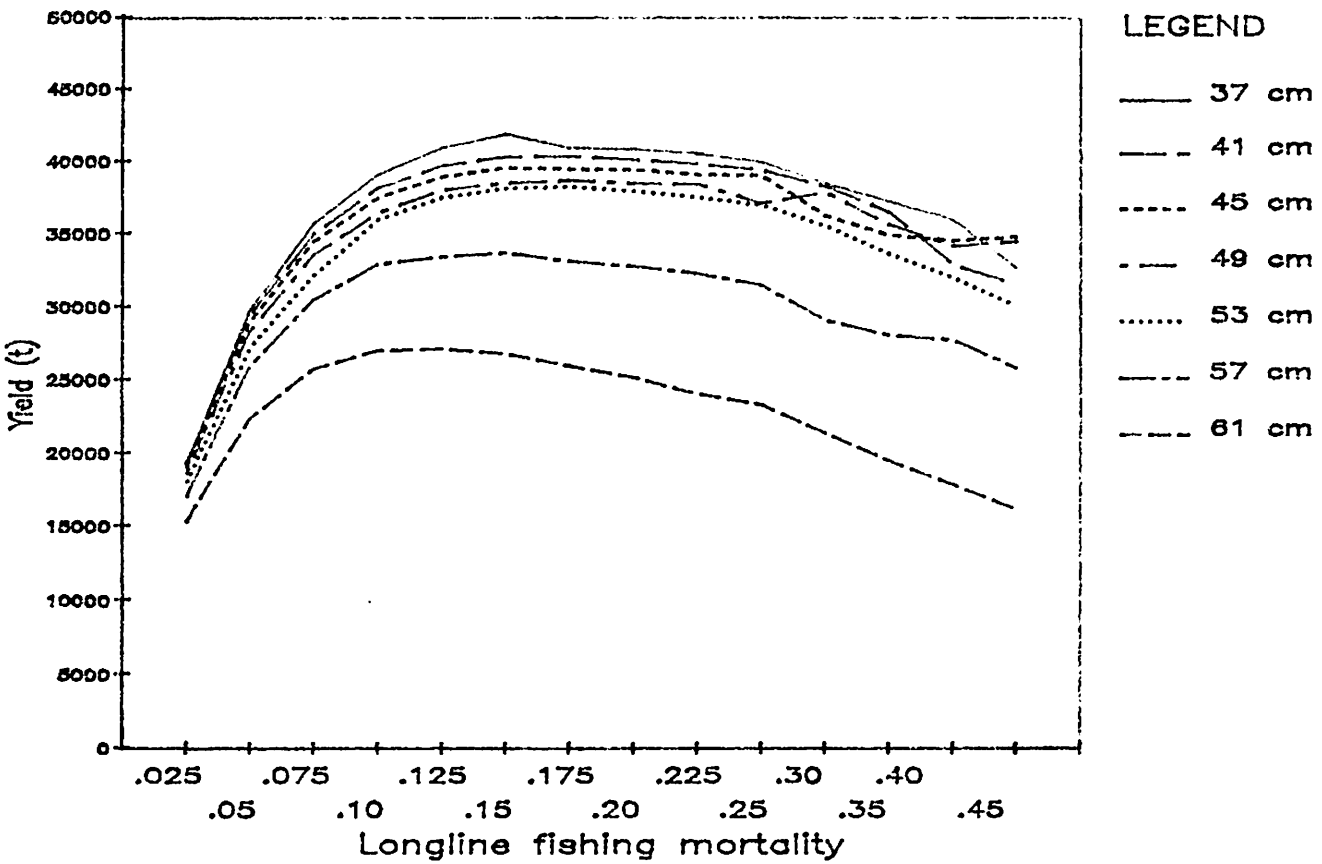


FIGURE 9 VERSION 4 EQUILIBRIUM EGG PRODUCTION

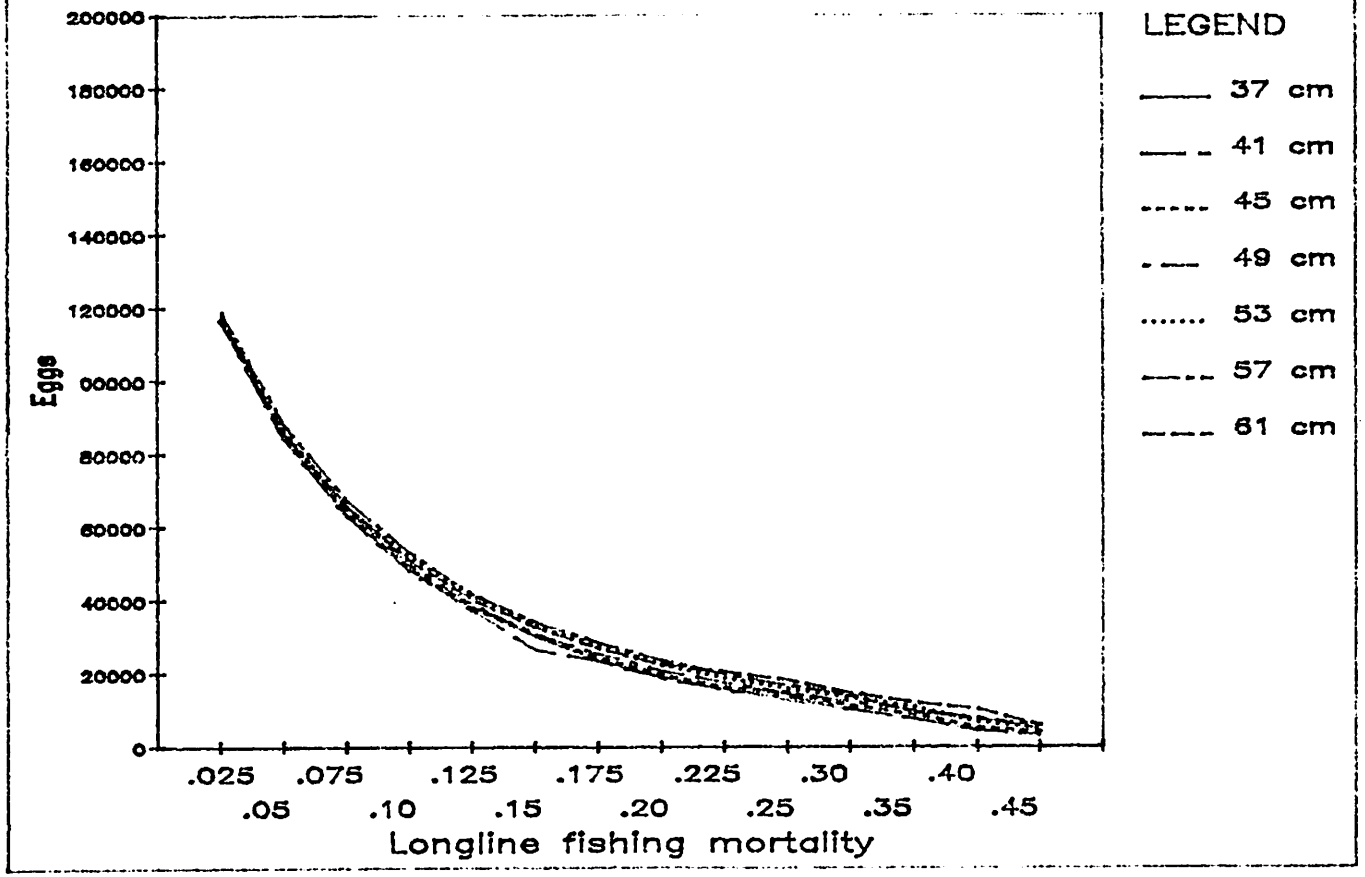


FIGURE 10. VERSION 4 VALUE

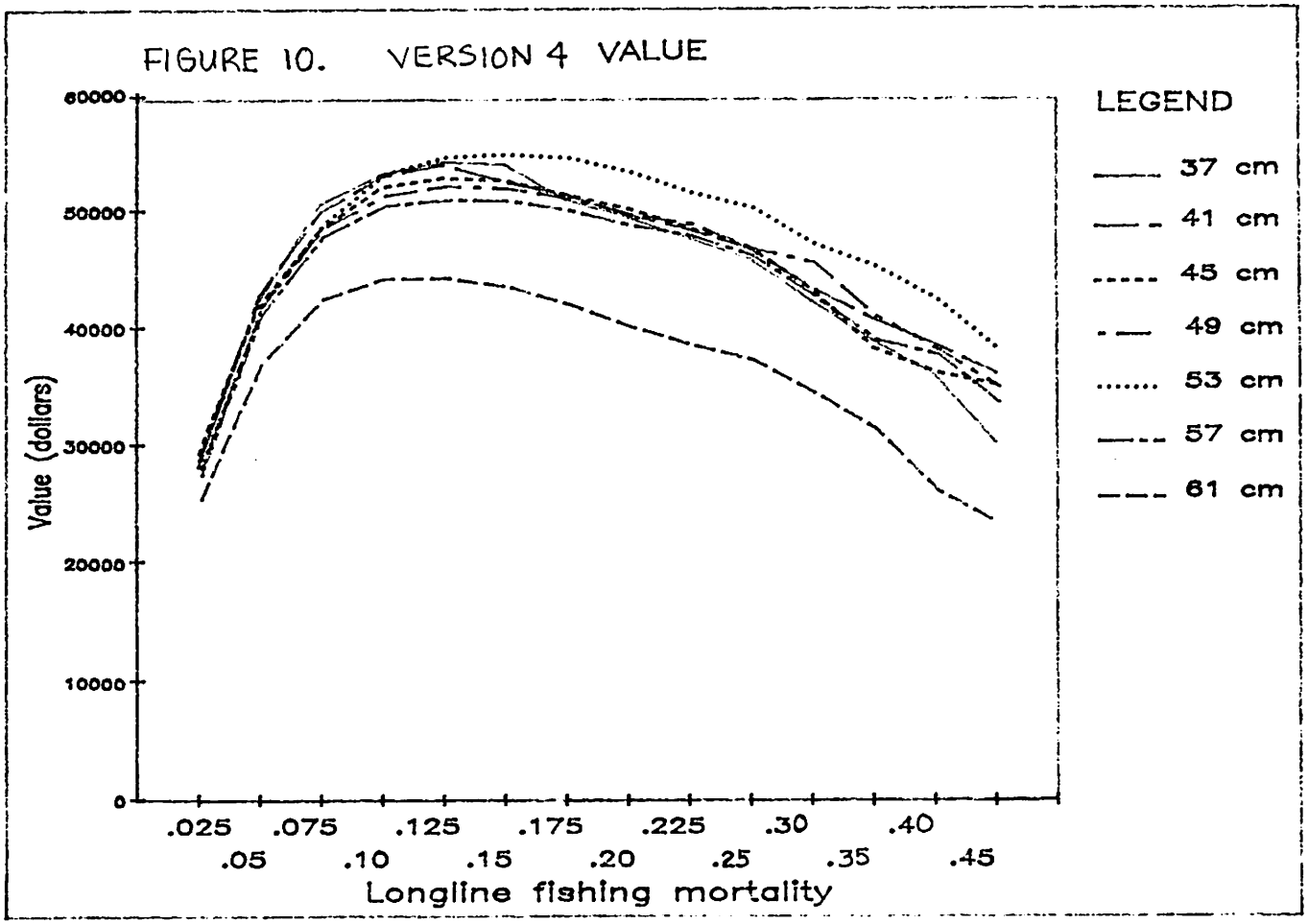
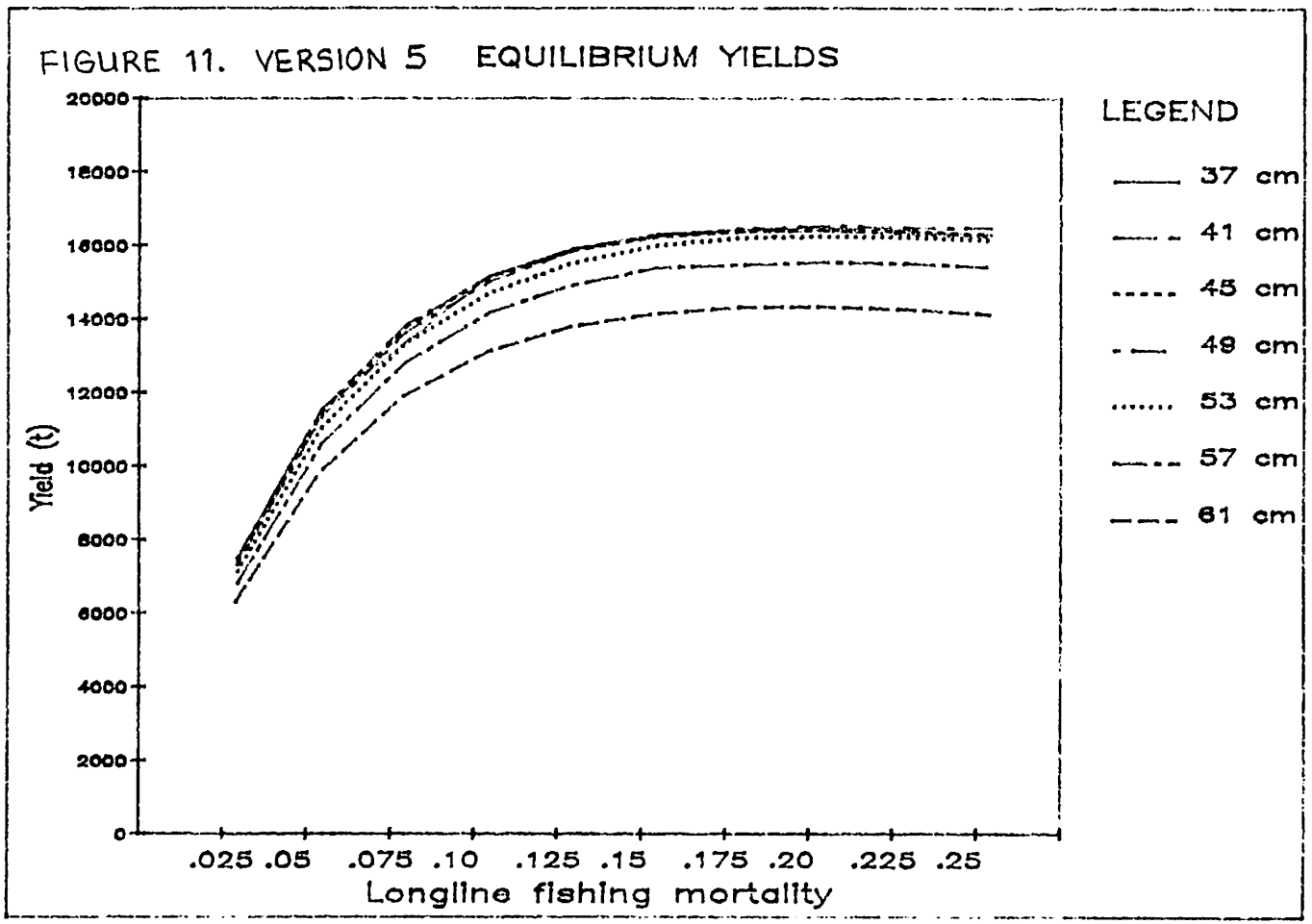


FIGURE 11. VERSION 5 EQUILIBRIUM YIELDS



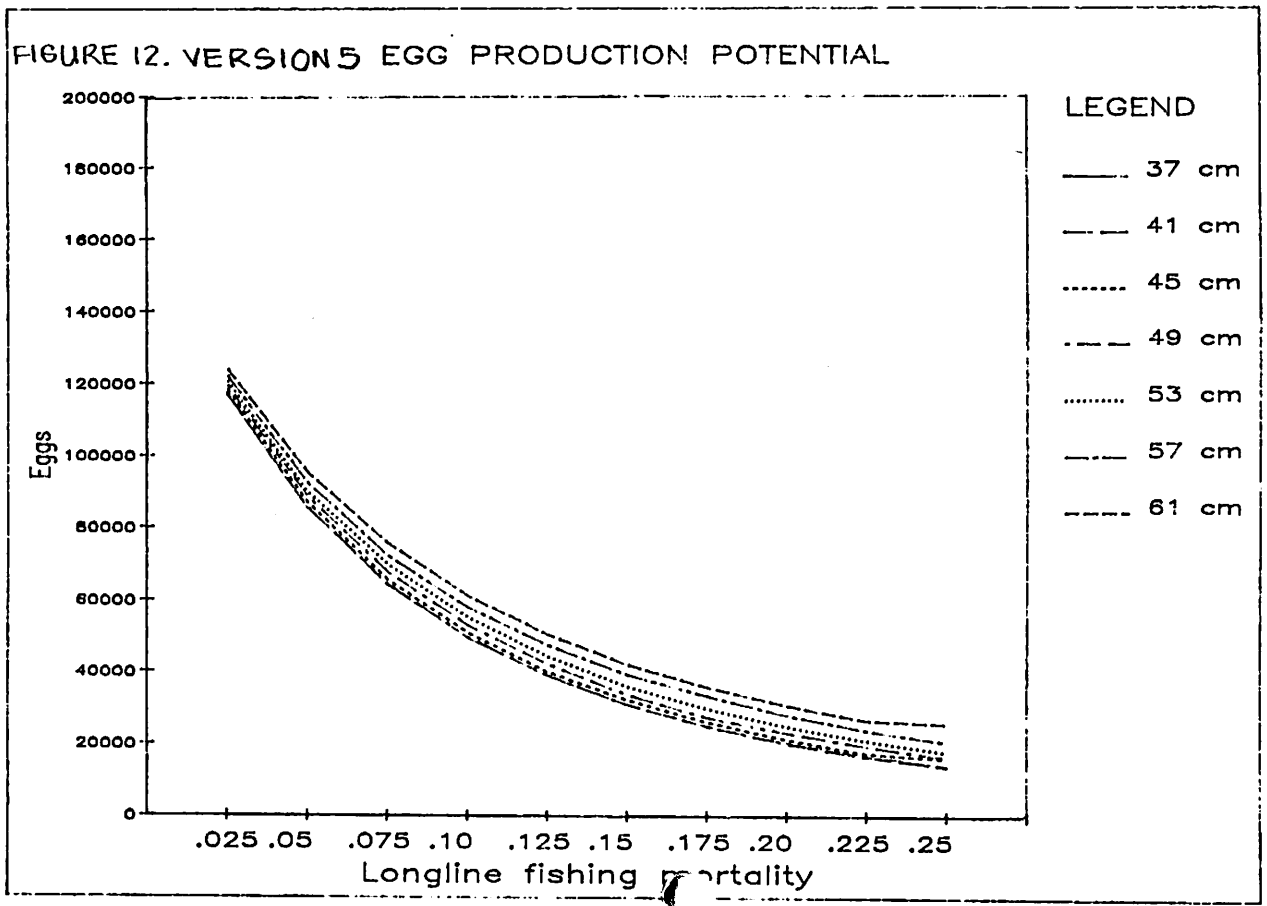


FIGURE 12. VERSION 5 EGG PRODUCTION POTENTIAL
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
Eggs
.025 .05 .075 .10 .125 .15 .175 .20 .225 .25
Longline fishing mortality
LEGEND
37 cm
41 cm
45 cm
49 cm
53 cm
57 cm
61 cm

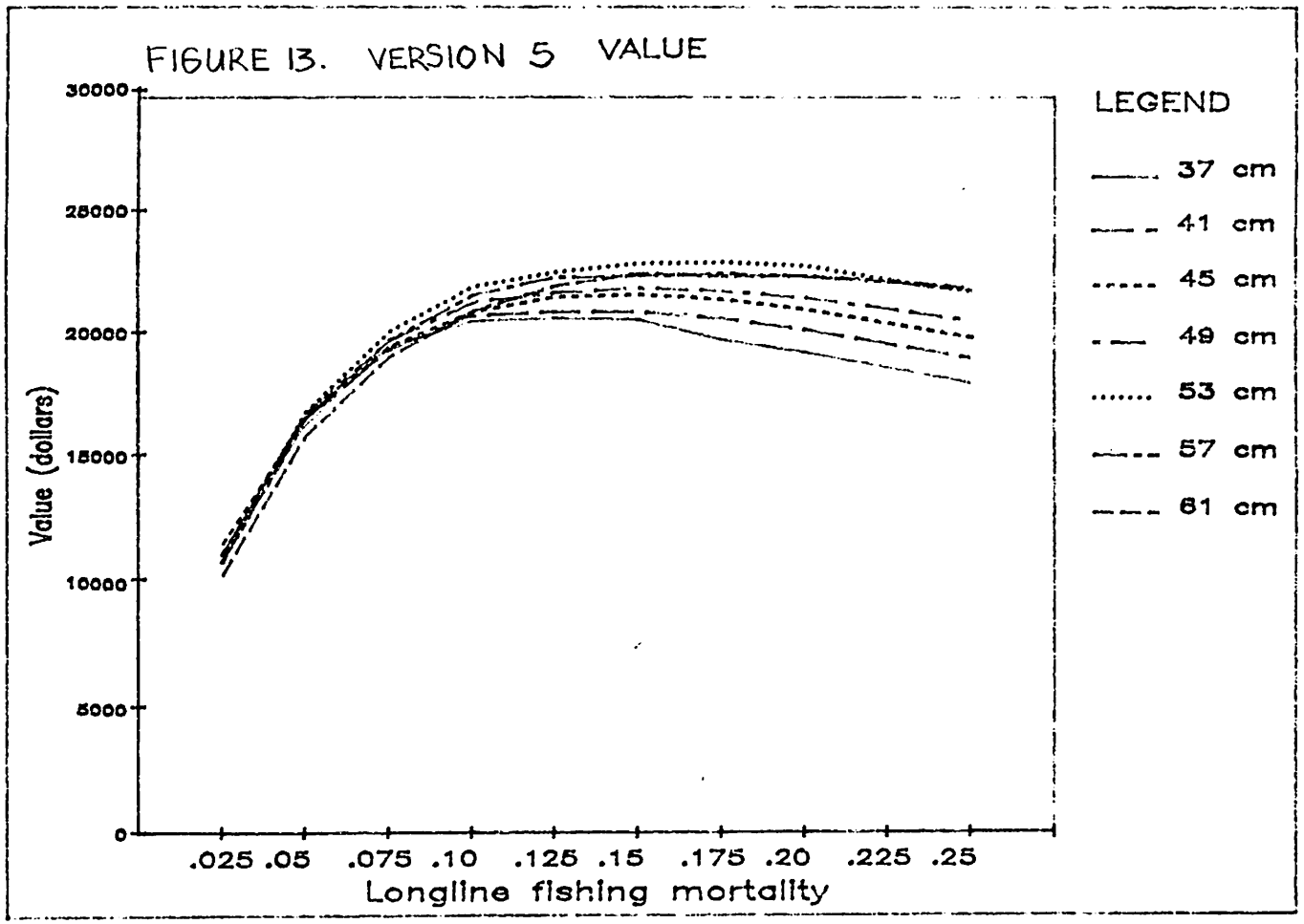
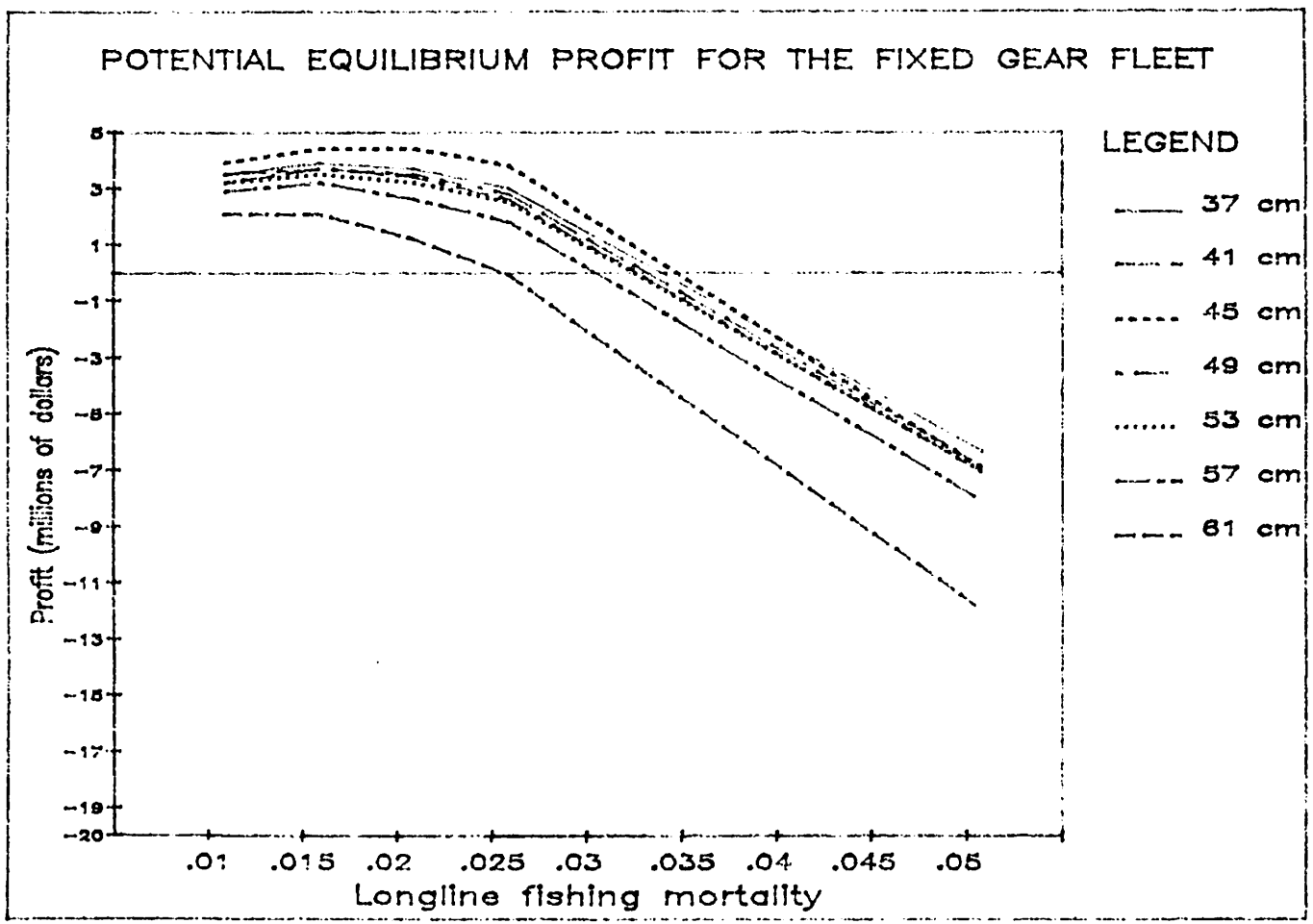
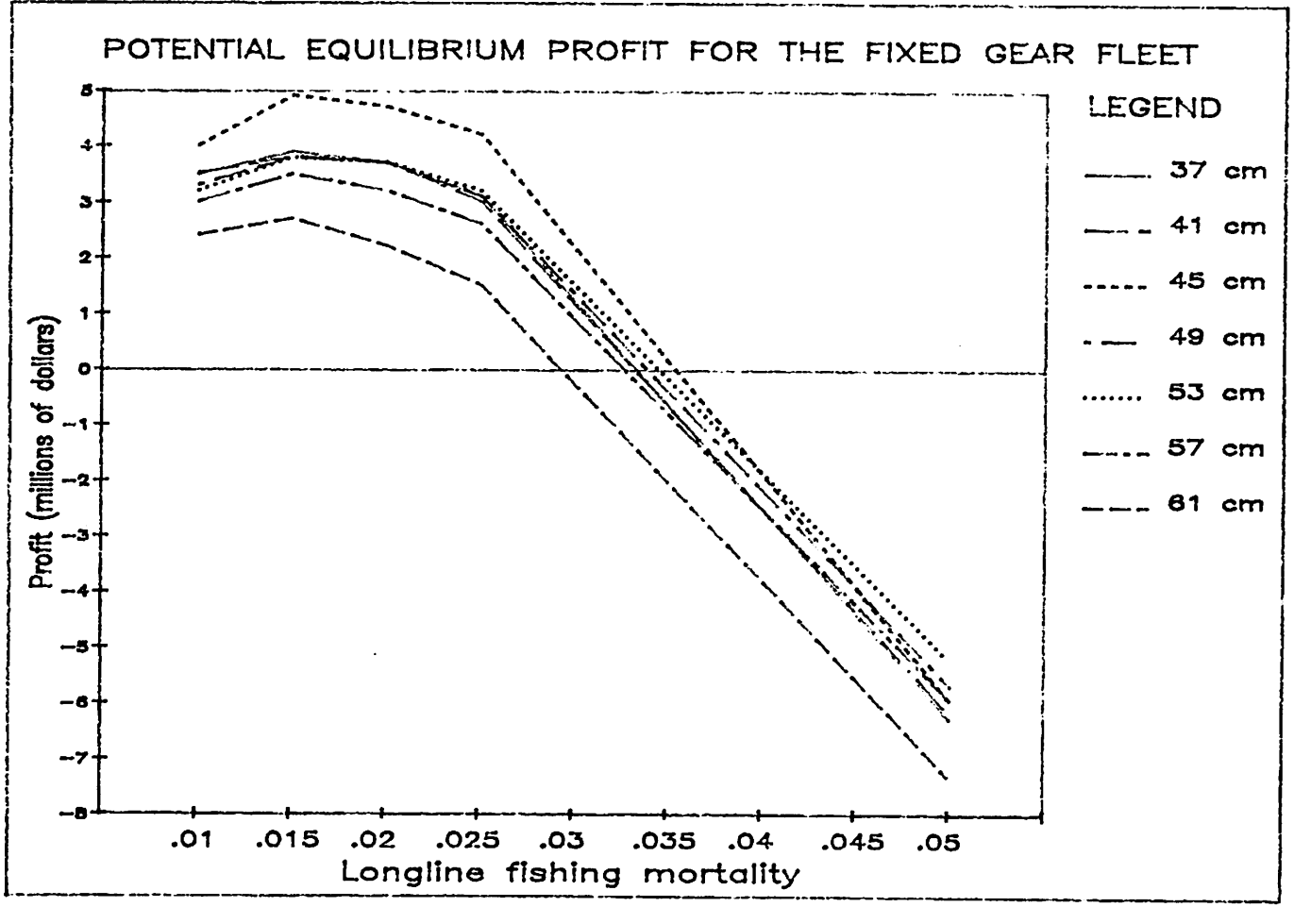


FIGURE 13. VERSION 5 VALUE
30000
25000
20000
15000
10000
5000
0
Value (dollars)
.025 .05 .075 .10 .125 .15 .175 .20 .225 .25
Longline fishing mortality
LEGEND
37 cm
41 cm
45 cm
49 cm
53 cm
57 cm
61 cm


POTENTIAL EQUILIBRIUM PROFIT FOR THE FIXED GEAR FLEET
LEGEND
37 cm
41 cm
45 cm
49 cm
53 cm
57 cm
61 cm
Profit (millions of dollars)
5
3
1
-1
-3
-5
-7
-9
-11
-13
-15
-17
-19
-20
.01
.015
.02
.025
.03
.035
.04
.045
.05
Longline fishing mortality

(Fixed only alternative)



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

March 16, 1987

Mr. John G. Peterson
6561 N.E. Windermere Road
Seattle, WA 98105

Dear John:

In response to your February 14 letter, I have chronicled the events leading up to my decision to recommend that the final notice of the 1987 initial groundfish specifications for the Gulf of Alaska include an apportionment to joint venture processing (JVP). Normally, I would not discuss a recommendation to Dr. Calio prior to his decision, but the substance of my recommendation apparently is already widely known.

At the December 1986 Council meeting Bill Robinson presented the results of the NMFS processor survey, but qualified the number by pointing out that 1986 actual production, as in past years, was only a fraction (less than 20 percent) of the 1986 survey results. He commented that, although the expected 1987 DAP pollock production would be the highest ever, it probably would fall substantially short of the survey results. The reasons for this included past performance, the knowledge that most survey responses assumed optimal harvesting and marketing conditions, and expected difficulties related to the availability of vessels and the transport of raw product from the fishing grounds to processing plants.

Although Bill presented our reservations about the survey results, the Council recommended that the DAP be set at 83,700 mt which resulted in no JVP amount for a directed pollock fishery (300 tons of the 84,000 ton pollock Target Quota [TQ] were allocated for a projected JV flatfish fishery). In contrast, the Council's 1986 recommendation was that 40,000 mt be apportioned initially to both DAP and JVP even though the DAP survey totalled about 95,000 mt. At that point in the meeting, John, I should have immediately focused the Council's attention on our reservations about the survey number.

Although I was generally aware of our regulatory requirements before the December meeting, NOAA General Counsel for the Region afterward underscored that the FMP and its implementing regulations required that the Secretary establish

initial apportionments of JVP and DAP that "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." On January 7, 1987, NOAA published in the Federal Register a preliminary notice of initial specifications with a request for public comments which included the Council's recommendation for DAP of 83,700 mt which reflected results of the processor survey without adjustment. We received several comments from the joint venture interests focusing on our comments at the December Council meeting and the Secretary's responsibility under the regulations to project increases in DAP as accurately as possible. NOAA Regional Counsel again urged me to establish the DAP apportionment based on the best information available to me.

I sought consultation with the Council at the January meeting, and we did have a brief discussion during which I suggested that setting a JVP amount would be more appropriate. I alluded to an amount of 10,000 mt, which had been discussed to some extent before the meeting. I carried away the advice of the Council to "do what I had to do," and to be sure what was done was "right."

In early February we in the Region carefully evaluated all of the survey responses in light of the fact that three months had passed and additional information was available regarding the potential activities of many of the survey respondents. In conducting our evaluation we accepted the original responses of most of the shore-based processors who were geared up and processing. We factored downwards the responses of a number of potential new entrants, both floaters and shore-based, on the basis of our knowledge of delays in starting up and the amounts processed in past start-up operations. In addition, we factored downwards requests from catcher/processors that had opted to fish the Bering Sea instead of the Gulf. As a result of our reevaluation, we had a relatively high degree of confidence that the DAP production for the year could be as high as 45,300 mt. Twenty percent of TQ, or 16,800 mt would be apportioned to Reserves to be available for later apportionment to DAP if needed. Thus, I concluded that the DAP could be as high as 62,100 mt.

On the basis of our early February analysis, I recommended that the final notice of the initial specifications for pollock in the Gulf of Alaska be 45,300 mt DAP, 16,800 mt Reserves, and the remaining 21,900 mt of the TQ of 84,000 mt would be apportioned to JVP.

Upon receiving my recommendation, Dr. Calio decided that he did not wish to establish the final initial specifications until the Council had an opportunity to consider the new

information and to make a recommendation to him. I understand that the Council will reconsider the issue at the March Council meeting.

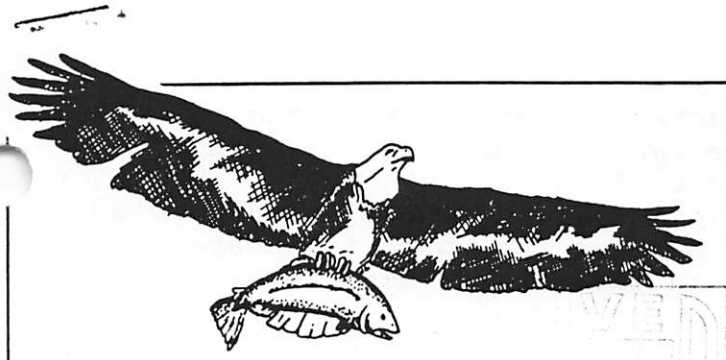
I hope this explanation adequately covers the matter. Please give me a call if not.

Sincerely

Bob

Robert W. McVey
Director, Alaska Region

AGENDA D-2(a)
MARCH 1987
SUPPLEMENTAL



Eagle Fisheries Inc.

P.O. Box 868 • Kodiak, Alaska 99615
(907) 486-5607

March 11, 1987

Mr. Robert W. McVey
Director, Alaska Region
National Marine Fisheries Service
Department of Commerce
P. O. Box 1668
Juneau, Alaska 99802

Re: DAP Allocation

Dear Sir:

I am writing in response to your letter of March 3 requesting information on the 1987 groundfish deliveries to date to our Kodiak plant. Your letter indicates that you are seeking this information in order to determine the Domestic Annual Processing ("DAP") catch in preparation for the March meeting of the North Pacific Fishery Management Council.

Eagle Fisheries is a new U.S. company which is wholly owned and managed by U.S. citizens, and which has made a very substantial investment in our bottomfish processing plant and equipment. We commenced an extensive plant renovation and equipment installation in December 1986, and we have just completed this work and received our certification from the Alaska Department of Environmental Conservation to commence processing. We have two filleting lines, using a Baader 182 and a Baader 189, and a capacity to process approximately 200,000 pounds of pollock and cod daily.

We are aware from the media that you have proposed to rescind the Council's allocation of substantially all Gulf of Alaska bottomfish to domestic processors for 1987. We understand that you are sceptical of the Kodiak shore processors' capacity to meet their production estimates, based on prior years' experience. However, based on our own investment here and our other contacts here in Kodiak, it appears to us that there is a very large increase in the energy and investment being put into bottomfish in Kodiak this year as opposed to prior years. One good indicator is that the Baader company, the principal supplier of bottomfish processing equipment, now has several service representatives here working full-time, whereas last year one service man from Seattle made periodic visits. A number of the local plants are now gearing up seriously for bottomfish processing just as we are.

In light of this situation, we believe that survey mentioned in your March 3 letter may produce misleading data. We assume the purpose of your obtaining data on the first two months' deliveries this year is to extrapolate a projected twelve month figure. But in the case of our plant, which has just come on line, your survey might lead you to assume

zero 1987 production unless it is adjusted to reflect the productive capacity being put in place during the last few months. The situation will be similar with respect to a number of the Kodiak plants. Therefore we urge you to give us and the other Kodiak shore plants a reasonable time to get our bottomfish operations on line and up to full capacity before trying to rescind our priority in favor of foreign interests.

Sincerely,

H. Reed Wasson
President

cc: Mr. James O. Campbell, Chairman
North Pacific Fishery Management Council

Hon. Jerome Selby
Borough Mayor, Kodiak Island Borough

North Pacific
Fishing Vessel
Owners' Association

NORTH PACIFIC FISHERY MANAGEMENT COUNCIL - JANUARY 1987

ADVISORY PANEL MINORITY REPORT - BLACK COD LIMITED ENTRY

Limited entry is perhaps the most controversial of fishery management issues . . . as the recent proposal to implement a moratorium on entry into the halibut fishery so dramatically demonstrated. Many fishermen fear that a limited entry program imposed in the black cod fishery would serve as a precedent, and that other fisheries might fall like dominoes. An attempt to suddenly impose limited entry in one fishery - without thorough consideration of the impact on others - will likely prompt the same well-organized and effective opposition which met the halibut proposal.

We recommend that the proposal be assigned to a work group for careful evaluation, taking into account the interests of and impacts on all fisheries. Should the Council decide to go forward with limited entry, it would be best to develop a generic approach which could be applied to various fisheries as future circumstances may dictate. Predictability of this sort might go a long way in reducing the paranoia which surrounds this controversial issue.

Respectfully,

Thorn Smith, North Pacific Fishing Vessel Owner's Association
Al Burch, Alaska Draggers Association
Rich White, Universal Seafoods

Building C-3, Room 218 Fishermen's Terminal Seattle, Washington 98119 Telephone 206-285-3383

AGENDA D-2(a)
MARCH 1987
SUPPLEMENTAL

ALASKA PACIFIC SEAFOODS, INC.

☐ MAIN OFFICE: 2155 N. NORTHLAKE WAY • SEATTLE, WASHINGTON 98103 • (206) 632-9900
☐ BOX 1126 • KODIAK, ALASKA 99615 • (907) 486-3234

March 17, 1987

North Pacific Fishery Management Council
ATTN: James O. Campbell, Chairman
P.O. Box 103136
Anchorage, Alaska 99615

Dear N.P.F.M. Council members,

On behalf of Alaska Pacific Seafoods, I would like to up-date you on our firm's utilization of groundfish during the period of January to March of 1987 and our projected utilization of groundfish for the period of September to December of 1987.

In previous correspondence with you, I projected that Alaska Pacific Seafoods' Pollock utilization from January to March would be in the area of 9980 MT. At this time we have processed only a quarter of that figure due to the fact that our groundfish harvest was not what we had anticipated based on our previous expierience. However, we still feel that Alaska Pacific Seafoods will have the capacity and resources to utilize the entire 14292 MT from September to December. As you know, Alaska Pacific Seafoods has the capacity to process 181 MT of Pollock a day. Over the past few months, this figure has proved to be realistic if not conservative.

In short, we at Alaska Pacific Seafoods, continue to expect our future utilization of groundfish to increase. It is my hope that the N.P.F.M. Council will consider this in all allocation decisions.

Sincerely,

John Sevier
Plant Manager

D-2(a)

GARVEY, SCHUBERT & BARER
A PARTNERSHIP OF PROFESSIONAL CORPORATIONS

WASHINGTON, D.C.
FIFTH FLOOR
1000 POTOMAC STREET N.W.
WASHINGTON, D.C. 20007
(202) 965-7880

TENTH FLOOR
1011 WESTERN AVENUE
SEATTLE, WASHINGTON 98104
(206) 464-3939

TELEX: 32-1037 (LEX SEA)
CABLE: LEX-SEATTLE

TELECOPIER
(206) 464-0125

PLEASE REPLY TO SEATTLE OFFICE

PORTLAND
SUITE 2650
1211 S.W. FIFTH AVENUE
PORTLAND, OREGON 97204
(503) 228-3939

March 16, 1987

Mr. Jim H. Branson
Executive Director
North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, Alaska 99510

Re: Gulf of Alaska Pollock TQ, DAP and JVP Specifications

Dear Mr. Branson:

We are writing on behalf of the American High Seas Fisheries Association to urge the Council to reconsider the TQ, DAP and JVP specifications it recommended in December for pollock in the Central and Western areas of the Gulf of Alaska.

The Gulf of Alaska Groundfish Fishery Management Plan (FMP) establishes a framework arrangement for setting the harvest quota (TQ) for the coming year, estimating the amount of fish which will be needed by domestic processors (DAP) and calculating the amount left over for harvest by U.S. joint venture fishermen (JVP). Under the framework arrangement established by the Council's FMP, the responsibility and authority for establishing the TQ, estimating the DAP and calculating the JVP have been delegated to the Alaska Regional Director of NMFS.

In fulfillment of the duties assigned to him by the Plan, the Regional Director surveyed the processing sector and reported the results of that survey to the Council at its December meeting. At the same meeting, the Regional Director's staff presented a special report to the Council detailing the unreliability of the raw survey data as a basis for estimating the actual requirements of the domestic processors. The NMFS report made clear that processors responding to the survey invariably overestimate the amount of fish they will actually use. (As an example, the processors claimed in response to the 1985 survey that they would use almost 100,000 m.t.

of pollock in the Central and Western Areas in 1986 -- while they actually processed only 10,000 m.t.). Nonetheless, without any explanation, the Council recommended that the DAP be set equal to the sum of the raw survey data. This, as the NMFS report made plain, was a gross overestimate of true DAP requirements.

Faced with the responsibility under the Council's plan and the implementing regulations to estimate DAP requirements "as accurately as possible," 50 C.F.R. 672.20(a)(2), FMP at section 5.2.2, and to make any surplus available to U.S. joint venture fishermen, the Regional Director advised the Council during the January Council meeting of his intention to "scale . . . down" the DAP estimate recommended th the Council and to "designate an appropriate amount of pollock for JV . . ." Meeting Transcript, Jan. 22, 1987 (statement of Robert W. McVey). The Regional Director told the Council that he "wanted to get the Council's advice relative to reducing the DAP to the extent of perhaps 10,000 tons and allowing that amount to go into the JVP." Id. After some discussion among Council members, Council Chairman Campbell stated: "It is simply a matter of timing, I guess, Bob, and it's in your ballpark now and properly should be there, I think." Id. (statement of James O. Campbell). Thus, the Regional Director consulted the Council on this issue in January and was advised that the decision was properly in his hands.

Thereafter, the Regional Director's staff continued to analyze the requirements of the DAP sector. In this process, they re-contacted many of the processors with no prior track record in the pollock fishery and discovered that a number of these processors did not now intend to process pollock or intended to do so on a smaller scale than they had expected at the time of the Fall survey. In light of this new information, the unreliability of the original survey results and the fact that domestic processors processed only 10,000 m.t. of pollock in the Central and Western Areas in all of 1986, the Regional Director proposed to set the DAP at 45,300 m.t. -- with a 16,800 m.t. Reserve -- leaving JVP of 21,900 m.t. In an effort to make the JVP available to U.S. joint venture fishermen during the Shelikof Strait spawning period, the Regional Director forwarded his determinations to Washington, D.C. for implementation in early February.

In order to prevent the joint venture fishery from taking place, the Alaska congressional delegation intervened to block the Regional Director's decision from being implemented -- a decision which the Council's FMP required him to make and which the Council Chairman himself had said was properly in the Regional Director's "ballpark." In response to this political pressure, Under Secretary Calio has now referred the issue back to the

Council for consideration at its March meeting, effectively eliminating the joint venture pollock fishery that normally takes place in Shelikof Strait in the first quarter of the year and depriving U.S. joint venture fishermen of almost $3 million in revenues.

In so doing, NOAA has violated the requirements of the Gulf of Alaska Groundfish FMP and the implementing regulations. (We attach our earlier letter to the Regional Director describing these requirements in more detail).

It is as plain as it could possibly be that domestic processors will not process more than 62,000 m.t. of pollock in the Central and Western Gulf in 1987 -- the sum of the DAP and Reserve recommended by the Regional Director. In 1986, overestimates of DAP caused about 27,000 m.t. out of the 100,000 m.t. harvest quota to be wasted in the Central and Western Gulf. That's a loss of over $3 million that would have been earned by U.S. joint venture fishermen in 1986 but for the overestimation of DAP. We are looking at a much larger potential waste in 1987 as a result of this practice.

The primary goal established by the Council in the Gulf of Alaska Groundfish FMP is to maximize the net economic benefit of the groundfish fisheries to the United States. This goal is clearly not being met by overestimating DAP requirements in the Gulf of Alaska and wasting fish surplus to those requirements which would otherwise be used by U.S. joint venture fishermen.

There is no compensating benefit to domestic processors from this waste. No one has ever attempted to demonstrate that the presence of joint venture fishermen in Shelikof Strait prevents Kodiak processors from obtaining all the fish they can use. Certainly, sending all the joint ventures into the Bering Sea has not produced an increase in production by the DAP sector. As of March 6 -- at the height of the spawning period -- NMFS reported that total DAP pollock production in the Central and Western Areas was still less than 200 tons. This compares to 1139 tons produced by the DAP sector and 51,780 tons produced by joint ventures in this fishery as of March 11, 1986. In fact, two Kodiak processors -- Alkod and Eagle Fisheries -- have recently asked NMFS to specify a JVP in the Central and Western Gulf so that some catcher boats who might service their plants would return to the area. Since the joint venture fleets have offered to deliver to shore-based tenders on a priority basis, it seems obvious that the presence of joint venture boats in the area would help, not hurt, U.S. processors.

The Council's FMP and the implementing regulations require the DAP to be estimated "as accurately as possible" by the Regional

Director. The Regional Director's estimate of DAP requirements is undoubtedly still too high. However, by setting the DAP at a level below the sum of the "hopes and dreams" expressed by the processors in their responses to the NMFS survey -- and attempting to make fish available to U.S. joint venture fishermen that would otherwise be wasted -- the Regional Director was taking a step in the right direction. The Council should reconsider the position it took in December and support the Regional Director's recommendations.

Very Truly Yours,

GARVEY, SCHUBERT & BARER

By Stephen B. Johnson
Stephen B. Johnson

cc: Senator Brock Adams
Senator Dan Evans
Congressman Don Bonker
Congressman Mike Lowry
Congressman John Miller
Congressman Sid Morrison
Congressman Norm Dicks
Congressman Al Swift
Congressman Rod Chandler

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January 16, 1987

Mr. Robert W. McVey
Director, Alaska Region
National Marine Fisheries Service
P.O. Box 1668
Juneau, AK. 99802

RE: Comment on Gulf of Alaska Pollock JVP Specification

Dear Mr. McVey:

We are writing on behalf of a group of joint venture fishermen (see list attached) to comment on the initial specifications for the Gulf of Alaska groundfish fishery published in the Federal Register of January 9, 1986 (52 Fed. Reg. 785). Our clients have traditionally participated in the joint venture pollock fisheries in the Gulf of Alaska. By grossly inflating the pollock DAP and reducing the TQ below the allowable biological catch, the initial specifications would arbitrarily eliminate the pollock joint venture fishery in the western/central Gulf. If this action is not reversed, substantial economic harm will result to our clients and to other U.S. joint venture fishermen. We therefore request that the Regional Director revise the initial TQ and DAP specifications that have been proposed for pollock in the western/central Gulf in order to realistically reflect the probable DAP production and the biologically available yield to permit a joint venture fishery during the Shelikof Strait roe season that will begin on February 15.

The initial specifications follow the recommendations of the North Pacific Fishery Management Council in setting the TQ for pollock in the western/central area equal to the grossly inflated DAP estimate. No proper basis has been provided by the Council or NMFS for setting the TQ any lower than the 95,000 ton ABC recommended by the plan team and adopted by the Council. The Council reduced the TQ below the ABC solely to eliminate joint venture fishing in the Gulf. Furthermore, neither the Council nor NMFS has made any evaluation of the highly inflated DAP

estimate for pollock that resulted from the industry survey. Based on past performance, there is absolutely no basis for setting the DAP any higher than the 40,000 ton JVP amount that was established in 1986. If the TQ and DAP estimates were set at reasonable amounts, then at least 40,000 metric tons of pollock would be available for allocation to joint ventures. Even if the inflated DAP estimate were accepted, with a TQ equal to the ABC of 95,000 tons, at least 10,000 tons of pollock would be available for joint venture fishing at the beginning of the fishing year.

The failure of NMFS to identify a JVP for pollock when there is clearly a surplus above DAP needs will result in a loss in revenue to U.S. fishermen ranging from 1.1 million to 4.4 million dollars. This loss will be inflicted on U.S. fishermen. The loss in revenue that these U.S. fishermen will suffer is not balanced by any benefits that will accrue to any other segment of the U.S. fishing industry. The FMP and the regulations clearly provide that the ultimate responsibility for establishing TQs and for making accurate DAP estimates rests with NMFS. We ask that you exercise that authority in a responsible manner by setting the pollock TQ at 95,000 tons and the DAP specification at 40,000 tons, which will allow the difference to be harvested by U.S. fishermen in the pollock joint venture fishery in the Gulf in 1987.

I. There is no justification for setting the pollock TQ lower than the 95,000 ton ABC adopted by the Council.

The initial TQ for pollock has been established according to the procedures adopted in amendment 15 to the Gulf of Alaska groundfish FMP and adopted on an emergency basis by the NMFS emergency rule published on January 6, 1987 (52 Fed. Reg. 422). The emergency rule provides that NMFS has the ultimate authority for establishing the TQ for each target species in the Gulf. 50 CFR §672.20(f)(2) (52 Fed. Reg at 427). The emergency rule provides that TQs will be established based on two factors: (1) an assessment of the biological condition of the species, and (2) socioeconomic considerations that are consistent with the goals and objectives of the Gulf of Alaska groundfish FMP. 50 CFR §672.20(f)(2)(i)(A),(B) (52 Fed. Reg. at 428).

In recommending that the pollock TQ be set equal to the grossly inflated DAP estimate of 84,000 metric tons, the Council simply ignored the factors prescribed in the FMP and the emergency rule. Even though the Council accepted the plan team's ABC recommendation of 95,000 tons (See 52 Fed. Reg. at 786), the Council ignored this specification in setting the TQ. As the discussion at the December Council meeting made clear, the Council set the TQ equal to the DAP for only one reason: to eliminate the JVP fishery for pollock in the Gulf of Alaska. By

eliminating the joint venture fishery, the Council denies U.S. joint venture fishermen access to up to 40,000 tons of pollock that would otherwise have been harvested during the Shelikof Strait joint venture fishery. Assuming an average ex-vessel value of $110/m.t., this will result in lost revenue to U.S. fishermen of up to 4.4 million dollars. There is absolutely no corresponding benefit that will result to any segment of the U.S. industry that can balance the significant losses imposed on U.S. fishermen by the arbitrary decision to eliminate the pollock joint venture fishery from the Gulf.

The TQ for pollock in the Gulf must be set on a rational basis. To set the TQ merely to damage one segment of the U.S. fishing industry, while failing to substantially benefit any other segment of that industry, deprives the TQ decision of any rational basis and renders the TQ arbitrary as a matter of law. Furthermore, establishing the pollock TQ on this basis would violate the specific terms of the FMP and implementing regulations. The regulations provide that when socioeconomic factors are used in determining a TQ, these socioeconomic considerations must be consistent with the goals and objectives of the groundfish FMP. As adopted in amendment 15, the primary goal of the groundfish FMP is to maximize the net economic benefit to the nation. As we have noted above, the only result of eliminating the pollock joint venture fishery in the Gulf is to eliminate the revenue to U.S. fishermen that would otherwise be employed in that fishery. Since no corresponding benefits have been identified by the Council or NMFS, it is clear that the effect of this decision is to reduce the net economic benefit to the U.S, which is clearly contrary to the primary goal established in the FMP.

Setting the pollock TQ equal to the DAP in order to eliminate the joint venture fishery would violate the general requirements of the MFCMA and applicable law for rational rulemaking and also the specific requirements of the groundfish FMP. Therefore, NMFS must exercise its responsibility to revise the arbitrary recommendation of the Council. Since no other basis has been provided for setting a pollock TQ, the TQ should be set equal to the 95,000 ton ABC recommended by the plan team and adopted by the Council at the December meeting.

II. <u>The DAP estimate for pollock should be set no higher than 40,000 metric tons</u>.

Both the FMP and its implementing regulations provide that NMFS must determine the DAP estimate for any species based on information that NMFS determines reflects as accurately as possible the probable increase in DAP harvesting and processing capacity from one year to the next. The Gulf of Alaska groundfish FMP provides that:

NMFS itself presented a report to the Council at the December meeting which made clear NMFS' own view that the survey results significantly over-estimate actual DAP production. No evidence has been provided that would suggest that the 1986 survey estimate for pollock of 84,000 tons is substantially more accurate than the 1985 survey. In fact, it is virtually certain that the survey results grossly over-estimate the potential increase in DAP pollock harvesting in the Gulf for 1987. As noted above, the 1986 pollock harvest in the Gulf was a mere 9,777 metric tons. An increase to 84,000 metric tons would require the domestic industry to increase its production by over 800% in one year, which is simply inconceivable. There is thus absolutely no basis for setting the DAP for pollock in the western/central Gulf any higher than the 40,000 ton amount that was established for 1986. Even this amount would require the domestic industry to increase its pollock harvest in the western/central Gulf by over 400%, an increase which is extremely unlikely for 1987.

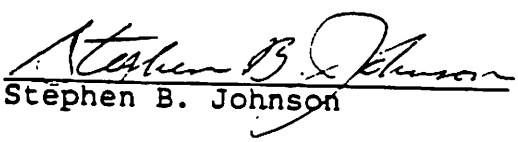
III. Conclusion.

The ultimate responsibility for establishing TQ and DAP amounts for the Gulf of Alaska groundfish fishery rests with NMFS. If NMFS fails to exercise its authority in a responsible manner, NMFS will inflict millions of dollars of losses on U.S. fishermen who would otherwise participate in the joint venture pollock fisheries in the Gulf. We therefore request that NMFS revise the TQ and DAP specifications for pollock in the western/central area of the Gulf of Alaska. We believe that if these specifications are set reasonably, at least 40,000 metric tons of pollock will be available for joint venture harvest in the Shelikof Strait joint venture fishery fishery. We urge NMFS to act as quickly as possible to publish revised specifications so that this joint venture fishery can take place in February as planned.

Thank you for considering our comments.

Very truly yours,

GARVEY, SCHUBERT & BARER

By 
Stephen B. Johnson

Joe Wabey (FV American Eagle)

Wilburn Hall (F/V Argosy)

Gunnar Ildhuso (F/V Gun Mar, F/V Mar Gun)

Frank Bohannon (F/V Neahkahnie)

Harold Clausen (F/V Nordic Star)

Vern Hall (F/V Progress)

Fred Yeck (F/V Seadawn)

Konrad Engeset (F/V Silver Sea)

Barry Ohai (F/V Starlite)

Cary Swasand (F/V Starward)

Bernt Bodal (F/V Starfish)

Wilhelm Jensen (F/V U.S. Dominator)

ProFish International, Inc.

PROFISH INTERNATIONAL

February 25, 1987

Dr. Anthony J. Calio, Administrator
Dr. William E. Evans, Asst Administrator for Fisheries
James Brennan, Deputy General Counsel
National Oceanic & Atmospheric Administration
Department of Commerce
Washington D.C. 20235

Dear Sirs:

ProFish International, Inc., and the owners/ operators of the 25 U.S. trawlers from whom we purchase fish for sale to foreign buyers applaud the re-evaluation of DAP and JVP for pollock in the Gulf of Alaska by your Regional Director in Alaska. Our formal request to the NPFMC during its December meetings for a specific JVP in Western - Central GOA was denied due to insufficient analysis of DAP requests. Operations we had planned for this area with U.S. catchers and specific Japanese buyers were aborted and efforts were shifted to the Bering Sea.

Now the season for roe bearing pollock in Bering Sea has accelerated dramatically over previous years. The major schools of pollock are already in spawning and post spawning condition. Our fishermen are daily requesting an update on the opening of the GOA for JV operations. Expectations are rising and certain fleets are ready to move now to prosecute this fishery at the level determined by your Regional Director.

Your urgent action to implement the legitimate establishment of JVP in Western - Central GOA is requested. Please advise the industry of your immediate action.

Sincerely,

W. T. Pereyra

Walter T. Pereyra
President

WTP:jaf

657 North 34th Street, Seattle, WA 98103 USA, 206-547-6800, Telex: 320355 PROFSH

Gulf of Alaska pollock DAP discussions at March 1987 Council meeting.

Thursday, March 18:

Bob McVey: Mr. Chairman, I'd like to refer to my "Dear John" (Peterson) which is in the supplementary folder, and it's in response to his request for an explanation for the action that the Region took in reevaluating DAP requirements in the Gulf. That is on our letterhead and it's directed to John Peterson and it bears my signature. I'll paraphrase this a little bit and run through a little bit of chronology so you know exactly what brought us to the point we're at now. We presented, that is Bill Robinson presented, the results of our DAP survey at the December '86 Council meeting. He qualified the number by pointing out that actual DAP production in past years was only a fraction of the 1986 survey results. The fraction was less than 20%. He commented that although they expected '87 DAP pollock production in the Gulf would be the highest ever, it probably would fall substantially short of the survey results. And the reasons for that conclusion was first of all the past past performance; secondly the responses to our questionnaire assumed optimum processing and marketing conditions; we expected there would be some difficulty with the availability of vessels, and that there would be a problem with the transport of raw product from the fishing grounds to processing plants. Although Bill presented those reservations about our survey results, the Council recommended that DAP be set at 83,700, which resulted in no JVP amount for a directed pollock fishery. In previous years the Council had evaluated very critically and held a substantial discussion on the DAP numbers and had set not only a DAP number but also an allowance for JV.

After that December meeting the NOAA General Counsel underscored to me that the FMP and the regulations require that we establish initial apportionments that, and I'm quoting here, "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." Now, on January 7 we published the preliminary notice of initial specifications and that included the Council's recommendation for a DAP of 83,700 mt. We received several comments from joint venture interests on that, focusing on our responsibility, the Secretary's responsibility, under the regulations to project increases in DAP as accurately as possible. Again, General Counsel urged me to establish a DAP apportionment based on the best information we had.

You'll remember that at the January meeting I asked for consultation with the Council and we did have a brief discussion during which I suggested that setting a JV amount would be more appropriate and I alluded to an amount for JV of 10,000 tons and that was a number that had been discussed to some extent before the meeting. The Council didn't vote on it but I did carry away the advice to do what I had to do and, if I remember right, to be sure what I did was right. I'll pretty much stick to the wording of this next paragraph and tell you what we did in early February. We carefully evaluated all of the survey responses, and by this I mean firm-by-firm and the number requests of each firm. Three months had past, we had some additional information regarding activities of many of the people that had responded to our survey. In conducting that reevaluation we accepted the original responses of most of the shorebased processors who were geared up and processing. We factored downward the responses of a number of new entrants, both floaters and

shorebased, on the basis of our knowledge that delays in start-up and the amount processed in past start-up operations. In addition, we factored downwards requests from catcher-processors that had opted to fish in the Bering Sea instead of the Gulf. As a result of that reevaluation we had a relatively high degree of confidence that DAP production for the year could be as high as 45,300 mt and we set aside 20% of TQ, or 16,800 mt, for apportionment to reservers that would be available for reapportionment to DAP if needed. Thus, I concluded that our DAP could be as high as 62,100 mt. And, on the basis of that early February analysis, I recommended to our Washington office that the final notice of the initial specifications for pollock in the Gulf be 45,300 mt for DAP, 16,800 for reserves, and that the remaining 21,900 mt of the TQ of 84,000 mt be apportioned to JVP.

This is not in the letter, but I want to emphasize that on our part there was not any effort to favor any particular industry sector. Rather, it was a conscientious effort to do exactly what the FMP and regs require of us which we've been reminded of by General Counsel. We submitted those recommendations and Dr. Calio decided that he did not wish to establish the final initial specifications until the Council had an opportunity to consider the new information and for the Council to make a recommendation to it. I understand that that was discussed to some degree at the Council Chairmen's meeting. So, that brings us to where we are now and it indicates the best available figures that we could put together. That was a month ago. The only subsequent information that may be of interest is the DAP catches to day of pollock in the Gulf which Bill (Robinson) provided in his summary. You might want to review that again. Mr. Chairman, that brings us to the present situation.

John Peterson: I don't believe I have to respond by telephone as you suggest in your letter, I believe I can do it face-to-face right here. This doesn't really square too well with my recollection of what has happened. At the meeting when we discussed the DAP survey it was a result of a revised questionnaire that was designed to give us more accurate information and I think I, for one, felt that it did because it was an improvement over what has been done in the past. It would also seem to me, as I recall and I think I asked the question when you raised the issue of 10,000 mt, there was no reason for the Council to make any decision at that time because traditionally you had made a mid-year survey which would determine whether any transfers would need to be made. It didn't seem to me that the end of January or early February was mid-year. It seems, however, also that you have no new information upon which to act; simply an analysis of the old information you had. I guess the question I would like to ask is whether or not you have surveyed recently the domestic processors to see if there is any change. What is their performance? I understand there has been an effort, but there's no information in here of what you have found out.

Chairman Campbell: Do you want Bill (Robinson) to come up, Bob, on that?

McVey: I can answer part of that, perhaps Bill can add to it. As I said, we have not done another survey since the January meeting, but we did have some additional information because we knew of the activities of some of the survey respondents that would indicate their requirements would be less. For example, the catcher-processors that had moved to the Bering Sea were less interested and would request less of a total request that we had thought a month earlier. With regard to your idea that we could do a later survey, a

mid-year survey and make releases at that time, the issue there is whether we establish a precedent by not having a JV allowance in the initial specification and that was rather forcefully presented by JV interests, that it was important, that if there were surplus pollock available, that they be declared as JV at the initial spec. I don't know whether Bill cares to add to that or not.

Bill Robinson: Mr. Chairman, I would only add that in determining what the most recent catch was we surveyed all the shoreside processors to determine in fact what they had processed through as late as last week and we were very up-to-date on our catcher-processor reporting system so that we were able to account for only slightly over 4,000, approximately 4,200 mt of pollock having been harvested from the Gulf through approximately mid-March.

J. Peterson: Do you have those figures on pollock and cod, as well?

Robinson: Yes, those figures are in the table that I gave you in our management report.

Oscar Dyson: I think one of the main questions that we've got to have answered is just how much fish are in that area, in the Shelikof Strait. I think the MILLER FREEMAN is there now, been there for a week and if they're there in the quantity they used to be, they're late. We've had several boats looking in the area and they came back pretty empty. However, there's one boat, one of the A boats that in the last ten years has been hitting some successful fishing, but I think we've got to have some sort of report on whether the fish are late, or whether they're not going to come, or just what is the status there.

Robinson: That's a very legitimate question that the AP raised as well and I'm as hopeful as you that Jim Balsiger can shed some light on that when he reports on the hydroacoustic surveys on the MILLER FREEMAN.

Rudy Petersen: Bill, on the 4,300 tons that have been harvested to date, how does that come out on your DAP estimates earlier on. Do you have an estimate at this same period of the year.

Robinson: No, our survey only breaks the year into the first six months and the second six months.

John Winther: How does this compare with this period last year, with DAP catch in the Gulf?

Robinson: I'm not sure, perhaps Janet could help me; I'm not sure we have information for this exact time time period last year.

Henry Mitchell: How many vessels are out there fishing in that area right now?

Campbell: Oscar, can you tell us?

Dyson: Well, I have a pretty good idea. There's one large boat that's fishing for pollock and we have probably another five or six smaller boats out of Kodiak and they've been making trips once in a while to try to find the fish and they haven't found very many, so they've been staying on the codfish.

Larry Cotter: I have heard the same thing, that the DAP sector was having great difficulty locating fish and as a result the 4,000 catch-to-date figure may be misleading if viewed against what may have happened last year. So, I think we probably ought to put that in its proper perspective and take that into account. You know, I think that the thing that concerns me is the process. When I made my decision in December I made it based on all sorts of different factors, the biological factors and what my view of what the status of those stocks might very well be, DAP capacity reports, and so on and so forth. And, I think that it's critical that we be consistent when we develop a process and we rely upon data, particularly at a December meeting when we make allocations, that even if that information may turn out to be . . . well, let me just say that I think that we ought to stick by the rules that we adopted to the greatest extent possible. Otherwise, we begin to run the risk of inpuning our own credibilities and raising questions that we really don't need raised and really don't need to talk about.

Campbell: I'd like to hear the AP report.

J. Peterson: I'd like to ask Bill one question, first. The 4,300 mt represents what percentage of the DAP survey? 5%, 10%?

Robinson: The original DAP survey?

J. Peterson: The one that we used, whatever that figure was.

Robinson: Approximately 5% of the original survey.

J. Peterson: When you resurveyed the industry and the calls, were there any reasons given why the pollock was down My understanding is that there is a lot of cod coming in; fishermen would rather fish cod because it's a higher price and for that reason there's been very little pollock delivered. Did you encounter anything of that sort? Did you encounter anything of that sort? Did you look or ask for any explanations?

Robinson: Well, in terms of why pollock wasn't being landed, the principal explanation was the difficulty in finding pollock combined with the decision by the boats in the absence of pollock to concentrate on cod which were at a very reasonable and profitable price. With respect to our reanalysis of the old survey, we did that based upon some new information on the activities of a lot of respondents in that survey that basically were either installing new groundfish lines or were refitting or rebuilding new vessels and bringing them into the fleet either as shoreside or primarily as catcher-processors. We had new information on whether they were on schedule and whether they intended to make it January 1 like they originally said or whether they were set back six months. We took into account the amounts that they said they were going to take, we for example basically know what a new catcher-processor does during its start-up year, versus when they're in full production, and we took that into consideration. The same with groundfish lines, we have information on where catcher-processors were actually fishing versus where they said they

might fish and one plant we knew was getting fish from the Bering Sea when they had indicated they were going to get fish the first six months of the year from the Gulf. These are just a whole list of factors that we had a whole list of factors that we had additional information on. Either we had gotten it in that three months' period or we just simply applied knowledge we had from staff within the Region. And this is how we got to our new estimate that said there could be as much as 62,000 mt in production, 45,000 mt which we felt fairly confident in.

J. Peterson: Mr. Chairman, it just seems to me that there was a very short fuse that was used to come up with this recommendation. But I would prefer to hear the AP report and I would also like to hear from any processors who might be here who could testify on what their performance was actually been.

[Chairman Campbell mentioned that time was short, there was a reception at 6 PM and Council staff needed to meet]

Don Collinsworth: Mr. Chairman, those considerations certainly are important, but if there is a . . . the suspense with regard to what the MILLER FREEMAN has seen out there with its acoustic work is something that I'd like to hear because fundamental to this is the question about the availability of the resource and if Dr. Balsiger has some information I sure would like to hear it.

Campbell: Well, why don't get that first, then, if you'd like.

Jim Balsiger: Mr. Chairman, I was able to communicate with the scientist in charge of the acoustic survey on the MILLER FREEMAN yesterday at which time they had just completed the first leg of the traditional hydroacoustic survey. This is extremely preliminary, it's qualitative in nature, and should be viewed with those qualifications in mind. I've listed eight points that are not necessarily in the precise order of importance, so that I would not fail to make each of them.

(Referring to overheads) The first one says that Leg 1 was just completed. Last year the first leg of the survey went from March 5 to March 12, so it's a few days different, but not much. They said that the geographic area of the pollock aggregation is smaller than last year. I have another chart that if you will follow this you will be able to see approximate distribution of the aggregation. The density of the aggregation is also less than last year, so it's not a matter of the same amount of fish being more compressed, the aggregations not only are smaller in size, but also smaller in density. There's two distinct layers in the Shelikof Strait. The first layer, at about 100 fathoms was primarily three-year-olds, a 1984 year class that we had expected and were hoping would be strong. He said that it was almost 100% three-year-olds in this layer. The second layer was near bottom, approximately 5 fathoms from the bottom. It contained all ages and all sizes from about 10 cm up to about 60 cm, with no particularly lacking lengths in that whole range, so there was evidence of 10 cm, which is one-year-olds so we do have some information that there is at least some one-year-olds. We don't measure them well, they're simply not sampled well. The two-year-olds were there as well as three, four, five, etc. The area that they found the aggregation this year is basically from Cape Kakurni (?) to Cape Igvak. We'll see approximately where that is in a minute. Age three fish dominate, not

only their exclusively present in the upper layer, but dominate the lower layer. Age two, 1985 year class, is fair to abundant. His assessment, and again qualitative, is it's probably an average year class. Age one fish he said were not rare, but recall that age one fish are not sampled well by the gear, so it's the same information we had on age ones last year. At least we knew that the year class wasn't entirely lacking like some earlier ones we had, but we really can't say whether it's going to be strong, weak or average yet.

Point #7 says that the gonad maturation is similar to last year. I think the point here is that it doesn't appear that a later maturity schedule this year is keeping the fish out of the Shelikof Strait. They may come in late due to some other reason, it isn't due to the fact that the eggs are maturing on a later schedule.

The last point on this slide says that in the estimation of Dr. Nunnelly, who is the scientist in charge, his estimation is that concentrations of larger fish not mixed with age threes would be hard to find. In other words, he didn't think that you'd be able to easily avoid three-year-olds in any catch that you make. I'm not sure that that's pertinent, but it's a comment he made.

(Referring to a map on the overhead) The blue area is the area of aggregation that was detected on Leg 1 of the survey last year, conducted March 5-12, 1986. This year, 1987, is shown in red and recall that not only is this a quite a bit lesser geographic area, but it's also an area that's lesser dense than last year. I've indicated Cape Kakurni (?) to Cape Igvak. (Another slide here) This is a slide of our hydroacoustic survey estimates through the years. The black lines are individual estimates made in '81, '83, '84, '85 and '86, and then I've made a little dotted line over to 1987, which is on the extreme right-hand side, to indicate that this is a preliminary number, it's possible that Legs 2 and 3 will show something quite a bit different than this, we just don't know yet. The red dots on there, dot #1, is the projection we made for 1985 in 1984 and of course that's the first year that we had this phenomenal failure of old fish to return to Shelikof Strait. Red dot #2 was the projection we made 1985 that we thought would show up in 1986, so actually a little bit more showed up last year than what we had projected. On the basis of the age structure in '86, last fall, we projected two possibilities for this year depending on what you believe about the strength of the '84 year class, which is the three-year-olds now. Our optimistic point suggested we would be back up there, less optimistic would put it right there (referred to chart). So, it would appear now that our estimate is going to be less than even our pessimistic projection from last year. Again, the dotted part is about where we'd be now and that's real preliminary. If the weather holds and the equipment stays together we expect to make two more transits of Shelikof Strait like we have in the past. I believe that's about all the notes I have here. I'll try to answer any questions, but I don't have a lot more information than this.

Rudy Petersen: Jim, could this be considered the best scientific information available at this time?

Balsiger: Well, I think this is probably the only scientific information we have on abundance in Shelikof Strait, so it's probably the best.

John Harville: First, an observation. While it's the best, I think he started out by pointing out that it's very preliminary and subject to a certain amount of question, particularly with two more legs yet to go in terms of the full survey. My question, does the age structure that you reviewed pretty much match what you anticipated from previous years? Sounded to me as though it did.

Balsiger: Well, the three-year-olds are certainly there in abundance and we were hoping and expecting that to be the case. We said the 1984 year class was the strongest we've seen for a long time and there's no problem with that. I think I'm a little surprised at the preliminary suggestion that the bottom layer contains modes at 12 cm, at 20 cm, at 30 cm, at 36 cm, 40 cm, 44 cm, etc. so that means that there is at least some fish there in each age class out to age six or seven and I'm not sure I would have expected to see fives, sixes, and sevens. However, you recall that this all has to be worked through their signal strength and target strength and this year they're using a slightly different transducer which gives them a little wider beam so it all needs to be recalibrated. That's why these are clearly qualitative suggestions and there's nothing quantitative yet.

Harville: If I may, Mr. Chairman, I was more interested in the smaller age classes. Those are coming along somewhat as anticipated if I remember last year's predictions. Is that correct?

Balsiger: Yes, I think you're correct.

Harville: The recruitment seems to be there.

Balsiger: Yes, again we see the two-year-olds pretty well and that was the 1984 year class which is there in abundance this year as three-year-olds. We see one-year-olds which gives us a very minor suggestion that at least we don't have year class failures. We reported last year we had seen fish from the '85 year class, those are the two-year-olds which Dr. Nunnelly says is probably an average year class. So, you're right.

Larry Cotter: Jim, I think on the previous slide you had up there it showed that the concentration of the pollock was substantially reduced in terms of area and then on the following slide the projected biomass level, even looking at the black dots, shows an increase over '86. How does that work?

Balsiger: I didn't mean to show an increase, I meant to show it going out there more or less level and we didn't make any projected estimate, but I guess my point was more there's no reason to believe at this point in time that it's going to increase as we had hoped it would last year. Those little dots out there were . . . I didn't even bother trying to multiply areas times densities and target strengths.

Cotter: What you're trying to say, I don't want to put words in your mouth, really is that at this point in time there's no reason to believe that the abundance of the stocks is going to increase at all over last year. And, if indeed, might even be lower.

Balsiger: Yes. There's a lot of inherent variation in these. If you look at our point estimates on each of the previous years, it wasn't 700,000 last year, it was more like 300,000 to 950,000 or something like that, so there's a lot of variation and I don't think we can preduct that there's going to be a remarkably different biomass estimate than last year based on what we've seen so far.

Henry Mitchell: Mr. Chairman, just to go back. If my recollection serves me correctly, we did set the TQ based on an assumption that there was going to be . . . .[tape faded out] What we're seeing here is that there is in fact not an improvement. We have two indications, this preliminary work and also the indications the commercial fleet has not been able to find [faded out].

Campbell: Any further questions? Do we have time to get the AP report, Clarence.

Clarence Pautzke: [gave the AP report, but it is reiterated by Nancy Munro later in this transcript]

Adjourned until March 19.

Council Meeting Transcription 3/19/87 11:10 a.m.
D-2(a) Gulf of Alaska - Pollock

Nancy Munro: Mr. Chairman, the AP vote was 14 to 1 to request National Marine Fisheries Service to provide updated information at the May meeting regarding TQ, DAP potential, and JVP plans. This would include any new and pertinent biological information...and as many of you know, at the time the AP met, we didn't have the hydroacoustic survey, so that was included...results of a formal survey of DAP processors, and an indication of the number of vessels gearing up for shoreside delivery. Just briefly, I think Clarence shared with you yesterday, there was a feeling on the AP that we were in a bit of a bind on this subject. We'd heard anecdotal information about the biology but really had nothing that we could deal with. And similarly, we heard much testimony from individual processors and also from JV people about what DAP potential was. It, however, was all anecdotal. NMFS was in a bind because they couldn't explain to us how the discounting had been done, so the AP was left feeling that they didn't really have anyway to know if the discounting had been done fairly, if it had taken into consideration some of the testimony from processors and that was the basic rationale for requesting NMFS to provide this updated information at the May meeting.

Campbell: Okay, are there any questions? Thank you Nancy. Mr. McVey you wanted to make a comment, I believe.

McVey: Yes Mr. Chairman, John Peterson has inquired of a number of witnesses regarding the times they were contacted by our people for survey information. I'd like to just tell you what sorts of surveys we've done since the January meeting. Immediately after the January meeting we did an incomplete survey of JVs. We contacted, as I recall, somewhere between 8 and a dozen to see what their interest was in fishing pollock in Shelikof. We got one who expressed some interest in moving quickly and getting something started. We were then looking at the reanalysis in early February and, as I indicated in my letter to John, we hand accepted the original responses of most of the shorebased processors who were geared up and processing. So there's no question about those, we'd bought their numbers and they were put in the list. Some of the others we had questions about and so we did some spot checking at that point before the reanalysis to find out where they were and how their operation was proceeding. That was used in the reanalysis which I have referred to previously. Then, just before this meeting we did a comprehensive survey of the processors to find out what their catch to date had been. It was not a resurvey of their estimate of capacity or anything of that kind--just how much fish have you processed to date. So that's the nature of the contacts and the survey information we've gathered since the January meeting.

J. Peterson: May I?

Campbell: John?

J. Peterson: It seems to me...earlier on... or maybe it's in the letter you indicated that you had discovered that the factory trawlers were migrating to the Bering Sea and that their DAP requests were no longer valid in the Gulf. Is that correct?

McVey: It's true for some...I can't give you the numbers, I guess maybe Bill or Janet can.

J. Peterson: I guess, the followup question I would have would be whether that DAP requirement was added to the Bering Sea?

McVey: I'd have to ask for some help.

Campbell: Bill do you want to come up? Excuse me Rudy.

Bill Robinson: Yes Mr. Chairman, we have both a check-in and check-out system and a weekly reporting system, and we're in contact with most of the catcher/processors quite often. So we did have some idea of the intent or changes in plans for several of the catcher/processors and we made adjustments based upon that knowledge.

J Peterson: I would just like to make a few comments on this whole procedure. It seems to me that there's a body of information that is being overlooked on the surveys. When the survey was made and it was determined that there was 4,297 tons of pollock had been caught up through March 13...3,172 tons of cod...there should have been, I think, some natural curiosity as to why--what caused these shortfalls. You're dealing with a different type of processing. You're not dealing with foreign directed fishing, you're not dealing with foreign processors, you're not dealing with joint ventures. You're dealing with domestic processing operations. I think it's important to determine whenever possible...and I think it would be possible...what factors would have caused these shortfalls.

First of all, it was a very short time frame--two or two and one-half months. During a period of time when weather is ferocious...how many fishing days were lost because of bad weather? What impact did that have on the projections. This, I think, is extremely significant. Were the fish available in catchable aggregations? Did anyone ask those questions? Was this cranked in to any of the survey? I think this is also very important. Was there any questions about the scheduling of the processors? Some processors have different schedules than others. Maybe some were not on-line yet. The other question that has come up and seems to be a nagging one, and that was, was there enough catching capacity? Was there enough harvesting capacity available to catch the fish that the processors wanted? It seems to me that these are the things that need to be looked into. If there is a shortfall...which there obviously was at this time...do the processors expect to make that up later on? Are they going to be processing all year long? Does their schedule call for increased processing later on in the year? These are factors that are extremely important. Other factors that may be involved that would be quite aside from these...Here in Kodiak itself is a new industry now that is going to require substantial support from cold storage and frozen shipping capacity. Were any of the operations shut down because of lack of that capacity? I don't know that that was the case at all, but it could be. These are the factors that need to be looked into when you have a shortfall of this sort. So often, and I think there may have been a reaction to this shortfall... there's going to be an oversupply of fish so we've got to get this fish into the hand of the joint ventures. I think that's a normal reaction in view of the situation as it's existed in the past. We have a developing industry. An industry that is relying on this fish. We give it to them in December...we

take it away from them...what kind of a yo-yo syndrome is that. How can a business operation plan and operate and be successful under those conditions. So, I think what I'm trying to say is that this is a different thing. Perhaps the simple rather antiseptic type of questionnaire is not sufficient. Perhaps there needs to be a more indepth analysis of what DAP requirements are. Thank you, Mr. Chairman.

Bill Robinson: May I comment, Mr. Chairman?

Campbell: Yes, go ahead, Bill.

Bill Robinson: If you'll recall, at the December meeting, most of the factors that you've mentioned, such as the availability of vessels, the difficulty in finding fish...we in fact mentioned when we qualified the survey. We have been aware of all of those factors and that's...we understand that those are reasons why the catch is only 4,300 mt at this point. We've always been aware of what the capacity is and we've been aware of what the developing capacity is. We've also been aware and believed in the intent to harvest larger quantities of fish and process larger quantities of fish than are currently being harvested...and we know why that's not happening. [Begin new tape] We've contacted most of the people, we talk with them every week or ten days, and we ask those very same questions. Why aren't you getting fish; what's the problem? We are aware of those, Mr. Peterson.

Campbell: Oscar?

Dyson: Yes, Bill, what method did you use to determine the amount of fish that the catcher/processor would use? It's my belief that it's probably 20 of those vessels and if they decided to come into an area, they would change the amount very quickly. What method did you use to get their needs?

Bill Robinson: Well, they were surveyed back in November, Oscar. Each and everyone of them responsed. Not only with their needs but where they intended to fish.

Dyson: That'd be interesting to find out. One more question, Mr. Chairman. It's my belief that the reason that the catch wasn't higher...or the production wasn't higher because of the lack of the harvestor. It just hasn't been there [fading]

Bill Robinson: Can't hear you Oscar.

Dyson: I said it's my opinion that the reason the catch hasn't been larger is because of the lack of harvesting. It's been too quick, they haven't been able to convert, many of the catcher boats have already been contracted to do other things, and you won't get that effort back until sometime later in the fall. So, that's what I think the reason is.

Campbell: Is that it Oscar? Bill, we had testimony from Henry Kim of Alcod Seafood...they testified that their figures were not given to you, because I guess it was a new acquisition. Do you know if the prior owner had submitted catch figures?

Bill Robinson: I can ask Janet if Swisher had given us any figures.

[inaudible]

Bill Robinson: No, apparently not. Alcod did contact us in late February though and indicate the size of the line they were installing and what their capacity was and what they would like to process. At the same time they were telling us that they weren't going to be able to do that because of a lack of vessels to supply the fish.

Campbell: But it is new capacity that you did not have?

Bill Robinson: Yes, that's correct.

Campbell: Any other comments, questions? So what's the pleasure of the Council?

Mace: It's gonna be a looong meeting.

Laughter...

Mace: This DAP estimate has always been a concern to the Permit Review Committee and to the full Council. I certainly support the need for assessments and support the Regional offices efforts in this direction because I think that provides a base-line...a base-mark...upon which we can made adjustments as the season goes on. I think what we're faced with now is the requirement Dr. Calio has punted...I think we have to pick up the ball and I think that we have to provide Mr. McVey direction to go ahead with his administrative needs to formalize those initial numbers. The process provides for an opportunity to change them as time goes on. In my view at least, and what I've been hearing it's probably pretty late for a spring fishery at Shelikof; there certainly would be an opportunity for a fall fishery if there is a surplus available. I hate to see this...if it does become a keep-away type of program...I'm sure that's not the intention of anyone, but I think if there is a surplus it should be provided to those users that have an interest in using it. Yesterday we got the results of the first leg on the hydroacoustic survey...I think it raised some questions from a conservation standpoint in all of our minds, and I don't think it's going to hurt us to wait until May, after we get the other two legs reviewed, to make a decision on this, but in the meantime I think that Mr. McVey has to be directed by the Council to proceed with the administrative needs that he's faced with on the basis of Dr. Calio's letter.

Winther: Mr. Chairman?

Campbell: I think Rudy was next.

R. Petersen: Mr. Chairman, one of the things that's bothered me...still bothers me...is this requirement for confidentiality in making a request for DAP. It seems to me that of the other things that are requested as far as economic data, that is certainly not in the category of being that confidential. I would hope that we could maybe get to the point where we could ignore that...not ignore it but maybe change it...so it wouldn't be in that category. One other thing is that I've heard different interpretations of just what the new information means to our present today status, and I just wonder if we could ask Mr. Balsiger to have an interpretation of if there is

anything that has changed that would require a difference in numbers then we've talked about and Mr. McVey has provided earlier.

Campbell: What do you want Jim to tell us?

R. Petersen: Well, I'd like to know if he feels that the numbers that we have in the letter to Mr. John Peterson from Bob McVey are still the numbers that we are looking at or if there is something that perhaps would change that. I don't know what numbers we should be using at this time, frankly.

Jim Branson: For TQ?

R. Peterson: For TQ.

Campbell: Would Jim be the proper one to ask?

[inaudible]

Balsiger: Mr. Chairman, the TQ, of course, incorporates a lot of socioeconomic aspects, the majority of which the team has not made judgement on. The ABC that the team recommended based on primarily the hydroacoustic survey and the fishery of 1986 is something we could comment on. I think that our position would be on the basis of the incomplete survey we've seen so far, the qualitative nature of the data, I don't believe that the team would find a reason to adjust their assessment of ABC at this time. Part of our analysis last year said we expected a strong 1984 year class. We were basing alot of our projections on that. I think it's evident that the 84 year class is there in abundance...we don't know exactly what the biomass is or the magnitude of that. Last year we also said we'd seen a smattering of one-year-olds which are not well sampled, but now...preliminarily again...we have evidence that these two-year-old fish...the 85 year class...are in the population. I think that generally speaking all we can conclude is that things are approximately what we expected from last year. I think perhaps I made a mistake on my chart when I had drawn that little dotted line which would have indicated an 87 hydroacoustic estimate of the biomass. That estimate simply can't be made yet. I intended that to be sort of a dotted line drawn over to the question mark saying, we don't know where it'll be but we don't have reason at this time to depart from our assessment of last year which was sort of status quo. It's a three-leg survey...only one leg is done...sampling has alot of variability anyway. I think it would be dangerous to make strong conclusions on the basis of one-third of the sample.

Cotter: On that Mr. Chairman?

Campbell: Yes?

Cotter: Jim, are you then withdrawing the statement you made yesterday in response to a question by myself that the biomass estimate would not increase but would remain level or possibly decrease. It would seem to me, by your statement now, that you are modifying that.

Balsiger: I intended to mean yesterday that if we had to draw a conclusion on the basis of this first leg, and if the area of fish was less than last year, if the density of fish in that area was less than last year, than

obviously...if that's the only information we had...I guess we'd go on to the conclusion that we aren't going to have the biomass we estimated last year. My presentation was more to the point that this information is real qualitative and preliminary, and I think that it's...as I said now, I don't think it's enough to make a biomass estimate on.

Campbell: Oscar?

Dyson: Where was that survey taken? In the lower Shelikof, middle, or where abouts?

Balsiger: It ran on approximately the same track line as last year. I have an overhead of that if you want to see it, but it goes pretty much from along the whole island, Kupreanof, strait all the way down, almost to the Semidi Island.

Dyson: The chart you had there...it showed the red mark is where you (inaudible). That was pretty small, wasn't it?

Balsiger: Yes it was. Of course we call it this red area that I drew on there was a result of a description over a phone of what Dr. Nunnally [?] had seen on the boat. He said, it's about from Cape Igvak [?] to Cape...I've forgotten the other Cape right now...but at the northern end of the red line. And if you notice the blue stuff wasn't uniformly wide as it went up the Strait...that got real narrow in some places as well. So it's possible when he relayed this to me, he simply gave me the main area of concentration. There may be a little red stuff up higher from the 87 survey. I think that his impression was that...general impressions are what I've been trying to relay.

McVey: Jim, how soon will the other two legs of this survey be completed. Certainly not in time for this decision, but... ?

Balsiger: Well, the three legs are run sequentially. As soon as one is done the next one starts. There's no crew change involved. The people are out there for the duration. So they'll be run basically this week and then the next week. Before it's cranked into a biomass estimate, however, biological samples that are collected have to be evaluated. In particular, otoliths are being collected from the samples of the fish that they collect from the trawls that they take on the transect lines because they have different target strengths for different ages and sizes of fish. So otoliths have to be read, the size, age distribution of the population in the Strait has to be calculated before it can be turned into a biomass estimate. I expect the otoliths will be given high priority at the Center...probably read by the first of June...maybe mid-May...but I don't think before that. And following that it takes a few weeks to get the final biomass estimates.

Campbell: I guess, with effort, could it be available by our next meeting, which is in the last week of May.

Balsiger: I wouldn't think that they'd be...if sufficient effort was brought to them, flame to their feet, or whatever...I suspect that they could get a preliminary number out. It depends on a number of things of course...how

quick the otoliths get back to Seattle and how quick the data tapes are back and all of that.

Campbell: Commissioner?

Collinsworth: I didn't have any question of Mr. Balsiger.

Campbell: No, I think we're done with that.

Collinsworth: Alright, Mr. Chairman, I will move that with regard to pollock apportionments to DAP and JVP in the Gulf, that the Council adopt the approach recommended by the Advisory Panel.

Mitchell: Second.

Campbell: Okay, you have a motion in front of you. Any comments or questions on the motion?

Mace: Yes, let's have that Advisory Panel recommendation.

Campbell: One more time?

Jim Branson: Where's Nancy?

Mitchell: Nancy's back there.

J. Peterson: I have a question, Mr. Chairman. What would Mr. McVey's function be between now and May?

Campbell: Okay, let's hear the motion and then Dr. Collinsworth can comment on that.

Nancy Munro: Mr. Chairman, the motion that passed in the AP. The AP recommends that the Council request NMFS to provide updated information at the May meeting regarding TQs, DAP potential, and JVP plans. This would include: (1) any new and pertinent biological information including the results from the ongoing hydroacoustic surveys and age-length studies; (2) the results of a formal survey of DAP processors, including an estimate of DAP processing capability ready but not able to get fish; and (3) an indication of the number of vessels gearing up for shoreside delivery.

Mitchell: Mr. Chairman a question. I had assumed that inherent within the AP recommendation that Mr. McVey would not go forward and allow for a JVP fishery to take place. Now that is not specifically spelled out, but is that exactly what the AP was requesting.

Nancy Munro: What I've read to you is the exact wording, but I think inherent in that, Mr. Mitchell, you are correct...that they were thinking that a final decision would then be made in May. And I think part of the AP discussion that Clarence shared with you yesterday...we did receive conflicting testimony if there was a decision delayed until May, how much that might hurt joint venture operators...and as Clarence discussed with you, we heard conflicting testimony on that.

Campbell: I think you had a question...or who had a question.

J. Peterson: I did. I would want to be sure that the motion includes direction to Mr. McVey to take no action until the May meeting.

Cotter: Mr. Chairman, I anticipated that I suppose and am prepared to offer a friendly amendment.

Campbell: Let's see if the maker of the motion wants to include in the main motion.

Collinsworth: If it's friendly.

Cotter: The amendment would be, in the interim the Council recommends the Regional Director not release any DAP in the Gulf to JVP.

Campbell: Do you want to include that in your main motion?

Collinsworth: For purposes of discussion, yes.

Campbell: Does the second concur? Second concurs.

?: Who seconded it?

Campbell: Henry. Second concurs. Okay, any further comments?

J. Peterson: Mr. Chairman, it seems to me that what is of upmost importance here is a matter of timing. At the January meeting when the Council rejected the request for 10,000 tons to go to JVs, it was my understanding that the industry would be resurveyed later in the year which was undefined...similarly to what happened the year before. And the year before when we reached the last quarter there was obviously a surplus, 10,000 tons at that time was released to joint venture. I think the timing of the effort to release to joint ventures so early in the year is what's causing so much heartburn. I don't believe there will be any loss of fish to joint ventures. If there is surplus fish and it becomes apparent, it will become apparent in the last quarter of the year, and with the harvesting capacity the joint venture fleet has, they can suck that up in a very short time. As a matter of fact, I think a letter from Annie Burnham indicated how happy they were with the 10,000 tons that was released last year...late in the year. I don't believe there would be any damage to joint venture people.

Campbell: John, that's certainly consistent with the conversation that went around this table in January. And let me again quote several comments that were made. In opening remarks I said that the JVs indicated they want to take that later in the year. Certainly, Bob McVey has the option to accommodate that if he wants. So really I see no need for this subject being in front of this at this time. You commented, it seems to me that in the normal process you re-evalute the usage of DAP, at some point mid-year and at that time you make fish available to JVs if there is non-preference or lack of performance. Oscar said as long as Bob can do it later on, I hate to see it brought up at this time. So your comment about...I think the whole issue...and something that's never come up is timing on when Bob proceeds with this. So I guess our motion is as promptly...I think...in front of us at this time.

Rudy?

R. Petersen: I know that there's some of the Korean companies that I'm familiar with quit buying pollock right now because the fact that there's no longer any roe in the Bering Sea area. I think that factor is very important..that by delaying this we're going to lose the fish that would return the largest economic value at this time. I felt...I repeat I guess...in December I felt that the numbers were perhaps not quite right and I voted against it. In January I felt the same way, the new numbers that Mr. McVey has come forward with are much more realistic, and I feel that at this time there is fish available that should be provided to the JVP.

Campbell: Rudy, I don't know, does roe peak earlier in Bering Sea than it does in Shelikof?

R. Petersen: I think so. Last year when the allocation to JVP was caught last year the roe was in very prime condition. And there was some discussion that perhaps we had opened a little too early, to lose that value. I think that...I understand very well this frustration and so on, from processors in Kodiak...but the fact that they are not getting the fish...you know you just can't set up a fish plant and say all of a sudden, okay, now boys, bring me the fish. It's just don't work that way; it's not quite that easy. In making a DAP request and filling out the forms, these things have got to be taken into consideration. Unless you have the effort and the vessels, that Mr. Robinson has surveyed and found out what the productivity are they going to deliver to your plant...unless you have all that information...you know, your information on your form is rather loose.

Campbell: We had testimony from Dave Woodruff that roe content had gone down and he actually had sent the technicians back to Japan. What do you feel about that.

R. Petersen: Well, I have other testimony that the roe is at the prime point right at this time...or I have heard it...you know, today.

Campbell: Okay, John?

Harville: Mr. Chairman, I urge support for the motion. I'd like to put that into a little more of a context of some of the discussion we've had up to this point. I was pretty hard on Steve Johnson with some of his quotes, but I certainly agree with a basic premise that he advanced which is the same one that Larry Cotter made the other day that we've put a system in place and we ought to stay with it. We have a habit in this Council of heaping ashes on our heads every once in a while and sometimes we should, but I think in this case if we have to heap any ashes on our heads it's because of the fact that we had such a workload on us in December that we did not give full consideration to a problem that was brought before us. In fact, the Regional Director Bob McVey called this to attention in his letter to John (Peterson). In his "Dear John" letter he says, "at that point in the meeting I should have immediately focused the Council's attention on our reservations about the survey," and not only he should have, but some of the rest of us should have because those reservations were brought forward and Mr. Chairman, you have directed that we take a look at our system perhaps to avoid some of the overload that can lead to such things.

I do think that it's imperative that we stay with our system and our system has included a frameworking structure in which the Regional Director is directed by this Council to make the decisions that have to be made on the basis of new information as it comes along. I also think that we have to be very cautious about how we start diddling with the system midway, making mid-year adjustments on the basis of very preliminary and very uncertain information. Dr. Balsiger emphasized for us the preliminary nature of that. Having said that, Mr. Chairman, and I hope I'm still being relevant to the issue, I think it turns out that the decision . . . and by the way, the advice from the AP that we take another look at it in June (sic) is of course right. We have to keep looking at it and if there is new advice to give to Mr. McVey, we should give it and he will be interested in it and take action accordingly. But, it turns out that I think fortuitously we probably made the right decision, whether we made it on the right basis or not, in December because while there may have been some weakness in that survey, we've had testimony here to the effect that some of the conservative estimates that were made of processing capacity on Kodiak were very conservative. We had one person telling us of a capacity something like three times what he had estimated originally, and we had . . . I won't review all of that. We also had testimony of this preliminary nature of the biology of the resource which while it isn't definitive at this point, still I think poses a conservation consideration that we ought to be looking at. We have to take conservation as a major concern on our parts. And we also have to be concerned about wise use of the resource. I'm concerned, seems to me unfortunate in terms of the monetary value of the resource, that we make a major harvest of a resource that's only 10% mature at this time when those fish could be set aside and used next year when there would be a much larger share of them that produce the roe product that's of such great value to the industry.

So, my point, Mr. Chairman, if I may, in supporting the motion, is I think it puts us on the right track of giving us time to view new data as it comes on line. We've already been advised that we're probably past the point of making major profit from the resource in the Shelikof at this point. As John Peterson pointed out, there's chance for another decision later down the track, as was originally planned, as was in our system. And I think my second point is we have a system, we should stay with it, we should support the idea of frameworking and the responsibility of the Regional Director to use his information and best judgement and I think the Regional Director has been reasonably forthright in pointing out the problems that have existed along the way. End of comment.

John Harville's comments on GOA pollock DAP/JVP, March 19, 1987, at Council meeting.

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