UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

APR 28 1992

MEMORANDUM FOR: Distribution*

FROM: for Donald J. Leedy
Joe P. Clem
Chief, Plans and Regulations Division

SUBJECT: Amendment 19 to the FMP for Groundfish of the Bering Sea and Aleutian Islands Area and Amendment 24 to the FMP for the Groundfish of the Gulf of Alaska

Attached is a copy of the subject amendments and associated documents prepared by the North Pacific Fishery Management Council for formal review.

The subject amendments would (1) reduce the Pacific halibut prohibited species bycatch limit for trawl gear in the Bering Sea and Aleutian Islands, (2) establish a Pacific halibut bycatch mortality limit for fixed gear in the Bering Sea and Aleutian Islands, and (3) establish authority to develop and implement time/area closures to reduce prohibited species bycatch rates. Amendments to current regulations are proposed that would improve the monitoring of prohibited species allowances and reduce certain prohibited species catch rates by delaying seasons.

Please provide your comments (including "no comments") by May 22, 1992. If you have any questions, call Don Leedy at (301) 713-2341.

Attachment

*Distribution

F/CM	F/PR2 - Kaufman
F/CM1 - Fricke, Surdi	F/PR3 - Hall
F/CM2 - Clem, Miller	F/RE1 - Holliday
F/FM3 - Magill	CS/EC - Cottingham
F/EN - Pallozzi	N/ORM4 - Burgess
GCF - Rogerson	GC - Johnson
GCEL - Kuruc	OGC - Malone
Fx3 - Sissenwine	OMB - Minsk
F/MS - Czerwonky	F/BP - Oliver

CHANGES TO THE FMP FOR THE GROUNDFISH FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS AREA

Revision of the 1992 PSC limit for halibut

On page 14-8, paragraph D of Section 14.4.2.2 is suspended through December 31, 1992. A new paragraph D is added, which will expire at the end of the 1992 fishing year, to read as follows:

During 1992, the primary and secondary PSC bycatch limits for trawl gear are 4,440 mt and 5,033 mt, respectively. A PSC mortality limit of 750 mt is established for non-trawl gear that is applicable to the BSAI management area.

CHANGES TO THE FMP FOR THE GROUNDFISH FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS AREA AND FOR GROUNDFISH OF THE GULF OF ALASKA

Time/area closure authority

For the BSAI FMP -- on page 14-17, sections 14.4.9 and 14.4.10 are redesignated as 14.4.10 and 14.4.11 and a new section 14.4.9 Time/area closure authority is added.

For the GOA FMP -- On page 4-12, a new section 4.2.6 Time/area closures is added.

Time/area closure authority

The Secretary, after consulting with the Council, may identify and establish by regulatory amendment time/area closures to reduce bycatch rates of prohibited species. Closures of all or part of an area would require a determination by the Secretary that the closure is based on the best available scientific information concerning the seasonal distribution and abundance of prohibited species and bycatch rates of prohibited species associated with various directed groundfish fisheries or gear types. A time/area closure will limited to the minimum size and duration, which the Secretary determines are reasonably necessary to accomplish the intent of the closure. Any time/area closure would be based upon a determination that it is necessary to prevent:

1. A continuation of relatively high bycatch rates of prohibited species with an area;

2. The take of an excessive share of PSC limits or bycatch allowances by vessels fishing within an area;

3. The closure of one or more directed fisheries for groundfish due to excessive prohibited species bycatch rates that occur in a specified fishery operating within an area; or

4. The premature attainment of specified PSC limits or bycatch allowances and associated foregone opportunity for vessels to harvest available groundfish.

DRAFT

ENVIRONMENTAL ASSESSMENT/REGULATORY IMPACT REVIEW/ INITIAL REGULATORY FLEXIBILITY ANALYSIS

FOR
AMENDMENT 19
TO THE FISHERY MANAGEMENT PLAN FOR
THE GROUNDFISH FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS AREA AND
AMENDMENT 24
TO THE FISHERY MANAGEMENT PLAN FOR
GROUNDFISH OF THE GULF OF ALASKA

Prepared by
the Staffs of the North Pacific Fishery Management Council,
Alaska Fisheries Science Center and
National Marine Fisheries Service

Anchorage, Alaska

April 10, 1992

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Management Background

The domestic and joint venture groundfish fisheries in the exclusive economic zone (3-200 miles offshore) in the waters off Alaska are managed under two Fishery Management Plans (FMP); one for the Bering Sea/Aleutian Islands (BS/AI), and the second for the Gulf of Alaska (GOA). These FMPs were developed by the North Pacific Fishery Management Council (Council) under the Magnuson Fishery Conservation and Management Act (Magnuson Act). The BS/AI and GOA FMPs were approved by the Secretary of Commerce and became effective in 1982 and 1978, respectively.

This document analyzes proposed Amendments 19 and 24 to the respective BS/AI and GOA FMPs. This amendment package is being developed outside of the Council's annual amendment cycle. The Council's Bycatch Committee has been working over the past year to develop alternatives to address bycatch management issues in both the BS/AI and the GOA. From a list of potential bycatch management alternatives, the Council selected those included in this draft EA/RIR/IRFA for analysis over the summer of 1991.

Amendment proposals and appropriate alternatives accepted by the Council are analyzed by the Groundfish Plan Teams or other staff analytical teams for their efficacy and for their potential biological and socioeconomic impacts. After reviewing this analysis, the Advisory Panel (AP) and Scientific and Statistical Committee (SSC) make recommendations as to whether the amendment alternatives should be rejected or changed in any way, whether and how the analysis should be refined, and whether to release the analysis for general public review and comment. If an amendment proposal and accompanying analysis is released for public review, the AP, SSC, and the Council consider subsequent public comments before the Council decides whether to submit the proposals to the Secretary of Commerce for approval and implementation.

Amendment 19/24 reflects the priority bycatch issues established by the Council during a teleconference meeting on July 3, 1991, including members of the PTs, industry, and the general public. The draft analysis for these amendments was reviewed by the Council in September, revised as directed by the Council, and released for public comment in November. The Council identified its preferred alternative in December.

1.2 Purpose of and Need for the Proposed Action

Because groundfish fisheries use non-selective harvesting techniques, incidental catches (bycatches) are taken as a byproduct of the groundfish catch. The bycatch species include crab, halibut, salmon, and herring. A conflict occurs when bycatch is thought to impact measurably the resources available to another fishery. Bycatch management attempts to balance the effects of various fisheries on each other. This is particularly contentious because fishermen value these alternative uses of crab, halibut, salmon, or herring very differently, depending on the fishery they pursue.

The prohibited species bycatch management measures for the groundfish fisheries principally have been established for the BS/AI by Amendments 16, 16a, and revised Amendment 16 and for the GOA by Amendment 14 and revised Amendment 21.

GOA Amendment 14 included the establishment of a halibut prohibited species catch (PSC) limit framework. The parts of the framework that have been implemented specify an annual process for establishing halibut PSC limits for the trawl and fixed gear fisheries and for apportioning those limits by season.

BS/AI Amendment 16 extended beyond 1991 the previously established PSC limits for halibut and crab in the groundfish trawl fisheries. Specific time/area closures are triggered when a PSC limit or allowance is taken.

BS/AI Amendment 16a established herring bycatch management measures that (1) set the herring PSC limit at one percent of the established herring biomass and (2) define a series of time/area closures (Herring Savings Areas) that are triggered by the attainment of the herring PSC limit. For the 1991 fishing year, the herring PSC limit was 834 metric tons. Amendment 16a also provided the Regional Director with the authority to: (1) limit the proportion of the pollock TACs that may be taken in the bottom trawl pollock fishery and (2) temporarily close limited areas in-season due to high bycatch rates. The latter is referred to as "hot spot authority".

BS/AI Amendments 16 and 16a also established procedures to apportion PSC limits to specified trawl fishery categories as prohibited species bycatch allowances. Annual fishery bycatch allowances may be further allocated into seasonal fishery bycatch apportionments. The attainment of a prohibited species bycatch allowance or seasonal apportionment triggers a fishery specific time/area closure.

Revised Amendments 16 for the BS/AI and 21 for the GOA implemented a vessel incentive program to reduce prohibited species bycatch rates in specified groundfish trawl fisheries. The incentive program was implemented in May, 1991.

Although these bycatch management measures are expected to continue to reduce the bycatch of halibut, crab, and herring in the BS/AI trawl groundfish fisheries and the bycatch of halibut in the GOA trawl and fixed gear fisheries, these measures have a number of deficiencies. First, the reductions in bycatch have come at unnecessarily high costs to the BS/AI trawl fisheries and the GOA trawl and fixed gear fisheries. The costs include those associated with closures that have decreased catches and increased harvesting costs. The 1990 and 1991 closures are listed in Table 1.

Three reasons why some bycatch rates are unnecessarily high and the amount of groundfish that can be harvested with the current halibut PSC limits is lower than necessary are that: (1) there is not an incentive program for all trawl fisheries; (2) existing hot spot authority for the BS/AI cannot be used quickly and there is no hot spot authority for the GOA; and (3) the current fishing seasons probably are not optimal with respect to controlling bycatch.

The second deficiency is that bycatches have exceeded what some consider to be appropriate levels. Table 2 lists estimated 1990 and 1991 prohibited species bycatch for BS/AI and GOA domestic (DAP) groundfish fisheries by species and fishery. The percent of the estimated bycatch of each bycatch species accounted for by each groundfish fishery, estimated bycatch rates, estimated groundfish catch, and estimated wholesale value by fishery are presented in Tables 2 through 6, respectively.

The halibut bycatch and bycatch rate estimates used in this report have been adjusted to reflect assumed discard mortality rates of 100 percent in the BS/AI trawl fisheries, 50 percent in the GOA trawl fisheries, 16 percent in all hook-and-line fisheries, and 12 percent in all pot gear fisheries. The International Pacific Halibut Commission (IPHC) is expected to revise these estimates in early 1992. IPHC staff has recommended that the following discard mortality rates be used: 75 percent in the BS/AI trawl fisheries, 65 percent in the GOA trawl fisheries, 16 percent in all hook-and-line fisheries, and 10 percent in all pot gear fisheries.

Table 1 Fishery closures in 1990 and 1991 due to prohibited species bycatch.

FISHERY	AREA	DATE	CAUSE
BSAI - 1990			
JV Flatfish	Zone 1	01/25 - 12/31	PSC - RKC
JV Flatfish	Zone 2H	02/27 - 12/31	PSC - HLBT
DAP Flatfish	Zone 1	02/27 - 03/01	PSC - BTAN
JV Flatfish	BSAI	03/05 - 06/24	PSC - HLBT
DAP Flatfish	Zone 1/2H	03/14 - 12/31	PSC - HLBT
DAP Flatfish	BSAI	03/19 - 08/04	PSC - HLBT
DAP plck/cod	Zone 1/2H	05/30 - 12/31	PSC - HLBT
DAP plck/cod	BSAI	06/30 - 12/31	PSC - HLBT
JVP Flatfish	BSAI	07/01 - 12/31	PSC - HLBT
DAP Flatfish	BSAI	11/16 - 12/31	PSC - HLBT
GOA - 1990			
DAP H&L	GOA	05/29 - 06/30	PSC - HLBT
DAP Non-pel	GOA	05/29 - 06/30	PSC - HLBT
DAP H&L	GOA	07/01 - 12/31	PSC - HLBT
DAP Non-pel	GOA	11/21 - 12/31	PSC - HLBT
BSAI - 1991			
Plck/cod	Zone 1/2H	02/17 - 03/31	PSC - HLBT
Plck/cod	BSAI	03/08 - 03/31	PSC - HLBT
Rock sole	Zone 1/2H	03/15 - 12/31	PSC - HLBT
Plck/cod	Zone 1/2H	04/19 - 05/03	PSC - HLBT
Plck/cod	Zone 1/2H	05/03 - 12/31	PSC - HLBT
Plck/cod	BSAI	05/08 - 07/01	PSC - HLBT
Rock sole	BSAI	06/06 - 12/31	PSC - HLBT
Plck/cod	BSAI	07/08 - 12/31	PSC - HLBT
Flatfish	HSA 2	07/14 - 08/15	PSC - HERRING
Flatfish	HSA 3	09/1 - 3/1/92	PSC - HERRING
Flatfish	Zone 1/2H	09/16 - 12/31	PSC - HLBT
Pollock	HSA 3	09/21 - 3/1/92	PSC - HERRING
Flatfish	BSAI	10/15 - 12/31	PSC - HLBT
GOA - 1991			
Non-pel Twl	GOA	05/08 - 07/01	PSC - HLBT
Hook & line	GOA	07/08 - 12/31	PSC - HLBT
Non-pel Twl	GOA	10/15 - 12/31	PSC - HLBT

Table 2 Estimated 1990 and 1991 prohibited species bycatch for BSAI and GOA groundfish fisheries by species and fishery.

Bering Sea/Aleutian Islands 1990

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon
Longline					
Pacific Cod	280.4	1,531	2	4	22
Rockfish	.5	0	0	0	0
Other	1.4	26	0	0	0
Sablefish	53.7	22	0	0	0
All targets	335.9	1,580	2	4	22
Pot					
Pacific Cod	2.5	20,023	9,762	0	0
Trawl					
Atka Mackerel	145.5	41	85	80	201
Pollock	684.5	287,558	5,937	610	1,546
Pacific Cod	2,662.4	745,859	20,672	4,846	139
Flatfish	4.0	5,659	482	5	0
Rockfish	226.5	6,367	271	84	152
Other	6.5	813	12	2	2
Pel Pollock	184.5	107,476	3,113	8,024	14,162
Rock Sole	328.8	432,566	66,172	133	12
Sablefish	28.3	3,432	108	0	0
Turbot	738.0	4,224	1,643	2	0
Arrowtooth	9.3	3	0	0	0
Y Sole	54.4	116,490	933	18	0
All targets	5,072.6	1,710,487	99,429	13,804	16,213
Unknown gear					
Unknown targets	1.5	0	0	0	0
All gears/targets	**5,412.5**	**1,732,090**	**109,193**	**13,809**	**16,235**

Bering Sea/Aleutian Islands 1991

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon	Herring
Longline						
Pacific Cod	269.9	5,229	12	41	56	.0
Rockfish	4.5	1	0	0	0	.0
Other	.5	15	0	0	0	.0
Sablefish	35.9	11	76	0	0	.0
All targets	310.8	5,256	88	41	56	.0
Pot						
Pacific Cod	.5	9,174	420	0	0	.0
Trawl						
Atka Mackerel	64.7	815	146	155	16	.0
Pollock	613.3	490,367	1,533	4,499	2,511	31.1
Pacific Cod	2,436.7	522,622	1,009	6,309	47	.7
Flatfish	56.1	111,340	1,125	4	12	7.8
Rockfish	162.9	5,161	197	733	4	.2
Other	9.8	3,938	129	17	4	.5
Pel Pollock	532.3	316,503	665	24,593	17,560	571.9
Rock Sole	1,158.6	706,363	85,903	825	619	34.2
Sablefish	14.7	701	3	1	1	.0
Turbot	398.1	16,221	2,057	154	5	.1
Arrowtooth	20.3	744	0	1	85	.0
Y Sole	646.7	390,958	18,779	411	882	568.6
All targets	6,114.3	2,565,732	111,545	37,702	21,743	1,215.1
Unknown gears						
Unknown targets	1.6	2	0	0	0	.0
All gears/targets	**6,427.2**	**2,580,164**	**112,053**	**37,743**	**21,799**	**1,215.1**

Table 2 Continued

Gulf of Alaska 1990

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon
Longline					
Rockfish	11.8	0	0	0	0
Other	62.3	96	0	0	0
Sablefish	1,111.4	222	93	0	62
All targets	1,185.5	318	93	0	62
Pot					
Other	31.7	101,431	15,369	455	0
Trawl					
Pollock	15.9	1,545	0	116	225
Flatfish	468.6	50,255	209	5,740	147
Rockfish	591.0	338	50	1,941	561
Other	888.6	35,345	158	3,997	1,644
Pel Pollock	2.1	10	0	3,773	1,492
Sablefish	46.1	237	5	197	1
Turbot	101.6	0	0	0	0
All targets	2,113.8	87,730	422	15,763	4,071
Unknown gear					
Unknown targets	1.9	0	0	0	0
All gears/targets	**3,332.9**	**189,479**	**15,884**	**16,219**	**4,133**

Gulf of Alaska 1991

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon
Jig					
All targets	7.0	0	0	0	0
Longline					
Pacific Cod	155.1	2	0	0	0
Rockfish	8.6	0	0	0	0
Other	1.4	0	0	0	0
Sablefish	731.9	395	0	0	12
All targets	896.9	398	0	0	12
Pot					
Pacific Cod	.5	31,436	131	0	0
Trawl					
Pollock	96.0	19,371	37	3,260	648
Pacific Cod	488.4	46,720	5	4,729	8
Deep Flat	402.4	8,416	82	2,914	715
Shallow Flat	15.8	11,404	6	45	33
Rockfish	610.2	6,554	2	22,598	933
Other	6.6	0	0	0	0
Pel Pollock	6.3	818	0	2,550	11,161
Sablefish	2.8	28	0	0	0
All targets	1,628.5	93,311	132	36,096	13,498
Unknown gear					
Unknown targets	43.5	0	0	0	0
All gears/targets	**2,576.5**	**125,145**	**264**	**36,096**	**13,510**

Notes: Halibut and herring are expressed in mt; bairdi and red king crab and chinook and other salmon are expressed in numbers. The halibut bycatch estimates have been adjusted to reflect assumed discard mortality rates of 100% in the BSAI trawl fisheries, 50% in the GOA trawl fisheries, 16% in all hook-and-line fisheries, and 12% in all pot gear fisheries. These estimates are based on data provided by the Alaska Region. The 1991 data are for January 1 - September 29. The totals include bycatches for some fisheries with such low levels of bycatch that they are not reported separately. Estimates of BSAI herring bycatch for 1990 were not available from the Region. In the GOA for 1990, Pacific cod is included as other.

Table 3 Percentage of bycatch accounted for by each fishery in 1990 and 1991.

Bering Sea/Aleutian Islands 1990

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon
Longline					
Pacific Cod	5.2	0.1	0.0	0.0	0.1
Rockfish	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0
Sablefish	1.0	0.0	0.0	0.0	0.0
All targets	6.2	0.1	0.0	0.0	0.1
Pot					
Pacific Cod	0.0	1.2	8.9	0.0	0.0
Trawl					
Atka Mackerel	2.7	0.0	0.1	0.6	1.2
Pollock	12.6	16.6	5.4	4.4	9.5
Pacific Cod	49.2	43.1	18.9	35.1	0.9
Flatfish	0.1	0.3	0.4	0.0	0.0
Rockfish	4.2	0.4	0.2	0.6	0.9
Other	0.1	0.0	0.0	0.0	0.0
Pel Pollock	3.4	6.2	2.9	58.1	87.2
Rock Sole	6.1	25.0	60.6	1.0	0.1
Sablefish	0.5	0.2	0.1	0.0	0.0
Turbot	13.6	0.2	1.5	0.0	0.0
Arrowtooth	0.2	0.0	0.0	0.0	0.0
Y Sole	1.0	6.7	0.9	0.1	0.0
All targets	93.7	98.8	91.1	100.0	99.9
Unknown gear					
Unknown targets	0.0	0.0	0.0	0.0	0.0
All gears/targets	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Bering Sea/Aleutian Islands 1991

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon	Herring
Longline						
Pacific Cod	4.2	0.2	0.0	0.1	0.3	0.0
Rockfish	0.1	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0
Sablefish	0.6	0.0	0.1	0.0	0.0	0.0
All targets	4.8	0.2	0.1	0.1	0.3	0.0
Pot						
Pacific Cod	0.0	0.4	0.4	0.0	0.0	0.0
Trawl						
Atka Mackerel	1.0	0.0	0.1	0.4	0.1	0.0
Pollock	9.5	19.0	1.4	11.9	11.5	2.6
Pacific Cod	37.9	20.3	0.9	16.7	0.2	0.1
Flatfish	0.9	4.3	1.0	0.0	0.1	0.6
Rockfish	2.5	0.2	0.2	1.9	0.0	0.0
Other	0.2	0.2	0.1	0.0	0.0	0.0
Pel Pollock	8.3	12.3	0.6	65.2	80.6	47.1
Rock Sole	18.0	27.4	76.7	2.2	2.8	2.8
Sablefish	0.2	0.0	0.0	0.0	0.0	0.0
Turbot	6.2	0.6	1.8	0.4	0.0	0.0
Arrowtooth	0.3	0.0	0.0	0.0	0.4	0.0
Y Sole	10.1	15.2	16.8	1.1	4.0	46.8
All targets	95.1	99.4	99.5	99.9	99.7	100.0
Unknown gears						
Unknown targets	0.0	0.0	0.0	0.0	0.0	0.0
All gears/targets	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 3 continued

Gulf of Alaska 1990

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon
Longline					
Rockfish	0.4	0.0	0.0	0.0	0.0
Other	1.9	0.1	0.0	0.0	0.0
Sablefish	33.3	0.1	0.6	0.0	1.5
All targets	35.6	0.2	0.6	0.0	1.5
Pot					
Other	1.0	53.5	96.8	2.8	0.0
Trawl					
Pollock	0.5	0.8	0.0	0.7	5.4
Flatfish	14.1	26.5	1.3	35.4	3.6
Rockfish	17.7	0.2	0.3	12.0	13.6
Other	26.7	18.7	1.0	24.6	39.8
Pel Pollock	0.1	0.0	0.0	23.3	36.1
Sablefish	1.4	0.1	0.0	1.2	0.0
Turbot	3.0	0.0	0.0	0.0	0.0
All targets	63.4	46.3	2.7	97.2	98.5
Unknown gear					
Unknown targets	0.1	0.0	0.0	0.0	0.0
All gears/targets	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Gulf of Alaska 1991

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon
Jig					
All targets	0.3	0.0	0.0	0.0	0.0
Longline					
Pacific Cod	6.0	0.0	0.0	0.0	0.0
Rockfish	0.3	0.0	0.0	0.0	0.0
Other	0.1	0.0	0.0	0.0	0.0
Sablefish	28.4	0.3	0.0	0.0	0.1
All targets	34.8	0.3	0.0	0.0	0.1
Pot					
Pacific Cod	0.0	25.1	49.6	0.0	0.0
Trawl					
Pollock	3.7	15.5	14.0	9.0	4.8
Pacific Cod	19.0	37.3	1.9	13.1	0.1
Deep Flat	15.6	6.7	31.1	8.1	5.3
Shallow Flat	0.6	9.1	2.3	0.1	0.2
Rockfish	23.7	5.2	0.8	62.6	6.9
Other	0.3	0.0	0.0	0.0	0.0
Pel Pollock	0.2	0.7	0.0	7.1	82.6
Sablefish	0.1	0.0	0.0	0.0	0.0
All targets	63.2	74.6	50.0	100.0	99.9
Unknown gear					
Unknown targets	1.7	0.0	0.0	0.0	0.0
All gears/targets	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: The estimates in this table were calculated using the data in Table 2. Therefore, the notes for that table also apply to these estimates.

Table 4 Estimated 1990 and 1991 prohibited species bycatch rates for BSAI and GOA groundfish fisheries by species and fishery.

Bering Sea/Aleutian Islands 1990

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon
Longline					
Pacific Cod	.55	.03	.00	.00	.00
Rockfish	1.11	.00	.00	.00	.00
Other	.67	.13	.00	.00	.00
Sablefish	1.38	.01	.00	.00	.00
Turbot	.35	.00	.00	.00	.00
All targets	.60	.03	.00	.00	.00
Pot					
Pacific Cod	.18	14.12	6.88	.00	.00
Trawl					
Atka Mackerel	0.45	.00	.00	.00	.01
Pollock	.46	1.91	.04	.00	.01
Pacific Cod	1.92	5.38	.15	.03	.00
Flatfish	.52	7.32	.62	.01	.00
Rockfish	.72	.20	.01	.00	.00
Other	1.27	1.59	.02	.00	.00
Pel pollock	.02	.09	.00	.01	.01
Rock sole	1.02	13.47	2.06	.00	.00
Sablefish	4.11	4.98	.16	.00	.00
Turbot	5.67	.32	.13	.00	.00
Arrowtooth	.57	.00	.00	.00	.00
Y. Sole	.30	6.44	.05	.00	.00
All targets	.31	1.04	.06	.01	.01
All gears/targets	.32	1.02	.06	.01	.01

Bering Sea/Aleutian Islands 1991

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon	Herring
Longline						
Pacific Cod	.50	.10	.00	.00	.00	.00
Rockfish	1.67	.00	.00	.00	.00	.00
Other	.50	.14	.00	.00	.00	.00
Sablefish	1.22	.00	.03	.00	.00	.00
Turbot	.30	.00	.00	.00	.00	.00
All targets	.54	.09	.00	.00	.00	.00
Pot						
Pacific Cod	.02	3.39	.16	.00	.00	.00
Trawl						
Atka Mackerel	.23	.03	.01	.01	.00	.00
Pollock	.39	3.11	.01	.03	.02	.00
Pacific Cod	2.01	4.32	.01	.05	.00	.00
Flatfish	.70	13.91	.14	.00	.00	.00
Rockfish	2.04	.64	.02	.09	.00	.00
Other	1.20	4.81	.16	.02	.00	.00
Pel pollock	.04	.27	.00	.02	.01	.00
Rock sole	1.72	10.48	1.27	.01	.01	.00
Sablefish	5.70	2.71	.01	.00	.00	.00
Turbot	4.78	1.95	.25	.02	.00	.00
Arrowtooth	2.60	.95	.00	.00	.11	.00
Y. Sole	.60	3.63	.17	.00	.01	.01
All targets	.36	1.51	.07	.02	.01	.00
All gear/targets	.36	1.47	.06	.02	.01	.00

Table 4 continued

Bering Sea and Aleutians Islands 1990-91

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon	Herring
Longline						
Pacific Cod	.52	.06	.00	.00	.00	.00
Rockfish	1.60	.00	.00	.00	.00	.00
Other	.61	.13	.00	.00	.00	.00
Sablefish	1.31	.00	.01	.00	.00	.00
Turbot	.35	.00	.00	.00	.00	.00
All targets	.57	.06	.00	.00	.00	.00
Pot						
Pacific Cod	.07	7.08	2.47	.00	.00	.00
Trawl						
Atka Mackerel	.35	.01	.00	.00	.00	.00
Pollock	.42	2.53	.02	.02	.01	.00
Pacific Cod	1.96	4.88	.08	.04	.00	.00
Flatfish	.68	13.33	.18	.00	.00	.00
Rockfish	.98	.29	.01	.02	.00	.00
Other	1.22	3.57	.11	.01	.00	.00
Pel pollock	.03	.18	.00	.01	.01	.00
Rock sole	1.49	11.44	1.53	.01	.01	.00
Sablefish	4.54	4.36	.12	.00	.00	.00
Turbot	5.32	.96	.17	.01	.00	.00
Arrowtooth	1.22	.31	.00	.00	.04	.00
Y. Sole	.56	4.03	.16	.00	.01	.00
All targets	.33	1.28	.06	.02	.01	.00
All gears/targets	.34	1.24	.06	.01	.01	.00

Table 4 continued

Gulf of Alaska 1990

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon
Longline					
Rockfish	1.58	.00	.00	.00	.00
Other	1.09	.02	.00	.00	.00
Sablefish	4.59	.01	.00	.00	.00
Turbot	1.58	.00	.00	.00	.00
All targets	3.86	.01	.00	.00	.00
Pot					
Other	.56	17.99	2.73	.08	.00
Trawl					
Pollock	.09	.08	.00	.01	.01
Flatfish	2.15	2.30	.01	.26	.01
Rockfish	1.76	.01	.00	.06	.02
Other	1.17	.46	.00	.05	.02
Pel pollock	.00	.00	.00	.07	.03
Sablefish	1.86	.10	.00	.08	.00
Turbot	3.84	.00	.00	.00	.00
All targets	1.02	.42	.00	.08	.02
All gears/targets	1.36	.78	.07	.07	.02

Gulf of Alaska 1991

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon
Jig					
All targest	1.58	.00	.00	.00	.00
Longline					
Pacific Cod	2.17	.00	.00	.00	.00
Rockfish	1.58	.00	.00	.00	.00
Other	1.58	.00	.00	.00	.00
Sablefish	3.53	.02	.00	.00	.00
All targets	3.15	.01	.00	.00	.00
Pot					
Pacific Cod	.01	3.36	.01	.00	.00
Trawl					
Pollock	.60	1.21	.00	.20	.04
Pacific Cod	.86	.83	.00	.08	.00
Deep flat	2.65	.55	.01	.19	.05
Shallow flat	.99	7.12	.00	.03	.02
Rockfish	3.02	.32	.00	1.12	.05
Other	.64	.00	.00	.00	.00
Pel pollock	.01	.01	.00	.04	.18
Sablefish	1.74	.18	.00	.00	.00
All targets	.95	.54	.00	.21	.08
All gears/targets	1.22	.59	.00	.17	.06

Table 4 continued

Gulf of Alaska 1990-91

Fishery	Halibut	Bairdi	Red King	Chinook	O Salmon
Jig					
All targets	1.58	.00	.00	.00	.00
Longline					
Pacific Cod	2.17	.00	.00	.00	.00
Rockfish	1.58	.00	.00	.00	.00
Other	1.09	.02	.00	.00	.00
Sablefish	4.10	.01	.00	.00	.00
Turbot	1.58	.00	.00	.00	.00
All targets	3.52	.01	.00	.00	.00
Pot					
Pacific Cod	.01	3.36	.01	.00	.00
Other	.56	17.99	2.73	.08	.00
All targets	.21	8.86	1.03	.03	.00
Trawl					
Pollock	.33	.61	.00	.10	.03
Pacific Cod	.86	.83	.00	.08	.00
Deep flat	2.65	.55	.01	.19	.05
Flatfish	2.15	2.30	.01	.26	.01
Shallow flat	.99	7.12	.00	.03	.02
Rockfish	2.23	.13	.00	.46	.03
Other	1.16	.46	.00	.05	.02
Pel pollock	.01	.01	.00	.06	.11
Sablefish	1.85	.10	.00	.07	.00
Turbot	3.84	.00	.00	.00	.00
All targets	.99	.48	.00	.14	.05
All gears/targets	1.30	.69	.04	.11	.04

Notes: Halibut and herring bycatch rates are expressed as percentages (100 x bycatch/groundfish catch). Crab and salmon bycatch rates are expressed in terms of number of crab or salmon per 1 mt of groundfish catch. The halibut bycatch estimates have been adjusted to reflect assumed discard mortality rates of 100% in the BSAI trawl fisheries, 50% in the GOA trawl fisheries, 16% in all hook-and-line fisheries, and 12% in all pot gear fisheries. These estimates are based on data provided by the Alaska Region. Estimates of BSAI herring bycatch for 1990 were not available from the Region. The 1991 data are for January 1 - September 29. In the GOA for 1990, Pacific cod is included as other.

Table 5 Groundfish catch by area and fishery, 1990-91.

(1,000's mt)

	BSAI 90	BSAI 91	GOA 90	GOA 91
Longline				
Pacific cod	51.2	54.5	.	7.1
Rockfish	.0	.3	.7	.5
Other fish	.2	.1	5.7	.1
Sablefish	3.9	3.0	24.2	20.7
Turbot	.4	.0	.0	.
All targets	55.8	57.8	30.7	28.5
Pot				
Pacific cod	1.4	2.7	.	9.4
Other fish	.	.0	5.6	.0
All targets	1.4	2.7	5.6	9.4
Trawl				
Atka Mackerel	32.1	28.4	.	.
Pollock	150.3	157.7	18.2	16.0
Pacific cod	138.7	121.0	.	56.6
Deep flatfish	.	.	.	15.2
Other flatfish	.8	8.0	21.8	.
Shallow flat	.	.	.	1.6
Rockfish	31.6	8.0	33.6	20.2
Other fish	.5	.8	76.2	1.0
Pelagic pollock	1,226.9	1,190.7	51.6	61.4
Rock sole	32.1	67.4	.	.
Sablefish	.7	.3	2.5	.2
Turbot	13.0	8.3	2.6	.
Arrowtooth	1.6	.8	.	.
Yellowfin sole	18.1	107.7	.	.
All targets	1,646.5	1,699.1	206.6	172.1
All gears/targets	1,703.7	1,759.6	242.9	210.0

Notes: These estimates are based on data provided by the Alaska Region. The 1991 data are through September 29. In the GOA for 1990, Pacific cod is included as other.

Table 6 BS/AI groundfish wholesale value by year and fishery, 1990-91.

	BSAI 90	BSAI 91
Longline		
Pacific cod	47,038,248	44,272,723
Rockfish	57,104	55,987
Other fish	86,066	146,969
Sablefish	10,097,055	6,909,784
Turbot	546,540	19,218
All targets	57,825,014	51,404,682
Pot		
Pacific cod	1,409,562	2,264,871
Other fish		8,810
Sablefish		245
All targets	1,409,562	2,273,925
Trawl		
Atka Mackerel	29,377,802	30,250,112
Pollock	82,724,239	76,163,334
Pacific cod	96,584,000	85,661,620
Other flatfish	608,911	5,628,362
Rockfish	23,013,485	7,668,262
Other fish	2,006,203	88,714
Pelagic pollock	533,592,141	554,748,193
Rock sole	15,924,152	28,696,694
Sablefish	552,541	307,952
Turbot	12,339,786	7,899,148
Arrowtooth	1,318,679	421,303
Yellowfin sole	9,352,324	61,163,633
All targets	807,394,263	858,697,326
Unknown gear		
Unknown target	808,291	639,363
All gears/targets	867,437,130	913,015,296

Notes: These estimates are based on product weight data provided by the Alaska Region and on 1990 first wholesale price data collected jointly by NMFS, ADF&G, and CFEC. The 1991 data are through September 29.

Four reasons why bycatches were higher than some expected or consider to be appropriate are that: (1) upon the closure of specified trawl fisheries in the BS/AI, non-trawl groundfish fisheries and certain other trawl fisheries are allowed to continue unrestricted with respect to prohibited species bycatch; (2) the current bycatch management regime does not explicitly address salmon bycatch; (3) bottom trawling was not effectively prevented once only pelagic trawls could be used; and (4) the current fishing seasons may contribute to higher bycatches.

The third deficiency is that the success of the bycatch management regimes in the BS/AI and GOA is also limited by inconsistencies and other deficiencies in the definitions of fisheries and the directed fishing standards. Currently, there are two different and inconsistent sets of definitions of fisheries for the purposes of monitoring PSC allowances and the vessel incentive program. There is also a third set of definitions which is referred to as the directed fishing standards. They are used to identify what fishing activity is prohibited by the closure of a specific fishery. The current standards have limited the effectiveness of fishery closures.

The purpose of the proposed action is to provide a short-term solution to the problems identified above and, by so doing, decrease the cost of the bycatch problem.

1.3 List of Amendment Proposals

The time required to address other fishery management issues has prevented the development of a comprehensive long-term solution to the bycatch problem. The Council has identified a number of changes to the current bycatch management regimes for the BS/AI and GOA that have a potential for reducing the bycatch problem. Two alternatives are being considered. They are the status quo and a combination of the changes listed below.

1. Improve the hot spot authority in the BS/AI and establish similar authority in the GOA.

2. Expand the vessel incentive programs in the BS/AI and GOA.

3. Delay the start of BS/AI and GOA fisheries.

4. Establish a halibut PSC mortality limit for the non-trawl fisheries in the BS/AI.

5. Change the PSC limit allowance groups for the BS/AI trawl fisheries.

6. Change the definitions of fisheries for the BS/AI and GOA.

7. Change the directed fishing standards for the BS/AI and GOA.

Establishing a halibut PSC limit for non-trawl fisheries in the BS/AI, establishing hot spot authority in the GOA, and only of three alternative changes to the BS/AI hot spot authority will require plan amendments. The other changes being considered can be implemented with a regulatory amendment. The specifics of these changes are defined more fully in Section 2.

1.4 Purpose of the Document

This document provides background information and assessments necessary for the Secretary of Commerce to determine if the Amendment is consistent with the Magnuson Act and other applicable law. It also provides the public with information to assess the alternatives that are being considered

and to comment on the alternatives. These comments will enable to Council and Secretary to make more informed decisions concerning the resolution of the management problems being addressed.

1.4.1 Environmental Assessment

One part of the package is the environmental assessment (EA) that is required by NOAA in compliance with the National Environmental Policy Act of 1969 (NEPA). The purpose of the EA is to analyze the impacts of major federal actions on the quality of the human environment. The EA 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 environmental impact study (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 the proposed changes will have significant impacts on the human environment and proceed directly with preparation of an EIS.

1.4.2 Regulatory Impact Review

Another part of the package is the Regulatory Impact Review (RIR) that is required by the National Marine Fisheries Service (NMFS) for all regulatory actions or for significant Department of Commerce or NOAA policy changes that are of significant 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 and whether or not proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the 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 record-keeping requirements. This Act requires that the head of an agency must certify that the regulatory and record-keeping requirements, if promulgated, will not have a significant effect on a substantial number of small entities or provide sufficient justification to receive a waiver.

This RIR analyzes the impacts of proposed changes to the BS/AI and GOA bycatch management regimes. The SAFE document and its appendix provide a description of and an estimate of the number of vessels and processors (small entities) to which regulations implementing these amendments would apply.

1.5 Description of the Groundfish Fisheries

The most recent description of the groundfish fishery is contained in the Draft Economic Status of

the Groundfish Fisheries off Alaska, 1991, an appendix to the Draft SAFE documents for the BS/AI and GOA groundfish fisheries for 1992. The draft includes information on the catch and value of the fisheries, the numbers and sizes of fishing vessels and processing plants, and other economic variables that describe or affect the performance of the fisheries.

2.0 THE ALTERNATIVES

As noted above, the Council has identified a number of changes to the current bycatch management regimes for the BS/AI and GOA that have a potential for reducing the bycatch problem. The two alternatives being considered are the status quo and changes for up to 6 and 7 elements, respectively, of the GOA and BS/AI bycatch management regimes. The types of changes and the sections in which they are defined are as follows: hot spot authority, Section 2.1; vessel incentive programs, Section 2.2; fishery start dates, Section 2.3; halibut PSC limit for the non-trawl fisheries in the BS/AI, Section 2.4; PSC limit allowances for BS/AI trawl fisheries, Section 2.5; fishery definitions, Section 2.6; and directed fishing standards, Section 2.7. These sections focus on the elements of the bycatch management regimes for which changes are being considered.

For the purposes of the analysis of the alternatives, the inshore/offshore allocations recommended by the Council in June are not considered. There are two reasons for this. First, those allocations have not been approved by the Secretary. Second, the regulations that address the apportionment of the PSC limits between the two user groups or other aspects of the recommended allocations were not available.

2.1 BS/AI and GOA Hot Spot Authority

Alternative 1: No hot spot closure authority exists for the GOA. The existing hot spot closure authority in the BS/AI would continue. This authority provides the Regional Director with substantial discretionary authority with respect to the specifics of a closure. As a result of this discretionary authority, a public comment period of up to 30 days is required before a proposed closure can be implemented.

Alternative 2.1: Hot spot authority would be established in the GOA that parallels a revised hot spot authority in the BS/AI. The hot spot authority in the GOA and BS/AI proposed under this alternative would eliminate the need for a public comment period prior to the implementation of a closure by making the hot spot authority specific with respect to the bycatch rate that would trigger a closure, the area and fisheries to which a closure would apply, and the length of the closure. This alternative would require an amendment to the GOA FMP and a regulatory amendment under the BS/AI FMP.

Alternative 2.2: The BS/AI and GOA FMPs would be amended to authorize the establishment, by regulatory amendment, of time/area closures to reduce bycatch rates of prohibited species. Any closure of an area to reduce prohibited species bycatch rates would require a determination by the Secretary, in consultation with the Council, that the closure is based on the best available scientific information concerning the seasonal distribution and abundance of prohibited species and bycatch rates of prohibited species associated with various directed groundfish fisheries or gear types. A time/area closure to reduce bycatch rates of prohibited species would be based upon a determination that such a closure was necessary to prevent:

1. a continuation of relatively high bycatch rates of prohibited species within an area; or

2. the premature attainment of specified PSC limits or bycatch allowances and associated forgone opportunity for vessels to harvest available groundfish.

To the extent practicable, the Secretary, in consultation with the Council, will consider the following in making the above determinations:

1. the effect of overall fishing effort within an area;

2. catch per unit of effort and rate of harvest;

3. relative distribution and abundance of groundfish and prohibited species within an area;

4. observed bycatch rates of prohibited species in an area, including historical bycatch rates observed in target fisheries operating in the area;

5. economic impacts of fishing business affected; and

6. any other factor relevant to the conservation and management of the groundfish fisheries, prohibited species taken incidental to groundfish operations, or marine mammals.

Alternative 2.3 (preferred alternative): This alternative is a combination of Alternatives 1, 2.1, and 2.2. The existing discretionary hot spot authority for the BS/AI would be maintained, but the FMPs would be amended so that future changes to measures dealing with time/area closures could be implemented by regulatory amendment as described in Alternative 2.2. That regulatory amendment authority could be used to extend the discretionary hot spot authority of the BS/AI to the GOA, to implement non-discretionary hot spot authority such as that discussed in Alternative 2.1, or to make other changes with respect to time/area closures.

2.2 Vessel Incentive Programs

2.2.1. BS/AI Vessel Incentive Programs

Alternative 1: The current vessel incentive program is limited to the following fisheries and bycatch species:

1. Pacific cod (halibut) and

2. rock sole and yellowfin sole/other flatfish (halibut in all areas and king crab in Zone 1).

Alternative 2.1: The expanded vessel incentive program would apply to the following fisheries and bycatch species:

1. Pacific cod (halibut),

2. rock sole and yellowfin sole/other flatfish (halibut in all areas and king crab in Zone 1),

3. pollock when the bottom trawl pollock fishery is closed (halibut),

4. all other trawl fisheries (halibut), and

5. all trawl fisheries (chinook salmon).

These five items are not sub-options, they are considered together as a set of proposed vessel incentive program fisheries. As with the current program, seasonal bycatch rate standards would be established for each of these fisheries and it would be a violation for a vessel to exceed a standard.

Alternative 2.2 (preferred alternative): The expanded vessel incentive program would apply to the following fisheries and bycatch species:

1. Pacific cod (halibut),

2. yellowfin sole (halibut),

3. rock sole and other flatfish (halibut),

4. rockfish (halibut),

5. Greenland turbot, arrowtooth flounder, and sablefish (halibut),

6. pollock when the bottom trawl pollock fishery is closed (halibut),

7. all other trawl fisheries (halibut),

8. rock sole and yellowfin sole/other flatfish (king crab in Zone 1),

9. all trawl fisheries (chinook salmon).

The BS/AI vessel incentive program can be changed with a regulatory amendment.

2.2.2 GOA Vessel Incentive Programs

Alternative 1: The current vessel incentive program is limited to the following fisheries and bycatch species:

1. Pacific cod (halibut) and

2. rockfish (halibut).

Alternative 2 (preferred alternative): The expanded vessel incentive program would apply to the following fisheries and bycatch species:

1. Pacific cod (halibut),

2. rockfish (halibut),

3. pollock when the bottom trawl pollock fishery is closed (halibut),

4. all other trawl fisheries (halibut), and

5. all trawl fisheries (chinook salmon).

These five items are not sub-options, they are considered together as a set of proposed vessel incentive program fisheries. As with the current program, seasonal bycatch rate standards would be established for each of these fisheries and it would be a violation for a vessel to exceed a standard. For 1992, the Council recommended that the same halibut bycatch rate standard be used for all but the mid-water pollock fishery.

The GOA vessel incentive program can be changed with a regulatory amendment.

2.3 Fishery Starting Dates

2.3.1 BS/AI Starting Dates

Alternative 1: January 1 would remain the starting date of all BS/AI groundfish fisheries except for the flatfish fisheries that start May 1.

Alternative 2.1: Six options are being considered with respect to a new starting date except for the flatfish fisheries that currently start May 1, they are as follows:

1. January 15 (all gear),
2. February 1 (all gear),
3. February 15 (all gear),
4. January 15 (trawl gear),
5. February 1 (trawl gear), and
6. February 15 (trawl gear).

The end of each fishing year would remain December 31.

Alternative 2.2 (preferred alternative): Except for the flatfish fisheries that currently start May 1, the trawl fisheries would begin January 20. The end of each fishing year would remain December 31.

In the BS/AI, fishing seasons can be changed with a regulatory amendment.

2.3.2 GOA Starting Dates

Alternative 1: January 1 would remain the starting date of all GOA groundfish fisheries, except the longline sablefish fishery that does not start until May 15.

Alternative 2.1: Six options are being considered with respect to a new starting date for all fisheries except the longline sablefish fishery. These options are the same as the options for the BS/AI under Section 2.3.1, alternative 2.1. The end of the fishing year would remain December 31. In the GOA, fishing seasons can be changed with a regulatory amendment.

Alternative 2.2 (preferred alternative): Except for the rockfish fishery, the trawl fisheries would begin the third Monday of January 20. The end of each fishing year would remain December 31.

In the GOA, fishing seasons can be changed with a regulatory amendment.

2.3.3 Starting Date of the GOA Rockfish Fisheries

Alternative 1: January 1 would remain the starting date of GOA rockfish fisheries.

Alternative 2 (preferred alternative): Two options are being considered with respect to a new starting date for the GOA rockfish fishery. They are July 1 and July 15. The end of the fishing year would remain December 31. The season delay of the GOA rockfish fishery would be accompanied by a revision of the directed fishing standards for rockfish to reduce the allowable amount of rockfish that may be retained as bycatch in other target fisheries (see Alternative 2 under Section 2.7). The Council's preferred alternative to delay the GOA rockfish trawl fishery to the beginning of the weekly reporting period closes to July 1.

2.4 BS/AI Halibut PSC Mortality Limit for the Non-Trawl Fisheries

Alternative 1: There are halibut PSC limits only for trawl fisheries.

Alternative 2.1: A halibut PSC mortality limit for the non-trawl fisheries would be established. The 6 options being considered with respect to the level of the limit are:

1. 500 mt as part of the current 5,333 mt mortality limit,
2. 1,000 mt as part of the current 5,333 mt mortality limit,
3. 1,500 mt as part of the current 5,333 mt mortality limit,
4. 500 mt but not as part of the current 5,333 mt mortality limit,
5. 1,000 mt but not as part of the current 5,333 mt mortality limit, and
6. 1,500 mt but not as part of the current 5,333 mt mortality limit.

For the purposes of the analysis, it will be assumed that the discard mortality rate in the BS/AI trawl fishery is 100% and, therefore, that the current 5,333 mt halibut PSC limit for the trawl fishery equivalently can be thought of as either a catch or mortality limit. Therefore, for options 1 - 3, the trawl limit would be reduced by 500 mt, 1,000 mt, and 1,500 mt, respectively. For all six options, the limit for the non-trawl gear group will be considered a discard mortality limit and the corresponding catch limits will be calculated using the best available estimates of discard mortality rates. Currently, these are 16% and 12%, respectively, for longline and pot gear.

Alternative 2.2 (preferred alternative): For 1992, a halibut PSC bycatch mortality limit of 750 mt would be established for the non-trawl fisheries and the halibut PSC bycatch limit for the trawl fisheries would be reduced from 5,333 mt to 5,033 mt. At the end of the 3rd quarter of 1992, any amount of halibut PSC that will not be used in the 4th quarter non-trawl fisheries will be converted to trawl PSC.

A plan amendment is required to establish a halibut PSC mortality limit for the non-trawl fisheries and to change the limit for the trawl fisheries.

2.5 PSC Limit Allowances for BS/AI Trawl Fisheries

Alternative 1: There are currently 4 trawl fisheries that receive crab and halibut PSC limit allowances. They are:

1. Greenland turbot,
2. rock sole,
3. yellowfin sole/other flatfish, and
4. P cod, b.t. pollock, m-w pollock, rockfish, Atka mackerel, sablefish, arrowtooth flounder, and other.

When the PSC apportionment of group 4 is taken, only the cod and bottom trawl pollock fisheries close. The mid-water pollock fishery receives a separate herring PSC limit allowance.

Alternative 2.1: The crab and halibut PSC limit allowances would be received by the following trawl fisheries:

1. Greenland turbot and arrowtooth flounder,
2. yellowfin sole,
3. rock sole and other flatfish,
4. P cod, and
5. b.t. pollock, m-w pollock, rockfish, Atka mackerel, sablefish, and other.

When the PSC apportionment of group 5 is taken, the Atka mackerel and m-w pollock fisheries would be excluded from the closure because the bycatch rates are much lower in these two fisheries. The mid-water pollock fishery would continue to receive a separate herring PSC limit allowance. These four items are not sub-options, they are considered together as a set of proposed PSC limit allowance fisheries.

Alternative 2.2 (preferred alternative):. The crab and halibut PSC limit allowances would be received by the following trawl fisheries:

1. Greenland turbot, arrowtooth flounder, and sablefish,
2. yellowfin sole,
3. rock sole and other flatfish,
4. P cod,
5. rockfish, and
6. b.t. pollock, m-w pollock, Atka mackerel, and other.

When the PSC apportionment of group 6 is taken, the Atka mackerel and m-w pollock fisheries would be excluded from the closure because the bycatch rates are much lower in these two fisheries. The mid-water pollock fishery would continue to receive a separate herring PSC limit allowance.

In the BS/AI, the trawl fisheries that receive PSC limit allowances can be changed with a regulatory amendment.

2.6 BS/AI and GOA Fishery Definitions

Alternative 1: There are two separate sets of definitions of fisheries for the purposes of monitoring PSC limit allowances and the vessel incentive program.

For the purposes of the PSC allowance program, each trawler vessel is assigned to a fishery for a week and area based on the following definitions. The first set of criteria that are met determine the fishery to which the vessel is assigned. Retained catch is calculated in round weight equivalents.

1. DAP midwater pollock fishery, if pollock is at least 95 percent of the vessel's total groundfish catch.

2. DAP Greenland turbot fishery, if the retained catch of Greenland turbot and arrowtooth flounder, in the aggregate, is at least 20 percent of the total retained catch of all other groundfish.

3. DAP rock sole fishery, if the retained catch of rock sole is at least 20 percent of the total retained catch of all other groundfish.

4. DAP flatfish fishery, if the retained catch of yellowfin sole and "other flatfish," in the aggregate, is at least 20 percent of the total retained catch of all other groundfish.

5. DAP other fishery, if the vessel was in a DAP fishery but none of the above criteria were met.

6. JVP flatfish fishery means JVP fishing with trawl gear during any weekly reporting period which results in deliveries to foreign vessels of amounts of yellowfin sole, rock sole, and "other flatfish," in aggregate amounts, that are 20 percent or more of the total amount of groundfish delivered calculated in round weight equivalents.

For the purposes of the vessel incentive program, each vessel is assigned to a fishery for a week based on the following definitions. The first set of criteria that are met will determine the fishery to which the vessel is assigned. The BS/AI categories are:

1. Greenland turbot fishery, if Greenland turbot is at least 35 percent of the vessel's total groundfish catch, excluding non-allocated species.

2. Pacific cod fishery, if Pacific cod is at least 45 percent of the vessel's total groundfish catch, excluding non-allocated species.

3. Flatfish fishery, if yellowfin sole, rock sole, and other flatfish comprise at least 40 percent of the vessel's total groundfish catch, excluding non-allocated species.

4. Other non-pelagic trawl fishery, if pollock is less than 95 percent of the vessel's total groundfish catch, excluding non-allocated species.

For the GOA, a trawl vessel's observed GOA groundfish catch of the TAC species each week, excluding arrowtooth flounder, is used as a basis for assigning it to one of three fisheries for that week. Arrowtooth flounder is excluded because, although this species may comprise a large percentage of groundfish catch, it typically is not retained. The first set of criteria that a vessel meets will determine the fishery to which the vessel is assigned by NMFS.

1. Pacific cod fishery, if Pacific cod is at least 45 percent of the vessel's total groundfish catch, excluding non-allocated species and arrowtooth flounder.

2. Bottom rockfish fishery, if rockfish (Pacific Ocean perch, shortraker/rougheye rockfish, slope rockfish, demersal shelf rockfish, and thornyhead rockfish, in the aggregate) is at least 30 percent of the vessel's total groundfish catch, excluding non-allocated species and arrowtooth flounder.

3. Other non-pelagic trawl fishery, if pollock is less than 95 percent of the vessel's total groundfish catch, excluding non-allocated species and arrowtooth flounder.

Alternative 2 (preferred alternative): The two sets of definitions would be changed so that one set of definitions would be used for monitoring both the vessel incentive program and PSC limit allowances.

The definitions of fisheries for both the incentive program and the PSC limit allowances would be as follows:

1. Mid-water pollock if pollock is $\geq$ 95% of the total groundfish catch, excluding non-allocated species.

2. Other targets determined by dominant TAC species in terms of the round weight equivalent of retained catch.

3. For the BS/AI, a flatfish fishery consisting of rock sole, yellowfin sole, and other flatfish (excluding Greenland turbot and arrowtooth flounder) will be defined and then subdivided into three fisheries. If yellowfin sole accounts for at least 70% of the retained flatfish catch, it is a yellowfin sole fishery. Otherwise, it is a rock sole or other flatfish fishery depending on which is dominant in terms of retained catch.

These definitions will continue to be applied by area, week, and gear for monitoring PSC allowances and applied by week and gear, but not by area, for monitoring the incentive program.

For both the BS/AI and GOA, estimates of total groundfish catch of the TAC species, not retained catch, would continue to be used to: (1) set bycatch rate standards for the incentive program and for hot spot authority closures; (2) monitor the standards; and (3) estimate total bycatch.

2.7 Directed Fishing Standards

Alternative 1: The directed fishing standards for Pacific cod in the BS/AI and groundfish in the GOA would remain at 20 percent when caught by vessels using any trawl gear, directed fishing by vessels using pelagic trawl gear for all groundfish would be allowed after the halibut PSC allowance had been reached, and non-pelagic trawls could still be maintained in a fishing condition by vessels fishing in areas closed to non-pelagic trawling for a particular target species category.

Alternative 2 (preferred alternative): The regulations would be amended to allow more effective enforcement of directed fishery closures and to further limit trawl bycatch amounts of halibut after a halibut PSC bycatch allowance specified for a BS/AI trawl fisheries or the halibut PSC limit specified for GOA trawl gear has been reached. Under this alternative, management measures would be incorporated into BS/AI and GOA regulations that are similar to those implemented under an August 13, 1991, interim emergency rule (56 FR 38346). Furthermore, the definition of fishing trip for purposes of the directed fishing rule would be amended so that a trip terminates at the end of a weekly reporting period. Specifically, the following measures would be implemented under this alternative.

1. With one exception, trawling for groundfish in the GOA would be prohibited when the halibut prohibited species catch (PSC) limit or seasonal allowance thereof is reached. Directed fishing for pollock by vessels using pelagic trawls would be allowed.

2. Directed fishing standards would be specified for aggregate amounts of GOA and BS/AI groundfish other than pollock, that are caught while fishing for pollock with pelagic trawl gear. Two options for an aggregate directed fishing standard are proposed at five and seven percent. The aggregate directed fishing standard for groundfish would not preempt more conservative standards established for specific target fisheries.

3. Directed fishing standards for GOA rockfish species of the genera Sebastes and Sebastolobus would be reduced to 15 percent of the aggregate amounts of deepwater flatfish, flathead sole, arrowtooth flounder, and sablefish; plus 5 percent of the aggregate amount of all other fish species retained at the same time by a vessel during the same fishing trip.

4. For purposes of the directed fishing rule, the operator of a vessel is engaged in a single fishing trip, from the date when fishing commences or continues in an area after the effective date of a notice prohibiting directed fishing in that area, until the first date on which at least one of following occurs: (1) a weekly reporting period ends; (2) the vessel enters or leaves a reporting area for which an area specific TAC or directed fishing standard is established; or (3) any fish or fish product is offloaded or transferred from that vessel.

3.0 ANALYSES OF THE ALTERNATIVES

This section contains a qualitative analysis of all of the elements of the two alternatives and a quantitative analysis of all of the elements except hot spot authority and the fishery definitions. The qualitative analysis and quantitative analysis that is not based on the bycatch model are presented by element in Sections 3.1 - 3.7. The quantitative analysis presented in Section 3.8 is based on the bycatch simulation model.

3.1 BS/AI and GOA hot spot authority

At times, exceptionally high bycatches of prohibited species may occur in the Alaska groundfish fisheries in certain areas and during short time periods. The occurrences of such a hot spot can increase significantly the average bycatch rate of a fishery. Inseason authority potentially could be used to reduce the average bycatch rates in a fishery by temporarily closing hot spots.

Limited hot spot authority already exists under the BS/AI FMP and its implementing regulations (see 50 CFR 675.20(e)(1)(iv)). This authority was implemented as part of Amendment 16a to the BS/AI FMP. Hot spot authority, however, has not been implemented under the GOA FMP. NMFS has determined that the current hot spot authority in the BS/AI will not be as effective as intended because implementing procedures require a comment period of up to 30 days before becoming effective. As a result, too much time would lapse before a hot spot area could be closed to fishing. During this time, unacceptable amounts of bycatch species could be caught before a fishery would be closed and, by that time, the area may no longer be a hot spot.

As a result of the deficiencies of the current hot spot authority in the BS/AI and the lack of any such authority in the GOA, the Council is considering two alternative improvements to the BS/AI hot spot authority and the establishment of similar authority in the GOA. The first change being considered for the BS/AI can be accomplished with a regulatory amendment. The other changes would require a plan amendment.

The comment period delay under the current hot spot authority occurs because the current regulations provide for substantial discretionary authority by the Regional Director. The requirement of a comment period of up to 30 days can be eliminated by limiting the discretionary authority. This can be done with implementing regulations that are specific concerning what bycatch rate will trigger a closure, the fisheries and areas to be included in a closure, and the length of the closure.

Two independent analyses by NMFS staff have determined that the hot spot authority proposed under Alternative 2.1 would probably not be effective in reducing bycatch rates and that it could in fact increase bycatch rates. The problem is that by the time a bycatch rate for an area and fishery has been reported and the decision is made to close an area, the area may no longer have an unusually high bycatch rate. By then, it may have a lower bycatch rate than other areas, in which case, the closure would increase the average bycatch rate for the period the closure is in effect. The analysis is presented in Appendix 1.

The time/area closure authority proposed under Alternative 2.2 would allow the Secretary, in consultation with the Council, to develop and implement regulatory amendments to close areas during those times of the fishing year that an area has been observed to exhibit high bycatch rates. While this authority would not allow for timely inseason closures of unanticipated 'hot spots,' it would allow for the deliberative development and implementation of time/area closures in areas observed to have consistently high bycatch rates during certain times of the year. This alternative would provide a more expedient mechanism for implementing time/area closures.

The preferred alternative (2.3), combines the benefits of the current hot spot authority in the BS/AI with those of Alternative 2.2. The increased regulatory authority could be used to extend the discretionary hot spot authority of the BS/AI to the GOA, to implement non-discretionary hot spot authority such as that discussed in Alternative 2.1, or to make other changes with respect to time/area closures. In so doing, the preferred alternative meets the Council's objective of providing the Regional Director with as much flexibility as possible to deal with both expected and unexpected bycatch hot spots. If the regulatory amendment authority provided by Alternative 2.3 is only used when there is adequate analysis to conclude that the closure would decrease the bycatch problem, this alternative would tend to result in net benefits to the nation.

3.2 BS/AI and GOA Vessel Incentive Programs

For a given PSC limit, or apportionment thereof, the amount of groundfish that can be harvested prior to a PSC induced closure is determined by the average bycatch rate of the fishery. Therefore,

a PSC limit was expected by some to act as an incentive to fishermen to reduce bycatch rates. The increased opportunity to harvest groundfish, which results from reduced bycatch rates, benefits the groundfish fleet as a whole. Practically, however, individual operations often harvest groundfish rapidly and ignore bycatch to meet catch expectations of the individual vessels before the fishery is closed.

This behavior results in bycatch rates that are unnecessarily high. Therefore, it imposes a much higher cost on the fishery in terms of the foregone opportunity to harvest available groundfish. A fishing operation that concentrates on keeping its bycatch rate low bears the costs of doing so in terms of decreased catch and increased operating costs to fish "cleaner." Currently, the operation does not receive benefits proportional to its reduction of bycatch or the costs it incurs to fish "cleaner." An operation that does not act to control its bycatch rates will not bear such costs. Also, it will not likely share fully in the cost of the foregone opportunities it imposes on the fishery as a whole by contributing to premature closures. Indeed, such an operation may receive a disproportionately large share of the benefit of actions taken by others to reduce the fishery's average bycatch rate.

To begin to address this situation, the Council adopted a vessel incentive program to encourage vessel operators to change fishing practices that result in high bycatch rates of prohibited species. This program became effective May 6, 1991, under rulemaking that implemented revised Amendment 16 to the BS/AI FMP and revised Amendment 21 to the GOA FMP. As noted in Section 2.2, it currently applies to a limited number of fisheries and bycatch species.

During 1991, three bycatch management concerns arose that initiated Council recommendations to consider expanding the incentive program. These concerns are listed and discussed below.

1. The ability of fishermen to modify bottom trawl gear so that it met the definition of a "pelagic trawl" allowed fishermen to continue to fish on bottom with high bycatch rates after the PSC limits for non-pelagic trawl gear had been taken. This severely limited the effectiveness of the non-pelagic trawl gear closures and resulted in an unexpectedly large amount of halibut being taken as bycatch in the "pelagic trawl" fishery.

2. The Council considered salmon bycatch amounts in the 1991 groundfish trawl fisheries to be unacceptably high (Table 2). Of special concern was the large number of chinook salmon taken in the BS/AI mid-water pollock fishery and the GOA rockfish fishery. As of September 29, 1991, about 37,700 chinook salmon had been taken in BS/AI trawl operations and about 36,100 chinook salmon had been taken in GOA trawl operations. The 1991 BS/AI average chinook salmon bycatch rates, defined in terms of chinook salmon per 1 mt of groundfish catch, ranged from less than 0.005 in the sablefish, arrowtooth flounder, yellowfin sole and other flatfish fisheries to 0.09 in the rockfish fisheries (Table 4). The 1991 GOA average chinook salmon bycatch rates ranged from less than 0.005 in the sablefish fishery to 1.12 in the rockfish fishery.

3. The inability to rapidly and effectively implement a closure with the BS/AI hot spot authority eliminated a potential safeguard against fisheries with unexpectedly high bycatch rates.

A specific change in the vessel incentive program has been proposed to deal with each of these three concerns. The first concern, for other than the pollock fishery, was eliminated by the provision in Amendment 16a that requires the closure of the BS/AI trawl cod fishery once the other fishery PSC limit allowance is taken. The addition of the pelagic trawl pollock fishery to the incentive program

for periods and areas in which only pelagic trawls can be used should eliminate this concern for the pollock fishery. It does this for vessels with observers by, in practice, replacing a gear definition with a bycatch rate performance standard. As a result, once only pelagic trawl gear is permitted in an area, fishermen who continue to fish but cannot maintain the low bycatch rates expected in the mid-water pollock fishery would be in violation. This is expected to result in fishing vessels with observers operating within the intent of the bottom trawl closures and prevent unexpectedly high bycatch in the "pelagic trawl" fishery.

The halibut bycatch rate standard for the pelagic pollock fishery is intended to differentiate between mid-water and other trawl fisheries. For 1990 and 1991 through September 29 combined, a rate of 0.1% does this. About 94% of the catch in the BS/AI mid-water pollock fishery was associated with monthly halibut bycatch rates at or below 0.1%. Although 45% of the catch in the bottom trawl pollock fishery is associated with bycatch rates below 0.1%, the average bycatch rate in that fishery was 0.42% and the average rate for the observations with rates below 0.1% was 0.03%. This is less than the average for the pelagic pollock fishery as a whole.

A bycatch rate standard of 0.1% probably is appropriate for the Gulf. For 1990 and 1991 through September 29 combined, all of the catch in the Gulf mid-water pollock fishery was associated with bycatch mortality rates below 0.1%. Only 22% of the catch in the Gulf bottom trawl pollock fishery was associated with rates of less than 0.1% and the average rate for that 22% was 0.0159% compared to 0.33% for the bottom trawl pollock fishery as a whole. As noted above, the halibut bycatch information presented in this report has been adjusted to reflect discard mortality rates. Because halibut discard mortality was assumed to be 50% in the GOA trawl fisheries, the actual bycatch rate standard without adjusting for discard mortality would be .2%.

The second concern, that is the lack of control of chinook salmon bycatch, is in part addressed by adding chinook to the vessel incentive program. The unexpectedly high bycatch of chinook in the BS/AI and GOA occurred principally due to exceptionally high bycatch rates by a small part of the fleet. By adding chinook to the incentive program, each vessel is provided an incentive to avoid fishing practices that result in unusually high chinook bycatch rates.

If the monthly GOA chinook salmon bycatch rate standard had been set at 0.2 salmon per metric ton of groundfish catch for 1990 and 1991 and if vessels with rates above that level had acted like the other vessels, the average bycatch rate would have been 0.0472 instead of 0.1369. That is, there would have been an 65.5% reduction in chinook bycatch. If instead, it is assumed that vessels with rates at least 100% above that level would have acted like the other vessels, the average bycatch rate would have been 0.0720 instead of 0.1369. This is a 47.4% reduction in the bycatch rate. For 1990 and 1991 combined, a standard of 0.2 would have affected about 26% of the catch in the flatfish fisheries and substantially less of the catch in the other trawl fisheries (Table 7). For the trawl fisheries as a whole, 85% of the catch was associated with bycatch rates at or below this tentative standard.

Similarly, if the monthly BS/AI chinook bycatch rate standard had been set at 0.044 salmon per metric ton of groundfish catch for 1990 and 1991 and if vessels with rates above that level had acted like the other vessels, the average bycatch rate would have been 0.0068 instead of 0.0154. That is, there would have been an 55.8% reduction in chinook bycatch. If instead, it is assumed that vessels with rates at least 100% above that level would have acted like the other vessels, the average bycatch rate would have been 0.0098 instead of 0.0154. This is a 36.4% reduction in the bycatch rate. For 1990 and 1991 through September 29 combined, a standard of 0.044 would have affected about 24% of the catch in the Pacific cod fishery and substantially less of the catch in the other trawl fisheries. For the trawl fisheries as a whole, 91% of the catch was associated with bycatch rates at or below this tentative standard.

Table 7 Catch and bycatch rates associated with the tentative bycatch rate standards for the aditional vessel incentive programs.

BS/Al chinook salmon standard of 0.044 salmon per metric ton of groundfish

Fishery	Catch below standard	Adjusted mean bycatch rate	Catch below 2 x standard	Adjusted mean bycatch rate	Mean bycatch rate
Atka M.	100%	0.004	100%	0.004	0.004
b.t. pollock	94%	0.007	97%	0.008	0.017
P. cod	76%	0.025	89%	0.022	0.043
O. flat	100%	0.000	100%	0.000	0.000
yfs	99%	0.001	99%	0.001	0.003
rock sole	97%	0.004	97%	0.004	0.010
m-w pollock	93%	0.007	98%	0.009	0.014
sablefish	100%	0.001	100%	0.001	0.001
turbot	95%	0.001	97%	0.003	0.010
arrowtooth	100%	0.000	100%	0.000	0.000
rockfish	91%	0.003	93%	0.004	0.021
other	97%	0.005	98%	0.006	0.015
all the above	91%	0.0068	97%	0.0098	0.0154

BS/Al halibut bycatch mortality rate standard of 1% (0.01 mt of halibut per mt of groundfish)

Fishery	Catch below standard	Adjusted mean bycatch rate	Catch below 2 x standard	Adjusted mean bycatch rate	Mean bycatch rate
Atka M.	98%	0.25%	99%	0.25%	0.35%
b.t. pollock	90%	0.20%	96%	0.27%	0.42%
m-w pollock	99%	0.02%	100%	0.03%	0.03%
rockfish	72%	0.53%	93%	0.71%	0.98%
sablefish	46%	0.27%	50%	0.40%	4.54%
turbot	61%	0.32%	77%	0.54%	2.70%
arrowtooth	79%	0.37%	86%	0.48%	1.22%
other	57%	0.26%	72%	0.49%	1.22%
all the above	98%	0.0572%	99%	0.0759%	0.1095%

GOA chinook salmon standard of 0.2 salmon per metric ton of groundfish

Fishery	Catch below standard	Adjusted mean bycatch rate	Catch below 2 x standard	Adjusted mean bycatch rate	Mean bycatch rate
b.t. pollock	82%	0.041	93%	0.071	0.098
P. cod	96%	0.049	99%	0.055	0.065
m-w pollock	96%	0.047	100%	0.056	0.056
sablefish	97%	0.070	100%	0.075	0.075
rockfish	82%	0.023	93%	0.052	0.456
flatfish	74%	0.062	78%	0.075	0.225
all the above	85%	0.0472	98%	0.0720	0.1369

GOA halibut bycatch mortality rate standard of 2.7% (0.027 mt halibut per mt of groundfish)

Fishery	Catch below standard	Adjusted mean bycatch rate	Catch below 2 x standard	Adjusted mean bycatch rate	Mean bycatch rate
b.t. pollock	100%	0.292	100%	0.292	0.326
m-w pollock	100%	0.007	100%	0.007	0.007
sablefish	97%	1.643	97%	1.643	1.852
flatfish	76%	1.721	96%	2.130	2.297
all the above	96%	0.6262	99%	0.7318	0.7648

The third concern, the inability of hot spot authority to act as a safeguard against fisheries with unexpectedly high bycatch rates in certain time/areas that decrease the amount of groundfish that can be harvested before a halibut PSC limit is taken, is addressed by extending the incentive program for halibut bycatch to all other trawl fisheries. This would be done by establishing a single halibut bycatch rate standard for all the trawl fisheries that would not otherwise be subject to the incentive program. The objective of such a standard is to provide all fishermen with an incentive to avoid what would be considered to be an exceptionally high bycatch rate in any of these fisheries.

If the monthly GOA halibut bycatch rate standard had been set at 2.7% (i.e., 2.7 mt of halibut per 100 mt of groundfish) for all trawl fisheries, except the Pacific cod and rockfish fisheries, in 1990 and 1991, and if vessels with rates above that level had acted like the other vessels, the average bycatch rate would have been 0.626% instead of 0.765%. That is, there would have been a 18.2% reduction in halibut bycatch in these other trawl fisheries. If instead, it is assumed that vessels with rates at least 100% above that level would have acted like the other vessels, the average bycatch rate would have been 0.732% instead of 0.765%. This is a 4.3% reduction in the bycatch rate. For 1990 and 1991 combined, a standard of 2.7% would have affected about 24% of the catch in the flatfish fisheries and substantially less of the catch in the other trawl fisheries. For these trawl fisheries as a whole, 96% of the catch was associated with bycatch rates at or below this tentative standard.

Similarly, if the monthly BS/AI halibut bycatch rate standard had been set at 1% for all trawl fisheries, except the Pacific cod, rock sole, and yellowfin sole/other flatfish fisheries, and if vessels with rates above that level had acted like the other vessels, the average bycatch rate for 1990 and 1991 combined would have been 0.0572% instead of 0.1095%. That is, there would have been a 47.8% reduction in halibut bycatch in these other trawl fisheries. If instead, it is assumed that vessels with rates at least 100% above that level would have acted like the other vessels, the average bycatch rate would have been 0.0759% instead of 0.1095%. This is a 30.7% reduction in the halibut bycatch rate for that group of fisheries. For 1990 and 1991 combined, a standard of 1% would have only affected 54% of the catch in the sablefish fishery and substantially less of the catch in the other trawl fisheries. For these fisheries as a whole, about 2% of their total catch was associated with halibut bycatch rates greater than 1%.

The preferred alternative for the BS/AI allows for the establishment of separate halibut bycatch rate standards for each of trawl fishery category that is eligible to receive separate PSC bycatch allowances under alternative 2.2. Furthermore, a separate halibut bycatch rate standard would be specified for the mid-water pollock fishery when the bottom trawl pollock fishery is closed. This was done to allow for natural differences in typical bycatch rates among these fisheries. This tends to make the incentive program more effective and equitable, but it also tends to decrease the number of observations for a vessel for a fishery in any month.

3.3 Starting Dates for BS/AI and GOA Fisheries

Because there is sufficient harvesting and processing capacity to allow most TACs to be utilized fully in fisheries that last much less than 12 months, the beginning of fishing seasons can be selected to reduce bycatch rates or to meet other objectives. In an open access fishery, each fishing operations has an incentive to begin fishing as soon as possible, even if it is in the best interest of the fleet as a whole to delay the start of a fishery. Therefore, by delaying the start of a fishery to a mutually beneficial date, the Council can provide benefits that the fleet would not otherwise receive.

However, due to the annual variability of seasonal bycatch rates, differences in the optimal seasons among individual fishing operations, and annual variability in other factors that determine the optimal seasons for the fleet as a whole or for individual operations, it may be very difficult to predict the optimal season or to find one that is mutually beneficial.

In 1991, bycatch of chinook salmon in the BS/AI and GOA groundfish trawl fisheries totaled about 73,800 fish through September 29. About half was taken in each of these two areas. Though salmon is a prohibited species in both areas and cannot be retained, there are no caps established, as with halibut, crab, and herring, which result in groundfish fishery closures. As a partial short-term solution to the salmon bycatch problem, the Council is considering proposed changes/delays in the groundfish seasons and the previously discussed addition of chinook salmon to the vessel incentive program.

There is also evidence that such a delay could reduce average halibut bycatch rates in some groundfish fisheries. Such an overall season delay has been proposed in the past for reasons other than bycatch. The pollock roe fishery has the potential to benefit from a season delay that results in more of the harvest occurring later in the first quarter when the roe is at peak quality and value.

In terms of chinook bycatch, the highest rates in the BS/AI have occurred in the first few weeks of the year while in the GOA, the highest rates occurred later in the year (in March) in the rockfish trawl fisheries. Nevertheless, there has been substantial bycatch of salmon in the first few weeks of the year in the GOA as well. The problem of high salmon bycatch in the GOA rockfish fisheries is being addressed by a further season delay for that fishery.

A major reason to extend the overall season delay to the GOA is to have concurrent season openings in the two areas and, thereby, decrease the opportunity for vessels that fish principally in the BS/AI to also fish in the GOA. Limiting competition from BS/AI vessels will tend to benefit the GOA vessels and those who benefit from their catch. But it will do so at the expense of those who benefit from the catch of BS/AI vessels. It will also tend to increase the number of vessels required to take the BS/AI and GOA TACs. Finally, it will tend to result in less intensive fisheries in the Gulf. This may decrease the potential for the groundfish fisheries in the GOA to have an adverse effect on marine mammal populations. In the past, the lack of concurrent seasons has resulted in what some considered an unacceptably high level of competition from BS/AI vessels and more intensive fisheries.

The effects of alternative starting dates will in part be determined by the amount of catch that would be redistributed to later in the year. Estimates of the percentage of annual catch by fishery that occurred in 1990 and 1991 in each of three alternative periods that would be closed at the beginning of the year are presented in Table 8.

The effects on bycatch of the fishery delays being considered were estimated using weekly catch and bycatch data for 1990 and 1991. Two sets of estimates were made. They are based on the assumptions that: (1) total annual catch would not have changed had the fisheries been delayed and (2) the catch that did occur before the proposed start dates would have been redistributed proportionally to actual catch during the remainder of either the first quarter or the year without changing the bycatch rates of either of these two remaining periods. Therefore, the two sets of estimates differ due to the assumption concerning whether the actual catch during a proposed closure would have been made up in the first quarter or during the rest of the year as a whole.

Both sets of estimates are driven by the estimated weekly bycatch rates for 1990 and 1991 that were in part determined by the PSC limit induced area closures that occurred in 1990 and 1991. A delay in the fisheries would tend to delay the dates of these area closures and, thereby, change the weekly bycatch rates for some fisheries. It is not known how the failure to account for these changes in weekly bycatch rates affects the estimates of the effects of the season delays. The actual closures for 1990 and 1991 are summarized in Table 1.

Table 8 Percentage of annual groundfish catch by fishery during the first 2, 4, and 6 weeks of 1990 and 1991.

Gear	Target	Period	BSAI 90	BSAI 91	GOA 90	GOA 91
Longline	P. Cod	Jan 1 - Jan 14	1.4	1.7	.	2.4
		Jan 1 - Jan 27	3.6	5.2	.	3.6
		Jan 1 - Feb 10	7.2	8.6	.	7.1
	Rockfish	Jan 1 - Jan 14	.0	.0	.1	5.0
		Jan 1 - Jan 27	.0	.0	5.2	7.8
		Jan 1 - Feb 10	.0	.0	6.7	9.6
	Sablefish	Jan 1 - Jan 14	3.2	2.5	.0	.0
		Jan 1 - Jan 27	6.5	4.7	.0	.0
		Jan 1 - Feb 10	10.2	7.7	.0	.0
	Other	Jan 1 - Jan 14	.0	11.4	4.9	.0
		Jan 1 - Jan 27	.0	11.4	20.5	.0
		Jan 1 - Feb 10	.0	11.4	27.2	.0
Pot	P. Cod	Jan 1 - Jan 14	.0	.0	.	3.9
		Jan 1 - Jan 27	.0	.0	.	8.4
		Jan 1 - Feb 10	.0	.0	.	13.9
	Other	Jan 1 - Jan 14	.0	.0	.0	76.6
		Jan 1 - Jan 27	.0	.0	.0	76.6
		Jan 1 - Feb 10	.0	.0	.1	76.6
Trawl	Atka Mackerel	Jan 1 - Jan 14	.0	8.9	.	.
		Jan 1 - Jan 27	1.1	20.1	.	.
		Jan 1 - Feb 10	1.8	29.8	.	.
	Pollock	Jan 1 - Jan 14	4.2	5.7	.6	9.7
		Jan 1 - Jan 27	6.6	14.2	.6	24.5
		Jan 1 - Feb 10	7.2	26.4	.6	32.7
	P. Cod	Jan 1 - Jan 14	3.9	4.4	.	.7
		Jan 1 - Jan 27	10.0	13.9	.	2.7
		Jan 1 - Feb 10	17.8	19.2	.	10.5
	Deep flatfish	Jan 1 - Jan 14	.	.	.	1.5
		Jan 1 - Jan 27	.	.	.	2.5
		Jan 1 - Feb 10	.	.	.	2.7
	Flatfish	Jan 1 - Jan 14	3.3	.1	.3	.
		Jan 1 - Jan 27	3.3	1.3	1.3	.
		Jan 1 - Feb 10	3.3	1.6	2.0	.
	Shallow Flatfish	Jan 1 - Jan 14	.	.	.	.0
		Jan 1 - Jan 27	.	.	.	.0
		Jan 1 - Feb 10	.	.	.	7.9
	Rockfish	Jan 1 - Jan 14	.0	.0	.4	.0
		Jan 1 - Jan 27	.0	.0	.4	.0
		Jan 1 - Feb 10	.0	.0	.5	.0
	Other	Jan 1 - Jan 14	.0	.0	.4	.0
		Jan 1 - Jan 27	.0	.0	1.6	.0
		Jan 1 - Feb 10	.1	.0	3.8	.0
	Pel. Pollock	Jan 1 - Jan 14	2.7	7.7	11.3	5.6
		Jan 1 - Jan 27	6.5	17.2	26.8	8.6
		Jan 1 - Feb 10	11.3	25.3	28.1	18.8
	Rock sole	Jan 1 - Jan 14	16.1	6.8	.	.
		Jan 1 - Jan 27	35.4	13.6	.	.
		Jan 1 - Feb 10	50.4	22.5	.	.
	Sablefish	Jan 1 - Jan 14	4.8	11.4	.9	.0
		Jan 1 - Jan 27	27.7	11.4	.9	.0
		Jan 1 - Feb 10	27.7	11.4	.9	.0
	Turbot	Jan 1 - Jan 14	.3	.0	.0	.
		Jan 1 - Jan 27	.3	.0	.0	.
		Jan 1 - Feb 10	.3	.0	.0	.

Notes: With the exception of rock sole, no BSAI flatfish catch is included because currently the other flatfish fisheries do not open until May 1. These estimates are based on data provided by the Alaska Region. The 1991 data are through September 29. In the GOA for 1990, Pacific cod is included as other.

3.3.1 Season Delays in the Bering Sea/Aleutian Islands

Proposals to delay the start of the BS/AI groundfish fisheries are being considered as a method of reducing salmon and halibut bycatch rates. However, such delays may have other effects on the fisheries. For example, they may: (1) change pollock roe recovery rates and the value of the A season pollock fishery; (2) change the duration and value of the roe rock sole fishery; (3) change fishing costs through their effects on catch per unit of effort; and (4) change the effects of the fisheries on fishery stocks or marine mammals. Weekly bycatch rates for halibut and chinook salmon by fishery for 1990 and 1991 are presented in Appendix 2.

The estimates in Table 9 are based upon the assumptions that: (1) catch that occurred during the first 2, 4, or 6 weeks would have been redistributed on the basis of catch during the rest of the quarter and (2) the bycatch rates during the rest of the quarter would not have changed. These estimates indicate that in 1990 none of the delays would have changed substantially halibut or chinook bycatch in the trawl fisheries. It was estimated that a January 15 opening would have increased trawl halibut and chinook bycatch, respectively, by 1.1% and 2.7%. It was estimated that a February 1 opening would have reduced trawl halibut bycatch by 5.5% and crab bycatch by substantially more without changing chinook bycatch. The estimated crab and halibut savings are probably overstated because had the fisheries begun February 1, the DAP flatfish closures of Zone 1/2H and the entire BS/AI would have occurred later and the average weekly bycatch rates of crab would have been higher than the actual bycatch rates during February and March.

It was estimated that in 1991 a two-week delay would have resulted in a significant decrease in chinook bycatch by the trawl fisheries but no other significant changes in halibut or chinook bycatch. Compared to a 2-week delay, further delays in 1991 would have increased trawl fishery and total groundfish fishery bycatch of halibut and chinook. The results for the two years together are similar to those of 1991 except that the percentage or absolute increase in halibut bycatch with a delay of more than two weeks is moderated.

The estimated effects change somewhat when it is assumed that catch would have been redistributed throughout the rest of the year, not just during the rest of the quarter (Table 10). However, because there is probably sufficient harvesting and processing capacity to prevent the proposed delays from decreasing catch during the first quarter, the estimates in Table 9 are thought to be better.

The differences in the estimated effects of the delays for 1990 and 1991 indicate that the bycatch effects of a delay will vary from year to year. Therefore, it is difficult to know with any certainty what the direction of change in bycatch by species will be as the result of a specific delay. Therefore, it is difficult to identify a delay as being clearly preferable in terms of its effects on bycatch.

In the BS/AI, fishing for pollock began on January 1 and continued until about the end of March, when the A season allowance was reached, two months ahead of the B season opening on June 1. Catch through the end of February averaged about 55,000 mt per week, with the peak harvest occurring in mid-February. Weekly catch, wholesale value, and roe production data for the first three months of 1990 and 1991 pollock fisheries are presented by area in Table 11.

Catch in the AI pollock fisheries was very limited in the first quarter of 1990. In 1991, most of the first quarter catch occurred in March after the BS pollock fishery had closed. However, the roe recovery rates, the roe recovery rates adjusted for weekly roe price differences, and the estimated wholesale value per metric ton of catch were higher prior to March with the peaks of all three occurring in late February.

Table 9 Estimates of what BS/AI bycatches would have been with alternative starting dates if catch had been redistributed to the rest of the first quarter.

1990

	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
Longline					
All Targets					
Jan 1	336.6	1,580	2	4	22
Jan 15	330.5	1,570	2	5	22
Feb 1	330.9	1,573	2	6	22
Feb 15	328.7	1,553	2	8	22
Pots					
All Targets					
Jan 1	2.5	20,023	9,762	0	0
Jan 15	2.5	20,023	9,762	0	0
Feb 1	2.5	20,023	9,762	0	0
Feb 15	2.5	20,023	9,762	0	0
Trawl					
All Targets					
Jan 1	4,348.6	1,710,192	99,144	13,798	16,213
Jan 15	4,325.5	1,686,349	84,409	14,190	16,214
Feb 1	3,840.4	1,294,624	58,260	13,848	16,218
Feb 15	3,772.8	1,180,771	46,661	13,582	16,191
All Gear					
Jan 1	4,687.7	1,731,794	108,908	13,802	16,235
Jan 15	4,658.1	1,707,413	94,134	14,189	16,236
Feb 1	4,173.5	1,315,671	67,981	13,844	16,240
Feb 15	4,104.2	1,202,591	56,443	13,695	16,213

1991

	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon	Herring
Longline						
All Targets						
Jan 1	310.8	5,256	88	41	56	
Jan 15	309.3	4,901	87	41	56	
Feb 1	310.4	4,634	86	42	56	
Feb 15	307.1	3,821	84	43	56	
Pots						
All Targets						
Jan 1	.5	9,174	420	0	0	
Jan 15	.5	9,174	420	0	0	
Feb 1	.5	9,174	420	0	0	
Feb 15	.5	9,174	420	0	0	
Trawl						
All Targets						
Jan 1	6,114.3	2,565,732	111,545	37,702	21,743	1,215.1
Jan 15	6,255.5	2,646,132	96,649	23,300	21,393	1,214.9
Feb 1	6,556.6	2,934,303	102,537	25,669	21,654	1,214.6
Feb 15	7,221.1	3,373,991	89,802	25,718	22,214	1,214.7
All Gear						
Jan 1	6,427.2	2,580,164	112,053	37,743	21,799	1,215.1
Jan 15	6,565.6	2,657,803	97,010	23,304	21,447	1,214.9
Feb 1	6,864.5	2,940,493	102,650	25,607	21,702	1,214.6
Feb 15	7,512.4	3,367,368	89,697	25,563	22,250	1,214.6

Table 9 continued

1990 and 1991	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon	Herring
Longline						
All Targets						
Jan 1	647.4	6,838	90	45	78	
Jan 15	639.7	6,492	89	46	78	
Feb 1	641.3	6,235	88	48	78	
Feb 15	635.6	5,477	87	51	78	
Pots						
All Targets						
Jan 1	3.0	29,197	10,182	0	0	
Jan 15	3.0	29,197	10,182	0	0	
Feb 1	3.0	29,197	10,182	0	0	
Feb 15	3.0	29,197	10,182	0	0	
Trawl						
All Targets						
Jan 1	10,462.9	4,275,923	210,698	51,500	37,956	1,215.1
Jan 15	10,600.9	4,340,641	182,173	37,510	37,582	1,214.7
Feb 1	10,383.0	4,191,992	160,859	39,380	37,784	1,214.2
Feb 15	10,887.6	4,427,797	135,974	39,143	38,197	1,213.9
All Gear						
Jan 1	11,114.9	4,311,958	220,962	51,545	38,034	1,215.1
Jan 15	11,243.0	4,373,110	192,228	37,531	37,659	1,214.7
Feb 1	11,024.9	4,220,570	170,713	39,323	37,857	1,214.2
Feb 15	11,517.0	4,450,305	145,737	39,035	38,266	1,213.9

Notes: Halibut and herring are expressed in mt; bairdi and red king and chinook and other salmon are expressed in numbers. The halibut bycatch estimates have been adjusted to reflect assumed discard mortality rates of 100% in the BSAI trawl fisheries, 50% in the GOA trawl fisheries, 16% in all hook-and-line fisheries, and 12% in all pot gear fisheries. These estimates are based on data provided by the Alaska Region. The 1991 data are for January 1 - September 29. It is assumed that the redistribution of catch to later periods will not change the bycatch rates of the later periods. Herring bycatch was not available from the Region for 1990. With the exception of rock sole, no BSAI flatfish fishery data are included prior to May 1 because currently the other flatfish fisheries do not open until May 1.

Table 10 Estimates of what BSAI bycatches would have been with alternative starting dates if catch had been redistributed to the rest of the year.

1990

	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
Longline					
All Targets					
Jan 1	336.6	1,580	2	4	22
Jan 15	332.5	1,591	2	5	22
Feb 1	336.1	1,627	2	5	23
Feb 15	340.8	1,671	2	5	24
Pots					
All Targets					
Jan 1	2.5	20,023	9,762	0	0
Jan 15	2.5	20,023	9,762	0	0
Feb 1	2.5	20,023	9,762	0	0
Feb 15	2.5	20,023	9,762	0	0
Trawl					
All Targets					
Jan 1	4,348.6	1,710,192	99,144	13,798	16,213
Jan 15	4,181.3	1,622,437	78,500	13,327	16,721
Feb 1	3,595.3	1,223,484	49,547	11,835	17,442
Feb 15	3,371.1	1,099,018	35,782	10,240	18,331
All Gear					
Jan 1	4,687.7	1,731,794	108,908	13,802	16,235
Jan 15	4,519.1	1,643,725	88,519	13,323	16,733
Feb 1	3,940.7	1,245,063	59,973	11,824	17,442
Feb 15	3,723.6	1,121,324	46,748	10,226	18,322

1991

	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon	Herring
Longline						
All Targets						
Jan 1	310.8	5,256	88	41	56	
Jan 15	311.4	4,797	88	41	57	
Feb 1	316.5	4,369	89	43	59	
Feb 15	318.7	3,596	91	44	61	
Pots						
All Targets						
Jan 1	.5	9,174	420	0	0	
Jan 15	.5	9,174	420	0	0	
Feb 1	.5	9,174	420	0	0	
Feb 15	.5	9,172	420	0	0	
Trawl						
All Targets						
Jan 1	6,114.3	2,565,732	111,545	37,702	21,743	1,215.1
Jan 15	6,196.0	2,622,750	91,986	22,037	22,722	1,300.2
Feb 1	6,325.1	2,797,401	89,197	21,847	24,929	1,429.6
Feb 15	6,538.2	2,949,193	73,381	19,352	27,400	1,571.4
All Gear						
Jan 1	6,427.2	2,580,164	112,053	37,743	21,799	1,215.1
Jan 15	6,513.6	2,632,664	92,355	22,039	22,739	1,297.7
Feb 1	6,653.0	2,800,938	89,404	21,800	24,888	1,423.4
Feb 15	6,872.1	2,945,162	73,530	19,272	27,286	1,560.7

Table 10 continued

1990 and 1991	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon	Herring
Longline						
All Targets						
Jan 1	647.4	6,836	90	45	78	
Jan 15	644.0	6,384	90	46	80	
Feb 1	652.8	5,977	91	47	82	
Feb 15	658.9	5,256	92	49	85	
Pots						
All Targets						
Jan 1	3.0	29,197	10,182	0	0	
Jan 15	3.0	29,197	10,182	0	0	
Feb 1	3.0	29,197	10,182	0	0	
Feb 15	3.0	29,196	10,183	0	0	
Trawl						
All Targets						
Jan 1	10,462.9	4,275,923	210,689	51,500	37,956	1,215.1
Jan 15	10,342.6	4,227,648	170,288	35,210	39,342	1,276.0
Feb 1	9,802.9	3,951,771	137,033	33,250	42,061	1,365.0
Feb 15	9,704.8	3,926,652	106,725	29,005	45,166	1,465.9
All Gear						
Jan 1	11,114.9	4,311,958	220,962	51,545	38,034	1,215.1
Jan 15	10,999.8	4,259,676	180,862	35,214	39,375	1,274.4
Feb 1	10,481.5	3,980,004	148,186	33,208	42,032	1,361.2
Feb 15	10,400.7	3,951,116	118,654	28,936	45,070	1,459.7

Notes: Halibut and herring are expressed in mt; bairdi and red king and chinook and other salmon are expressed in numbers. The halibut bycatch estimates have been adjusted to reflect assumed discard mortality rates of 100% in the BSAI trawl fisheries, 50% in the GOA trawl fisheries, 16% in all hook-and-line fisheries, and 12% in all pot gear fisheries. These estimates are based on data provided by the Alaska Region. The 1991 data are for January 1 - September 29. It is assumed that the redistribution of catch to later periods will not change the bycatch rates of the later periods. Herring bycatch was not available from the Region for 1990. With the exception of rock sole, no BSAI flatfish fishery data are included prior to May 1 because currently the other flatfish fisheries do not open until May 1.

Table 11 BS/AI pollock fishery catch and value and roe production by week and by area for the first three months of 1990 and 1991.

Aleutian Islands

Week ending	Total catch	Roe mt	Roe %	Price adj.	Adjusted roe %	Value/mt total catch
1/13/90	701	11	1.61%	1.079	1.74	347
1/20/90	162	5	3.08%	1.132	3.49	529
1/06/91	8,652	288	3.33%	1.079	3.59	570
1/13/91	3,032	107	3.52%	1.079	3.80	648
2/24/91	1,035	40	3.88%	1.000	3.88	664
3/03/91	17,859	222	1.24%	1.000	1.24	455
3/10/91	22,411	533	2.38%	1.000	2.38	563
3/17/91	12,127	218	1.80%	1.000	1.80	534
3/24/91	12,547	66	.52%	1.000	.52	446

Bogoslof Island

1/13/91	25,149	1,144	4.55%	1.079	4.91	698
1/20/91	32,052	1,416	4.42%	1.132	5.00	675
1/27/91	31,975	2,135	6.68%	1.132	7.56	900
2/03/91	32,388	2,220	6.86%	1.094	7.50	875
2/10/91	34,653	2,728	7.87%	1.094	8.61	981
2/17/91	53,176	4,639	8.72%	1.000	8.72	1,039
2/24/91	2,635	150	5.69%	1.000	5.69	747
3/03/91	886	16	1.82%	1.000	1.82	357

Other Bering Sea

1/06/90	18,495	351	1.90%	1.079	2.05	508
1/13/90	20,161	466	2.31%	1.079	2.50	523
1/20/90	23,527	844	3.59%	1.132	4.06	627
1/27/90	26,999	1,120	4.15%	1.132	4.70	637
2/03/90	27,899	1,639	5.87%	1.094	6.43	764
2/10/90	31,894	2,309	7.24%	1.094	7.92	818
2/17/90	32,411	2,799	8.64%	1.000	8.64	961
2/24/90	18,752	1,369	7.30%	1.000	7.30	968
3/03/90	18,800	465	2.47%	1.000	2.47	562
3/10/90	29,060	405	1.39%	1.000	1.39	466
3/17/90	26,534	349	1.31%	1.000	1.31	435
3/24/90	22,376	175	.78%	1.000	.78	397
3/31/90	29,272	134	.46%	1.000	.46	395
1/06/91	31,124	523	1.68%	1.079	1.81	487
1/13/91	32,566	621	1.91%	1.079	2.06	496
1/20/91	27,128	512	1.89%	1.132	2.14	462
1/27/91	35,087	764	2.18%	1.132	2.46	470
2/03/91	22,363	455	2.03%	1.094	2.22	496
2/10/91	26,844	471	1.76%	1.094	1.92	483
2/17/91	25,071	468	1.87%	1.000	1.87	482
2/24/91	47,987	1,268	2.64%	1.000	2.64	540
3/03/91	783	15	1.95%	1.000	1.95	490
3/17/91	45	4	9.81%	1.000	9.81	460
3/24/91	59	8	13.81%	1.000	13.81	521
3/31/91	196	3	1.50%	1.000	1.50	278

Notes: These estimates are based on product weight data provided by the Alaska Region and on 1990 first wholesale price data collected jointly by NMFS, ADF&G, and CFEC. The roe price adjustment factors were provided by industry. The factors were used to adjust the roe recovery rates, not total wholesale value. The total value is for all pollock products, not just roe.

Catch in the Bogoslof pollock fishery was relatively constant for the third through sixth weeks of 1991, increased substantially in week seven, and fell to very low levels in the next two weeks. Unadjusted and adjusted roe recovery rates and total value per metric ton of catch were relatively high during weeks 4 through 7. All three peaked in week 7 and fall sharply by early March (week 9).

In the 1991 BS pollock fishery, catch and roe production fell off drastically after the end of February. During January and February, the unadjusted and adjusted roe recovery rates and value per metric ton of catch peaked in week 8. They peaked a week earlier in 1990, but in 1990 the Bogoslof fishery was treated as part of the BS fishery.

The 1991 roe recovery rates and values per metric ton of catch were lower in the BS than in either the Bogoslof area or the AI area. It has not been determined if this was due to differences in targeting strategies for fishing operations in these three areas or due to other factors.

For the BS/AI as a whole, these data indicate that if catch during the first two or three weeks had been replaced by catch during the rest of January and February, the roe recovery rates and the value of the pollock fishery probably would have increased. With the increase in capacity that has occurred since the A season of 1991, it is reasonable to assume that catch during the first two to three weeks could be replaced by catch during the next five weeks.

The weekly data for the 1990 and 1991 rock sole fishery (Table 12) indicate that although the first few weeks of 1990 and 1991 were relatively productive in terms of both catch per week and wholesale value per metric ton of catch, the peaks of both measures of productivity occurred latter in the first quarter. About 35.4% and 13.6%, respectively, of the of annual catch in the 1990 and 1991 rock sole fisheries was accounted for by the end of January. This suggests that the rock sole fishery probably would not be affected adversely by a two to three week delay.

None of the alternatives for a season delay are expected to have an adverse effect on marine mammals. The potential for adverse effects of the pollock fishery on Steller sea lions, including the effect of concentrated fishing effort on foraging activities of sea lions, have been addressed in regulations implementing Amendment 20 to the BSAI FMP (57 FR 2683, January 23, 1992). Sea lion protection measures implemented under Amendment 20 are intended to minimize potential adverse effects of the groundfish trawl fisheries on sea lion foraging activity in sensitive habitat areas and include closure of areas around specified sea lion rookeries to fishing with trawl gear. The effects of a delay on harvesting costs is considered in Section 3.8 through the use of the bycatch simulation model.

The preferred alternative, a delay of the BS/AI trawl fisheries until January 20, is expected to have effects that are between those of start dates of January 15 and February 1. This alternative was proposed by an industry group that represented various components of the trawl fishery.

3.3.2 Season Delays in the GOA

Two types of fishery delays are proposed jointly for the GOA. The first, which would be identical to the delay for the BS/AI, principally is intended to prevent the BS/AI fleet from fishing in the GOA prior to the BS/AI opening. The second, which would delay the GOA trawl rockfish fishery until July 1 or 15, principally is intended to reduce the bycatch of chinook salmon. In the 1991 Gulf of Alaska fisheries, the majority of chinook bycatch occurred in the trawl rockfish fisheries during the month of March.

Table 12 BS/AI catch in the rock sole fishery (in round weight) and wholesale value by week for the first three months of 1990 and 1991.

Week ending	Total Catch	Total Value	Value/mt catch
1/06/90	2,037	1,112,862	546
1/13/90	3,131	1,056,482	337
1/20/90	2,662	996,593	374
1/27/90	3,520	1,892,856	538
2/03/90	2,075	1,047,680	505
2/10/90	2,769	1,553,868	561
2/17/90	2,803	1,219,500	435
2/24/90	5,419	2,523,812	466
3/03/90	2,037	1,085,795	533
3/10/90	199	131,366	660
3/17/90	298	37,059	125
1/06/91	1,148	557,030	485
1/13/91	3,456	1,400,786	405
1/20/91	1,768	799,660	452
1/27/91	2,804	954,364	340
2/03/91	1,512	578,769	383
2/10/91	4,501	1,933,596	430
2/17/91	7,492	2,787,903	372
2/24/91	11,283	3,855,199	342
3/03/91	12,610	4,769,397	378
3/10/91	6,143	2,821,697	459
3/17/91	944	307,372	325
3/24/91	113	25,020	221
3/31/91	37	21,768	583

Notes: These estimates are based on product weight data provided by the Alaska Region and on 1990 first wholesale price data collected jointly by NMFS, ADF&G, and CFEC.

3.3.2.1 Delay of GOA Fisheries for all Species

In terms of the season delay for all GOA groundfish fisheries, the relevant fisheries include bottom and pelagic trawl pollock, Pacific cod, and deepwater flatfish. A delay similar to that for the BS/AI would clearly decrease the number of BS/AI vessels that would participate in the GOA fisheries during the beginning of the GOA season. It could also change bycatch rates in the GOA. Weekly catch and chinook and halibut bycatch data for each of these fisheries for 1990 and 1991 are presented in Appendix 2.

Estimates of what bycatches would have been for each starting date in 1990, 1991, and the two years together if the catch had been redistributed completely during the rest of the first quarter are in Table 13. Estimates of what would have happened had the catch been redistributed throughout the rest of the year are in Table 14.

The estimates in Table 13 indicate that in 1990 there would have been small decreases in chinook bycatch and small increases in halibut bycatch with delays of two to six weeks. In 1991 chinook and halibut bycatches would have increased but not substantially with a delay of two or four weeks; however, a six-week delay would have increased halibut and chinook bycatch, respectively, by almost 13% and 20%. For the two years together, the results are similar to those of 1991. These estimated changes were predicted for the fisheries as a whole. The further delay of the rockfish fishery is not expected to alter these estimates because catch in the rockfish fishery during the first six weeks of the year accounted for less than 1% of that fishery's annual catch in either 1990 or 1991 (Table 8).

Unlike the BS/AI, the estimates of the bycatch effects of the alternative start dates are about the same whether it is assumed catch will be redistributed throughout either the rest of the first quarter or the rest of the year.

The effect of a delay on the value of the pollock fishery may be less of a concern in the GOA than in the BS/AI and there is no roe rock sole fishery in the GOA to consider. As with the BSAI delay, none of the alternatives for a season delay are expected to have an adverse effect on marine mammals. The potential for adverse effects of trawl operations, particularly those for pollock, on Steller sea lions, including the effect of concentrated fishing effort on foraging activities of sea lions, has been addressed in regulations implementing Amendment 25 to the GOA FMP (57 FR 2683, January 23, 1992). Sea lion protection measures implemented under Amendment 25 are intended to minimize potential adverse effects of the groundfish trawl fisheries on sea lion foraging activity in sensitive habitat areas and include closure of areas around specified sea lion rookeries to fishing with trawl gear, together with spatial and temporal restrictions on GOA pollock harvests.

The preferred alternative. a delay of the GOA trawl fisheries until January 20, is expected to have effects that are between those of start dates of January 15 and February 1. The consensus among those representing the GOA trawl fisheries was that the GOA delay should coincide with the BS/AI delay and that a delay of two to three weeks would not have an adverse effect on the fisheries.

3.3.2.2 Further Delay of GOA Rockfish Fisheries

In 1991, the GOA trawl rockfish fishery accounted for 63 percent of the GOA chinook salmon bycatch, or about 22,700 fish, through September 29 (Table 3). Of this amount, about 21,800 were taken prior to July 1 and 19,713 were taken during the last three weeks in March.

Table 13 Estimates of what GOA bycatches would have been with alternative starting dates if catch had been redistributed to the rest of the first quarter.

1990

	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
Longline					
All Targets					
Jan 1	1,185.5	318	93	0	62
Jan 15	1,185.3	318	93	0	62
Feb 1	1,187.7	314	93	0	62
Feb 15	1,187.9	314	93	0	62
Pots					
All Targets					
Jan 1	31.7	101,431	15,369	455	0
Jan 15	31.7	101,431	15,369	455	0
Feb 1	31.7	101,431	15,369	455	0
Feb 15	31.7	101,431	15,369	455	0
Trawl					
All Targets					
Jan 1	2,113.8	87,730	422	15,763	4,071
Jan 15	2,157.2	89,278	422	15,293	4,092
Feb 1	2,235.1	91,779	422	14,501	4,131
Feb 15	2,248.5	91,598	422	14,540	4,146
All Gear					
Jan 1	3,332.9	189,479	15,884	16,219	4,133
Jan 15	3,375.3	190,934	15,884	15,725	4,152
Feb 1	3,452.5	193,423	15,884	14,938	4,192
Feb 15	3,465.1	193,307	15,884	14,988	4,207

1991

	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
Jig					
All Targets					
Jan 1	7.0	0	0	0	0
Jan 15	7.0	0	0	0	0
Feb 1	7.0	0	0	0	0
Feb 15	7.0	0	0	0	0
Longline					
All Targets					
Jan 1	896.9	398	0	0	12
Jan 15	881.9	398	0	0	12
Feb 1	880.9	398	0	0	12
Feb 15	880.3	398	0	0	12
Pots					
All Targets					
Jan 1	.5	31,436	131	0	0
Jan 15	.5	31,263	131	0	0
Feb 1	.5	31,231	133	0	0
Feb 15	.5	31,850	137	0	0
Trawl					
All Targets					
Jan 1	1,628.5	93,311	132	36,092	13,498
Jan 15	1,672.5	92,261	133	37,093	13,529
Feb 1	1,706.0	89,904	134	38,264	13,564
Feb 15	1,821.9	96,349	135	43,208	13,660
All Gear					
Jan 1	2,576.5	125,145	264	36,096	13,510
Jan 15	2,607.2	124,047	266	37,031	13,540
Feb 1	2,641.9	121,256	268	38,093	13,574
Feb 15	2,755.3	129,604	283	42,423	13,659

Table 13 continued

1990 and 1991	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
Jig					
All Targets					
Jan 1	7.0	0	0	0	0
Jan 15	7.0	0	0	0	0
Feb 1	7.0	0	0	0	0
Feb 15	7.0	0	0	0	0
Longline					
All Targets					
Jan 1	2,082.4	716	93	0	74
Jan 15	2,067.8	716	93	0	74
Feb 1	2,073.9	710	93	0	74
Feb 15	2,074.8	710	93	0	74
Pots					
All Targets					
Jan 1	32.2	132,867	15,500	455	0
Jan 15	32.2	132,428	15,499	455	0
Feb 1	32.2	131,949	15,500	455	0
Feb 15	32.2	132,183	15,500	455	0
Trawl					
All Targets					
Jan 1	3,742.3	181,041	555	51,165	17,569
Jan 15	3,832.8	182,370	555	52,152	17,624
Feb 1	3,946.4	184,192	556	53,886	17,707
Feb 15	4,073.0	188,594	558	58,239	17,809
All Gear					
Jan 1	5,909.4	314,624	16,148	52,315	17,642
Jan 15	5,985.4	316,198	16,152	53,199	17,695
Feb 1	6,100.4	318,887	16,161	54,869	17,776
Feb 15	6,224.5	324,499	16,171	58,116	17,871

Notes: Halibut and herring are expressed in mt; bairdi and red king and chinook and other salmon are expressed in numbers. The halibut bycatch estimates have been adjusted to reflect assumed discard mortality rates of 50% in the GOA trawl fisheries, 16% in all hook-and-line fisheries, and 12% in all pot gear fisheries. These estimates are based on data provided by the Alaska Region. The 1991 data are for January 1 - September 29. It is assumed that the redistribution of catch to later periods will not change the bycatch rates of the later periods.

Table 14 Estimates of what GOA bycatches would have been with alternative starting dates if catch had been redistributed to the rest of the year.

1990

	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
Longline					
All Targets					
Jan 1	1,185.5	318	93	0	62
Jan 15	1,193.7	320	94	0	62
Feb 1	1,224.4	323	97	0	64
Feb 15	1,237.2	326	98	0	65
Pots					
All Targets					
Jan 1	31.7	101,431	15,369	455	0
Jan 15	31.7	101,431	15,369	455	0
Feb 1	31.7	101,431	15,369	455	0
Feb 15	31.8	101,566	15,389	456	0
Trawl					
All Targets					
Jan 1	2,113.8	87,730	422	15,763	4,071
Jan 15	2,175.5	90,297	436	15,342	4,203
Feb 1	2,264.3	93,807	457	14,795	4,403
Feb 15	2,279.6	94,032	463	14,877	4,462
All Gears					
Jan 1	3,332.9	189,479	15,884	16,219	4,133
Jan 15	3,418.1	194,602	16,337	15,752	4,251
Feb 1	3,546.9	202,390	17,058	15,178	4,438
Feb 15	3,574.2	204,004	17,280	15,260	4,496

1991

	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
Jig					
All Targets					
Jan 1	7.0	0	0	0	0
Jan 15	7.0	0	0	0	0
Feb 1	7.0	0	0	0	0
Feb 15	7.0	0	0	0	0
Longline					
All Targets					
Jan 1	896.9	398	0	0	12
Jan 15	884.4	401	0	0	12
Feb 1	884.7	402	0	0	12
Feb 15	887.6	406	0	0	12
Pots					
All Targets					
Jan 1	.5	31,436	131	0	0
Jan 15	.5	30,805	129	0	0
Feb 1	.5	30,097	128	0	0
Feb 15	.6	29,968	126	0	0
Trawl					
All Targets					
Jan 1	1,628.5	93,311	132	36,096	13,498
Jan 15	1,673.0	90,697	167	36,117	13,952
Feb 1	1,704.3	86,902	142	36,179	14,426
Feb 15	1,796.9	88,341	153	37,563	15,603
All Gear					
Jan 1	2,576.5	125,145	264	36,096	13,510
Jan 15	2,625.6	121,337	264	36,006	13,922
Feb 1	2,676.2	116,012	265	35,937	14,342
Feb 15	2,810.8	116,539	274	36,893	15,338

Table 14 continued

1990 and 1991	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
Jig					
All Targets					
Jan 1	7.0	0	0	0	0
Jan 15	7.0	0	0	0	0
Feb 1	7.0	0	0	0	0
Feb 15	7.0	0	0	0	0
Longline					
All Targets					
Jan 1	2,082.4	716	93	0	74
Jan 15	2,077.8	720	94	0	74
Feb 1	2,105.3	726	96	0	76
Feb 15	2,120.2	733	97	0	76
Pots					
All Targets					
Jan 1	32.2	132,867	15,500	455	0
Jan 15	33.0	134,298	15,878	467	0
Feb 1	34.0	136,128	16,341	480	0
Feb 15	35.3	139,364	16,951	499	0
Trawl					
All Targets					
Jan 1	3,742.3	181,041	555	51,860	17,569
Jan 15	3,848.6	180,984	573	51,444	18,149
Feb 1	3,967.4	180,766	597	51,130	18,899
Feb 15	3,079.4	182,082	623	51,705	19,719
All Gear					
Jan 1	5,909.4	314,624	16,148	52,315	17,642
Jan 15	6,044.0	315,988	16,616	51,735	18,162
Feb 1	6,220.8	318,039	17,233	51,256	18,845
Feb 15	6,391.4	321,924	17,893	51,604	19,570

Notes: Halibut and herring are expressed in mt; bairdi and red king and chinook and other salmon are expressed in numbers. The halibut bycatch estimates have been adjusted to reflect assumed discard mortality rates of 50% in the GOA trawl fisheries, 16% in all hook-and-line fisheries, and 12% in all pot gear fisheries. These estimates are based on data provided by the Alaska Region. The 1991 data are for January 1 - September 29. It is assumed that the redistribution of catch to later periods will not change the bycatch rates of the later periods.

The general trend for the 1990 chinook and halibut bycatch rates was similar to the 1991 season with higher bycatch rates experienced in the early portion of the season and tapering downward as the season progressed (see Appendix 2). However, in 1990 the rockfish trawl fishery did not experience nearly the level of chinook bycatch that occurred in the early part of the 1991. The total number of chinook caught in the 1990 rockfish trawl fishery is estimated at 1,941 fish.

Although the current starting date of the GOA rockfish fishery is January 1, NMFS data for the 1991 season indicate that fishing commenced the first week of March and proceeded actively up until the Gulf-wide closure of non-pelagic trawl gear due to the attainment of the second quarter halibut PSC limit on May 8. The rockfish trawl fishery started again when the third quarter halibut PSC limit became available. In 1990 this fishery began in early January but followed a pattern similar to this year with a Gulf-wide closure of all trawl fishing on May 29 due to attainment of the second quarter halibut PSC limit. It began again on July 1 when the third quarter halibut PSC limit was released.

Fishing effort for rockfish by trawl gear is usually distributed throughout the Gulf of Alaska such that harvest quotas are reached at various times from various districts. In 1991, respective fishery closure dates and causes are presented in Table 15. Under the status column bycatch indicates that the fishery is closed but the species can total up to 20 percent of the catch in another trawl fishery. When the status is defined as PSC, the species must be discarded.

Table 16 presents estimates of what bycatches would have been for July 1 and July 15 starting dates for the GOA trawl rockfish fishery in 1990, 1991, and the two years together if the catch had been redistributed completely during the rest of the year. These estimates indicate that in 1990 the July 15 delay would have resulted in larger bycatch savings. The trawl rockfish fishery halibut and chinook salmon bycatch reductions would have been about 61% and 80%, respectively. In 1991, the savings would have been much greater. It was estimated that either delay would have decreased halibut and chinook salmon bycatch in the trawl rockfish fishery by about 66% and 99.8%, respectively.

The estimated dramatic reduction in chinook bycatch for either of the delays for 1991 is due to the difference in bycatch rates for the rockfish fishery between the first two quarters and the third quarter. After July 1, the 1991 fishery experienced little or no chinook bycatch. Halibut bycatch rates also were significantly lower for the third quarter relative to the first two quarters. After July 1, weekly halibut bycatch rates ranged from 4.70 to 13.15 kg/mt. Prior to this date, halibut bycatch rates ranged from 38.20 to 108.05 kg/mt. Weekly chinook and halibut bycatch rates for the rockfish fishery in 1990 and 1991 are presented in Appendix 2.

The estimated effects on halibut and chinook bycatch rates of trawl rockfish starting dates of the first of each month from January through December are presented in Figures 3.1 - 3.3, respectively, for 1990, 1991, and the two years combined. The estimates for January are the weighted average bycatch rates for the whole year and those for February are the weighted average bycatch rates for February through December. For 1990 and 1991 combined, the lowest chinook bycatch rate occurs with a June 1 start date and the lowest halibut bycatch rate occurs with a July 1 start date.

An effective delay of the GOA rockfish season would require that the directed fishing standards for rockfish be changed to more closely reflect true bycatch amounts of rockfish in other fisheries that commence prior to the proposed mid-year start of the rockfish fishery. Proposed directed fishing standards for GOA rockfish are addressed in Section 3.7.

The Council preferred alternative to delay the GOA rockfish fishery to the weekly reporting period closed to July 1, will decrease the opportunity for some trawl vessels to participate in this fishery.

Table 15 EEZ groundfish fisheries closures affecting GOA rockfish fisheries in 1991.

Area	Gear	Species	Status	Eff. Dates		Closure
				From	To	Cause
WG,EG	All	Shortr.-Rough.	Bycatch	02/25	12/31	TAC-OF
WG	All	Shortr.-Rough.	PSC	04/08	2/31	TAC
CG	All	Shortr.-Rough.	Bycatch	04/14	05/03	TAC-OF
CG,EG	All	Shortr.-Rough.	PSC	06/21	12/31	TAC
CG	All	POP	PSC	4/08	12/31	TAC
EG	All	POP	Bycatch	04/22	12/31	TAC
WG	All	POP	Bycatch	04/27	12/31	TAC
ALL	NP Trawl	All	Closed	05/08	07/01	PSC-Hal
650	Trawl	All	Closed	07/26	12/31	OF-DSR

Table 16 Estimates of what GOA bycatches would have been with rockfish fishery starting dates of July 1 and July 15 if catch had been redistributed to the rest of the year and if other GOA fishery had started January 22.

1990

	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
Longline					
Rockfish					
Jan 22	11.8	0	0	0	0
July 1	11.8	0	0	0	0
July 15	11.8	0	0	0	0
All Targets					
Jan 22	1,193.8	320	94	0	62
July 1	1,193.8	320	94	0	62
July 15	1,193.8	320	94	0	62
Pot					
Rockfish					
Jan 22	.0	0	0	0	0
July 1	.0	0	0	0	0
July 15	.0	0	0	0	0
All Targets					
Jan 22	31.7	101,431	15,369	455	0
July 1	31.7	101,431	15,369	455	0
July 15	31.7	101,431	15,369	455	0
Trawl					
Rockfish					
Jan 22	591.0	338	50	1,941	561
July 1	355.9	300	58	442	760
July 15	289.2	514	40	387	979
All Targets					
Jan 22	2,166.9	90,788	436	15,355	4,205
July 1	1,931.8	90,749	444	13,856	4,404
July 15	1,865.1	90,964	426	13,801	4,623
All Gears					
Rockfish					
Jan 22	602.8	338	50	1,941	561
July 1	367.8	299	58	441	759
July 15	303.8	507	39	382	967
All Targets					
Jan 22	3,414.2	195,381	16,402	15,754	4,249
July 1	3,179.2	195,342	16,410	14,254	4,448
July 15	3,115.2	195,550	16,391	14,195	4,655

Table 16 continued

1991	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
JIG					
Rockfish					
Jan 22	.5	0	0	0	0
July 22	.5	0	0	0	0
July 15	.5	0	0	0	0
All Targets					
Jan 22	7.0	0	0	0	0
July 1	7.0	0	0	0	0
July 15	7.0	0	0	0	0
Longline					
Rockfish					
Jan 22	8.6	0	0	0	0
July 1	8.6	0	0	0	0
July 15	8.6	0	0	0	0
All Targets					
Jan 22	884.0	400	0	0	12
July 1	884.0	400	0	0	12
July 15	884.0	400	0	0	12
Trawl					
Rockfish					
Jan 22	610.2	6,554	2	22,598	933
July 1	197.6	16,296	0	31	277
July 15	205.5	17,411	0	34	287
All Targets					
Jan 22	1,657.1	90,854	137	35,413	13,979
July 1	1,244.6	100,596	135	12,847	13,324
July 15	1,252.4	101,712	135	12,849	13,333
All Gears					
Rockfish					
Jan 22	619.3	6,554	2	22,598	933
July 1	205.3	16,493	0	32	280
July 15	212.8	17,691	0	34	291
All Targets					
Jan 22	2,613.5	121,503	265	35,357	13,935
July 1	2,199.4	131,443	262	12,791	13,282
July 15	2,206.9	132,641	262	12,794	13,293

Table 16 continued

1990 and 1991	Halibut	Bairdi	Red King Crab	Chinook	Other Salmon
JIG					
Rockfish					
Jan 22	.5	0	0	0	0
July 1	.5	0	0	0	0
July 15	.5	0	0	0	0
All Targets					
Jan 22	7.0	0	0	0	0
July 1	7.0	0	0	0	0
July 15	7.0	0	0	0	0
Longline					
Rockfish					
Jan 22	20.4	0	0	0	0
July 1	20.4	0	0	0	0
July 15	20.4	0	0	0	0
All Targets					
Jan 22	2,077.5	720	94	0	74
July 1	2,077.5	720	94	0	74
July 15	2,077.5	720	94	0	74
Pot					
Rockfish					
Jan 22	.0	0	0	0	0
July 1	.0	0	0	0	0
July 15	.0	0	0	0	0
All Targets					
Jan 22	33.0	134,299	15,879	467	0
July 1	33.0	134,299	15,879	467	0
July 15	33.0	134,299	15,879	467	0
Trawl					
Rockfish					
Jan 22	1,201.2	6,891	52	24,539	1,494
July 1	555.9	14,312	63	506	1,063
July 15	499.3	20,453	36	391	1,221
All Targets					
Jan 22	3,824.0	181,641	574	50,768	18,184
July 1	3,178.7	189,062	584	26,736	17,753
July 15	3,122.2	195,203	558	26,620	17,911
All Gears					
Rockfish					
Jan 22	1,222.1	6,891	52	24,539	1,494
July 1	575.7	14,359	63	508	1,066
July 15	520.3	20,436	36	391	1,220
All Targets					
Jan 22	6,027.9	316,919	16,675	51,111	18,179
July 1	5,381.5	324,387	16,686	27,080	17,751
July 15	5,326.1	330,464	16,659	26,963	17,905

Notes: Halibut and herring are expressed in mt; bairdi and red king and chinook and other salmon are expressed in numbers. The halibut bycatch estimates have been adjusted to reflect assumed discard mortality rates of 50% in the GOA trawl fisheries, 16% in all hook-and-line fisheries, and 12% in all pot gear fisheries. These estimates are based on data provided by the Alaska Region. The 1991 data are for January 1 - September 29. It is assumed that the redistribution of catch to later periods will not change the bycatch rates of the later periods.

Figure 3.1 Estimated annual bycatch rates for alternative start dates for the GOA trawl rockfish fishery in 1990.

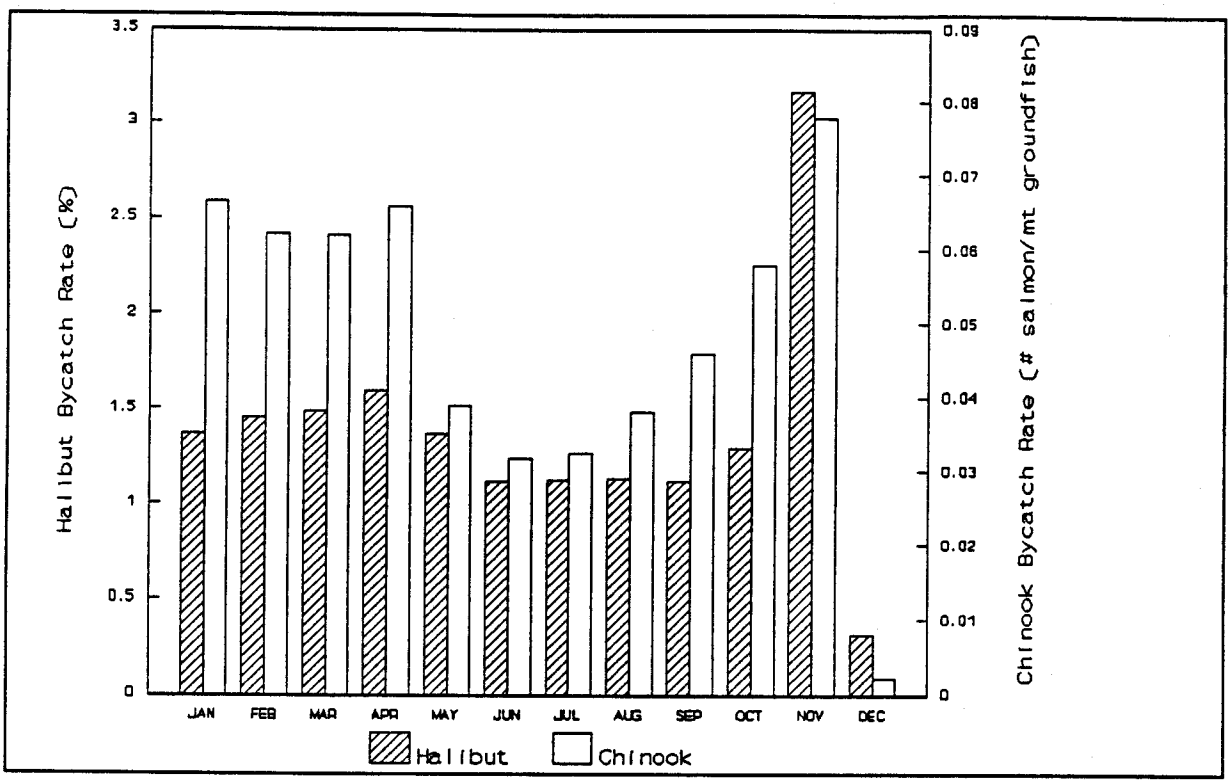


Figure 3.2 Estimated annual bycatch rates for alternative start dates for the GOA trawl rockfish fishery in 1991.

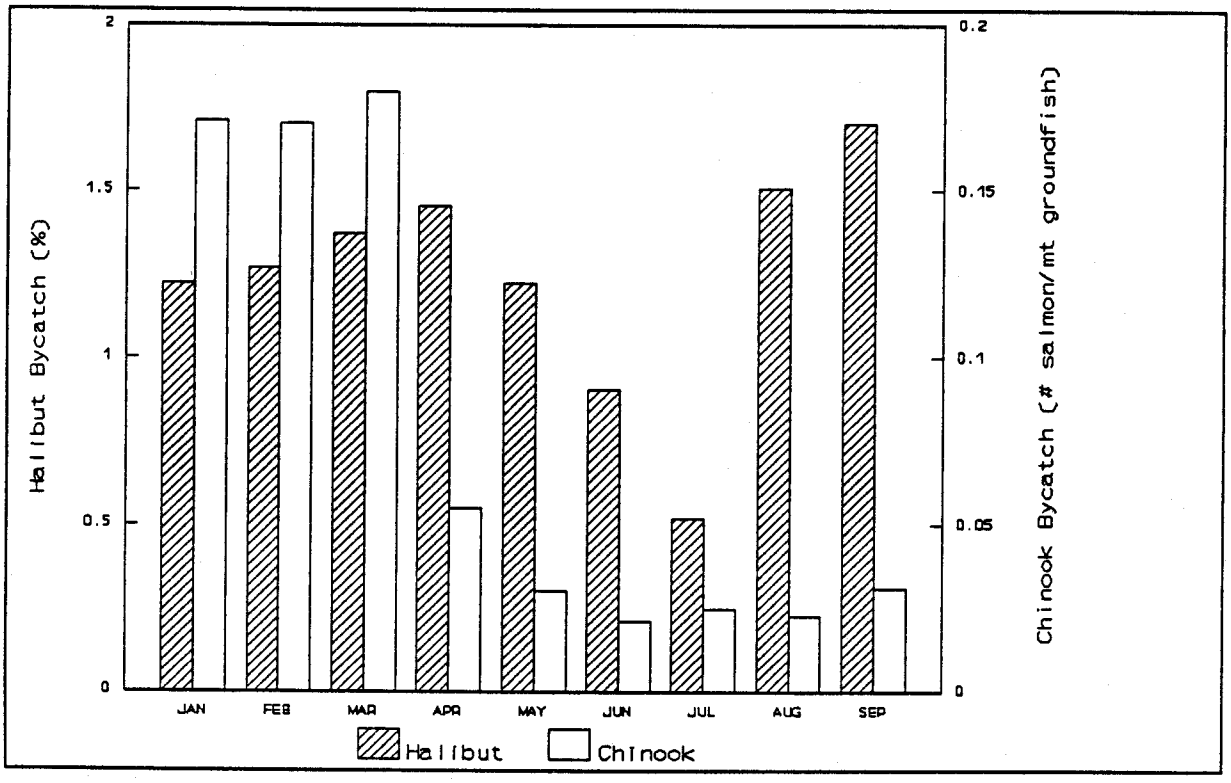
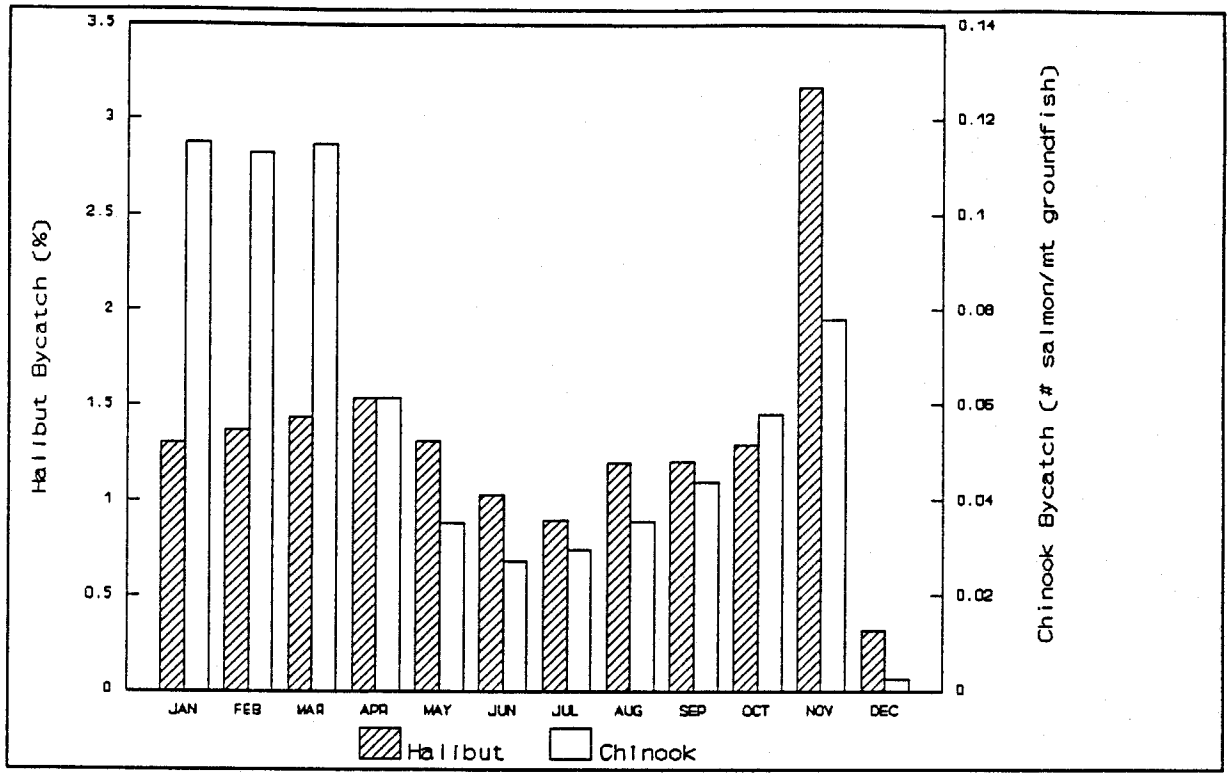


Figure 3.2 Estimated annual bycatch rates for alternative start dates for the GOA trawl rockfish fishery in 1990 and 1991 combined.



For example, the vessels that participate in the BS/AI pollock fishery would be more likely to participate in the rockfish fishery between the pollock A and B seasons, that is in April and May, than in July and August when the BS/AI pollock B season probably will still be open. The same may also be true for vessels that participate in the GOA pollock fisheries. Note that this will increase the number of boats required to harvest the groundfish TACs.

3.4 BS/AI Halibut PSC Limits for Non-Trawl Fisheries

The growth of the non-trawl groundfish fisheries in the BS/AI has led to concerns about the actual or potential bycatch in these fisheries. To date, the longline cod fishery accounts for most of the catch by non-trawl gear, but the pot cod fishery is also growing (Table 5).

Due to relatively high halibut bycatch rates, halibut is the bycatch species of most concern in these fisheries. It is estimated that about 2,100 mt and 1,950 mt of halibut bycatch were taken in these fisheries in 1990 and through September 29 in 1991, respectively, and that the associated bycatch mortalities were 338 mt and 311 mt (Table 2). Currently, it is assumed that the discard mortality rates are 16% in the longline fishery and 12% in the pot fishery.

To prevent the growth of these fisheries from resulting in an uncontrolled increase in halibut bycatch, the Council has proposed establishing a halibut PSC limit for the non-trawl fisheries. The two issues addressed in this section are first the choice of a limit of 500 mt, 1,000 mt, or 1,500 mt of bycatch mortality and second whether that limit will result in a decrease in the current trawl fishery limit of 5,333 mt.

The appropriate limit is determined by the broadly defined benefits and costs of each limit. The benefits of a limit are derived principally from any resulting decrease in halibut mortality and the associated future increases in benefits from the halibut fishery. The costs include those associated with the constraints placed on fishing operations or catch in the non-trawl groundfish fisheries. There are also management agency costs.

Experience with PSC limits in the trawl fishery has demonstrated that the establishment of PSC limits does not necessarily provide individual fishing operations with an incentive to reduce their bycatch rates even though it may be in the best interest of the fleet to do so. As a result, the PSC limits for halibut, which close the entire BS/AI, have reduced trawl groundfish catch. When this occurs, the cost of a PSC limit includes the net benefits that are foregone due to the reduced catch and there is a tradeoff between groundfish catch and future catch in the halibut fishery. Through September 29, 1991, it is estimated that the BS/AI longline and pot fisheries had halibut bycatch mortality of 311 mt and groundfish catch of 60,500 mt. The resulting bycatch mortality rate of 0.514% and a foregone growth factor of 1.6 indicate that the tradeoff is 0.82 mt of future halibut catch per 100 mt of groundfish catch or, equivalently, 122 mt of groundfish per mt of halibut. Unless the benefits of 1 mt (round weight) of halibut catch are at least 122 times the benefits of 1 mt of groundfish taken in the non-trawl groundfish fisheries, a PSC limit that reduces groundfish catch results in marginal costs exceeding marginal benefits. Note that the growth factor of 1.6 is for the trawl fishery that typically takes smaller halibut than does the non-trawl fishery. Therefore, a lower factor probably should be used for this fishery. If a lower factor had been used, the tradeoff would have been more than 122 mt of groundfish catch per 1 mt of catch in the halibut fishery. The tradeoff also would have been larger if a discount rate had been used. For the Pacific cod longline fishery, the corresponding tradeoff in 1991 was about 126 mt of groundfish catch per 1 mt of catch in the halibut fishery.

This suggests that a halibut PSC limit for non-trawl fisheries that actually reduces halibut bycatch probably will result in larger costs than benefits. That is, unless the PSC limit reduces bycatch rates and by so doing reduces total bycatch at a much lower cost than that associated with foregoing groundfish catch. This is not because halibut bycatch should not be regulated in these fisheries, it is because regulating bycatch solely with bycatch limits for a fishery as a whole tends to be an expensive way to control bycatch.

It is not known how rapidly catch in these non-trawl fisheries will increase or how bycatch rates would naturally tend to change. Therefore, it is difficult to estimate what PSC limit would impose a disproportionately high cost on this fishery. If bycatch rates do not change, limits of 500 mt and 1,000 mt, respectively, would permit catches of about 97,300 mt and 194,600 mt. This compares to a 1990 catch of 57,200 mt and a 1991 catch of 60,500 mt through September 29. These two limits would allow catch to exceed the 1991 catch by about 61% to 222%.

If the bycatch rate remains at the 1991 level, the Council's new preferred alternative PSC limit of 750 mt would allow catch in 1992 to exceed the 1991 catch by about 141%. Although the entry of new participants in the fishery and decreased cod abundance will tend to decrease catch per unit of effort and increase bycatch rates, this limit is expected to be sufficiently high that it will not close the non-trawl fisheries.

The next issue is whether the non-trawl fishery PSC limit would reduce the halibut PSC limit for the trawl fisheries. The arguments that are made above concerning the cost effectiveness of controlling non-trawl halibut bycatch with a PSC limit also apply to the trawl fisheries. However, due to the higher bycatch mortality rate for the bottom trawl fishery as a whole, the potential disparity between costs and benefits may not be as large. Through September 29, 1991, it is estimated that the BS/AI

bottom trawl fisheries had halibut bycatch mortality of 5,582 mt, assuming 100% discard mortality, and groundfish catch of about 508,400 mt. The resulting bycatch mortality rate of 1.1% and a foregone growth factor of 1.6 indicate that the tradeoff is 1.76 mt of future halibut catch per 100 mt of groundfish catch or, equivalently, 57 mt of groundfish per mt of catch in the halibut fishery. Although this is substantially lower than the 122 mt to 1 mt tradeoff for non-trawl gear, it is still quite likely that a reduction in the halibut PSC limit for the trawl fisheries would result in greater costs than benefits. For the Pacific cod trawl fishery, the corresponding tradeoff in 1991 was about 31 mt of groundfish catch per 1 mt of catch in the halibut fishery.

As with the non-trawl fisheries, the conclusion is not that halibut bycatch should not be regulated, it is that regulating bycatch with bycatch limits for a fishery as a whole tends to be an expensive way to control bycatch.

The tradeoff between the alternative uses of halibut can be analyzed in terms of both net national benefits and changes in regional economic activity. Estimates of the former are presented in Table 17. The tradeoffs are based on current estimates of bycatch rates, discard rates, gross and net wholesale value per metric ton of groundfish catch, and gross and net bycatch impact costs. Estimated benefit-cost ratios of reducing groundfish catch by 1 mt to decrease bycatch are reported in Table 17. The gross and net wholesale values per metric ton of groundfish catch are used to estimate the cost per metric ton of groundfish catch foregone due to a PSC limit that reduces catch. Similarly, the gross and net wholesale values of the bycatch species foregone per metric ton of groundfish catch are used to estimate the benefits of the reduction in bycatch associated with a 1 metric ton reduction in groundfish catch.

Groundfish wholesale price information are for 1990. Based on data used in the bycatch simulation model, it was assumed that net wholesale value of groundfish was 38% of its gross wholesale value. For both groundfish and the bycatch species, the net value account for only variable costs, not fixed costs. This definition of net value was used because fixed costs do not affect the marginal benefits or costs of reducing groundfish catch to reduce bycatch. The basis of the estimates of value for the groundfish species is presented in Appendix 3 which describes the bycatch simulation model.

Based on wholesale values net of variable costs, the estimated benefit-cost ratios of decreasing groundfish catch to decrease bycatch for 1991 ranged from 0.01 for the mid-water pollock fisheries to 0.48 for the rock sole fishery. This means that in the case of the mid-water pollock fishery and the rock sole fishery, respectively, a decrease in groundfish catch that would reduce the net value of the groundfish fisheries by $1 would provide increases in the combined net value of the halibut, crab, salmon, and herring fisheries by $0.01 and $0.48.

The Council's new preferred alternative, which reduces the trawl fishery halibut PSC limit by 300 mt, is expected to decrease trawl catch. Assuming that bycatch rates by fishery remain at their 1991 levels, the decrease in catch will be 50,000 (300/0.006 = 50,000) if most of the reduction occurs in the yellowfin sole fishery or about 6,000 mt (300/0.05 = 6,000) if most of the reduction occurs in the turbot and sablefish fisheries. Using the 1991 estimates in Table 17, a 50,000 mt reduction in yellowfin sole fishery catch would decrease the net wholesale value of groundfish catch by $10.8 million while decreasing the net wholesale value of the bycatch by less than $1.3 for a net loss of $9.5 million and a benefit cost ratio of about 0.1 to 1. A 6,000 mt reduction in turbot fishery catch would decrease the net wholesale value of groundfish catch by $2.16 million while decreasing the net wholesale value of the bycatch by less than $1.0 for a net loss of $1.16 million and a benefit cost ratio of about 0.46 to 1. The 300 mt reduction in the halibut PSC limit for the trawl fishery is expected to result in reductions in catch for the yellowfin sole, turbot, sablefish, and arrowtooth sole fisheries. Therefore, the estimated reductions in net benefits and the resulting benefit cost ratio are expected to be between those of the yellowfin sole and turbot fisheries.

Table 17 Benefit-cost tradeoffs between foregone groundfish and decreased bycatch for the Bering Sea/Aleutian Islands.

1990

Fishery		Groundfish catch Total	Retained	% ret.	Groundfish value per mt of groundfish catch gross	net	Bycatch value gross	net	Benefit-Cost ratios gross	net
FXD	C	52,629	49,808	94.6	921	350	39.9	20.3	.04	.06
FXD	S	3,897	3,705	95.1	2591	984	90.2	46.8	.03	.05
FXD	T	423	409	96.7	1292	491	22.9	11.9	.02	.02
TWL	A	32,091	23,534	73.3	915	348	29.9	15.5	.03	.04
TWL	B	150,289	125,841	83.7	550	209	34.7	17.3	.06	.08
TWL	C	138,743	95,883	69.1	696	265	141.5	71.2	.20	.27
TWL	F	773	354	45.8	788	299	62.0	28.8	.08	.10
TWL	K	31,621	21,498	68.0	728	277	47.7	24.6	.07	.09
TWL	P	1226948	1152053	93.9	435	165	1.6	.7	.00	.00
TWL	R	32,106	13,119	40.9	496	188	137.5	63.7	.28	.34
TWL	S	690	238	34.6	801	304	282.3	144.7	.35	.48
TWL	T	13,022	8,451	64.9	948	360	374.5	194.1	.40	.54
TWL	W	1,639	966	59.0	805	306	37.2	19.3	.05	.06
TWL	Y	18,097	9,983	55.2	517	196	33.7	15.4	.07	.08

1991

Fishery		Groundfish catch Total	Retained	% ret.	Groundfish value per mt of groundfish catch gross	net	Bycatch value gross	net	Benefit-Cost ratios gross	net
FXD	C	57,182	50,999	89.2	814	309	32.1	16.6	.04	.05
FXD	S	2,951	2,491	84.4	2342	890	80.2	41.6	.03	.05
FXD	T	9	9	100.0	2152	818	20.3	10.5	.01	.01
TWL	A	28,353	24,494	86.4	1067	405	15.4	7.9	.01	.02
TWL	B	157,694	137,381	87.1	483	184	33.5	16.2	.07	.09
TWL	C	121,031	87,475	72.3	708	269	143.5	72.8	.20	.27
TWL	F	8,007	3,260	40.7	703	267	76.7	35.1	.11	.13
TWL	K	8,003	4,912	61.4	958	364	140.1	71.8	.15	.20
TWL	P	1190,698	1152,912	96.8	466	177	4.6	2.2	.01	.01
TWL	R	67,428	23,762	35.2	426	162	160.9	78.0	.38	.48
TWL	S	259	126	48.8	1189	452	379.1	195.9	.32	.43
TWL	T	8,337	6,391	76.7	947	360	322.9	166.4	.34	.46
TWL	W	781	567	72.7	540	205	172.5	89.2	.32	.44
TWL	Y	107,714	65,268	60.6	568	216	50.5	24.7	.09	.11

Table 17 continued.

1990 and 1991 combined

Fishery		Groundfish catch Total	Retained	% ret.	Groundfish value per mt of groundfish catch gross	net	Bycatch value gross	net	Benefit-Cost ratios gross	net
FXD	C	109,811	100,807	91.8	865	329	35.8	18.3	.04	.06
FXD	S	6,848	6,197	90.5	2483	944	85.9	44.6	.03	.05
FXD	T	432	418	96.8	1310	498	22.8	11.9	.02	.02
TWL	A	60,444	48,028	79.5	987	375	23.1	12.0	.02	.03
TWL	B	307,983	263,223	85.5	516	196	34.1	16.8	.07	.09
TWL	C	259,774	183,359	70.6	702	267	142.5	72.0	.20	.27
TWL	F	8,780	3,613	41.2	710	270	75.4	35.2	.11	.13
TWL	K	39,624	26,410	66.7	774	294	66.3	34.2	.09	.12
TWL	P	2417646	2304964	95.3	450	171	3.1	1.6	.01	.01
TWL	R	99,533	36,881	37.1	448	170	153.4	73.6	.34	.43
TWL	S	949	365	38.5	907	345	308.7	158.7	.34	.46
TWL	T	21,360	14,842	69.5	948	360	354.3	183.3	.37	.51
TWL	W	2,420	1,533	63.4	719	273	80.9	41.9	.11	.15
TWL	Y	125,811	75,251	59.8	560	213	48.1	26.5	.09	.12

The following abbreviations are used.

FXD = Fixed gear (longline or pot)
TWL = Trawl gear
C = Pacific cod
P = mid-water pollock
B = bottom pollock
Y = yellowfin sole
R = rock sole
W = arrowtooth flounder
T = greenland turbot
F = other flatfish
S = sablefish
A = atka mackerel

Although these are only rough approximations of the actual benefit-cost ratios, they suggest that, subject to very large errors in these estimates, reducing groundfish catch to reduce bycatch probably will result in greater costs than benefits. Future bycatch management research is expected to provide improved measures of net values and a more comprehensive measure of the benefits and costs of reducing bycatch by reducing groundfish catch.

Estimates of the tradeoffs in terms of regional economic activity are available from the Alaska Fishery Economic Assessment Model that was used to estimate the regional impacts of the inshore/offshore allocation alternatives. The model's results with respect to the tradeoffs of 126 mt to 1 mt for the 1991 longline cod fishery and 31 mt to 1 mt for the trawl cod fishery are summarized in Table 18.

The estimates indicate that if 126 mt of groundfish catch are foregone to increase catch in the halibut fishery by 1 mt, household income and total regional economic activity would be reduced substantially for Alaska alone and for the combined region of Alaska and the Pacific Northwest. The estimates indicate that if 31 mt of groundfish catch are foregone to increase catch in the halibut fishery by 1 mt, household income and total regional economic activity would be increased substantially for Alaska alone but decreased substantially for the combined region of Alaska and the Pacific Northwest. For the 31 mt to 1 mt tradeoff, Alaska economic activity is greater for halibut taken in the halibut fishery principally because, in this example, it was assumed that all of the groundfish would be processed at sea and all of the halibut would be processed in Alaska.

The decision concerning whether the halibut PSC limit for the non-trawl fisheries will decrease the 5,333 mt limit for the trawl fishery will affect the distribution of cod catch between gear groups. There has not been sufficient time to analyze fully the implications of such an effect. The explicit allocation of the cod TAC between the trawl and fixed gear fisheries is the subject of a separate amendment proposal that the Council may consider during 1992. Given the information that is available, it is not known whether a decrease in the percentage of the cod TAC taken with trawl gear would provide positive or negative net benefits to the nation. Such a determination is beyond the scope of the current analysis.

3.5 BS/AI Trawl Fishery Group PSC Limit Allowances

Two problems would be resolved with the proposed changes to the PSC allowance groups. The first is that with the current program for PSC limit allowances among trawl fisheries, the bycatch of halibut, crab, or herring in a large number of trawl fisheries is counted against the allowance for the other trawl fisheries; however, once the other trawl fishery allowance is taken, only the trawl cod and bottom trawl pollock fisheries are closed. This means that the bycatches of the other fisheries in this group contribute to the closure of the pollock and cod fisheries but are not limited. The sablefish, rockfish, arrowtooth flounder, Atka mackerel, and mid-water pollock fisheries are included in this group.

Alternative 2.1 The equity problem and the lack of control of bycatch in some trawl fisheries with relatively high bycatch rates are addressed by two proposed changes to the PSC limit allowance program. First the cod fishery would receive a separate allowance because it has a relatively high halibut bycatch rate and it is a relatively large fishery and, therefore, currently takes much of the halibut allowance for the other trawl group.

Second, with the exception of the Atka mackerel and mid-water pollock fisheries, all the fisheries in the other trawl fishery group would close when this group's PSC limit allowance is taken. This will eliminate the current problem of bycatch in the sablefish, rockfish, and other fisheries not being

Table 18 Changes in household income and total community impacts due to increases in landings.

	Alaska	Alaska + PNW
Halibut--1 mt		
Income	$ 3,089	$ 4,020
Impacts	$ 4,389	$ 6,252
F/LL Pacific cod--126 mt		
Income	$ 9,018	$36,839
Impacts	$20,204	$86,122
F/T Pacific cod--31 mt		
Income	$ 1,566	$13,115
Impacts	$ 2,693	$28,266

Note: These estimates were calculated from the Alaska Fishery Economic Assessment Model (FEAM), with no leakages assumed. The halibut is delivered to Kodiak, with a finished product (H&G) price of $2.20/lb, the longline cod is processed by a Bering Sea freezer longliner with an H&G price of $0.52/lb and the Pacific cod utilized by the factory trawler is processed as fillets with a price of $1.85/lb. It was estimated that 85.9% and 46.7%, respectively, of the 1991 catch in the cod longline and trawl fisheries was retained. These retention rates were used in generating the estimates in the table. The "PNW" is the Pacific Northwest.

controlled by the PSC limits. The Atka mackerel fishery is exempted from the closure due to the combination of its relatively low bycatch rates and its small size. The mid-water pollock fishery is excluded due to its exceptionally low bycatch rates.

The second problem that would be resolved with the proposed changes to the PSC allowance groups is that the current regulations place yellowfin sole and the "other flatfish" fisheries in the same group even though halibut bycatch rates are higher in the latter fishery. In 1990, the halibut bycatch rate was 0.30% in the yellowfin sole fishery compared to 0.52% for other flatfish and in 1991 it was 0.60% compared to 0.70%. By combining the other flatfish fishery with the rock sole fishery, that has had substantially higher bycatch rates, the potential for the other flatfish fishery to close the yellowfin sole fishery is eliminated. Because the rock sole fishery occurs before the other flatfish group fishery, combining other flatfish with rock sole, for the purposes of the PSC limit allowances, is not expected to have an adverse effect on the rock sole fishery. However, the same may not be true for the yellowfin sole fishery.

Alternative 2.2 (preferred alternative) The equity problem and the lack of control of bycatch in some trawl fisheries with relatively high bycatch rates are addressed by the changes of Alternative 2.1 plus two other changes. First the rockfish fishery would receive a separate allowance because it has a relatively high halibut bycatch rate.

Second, bycatch in the sablefish fishery would be counted against the turbot/arrowtooth allowances instead of against the other trawl allowances. This will eliminate the current problem of bycatch in the sablefish fishery not being controlled by the PSC limits. The sablefish fishery was placed with the Greenland turbot and arrowtooth flounder fisheries due to the associations between these species in the deepwater fishery and because the same vessels tend to participate in these three fisheries.

3.6 BS/AI and GOA Fishery Definitions

Concerns have been raised regarding the two sets of fishery definitions that are used to monitor the vessel incentive program and monitor PSC limit allowances.

Incentive Program Definitions With respect to the first set of definitions, the concerns are as follows. Fishery definitions based on total catch composition may not provide an effective index of a vessel operator's intended target fishery operation, especially if target operations involve large amounts of non-target groundfish discards. Of special concern are those vessel operators that fish for species included under the incentive program (BS/AI flatfish and Pacific cod and GOA Pacific cod and rockfish), but intentionally or unintentionally catch and discard large amounts of other groundfish. As a result, the vessel may be assigned to other then its target fishery based on total observed groundfish catch composition. Concern has been raised that a vessel operator may purposely target on species he intends to discard to manipulate total catch composition in a manner that prevents the vessel from being assigned to a fishery included under the incentive program. Another concern is that the catch composition percentages and the ordering of the percentages that are currently used to define fisheries for the incentive program are somewhat arbitrary and may become less appropriate as the determinants of catch composition change over time.

These problems would be eliminated or substantially reduced by defining all fisheries, except the mid-water pollock fishery, on the basis of the dominant retained catch species for a week. It would be unusual for the dominant retained species not to be the target species of a fishing operation. It would also be much more costly for a fishing operation to fish strategically to avoid being classified in an incentive program fishery when fisheries are defined in terms of retained catch. The problem of strategic behavior to avoid being included in the incentive program is also reduced by the addition

of all other trawl fisheries in the incentive program. By reducing the incentive for such behavior, the proposed definitions would both increase the coverage of the incentive program to its intended level and reduce the fishing mortality associated with fish that, under the current definitions, are caught and discarded by a vessel to change how its fishing activity is defined.

There is another reason that fishermen may target on fish that they intend to discard. This can be done to decrease their monthly bycatch rates. For example, a vessel that is in the cod fishery and has a bycatch rate that exceeds the bycatch rate standard may be able to briefly target on and discard mid-water pollock to increase its catch without increasing its bycatch and thereby decrease its monthly bycatch rates. Such behavior may be more likely to occur if fisheries are defined in terms of retained catch because a vessel could harvest and discard large amounts of pollock without being classified as being in the mid-water pollock fishery. The cost to the vessel of doing this is expected to limit such behavior.

An additional advantage of principally using definitions based on retained catch is that both weekly processing date reported by each processor and observer data can, in many cases, be used to classify the weekly fishing activity of a vessel. When this can be done, the classification of a vessel's activity should be less subject to challenge when a vessel is thought to have exceeded a bycatch standard.

PSC Limit Allowance Monitoring Definitions The principal concerns with the current definitions are that: (1) the catch composition percentages and the ordering of the percentages that are currently used are somewhat arbitrary and may not always reflect the intent of a fisherman to target on a specific species and (2) they are not consistent with the definitions used for the incentive program. Both problems would be eliminated by using the same set of definitions that is proposed for the vessel incentive program.

3.7 BS/AI and GOA Directed Fishing Standards

During 1991, the NMFS and the Council became aware of enforcement and implementation problems associated with existing directed fishery closures triggered by attainment of PSC limits or TAC amounts. In response to these problems, an emergency rule was implemented on August 7, 1991 that accomplished the regulatory changes proposed under Alternative 2 of Section 2.7.

The emergency rule is scheduled to expire November 12, 1991, with a possible extension through the end of the 1991 fishing year. Expiration of the emergency rule must be followed by a regulatory amendment to incorporate these regulatory changes on a more permanent basis. The following discussion is intended to support a regulatory amendment to accomplish this action and describes the problem that each component of the emergency rule is designed to address. The environmental assessment prepared for the emergency rule in incorporated into this document by reference.

3.7.1 Definition of a fishing trip for purposes of calculating directed fishing standards

Closures of target (directed) fishing operations for specified groundfish species are routinely implemented to limit further harvest of a species when (1) the total allowable catch (TAC) specified for a fishery is approached, (2) a fishery has attained a prohibited species bycatch allowance, or (3) a fishery incidently catches a groundfish species whose harvest amounts have triggered overfishing concerns.

Closures of directed fishing efforts for groundfish species are implemented and enforced under regulations that implement directed fishing rules at 50 CFR parts 672.20(g) and (h) and 675.20(h) and (i). These rules specify bycatch standards for groundfish species that vessels must comply with

during each fishing trip. If allowable bycatch amounts are exceeded during a "fishing trip" the vessel is considered in violation of the applicable directed fishing closure.

As indicated above, the amount of a groundfish species that may be retained on board a vessel when directed fishing is closed is measured on the basis of a fishing trip. As applied, a fishing trip for a vessel begins after the effective date of a directed fishing closure until any offload or transfer of any fish or fish product from that vessel or until the vessel leaves a regulatory area or district (GOA) or management area (BS/AI) where fishing activity commenced, whichever occurs first.

In the BS/AI, directed fishing closures may be implemented for other than the two existing management areas (Bering Sea area and Aleutian Islands area). This situation has undermined effective enforcement of such closures and imposes unnecessary burdens on fishing vessels. Vessels should be able to move into areas where a directed fishing prohibition applies even though vessels have the prohibited species on board. In response to this predicament, the definition of a "fishing trip for BS/AI operations was temporarily amended under the August 7, 1991, emergency rule so that the end of a fishing trip is defined as when "the vessel enters or leaves a subarea or reporting area to which a directed fishing prohibition applies, or until any offload or transfer of any fish or fish product from that vessel, whichever occurs first."

This revised definition of "fishing trip" must be retained in BS/AI regulations after the interim emergency rule expires and expanded to GOA regulations to allow directed fishing closures for GOA pollock that are based on other than established regulatory areas. Furthermore, the definition of "fishing trip" must be further revised to limit the opportunity to "top off" retained amounts of fish with catches of groundfish species for which directed fishing is prohibited. For example, a catcher/processor vessel fishing in an area closed to directed fishing for Pacific cod may not offload fish or fish products for 3-4 weeks. Prior to offloading product when sufficient amounts of other fish and fish products are on aboard, the vessel operator may legally conduct target operations for Pacific cod and retain amounts of Pacific cod consistent with the directed fishing standards. "Topping off" groundfish catch in this manner is inconsistent with the intent of the directed fishing rule to limit groundfish bycatch to minimum amounts necessary to harvest groundfish in open fisheries.

The above problem would be addressed by limiting the opportunity for fishermen to "top off" their catch of groundfish with species closed to directed fishing. This could be accomplished by revising the definition of "fishing trip" so that a trip would terminate at the end of a weekly reporting period, thus limiting the opportunity to "top off" catches to a weekly period, instead of a 3-4 week or longer period.

3.7.2 Restrictions on the use of trawls in the Gulf of Alaska

In the GOA, Pacific halibut are caught in the groundfish fisheries as bycatch. Halibut bycatch is controlled through the use of PSC limits. For the 1991 fishing year, 2,000 metric tons (mt) of Pacific halibut mortality are apportioned to trawl gear. This amount is seasonally apportioned into bycatch allowances for each of the four calendar quarters. The allowances are: 600 mt for each of the first and second calendar quarters and 400 mt for each of the third and fourth calendar quarters.

Gulf of Alaska regulations at 50 CFR 672.20(f) require the Regional Director, NMFS, to prohibit fishing for groundfish with non-pelagic trawl gear for the remainder of a season or for the remainder of the fishing year if the trawl bycatch allowance or the trawl PSC limit is reached. Pelagic trawl gear is defined at 50 CFR 672.2.

As currently defined in regulations, the wide mesh configuration of the forward portion of a pelagic trawl is intended to release bycatches of halibut that are susceptible to capture by a pelagic trawl while fishing for groundfish species, such as pollock. The NMFS has learned, however, that when directed fishing closures to non-pelagic trawls are instituted, some fishermen use reconfigured bottom trawls and resume fishing on the sea bed for the same species for which the fishermen were fishing prior to the closure. Subsequent Pacific halibut bycatches would be expected to continue, probably at the same rate experienced with bottom trawls. Although any bycatches would be counted against the next quarter's bycatch allowance, the Council's intent to promote trawling opportunity through the year would be thwarted. When the entire 2,000 mt of Pacific halibut mortality is reached, halibut bycatch could still continue, thwarting the Council's intent to limit the amount of trawl-caught mortality to 2,000 mt.

The Council preferred alternative is therefore, an amendment to existing GOA regulations that would prohibit all trawling for groundfish, except pollock, once the halibut bycatch allowance apportioned to trawl gear is reached. Trawling for pollock with pelagic trawls would still be allowed.

3.7.3 Directed fishing standards

When the directed trawl fishery for BS/AI Pacific cod or other groundfish species, and the directed fishery for GOA groundfish with non-pelagic trawl gear are closed due to attainment of halibut bycatch allowances, fishermen may fish for pollock with pelagic trawl gear and then top off their catches of pollock with Pacific cod or other bottom dwelling groundfish, resulting in high bycatch rates of halibut. Existing standards for directed fishing at 50 CFR 672.20(g) and 50 CFR 675.20(h) allow retained amounts of Pacific cod or other shelf groundfish species to comprise up to 20 percent of all other fish or fish products retained on board a vessel during a trip. Allowable amounts of BS/AI slope species (sablefish, Greenland turbot, and rockfish) are constrained to one percent of other fish or fish products retained on board a vessel during a trip. GOA sablefish is also constrained to 15 percent of other slope groundfish species, plus 5 percent of all other fish species retained on board a vessel during a trip.

A pelagic trawl as defined normally is not used to fish for bottom dwelling groundfish species, and the pelagic trawl fishery for pollock normally intercepts only small amounts of these species as bycatch. A vessel, however, could use reconfigured pelagic trawl gear to target on bottom dwelling species, such as Pacific cod, topping off the amounts of retained pollock onboard with up to 20 percent of Pacific cod or other shelf species. Because the value of trawl-caught Pacific cod that has been frozen at sea is relatively high, the economic incentive to top off with Pacific cod or other high valued shelf species exists. Trawling for these species with reconfigured pelagic trawl gear, however, would result in additional catches of Pacific halibut, increasing the problem of halibut bycatch in areas where the seasonal or annual halibut bycatch allowance to trawl gear has been reached.

To resolve this problem in the BS/AI and GOA, two options are considered to reduce the directed fishing standard for groundfish caught in a pollock fishery using pelagic trawl gear. The first option would limit the total amount of groundfish species to less than 7 percent of the amount of pollock retained onboard. This standard was recommended by the Council in recognition that some bycatch of other groundfish may occur in the pelagic pollock fishery and that any standard specified should be high enough to avoid wasteful discard of incidentally caught groundfish. A second option is also proposed that would limit the total amount of groundfish to 5 percent of the amount of pollock retained onboard. A 5 percent standard is proposed, because this amount is more than adequate to support groundfish bycatch needs in the pelagic pollock trawl fishery and is consistent with other directed fishing standards set at 5 percent in the GOA. Consistency with existing standards will lessen confusion within the fishing industry on allowable amounts of groundfish that may be retained as

bycatch and will facilitate compliance and enforcement of directed fishing standards. The Councils preferred alternative however, is to reduce the directed fishing standards for groundfish for which directed fishing is prohibited and are caught in a pelagic trawl pollock fishery to 7%.

Existing standards for specified slope groundfish species (one percent in the BS/AI and 5 percent in the GOA) are already sufficiently low so as to preempt an incentive to 'top off' pollock catches with these species. In fisheries still open to all trawl gear, the directed fishing standards for specific groundfish species would remain unchanged.

The directed fishing standards for GOA rockfish would also be reduced under the Council's consideration of a mid-year delay of the GOA rockfish season described under Alternative 2 in Section 2.3.3 of this document. Directed fishing standards for rockfish must be reduced to limit the incentive for fishermen to 'top off' their catches of other groundfish with rockfish species during the period that directed fishing for rockfish is closed. The intent of the proposed rockfish season delay is to avoid high bycatch rates of halibut and chinook salmon that have been observed to occur earlier in the year. The existing directed fishing standards for GOA rockfish allow the retention of up to 20 percent rockfish species relative to all other fish or fish product retained on board a vessel during a fishing trip. Actual bycatch rates of rockfish in other groundfish operations are much lower than 20 percent. The existing standards for rockfish, therefore, allows vessels to target on rockfish during the period that this fishery is closed, provided retained amounts of rockfish do not exceed 20 percent of other fish or fish products on board. As a result, high bycatch rates associated with target operations for rockfish could continue.

Adoption of the revised standards for rockfish described under Alternative 2 in Section 2.7 of this document (15 percent rockfish relative to slope species, plus 5 percent rockfish relative to shelf species) would effectively limit the retention of rockfish to amounts that more closely reflect true bycatch of these species in other target operations. As a result, reduced bycatch rates of halibut and chinook salmon associated with the rockfish fishery would be expected during the period that directed fishing for rockfish is prohibited.

3.8 Bycatch Simulation Model Based Analysis of BS/AI Alternatives

To examine the likely consequences of the proposed changes to the status quo, as outlined in Section 2, a fishery simulation model of the Bering Sea/Aleutian Islands groundfish fisheries was constructed. The model uses 1990 and 1991 domestic fishery (DAP) data to predict the future pattern of groundfish fishing, the expected bycatches, the likely catch per unit of effort, and the anticipated value of the groundfish fisheries and the foregone value of other fisheries due to bycatch in the groundfish fisheries. The values of groundfish and bycatch are measured in terms of both gross and net wholesale value, where the latter is gross value net of variable costs. The simulation model is described more fully in Appendix 3.

The ability of the model to accurately predict the effects of alternative bycatch management measures is severely limited for the reasons listed below.

1. The temporal and spatial variability of bycatch rates and the uncertainty about future TAC's and their distribution among fisheries, time, and areas introduce large amounts of uncertainty in the analysis of the effects of the alternatives on catch and bycatch.

2. The variability in product prices, CPUE, and other factors that determine the gross and net value per unit of groundfish catch has a similar result with respect to the estimates of economic performance.

3. The variability of the factors that determine impacts costs per unit of bycatch result in uncertainty concerning the total bycatch impact costs associated with each set of bycatch management measures.

4. The use of 1990 and 1991 catch data to predict the distribution of future catch by time and area prevents fishing in areas and times that were closed in both 1990 and 1991. Therefore, even though the proposed measures are predicted to reduce bycatch rates and postpone closures compared to 1990 and 1991, effort and catch will be redistributed to other areas and fishery wide bycatch rates will change as if there were a closure. This deficiency is a problem when the regulatory changes being considered are expected to delay closures, such as with the season delays and the additional vessel incentive programs.

5. The model redistributes the effort and catch of a fishery among areas in response to PSC limit induced closures but it does not redistribute catch among fisheries.

6. The future bycatch rate effects of the incentive program that was implemented in April of 1991 and the incentive program changes being considered in this amendment are not known. For the purposes of the model and estimating what the bycatch rates would be by cell with and without expansions of the incentive program for 1992, 1990 and 1991 bycatch rates were adjusted by cell. This was done based on the assumption that no fishing operation would have a monthly bycatch rate that exceeded a bycatch rate standard by more than 100 percent and that those operations that would have had such rates in the absence of the incentive program would on average act like the other operations. Therefore, bycatch rates were recalculated by cell by excluding monthly observations for operations that exceeded the standards by more than 100 percent.

7. Catch and bycatch data for 3-digit reporting areas provided by the Region was apportioned to subareas using more detailed data from the observer program. This was done to account for two types of areas that did not consistently correspond to the reporting areas for 1990 and 1991. These were the herring savings areas the new Bogoslof pollock area. Given the time and data that were available, it was not possible to make this apportionment to sub areas without losing data for some cells. The model results for some of the runs discussed below and for the unconstrained cases, that are used to determine the PSC limits allowance for each trawl fishery or groups of fisheries, indicate that the lost data included some cells with higher than average halibut bycatch rates. As a result of this, the model probably understates the expected halibut bycatch for each run. Therefore, the model is expected to provide better estimates of the differences that would occur among the alternatives than of what would occur with a specific alternative.

Four model runs were made to provide estimates of the effects of a group of changes both with and without an effective vessel incentive program being in place. This was done due to the uncertainty concerning the effects of the current incentive program and the proposed expansions of the incentive program. An additional run was made to estimate the effect of changing the BSAI PSC limit allowance groups. The estimates generated in the five runs are summarized in Table 19.

Run 1 is the status quo with the assumption that the current incentive programs will be effective in reducing bycatch rates. Run 2 includes a number of changes to the status quo and the assumption that the current and proposed incentive programs will be effective. The changes are as follows: (1) all trawl fisheries are delayed until January 20; (2) the PSC limit allowance groups are changed; (3) the proposed incentive programs are implemented; and (4) a non-trawl gear halibut PSC limit of 500 mt is imposed and the trawl halibut PSC limit is reduced by 500 mt. Therefore, the differences between the estimates for Runs 1 and 2 are estimates of the effects of that group of changes.

Table 19. Summary of biological and economic impacts resulting from imposition of proposed bycatch management rules - simulation model results

	RUN 1 Status Quo Existing Incentive Program	RUN 2 Season Delay New Incentive Program New Target Fishery Aggregations Fixed Gear Halibut PSC (5,333 mt)	RUN 3 Season Delay New Incentive Program Old Target Fishery Aggregations Fixed Gear Halibut PSC (5,333 mt)	RUN 4 Status Quo Assuming No Incentive Program	RUN 5 Season Delay No Incentive Program New Target Fishery Aggregations Fixed Gear Halibut PSC (5,333 mt
BYCATCH AMOUNTS					
Halibut (mt)	4,444	3,824	3,826	5,241	5,129
Herring (mt)	994	994	994	1,065	1,065
Red king crab (no.)	113,666	91,041	91,780	126,285	100,266
C. bairdi (no.)	1,967,205	1,924,392	1,926,233	2,098,691	2,061,006
Chinook (no.)	25,474	11,336	11,338	25,935	17,792
GROUNDFISH CATCH (mt)					
Fixed gear cod and sablefish	60,770	64,934	64,934	59,323	62,617
Pollock-Surimi	1,399,097	1,349,319	1,349,319	1,374,464	1,320,204
Cod, Atka mackerel - fillet	140,898	127,566	127,566	143,251	144,761
All other - H & G	161,036	163,208	163,221	198,013	205,088
TOTAL	1,761,801	1,705,027	1,705,040	1,775,051	1,732,670
GROSS REVENUE ($1,000s)					
Fixed gear cod and sablefish	$60,980	$64,775	$64,775	$59,528	$62,641
Pollock-Surimi	$657,520	$615,187	$615,187	$644,530	$601,669
Cod, Atka mackerel - fillet	$107,516	$96,341	$96,304	$108,020	$110,440
All other - H & G	$99,823	$99,618	$99,615	$122,417	$127,665
TOTAL	$925,838	$875,921	$875,881	$934,495	$902,415
TOTAL COSTS ($1,000s)					
Fixed gear cod and sablefish	$38,905	$41,327	$41,327	$37,979	$39,965
Pollock-Surimi	$406,347	$380,185	$380,185	$398,319	$371,832
Cod, Atka mackerel - fillet	$65,907	$59,057	$59,034	$66,216	$67,700
All other - H & G	$63,687	$63,556	$63,554	$78,102	$81,450
TOTAL	$574,847	$544,125	$544,101	$580,616	$560,946
NET REVENUES (Gross revenue - Total cost, $1,000s)					
Fixed gear cod and sablefish	$22,075	$23,449	$23,449	$21,549	$22,676
Pollock-Surimi	$251,173	$235,001	$235,001	$246,210	$229,838
Cod, Atka mackerel - fillet	$41,609	$37,284	$37,270	$41,804	$42,740
All other - H & G	$36,136	$36,062	$36,061	$44,315	$46,215
TOTAL	$350,992	$331,796	$331,780	$353,878	$341,469
PRESENT GROSS VALUE OF BYCATCH ($1,000s)					
Halibut (all fisheries)	$29,108	$25,047	$25,060	$34,329	$33,595
Pacific herring (all fisheries)	$1,362	$1,362	$1,362	$1,459	$1,459
Red king crab (all fisheries)	$2,387	$1,912	$1,927	$2,652	$2,106
Bairdi crab (all fisheries)	$3,934	$3,849	$3,852	$4,197	$4,122
Chinook salmon (all fisheries)	$1,401	$623	$624	$1,426	$979
TOTAL	$38,192	$32,793	$32,826	$44,063	$42,260
PRESENT NET VALUE OF BYCATCH ($1,000s)					
Halibut (all fisheries)	$15,110	$13,002	$13,008	$17,819	$17,439
Pacific herring (all fisheries)	$681	$681	$681	$730	$730
Red king crab (all fisheries)	$1,050	$841	$848	$1,167	$926
Bairdi crab (all fisheries)	$1,416	$1,386	$1,387	$1,511	$1,484
Chinook salmon (all fisheries)	$548	$244	$244	$558	$383
TOTAL	$18,805	$16,153	$16,168	$21,784	$20,961
Gross Groundfish Revenue - Gross Bycatch Value	$887,646	$843,128	$843,055	$890,431	$860,155
Net Groundfish Revenue - Net Bycatch Value	$332,187	$315,643	$315,612	$332,094	$320,508

Run 3 differs from Run 2 only in that the current PSC limit allowance groups are used in Run 3, not the proposed groups used in Run 2. Therefore, the differences between the estimates for Runs 2 and 3 are estimates of the effects of also changing the PSC limit groups after the other changes have been made.

Finally, Runs 4 and 5 are similar to runs 1 and 2 except that it is assumed that neither the current nor the additional incentive programs will reduce bycatch rates. Therefore, the differences between the estimates for runs 4 and 5 are estimates of the effects of that group of changes if neither set of incentive programs is effective in reducing bycatch rates. The incentive programs are expected to decrease bycatch rates, but perhaps by less than assumed in Runs 1 and 2; therefore, all else being constant, these two sets of estimates of the effect of the group of changes would tend to bracket the actual effects.

A comparison of the estimates of Runs 1 and 2 indicates that if the existing and proposed incentive programs are assumed to be effective, the bycatch management changes included in Run 2 would have the following effects.

1. Halibut bycatch mortality would be reduced by 14%.

2. Herring bycatch would not change.

3. Red king crab bycatch would decrease by 20%.

4. There would not be a significant change in bairdi bycatch.

5. Chinook bycatch would be reduced by 55%.

6. Groundfish catch would be reduced by 3.2%, which probably is not a statistically significant change.

7. Both the gross and net wholesale value of the groundfish catch would be reduced by 5.4%. These may not be statistically significant changes.

8. Both the gross and net wholesale value of the bycatch would decrease by about 14.2%.

A comparison of the estimates of Runs 2 and 3 indicates that the proposed changes in the grouping of trawl fisheries for the purposes of PSC limit allowances would not have a significant effect on bycatch, catch, or the value of either.

A comparison of the estimates of Runs 4 and 5 indicates that if the existing and proposed incentive programs are assumed to be ineffective, the bycatch management changes included in Runs 2 and 5 would have the following effects.

1. Halibut bycatch mortality would be reduced by 2.1%, which is not a statistically significant change.

2. Herring bycatch would not change.

3. Red king crab bycatch would decrease by 21%.

4. There would not be a significant change in bairdi bycatch.

5. Chinook bycatch would be reduced by 31%.

6. Groundfish catch would be reduced by 2.4%, which is not a statistically significant change.

7. The gross and net wholesale value of the groundfish catch would be reduced by 3.4% and 3.7%, respectively. These may not be statistically significant changes.

8. The gross and net wholesale value of the bycatch would decrease by about 4.3% and 4.7%, respectively.

A comparison of the estimates of Runs 2 and 5 indicates the importance of the incentive programs. The estimates for these two runs indicate that the incentive programs would have the following effects.

1. Halibut bycatch mortality would be reduced by 25%.

2. Herring bycatch would be reduced by 6.7%.

3. Red king crab bycatch would decrease by 9%.

4. Bairdi bycatch would be reduced by 6.6%

5. Chinook bycatch would be reduced by 36%.

6. Groundfish catch would be reduced by 1.6%.

7. The gross and net wholesale value of the groundfish catch would be reduced by 3% and 2.6%, respectively. These may not be statistically significant changes.

8. The gross and net wholesale value of the bycatch would decrease by about 22% and 23%, respectively.

The differences in groundfish catch estimates between Runs 1 and 2 are due to differences in catch composition that change the amount of catch can be taken with a given set of TACs. They are not due to halibut bycatch induced closures of the entire BS/AI that would decrease groundfish catch because such closures are not estimated to occur with either of these runs.

There are two reasons the catch composition of each fishery may differ between the runs. First, the season delay included in Run 2 results in changes in the temporal distribution of catch which in turn change the annual catch composition of each fishery. Second, Run 2 includes additional incentive programs, and the method used to estimate the effects of the additional programs changes the bycatch rates and catch compositions of each cell. It is assumed that all individual fishing operations with bycatch rates that exceeded the bycatch rate standards by more than 100% during a month would have acted like other operations during that month in terms of their bycatch rates and catch compositions.

If it is assumed that, in the absence of halibut bycatch induced closures of the entire BS/AI, there will be no significant differences between Runs 1 and 2 in terms of groundfish catch and value, the changes included in run 2 would provide about $5.4 million or $2.7 million of benefits in terms of reduced gross or net bycatch impact cost, respectively. In this case, these would be estimates of net benefits because there would be no offsetting costs in terms of foregone groundfish catch and value.

As noted in previous analyses of bycatch management measures, the bycatch model ignores any costs associated with actions the groundfish fishery takes to reduce bycatch rates. For example, the costs incurred by individual fishing operations in attempting to stay below the bycatch rate standards of the incentive programs are not considered. It is not known what these costs would be, but it can be assumed that they are lower than the costs of reducing bycatch by reducing groundfish catch.

4.0 SUMMARY OF BIOLOGICAL AND ECONOMIC DIFFERENCES AMONG THE ALTERNATIVES

4.1 Biological Implications

Halibut

It is very difficult to make precise estimates of the effects of bycatch on the commercial-sized component of halibut stocks because bycatch is largely made up of younger migrating halibut. Growth, mortality, and migration greatly complicate the estimation procedures. If the same age composition occurred in both fisheries one could consider the bycatch removals as merely increasing the directed removals. Migration rates of juvenile halibut are not well known, so the impact of bycatch of juvenile halibut from specific areas on adult populations in those or other areas must be made estimated indirectly.

Bycaught halibut are generally smaller than those harvested by the directed fishery. Consequently, factors such as maturity, reproductive capacity, survivorship, and growth substantially affect stock productivity. By allowing small halibut to remain at large for a longer period of time, a net gain in stock biomass occurs due to the greater cumulative gain in individual weight relative to losses incurred due to mortality. Smaller fish are less likely to be reproductively mature, and have less reproductive capacity. Those harvested earlier in their life history not only contribute less in terms of short term yield, but they also contribute less to the maintenance of future stock biomass or to future yields. Bycatch losses affect recruitment, future catch, and future reproductive potential of the stock.

In 1990, the IPHC staff improved its method of compensating for bycatch. The new approach is to reduce harvest in the directed fishery such that the reproductive potential of the exploitable component of the stock would be the same after bycatch as it would have been if bycatch had not occurred. The compensation factor was determined to be one mt of catch limit reduction for each mt of bycatch mortality.

Impact on the halibut fishery consists of two parts: (1) the catch limit reduction to maintain reproduction, and (2) reduced recruitment to the directed halibut fishery from bycatch of pre-recruits. Reproductive compensation for bycatch immediately deprives the directed fishery of one mt of yield for each mt of bycatch the previous year. But this amounts to leaving fish in the stock rather than catching them right away, and some are caught later. On the average, about 0.6 mt of the one mt bycatch compensation is eventually caught, so the net impact of reproductive compensation is 0.4 mt per mt of bycatch. Bycatch eventually reduces recruitment to the directed fishery, and amounts to 1.2 mt of lost yield for each mt of bycatch. The combined effects of reproductive compensation and lost recruitment shows a net loss to the directed fishery of 1.6 mt for each mt of bycatch: 0.4 mt from reproduction compensation and 1.2 mt from reduced recruitment.

If the reproductive compensation is done correctly and if the bycatch is estimated correctly, the halibut spawning stock size will remain in the same condition whether bycatch occurs or not. The halibut fishery pays for maintenance of the resource through lower catches. Therefore, changes of $\pm$ 50 percent in the bycatch limits will be felt in the halibut fishery, but should not affect the

condition of the resource. This would mean that the differences in expected halibut bycatch among the alternatives being considered are expected to affect halibut fishery quotas but not the condition of the halibut resource.

Crab

The adjustments to crab fishery quotas in response to crab bycatch in the groundfish fishery do not begin immediately as they do for halibut. The adjustments are made as the effects of bycatch affect the estimates of adult male and female crab. That is, crab catch limits are based on estimates of the condition of the mature crab stocks with particular emphasis being given to the population of male crab unless the female stocks are at a critically low level.

Herring

The bycatch simulation model was used to evaluate the magnitude of the herring bycatch under varies alternatives. Because herring bycatch is expected to be about the same under all of the alternatives considered, the expected effects on herring bycatch probably do not provide a basis for choosing among the alternatives.

Salmon

The analysis of the alternatives indicate that Alternative 2, including the delay of the groundfish fisheries and the addition of salmon to the incentive program, would decrease salmon bycatch substantially. This could result in benefits in terms of both the condition of some stocks and the harvest in salmon fisheries.

Marine Mammals and Birds

None of the actions proposed under any of the alternative considered are expected to have an adverse impact on Steller sea lions, other marine mammals, or sea birds. Substantial declines in abundance of North Pacific Ocean Steller sea lion (Eumetopias jubatus) and harbor seal (Phoca vitulina) populations have been observed over the past two decades. Presently, the cause or causes of these observed population reductions are unknown. NMFS permanently listed the Steller sea lion as a threatened species on November 26, 1990, and implemented regulations under The Endangered Species Act and Amendments 20 and 25 to the BSAI and GOA FMPS, respectively, to minimize potential adverse effects of groundfish fisheries on Steller sea lions. Given these protection measures and the fact that none of the management measures considered will significantly change fishing distribution or harvest levels, adoption of either alternative is not likely to have any effect on Steller sea lions, other marine mammals, or birds.

4.2 Reporting Costs

Existing reporting practices would not need to be augmented to implement any of the alternatives. Observers aboard most groundfish fishing vessels would be expected to provide estimates of catch regardless of which alternative is selected. The extension of the incentive program to salmon may require adjustments in sampling or estimation procedures.

4.3 Administrative, Enforcement, and Information Costs

The expansion of the incentive program will increase administrative and legal costs. Without a commensurate increase in General Counsel and Enforcement staff dedicated to the review and

prosecution of violations of the incentive program, existing limits on the number of cases that can be pursued may decrease the effectiveness and equity of the incentive program. At present, NMFS enforcement dedicates one agent month per violation to conduct the investigative work necessary to prepare an incentive program violation for possible prosecution. The casework on each violation is further reviewed by General Counsel, Alaska Region (GCAK) before a determination is made to issue a notice of violation and assessment (NOVA) and proceed with prosecution. Lacking an increase in staff, NMFS would proceed to identify and prosecute violators of the expanded program to the limited extent possible.

The work load necessary to investigate and review an additional 24 cases per year would require two additional full time enforcement agents at the GS-12 level (about $50,000 per agent). Due to the remote nature of Alaska fishing communities, travel of enforcement agents to obtain initial interviews of observers, crew, vessel operators/owners, and others necessary for case documentation is estimated at about $1,500 per case. Expenses for observer travel necessary for additional case documentation is estimated at another $1,000 per case. Given a load of 24 additional violations per year, therefore, travel costs necessary to develop supporting evidence could reach an additional $60,000 per year. This value would increase to the extent that NMFS would incur the salary costs of observers during the period they are being interviewed an away from their contracted duties as an observer.

The additional legal work involving review and prosecution of violations of the expanded observer program would require two additional staff attorneys for General Counsel, Alaska Region. Assuming the staff attorneys would be hired at the GS-13 level, salary and befits for additional GCAK staff are estimated at about $124,000.

4.4 Distribution of Costs and Benefits

The data in Table 19 provide estimates of the distributions of benefits and cost that can be quantified more readily. Other benefits and costs that have not been quantified are discussed in Section 3.

4.5 Effects on Consumers

None of the alternatives is expected to have a large enough effect on groundfish, halibut, herring, crab, or salmon catch to measurably change the well being of domestic consumers in terms either of the amount of product available to domestic consumers or the prices they pay for fishery products.

5.0 EFFECTS ON ENDANGERED AND THREATENED SPECIES AND ON THE ALASKA COASTAL ZONE

None of the alternatives are expected to have any adverse effect on endangered or threatened species or their habitat. Thus, formal consultation under Section 7 of the Endangered Species Act is not required.

Also, for each of the reasons discussed above, each of the alternatives would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of Section 333307(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

6.0 OTHER EXECUTIVE ORDER 12291 REQUIREMENTS

Executive Order 12291 requires that the following three issues be considered:

(a) Will the amendment have an annual effect on the economy of $100 million or more?

(b) Will the amendment lead to an increase in the costs or prices for consumers, individual industries, Federal, State, or local government agencies or geographic regions?

(c) Will the amendment have significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of U.S. based enterprises to compete with foreign enterprises in domestic or export markets?

Regulations do not impose costs and cause redistribution of costs and benefits. If the proposed regulations are implemented to the extent anticipated, these costs are not expected to be significant relative to total operational costs

The amendments would not have significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of U.S. based enterprises to compete with foreign enterprises in domestic or export markets.

The amendments should not lead to a substantial increase in the price paid by consumers, local governments, or geographic regions since no significant quantity changes are expected in the groundfish markets. Where more enforcement and management effort are required, costs to state and federal fishery management agencies will increase.

These amendments should not have an annual effect of $100 million, since although the total value of the domestic catch of all groundfish species is over $100 million, these amendments are not expected to substantially alter the amount of distribution of this catch.

7.0 IMPACT OF THE AMENDMENTS RELATIVE TO THE REGULATORY FLEXIBILITY ACT

The Regulatory Flexibility Act (RFA) requires that impacts of regulatory measures imposed on small entities (i.e., small businesses, small organizations, and small governmental jurisdictions with limited resources) be examined to determine whether a substantial number of such small entities will be significantly impacted by the measures. Fishing vessels are considered to be small businesses. Over 2,000 vessels may fish for groundfish off Alaska in 1992, based on Federal groundfish permits issued by NMFS. While these numbers of vessels are considered substantial, regulatory measures will only affect a smaller proportion of the fleet.

8.0 FINDINGS OF NO SIGNIFICANT IMPACT

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

_____ _____

Assistant Administrator for Fisheries Date

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APPENDIX 1.1

BYCATCH HOTSPOT ANALYSIS USING 1991 OBSERVER DATA

By

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Alaska Regional Office

Under the proposed "hot spot" authority, the Regional Director would close 3-digit statistical areas, or smaller areas pending data availability, for a fishery if a predetermined bycatch rate is exceeded in that fishery. The elements of "hot spot" authority are listed below.

1. A closure under "hot spot" authority would be non-discretionary. The Regional Director must implement a closure for a fishery if a predetermined bycatch rate for that fishery is exceeded in a 3-digit statistical area.

2. Observed bycatch rates made by NMFS-certified observers will be the basis of the closure.

3. If a predetermined bycatch rate for a fishery is determined to have been exceeded for a week in a 3-digit area, the Regional Director must close that area to that fishery for the next reporting week.

5. Actual conditions triggering a closure would be contained in regulations implementing the FMPs. Changes to those conditions could be made by the Regional Director in consultation with the Council prior to a new fishing year using procedures specified in regulations.

Information on bycatch rates would be obtained from weekly observer reports. Given current methods of communications between observers on vessels and NMFS, information about bycatch rates for any given week are not received until the subsequent week. Administrative requirements to implement a closure will dictate that the actual week closed would be the second week after a "hot spot" week occurred. That is, if week one is a hot spot week, the closure would occur in week three.

In preparing an analysis of "hot spot" authority, 1991 data were reviewed to estimate the impacts of this authority had it been in effect in 1991. Because the week that would be closed after a "hot spot" rate was observed would be two weeks later, NMFS was especially interested in bycatch rates during that particular week. If bycatch rates were still "hot" during the third week, then a closure of the week would be correct. If, however, bycatch rates were reduced, then a closure of the third week would be incorrect.

A series of four tables is presented in this appendix to illustrate the results of this analysis. Table 1 summarizes bycatch rates for each target fishery in each 3-digit area that were higher than average bycatch rates for the overall management area. For the GOA, these rates are shown for halibut and chinook salmon. For the BS/AI, these rates are shown for halibut, red king crab, Tanner crab (c. bairdi), salmon, and herring. Table 2 lists examples of predetermined bycatch rates that would

have triggered closures under "hot spot" authority, had annual average rates for each area and fishery been used to trigger closures. These rates represent the average of the high bycatch rates summarized in Table 1. Halibut bycatch rates in BS/AI midwater pollock were excluded when calculating average the halibut bycatch rate because they were especially low. These rates in the turbot fisheries were excluded, because they were especially high. Table 3 lists associated groundfish catches and prohibited species catches for the weeks that would have been closed. Finally, Table 4 lists the number of times that the observed bycatch rate in the week that would have closed actually exceeded the predetermined rate, that is, it lists the number of times the time/area closures would have been correct.

The summaries show average bycatch rates listed in Attachment 1 only for those 3-digit statistical areas when the average rate for a fishery was higher than the average rate for the overall GOA or BS/AI management area. For example, in the GOA rockfish fishery, the average halibut bycatch rates reported for areas 620 and 630 were 79.88 and 112.62 kg/mt, respectively, which were higher than the overall GOA bycatch rate of 69.70 kg/mt. The reports are from weekly observer reports through July 21, 1991.

Table 4 is a critical because it contains estimates of the numbers of times the correct closures would have been made, given the closure triggering rates used in this analysis. An example of how to interpret Table 4 may be helpful. The BS/AI Pacific cod trawl fishery during 1991 exceeded the predetermined halibut bycatch rate 29 times. During the third week, which is the week that would have been closed, the observed bycatch rate exceeded the predetermined rate 10 times. "Hot spot" authority, therefore, would have been effective only 34 percent of the time.

Table 4 indicates little correlation between occurrences of "hot spot" bycatch rates and actual fishing weeks. Implementation of "hot spot" authority as proposed herein must take this fact into consideration. "Hot spot" bycatch rates may or may not continue into the week that is actually closed. Fishermen may take steps to avoid bycatches of prohibited species for purposes of avoiding closures, but actual savings of prohibited species may not occur. A closer correlation would be obtained by reducing the predetermined "hot spot" rate to a lower rate, but that would increase the number of closures, imposing higher industry and management costs. It would also ignore the fact that the intent of hot spot authority is to close time/areas with exceptionally high bycatch rates, not lower than average rates.

Table 1. Summary of 1991 observed bycatch rates for halibut (kg/mt), red king crab and Bairdi crab (numbers/mt), chinook salmon (numbers/mt), and herring (kg/mt) by 3-digit statistical area, that were higher than the average bycatch rate for the management area.

BERING SEA/ALEUTIAN ISLANDS

		511	513	514	515	516	517	519	521	522	530	540	BSAI Avg.
Pollock (B)	Halibut	14.48			18.19		10.96	13.03		14.79			7.36
	RKC	0.23				1.52							0.07
	Bairdi	10.01			66.73					6.58			4.47
	Salmon						0.21					0.06	0.04
	Herring								0.12				0.08
Pollock (M)	Halibut	0.19	0.47						0.76				0.20
	RKC												0.00
	Bairdi	0.11	0.09				0.11		0.27				0.08
	Salmon						0.13						0.03
	Herring						0.93						0.17
Cod	Halibut	19.22	47.43		18.05		27.49	33.06					17.95
	RKC												0.00
	Bairdi	4.22					8.88						3.92
	Salmon							0.06	0.08	0.06			0.04
	Herring												0.00
Turbot	Halibut						124.00			767.87			43.70
	RKC											0.32	0.16
	Bairdi				3.31		1.73						1.42
	Salmon						0.05						0.02
	Herring												0.00
Flatfish & rocksole	Halibut	15.58	14.65				70.76						9.16
	RKC					2.82							0.56
	Bairdi	9.34	8.72			7.67	18.53						8.29
	Salmon								0.06				0.01
	Herring			6.23						16.68			3.64

GULF OF ALASKA

Target fishery	PSC Species	3-Digit Statistical Area 610	620	621	630	631	640	680	GOA Avg.
Rockfish	Halibut		79.88		112.62				69.70
	Salmon		9.94						1.49
Cod	Halibut				26.68				16.17
	Salmon			0.08	0.15				0.05
Flatfish (DW)	Halibut		63.74		68.80				60.03
	Salmon		0.32		0.31				0.28

Table 2. Examples of predetermined byctach rates, summarized from the average of the high rates shown in Table 1.

BERING SEA/ALEUTIANS			GULF OF ALASKA		
Halibut	-	24.44 kg/mt	Halibut	-	70.23 kg/mt
RKC	-	1.22 no/mt	Salmon	-	2.16 no/mt
Bairdi	-	9.75 no/mt			
Salmon	-	0.08 no/mt			
Herring	-	5.99 kg/mt			

Table 3. Estimates of 1991 groundfish trawl catches (mt) and prohibited species catches in the 3-digit statistical areas of the BSAI and in the GOA that might have been closed under "hot spot" authority.

Bering Sea and Aleutian Islands Area
Bycatch Species

Species	Halibut		Chinook Salon		Herring	
	Trawl Catch (mt)	Bycatch (mt)	Trawl Catch (mt)	Bycatch (no.)	Trawl Catch (mt)	Bycatch (mt)
Pacific cod	22,339	755	10,413	509	No closures	
Flatfish & rock sole	5,616	132	948	0	13,450	141
Turbot	639	102	22	1	No closures	
Pollock (B)	3,839	46	4,165	323	No closures	
Pollock (M)	No closures		57,469	1,613	22,799	136
Total		1,035		2,446		277

Gulf of Alaska

Species	Halibut		Chinook Salmon	
	Trawl Catch (mt)	Bycatch (mt)	Trawl Catch (mt)	Bycatch (no.)
Rockfish	2,273	247	707	2,877
Pacific cod	No closures		No closures	
Deep water flatfish	605	83	272	1
Total		330		2,878

Table 4. Number of times during 1991 when observed bycatch rates were higher (+) than the predetermined "hot spot" bycatch rate. Total means total number of weeks that could have been closed. (%) means proportion of weeks closed when bycatch rate was higher than predetermined rate compared to total number of weeks.

Bering Sea and Aleutian Islands Area
Bycatch Species

Fishery	Halibut			Chinook Salmon			Herring		
	+	Total	%	+	Total	%	+	Total	%
Pacific cod	10	29	34	0	6	0	No closures		
Flatfish & rock sole	3	12	25	0	2	0	4	10	40
Turbot	2	9	22	0	1	0	No closures		
Pollock (B)	3	12	25	3	8	38	No closures		
Pollock (M)	No closures			0	7	0	0	1	0

Gulf of Alaska

Fishery	Halibut			Chinook Salmon		
	+	Total	%	+	Total	%
Rockfish	6	15	40	1	5	20
Pacific cod	No closures			No closures		
Deep water flatfish	1	6	17	0	2	0

APPENDIX 1.2

BYCATCH HOTSPOT ANALYSIS USING 1990 OBSERVER DATA

By

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DATA and METHODS

Two data sets were created, one for the Eastern Bering Sea and one for the Gulf of Alaska, from the 1990 Observer Data Base (NORPAC). Data on catch (trawl gear only) of all allocated groundfish species and prohibited species (halibut, herring, red king crab, Tanner crab and salmon) were aggregated by vessel, week and ½ x 1° block, and then further by statistical area and fishery according to the following prioritized definitions:

1) Bering Sea: Arrowtooth flounder ≥ 20% of total catch
- Atka mackerel ≥ 20% of total catch
- Sablefish ≥ 20% of total catch
- Rockfish ≥ 35% of total catch
- Bottom Pollock ≥ 20% of total catch
- Other flatfish ≥ 40% of total catch
- Pacific cod ≥ 40% of total catch
- Greenland turbot ≥ 35% of total catch
- Midwater Pollock ≥ 95% of total catch

2) Gulf of Alaska: Shallow flatfish ≥ 20% of total catch
- Deepwater flatfish ≥ 20% of total catch
- Sablefish ≥ 20% of total catch
- Bottom Pollock ≥ 35% of total catch
- Rockfish ≥ 20% of total catch
- Pacific cod ≥ 40% of total catch
- Midwater Pollock ≥ 95% of total catch

Data for each region were printed out by fishery and statistical area in chronological order permitting sequential analysis of the progress of each fishery in each statistical area throughout the year. Data were analyzed in two ways. First, the frequency and duration of hotspots were cataloged, and the month and location within each statistical area where prohibited species were caught was plotted (since the original data was requested by ½ x 1° blocks). This permitted analysis of when, how long and how frequently the hotspot rate was exceeded, as well as an idea of where within statistical areas the catches of prohibited species were the greatest. Second, in an attempt to simulate the progress of fisheries in a year, a "hotspot" bycatch rate was established for each fishery and PSC (2X the fisheries annual average bycatch rate for the year for the Bering Sea or Gulf of Alaska). Anytime that the hotspot rate was exceeded in a statistical area for 2 consecutive weeks, the following scenario would occur: the statistical area was closed to that fishery for the second and third weeks following the end of the 2-week high bycatch rate episode and the amount of PSC "savings" was accumulated (the amount of each prohibited species that would not have been caught by that fishery had the

fishery actually been closed in 1990). There were no provisions made for redirecting fishing effort away from closed areas.

RESULTS AND DISCUSSION

Table 1 summarizes the data on the duration and frequency of occurrence of 2X the fisheries' annual average bycatch rate for each prohibited species. For example, in the Gulf of Alaska, the halibut hotspot rate was recorded in 111 of 397 weeks of data for all fisheries, or 28% of the time. Percentages by fishery for halibut ranged from 13% by midwater pollock to 38% by Pacific cod. Of these 111 weeks with high halibut bycatch rates, 32 were single weeks, there were 12 2-week periods (24 weeks), 4 3-week periods (12 weeks), 4 4-week periods (16 weeks), 2 6-week periods (12 weeks), and one 7 and 8 week periods respectively. The mean duration for all high rate periods was 2.0 weeks, and the mean for all those 2 weeks and over was 3.3 weeks. In the Bering sea, the mean duration for all high halibut rate periods was 1.7 weeks, and the mean for all those 2 weeks and over was 2.8 weeks.

The distribution of high bycatch rates for all species was similar, with most (between one-third and half) of the observations being of one week in duration and many fewer at two weeks in duration and greater. Consequently, hotspot closures which would react to only one week of observed high bycatch rates would occur far too frequently to be administratively possible and would subject the fishery to far too many regulations for little gain in bycatch reduction. Hotspot closures which would trigger on two weeks of observed high bycatch rates would occur less frequently but still may not yield a lot in bycatch savings because the "hotspot" period would end prior to the closure implementation.

Table 2 lists the ½ x 1° blocks which contributed the bulk of the bycatch resulting in high observed rates for at least 3 consecutive weeks. This analysis was limited to halibut, salmon and herring bycatch in the primary fisheries which caught them (rockfish, cod, bottom and midwater pollock, and turbot). In the Bering Sea, the blocks that continually provided a large amount of halibut, herring and salmon bycatch are those near and including Unimak Pass in 517. In the gulf, it is difficult to pinpoint one area as "hot", but possibly near the mouth of Shelikof gully south of Kodiak would be one. In the gulf cod fishery, it seemed anywhere they fished in 62 or 63 yielded high halibut bycatch in April-May and August-September.

Bycatch "savings" (Table 3) were analyzed with the following proposed "hotspot" scenario: 2 weeks of observed high bycatch rates in a statistical area by a fishery (2X the fishery annual average) followed by one week of administrative details to impose a 2-week closure starting the following week. This analysis was done with the knowledge that almost all of the hotspot periods lasted for 2 weeks or less, but that some, which lasted longer, accounted for a substantial amount of bycatch. With this scenario, it was estimated that 7.2% of the halibut bycatch could be "saved" in the Gulf of Alaska and 8.2% in the Bering Sea, but this is also with the assumption that the fishing effort in closed areas was not moved somewhere else. In the gulf, hotspot authority for other species similar to that detailed above provided no more than 5.9% savings, and may not be worth the administrative and fishery hassles.

In the Bering Sea, hotspot authority like the one proposed provided savings of 11.1% of the herring bycatch (almost all in the mid-water pollock fishery), 8.8% of the red king crab, 15.6% of the Tanner crab, and 14.7% of the salmon (almost all in the mid-water pollock fishery). With regard to halibut, hotspot authority in the Bering Sea in 1990 would have only been effective in the rockfish, bottom pollock, cod and turbot fisheries (accounting for 93% of the bycatch savings). With regard to herring and salmon, hotspot authority would only have been effective in the mid-water pollock fishery. However, it must also be remembered that all of these closures (56 for Bering Sea halibut) resulted

in only a 8.2% savings in halibut bycatch weight. On a per-closure basis, there is greater halibut savings per closure in the turbot and rockfish fisheries than in the bottom pollock or cod fisheries. With regard to the Bering Sea cod fishery and halibut bycatch, there are many vessels near the average bycatch rate. Consequently, there can be a lot of halibut caught in the cod trawl fishery without kicking in a "hotspot". In the gulf the rockfish and cod fisheries provided the bulk of the halibut savings, while the cod fishery in the gulf had a distribution of halibut bycatch rates similar to that observed in the Bering sea.

TABLE 1 GULF OF ALASKA AND BERING SEA "HOTSPOT' ANALYSIS WITH 1990 OBSERVER DATA - NUMBER OF TIMES BYCATCH RATE WAS AT LEAST 2X FLEET AVERAGE

I. GULF OF ALASKA

PROHIBITED SPECIES

	HALIBUT	HERRING	RED KING CRAB	TANNER CRAB	SALMON
# 1 WEEK	32	8	27	34	32
# 2 WEEKS	12	3	4	5	5
# 3 WEEKS	4	0	2	2	4
# 4 WEEKS	4	0	2	1	0
# 5 WEEKS	0	0	0	1	2
# 6 WEEKS	2	0	0	0	0
# 7 WEEKS	1	0	0	0	1
# 8 WEEKS	1	0	0	0	0
MEAN DURATION 2+	3.3 WEEKS	2.0 WEEKS	2.8 WEEKS	2.8 WEEKS	3.2 WEEKS
MEAN DURATION ALL	2.0	1.3	1.4	1.4	1.6

TOTAL # WEEKS AND PERCENT BY FISHERY THAT BYCATCH RATE EXCEEDED 2X THE FLEET AVERAGE

PROHIBITED SPECIES

FISHERY	HALIBUT	HERRING	RED KING CRAB	TANNER CRAB	SALMON	TOTAL WEEKS OF DATA
SHALLOW FLATFISH	5 (28%)	0 (0%)	2 (11%)	4 (22%)	2 (11%)	18
DEEPWATER FLATFISH	7 (35)	0 (0)	1 (5)	3 (15)	4 (20)	20
SABLEFISH	10 (22)	1 (2)	8 (18)	7 (15)	6 (13)	45
BOTTOM POLLOCK	19 (24)	2 (2)	16 (20)	8 (10)	14 (18)	80
ROCKFISH	28 (30)	5 (5)	15 (16)	13 (14)	16 (17)	93
PACIFIC COD	36 (38)	3 (3)	7 (7)	19 (20)	24 (26)	94
MIDWATER POLLOCK	6 (13)	3 (6)	0 (0)	5 (11)	5 (11)	47
TOTAL GULF	111 (28)	14 (4)	49 (12)	59 (15)	71 (18)	397

TABLE 1 (CONT)

II. BERING SEA

PROHIBITED SPECIES

	HALIBUT	HERRING	RED KING CRAB	TANNER CRAB	SALMON
# 1 WEEK	88	22	66	60	66
# 2 WEEKS	35	12	14	19	22
# 3 WEEKS	7	2	1	7	3
# 4 WEEKS	7	2	0	0	3
# 5 WEEKS	6	0	2	1	1
# 6 WEEKS	1	0	0	0	3
# 7 WEEKS	0	0	0	1	0
#11 WEEKS	0	0	0	1	0
#14 WEEKS	0	0	0	1	0
#16 WEEKS	0	0	0	1	0
MEAN DURATION 2+	2.8 WEEKS	2.4 WEEKS	2.4 WEEKS	3.6 WEEKS	2.8 WEEKS
MEAN DURATION ALL	1.7	1.6	1.3	1.9	1.6

TOTAL # WEEKS AND PERCENT BY FISHERY THAT BYCATCH RATE EXCEEDED 2X THE FLEET AVERAGE

PROHIBITED SPECIES

FISHERY	HALIBUT	HERRING	RED KING CRAB	TANNER CRAB	SALMON	TOTAL WEEKS OF DATA
ARROWTOOTH FLOUNDER	17 (48%)	0 (0%)	5 (14%)	8 (23%)	5 (14%)	35
ATKA MACKEREL	0 (0)	0 (0)	4 (19)	2 (10)	3 (14)	21
SABLEFISH	4 (44)	0 (0)	4 (44)	2 (22)	1 (11)	9
ROCKFISH	17 (24)	0 (0)	11 (15)	11 (15)	13 (18)	71
BOTTOM POLLOCK	100 (44)	20 (9)	38 (17)	54 (24)	48 (21)	228
FLATFISH	13 (30)	4 (9)	5 (11)	9 (20)	3 (7)	44
PACIFIC COD	40 (20)	11 (6)	24 (12)	50 (26)	30 (5)	196
TURBOT	13 (20)	2 (3)	9 (14)	13 (20)	6 (9)	64
MIDWATER POLLOCK	39 (19)	23 (11)	7 (3)	23 (11)	45 (22)	208
TOTAL EBS	243 (31)	60 (7)	107 (12)	172 (20)	154 (18)	876

TABLE 2. HOTSPOT LIST IN THE GULF OF ALASKA AND EASTERN BERING SEA

BASED ON 1990 OBSERVER DATA BASE - TIMES AND AREAS WHERE/WHEN THE FISHERY AVERAGE FOR THE WEEK EXCEEDED 2X THE ANNUAL FISHERY AVERAGE FOR EACH PROHIBITED SPECIES FOR AT LEAST 3 CONSECUTIVE WEEKS

I. **GULF OF ALASKA**

FISHERY	PROHIBITED SPECIES	SUBAREA & TIME		# WEEKS	BLOCKS
COD	SALMON	62	Mar-Apr	4	154570 154573
		62	Aug-Sep	7	154560 154563
		62	Oct-Nov	3	154560 154563
COD	HALIBUT	62	Apr-May	6	154570 154573 155550 155553 156550 156553
		62	Aug-Sep	4	156553 156560 157550 157553
		62	Sep-Nov	7	154553 154560 155553 155560 155563 156550 157553 158543
		63	Apr-May	3	150580 151573 151580 153580
		63	Aug	3	153560 153563
		63	Sep	4	151573 152570 153563 153573

I. **GULF OF ALASKA (continued)**

FISHERY	PROHIBITED SPECIES	SUBAREA & TIME		# WEEKS	BLOCKS
BOTTOM POLLOCK	HALIBUT	63	Oct-Nov	4	153563 153570 153580
ROCKFISH	SALMON	62	Apr-May	5	155550
		63	Apr	3	149573
	HALIBUT	61	Mar-May	8	159540 160540 161540 162540
		63	Apr-May	6	147580 148573 150563

II. **BERING SEA**

FISHERY	PROHIBITED SPECIES	SUBAREA & TIME		# WEEKS	BLOCKS
BOTTOM POLLOCK	HALIBUT	511	Feb	3	163550 163553 163560
		511	May	4	163543 163550 163553 164543 164550
		513	Oct-Nov	5	165570 165573 166573 168573 169573
		514	Oct-Nov	5	168580
		517	Aug-Sep	4	165540 165543
		517	May-Jun	6	165540 165543
		517	Nov	4	165543
		540	Sep-Oct	6	172520 173513
		540	Nov-Dec	4	172520 173513
MIDWATER POLLOCK	SALMON	517	Jan-Feb	5	165540 165543 166543
		517	Sep-Oct	6	165540 165543 167550
		550	Nov-Dec	6	

II. **BERING SEA (continued)**

FISHERY	PROHIBITED SPECIES	SUBAREA & TIME		# WEEKS	BLOCKS
COD	SALMON	517	Mar	3	165543 169560
		517	Apr-May	4	165543 169560
		521	Mar-Apr	6	170560
COD	HALIBUT	517	Mar	3	165540 168553 168560 169560
		517	Jul	4	164550
		540	Dec	3	175520
TURBOT	HALIBUT	517	Mar-Apr	5	165540 165543
		518	Mar-Apr	3	167540 167543
MIDWATER POLLOCK	HERRING	517	Jun-Jul	3	165540 165543
		521	Sep-Oct	4	175590 175593 176590 176593 177590 177593

Table 3. **GULF OF ALASKA "HOTSPOT' ANALYSIS WITH 1990 OBSERVER DATA - 2 WEEKS HIGH, ONE WEEK OFF, 2 WEEKS CLOSED**

= number of times that prohibited species bycatch rate exceeded 2X the annual fishery rate for at least 2 consecutive weeks in a statistical area

AMT and % = amount (kg for halibut and herring, numbers for crabs and salmon) and percent of total prohibited species catch for year caught in second and third weeks after the end of all two-week high bycatch episodes

	PROHIBITED SPECIES											
	--- HALIBUT ---			--- HERRING ---			RED KING CRAB			- TANNER CRAB -			---- SALMON ---		
FISHERY	#	AMT	%	#	AMT	%	#	AMT	%	#	AMT	%	#	AMT	%
SHALLOW FLATFISH	1	6	<0.1	0	0	0	0	0	0	1	0	0	1	0	0
DEEPWATER FLATFISH	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0
SABLEFISH	1	324	<0.1	0	0	0	1	0	0	0	0	0	1	0	0
BOTTOM POLLOCK	4	4,012	0.4	0	0	0	3	10	0.4	0	0	0	3	2	<0.1
ROCKFISH	7	35,875	3.9	2	0	0	2	29	1.0	2	23	0.1	2	381	5.6
PACIFIC COD	8	26,095	2.8	0	0	0	2	52	1.9	5	1,150	5.7	3	0	0
MIDWATER POLLOCK	1	860	<0.1	1	0	0	0	0	0	1	20	<0.1	1	0	0
TOTAL GULF	24	67,172	7.2	3	0	0	8	91	3.2	8	1,193	5.9	12	383	5.7

TABLE 3 (cont) EASTERN BERING SEA "HOT SPOT" ANALYSIS WITH 1990 OBSERVER DATA - 2 WEEKS HIGH, ONE WEEK OFF, 2 WEEKS CLOSED

= number of times that prohibited species bycatch rate exceeded 2X the annual fishery rate for at least 2 consecutive weeks in a statistical area

AMT and % = amount (kg for halibut and herring, numbers for crabs and salmon) and percent of total prohibited species catch for year caught in second and third weeks after the end of all two-week high bycatch episodes

	PROHIBITED SPECIES											
	--- HALIBUT ---			--- HERRING ---			RED KING CRAB			- TANNER CRAB -			---- SALMON ---		
FISHERY	#	AMT	%	#	AMT	%	#	AMT	%	#	AMT	%	#	AMT	%
ARROWTOOTH FLOUNDER	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0
ATKA MACKEREL	0	0	0	0	0	0	2	14	<0.1	0	0	0	0	0	0
SABLEFISH	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROCKFISH	4	11,869	1.1	0	0	0	0	0	0	2	564	0.1	4	8	<0.1
BOTTOM POLLOCK	25	20,589	2.7	5	38,880	1.7	8	805	4.1	7	40,425	7.4	12	26	0.2
FLATFISH	4	2,009	0.3	1	553	<0.1	2	519	2.7	3	28,442	5.2	0	0	0
PACIFIC COD	9	11,278	1.5	2	0	0	1	0	0	8	4,934	0.9	4	73	0.6
TURBOT	3	13,864	1.8	0	0	0	1	0	0	5	231	<0.1	1	0	0
MIDWATER POLLOCK	8	2,134	0.3	8	208,458	9.4	3	387	2.0	5	10,847	2.0	11	1,595	13.8
TOTAL EBS	56	61,743	8.2	16	247,891	11.1	17	1,711	8.8	31	85,423	15.6	32	1,702	14.7

APPENDIX 2

WEEKLY CATCH AND HALIBUT AND CHINOOK SALMON BYCATCH DATA

BY AREA FOR SELECT FISHERIES, 1990 AND 1991

Notes: The halibut bycatch estimates have been adjusted to reflect assumed discard mortality rates of 100% in the BS/AI trawl fisheries, 50% in the GOA trawl fisheries, 16% in all hook-and-line fisheries, and 12% in all pot gear fisheries. These estimates are based on data provided by the Alaska Region. The 1991 data are for January 1 - September 29.

1990 BSAI bottom trawl pollock fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/90	2636.06	60.81	23.07	50.90	.02
01/13/90	3619.52	35.95	9.93	96.20	.03
01/20/90	1949.09	194.36	99.72	12.60	.01
01/27/90	1667.52	32.66	19.59	17.28	.01
02/03/90	336.88	12.30	36.51	5.38	.02
02/10/90	683.04	4.27	6.25	14.39	.02
02/17/90	582.45	5.66	9.72	11.65	.02
02/24/90	423.67	.12	.28	2.14	.01
03/03/90	1753.16	19.20	10.95	21.46	.01
03/10/90	3270.39	5.03	1.54	24.15	.01
03/17/90	1380.43	5.58	4.04	46.11	.03
03/24/90	2588.39	1.20	.46	15.07	.01
03/31/90	5651.27	9.25	1.64	86.33	.02
04/07/90	8041.24	13.93	1.73	30.32	.00
04/14/90	4332.14	24.02	5.54	44.06	.01
04/21/90	3423.60	22.48	6.57	19.11	.01
04/28/90	3554.75	21.68	6.10	1.48	.00
05/05/90	3701.51	13.15	3.55	2.36	.00
05/12/90	2151.42	18.77	8.72	.05	.00
05/19/90	2661.10	46.97	17.65	.00	.00
05/26/90	5442.86	47.18	8.67	.00	.00
06/02/90	866.27	9.02	10.41	.96	.00
06/09/90	5101.77	4.84	.95	.00	.00
06/16/90	4733.80	5.22	1.10	.00	.00
06/23/90	5121.38	10.73	2.10	.00	.00
06/30/90	2549.48	7.53	2.95	.00	.00
07/07/90	1789.13	6.29	3.52	.00	.00
07/14/90	1627.78	1.31	.80	.00	.00
07/21/90	3960.49	7.33	1.85	13.78	.00
07/28/90	1825.18	2.24	1.23	.00	.00
08/04/90	4029.21	.59	.15	.00	.00
08/11/90	2390.95	.70	.29	.00	.00
08/18/90	5491.31	1.08	.20	.00	.00
08/25/90	7160.55	3.24	.45	.01	.00
09/01/90	4193.73	2.56	.61	.00	.00
09/08/90	5518.73	1.63	.30	.99	.00
09/15/90	7560.23	1.20	.16	1.97	.00
09/22/90	7916.99	2.29	.29	1.60	.00
09/29/90	4735.25	5.46	1.15	18.04	.00
10/06/90	8066.67	5.41	.67	19.80	.00
10/13/90	5437.34	8.94	1.64	49.67	.01
10/27/90	37.10	.00	.00	.00	.00
11/10/90	122.80	.01	.08	1.23	.01
12/01/90	112.50	1.62	14.40	1.12	.01
12/22/90	89.90	.73	8.12	.00	.00

1991 BSAI bottom trawl pollock fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/91	2577.77	36.84	14.29	1511.99	.59
01/13/91	6406.04	36.30	5.67	450.98	.07
01/20/91	8542.83	39.97	4.68	352.77	.04
01/27/91	4868.82	39.50	8.11	66.17	.01
02/03/91	8075.59	30.28	3.75	171.31	.02
02/10/91	11115.37	12.84	1.16	833.16	.07
02/17/91	6571.67	18.27	2.78	318.58	.05
02/24/91	12815.31	55.65	4.34	372.07	.03
03/03/91	767.02	7.11	9.27	36.23	.05
03/10/91	173.53	.04	.23	1.74	.01
03/17/91	502.38	1.69	3.36	.00	.00
03/24/91	58.80	.25	4.25	.00	.00
03/31/91	172.64	.33	1.91	.00	.00
04/14/91	55.92	.02	.36	.00	.00
04/21/91	222.16	1.43	6.44	9.36	.04
04/28/91	1040.22	6.13	5.89	21.29	.02
05/05/91	205.90	3.00	14.57	.00	.00
05/12/91	7.44	.01	1.34	.00	.00
05/19/91	8.82	.03	3.40	.00	.00
05/26/91	102.82	1.32	12.84	.00	.00
06/02/91	217.20	.68	3.13	1.30	.01
06/09/91	2990.71	11.68	3.91	25.35	.01
06/16/91	1852.80	6.91	3.73	.00	.00
06/23/91	1133.43	2.59	2.29	.00	.00
06/30/91	2824.57	6.76	2.39	17.18	.01
07/07/91	7474.25	54.42	7.28	43.20	.01
07/14/91	6873.10	83.58	12.16	12.11	.00
07/21/91	3342.28	4.37	1.31	8.40	.00
07/28/91	10098.07	6.99	.69	5.51	.00
08/04/91	4678.93	8.41	1.80	16.08	.00
08/11/91	8893.94	14.03	1.58	18.07	.00
08/18/91	7758.92	7.11	.92	16.45	.00
08/25/91	11285.54	27.87	2.47	20.33	.00
09/01/91	16935.53	59.66	3.52	37.00	.00
09/08/91	6555.74	26.04	3.97	132.42	.02
09/15/91	106.10	.19	1.79	.00	.00
09/22/91	208.68	.80	3.83	.00	.00
09/29/91	172.93	.23	1.33	.00	.00

1990 BSAI cod fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/90	771.25	40.12	52.02	7.72	.01
01/13/90	4681.05	90.71	19.38	86.59	.02
01/20/90	3890.33	232.15	59.67	78.34	.02
01/27/90	4467.38	123.84	27.72	101.61	.02
02/03/90	5430.41	241.82	44.53	112.94	.02
02/10/90	5437.90	56.34	10.36	123.22	.02
02/17/90	6113.64	68.55	11.21	108.01	.02
02/24/90	6291.08	99.43	15.80	108.41	.02
03/03/90	9828.54	156.08	15.88	245.58	.02
03/10/90	9191.90	158.01	17.19	353.13	.04
03/17/90	8811.72	114.50	12.99	736.76	.08
03/24/90	6645.93	77.74	11.70	1123.50	.17
03/31/90	4532.32	71.61	15.80	535.44	.12
04/07/90	4659.86	71.45	15.33	196.70	.04
04/14/90	5776.71	188.04	32.55	346.40	.06
04/21/90	5787.94	95.50	16.50	149.24	.03
04/28/90	5623.83	64.79	11.52	104.64	.02
05/05/90	7669.69	159.57	20.81	82.88	.01
05/12/90	5707.56	204.79	35.88	88.04	.02
05/19/90	3389.44	62.83	18.54	.00	.00
05/26/90	2936.16	39.21	13.35	.00	.00
06/02/90	3027.71	41.00	13.54	10.05	.00
06/09/90	2364.44	23.55	9.96	.00	.00
06/16/90	2420.67	20.31	8.39	.00	.00
06/23/90	3292.73	20.35	6.18	.00	.00
06/30/90	3174.41	32.69	10.30	13.34	.00
07/07/90	239.12	1.91	7.99	.00	.00
07/21/90	77.50	.17	2.19	.00	.00
07/28/90	5.86	.04	6.83	.00	.00
08/11/90	43.47	.21	4.83	.00	.00
08/25/90	8.00	.02	2.50	.00	.00
09/15/90	2.28	.00	.00	.00	.00
09/22/90	92.68	.62	6.69	.03	.00
09/29/90	54.80	.10	1.82	.16	.00
10/06/90	14.21	.12	8.44	.14	.01
10/13/90	96.76	.50	5.17	9.44	.10
10/20/90	25.72	.25	9.72	.31	.01
10/27/90	118.87	1.42	11.95	.00	.00
11/03/90	6.23	.20	32.10	.00	.00
11/10/90	665.70	12.68	19.05	17.15	.03
11/17/90	163.27	1.30	7.96	2.47	.02
11/24/90	1491.90	28.26	18.94	56.13	.04
12/01/90	1012.23	14.69	14.51	12.15	.01
12/08/90	945.70	22.77	24.08	10.72	.01
12/15/90	662.56	7.07	10.67	5.98	.01
12/22/90	588.58	8.01	13.61	9.88	.02
12/29/90	478.42	6.70	14.00	8.40	.02
12/31/90	24.32	.37	15.21	.49	.02

1991 BSAI cod fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/91	2239.85	65.58	29.28	45.92	.02
01/13/91	3106.69	101.88	32.79	876.76	.28
01/20/91	4542.09	96.39	21.22	127.74	.03
01/27/91	6963.73	184.94	26.56	121.25	.02
02/03/91	2876.09	96.89	33.69	56.07	.02
02/10/91	3566.26	80.06	22.45	172.48	.05
02/17/91	4970.94	111.82	22.49	165.04	.03
02/24/91	3437.46	78.55	22.85	265.13	.08
03/03/91	3544.69	89.18	25.16	304.07	.09
03/10/91	7305.43	184.49	25.25	538.16	.07
03/17/91	4258.29	124.72	29.29	141.96	.03
03/24/91	4346.86	102.73	23.63	103.30	.02
03/31/91	2392.07	31.78	13.29	228.44	.10
04/07/91	15809.63	237.41	15.02	976.50	.06
04/14/91	18462.14	223.00	12.08	1143.60	.06
04/21/91	15048.56	210.50	13.99	757.72	.05
04/28/91	10074.20	173.99	17.27	146.88	.01
05/05/91	5075.05	182.49	35.96	128.75	.03
05/12/91	1253.16	28.35	22.62	5.23	.00
05/19/91	258.11	8.48	32.85	1.57	.01
05/26/91	644.63	15.92	24.70	1.34	.00
06/02/91	189.70	3.34	17.61	1.27	.01
06/09/91	17.05	.44	25.81	.00	.00
07/07/91	532.59	3.43	6.44	.00	.00
07/14/91	106.97	.30	2.80	.00	.00
08/25/91	8.71	.00	.00	.00	.00

1990 BSAI pelagic pollock fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/90	15859.19	.60	.04	241.24	.02
01/13/90	17242.79	.81	.05	387.99	.02
01/20/90	21739.71	.63	.03	500.63	.02
01/27/90	25331.61	.99	.04	1207.57	.05
02/03/90	27561.84	.18	.01	1091.13	.04
02/10/90	31210.62	3.55	.11	603.97	.02
02/17/90	31828.61	.44	.01	538.29	.02
02/24/90	18328.65	.11	.01	360.65	.02
03/03/90	17046.50	2.60	.15	396.61	.02
03/10/90	25789.47	4.98	.19	225.98	.01
03/17/90	25153.58	20.95	.83	316.31	.01
03/24/90	19787.32	6.96	.35	97.85	.00
03/31/90	23620.27	8.41	.36	380.91	.02
04/07/90	19703.13	14.51	.74	84.72	.00
04/14/90	27796.89	4.70	.17	141.24	.01
04/21/90	26513.09	3.79	.14	79.78	.00
04/28/90	22377.45	1.87	.08	4.66	.00
05/05/90	20844.87	.71	.03	.00	.00
05/12/90	22925.97	.20	.01	.23	.00
05/19/90	25414.66	2.99	.12	7.41	.00
05/26/90	29971.88	3.65	.12	.00	.00
06/02/90	28206.69	1.28	.05	.00	.00
06/09/90	13714.32	2.46	.18	.00	.00
06/16/90	27754.73	6.39	.23	.00	.00
06/23/90	27094.22	3.03	.11	.00	.00
06/30/90	32311.79	6.74	.21	.00	.00
07/07/90	25401.17	.99	.04	.00	.00
07/14/90	31104.05	8.79	.28	.00	.00
07/21/90	24579.34	7.21	.29	215.06	.01
07/28/90	25312.12	4.37	.17	.00	.00
08/04/90	46532.26	4.84	.10	163.12	.00
08/11/90	34723.94	12.19	.35	.00	.00
08/18/90	31636.53	5.29	.17	.00	.00
08/25/90	36973.11	9.34	.25	.00	.00
09/01/90	37135.02	2.99	.08	.00	.00
09/08/90	35748.81	2.65	.07	45.62	.00
09/15/90	41473.21	2.39	.06	54.53	.00
09/22/90	37338.20	1.62	.04	67.86	.00
09/29/90	48711.30	3.33	.07	44.92	.00
10/06/90	46871.98	4.98	.11	117.55	.00
10/13/90	30779.95	3.14	.10	327.87	.01
10/20/90	12178.93	.90	.07	158.80	.01
10/27/90	20451.97	1.78	.09	.00	.00
11/03/90	19704.17	2.87	.15	9.39	.00
11/10/90	10040.94	.85	.08	100.41	.01
11/17/90	1861.12	.15	.08	18.61	.01
11/24/90	14.05	.00	.00	.42	.03
12/29/90	1108.93	.09	.08	11.09	.01
12/31/90	2136.77	.19	.09	21.36	.01

1991 BSAI pelagic pollock fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/91	37197.74	1.59	.04	11148.81	.30
01/13/91	54340.97	13.33	.25	3085.78	.06
01/20/91	50637.11	4.09	.08	579.34	.01
01/27/91	62192.71	15.42	.25	792.74	.01
02/03/91	46675.42	3.98	.09	1186.08	.03
02/10/91	50381.34	12.45	.25	1173.54	.02
02/17/91	71675.45	2.83	.04	1229.88	.02
02/24/91	38841.86	3.45	.09	1820.73	.05
03/03/91	18761.11	.04	.00	164.74	.01
03/10/91	22237.89	.04	.00	161.57	.01
03/17/91	11669.49	.00	.00	314.28	.03
03/24/91	12546.67	.00	.00	544.76	.04
03/31/91	23.00	.11	4.78	.00	.00
04/28/91	112.60	.30	2.66	.11	.00
06/02/91	1241.06	.13	.10	.00	.00
06/09/91	49483.95	4.31	.09	167.86	.00
06/16/91	50409.97	7.81	.15	42.79	.00
06/23/91	38299.98	18.39	.48	97.44	.00
06/30/91	55726.31	11.01	.20	32.65	.00
07/07/91	49845.52	88.53	1.78	216.47	.00
07/14/91	46421.88	35.95	.77	.00	.00
07/21/91	55766.18	32.42	.58	.00	.00
07/28/91	58164.57	20.11	.35	64.12	.00
08/04/91	62163.12	101.54	1.63	317.78	.01
08/11/91	63820.29	38.59	.60	670.69	.01
08/18/91	74129.95	73.33	.99	286.72	.00
08/25/91	48130.69	20.46	.43	49.82	.00
09/01/91	41816.31	19.89	.48	251.47	.01
09/08/91	17985.04	2.17	.12	192.75	.01
09/15/91	.10	.00	.00	.01	.10

1990 BSAI rock sole fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/90	2037.25	31.90	15.66	7.05	.00
01/13/90	3131.20	31.91	10.19	.00	.00
01/20/90	2661.95	25.30	9.50	2.12	.00
01/27/90	3520.47	33.48	9.51	.00	.00
02/03/90	2075.41	12.07	5.82	.00	.00
02/10/90	2769.25	29.27	10.57	.00	.00
02/17/90	2802.92	20.89	7.45	.00	.00
02/24/90	5418.66	86.73	16.01	54.17	.01
03/03/90	2037.25	38.63	18.96	36.87	.02
03/10/90	199.11	4.25	21.34	.00	.00
03/17/90	297.54	2.47	8.30	.00	.00
08/04/90	15.67	.02	1.28	.00	.00
08/11/90	465.51	1.73	3.72	4.66	.01
08/25/90	204.30	.36	1.76	.00	.00
09/01/90	87.52	.08	.91	.00	.00
09/08/90	136.35	.06	.44	.00	.00
09/15/90	603.98	.21	.35	.00	.00
09/22/90	456.25	.56	1.23	.00	.00
09/29/90	193.38	.02	.10	.00	.00
10/06/90	585.76	.67	1.14	.00	.00
10/13/90	236.66	.30	1.27	.00	.00
10/20/90	742.94	1.48	1.99	7.44	.01
10/27/90	701.08	2.31	3.29	21.05	.03
11/10/90	381.04	2.11	5.54	.00	.00
11/17/90	344.23	1.98	5.75	.00	.00

1991 BSAI rock sole fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/91	1148.17	21.86	19.04	.00	.00
01/13/91	3455.93	38.39	11.11	.00	.00
01/20/91	1767.80	16.82	9.51	4.02	.00
01/27/91	2803.58	18.57	6.62	3.64	.00
02/03/91	1511.83	13.22	8.74	2.25	.00
02/10/91	4501.11	64.65	14.36	7.82	.00
02/17/91	7491.54	63.87	8.53	12.60	.00
02/24/91	11282.67	262.44	23.26	7.22	.00
03/03/91	12609.94	245.45	19.46	.00	.00
03/10/91	6143.13	119.02	19.37	769.88	.13
03/17/91	944.48	25.71	27.22	3.55	.00
03/24/91	113.31	.42	3.71	.00	.00
03/31/91	37.36	.12	3.21	.00	.00
04/28/91	404.05	8.72	21.58	6.94	.02
05/05/91	629.21	18.86	29.97	.00	.00
05/12/91	583.39	17.29	29.64	.00	.00
05/19/91	3548.47	53.80	15.16	.05	.00
05/26/91	3405.15	109.95	32.29	3.90	.00
06/02/91	1870.22	28.67	15.33	3.13	.00
06/09/91	392.92	3.57	9.09	.00	.00
06/23/91	284.73	2.96	10.40	.00	.00
06/30/91	654.15	4.71	7.20	.00	.00
07/07/91	124.99	.87	6.96	.00	.00
08/04/91	307.09	10.78	35.10	.00	.00
08/11/91	248.13	4.30	17.33	.00	.00
08/18/91	109.32	.17	1.56	.00	.00
09/15/91	425.31	.68	1.60	.20	.00
09/22/91	592.31	2.65	4.47	.00	.00
09/29/91	37.46	.08	2.14	.00	.00

1990 GOA bottom trawl pollock fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/90	107.14	.00	.00	4.29	.04
03/03/90	1.93	.00	.00	.00	.00
03/31/90	.25	.00	.00	.00	.00
04/14/90	688.16	.00	.01	.00	.00
04/21/90	837.17	.01	.01	.00	.00
04/28/90	452.24	.00	.01	.00	.00
05/12/90	478.17	.00	.01	.00	.00
05/19/90	536.46	.01	.02	.04	.00
05/26/90	455.46	.00	.01	.00	.00
06/02/90	531.22	.00	.01	.00	.00
07/07/90	652.39	.00	.01	.00	.00
07/14/90	584.68	.00	.01	.00	.00
08/04/90	982.22	.01	.01	.00	.00
08/11/90	1063.41	.01	.01	.00	.00
08/18/90	1590.03	6.21	3.91	.00	.00
08/25/90	1691.22	.69	.41	.00	.00
09/01/90	495.91	.06	.12	.00	.00
09/08/90	1226.58	2.38	1.94	.00	.00
09/15/90	748.88	2.41	3.22	.00	.00
09/22/90	1643.04	1.49	.91	.00	.00
09/29/90	1328.38	1.50	1.13	.00	.00
10/06/90	1004.81	.60	.59	.00	.00
10/13/90	63.04	.03	.55	14.50	.23
10/20/90	1085.37	.44	.41	97.51	.09

1991 GOA bottom trawl pollock fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/91	6.93	.03	4.20	1.94	.28
01/13/91	1547.76	4.06	2.62	176.82	.11
01/20/91	1167.98	5.11	4.38	209.22	.18
01/27/91	1198.67	4.73	3.95	355.61	.30
02/03/91	663.17	1.29	1.95	83.71	.13
02/10/91	662.36	6.38	9.63	350.20	.53
02/17/91	533.00	5.71	10.72	234.52	.44
03/03/91	1.72	.10	57.58	.00	.00
03/10/91	176.66	6.20	35.07	95.12	.54
03/17/91	984.65	4.80	4.87	35.10	.04
03/24/91	95.30	1.65	17.36	2.86	.03
04/07/91	.96	.01	6.86	.25	.26
04/14/91	45.53	.18	3.99	.46	.01
04/21/91	346.54	2.12	6.12	252.97	.73
04/28/91	471.85	11.10	23.52	160.14	.34
05/05/91	81.74	.69	8.50	56.68	.69
05/19/91	14.99	.10	6.86	3.90	.26
05/26/91	31.06	.21	6.86	8.08	.26
07/07/91	992.15	6.81	6.86	257.96	.26
07/14/91	1441.49	9.59	6.65	352.18	.24
07/21/91	1588.63	2.41	1.52	110.51	.07
07/28/91	806.49	4.84	6.01	147.31	.18
08/04/91	423.90	1.75	4.13	42.75	.10
08/11/91	176.45	.64	3.62	8.82	.05
08/18/91	263.21	.71	2.70	.00	.00
08/25/91	143.99	.15	1.06	.00	.00
09/08/91	328.33	3.36	10.23	.00	.00
09/15/91	74.75	.51	6.86	19.44	.26
09/22/91	1078.46	6.31	5.85	162.94	.15
09/29/91	684.89	4.44	6.48	130.08	.19

1990 GOA rockfish fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/13/90	125.69	1.78	14.16	1.26	.01
01/27/90	2.74	.02	7.13	.00	.00
02/03/90	2.85	.02	7.13	.00	.00
02/10/90	34.40	.25	7.13	.00	.00
03/10/90	917.06	26.30	28.68	7.28	.01
03/17/90	1420.07	86.51	60.92	.00	.00
03/24/90	786.96	13.39	17.02	1.72	.00
03/31/90	1855.73	62.93	33.91	10.47	.01
04/07/90	1119.84	20.19	18.03	817.31	.73
04/14/90	1191.82	29.19	24.49	321.88	.27
04/21/90	1518.40	23.59	15.54	218.82	.14
04/28/90	1526.93	28.52	18.68	2.03	.00
05/05/90	1181.01	7.70	6.52	145.97	.12
05/12/90	1774.55	18.32	10.33	132.47	.07
05/19/90	1464.02	56.41	38.53	.00	.00
05/26/90	1599.69	17.70	11.07	12.39	.01
06/02/90	694.81	25.90	37.28	53.52	.08
06/09/90	108.13	.03	.32	2.16	.02
07/07/90	2550.41	51.93	20.36	70.24	.03
07/14/90	4226.33	38.72	9.16	34.50	.01
07/21/90	3052.71	21.65	7.09	78.82	.03
07/28/90	1073.89	5.74	5.34	2.02	.00
08/04/90	1209.58	16.22	13.41	.21	.00
08/11/90	659.25	5.32	8.07	.03	.00
08/18/90	1118.11	5.61	5.02	3.68	.00
08/25/90	408.58	.62	1.51	4.09	.01
09/01/90	193.65	.30	1.52	3.87	.02
09/08/90	.04	.00	5.73	.00	.00
09/29/90	229.18	1.63	7.12	.00	.00
10/06/90	1422.23	6.30	4.43	14.22	.01
11/24/90	105.86	18.22	172.16	2.12	.02

1991 GOA rockfish fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
03/03/91	34.16	.62	18.11	15.78	.46
03/10/91	263.66	6.83	25.89	1665.58	6.32
03/17/91	979.17	24.10	24.61	8119.25	8.29
03/24/91	2678.34	93.70	34.98	7701.85	2.88
03/31/91	2516.66	137.63	54.69	4218.29	1.68
04/07/91	1708.02	106.34	62.26	102.84	.06
04/14/91	849.31	39.32	46.29	42.29	.05
04/21/91	2307.29	85.25	36.95	359.98	.16
04/28/91	1038.21	37.63	36.24	357.19	.34
05/05/91	66.23	2.04	30.80	1.99	.03
05/12/91	34.57	1.09	31.47	1.06	.03
07/07/91	112.08	.34	3.05	.00	.00
07/14/91	439.68	2.27	5.15	.00	.00
07/21/91	322.82	1.78	5.52	.00	.00
07/28/91	721.76	1.81	2.50	1.30	.00
08/04/91	820.94	5.38	6.55	.00	.00
08/11/91	151.29	.22	1.48	.00	.00
08/18/91	777.23	3.17	4.08	.00	.00
08/25/91	614.97	7.13	11.60	.00	.00
09/01/91	1005.06	13.24	13.17	.00	.00
09/08/91	286.77	6.51	22.70	.00	.00
09/15/91	939.79	10.54	11.22	10.75	.01
09/22/91	159.11	9.68	60.86	.00	.00
09/29/91	1385.47	13.57	9.80	.00	.00

1990 GOA pelagic pollock fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/90	2075.21	.00	.00	290.53	.14
01/13/90	3772.78	.00	.00	528.19	.14
01/20/90	3045.05	.00	.00	426.31	.14
01/27/90	4938.98	.00	.00	676.85	.14
02/03/90	678.49	.00	.01	.01	.00
02/24/90	1839.56	.01	.00	95.03	.05
03/03/90	2850.42	.02	.01	.00	.00
04/07/90	1465.74	.01	.01	42.96	.03
04/14/90	1239.72	.02	.01	25.26	.02
04/21/90	178.00	.00	.01	5.34	.03
04/28/90	28.40	.00	.01	.85	.03
05/19/90	189.45	.00	.01	5.68	.03
05/26/90	201.68	.00	.01	6.05	.03
06/02/90	91.80	.00	.01	2.75	.03
06/09/90	276.14	.01	.02	8.28	.03
06/16/90	303.94	.00	.02	.00	.00
06/23/90	281.04	.01	.03	22.48	.08
06/30/90	107.21	.01	.06	8.39	.08
07/28/90	14.00	.01	.41	.14	.01
08/25/90	11.01	.00	.41	.11	.01
09/01/90	264.97	.03	.10	.00	.00
09/08/90	801.19	.33	.41	8.01	.01
09/15/90	2324.48	.04	.02	92.98	.04
09/22/90	2064.40	.85	.41	20.64	.01
09/29/90	2386.93	.03	.01	47.52	.02
10/06/90	4651.16	.12	.03	511.63	.11
10/13/90	5320.23	.30	.06	266.01	.05
10/20/90	9557.48	.22	.02	549.20	.06
10/27/90	628.69	.06	.09	131.41	.21
11/17/90	.10	.00	.02	.01	.10

1991 GOA pelagic pollock fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/91	1047.61	.03	.03	258.98	.25
01/13/91	2383.22	.37	.15	657.48	.28
01/20/91	978.64	.01	.01	303.38	.31
01/27/91	861.48	.06	.06	136.09	.16
02/03/91	4119.85	.01	.00	524.04	.13
02/10/91	2152.22	.00	.00	185.52	.09
02/17/91	1203.03	.35	.29	82.16	.07
03/31/91	958.80	.00	.00	.00	.00
04/07/91	2283.30	.00	.00	.00	.00
04/14/91	164.00	.00	.00	.00	.00
06/16/91	567.14	.01	.02	20.93	.04
06/23/91	3545.55	.05	.01	70.91	.02
06/30/91	3805.38	.08	.02	49.94	.01
07/07/91	5033.98	.24	.05	28.40	.01
07/14/91	5591.96	.21	.04	35.60	.01
07/21/91	12918.23	2.13	.16	102.81	.01
07/28/91	13750.43	2.75	.20	94.00	.01

1990 GOA cod fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/90	2.80	.01	2.18	.03	.01
01/13/90	330.37	2.29	6.94	74.90	.23
01/20/90	231.95	1.17	5.03	14.19	.06
01/27/90	664.08	3.73	5.62	49.21	.07
02/03/90	687.02	2.85	4.15	32.08	.05
02/10/90	965.01	4.24	4.39	63.34	.07
02/17/90	1521.98	6.06	3.98	113.85	.07
02/24/90	2534.44	12.90	5.09	307.17	.12
03/03/90	3224.49	10.07	3.12	117.65	.04
03/10/90	3998.80	16.45	4.11	273.73	.07
03/17/90	6559.71	34.10	5.20	535.00	.08
03/24/90	5088.06	17.15	3.37	447.87	.09
03/31/90	4875.94	26.94	5.52	125.12	.03
04/07/90	4813.69	13.27	2.76	260.69	.05
04/14/90	5703.94	33.60	5.89	343.78	.06
04/21/90	3305.25	33.42	10.11	13.07	.00
04/28/90	1608.41	26.56	16.52	117.07	.07
05/05/90	74.77	1.77	23.70	12.19	.16
05/12/90	418.22	23.05	55.11	18.31	.04
05/19/90	115.84	3.84	33.13	10.57	.09
05/26/90	373.20	11.13	29.83	34.91	.09
06/02/90	225.44	6.05	26.82	16.83	.07
06/16/90	308.08	.00	.00	.00	.00
06/23/90	354.58	.00	.00	.00	.00
06/30/90	516.68	.00	.00	.00	.00
07/07/90	1155.76	21.08	18.24	18.60	.02
07/14/90	1412.37	35.27	24.97	.00	.00
07/21/90	2761.26	7.35	2.66	20.81	.01
07/28/90	3154.47	27.04	8.57	16.10	.01
08/04/90	880.28	9.63	10.94	11.05	.01
08/11/90	2197.45	25.15	11.44	82.67	.04
08/18/90	1632.04	14.38	8.81	26.34	.02
08/25/90	1467.10	56.02	38.18	30.49	.02
09/01/90	1942.14	30.67	15.79	128.56	.07
09/08/90	906.42	19.95	22.01	70.05	.08
09/15/90	694.19	21.04	30.31	38.17	.05
09/22/90	684.83	31.09	45.40	78.30	.11
09/29/90	768.00	20.87	27.17	59.77	.08
10/06/90	1411.68	170.10	120.50	66.76	.05
10/13/90	905.77	9.69	10.70	4.02	.00
10/20/90	2125.97	7.77	3.65	17.88	.01
10/27/90	1865.63	33.90	18.17	141.89	.08
11/03/90	902.25	38.81	43.01	142.46	.16
11/10/90	430.38	9.56	22.21	36.75	.09
11/17/90	92.05	2.50	27.11	7.26	.08
11/24/90	116.25	5.59	48.12	16.28	.14
12/15/90	25.62	.12	4.52	.26	.01
12/22/90	89.37	.40	4.52	.89	.01
12/29/90	117.62	.00	.01	.00	.00

1991 GOA cod fishery

Week	Groundfish Tons	Halibut Tons	Halibut kg/mt	Chinook Bycatch	Chinook per mt
01/06/91	271.33	1.54	5.69	13.46	.05
01/13/91	125.64	1.13	8.99	6.28	.05
01/20/91	126.27	1.28	10.13	13.63	.11
01/27/91	977.64	10.69	10.94	42.80	.04
02/03/91	3374.56	23.49	6.96	112.70	.03
02/10/91	1088.67	7.15	6.57	71.87	.07
02/17/91	3264.37	19.72	6.04	93.03	.03
02/24/91	3731.77	34.97	9.37	516.43	.14
03/03/91	6016.99	47.03	7.82	812.25	.13
03/10/91	6506.90	67.90	10.43	1540.13	.24
03/17/91	7960.39	52.87	6.64	219.62	.03
03/24/91	9297.82	70.04	7.53	195.00	.02
03/31/91	7572.68	56.97	7.52	230.34	.03
04/07/91	2102.60	20.05	9.54	176.54	.08
04/14/91	1764.88	28.06	15.90	295.21	.17
04/21/91	1655.22	33.93	20.50	239.81	.14
04/28/91	660.44	10.64	16.10	139.60	.21
05/05/91	45.06	.78	17.26	10.36	.23
08/25/91	1.02	.01	6.80	.05	.05
09/01/91	17.78	.15	8.68	.00	.00

APPENDIX 3

FISHERY SIMULATION MODEL

To examine the likely consequences of the proposed changes to the status quo, as outlined in Section 2, a fishery simulation model of the Bering Sea/Aleutian Islands groundfish fisheries was constructed. The model uses 1990 and 1991 domestic fishery (DAP) data to predict the future pattern of groundfish fishing, the expected bycatches, the likely catch per unit of effort, and the anticipated value of the groundfish fisheries and the foregone value of other fisheries due to bycatch in the groundfish fisheries. The simulation model is implemented as a collection of programs written for the Statistical Analysis System (SAS). The modelling system is described in the following three sections. The results of various simulations are included in Section 3.8.

Background

The current version of the fishery simulation is a SAS programming model written by Terry Smith of the University of Alaska. The model is a revision of a SAS modelling system written by Fritz Funk of the Alaska Department of Fish and Game (Funk, 1990) which was, in turn, based on a spreadsheet simulation developed by Smith (Smith, 1989). The simulation models have been used in two ways: to quantitatively estimate the impacts of proposed changes to the bycatch management regime in the Bering Sea/Aleutian Islands for the purposes of regulatory analysis contained in an EA/RIR/IRFA; and, to provide guidance to the North Pacific Fishery Management Council in allocating the various prohibited species (currently, red king crab, C. bairdi Tanner crab, Pacific halibut and Pacific herring) to defined groundfish target fisheries.

The modelling system

In simplest terms, the model calculates expected bycatch as the product of expected groundfish catch and expected bycatch rate (in terms of numbers of animals per metric ton of total groundfish or metric tons of bycatch per metric ton of groundfish). The modelling system consists of four separate SAS programs (Figure 1) designed to: (1) calculate the relevant bycatch rates for a defined target fishery by processor type, month, and statistical area or sub-statistical area [BYRATES.SAS]; (2) determine the expected groundfish catch and the species composition of that catch for the same processor type, month, statistical or sub-statistical area [ARPROP.SAS and BYRATES.SAS]; and, (3) simulate the fishery by tracking, on a weekly basis, for each target fishery, catch and bycatch [SIMBSAI.SAS and SIMGOA.SAS].

The fourth program [CATBLOCK.SAS] is used to calculate the proportion of catch which would occur in a sub-statistical area and the relative bycatch rates for the subarea (relative to the rate in the entire statistical area). Sub-statistical areas are parts of statistical areas (the fundamental geographic reporting unit) defined by the intersection of the statistical areas with bycatch or groundfish closure zones which span statistical areas. Currently, the three herrings savings area (Summer Herring Savings Area I, Summer Savings Area II, and Winter Herring Savings Area) as defined in Amendment 16a to the groundfish FMP of the BSAI, and the Inshore Operational Area as defined by Amendments 18/23 to the groundfish FMPs (the "inshore/offshore" amendment to be submitted to the Secretary of Commerce for approval), are the only zones which define sub-statistical areas (see Figure 2).

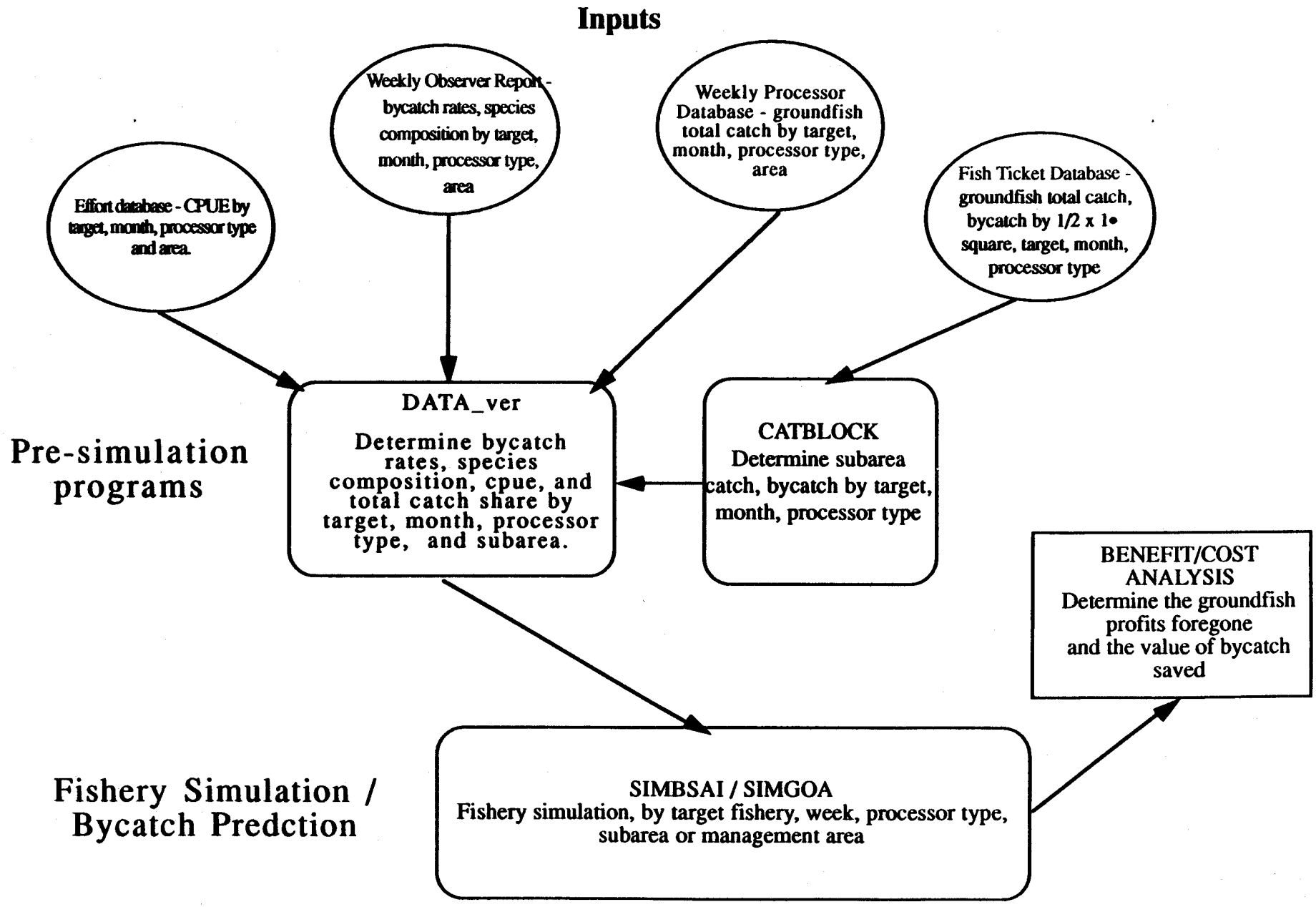

Figure 1. The Groundfish Fishery Simulation Model: a structural diagram of the SAS program system used to predict bycatch for Amendments 19/24.

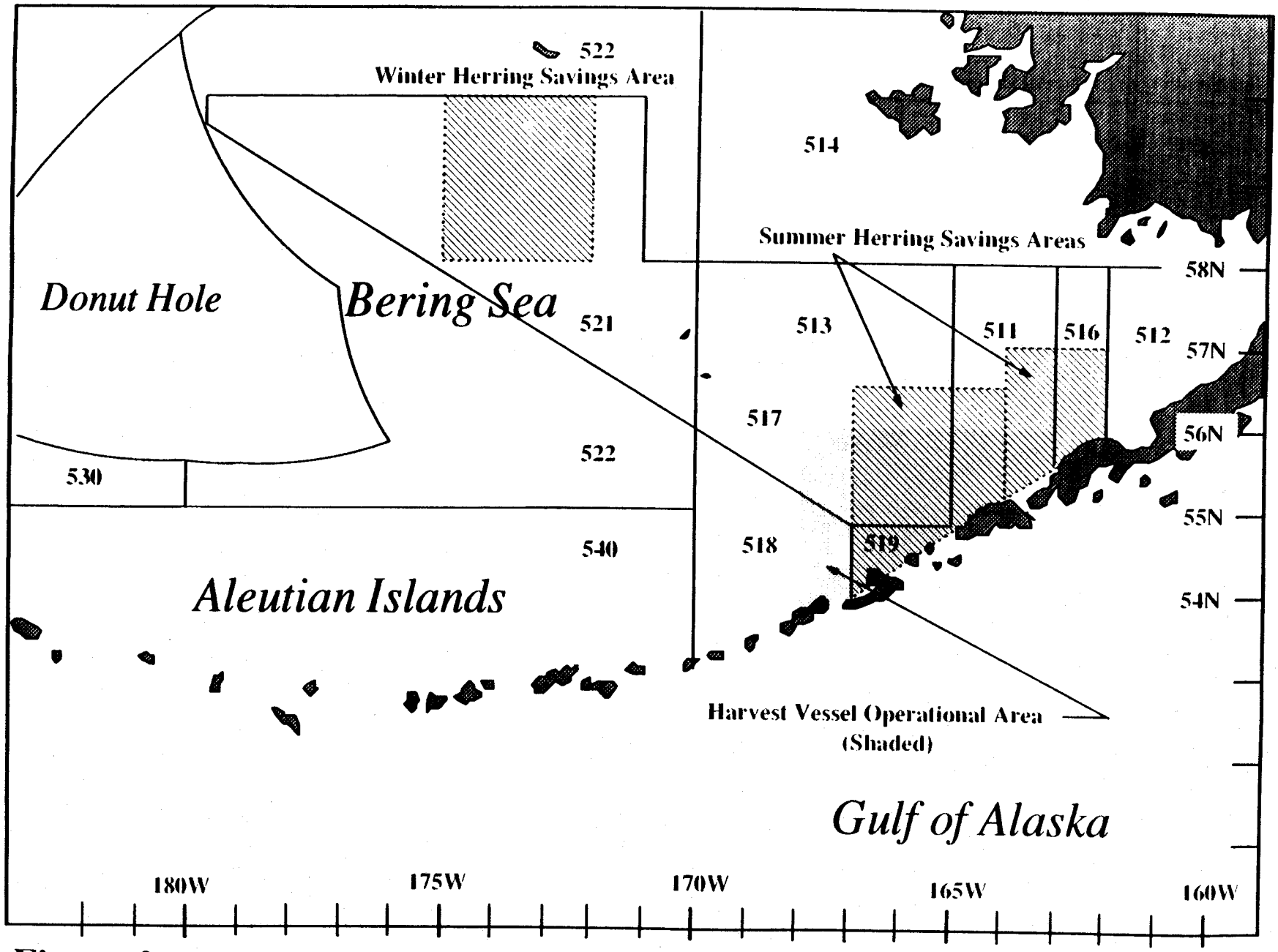
522
Winter Herring Savings Area
514
Summer Herring Savings Areas
Donut Hole
Bering Sea
521
513
511
516
512
58N
57N
517
56N
522
530
55N
540
518
519
54N
Aleutian Islands
Harvest Vessel Operational Area
(Shaded)
Gulf of Alaska
180W
175W
170W
165W
160W

Figure 2

If a TAC for a species is met or if a particular fishery's PSC apportionment is taken, the relevant fishery is closed and the week's simulation is rerun under the assumption that the closed fishery will relocate to the remaining open areas such that no groundfish catch is foregone, except, of course, in the case of closure of the entire BSAI by virtue of attainment of the secondary halibut PSC limit. Total effort (based on CPUE) is recalculated and used in a cost sub-model which calculates, for each groundfish fishery, gross and net wholesale value, and, for each regulated prohibited species, the present gross and net wholesale value of foregone catch for the fisheries which target on the regulated species.

Implementation

Bycatch rates. Data from the domestic observer program weekly radio messages and from the Region's weekly processor reports are combined by the Region to estimate total catch and bycatch by week, area, gear, and operation. These estimates of catch and bycatch were used to determine the bycatch rates for red king crab, C. bairdi Tanner crab, C. opilio Tanner crab, Pacific halibut, Pacific herring, chinook salmon, and all other salmon. The rates for all species are in the units of animals per metric ton (mt) of total groundfish harvest (retained and discarded), except for herring and halibut, where rates are reported as kilograms of bycatch per mt of total groundfish catch. From these data, monthly bycatch rates and species composition (the proportion of total catch contributed by each species in these multi-species fisheries), are calculated for 13 defined target fisheries: mid-water pollock, bottom trawl pollock, Atka mackerel, arrowtooth flounder, bottom trawl Pacific cod, fixed gear P. cod, yellowfin sole, rock sole, other flatfish, trawl sablefish, fixed gear sablefish, rockfish, and Greenland turbot. Observations from 1990 and 1991 are averaged to provide some measure of smoothing of the historical series. Relative bycatch rates are also assigned by sub-statistical area by the program CATBLOCK.SAS which reads 1990 haul by haul information in which total catch and bycatch is reported by 1/2 x 1 degree square and then aggregates this information over the relevant subarea.

Groundfish catch. Data from the weekly processor report database are used to determine future groundfish catch by fishery, processor type, month and subarea. Again, 1990 and 1991 catch performance is averaged to impute the distribution of the 1992 groundfish total catch. Also, 1/2 x 1 degree catch detail is used to determine the share of total catch for each sub-statistical area. The final section of the program ARPROP.SAS assembles the detailed information on groundfish catch, species composition, bycatch rates and, from a separate database, catch per unit of effort (CPUE), and prepares an output data set which contains species catch for each fishery, by month and subarea, as well as the expected bycatch rate and CPUE for that fishery cell. Depending on the simulation, the simulation data would potentially contain catch, bycatch and CPUE information for 6,864 cells (12 months x 13 fisheries x 2 processor types x 22 subareas). Since the fisheries do not occur in all areas in all seasons the number of non-empty cells is less than this.

Groundfish value. Wholesale price data collected by the joint NMFS and ADF&G 1990 groundfish processor survey were used together with weekly processor report data for 1990 and 1991 to estimate the gross wholesale value for each cell with catch and bycatch data. Gross wholesale value net of variable cost was calculated using these estimates of gross value and estimates of variable cost. The latter are based on a simplistic cost model in which one component of variable cost is a function of retained catch and the other component is a function of CPUE. Data collected for Amendment 18/23 (Inshore/Offshore) was used to estimate these two components of variable cost for three types of operations, catching and processing for surimi, catching and processing for fillets, and catching and processing for headed and gutted products. The part of variable cost that is dependent on catch was assumed to be 30.6%, 29.3%, and 29.3%, respectively, of the gross wholesale value of each of these types of operations. For the base case, the part of variable cost that is dependent on CPUE was

assumed to be 31.2%, 32.0%, and 34.5%, respectively, of the gross wholesale value of each of these types of operations. For the non base cases, this part of variable cost was adjusted to reflect the changes in CPUE.

Bycatch impact cost. The effect of bycatch on other fisheries, that is the bycatch impact cost, was estimated in terms of foregone wholesale value and foregone wholesale value net of variable costs. The estimates of impact cost per unit of crab bycatch are based on the expected growth and natural mortality that would occur between the typical ages of capture as bycatch in the groundfish fishery and retention in the crab fishery. The estimation procedure was discussed more fully in Appendix 2.1 of the Amendment 16a EA/RIR/IRFA.

For herring, the average age of capture in sac roe herring and groundfish fisheries was assumed to be similar. Most trawl herring bycatch occurs in the late summer and fall, approximately 6 months before the sac roe fishery. To allow for growth and natural mortality effects over this 6-month period, the estimated impact cost per metric ton of herring was computed using the spring spawner-equivalent of the trawl bycatch. This was computed by multiplying 1 mt of trawl bycatch by 0.83 to allow for mortality and growth effects from the time that the bycatch occurred until the spring spawning period. If herring bycatch reduces subsistence catch as well as commercial catch, the impact cost per unit of bycatch is underestimated by the difference in benefits per unit of catch in the subsistence and commercial herring fisheries.

A different method is used to estimate the impact cost per unit of halibut bycatch because the quotas in the halibut fisheries are adjusted based on estimated bycatch mortality. In the past, the IPHC reduced the total quota for the halibut fishery by about 1.6 mt for each 1 mt of estimated bycatch mortality in the groundfish fishery. The policy of the IPHC is now to maintain reproductive output (egg production) at the same level it would be in the absence of bycatch. This results in bycatch in one year affecting halibut quotas over a 9-year period. Based on IPHC estimates of the effect by year for each of the nine years (Bill Clark), the discounted present value of the resulting change in quotas is approximately 1.32 mt of halibut for each 1 mt of halibut bycatch mortality.

The estimates of bycatch impact costs per unit of bycatch and the assumptions on which they are based are summarized in Table 1. A "benefit/cost" accounting stance is used to contrast the value of the foregone groundfish catch with the value of the bycatch saved, all relative to the status quo. For both groundfish and the other species, the variable costs that are subtracted to estimate net value consist of variable costs for harvesting and processing.

Simulation. The fishery simulation is implemented as a SAS program which uses the input data set to simulate a quasi-weekly fishery by dividing each month into four identical periods. After initialization, the simulation calculates the week's groundfish catch, by species, the bycatch, by prohibited species, and the effort (in total hours trawled, no CPUE data on fixed gear fisheries is available) for each fishery in each subarea. Species catches in all target fisheries are totaled and compared with the overall TAC for the species. If a species' TAC is reached the fishery is closed. Similarly, the bycatch for each regulated species is totaled and compared with the fishery's PSC apportionment (a share of the overall PSC limit as assigned by the Council and based on a simulation in which it is assumed that the fishery has no constraints on the amount of bycatch taken). If a fishery's PSC apportionment is taken, the appropriate management action is implemented (closure of a specified area for the remainder of the fishing year or for a set period of time). The week's simulation is then rerun to determine the proportion of the fishery's catch that was taken in the areas which were determined to close during the period and the resulting catch in the remaining open areas adjusted upward in direct proportion to the catch foregone. The simulation continues in this manner

Table 1. Estimated bycatch impact cost.

	Halibut	Herring	Red king	Bairdi	Chinook
Foregone catch	1.32	0.83	3.5	0.83	20
Recovery factor	0.75	1.0	0.66	0.66	0.8
Wholesale price	$3.00	$0.75	$9	$3.50	$ 3.40
Foregone gross wholesale value	$6,550	$1,370	$21	$2	$55
Variable cost	48%	50%	56%	64%	61%
Foregone net wholesale value	$3,400	$ 685	$9.24	$0.72	$21.50

Notes: The estimates of foregone catch are in metric tons for halibut and herring and in numbers of crab or salmon. The estimates of foregone value are per mt of halibut or herring bycatch mortality and per crab or salmon of bycatch mortality.

through the fishing year, tracking the status of each fishery for each week. At the conclusion of the simulation the program reports the annual closure events and the resulting total catch, species' catch, bycatch, and effort, in various levels of detail. The catch, bycatch and effort information is passed to a cost sub-model implemented as a computer spreadsheet.

Limitations

The ability of the model to accurately predict the effects of alternative bycatch management measures is severely limited for several reasons. First, the temporal and spatial variability of bycatch rates and the uncertainty about future TAC's and their distribution among fisheries, time, and areas introduce large amounts of uncertainty in the analysis of the effects of the alternatives on catch and bycatch. Second, the variability in product prices, CPUE, and other factors that determine the gross and net value per unit of groundfish catch has a similar result with respect to the estimates of economic performance. Third, the variability of the factors that determine impacts costs per unit of bycatch result in uncertainty concerning the total bycatch impact costs associated with each set of bycatch management measures. Fourth, the use of 1990 and 1991 catch data to predict the distribution of future catch by time and area prevents fishing in areas and times that were closed in both 1990 and 1991. Therefore, even though the proposed measures are predicted to reduce bycatch rates and postpone closures compared to 1990 and 1991, effort and catch will be redistributed to other areas and fishery wide bycatch rates will change as if there were a closure. Fifth, the model redistributes the effort and catch of a fishery among areas in response to PSC limit induced closures but it does not redistribute catch among fisheries. Finally, the future bycatch rate effects of the incentive program that was implemented in April of 1991 and the incentive program changes being considered in this amendment are not known. For the purposes of the model and estimating what the bycatch rates would be by cell with and without expansions of the incentive program for 1992, 1990 and 1991 bycatch rates were adjusted by cell. This was done based on the assumption that no fishing operation would have a monthly bycatch rate that exceeded a bycatch rate standard by more than 100 percent and that those operations that would have had such rates in the absence of the incentive program would on average act like the other operations. Therefore, bycatch rates were recalculated by cell by excluding monthly observations for operations that exceeded the standards by more than 100 percent.

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