14-Jun 1989 BERING SEA AND ALEUTIANS: CURRENT APPORTIONMENTS AND CURRENT CATCHES
DAP CATCHES THROUGH: 03-Jun JVP CATCHES THROUGH 18-Mar *

SPECIES		CURRENT APPORT.		CURRENT CATCHES		SPECIES		CURRENT APPORT.		CURRENT CATCHES	
POLLOCK (BER. SEA)		CTAC	1,139,000	TOTAL	462,203	POP	(AL. IS.)	CTAC	5,100	TOTAL	451
		DAP	1,045,585	DAP	396,037			DAP	5,100	DAP	451
ABC=	1,340,000	JVP	93,415	JVP	66,166	ABC=	16,600	JVP	0	JVP	0
OTAC=	1,340,000	"RES"	201,000	REMAIN.	676797	OTAC=	6,000	"RES"	900	REMAIN.	4,649
POLLOCK (AL. IS.)		CTAC	11,432	TOTAL	1,776	ROCKFISH	(BER. SEA)	CTAC	340	TOTAL	195
		DAP	11,432	DAP	1,776			DAP	340	DAP	187
ABC=	117,900	JVP	0	JVP	0	ABC=	400	JVP	0	JVP	8
OTAC=	45,000	"RES"	2,018	REMAIN.	9,656	OTAC=	400	"RES"	60	REMAIN.	145
YELLOWFIN SOLE		CTAC	155,274	TOTAL	123,721	ROCKFISH	(AL. IS.)	CTAC	935	TOTAL	62
		DAP	45,274	DAP	3,541			DAP	935	DAP	62
ABC=	241,000	JVP	110,000	JVP	120,180	ABC=	1,100	JVP	0	JVP	0
OTAC=	182,675	"RES"	27,401	REMAIN.	31,553	OTAC=	1,100	"RES"	0	REMAIN.	873
GREENLAND TURBOT		CTAC	6,800	TOTAL	2,209	SABLEFISH	(BER. SEA)	CTAC	2,380	TOTAL	320
		DAP	6,800	DAP	2,209			DAP	2,380	DAP	320
ABC=	20,300	JVP	0	JVP	0	ABC=	2,800	JVP	0	JVP	0
OTAC=	6,000	"RES"	1,200	REMAIN.	4,591	OTAC=	2,800	"RES"	420	REMAIN.	2,060
ARROWTOOTH FLOUNDER		CTAC	5,800	TOTAL	1,772	SABLEFISH	(AL. IS.)	CTAC	2,890	TOTAL	1,058
		DAP	5,100	DAP	1,575			DAP	2,890	DAP	1,058
ABC=	163,700	JVP	700	JVP	197	ABC=	3,400	JVP	0	JVP	0
OTAC=	5,531	"RES"	200	REMAIN.	4,028	OTAC=	3,400	"RES"	510	REMAIN.	1,832
OTHER FLOUNDERS		CTAC	63,906	TOTAL	16,472	ATKA MACKEREL		CTAC	17,242	TOTAL	1,331
		DAP	23,906	DAP	5,874			DAP	17,242	DAP	1,330
ABC=	155,900	JVP	40,000	JVP	10,598	ABC=	21,000	JVP	0	JVP	1
OTAC=	75,183	"RES"	11,277	REMAIN.	47,434	OTAC=	20,285	"RES"	3,043	REMAIN.	15,911
ROCK SOLE		CTAC	77,148	TOTAL	43,191	SQUID		CTAC	875	TOTAL	32
		DAP	67,543	DAP	30,273			DAP	850	DAP	29
ABC=	17,100	JVP	9,605	JVP	12,918	ABC=	10,000	JVP	25	JVP	3
OTAC=	90,762	"RES"	13,614	REMAIN.	33,957	OTAC=	1,000	"RES"	125	REMAIN.	843
PACIFIC COD		CTAC	196,079	TOTAL	92,548	OTHER		CTAC	15,274	TOTAL	2,808
		DAP	158,613	DAP	58,633	SPECIES		DAP	11,274	DAP	1,196
ABC=	370,600	JVP	37,466	JVP	33,915			JVP	4,000	JVP	1,612
OTAC=	230,681	"RES"	34,602	REMAIN.	103,531	OTAC=	10,000	"RES"	(2,010)	REMAIN.	12,466
POP	(BERING SEA)	CTAC	4,250	TOTAL	501	TOTAL		CTAC	1,704,725	TOTAL	750,650
		DAP	4,250	DAP	501			DAP	1,409,514	DAP	505,052
ABC=	6,000	JVP	0	JVP	0			JVP	295,211	JVP	245,598
OTAC=	5,000	"RES"	750	REMAIN.	3,749	TAC=	2,000,000	RESERVE	295,275	REMAIN.	954,075

CTAC = CURRENT TOTAL ALLOWABLE CATCH
TOTAL = TOTAL CATCH: DAP + JVP
"RES" = OTAC (ORIGINAL TAC) MINUS CTAC
REMAIN = CTAC - TOTAL CATCH

REMAINDER PLUS RESERVE GIVES TOTAL REMAINDER: 1,249,350

* LAST WEEK OF JVP FISHING

14-Jun 1989 GULF OF ALASKA CURRENT APPORTIONMENTS AND CURRENT CATCHES

DAP CATCHES THROUGH: 03-Jun

SPECIES		CURRENT APPORT.		CURRENT CATCHES	
POLLOCK (WESTERN/CENTRAL)	ABC= 60,000	TAC	53,750	TOTAL	58,476
		DAP	53,750	DAP	58,476
		JVP	0	JVP	0
		RES	0	REMAIN.	(4,726)
POLLOCK (SHELIKOF STRAITS)	ABC= N/A	TAC	6,250	TOTAL	6,425
		DAP	6,250	DAP	6,425
		JVP		JVP	0
		RES	0	REMAIN.	(175)
POLLOCK (EASTERN)	ABC= 3,400	TAC	200	TOTAL	41
		DAP	200	DAP	41
		JVP	0	JVP	0
		RES	0	REMAIN.	159
PACIFIC COD (WESTERN)	ABC= 13,500	TAC	13,500	TOTAL	11,608
		DAP	13,500	DAP	11,608
		JVP	0	JVP	0
		RES	0	REMAIN.	1,892
PACIFIC COD (CENTRAL)	ABC= 52,000	TAC	52,000	TOTAL	15,220
		DAP	52,000	DAP	15,220
		JVP	0	JVP	0
		RES	0	REMAIN.	36,780
PACIFIC COD (EASTERN)	ABC= 5,700	TAC	5,700	TOTAL	37
		DAP	5,700	DAP	37
		JVP	0	JVP	0
		RES	0	REMAIN.	5,663
FLOUNDERS (WESTERN)	ABC= 111,500	TAC	3,200	TOTAL	211
		DAP	3,200	DAP	211
		JVP	0	JVP	0
		RES	0	REMAIN.	2,989
FLOUNDERS (CENTRAL)	ABC= 384,300	TAC	31,800	TOTAL	6,105
		DAP	21,800	DAP	6,105
		JVP	10,000	JVP	0
		RES	0	REMAIN.	25,695
FLOUNDERS (EASTERN)	ABC= 58,900	TAC	1,000	TOTAL	810
		DAP	1,000	DAP	810
		JVP	0	JVP	0
		RES	0	REMAIN.	190
SABLEFISH (WESTERN)	ABC= 4,900	TAC	3,770	TOTAL	1,829
		DAP	3,770	DAP	1,829
		JVP	0	JVP	0
		RES	0	REMAIN.	1,941
SABLEFISH (CENTRAL)	ABC= 13,900	TAC	11,700	TOTAL	10,277
		DAP	11,700	DAP	10,277
		JVP	0	JVP	0
		RES	0	REMAIN.	1,423
SABLEFISH (EASTERN)	ABC= 12,100	TAC	10,530	TOTAL	11,032
		DAP	10,530	DAP	11,(
		JVP	0	JVP	0
		RES	0	REMAIN.	(502)
OTHER ROCKFISH (WESTERN)	ABC= 5,774	TAC	5,774	TOTAL	825
		DAP	5,774	DAP	825
		JVP		JVP	0
		RES	0	REMAIN.	4,949
OTHER ROCKFISH (CENTRAL)	ABC= 8,452	TAC	8,452	TOTAL	5,941
		DAP	8,452	DAP	5,941
		JVP		JVP	0
		RES	0	REMAIN.	2,511
OTHER ROCKFISH (EASTERN)	ABC= 5,774	TAC	5,774	TOTAL	4,855
		DAP	5,774	DAP	4,855
		JVP	0	JVP	0
		RES	0	REMAIN.	919
PELAGIC SHELF ROCKFISH (WESTERN)	ABC= 1,000	TAC	500	TOTAL	8
		DAP	500	DAP	8
		JVP	0	JVP	0
		RES	0	REMAIN.	492
PELAGIC SHELF ROCKFISH (CENTRAL)	ABC= 4,800	TAC	2,400	TOTAL	380
		DAP	2,400	DAP	3(
		JVP	0	JVP	
		RES	0	REMAIN.	2,020
PELAGIC SHELF ROCKFISH (EASTERN)	ABC= 800	TAC	400	TOTAL	338
		DAP	400	DAP	338
		JVP	0	JVP	0
		RES	0	REMAIN.	62
DEMERSAL SHELF ROCKFISH (SE OUTSIDE)	ABC= N/A	TAC	420	TOTAL	213
		DAP	420	DAP	213
		JVP	0	JVP	0
		RES	0	REMAIN.	207
THORNYHEADS (GULF-WIDE)	ABC= 3,800	TAC	3,800	TOTAL	2,141
		DAP	3,800	DAP	2,141
		JVP	0	JVP	0
		RES	0	REMAIN.	1,659
OTHER SPECIES		TAC	11,046	TOTAL	896
		DAP	11,046	DAP	896
		JVP	0	JVP	0
		RES	0	REMAIN.	10,150
TOTAL	ABC= 750,600	TAC	231,966	TOTAL	137,668
		DAP	221,966	DAP	137,66
		JVP	10,000	JVP	
		RES	0	REMAIN.	94,298

CTAC = CURRENT TOTAL ALLOWABLE CATCH

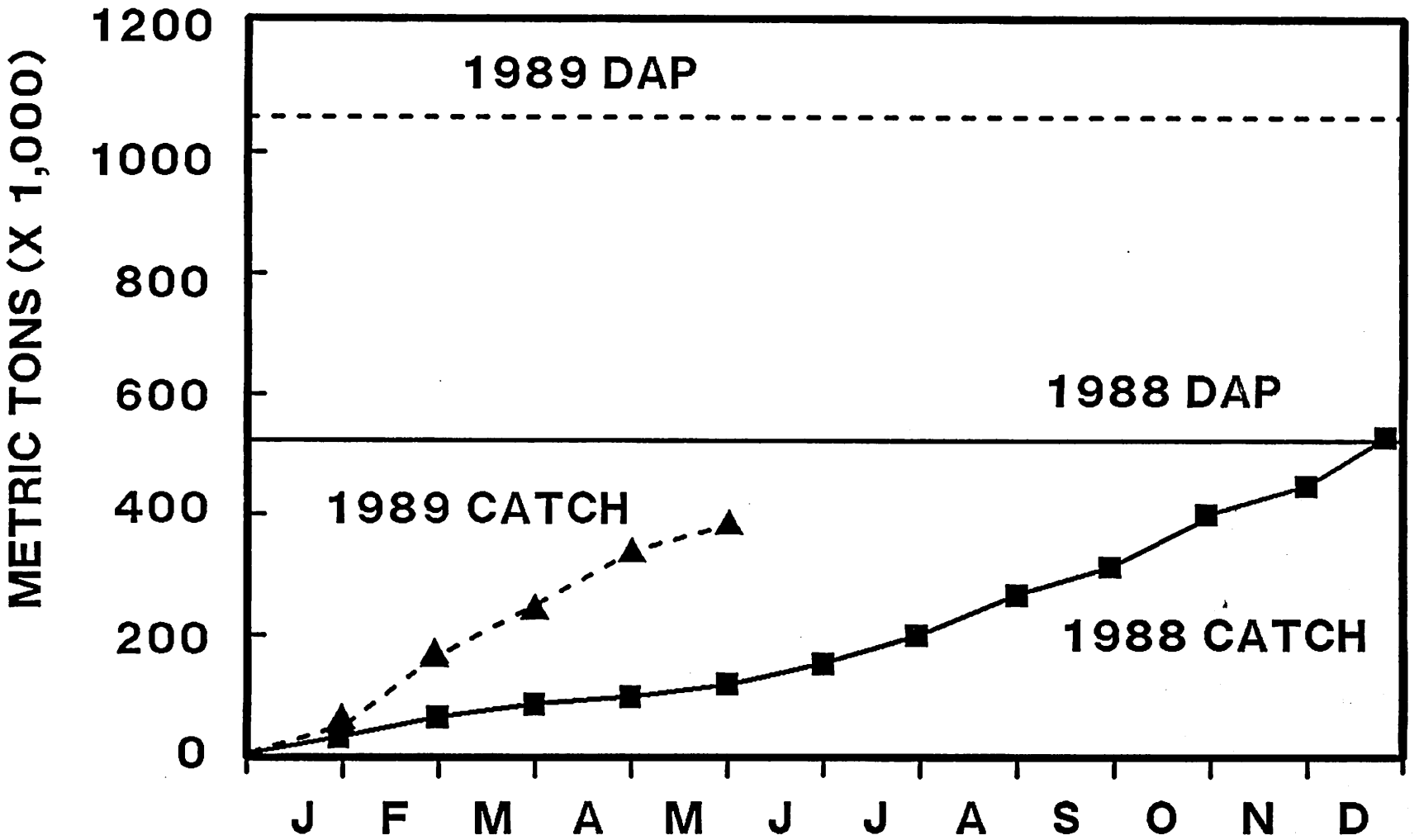
TOTAL = TOTAL CATCH: DAP + JVP

"RES" = OTAC (ORIGINAL TAC) MINUS CTAC

REMAIN = CTAC - TOTAL CATCH

DAP CATCH

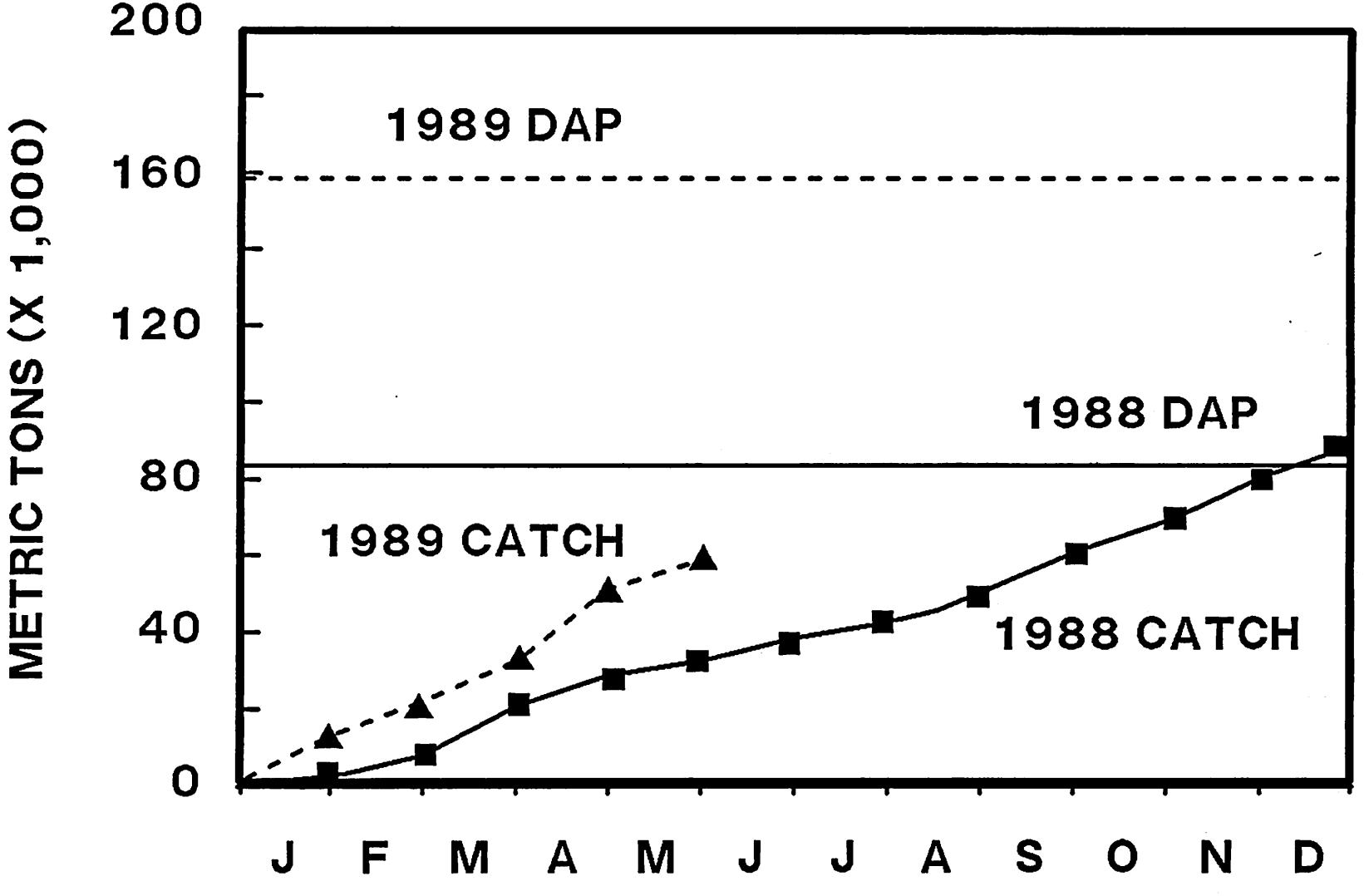
BSAI POLLOCK



(2)

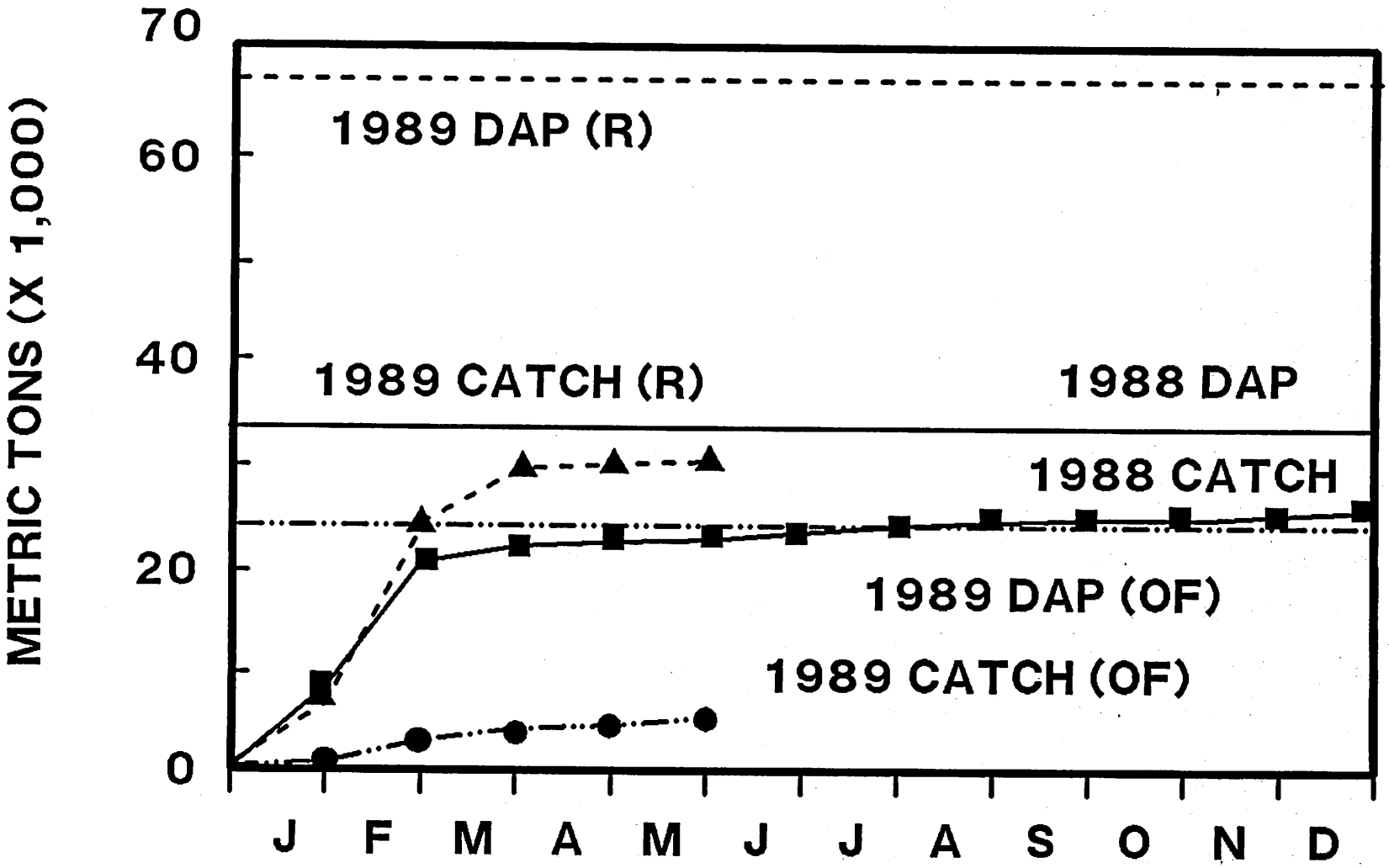
DAP CATCH

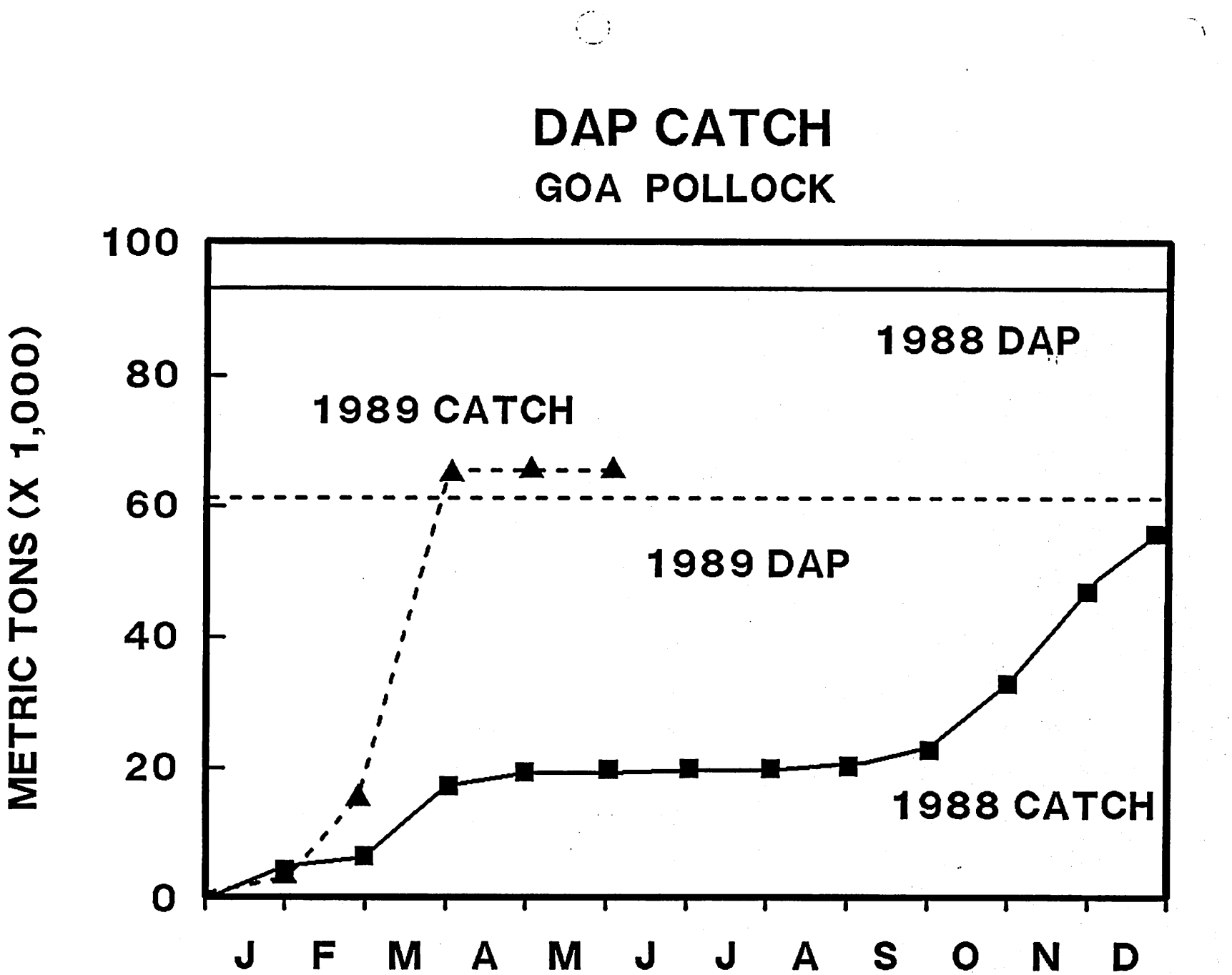
BSAI PACIFIC COD



DAP CATCH

BSAI "OTHER FLATFISH" / ROCK SOLE




DAP CATCH
GOA POLLOCK
METRIC TONS (X 1,000)
100
80
60
40
20
0
1988 DAP
1989 CATCH
1989 DAP
1988 CATCH
J
F
M
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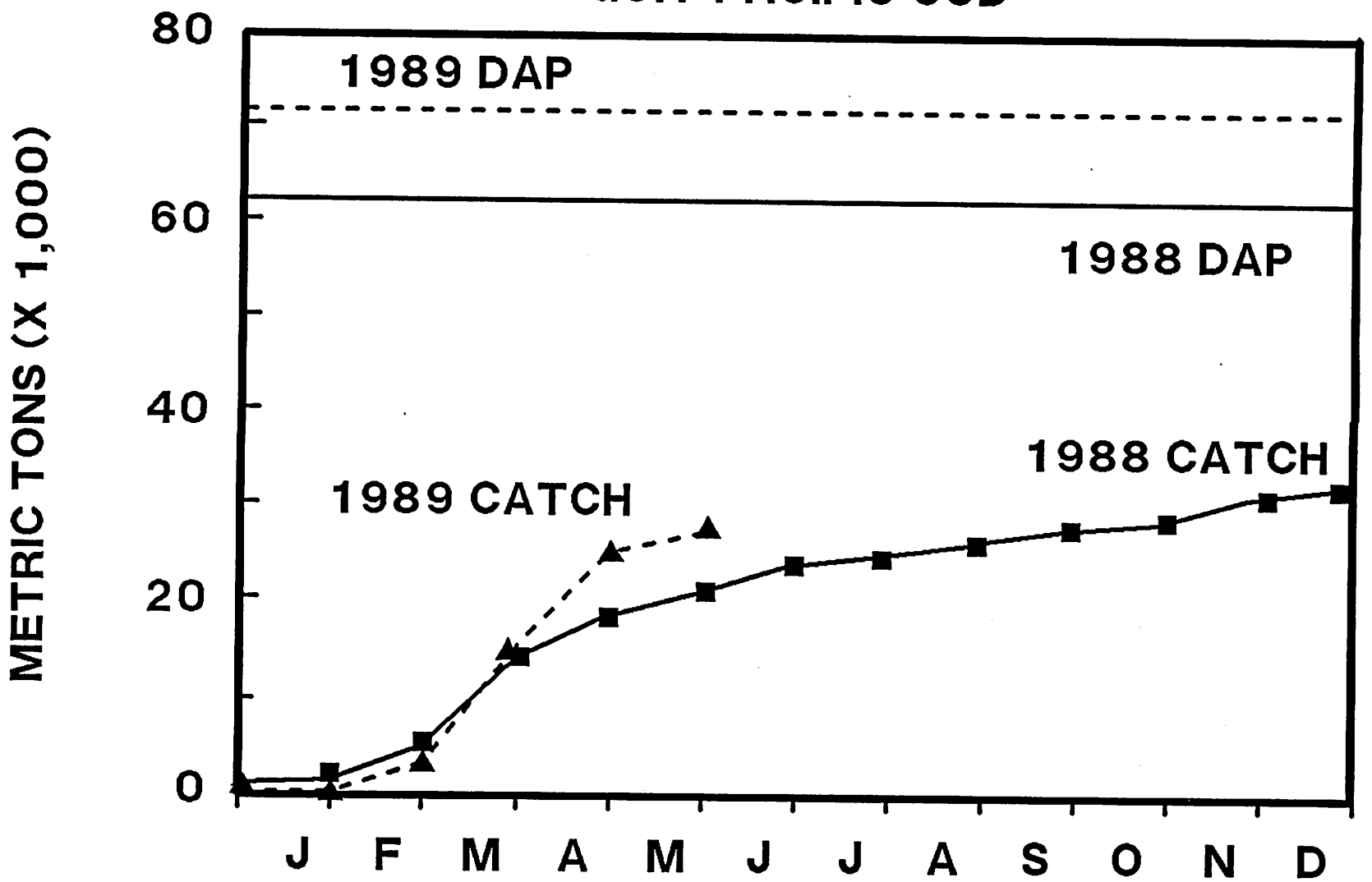
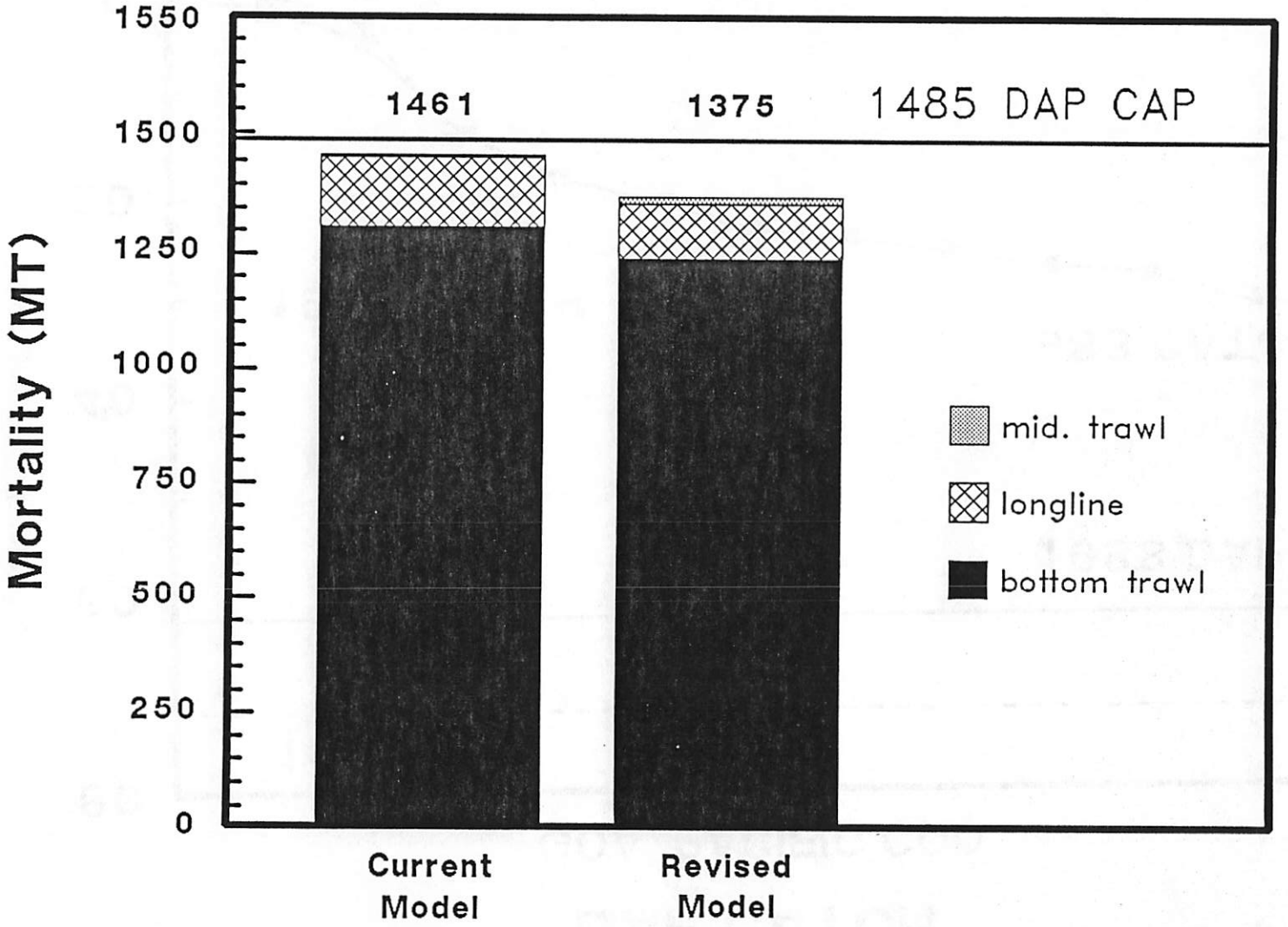
DAP CATCH

GOA PACIFIC COD



Halibut Mortality
in 1989 GOA Groundfish Fisheries



Bycatch Management in the Bering Sea Groundfish Fisheries
NOAA Fisheries

EXECUTIVE SUMMARY

Red king crab bycatch management in Zone 1:

- Midwater trawl operations could be allowed to operate with observers throughout the area known as Zone 1 with the objective of a "zero" crab bycatch.

- Bottom trawl operations could be allowed to operate with observers in Zone 1 outside of a closed area where relatively high concentrations of red king crab exist. This closure would protect a major percentage of the red king crab stock and could be modified to reflect the most recent stock assessment surveys. A discussion is presented on one possible area closure between 161 and 164½W. longitude, south of 58½N. latitude. When an operation's observed weekly bycatch rate exceeds a fixed rate by 100 percent during any two weeks, Zone 1 would be closed to the operation for the remainder of the year.

C. bairdi and Pacific halibut bycatch management:

- Without observers, a fishery's bycatch can be estimated by applying bycatch coefficients (Appendix 1) against reported catch composition. When estimated bycatch reaches the fishery's portion of the PSC limit established by the Council for an area, that area would be closed to vessels of that fishery. C. bairdi bycatch limits would be established for Zone 1 and for a modified "Zone 2". A single halibut PSC limit would be established for the entire Bering Sea.

Other options with comprehensive observer coverage:

- Option 1: Observed bycatch for a fishery operation would be compared to its allowable bycatch estimated from applying bycatch coefficients against the species composition of its weekly groundfish harvest. Those operations having a smaller observed bycatch will have the savings "credited" to their operation. When estimated bycatch reaches the amount of PSC apportioned to a fishery in that area, the fishery would be closed except to those operations with bycatch "credit." These operations may continue fishing with observers until their bycatch "credit" has been taken.

- Option 2: When a fishery's estimated bycatch reaches 25, 50, and 75 percent of an established PSC limit, a fishery operation's observed bycatch would be compared to its estimated (i.e., allowable) bycatch as calculated by applying bycatch coefficients against the operations groundfish catch composition. If these "checkpoint" comparisons show an operation exceeded its allowable bycatch, the operation must cease fishing in the area for the remainder of the year. During any two weeks, an operation's observed weekly bycatch could be 150 to 200 percent of the allowable bycatch. If an operation's observed bycatch is at this level for a third week or during any one week exceeds 200 percent of the allowable bycatch, it would be excluded from the fishing area for the remainder of the year. Only those operations that have passed a previous checkpoint may continue fishing once 75 percent of the PSC has been reached. If an operation's observed bycatch exceeds the allowable bycatch during this period, that operation would be prohibited from fishing the following year until 25 percent of the PSC cap has been taken.

PSC Management in the Bering Sea

- NOAA, Fisheries Discussion Paper -

INTRODUCTION

At its January 1989 meeting, the Council requested that NOAA Fisheries develop a comprehensive bycatch management proposal for the Bering sea trawl fisheries and to present it to the Council at its June meeting for implementation in 1990 and beyond. The purpose of this paper is to respond to the Council's request and present to the Council some options for prohibited species bycatch management. These options are intended to provide some guidance for Council direction to its Bering Sea Plan Team in developing an amendment to augment the bycatch management scheme envisioned under Amendment 12a.

Adoption of a new prohibited species management plan for 1990 would require final Council action by the December meeting and even then, emergency action would be required to implement the plan earlier than June 1990. Adherence to this schedule would require that the Council direct its Plan Team to prepare an amendment package for consideration by the Council at its September meeting so that the amendment may be sent out for public review. The Council may wish to consider whether this schedule is realistic in light of other priorities and staff workloads.

The following discussion describes options for bycatch management of red king crab, C. bairdi Tanner crab, and Pacific halibut in the Bering Sea and Aleutians Islands area groundfish fisheries. A comprehensive, fishery-wide observer program, together with adequate recordkeeping and reporting of catch and discards, is essential for an equitable, effective bycatch management scheme. Although some level of observer coverage is likely for 1990, the actual extent of coverage is unknown. Thus options are presented both with and without the assumption of comprehensive observer coverage.

The assumed goals for bycatch management are to (1) assure that the bycatch of crabs and halibut do not cause biological harm to those resources, (2) provide for the harvest of the allowable catch of groundfish, and (3) minimize the wasteful bycatch of crab and halibut species.

BYCATCH MANAGEMENT

Without a comprehensive observer program, NMFS must rely on empirical methods to estimate bycatch. Methods have been developed for estimation of halibut and C. bairdi bycatch using observed rates in the 1986-1988 joint venture groundfish fisheries, but no method has been developed for accurately predicting red king crab bycatch (Appendix 1). When estimated bycatch levels for C. bairdi and halibut reach established PSC limits, area closures would be triggered to limit further take of these species. This method is not based on knowledge of the actual catch of prohibited species and thus does not allow management of these catches to any specific level.

Once comprehensive observer coverage is available for a particular fishery or area, actual bycatch amounts or rates can be monitored for fishery operations that would trigger area closures to those operations when established limits are reached. Bycatch management schemes with comprehensive observer coverage can monitor individual fishery operations and provide an incentive to reduce bycatch rates, i.e., those operations with reduced rates would be allowed to continue fishing in an area closed to other operations.

Red King Crab:

Since no method now exists to accurately estimate red king crab bycatch from catches of target species, any bottom trawl effort in much of the area now known as Zone 1 will have an unpredictable impact on red king crab. Therefore, it is proposed that a basic element of the red king crab management scheme is a closure to trawling of a portion of Zone 1. The size of this closure would be dependent on the proportion of the red king crab stock the Council wished to give absolute protection. Further modification of this closure could be made if mandatory observer coverage was instituted to ensure king crab bycatch was regulated. Figure 1 shows one example of a bottom trawl area closure in Zone 1 that, based on 1988 NMFS crab survey results, would protect 69 percent of the total red king crab stock and about 68 and 85 percent of the mature males and females, respectively. During 1988-1987, between 74 and 90 percent of the commercial red king crab harvest also came from this area. Although current information indicates this area closure would protect a significant portion of the red king crab stock, future surveys of crab stocks may indicate that the closure should be shifted to the west or east to reflect fluctuations in stock movements. Thus, any closure designed to protect king crab stocks should be allowed to shift, based on the most recent stock assessment surveys, so that the desired level of crab protection may be maintained.

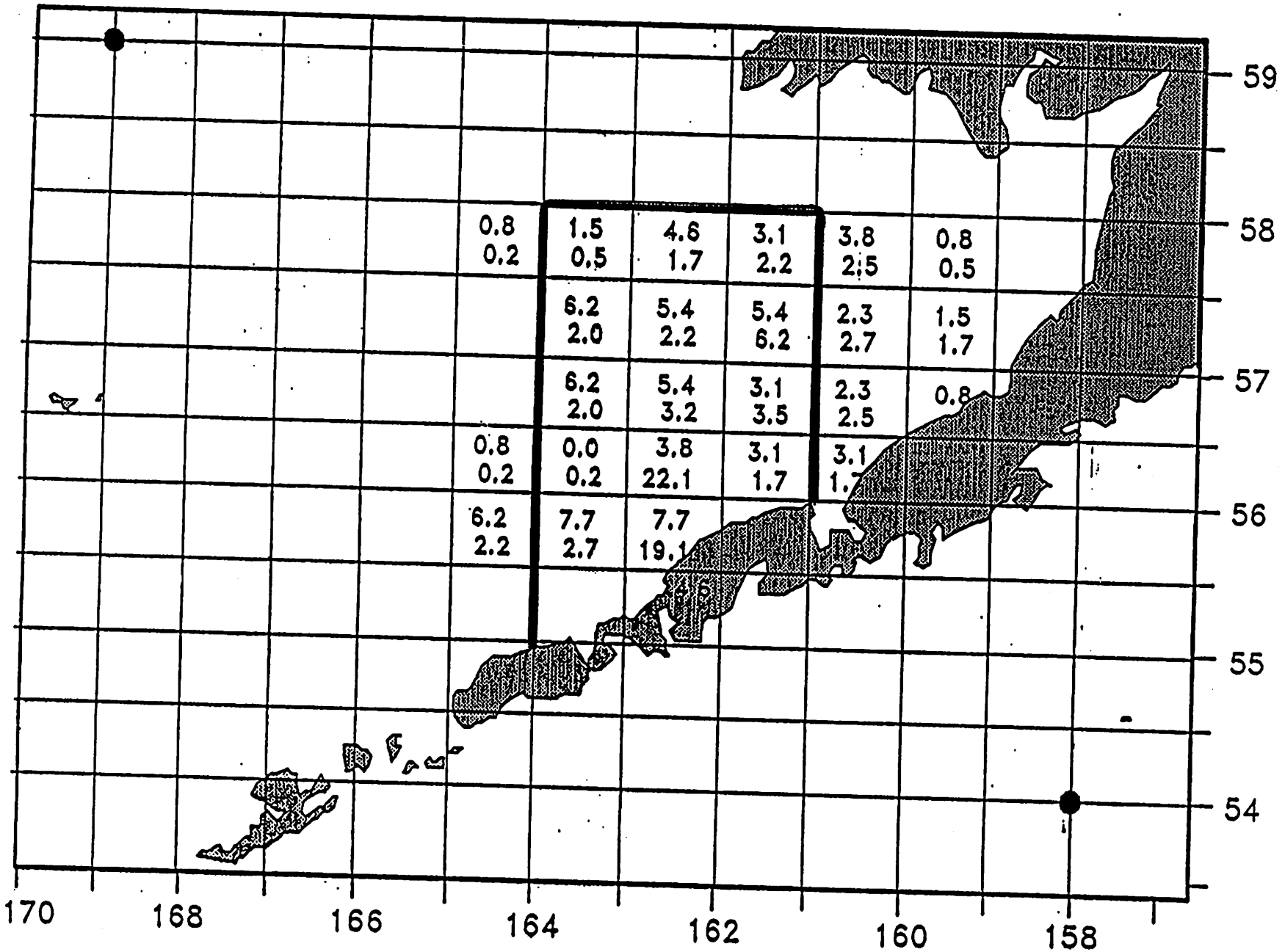


Figure 1. Example bottom trawl closure for red king crab protection based on 1988 NMFS crab survey. Numbers show percent (in numbers) of total stock by 1 x ½ degree blocks. Top numbers are percent of total mature male stock, bottom numbers are percent of total red king crab stock.

The following allowances for trawl gear could be made in Zone 1 provided that trawl operations have 100 percent observer coverage:

- Midwater trawl fisheries could be allowed to operate year-round throughout Zone 1. Observers would monitor these vessels, which must operate with the objective of a "zero" crab bycatch. Zone 1 would be closed to a vessel when observer data show an unacceptable bycatch of red king crab, indicating the vessel's trawl gear was fished on the sea bottom.

- The Port Moller Pacific cod fishery could be allowed within a straight line approximating the 25 fathom depth contour throughout Zone 1 provided that the fishery meets the bycatch rate provisions discussed below for other bottom trawl operations.

- Other bottom trawl operations could be allowed to operate in Zone 1 outside of closed areas where relatively high concentrations of red king crab exist. When an operation's observed weekly bycatch rate exceeds a fixed rate by 100 percent for any two weeks, Zone 1 would be closed to the operation for the remainder of the year. A bycatch rate rather than a PSC limit is advocated as an incentive to bottom trawl vessels to reduce red king crab bycatch rates to a more desirable level. This recommendation is made on the assumption that the bottom trawl area closure would already provide sufficient protection to most of the red king crab stock. The 1986-1989 joint venture observer data show the average red king crab bycatch rate in Zone 1 by all JV bottom trawl operations to be about 0.7 red king crab/mt groundfish. In 1989, the average bycatch rate was 0.96 red king crab/mt groundfish.

- Alternatively, with 100 percent observer coverage, a PSC limit for Zone 1 could be imposed on trawl fisheries outside of the closed areas. Once observer information indicates that the PSC limit has been reached, Zone 1 would be closed to further bottom trawl fishing.

A king crab closure area would force groundfish operations to relocate to other areas and additional operational costs due to seasonal modification of fishing patterns may be incurred by these operations as a result. Industry comment on this proposed amendment would give the Council information on the nature and magnitude of any such costs. The above allowances for the trawl fisheries, together with those currently provided for the Port Moller Pacific cod fishery should provide opportunity for the harvest of TAC in the Bering Sea area.

The potential importance of the example red king crab closure depicted in Figure 1 to selected target fisheries is shown in Table 1. The 1986-88 joint venture data indicate that 9 percent of the total JV harvest came from the closed area shown in Figure 1. When just the JV bottom trawl fisheries are considered, the area accounted for 19 percent of the total catch. If these fisheries were prohibited in the closed area, they would have to relocate to other productive fishing grounds outside the closed area to harvest their yellowfin sole and other flatfish allocations, although some seasonal adjustment in fishing pattern would probably be required. The JV flounder fishery demonstrated that this was possible when, in 1987 and 1988, all of Zone 1 was closed to directed fishing for yellowfin sole and other flatfish for bycatch control purposes on April 25 and March 8, respectively. The JV flounder fisheries relocated to areas north of Zone 1 and continued fishing until their allocation levels were reached.

Table 1. Potential displacement of groundfish operations as a result of the red king crab protection area shown in Figure 1 (based on 1986-88 JV observer data).

	Total 1986-88 JV groundfish harvest in closed area (mt)	Percent of total JV harvest in BSAI
Target Fishery:		
Midwater pollock	25,625	2.54
Atka mackerel	0	
Yellowfin sole/other flounder	98,690	24.73
Rock sole	3,601	34.22
Pollock bottom trawl	22,600	0.18
Other bottom trawl	21,500	0.08
*All bottom trawl fisheries	146,391	19.14
Total JV groundfish harvest	172,016	9.39

* Excludes midwater pollock

C. bairdi Tanner crab and Pacific halibut:

Without observers, a vessel's bycatch amount of C. bairdi and halibut can be estimated by applying existing bycatch estimators (Appendix 1) against the reported catch composition of groundfish harvests. When the estimated bycatch for these species reaches the PSC limits established by the Council, area closures would be triggered to reduce further take of halibut and C.bairdi in the groundfish fisheries.

NMFS recommends that the Council consider developing PSC limits based upon a fixed percentage of stock abundance, as determined during annual stock surveys, so that allowable bycatch amounts may change annually to reflect stock condition. These limits would be apportioned to the DAP and JVP flatfish fisheries and "other fisheries" based on those fisheries' proportion of the total TAC projected to be taken by bottom trawl gear. The most limiting PSC amount would determine when an area is closed to a fishery, regardless of PSC amounts that may remain for other bycatch species.

Unlike red king crab, C.bairdi are widely distributed throughout the Bering Sea shelf area, although several areas of the shelf can be identified as having greater concentrations of C.bairdi. Figure 2 shows two areas that have sufficient amounts of C. bairdi to warrant area closures for bottom trawl vessels when separate PSC limits established for these areas are reached. Based on 1988 crab survey data, 65 percent of the mature males and 37 percent of the total C. bairdi stock are distributed in Zone 1. A modified "Zone 2" contains 28 and 47 percent of the mature males and total stock, respectively. Closure of these two areas would protect 93 percent of the mature males and 84 percent of the total C. bairdi stock. The Council may consider closing a smaller portion of "Zone 2" around the Pribilof Islands (Figure 2) when estimated bycatch levels reach 50 percent of the PSC limit for "Zone 2." The Pribilof Island area contains a high density of C. bairdi (over 20 percent of the stock) and its closure to bottom trawling could sufficiently reduce total bycatch so that closure of all of Zone 2 becomes unnecessary, or at least delayed.

Closure of Zones 1 and 2 to bottom trawling would result in the relocation of the trawl fleet to northern slope areas of the Bering Sea. Concentrated trawl effort in this area could result in increased bycatch of C. opilio Tanner crab. Recent crab surveys indicate these stocks are in high relative abundance and increasing. Although the Council has not previously adopted specific bycatch measures for this species, an increased bycatch by the groundfish fleet could probably be tolerated by the stock. The likelihood of relocation of bottom trawl effort to more

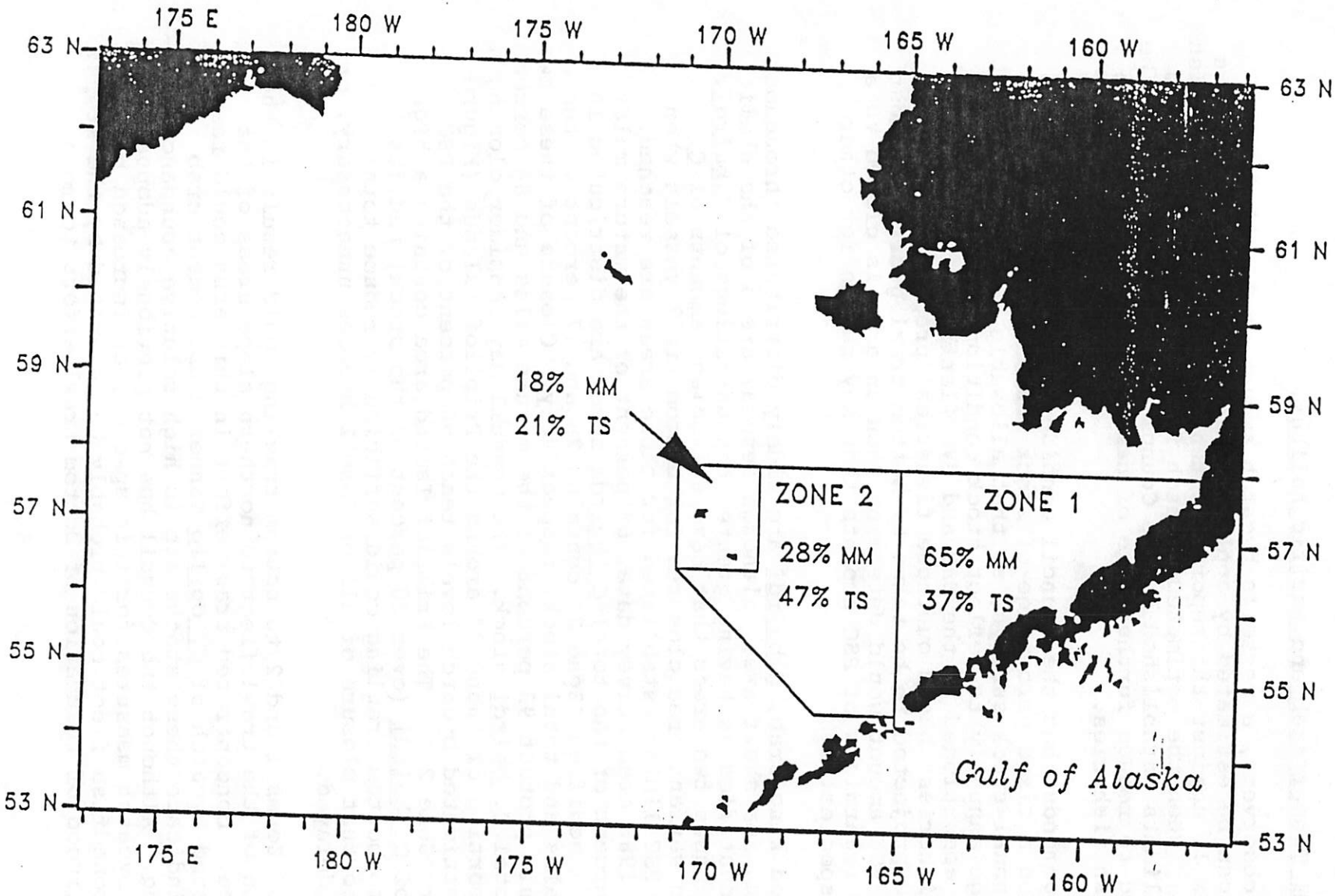


Figure 2. Example closures for C. bairdi based on 1988 crab survey. Numbers show % of mature males (MM) and total stock (TS) in each area.

northern fishing grounds and ensuing increase in C. opilio bycatch could be reduced with the two-stage closure of Zone 2 described above.

Unlike C. bairdi and red king crab, halibut bycatch rates do not appear to vary significantly with area. Once the halibut PSC limit is estimated to have been taken, therefore, area closures short of the entire Bering Sea will not provide a practical means to limit subsequent halibut bycatch. The Council could choose to close the entire Bering Sea in a two stage process as envisioned under Amendment 12a, although this action would not provide an incentive to reduce bycatch rates and limit halibut bycatch in areas that remain open.

Additional bycatch management options for C. bairdi and halibut with comprehensive observer coverage:

NMFS believes that all future bycatch management schemes should include at least some level of observer coverage to manage halibut and crab bycatch in the groundfish trawl and longline fisheries. The red king crab bycatch management scheme discussed above would provide observer information on C. bairdi and halibut bycatch in the Zone 1 trawl fisheries. A comprehensive observer program outside of Zone 1 is necessary if adequate incentive programs are to be implemented that would encourage individual groundfish operations to develop methods to reduce bycatch. Such incentive programs would monitor individual fishing operations and allow "clean" operations to continue fishing in an area closed to other operations. Programs of this type should limit the necessity of closing all or parts of the entire Bering Sea to groundfish operations.

-Option 1 (PSC "credit" option): Observed bycatch for a fishery operation would be compared to its estimated bycatch as derived from the updated estimators applied to species composition of its weekly groundfish harvest. Those operations having a smaller observed bycatch will have the savings "credited" to their operation. -When estimated bycatch reaches the amount of PSC apportioned to a fishery in that area, the fishery would be closed except to those operations with bycatch "credit." These operations may continue fishing with observers until their bycatch "credit" has been taken.

When practicable, a fishery operation would be defined as the level where first sorting of catch occurs, although several operations (e.g. catcher/processor vessels) under the same company may be identified as a single operation. Bycatch credits stay with the operation during the fishing season, although catcher vessels delivering to an operation would be free to go from one operation to another during the fishing season.

This option provides an incentive both to take observers and to fish cleanly throughout the fishing season. If observer coverage of fishery operations is less than 100 percent, it may be necessary to close a fishery when estimated bycatch levels reach a certain percentage of the established PSC limit for an area. This precaution would be taken to provide a bycatch allowance for those operations without observers that may have taken more bycatch than predicted. The allowance could change with the level of observer coverage, but without 100 percent observer coverage, NMFS recommends that an area be closed when estimated bycatch equals 90 percent of the established PSC limit for that area.

-Option 2 (PSC "checkpoint" option): This option would require 100 percent observer coverage of individual fishing operations. Observers would monitor bycatch amounts for individual fishery operations and would report those amounts on a weekly basis. Bycatch checkpoints would be established at 25, 50, and 75 percent levels of established PSC limits. When 25 and 50 percent of the PSC limits established for C. bairdi and halibut are reached, the fishery operations' observed bycatch up to that point would be compared against estimated bycatch based on species composition of groundfish harvests. If these comparisons show that an operation exceeded the estimated bycatch, the operation must cease fishing in the area for the remainder of the year.

During any two weeks, an operation's observed weekly bycatch could be 150 - 200 percent of the estimated bycatch. If an operation's weekly observed bycatch is at this level for a third week, or during any one week exceeded 200 percent of the estimated bycatch, it would be excluded from the fishing area for the remainder of the year. This could be implemented in combination with the checkpoints in paragraph one, or could form the basis for an independent management regime.

When 75 percent of a species' PSC limit for an area is reached, no new operation may commence in the area and only those operations that have successfully completed one or more previous checkpoints and have not been excluded from the area would be allowed to continue fishing until the PSC limit is reached. Any operation with an observed bycatch greater than its estimated bycatch during this period, would be prohibited from fishing in the area the following fishing year until after the first 25 percent of the PSC cap has been taken. This measure is intended to encourage vessels to maintain "clean" operations through the end of the year.

APPENDIX 1

The Use of Groundfish Catches to Estimate Bycatch

Suppose a group of boats fish, with the same target species, in the same subarea for a given week. Let y represent the total bycatch of a given species for the boats and x_1, x_2, x_3, and x_4 represent, respectively, the total pollock, pacific cod, yellowfin sole, and other flatfish catches. The goal is to use x_1, x_2 x_3, and x_4 to estimate y. We consider here an estimator of the form $b_1x_1+b_2x_2+b_3x_3+b_4x_4$. The determination of values for the coefficients b_1, b_2, b_3, and b_4 will be discussed later.

Consider the following 8 models:

M_1: the values of the b_i's depend upon the year, the subarea, and the quarter in which the x_i's are observed.

M_2: the values of the b_i's depend upon the year and the quarter in which x_i's are observed, but not on the subarea.

M_3: the values of the b_i's depend upon the year and the subarea in which the x_i's are observed, but not on the quarter.

M_4: the values of the b_i's depend upon the year in which the x_i's are observed, but not the quarter and subarea.

M_5: the values of the b_i's depend upon the subarea and the quarter in which the x_i's are observed, but not the year.

M_6: the values of the b_i's depend upon the quarter in which the x_i's are observed, but not the year and subarea.

M_7: the values of the b_i's depend upon the subarea in which the x_i's are observed, but not the year and the quarter.

M_8: the values of the b_i's depend upon neither the year nor the subarea nor the quarter in which the x_i's are observed.

If $(y_i,x_{1i},x_{2i},x_{3i},x_{4i})$ represents the i-th of n observations of the vector (y,x_1,x_2,x_3,x_4), for i=1,...,n, the n vectorial observations $(y_1,x_{11},x_{21},x_{31},x_{41})$, ...,$(y_n,x_{1n},x_{2n},x_{3n},x_{4n})$ may be used to select an appropriate model from among those just listed.

For a given model and a given observed prohibited species catch, y_j, we can calculate a "predicted" value for y_j as follows:

a. delete the vectorial observation $(y_j,x_{1j},x_{2j},x_{3j},x_{4j})$ from the data

b. use the remaining n-1 vectorial observations to estimate values for the parameters in the model

c. apply the model, with parameters replaced by their estimates, to $(x_{1j}, x_{2j}, x_{3j}, x_{4j})$ to get a predicted value for y_j.

A "predicted" value for each of $y_1, y_2, \ldots, y_n$ is obtained in this manner for each model being considered. Let $\hat{y}_{1M_h}, \ldots, \hat{y}_{nM_h}$ represent the predicted values of $y_1, \ldots, y_n$ for model M_h, h=1,...,8. Set

$$\text{PRESAV}(M_h) = \sum_{i=1}^{n} |y_i - \hat{y}_{iM_h}| ,$$

for h=1,...,8. To select an appropriate model, we examine the predition sum of absolute values (PRESAV) for the various models and look for those models which produce small PRESAV's.

The following values for prediction sum of absolute values were found when 1987 and 1988 JVP observer obtained weekly summary data were used:

	Prohibited Species		
Model	Halibut	Bairdi	Red King Crab
M_1	2785873	883891	243265
M_2	2051550	773516	284550
M_3	1982720	726718	228474
M_4	2207621	809114	273780
M_5	2076229	752599	169257
M_6	1929829	817961	263936
M_7	2195205	769056	210867
M_8	2089256	889060	255506

Thus these data indicate that reasonable models appear to be M_6 for halibut and M_5 for bairdi and red king crab.

The procedure for using a set of vectorial observations $(y_1, x_{11}, x_{21}, x_{31}, x_{41}), \ldots, (y_n, x_{1n}, x_{2n}, x_{3n}, x_{4n})$ to get estimates for b_1, b_2, b_3, and b_4 is an application of a technique developed by R. F. Kappenman ("Robust symmetric distribution location estimation and regression", Journal of Statistical Planning & Inference, 19(1988),55-72). We also use the constraint that $\Sigma y_i = \Sigma (b_1 x_{1i} + b_2 x_{2i} + b_3 x_{3i} + b_4 x_{4i})$. That is, estimates of b_2, b_3, and b_4 are the values of these constants which minimize

$$\Sigma v_i (z_i - b_2 w_{1i} - b_3 w_{2i} - b_4 w_{3i})^2$$

where

$$z_i = y_i - \frac{\Sigma y_i}{\Sigma x_{1i}} x_{1i}, \quad w_{1i} = x_{2i} - \frac{\Sigma x_{2i}}{\Sigma x_{1i}} x_{1i}, \quad w_{2i} = x_{3i} - \frac{\Sigma x_{3i}}{\Sigma x_{1i}} x_{1i},$$

$$w_{3i} = x_{4i} - \frac{\Sigma x_{4i}}{\Sigma x_{1i}} x_{1i}, \qquad v_i = \frac{1}{1 + \left(\frac{z_i - b_{20}w_{1i} - b_{30}w_{2i} - b_{40}w_{3i}}{d}\right)^2}$$

and d = median $\{|z_i - b_{20}w_{1i} - b_{30}w_{2i} - b_{40}w_{3i}|\}$. Here b_{20}, b_{30}, and b_{40} are the least absolute values estimates of b_2, b_3, and b_4. Once estimates of b_2, b_3, and b_4 are obtained, the equation

$$b_1 = \frac{\Sigma y_i - b_2\Sigma x_{2i} - b_3\Sigma x_{3i} - b_4\Sigma x_{4i}}{\Sigma x_{1i}}$$

is used to get an estimate of b_1.

The 1986, 1987, and 1988 JVP weekly summary data were used to get estimates of the parameters b_1, b_2, b_3, and b_4. These are, for halibut:

Quarter	b_1	b_2	b_3	b_4
1	1.1007	11.2288	0.9586	0.6760
2	2.3226	19.3926	0.4108	6.3910
3	3.1192	8.1258	4.6134	0
4	2.2913	24.4234	7.2488	0

For bairdi they are:

Quarter	b_1	b_2	b_3	b_4
1	0	2.3951	0.9307	1.2952
2	0	9.1384	0	1.5194
3	0.5658	0	0	2.3976
4	0.7548	0	1.6668	5.8105

These estimates and the 1989 JVP groundfish catches were then used to "estimate" observed 1989 JVP prohibited species catches corresponding to the groundfish catches. The actual total halibut bycatch was 508862 and the estimate of this total was 489578. The actual total bairdi bycatch was 208225 and the estimate of this total was 199107.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
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NEWS RELEASE
Steven Pennoyer
907-586-7221

June 15, 1989

For Immediate Release

CLOSURE OF OTHER ROCKFISH FISHERY IN EASTERN GULF OF ALASKA

Fishermen may no longer retain species of the Other Rockfish category in the Eastern Regulatory Area of the Gulf of Alaska after 12:00 noon, Alaska Daylight Time, June 19, 1989, according to Steven Pennoyer, Director, National Marine Fisheries Service. The Other Rockfish Total Allowable Catch (TAC) of 5,774 mt will be reached on that date. Further catches of Other Rockfish in the Eastern Regulatory Area must be treated as prohibited species and discarded at sea. In the Eastern Regulatory Area, Other Rockfish includes the Slope Rockfish assemblage from the West Yakutat, East Yakutat, and Southeast Outside districts, as well as Demersal Shelf Rockfish from the West Yakutat and East Yakutat districts; species assemblages are listed below.

Pelagic Shelf Rockfish in the Eastern Regulatory Area closed on June 13, 1989. The only rockfish category remaining open in the Eastern Regulatory area after June 19 is Demersal Shelf Rockfish in the Southeast Outside District (SEO). However, vessels registered under the laws of the State of Alaska are advised that the State has imposed restrictions on the harvest of Demersal Shelf Rockfish in the SEO. For information contact the Alaska Department of Fish and Game: (Sitka: Tory O'Connell (907) 747-6688; Petersburg: Barry Bracken (907) 772-3801).

SLOPE ROCKFISH species include: northern, Pacific ocean perch, rougheye, sharpchin, shortraker, aurora, blackgill, chilipepper, darkblotch, greenstriped, harlequin, pygmy, red banded, shortbelly, splitnose, stripetail, vermilion, and yellowmouth rockfish.

DEMERSAL SHELF ROCKFISH species include: boccacio, canary, china, copper, quillback, redstripe, rosethorn, silvergrey, tiger, and yelloweye rockfish.

PELAGIC SHELF ROCKFISH species include: black, blue, dusky, widow, and yellowtail rockfish.

For further information regarding this notice, call Janet Smoker or Jessie Gharrett at (907) 586-7230.