MEMORANDUM

TO: Council, SSC and AP Members

FROM: Clarence G. Pautzke
Executive Director

DATE: September 18, 1995

SUBJECT: Crab Bycatch Management

ESTIMATED TIME
6 Hours
(all D-4 items)

ACTION REQUIRED

(c) Initial review of an analysis allowing inseason adjustments of Tanner crab PSC among areas.
(d) Final review of analysis of Bristol Bay red king crab protection area. Also, review crab rebuilding issues and reports.

BACKGROUND

Tanner crab PSC bycatch management

In June 1995, the Council directed Staff to prepare an EA/RIR analysis to examine impacts of allowing greater flexibility in the management of C. bairdi Tanner crab bycatch limits in Zones 1 and 2. Currently, the FMP establishes bairdi PSC limits for trawl fisheries at 1 million crab for Zone 1 and 3 million crab for Zone 2. Attainment of a trawl fishery allowance forces movement of fishing operations into Zone 2. Because Zone 2 typically has higher bycatch rates of halibut, there is increased potential for attainment of halibut allowance, resulting in closure of the entire BSAI to that fishery. This situation, which occurred in the yellowfin sole in 1994 and the Pacific cod fishery in 1995, may have been avoided with increased flexibility in the management of bairdi PSC limits between Zones. The analysis examines the following alternatives:

Alternative 1. Status quo.

Alternative 2. Increase the Zone 1 bairdi PSC limit and reduce the Zone 2 limit by that amount.

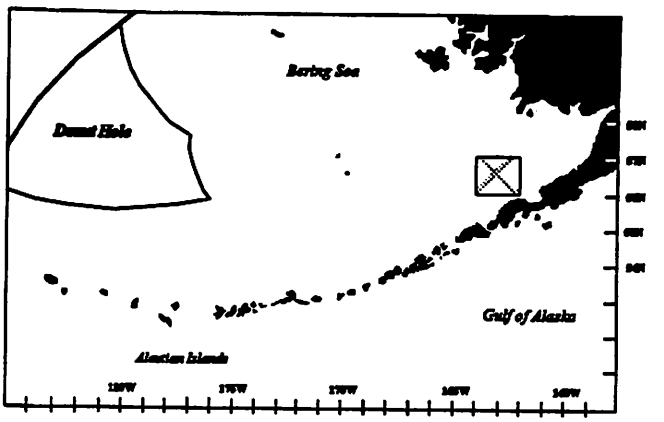
Alternative 3. Combine Zones 1 and 2 to create a single annual limit of 4 million bairdi crab.

Alternative 4. Based on in-season data, allow Regional Director to increase the Zone 1 bairdi PSC limit and reduce the Zone 2 limit by that amount for specified fisheries.

NMFS will present results of their analysis. At this meeting, the Council may review the analysis, make recommended changes, and release the document for public review. If final action were taken in December, implementation could occur by mid-1996.

Bristol Bay Red King Crab Closure Area

On January 26, 1995, NMFS implemented by emergency rule (ER) a closure to trawling in a portion of Bristol Bay to protect red king crabs. The closed area encompasses from 162°W to 164°W longitude, 56°N to 57°N latitude. The ER also required observers on trawl vessels targeting flatfish in Zone 1 outside the closed area, and allowed pelagic trawling for pollock within the closed area but with 100% observer coverage. At the January meeting, the Council reviewed the ER and recommended that six alternatives to the status quo be analyzed for possible plan amendment.



A draft EA/RIR was reviewed by the Council in June, and was released for public review pending SSC approval. The SSC met by teleconference in August and approved the document with some minor revisions. Minutes of their meeting are attached.

Alternatives to the status quo all have an eastern border along Area 512, which is permanently closed to all trawling. All six alternatives to the status quo have longitudinal boundaries of 162°W longitude and 164°W longitude. Southern and northern boundaries of each alternative are:

Alternative 1.	status quo.
Alternative 2.	56° 10'N to 57°N latitude.
Alternative 3.	56° 00'N to 57°N latitude (same as emergency rule).
Alternative 4.	55° 45'N to 57°N latitude.
Alternative 5.	56° 10'N to 58°N latitude.
Alternative 6.	56° 00'N to 58°N latitude.
Alternative 7.	56° 45'N to 58°N latitude.

If final action is taken at this meeting, the amendment could be implemented in early 1996.

Review Crab Rebuilding Issues

In January, the Council requested member Dr. David Fluharty to chair a committee composed of members of the BSAI groundfish and crab plan teams to develop a rebuilding plan for the Bering Sea crab stocks. The teams met jointly on March 21-22 in Seattle. The goal of the meeting was to synthesize available information on sources and magnitude of crab mortality and ecosystem relationships and to identify alternative strategies the Council might use to enhance the survival of crab stocks and thus promote rebuilding. Minutes of the meeting were distributed in April.

Two major components of a rebuilding plan were suggested by the Committee and by the industry at a feedback session in April: (1) The first component would be to protect juvenile red king crab habitat by closing areas to all fishing. The Committee reached consensus that it was important to retain a minimum spawning stock and provide adequate habitat and protection for juvenile red king crab. Juvenile red king crab have been found to occupy nearshore areas of Bristol Bay, and require living substrate (such as bryozoans and stalked ascidians) for predator protection. A subsection of this area would include the northern Bristol Bay closure that the Council approved for analysis in January. (2) The second component would be to examine ways to reduce competition and predation by groundfish on Tanner and snow crab. Stomach samples indicate that Pacific cod, yellowfin

sole, flathead sole, and rock sole may consume a very large proportion of young Tanner and snow crab. Individual bycatch quotas (IBQs) have been suggested as a means to increase the catch of these groundfish without impacting more crab.

Current proposals to protect crab stocks.

1. Close trawling in central Bristol Bay
2. Close trawling in northern Bristol Bay
3. Reduce existing crab bycatch limits, and initiate bycatch limits for snow crab
4. Institute an individual vessel bycatch accounting program

In addition to establishing the rebuilding committee, the Council initiated several analyses to examine impacts of proposals to control crab bycatch in the groundfish fisheries. The first analysis, which has been completed, examined impacts of a trawl closure area in central Bristol Bay to protect adult red king crabs. A second analysis examines the effects of instituting a trawl closure area in the northeast section of Bristol Bay to protect juvenile crab, seabirds, marine mammals, and spawning herring stocks. A third analysis examines the impacts of reducing the existing crab bycatch limits for groundfish trawl fisheries. In addition, in June, the Council adopted for analysis an individual vessel bycatch accounting program for all BSAI non-pollock fisheries as part of a proposed ITQ program for the pollock fishery. Dave Witherell and Gretchen Harrington (our summer intern) have prepared a discussion paper, which evaluates these proposed management measures from a rebuilding perspective. Their paper is attached as item D-4(d)(1), and they will available to present their findings to the Council.

At this meeting, the Council needs to determine how to proceed with this issue. Should the crab rebuilding committee meet again? If so, what is their goal?

[Prepared as a Discussion Paper for the NPFMC meeting, September 1995]

Evaluation of Alternative Management Measures to Reduce the Impacts of Trawling and Dredging on Bering Sea Crab Stocks

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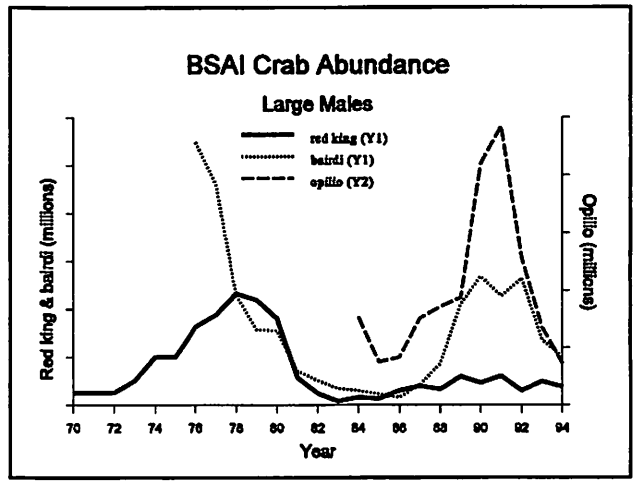
Abstract - The North Pacific Fishery Management Council is looking for ways to rebuild red king, Tanner, and snow crab stocks in the Bering Sea. The Council has delegated authority over crab management to the State of Alaska and is thus constrained to modifying it's management strategies for groundfish and scallop fisheries as a means to reduce the impacts on crab populations. In this paper, we examine several alternative management measures that the Council has proposed to reduce impacts of trawling and dredging on crab stocks. These measures include time/area closures, bycatch limits, and market solutions. Our analysis suggests that a comprehensive trawl/dredge closure area in the nearshore waters of Bristol Bay may allow increased red king crab recruitment by protecting juvenile crab and their habitat. Bycatch limits previously established for trawl and dredge fisheries could be reduced to conserve some crab, but would have little benefit to crab stocks. Similarly, bycatch management through individual vessel bycatch accountability may allow slightly larger harvests of crab predators and competitors such as yellowfin sole and Pacific cod, but the impact on crab rebuilding would be minor.

Bering Sea crab stocks are currently at relatively low levels based on National Marine Fisheries Service (NMFS) bottom trawl survey data. Data from the 1994 NMFS survey indicate that exploitable biomass of Bristol Bay red king crab (*Paralithodes camtschaticus*), and Bering Sea Tanner crab (*Chionoecetes bairdi*) and snow crab (*Chionoecetes opilio*) stocks are about one-fifth record levels (Stevens et al. 1994). The survey revealed that the female red king crab stock in Bristol Bay was below a threshold of 8.4 million females > 90 mm (3.5", the size at 50% maturity). The survey also detected low abundance of pre-recruit red king and Tanner crab, but a fair amount or pre-recruit snow crab were observed. These numbers suggest that declines in red king and Tanner crab abundance will continue, but that the snow crab stock may increase in coming years.



Crab fisheries have been impacted by these low stock sizes. Red king crab stocks are at their lowest since the fishery was closed after the first stock collapse in 1983. In 1994 Bristol Bay was closed to red king crab fishing because the annual trawl surveys indicated little prospect for increased recruitment of mature males or females, and the female threshold was not reached. The 1994 Tanner crab fishery in the Bering Sea opened as scheduled, but with a much reduced guideline harvest level of 7.5 million pounds. Additionally, the area east of 163°W was closed to Tanner crab fishing to minimize the bycatch of female red king crabs. The 1995 snow crab harvest was less than one-fourth of the record 1991 harvest (73.6 million pounds in 1995, 325 million pounds in 1991).

This situation has prompted the North Pacific Fishery Management Council to examine ways to rebuild red king, Tanner, and snow crab stocks in the Bering Sea. In January 1995, the Council formed a committee to develop a rebuilding plan for Bering Sea crab stocks. The committee was composed of Bering Sea/Aleutian Islands (BSAI) Crab Plan Team and Groundfish Plan Team members, and was chaired by Council member Dr. Dave Fluharty. The committee synthesized available information on sources and magnitude of crab mortality and

identified alternative management strategies the Council might use to enhance the survival of crab stocks and thus promote rebuilding (Witherell 1995). A rebuilding goal has yet to be specified, however. In addition to establishing the rebuilding committee, the Council initiated several analyses to examine impacts of proposals to control crab bycatch in the groundfish fisheries. The first analysis, which has been completed, examined impacts of a trawl closure area in central Bristol Bay to protect adult red king crabs. A second analysis examines the effects of instituting a trawl closure area in the northeast section of Bristol Bay (north of 58°N and east of 162°W) to protect juvenile crab, seabirds, marine mammals, and spawning herring stocks. A third analysis examines the impacts of reducing the existing crab bycatch limits for groundfish trawl fisheries. In addition, in June, the Council adopted for analysis an individual vessel bycatch accounting program for all BSAI non-pollock fisheries as part of a proposed ITQ program for the pollock fishery. Because these analyses were initiated before the committee could report to the Council, we make a preliminary examination of these alternative management measures from a rebuilding perspective, and suggest some options to be considered.

Proposals currently being analyzed by the Council to protect crab stocks.

1. Institute a trawl area closure in central Bristol Bay
2. Institute a trawl area closure in northern Bristol Bay
3. Reduce existing crab bycatch limits, and initiate bycatch limits for snow crab
4. Institute an individual vessel bycatch accounting program

Developing a rebuilding plan for crab stocks will be complex due to the existing management regime, sources of mortality, and life history. Crab year-class strength depends both on the number of spawners and on environmental condition such as temperature and currents (Tyler and Kruse 1995). Habitat availability for larval settlement and rearing is also likely to be important, particularly for red king crabs. Survival of juvenile crab after settlement until they reach maturity depends on a number of factors, which are listed in the accompanying table. Rebuilding crab stocks will hinge upon changing management strategies for crab, scallop, and groundfish fisheries to maintain adequate crab spawning stock and provide suitable habitat. However, abiotic factors (temperature, currents, etc.) may play a larger role in determining crab year-class strength.

Sources of mortality for adult and juvenile crab in the BSAI.

Crab Fishery	Groundfish/Scallop Fishery	Natural Mortality
✓ fishery removals	✓ habitat impacts	✓ predation
✓ bycatch	✓ bycatch	✓ competition
✓ ghost fishing	✓ ghost fishing by pots	✓ parasites/disease
	✓ unobserved mortality	✓ other sources

Alternatives and Options

Rebuilding options available to the Council are limited without major changes to the BSAI king and Tanner crab fishery management plan (FMP). Under the crab FMP, management measures fall into three categories: (1) those that are fixed in the FMP and under Council control, (2) those that are framework measures that the State can change following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. Under this plan, conservation and rebuilding

Management measures used to manage king and Tanner crabs in the BS/AI management unit category.

Category 1 (Fixed in FMP)	Category 2 (Frameworked in FMP)	Category 3 (Discretion of State)
* Legal Gear	* Minimum Size Limits	* Reporting Requirements
* Permits Requirements	* Guideline Harvest Levels	* Gear Placement and Removal
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
	* Closed Waters	* Bycatch Limits (in crab fisheries)
	* Pot Limits	* Other
	* Registration Areas	

of crab is mainly at the State's discretion. For example, if the Council wanted to develop a crab rebuilding plan based on limiting crab harvest, the crab FMP would need to be amended to limit guideline harvest levels. Thus, without amending the crab FMP, the Council is constrained to managing groundfish and scallop fisheries that impact the crab resource.

The State of Alaska is also working to rebuild and maintain viable crab stocks. The State has been conducting research on crab stock dynamics (Zheng et al. 1994, Zheng et al. 1995, Tyler and Kruse 1995), as well as evaluating changes to crab fishery management (Kruse 1993, Schmidt and Pengilly 1993, Murphy et al. 1994, Kruse 1995, Zhou and Shirley 1995). Modifications to crab harvesting strategies (based on size limits, sex restrictions, and seasons) and gear design that would reduce bycatch and handling mortality are currently being evaluated (Kruse 1995). Mortality caused by ghost fishing of lost crab pots and groundfish pots remains unquantified, but escape mechanisms have been required to reduce potential impacts (Kruse and Kimker 1993).

The State has instituted numerous regulatory changes in the past few years to reduce crab bycatch in the crab fishery. Crab bycatch in the directed fishery includes females of target species, sublegal males of target species, and non-target crab. Beginning in 1993, the Tanner crab season opened on November 1 to coincide with the opening of the red king crab fishery. This allowed retention of legal males of both species, thereby reducing bycatch (prior to 1993, the Tanner crab fishery opened 7 days after the Bristol Bay red king crab fishery closed, resulting in high bycatch of red king crab). A regulation instituted in 1993 to restrict tunnel openings on crab pots to a 3" maximum successfully reduced the bycatch of red king crab in both Tanner and snow crab fisheries. As shown in the following tables, bycatch of red king crab in the 1993 Tanner and show crab fisheries was reduced to 257,737 crab (Tracy 1994). Bycatch in the red king crab fishery increased to 5.5 million red king crab in 1993. However, to further reduce the bycatch of juveniles, females, and non-target crab, a regulation scheduled to be implemented in September 1995 will require all king crab pots in Bristol Bay to have at least one-third of one vertical surface of the pot composed of not less than 7.75" stretched mesh webbing.

Crab bycatch in the 1992 crab fisheries.

	Red king fishery	Tanner fishery	Snow fishery
legal males	1,070,472	14,629,181	267,767,184
non-legals	4,714,194	25,958,176	6,024,441
red king crab	-	1,477,695	33,731
Tanner crab	1,543,952	-	14,740,655
snow crab	20,586	2,758,365	-
hybrid C. spp.	nr	886,617	8,459,854

Crab bycatch in the 1993 crab fisheries.

	Red king fishery	Tanner fishery	Snow fishery
legal males	2,022,165	7,209,948	228,487,123
non-legals	5,502,508	18,150,624	4,563,916
red king crab	-	233,272	24,465
Tanner crab	3,968,374	-	6,700,215
snow crab	20,012	1,485,835	-
hybrid C. spp.	nr	293,428	9,613,355

Although the Council delegates management authority of the crab fishery to the State, the Council does have direct control over the groundfish and scallop fisheries in the EEZ. In harvesting groundfish and scallops, mobile gear fisheries take crab as bycatch and possibly damage crab habitat. Among the objectives of the BSAI groundfish FMP is minimizing the impact of groundfish fisheries on crab and other prohibited species, while providing for rational and optimal use of the region's fishery resources. Although all gear types used to catch groundfish have some potential to catch crab incidentally and impact habitat, managers have been primarily concerned with reducing the impacts of dredge and trawl fisheries.

Fishery managers and crab fishing representatives have been concerned with mortality of crab captured incidentally in scallop dredge and groundfish trawl fisheries and its impact on crab stocks (NPFMC 1986, Thomson 1989, NPFMC 1995). Together, these fisheries bycaught about 248,500 red king crab, 3,700,000 Tanner crab, and 14,800,000 snow crab in 1993. Although these numbers appear large, the impact of crab bycatch from trawl and dredge fisheries on Bering Sea crab populations may be relatively minor because (1) bycatch in trawl/dredge fisheries accounts for a very small percentage of the crab population in most years, (2)

Crab bycatch in the 1993 BSAI groundfish and scallop fisheries, by gear type.

	Red king	Tanner	Snow
Trawl	248,121	3,412,342	14,631,617
Hook and Line	417	7,949	127,966
Groundfish pot	11	1,535	1,138
Scallop dredge	6	276,000	15,000

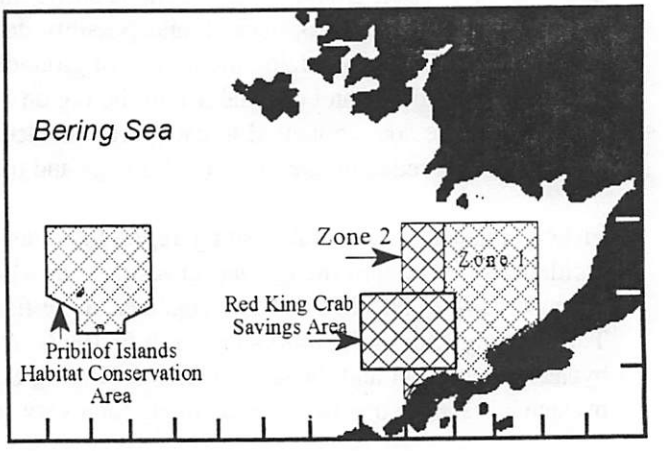
not all crabs taken are mature and (3) some bycatch survives. Total crab bycatch by groundfish fisheries has accounted for about 0.6% of the red king crab stock, 1.2% of the Tanner crab stock, and 0.1% of the snow crab stock in the Bering Sea as indexed by the 1992-94 NMFS surveys. Examination of crab bycatch length frequency suggests that most bycatch is smaller than market size, but larger than the size of 50% maturity for females. Bycatch of red king crab has averaged about 106 mm for females and 132 mm for males (Guttormson et al. 1990, NPFMC 1995) and bycatch of snow crab consisted of small (40-80 mm) individuals (NPFMC 1994); data for Tanner crab are limited and have not been examined. When survival is factored into the equation, impacts of bycatch become smaller. Stevens (1990) found that 21% of the king crabs and 22% of the Tanner crabs captured incidentally in BSAI trawl fisheries survived at least 2 days following capture. Observations of the 1993 BSAI scallop fishery indicated immediate survival of bycaught crabs was about 80-90% (Urban et al. 1994). Potential impacts of dredging and trawling on crabs that come into contact with the gear but are not captured, has proven difficult to quantify because they occur on the ocean floor and cannot be directly observed.

Trawling and dredging may negatively impact crab habitat, particularly living substrate on which young red king crab depend for food and protection from predators. Juvenile red king crab in the Bering Sea depend on both physical substrate and biogenic assemblages for settlement, food, and protection from predators (McMurray et al. 1984, Stevens et al. 1992). Both the physical substrate (cobble, shell) and biogenic assemblages (such as ascidians and tube-building polychaete worms) are vulnerable to trawling. Studies have shown that trawling and dredging impacts the seabed through scraping and ploughing, sediment re-suspension, and physical destruction, removal, or scattering of non-target benthos (Messieh et al. 1991, Jones 1992). In the Wadden Sea, scientists have observed destruction and elimination of erect epifaunal species (Reise 1982). If habitat is impacted by trawling and dredging, crab settlement and survival could be reduced, thereby lowering recruitment.

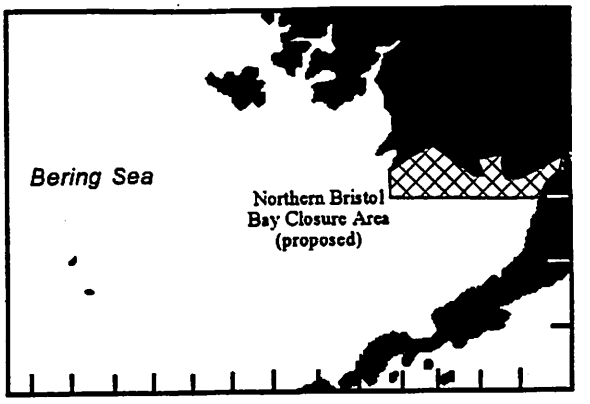
The focus of this paper is on what the Council can do to lessen the impacts of trawling and dredging as an aid to rebuilding crab stocks. Three alternatives (time/area closures, bycatch limits, and vessel bycatch accounts), which have been proposed by the Council as potential measures to reduce the impact of groundfish fishing on crab resources, were examined.

Time/Area Closures

Large portions of the Bering Sea have been closed to trawling to protect adult king crab and crab habitat. Crab protection zones were implemented in 1987 to prevent the incidental catch of adult male and female red king crabs in the domestic trawl fisheries. Protection Zone 1 is closed to trawling year-round and covers a substantial portion of the red king crab mating area. Protection Zone 2 extends the Zone 1 closure west to 163°W from March 15 to June 15. The Pribilof Islands Habitat Conservation Area was implemented in 1995 to protect blue king crabs and their habitat. Due to the continued decline in the red king crab population, NMFS (at the Council's request) issued an emergency order in January 1995 to close to trawling the red king crab savings area. In September, the Council will consider making this a permanent time/area closure to reduce bycatch of adult red king crab.



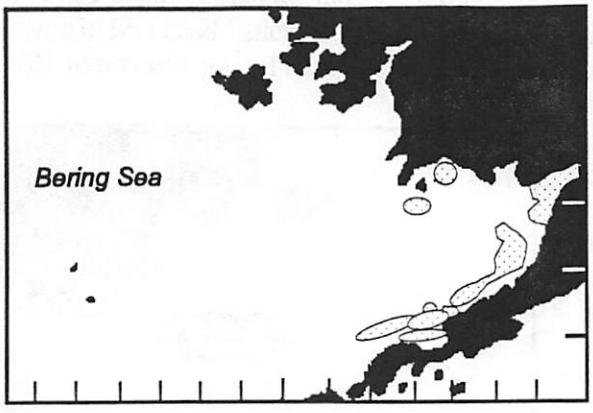
Closure areas have also been proposed to protect juvenile crab and their habitat from negative impacts associated with bottom trawling. Armstrong et al. (1993) suggested that nearshore areas from Unimak Island to east of Port Moller, which are important breeding and hatching grounds (and contain juvenile habitat) be closed to trawling. In January 1995, the Council initiated an analysis of a trawl area closure in northern Bristol Bay east of 162°W longitude and north of 58°N latitude. The objective of the proposed closure is to increase crab recruitment into the adult populations, rebuilding the population of red king crab to their relative historical level. This area, as well as other nearshore (<50 m) areas in Bristol Bay, is known to contain juvenile red king crab habitat. In addition to protecting red king crabs, the northern Bristol Bay closure was proposed as a protection measure for migrating herring, seabirds, and marine mammals. Portions of the northern area are already closed to protect walrus. Since 1992, the areas within a 12 mile radius of Round Island, the Twins, and Cape Pierce have been closed to all fishing from April 1 through September 30.



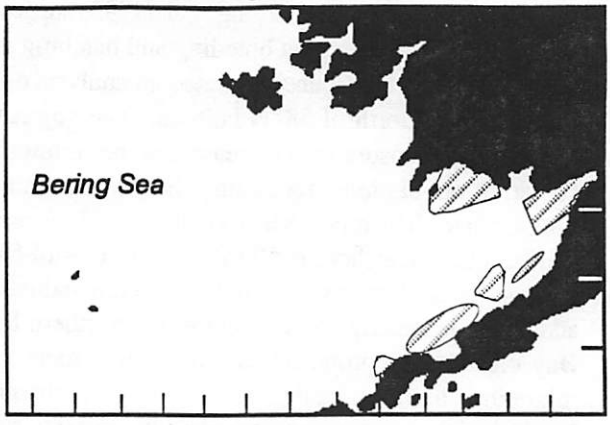
The effectiveness of any trawl/dredge closure designed to protect juvenile red king crab hinges on our understanding of recruitment dynamics and the distribution of juveniles and their habitat. It has been hypothesized that red king crab encounter a critical intersection at the settlement and juvenile stage, when the availability of appropriate habitat constrains the abundance of juveniles, in turn affecting the year class strength and recruitment (Cassano et al. 1995). Larval crab drift with the current before they settle on the sea floor to begin life on the benthos. Larval settlement and survival patterns vary according to ocean currents and availability of appropriate substrate. If the current transports the larvae to an area without suitable habitat, the chances of survival are slim (McMurray et al. 1984, Jewett & Onuf 1988). Larval crab settle in late July and August in areas with biotic assemblages and rocky substrate, where they stay as juvenile crab for the first two years before they move to deeper waters. Juvenile red king crab are solitary, cannibalistic, and require habitat that provides protection. Therefore, during this time they are mainly found among biogenic assemblages, such as tube building polychaete worms, sea onion, erect bryozoans, mussels, kelp, and ascidians (McMurray et al. 1984, Armstrong et al. 1993, NOAA 1991). If no epifauna community exists, juveniles can be found on rocky or gravel substrate, but it is considered to be inferior habitat (McMurray et al. 1984).

In the Bering Sea, juvenile red king crab inhabit depths less than 50 m, and have been found along the Alaska Peninsula, and around Kvichak and Togiak Bays (McMurray et al. 1984). Within this area juveniles live among epifaunal communities, which are associated with gravel/cobble substrate. Juvenile distribution in Bristol Bay can be interpreted from published maps showing the distribution of associated substrate (gravel and cobble) and areas sampled for young crab (McMurray et al. 1984, NOAA 1991, Armstrong et al. 1993). Suitable juvenile habitat is "extremely patchy" in Bristol Bay (McMurray et al. 1984, Jewett & Onuf 1988). Areas shown by surveys to contain age 0-2 juvenile crab likely underestimate their actual distribution because: (1) the entire area has not been sampled, and (2) young crab are difficult to catch with sampling gear, particularly in cobble habitats (Stevens et al. 1992). Furthermore, distribution of juvenile red king crab may be affected by year class strength. Juvenile surveys were conducted in years of low stock abundance, 1984 and 1991. The abundance and distribution of juveniles might have been more encompassing and conclusive had the surveys occurred in the early 1970s. Sample areas with low abundance could be viable habitat in times of high abundance. From the existing survey data it is not possible to determine the exact distribution of juveniles in any given year. However, by combining the survey data of where juveniles have been sampled with substrate information, a general map of juvenile red king crab habitat can be constructed.

Distribution of juvenile red king crab 0-2 years



Distribution of gravel sediment (> 10%)



Although the proposed closure area in northern Bristol Bay would protect some juvenile red king crab habitat, more comprehensive nearshore area closures may be considered. Due to the depressed state of the stock and the existing knowledge that trawling may potentially damage juvenile habitat, a modified trawl closure might be warranted. Both Armstrong et al. (1993) and Cassano et al. (1995) propose more extensive trawl closures to protect both spawning females and juvenile habitat from impacts of trawling. The lack of suitable habitat could be a population constraint, and habitat protection should be considered as a means to increase red king crab populations (Armstrong 1993, Cassano et al. 1995). Since there is uncertainty about the exact interactions between trawling and juvenile crab and its habitat, the ultimate trawl closure system would allow research trawling in designated areas to study the interactions between trawling, juveniles, and their habitat. Incorporated into this system is the ability to adapt to the new information gathered by research. As the effects of trawling and the juvenile habitat are better understood, modifications and adjustments could be made to evaluate existing management measures.

Another factor to consider when developing appropriate refugia for juvenile red king crab is their migration into deeper water as they get older. Cassano et al. (1995) propose closing migration corridors for juvenile crabs between the ages of 2-4 as they migrate into deeper waters and into the adult protection zone. After the age of 2 juvenile crabs begin podding, forming into large clusters of crab, for protection from predators as they move into deeper waters (>50 m) (Jewett & Onuf 1988, Dew 1990, Stone et al. 1993). These pods are vulnerable to trawling, which could cause direct mortality or break up pods and expose crabs to predation. Migration corridors may allow the juveniles to move safely from nearshore nursery areas into the existing adult protection areas.

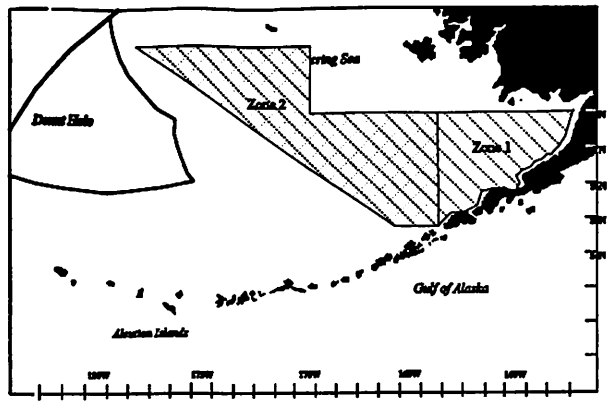
If taken further, analysis of area closures should take into account costs to the affected fisheries, benefits to future crab fisheries and effects of the displaced trawl effort on other areas. To date, relatively little domestic trawling has occurred in the nearshore areas of Bristol Bay, so costs to affected fisheries may be minimal. However, combined with the closure of the Pribilof Islands Area to trawling, additional closures in Bristol Bay to bottom trawling could potentially shift trawling into Tanner and snow crab habitat. Potential benefits of a nearshore closure to future crab fisheries are difficult to quantify. However, if environmental conditions for spawning, settlement, and survival are favorable such that stocks rebuild to historic levels, benefits to crab fishermen would be substantial.

Bycatch Limits

Another management measure that has been proposed to rebuild crab is a reduction of the existing Prohibited Species Catch (PSC) limits for BSAI king crab and Tanner crab, and implementation of a new PSC limit for snow crab. Prohibited species bycatch limits and zones were designed to control the number of adult red king crabs and Tanner crabs taken as bycatch in trawl fisheries. Limits were not established as a crab conservation measure, but rather to allocate crab among the crab and groundfish fisheries. Current crab PSC limits, which were

negotiated by crab and groundfish industry representatives, are 1,000,000 Tanner crab and 200,000 red king crab in Zone 1 and 3,000,000 Tanner crab in Zone 2. To allocate total groundfish harvest under established PSC limits, PSC is apportioned among trawl fisheries during the annual specification process. When a target fishery attains a PSC apportionment or seasonal allocation specified in regulations, the bycatch zone to which the allocation applies closes to that target fishery for the remainder of the season.

Prohibited Species Bycatch Limitation Zones



Bycatch management has become increasingly complex over the past ten years. Bycatch limits for domestic fisheries were first adopted in 1986 under BSAI groundfish FMP Amendment 10, which specified red king crab and Tanner crab PSC limits for the yellowfin sole/other flatfish fishery only (NPFMC 1986). PSC limits of 135,000 red king crab and 80,000 Tanner crab in Zone 1, and 326,000 Tanner crab in Zone 2 were negotiated between representatives of crab and groundfish fishermen. In 1989, under FMP Amendment 12a, crab PSC limits were extended to the remaining trawl fisheries and crab PSC limits were increased to the current levels. These limits were further apportioned among joint-venture (JV) flatfish fisheries, other JV fisheries, domestic flatfish fisheries, and other domestic fisheries. FMP Amendment 16, adopted in 1990, authorized seasonal apportionment of PSC limits, and apportioned the trawl PSC limits for 1991 into allowances for domestic turbot, rock sole, yellowfin sole/other flatfish, other domestic groundfish, and JV flatfish. More recently, PSC limits for crab have been apportioned among the following trawl fisheries: yellowfin sole, rock sole/other flatfish, turbot/sablefish/arrowtooth, rockfish, Pacific cod, and pollock/Atka mackerel/other species. Crab PSC limits for the scallop fishery were implemented by the State in 1993, and were adopted by the Council as part of a federal scallop FMP amendment in June 1995.

By design, crab bycatch limits have constrained the scallop fishery in the Bering Sea. There have been no scallop TACs set for the Bering Sea; consequently, the fishing season ends once a bycatch limit is reached. The State set crab bycatch limits in the Bering Sea based on a preferred bycatch rate, extrapolated to a limit based on the projected number of vessels participating and limited season length. For 1993, PSC limits were set at 260,000 Tanner crab and 17,000 red king crab. The season closed when 276,500 Tanner crab were taken.

Crab PSC limits have not constrained most groundfish trawl fisheries. Rather, these fisheries close either upon reaching the total allowable catch quota (TAC) or attainment of halibut PSC limits. The one notable exception is the rock sole/other flatfish trawl fishery, which was limited in 1993 and 1994 despite relatively high levels of crab PSC apportioned to that fishery. For example, in 1994 Zone 1 was closed on February 28 due to attainment of red king crab PSC limit (110,000 crabs) and Zone 2 closed on May 7 due to the Tanner crab PSC limit (260,000 crabs). In 1995, the red king crab PSC was not reached, in part due to emergency implementation of the red king crab savings area (NPFMC 1995).

Recent data indicate that the current PSC limits for crab could be reduced from existing levels, yet not impact groundfish fisheries if the available PSC is optimally allocated among target fisheries and seasons. As shown by the adjacent table, the average bycatch taken each year has been less than the PSC limit. Hence, based on average bycatch needs, PSC limits could be reduced by about 20,000 red king crab and 1,000,000 Tanner crab (Zones 1 and 2 combined). Optimal allocation will be

Crab PSC bycatch in the 1992-1994 trawl fisheries.

	Red king (Zone 1)	Tanner (Zone 1)	Tanner (Zone 2)
1992	110,520	853,269	2,326,578
1993	183,713	1,031,985	2,337,884
1994	244,634	752,886	1,692,628
PSC Limit	200,000	1,000,000	3,000,000
Average	179,622	879,380	2,119,030

difficult to achieve because these apportionments are made pre-season. However, the Council will be considering a FMP amendment in September that would allow additional flexibility for in-season allocation of Tanner crab PSC among the bycatch limitation zones. More flexibility could be achieved with market solutions to bycatch, as discussed later in this paper.

The proposed PSC limit for opilio crab taken incidentally in BSAI trawl fisheries could be negotiated by industry representatives based on bycatch needs. Bycatch of "other crab"[1] (hereafter referred to as snow crab) in BSAI groundfish fisheries totaled 17.7 million in 1992, 14.8 million in 1993, and 12.5 million in 1994. This bycatch equates to about 0.2% of the snow crab stock as measured by the NMFS survey index of abundance (Stevens et al. 1994). Most snow crab bycatch is taken in the trawl fisheries (99%) and to a lesser extent in the longline (0.7%) and groundfish pot fisheries (0.3%). Although snow crabs are bycaught in nearly every trawl fishery, the yellowfin sole fishery takes the vast majority (70% on average 1992-1994). Bycatch is highest in the areas north and east of the Pribilof Islands, corresponding to NMFS statistical areas 513, 514, and 521 (NPFMC 1994). PSC caps for snow crab in Zone 1 make little sense due to the low numbers taken there. On the other hand, 60-86% of the snow crab bycatch comes from the area encompassed by the existing crab protection Zone 2. Average snow crab bycatch in Zone 2 was about 10.8 million crabs, which provides a reference point for industry representatives to negotiate the proposed snow crab PSC limit.

Snow crab bycatch in the 1992-1994 trawl fisheries, by zone.

	Zone 1	Zone 2	Other areas	Total
1992	104,844	11,996,347	5,561,358	17,662,549
1993	40,611	8,123,627	5,797,956	14,760,722
1994	25,334	11,424,057	1,032,736	12,482,127
Average	56,930	10,780,853	4,130,683	14,968,466

Crab PSC limits were designed as an allocative measure, not a conservation measure. Reducing the PSC limits will not do much to rebuild crab stocks. There are several reasons for this including: (1) bycatch appears to be a relatively minor source of crab mortality, (2) fleet-wide PSC limits provide vessels with no incentive to reduce bycatch rates, (3) halibut PSC limits already constrain most fisheries. Current bycatch limits amount to 0.7% of the red king crab and 2.0% of the eastern Bering Sea Tanner crab stocks based on NMFS survey index of abundance. It has been estimated that approximately 0.75% to 1.5% of the total mature red king crab stock in Bristol Bay is impacted by trawling each year (NPFMC 1995). For comparison, natural mortality annually removes about 20% to 25% of the red king crab stock (NPFMC 1990). Because bycatch mortality caused by trawl/dredge fisheries is probably very small relative to other sources of removals due to natural and fishing mortality, reductions in bycatch limits will not result in measurable improvements to crab stock abundance. Potential "savings" of crab through PSC reduction identified in this paper (20,000 red king crab and 1,000,000 Tanner crab) are not really savings because they would not be bycaught under the existing constraints of halibut PSC limits anyway. Also, reducing the existing crab PSC caps may cause lower groundfish harvests unless the limits are optimally allocated among target fisheries and seasons (Smith 1993). This may be impossible to achieve, and consequently, groundfish trawl fisheries may be negatively impacted. From a crab rebuilding perspective, a lower bycatch limit may result in fewer crab predators and competitors harvested, increasing mortality on juvenile crab.

Market Solutions

Individual bycatch quotas (IBQ's), also called individual bycatch accounts (IBA's), or vessel bycatch accounts (VBA's), have been proposed by the Council's Crab Rebuilding Committee and others as a means to reduce bycatch rates of halibut and crabs in trawl and scallop fisheries. In June 1995, the Council adopted for analysis an IBQ program for all BSAI non-pollock fisheries as part of a proposed individual transferrable quota (ITQ) program for the pollock fishery. Options for a VBA program analysis were proposed in August 1995 by the

[1]The NMFS observer data set groups crab bycatch into red king crab, other king crab, C. bairdi Tanner crab, and other Tanner crab. In the Bering Sea, other Tanner crab are almost entirely snow crab.

United Catcher Boats. Analysis of a VBA or other individual vessel bycatch program will require substantial time and consideration.

In theory, a VBA system would provide an incentive for each vessel to reduce its bycatch rate to maximize its catch of groundfish. Fishermen with high bycatch rates would be penalized by having to purchase additional bycatch allowances or by catching less groundfish. Fishermen with low bycatch rates would benefit by being able to catch additional groundfish without being shut down by vessels with higher bycatch rates, as they are under the current PSC system. In the current open access system, individual fishermen have no incentive to avoid bycatch; in fact just the opposite is true, because an individual fishermen who adopts bycatch reducing tactics will probably catch less target species (Huppert et al. 1992).

History has shown that individual vessels can reduce their bycatch with individual vessel incentives. In 1983, BSAI FMP Amendment 3 mandated a substantial reduction in foreign bycatch rates of halibut and crab, and total bycatch of salmon over a 5-year period. Foreign fleets successfully accomplished this goal. The Japanese fleet accomplished this by allocating its PSC share among participating vessels based on historical performance. If a vessel allocation was exceeded for any one species, that vessel had to stop fishing unless it purchased unused bycatch shares from other vessels. The result was an accumulated bycatch savings by the entire fleet (Hastings 1991).

One benefit of implementing a VBA program is that it would make reductions in crab PSC limits more acceptable to trawl fishermen. Even under an overall reduced PSC limit, trawl fishermen could potentially increase their groundfish catch under a VBA program. This would be especially true if VBAs were fully transferrable among target fisheries and seasons. As previously stated, however, reductions in crab bycatch will not have much impact on crab rebuilding.

From a crab rebuilding perspective, a VBA program could benefit crab stocks by allowing increased harvests of crab predators and competitors, which have increased in recent years. Biomass of crab competitors (inshore benthic infauna consumers such as starfish and flatfish) has increased about 40% from 1979-1993 (Livingston et al. 1993). Most of this increase is attributable to a growing rock sole biomass, and to a lesser extent starfish and flathead sole biomass. Of the crab species, only snow crab comprises a substantial portion of the infauna consumer guild (species that eat clams, polycheates, etc.). Yellowfin sole had dramatically increased in abundance in the early 1980s to become the largest component of this guild until the early 1990s when rock sole became co-dominant. Mean size at age has declined for yellowfin sole and rock sole, indicating stress caused by competition, and to a lesser extent a decrease in average bottom temperature (P. Livingston, personal communication, 3/20/95).

Predation by groundfish may be another factor affecting the recovery of crab stocks. For snow crabs, estimates of annual consumption by groundfish from May through September ranged from 9 billion to 31 billion crabs (Livingston et al. 1993). Snow crabs consumed were primarily age 1, and to a lesser extent age 2 and 3 crabs. Pacific cod is a primary predators of snow crab, particularly softshell female and juvenile crab (McLellan & Leong 1981, Livingston 1989, Livingston et al. 1991). Flathead sole, yellowfin sole, and rock sole have been found to prey on young snow crabs (Haflinger and Roy 1983, Livingston et al. 1993). Annual consumption of Tanner crabs by groundfish ranged from 10 billion to 153 billion crabs, consisting primarily of Age 0 and Age 1 crabs (Livingston et al. 1993). Yellowfin sole and flathead sole were found to be the primary consumers of small Tanner crabs, whereas Pacific cod preyed on the larger juveniles. Although yellowfin sole and Pacific cod are known predators of juvenile and molting red king crab (Haflinger and McRoy 1983, Livingston et al. 1991), data suggest that mortality caused by groundfish predators on adult red king crab may be low during summer months.

It should be noted that even under a VBA program, fisheries will be unable to harvest crab competitors and predators to the point where these stocks stabilize in abundance. Total annual BSAI groundfish harvest is

limited by an optimum yield cap of two million metric tons. This cap generally results in TAC allocations to higher valued species and fisheries with lower halibut bycatch that flatfish fisheries (Witherell 1994). It is unlikely that pollock TAC would be reduced by 580,000 mt in order to harvest yellowfin sole, rock sole, flathead sole, and other flatfish to their ABC levels. Additionally, populations of another predator of juvenile red king crab, sockeye salmon (Wespestad et al. 1994), remain high and will not be impacted by a groundfish VBA program.

One potential limitation of a VBA system is that there will still be a race for fish TAC. Unless an individual fishing quota system were implemented in concert with a VBA system, fishermen will still harvest fish as early in the season as possible, so as to catch some fish before TACs are reached by the fleet. Additionally, fishermen will tend to race for and use their VBA shares for higher valued species (such as Pacific cod and rock sole), potentially leaving less valuable species unharvested (such as flathead sole). From a crab rebuilding perspective, this may have positive or negative consequences depending on what species are harvested and where and when fishing occurs.

A critical factor that must be worked out before implementing a VBA system is monitoring of individual vessels bycatch. On vessels with 100% observer coverage, monitoring may be rather straightforward, using observer samples to extrapolate bycatch numbers. However, bycatch accounting on vessels with 30% coverage or no coverage requirement would require a different approach, and one not easily solved. There are also unresolved questions regarding enforcement of VBAs using observer data. These and other potential implementation issues are being examined by NMFS.

Other Options

Bycatch Penalties and Fees - Penalties and fees have been proposed as a disincentive for individual fishermen to catch bycatch. An evaluation by Marasco and Terry (1982) suggested that economic disincentives would be preferable to PSC limits, time/area closures, gear restrictions, and reduced groundfish quotas as a way to minimize the impact and control costs of incidental catch. The BSAI groundfish FMP Amendment 16 originally contained a "penalty box" system that would temporarily remove vessels with high PSC bycatch rates from the fishery on a real time basis. This system was disapproved by the Secretary of Commerce. In its place, the Council adopted a vessel incentive program (VIP) and gear restrictions. The intended effect of the VIP program is to increase the opportunity to harvest groundfish TACs before established PSC limits are reached. The VIP program is based on specification of bycatch rate standards that, when exceeded, constitute a violation of the regulations implementing the VIP, and monetary penalties are assessed. In 1994, bycatch rate standards were 2.5 red king crabs per ton of groundfish in the BSAI yellowfin sole and non-pollock trawl fisheries in Zone 1. Analysis indicates that the VIP may have helped reduce crab bycatch rates in the yellowfin sole fishery, but not in the rock sole fishery. Bycatch rates of red king crab in the at-sea processing yellowfin sole fishery were reduced from 0.31 in 1992 and 0.14 in 1993, to only 0.08 crab per metric ton of groundfish in 1994. Bycatch rates in the rock sole fishery increased from 1.12 in 1992 to 2.03 in 1993, and up to 2.77 crab per metric ton of groundfish in 1994 (NMFS 1994). Unfortunately, because the VIP program is based on rates of PSC per metric ton of groundfish, fishermen that use selective gear to reduce juvenile groundfish bycatch may actually be penalized for violating the VIP. Additionally, due to its cumbersome legal nature, very few cases have been prosecuted.

Gear and season modification - Gear restrictions have been used to reduce bycatch and ghost fishing. To reduce the potential for ghost fishing by lost pots, pots used in the groundfish fishery require a biodegradable panel constructed of # 30 or less cotton thread, that is a minimum of 18" long, parallel to and within 6" of the bottom of each pot. In the trawl fisheries, minimum mesh sizes regulations were recently adopted by the Council to reduce the bycatch of juvenile fish. Mesh regulations may also reduce the bycatch of small crabs. At the rebuilding committee meeting, one industry representative suggested that trawls fitted with bigger discs with wide spacing on the footrope would catch less crabs. Season adjustments could possibly be designed to structure the

fishing season to avoid times and areas of high crab bycatch, however, they have not been explored at this time.

Discussion

The Council has initiated analysis of several proposed measures to reduce potential negative impacts of groundfish fishing on crab stocks. Of all the measures examined, the proposed closure of northern Bristol Bay to protect juvenile habitat appears to offer the most conservation benefit to crab stocks. However, data on habitat and juvenile red king crab distribution suggest that a more comprehensive trawl/dredge closure area in the nearshore waters of Bristol Bay should be considered. Analysis also suggests that bycatch limits previously established for trawl and dredge fisheries could be reduced, but that conservation benefits to crab stocks would be negligible. Bycatch management through individual vessel bycatch accountability provides a means, within existing bycatch limits, to somewhat increase the removal of crab predators and competitors such as yellowfin sole and Pacific cod. However, these measures alone will not rebuild crab stocks.

Summary of alternative management actions and goals of reducing impacts of trawling and dredging.

Goal	Status quo	Offshore Closure	Nearshore Closure	PSC Reduction	VBA Program
Reduce crab bycatch by trawlers	0	+	?	+	+
Reduce crab predation/competition	0	-	?	-	+
Protect juvenile habitat	0	0	+	0	0

Crab stocks will rebuild only when recruitment increases. Managers can affect recruitment by ensuring there are adequate numbers of spawners, providing adequate habitat available for settlement, and reducing fishing mortality on juvenile crab. Conservation of spawning stocks can be accomplished by the State through adjustments to GHLs in crab fisheries. Adjustments to existing bycatch limits in other fisheries will have only a very small impact on increasing adult stocks sizes or reducing juvenile mortality. To reduce juvenile mortality by limiting bycatch of non-target crab in crab fisheries, the Council or State could consider implementing measures such as bycatch limits or a VBA program for crab fisheries.

Once these actions have been taken, then the crab stocks will be in the best possible position to recover if environmental and other ecological factors create a suitable situation for the stocks to flourish. This may take years. For example, although large areas around Kodiak Island have been closed to trawling and dredging since 1987, stocks of red king crab in that area have not recovered to levels which can support a crab fishery. In cases such as these, there is little more managers can do but wait.

This paper highlights the need for continuing research. Improved knowledge of crab recruitment, life history, habitat needs, the effects of trawling on habitat, as well as a review of crab management strategies around the world would aid in effective management of crab stocks. Some of this work is underway (e.g., Kruse 1995), and we would encourage government agencies and universities to continue this research.

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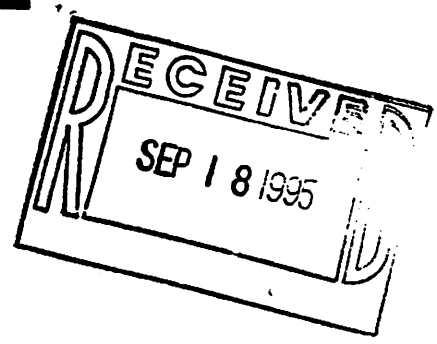
ProFish



September 18, 1995

Dr. Clarence Pautzke
Executive Director
North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, Alaska 99510

RE: Draft EARIR for Red King Crab Bycatch

Dear Clarence:

Upon reviewing the Council's draft "EARIR for Red King Crab Bycatch in the Bering Sea Trawl Fisheries", I was surprised to learn that the analysis neglected to include the alternative of a seasonal closure. In June, the Council voted unanimously to have a seasonal closure included in the mix of alternatives. I am curious to know why this alternative was omitted in the analysis. Also, I would appreciate your opinion as to whether or not the Council can consider a seasonal closure, given that this alternative is not explicity identified and analyzed. I have noted that there is some information on red king crab bycatch in the yellowfin sole fishery in the State's analysis. Will this be sufficient?

Another problem is that the State's analysis fails to include an alternative whereby the closure would apply to bottom trawl only. The Secretarial Emergency Action last spring specifically allowed for mid-water trawling with a provision for 100% observer coverage for any mid-water trawling within the closed area. I understand that that arrangement worked well and to my knowledge created no enforcement problems. Is it your opinion that a closure to bottom trawl alone can be considered again even if each alternative in the EARIR is for closures to all trawling? My concern is that although some may construe allowing mid-water trawling to be a less restrictive alternative (and therefore a permissible alternative), there is the potential problem that the impact of allowing mid-water trawling may not have been adequately analyzed in the EARIR.

I apologize for raising these questions at such a late date but they only surfaced upon review of the EARIR. Thank you in advance for looking into these matters. I look forward to seeing you next week at our September meeting.

Yours sincerely,

Walter T. Pereyra
President

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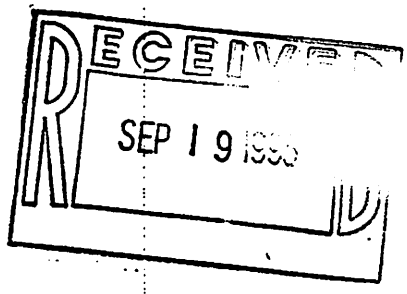
AGENDA D-4(d)
SEPTEMBER 1995
SUPPLEMENTAL



September 18,1995

Mr. Rick Lauber, Chairman
Dr. Clarence Pautzke, Executive Director
North Pacific Fishery Management Council
Post Office Box 103136
Anchorage, Alaska 99510

Re: Red King Crab / Trawl Closure Amendment

Dear Rick,

There are four key points to be made concerning the proposed plan amendment.

I. An appropriately designed closure area can be beneficial to both the Rocksole and Red King crab fisheries, by making more crab available to the later and avoiding premature closures in the former.
II. At low levels of RKC stock abundance, a closure may be a biologically useful precautionary measure as well as providing the above economic benefits to fishers.
III. A plan amendment is not necessary to implement a seasonal bottom trawl closure tied to a biological trigger. This can be achieved with the existing "hot spot" authority in the existing BSAI groundfish management plan.
IV. None of the alternatives in the EA/RIR, which is primarily focused on the Rocksole fishery in the 1st quarter, are appropriate because all the alternatives are year-round closures to all trawl fisheries including mid-water pollock.

A Win/Win Closure

The Rocksole fishery in the winter season is the fishery which has repeatedly been allowed to exceed its RKC PSC allowance, and appropriately the EA/RIR focuses on this fishery. Given the low abundance of RKC at this time and the lack of a floating cap that is adjusted according to the population of king crab there is legitimate concern that the biological bycatch impacts of the rocksole fishery can not be compensated for merely by re-allocation of crab away from the directed RKC fishery at current stock levels.

The lack of an effective system of individual accountability to control bycatch in a derby fishery for a high valued species such as rocksole during the roe season has resulted in excessive bycatch by some operators who fail to make the effort to avoid bycatch 'hot spots'. This in turn has led to either PSC cap over-runs, or early closure of the fishery, impacting fishers who have avoided excessive crab bycatch as well as those responsible for the closure.

A closure of the area where RKC bycatch consistently exceeds the VIP standard to the Rocksole fishery would benefit both crabbers and trawlers. By contrast the midwater pollock fishery operates to some extent in the same area but has essentially a zero crab bycatch. A closure that included MW Pollock is an unnecessary cost imposed on those fishers with no countervailing benefits.

It is unfortunate that a seasonal, fishery specific closure, perhaps triggered by an index RKC abundance as measured by the trawl survey was not included in the analysis, because much of the analytical work is supportive of such a closure. It is a reasonable alternative and there were requests to the council for its inclusion. Perhaps, NOAA-GC will construe that because it falls between status quo and a year round all trawl closure, it is an option available to the council despite not being explicitly included.

Fortunately, the question of whether the above option is available within the plan amendment proposal is unimportant, because the authority to implement such a closure all ready resides with the Regional Director in the form of 'Hot Spot' authority.

Hot Spot Authority

Hot Spot authority is provided to the RD in the BSAI groundfish management plan regulations at 675.20-e-1-iv, as detailed in e-3, e-6, f, and g. Some of the relevant language is quoted below.

(e) Inseason adjustments.

(1) ***(iv) Interim closures of statistical areas, or portions thereof, to directed fishing for specified groundfish species.***

(3) Any inseason closure of a statistical area, or portion thereof... must be based upon a determination that such closures are ***necessary to prevent***;

(i) A ***continuation of relatively high bycatch rates*** ...in a ***statistical area, or portion*** thereof;

(ii) The ***take of an excessive share of PSC limits*** ...

(iii) The ***closure of one or more directed fisheries for groundfish due to excessive prohibited species bycatch rates occurring in a specified fishery*** operating within all or part of a statistical area; or

(iv) The ***premature attainment of established PSC limits*** or bycatch allowances and associated ***loss of opportunity to vessels to harvest the groundfish*** optimum yield (OY).

(6) The ***inseason closure ...shall not extend beyond a 60-day period*** unless information considered under paragraph (f) of this section warrants an extended closure period. Any closure of a statistical area, or portion thereof, to reduce prohibited species bycatch rates ***requires a determination*** by the Regional Director 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 groundfish fisheries.

(f) Data. All ***information relevant to one or more*** of the following ***factors may be considered...*** (1) The ***effect of overall fishing effort*** within a statistical area... (2) ***Catch per unit of effort*** and rate of harvest...(3) Relative ***distribution and abundance of stocks*** of groundfish species and prohibited species ... (4) The ***condition of a stock*** ...(5) ***Inseason prohibited species bycatch rates***..(6) ***Historical prohibited species bycatch rates*** observed in groundfish fisheries in all or part of a statistical area;... (7) ***Economic impacts*** on fishing businesses affected; and...(8) Any other ***factor relevant to the conservation and management*** of groundfish species or any incidentally caught species, which are designated as prohibited species or for which a PSC limit has been specified.

Surely this is exactly the type of situation for which hot spot authority was designed. It deals with a specific problem fishery, without impacting other fisheries which may operate in the area for different targets or at different times without contributing to the problem. It also provides flexibility to respond to changes in abundance or distribution that might cause bycatch rates and patterns to shift over time.

Given the ***condition of a stock*** of RKC the RD should use this authority to close the ***portion of the statistical area*** north of 56 10 between 162 and 164 degrees, where ***historical prohibited species bycatch rate*** for RKC has consistently been higher than the VIP standard, for ***a 60-day period*** during the rocksole fishery to ***prevent a continuation of relatively high bycatch rates.*** The rocksole fishery has ***taken of an excessive share of PSC limits*** resulting in the ***closure of one or more directed fisheries for groundfish due to excessive prohibited species bycatch rates occurring in that specified fishery.*** This ***premature attainment of established PSC limits*** has led to the ***loss of opportunity to vessels to harvest the groundfish.***

The Analysis

Because so much of the analysis in the EA/RIR is focused on the 1st quarter rocksole fishery, it provides an adequate basis for adopting the alternative outlined above. However, as noted, the alternative is not included in the document. The EA/RIR is inadequate for adopting the alternatives that are included because they extend to other fisheries at other times of year, even including midwater trawl gear.

The only real analysis in the EA/RIR which would provide such a basis is the model run. On page 29 of the EA/RIR the preparer has pointed out a number of caveats and states the model is "severely limited" in its ability to accurately predict the effects of the alternatives.

<u>YFS and the Model</u>

Apart from rocksole, the fishery that is most directly impacted by the alternative closures is the YFS fishery. However, as the caveats 5 - 8 explain, "movement into areas...not heavily fished...will not be accurately predicted" and "This will not allow the impacts of the various closures on the yellowfin sole fishery during the 1st four months of the year to be assessed", nor does the model "redistribute catch among fisheries" when an early closure does occur or capture the costs of fishing in second best areas.

The problem here goes much further than just the impact on YFS in the 1st four months. By not capturing those impacts, the model is blind to closure of YFS due to the 1st semester halibut cap being taken, and programs effort into the May Round Island fishery which has low bycatch, and concludes that the TAC can be taken within the cap. In reality the ER closure shifted the YFS fishery to areas of higher bairdi in zone 1, triggering a zone 1 closure. In turn effort shifted to the balance of zone 2 not included in the new Pribilof closure and into the predictable (to fishers if not to the model) higher halibut rates, triggering the BSAI wide closure which pre-empts the May Round Island fishery window. The closures in flat fish shifted effort into P. Cod, which as noted, is not captured by the model either.

Other Fisheries

The inability of the model to capture any of this string of dominos leaves the reviewer of the EA/RIR with only the anecdotal (though no joke) reports of what occurred in reality in the 95 season. These were submitted in more detail by myself in a letter to the SSC reviewers dated Aug. 3, '95.

Even if all these impacts were captured by the model, there is no attempt made to differentiate which costs and benefits flow from the rocksole component of the closure and which relate to the closure of the low impact fisheries.

Mid-water Pollock and Enforcement

No justification of any sort is offered in the analysis for the inclusion of non-bottom trawl fisheries in a crab protection measure. Mid-water trawl was not included in the ER version of the closure, however at the council level there were arguments to include it offered by the Coast Guard. These related to ease of enforcement (i.e.: a fly over could spot any violations). This is not an adequate basis for including a fishery in a closure action though it has been done before. There is also extensive precedent for not taking that course. Whenever PSC caps or TACs are reached closures are implemented for specific fisheries. In the case of PSC caps applying to pollock those closures are not only fishery specific, but gear specific as well. In the ITQ and CDQ fisheries, closures are even vessel specific. There is no more justification for including pelagic pollock gear in any RKC measure than P.Cod longline gear.

A Picture is Worth a Thousand Words

Aside from the model run, the EA/RIR does include some graphics of the distribution of bycatch rates in a mapped presentation. The issue was raised during review of the same figures in the ER analysis last year, of whether the black and white display captures the real dimensions of complex data in a manner that is not misleading to the decision makers. Well over a thousand words are devoted to examining this question on pg. 16 & 17 of the analysis. The conclusion that the maps "are fairly indicative of the location of king crab bycatch misses the point.

On the face of it there is no way to know whether the dots are indicative of where effort occurs or where relative differences in crab bycatch rates occur. The dots do reveal where some level of crab bycatch occurs, but the particular threshold chosen (50 per haul) equates roughly to the "okey dokey" VIP rate of 2.5 (assuming a typical rocksole tow is 20 MT or more). By contrast the average rate in the area north of 56 10 approaches twice the VIP rate. A more useful map with a similar format would have employed multiple symbols reflecting varying levels of bycatch (i.e.: 0-25, 25 -50, 50-100 >100) or average rate/MT by small area block. Even better would be the use of contouring algorythm to display the distribution of bycatch rates.

Given the superiority of alternative displays of data of this sort, and since the analyst had produced draft contoured plots as of the June meeting, the inclusion of the old one dimensional plots hardly constitutes providing the "best available information".

56 Degrees or 56 10

The discussion above is relevant because the real debate is not whether a closure of some sort is appropriate, but what the boundries should be. While rates fluctuate annually due to a variety of factors, on average the RKC rates are higher north of 56 10 than between 56 and 56 10, and lower again to the south of 56. The trend with halibut and bairdi are pretty much the reverse. Target CPUE for rocksole also diminishes to the south. 56 10 is not optimal for any one factor but it is the best balancing of competing considerations.

The model does not seem to indicate much net difference between alternatives, but 1995 experiance has shown that the model severely understates impacts on the trawl fishery. The model also has an additional inherent structural weakness resulting from the use of weekly time steps. This results in the model assuming that a fishery can only close at the end of the week, and so if a cap is reached on Monday, catch and bycatch continue to accrue until the end of the week.

In the case of Alt. 2 (56 10), table A24 of the model shows 65,000 additional RKC caught after the cap is reached, that would not happen in reality if NMFS requires daily reporting and closes at the cap. Thus the benefits in RKC savings of Alt 3 (56 degrees) vs Alt.2 are overstated by that amount. Even so, the model outputs show no net benefit to more restrictive closures than Alt.2.

Bairdi, the Forgotten Impacts

While it is understandable that a review of a closure proposal designed to protect RKC would focus on king crab, the impacts on bairdi merit serious attention as well. The model, with all its caveats, does project relative differences in bycatch levels of various PSCs amongst the alternatives in a useful fashion (for rocksole the results are quite similar to those i submitted last year based on a single fishery model for rocksole). While this information is available in the fine print of the appendix tables, scant attention is paid to bairdi impacts in the text.

It is worth noting from table A21 that in the rocksole fishery alone, moving from status quo to Alt. 2 increases bairdi bycatch roughly 50% (from 331,000 to 516,000), while Alt. 3 nearly triples bairdi bycatch (965,000). Assuming that in the real world, NMFS were to require daily reporting and managed to close rocksole at the cap of 110,000 RKC, Alt. 3 represents a trade off of 50,000 king crab for 630,000 Bairdi. If we are at very low levels of RKC abundance maybe such a trade makes sense as a biological precaution. However, while a closure may have actual benefits for rocksole fishers during the roe season (though not for trawlers in other targets), it isn't as clear that from the perspective of a crabber there is a net economic gain from the larger closure alternatives.

Add in the YFS bairdi and opilio impacts, which are admittedly not correctly modeled (because the model assumes significant tonnages with low tanner catches in May and June in 514, when in reality this effort will end up in zone 2 where tanner rates are highest) and the cost to crabbers increases even more.

Conclusion

The analysis does not support the adoption of any closure to all trawling on a permanent year round basis. Despite the statement on page 5 that "hot spot" authority "is not currently under consideration" as an alternative, the council should call on the RD to use such authority to impose the Alt. 2 area definition closure on the bottom trawl fishery for 60 days beginning January 20th if this year's trawl survey results continue to show low abundance of RKC stocks. The analysis contains the information which does indicate that the benefits of this action to rocksole trawlers and the intangible precautionary conservation value for RKC, outweigh the cost to tanner crab fishers.

Thank you for your review of these comments.

Sincerely,

dave fraser
FV Muir Milach
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98368

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North Pacific Fishery Management Council
Richard B. Lauber, Chairman
605 West 4th Avenue
Anchorage, Alaska 99501

September, 21, 1995

Dear Mr. Lauber,

The following is our Pot Sanctuary proposal for a closure area.

As we all know, for the second time in two years the Bristol Bay Red King Crab season will be closed. In order to reverse this trend, a long term solution is called for. In the last ten years we have seen numerous regulations implemented which pursue short-term goals. As a result the Red King Crab stock has not regained its former strength. A long-term approach must be adopted by the council in regards to a Pot Sanctuary to ensure the future of Red King Crab stocks.

The No-Trawl Zone(Pot Sanctuary) introduced in 1986 was a good idea to a degree. It reduced bycatch of adult and subadult crab substantially. However, it did little to protect adult breeding and female spawning areas as well as juvenile habitat. It is these long-term goals which have been sacrificed in the current No-Trawl Zone. The goals of the No-Trawl Zone can be made to be more long term oriented by adopting the borders of the old Pot Sanctuary as it was just prior to 1981.

The Pot Sanctuary was incorporated in 1964-1965 just North of Unimak Island and soon was expanded to include waters to 160

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degrees West as the Eastern boundary. This area included juvenile habitat as well as adult breeding and female spawning grounds. It also was able to reduce the amount of adult and subadult bycatch. In addition, it allowed for the female population North of Unimak Island to remain healthy. This area is of prime importance in regards to spawning, egg hatch, and larvae reaching suitable habitat.

History shows us that crab stocks rebounded in the 70's after continued low abundance in the 60's. This coincides with the incorporation of the Pot Sanctuary in 1964-1965 and its expansion soon after.

If a Pot Sanctuary were introduced similar to the one prior to 1981, females would be allowed to reinhabit this productive area North of Unimak Island. In addition, juvenile habitat would be restored.

In 1981, the Pot Sanctuary was opened to trawling on a trial basis. This trial has lasted for quite some time and has proven to be disastrous to Red King Crab stocks. It is now time to call an end to the trial and close trawling once again in the Pot Sanctuary.

Armstrong, D.A., T.C. Wainwright, G.C. Jensen, P.A. Dinnel, and H.B. Andersen. 1993. Taking refuge from bycatch issues: red king crab (Paralithodes camtschaticus) and trawl fisheries in the eastern Bering Sea. Can. J. Fish. Aquat. Sci. 50: 1993-2000.

Sincerely,

Kris Poulsen
Kris Poulsen & Associates

DRAFT FOR COUNCIL REVIEW

Environmental Assessment and Regulatory Impact Review for an Amendment to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area that would

ENHANCE THE MANAGEMENT FLEXIBILITY OF THE C. BAIRDI TANNER CRAB BYCATCH LIMITS ESTABLISHED FOR ZONES 1 AND 2 OF THE BERING SEA AND ALEUTIAN ISLANDS AREA

Prepared by
National Marine Fisheries Service
September 1995

EXECUTIVE SUMMARY

At its June 1995 meeting, the Council received a request from representatives of the BSAI trawl industry to take action to allow increased management flexibility of the C. bairdi PSC limits established for trawl fisheries in Zones 1 and 2. Currently, the FMP establishes a 1 million crab PSC limit for Zone 1 and a 3 million crab limit for Zone 2. Attainment of a trawl fishery bycatch allowance of C. bairdi in Zone 1 forces the movement of fishery operations into Zone 2 where C. bairdi bycatch rates typically are higher. Similarly, Pacific halibut bycatch rates typically are higher in Zone 2, thus increasing the potential for attainment of a halibut bycatch allowance and closure of the entire BSAI to that fishery. This situation can occur for nonpelagic trawl fisheries early in the year because ice cover in the Bering Sea, poor weather, distribution of target species, and the desire to avoid high halibut bycatch rates in Zone 2 constrain preferable fishing grounds to Zone 1.

The current management regime allows for no flexibility in the management of the C. bairdi PSC limits between Zone 1 and Zone 2. Increased flexibility in the management of these PSC limits could provide additional harvest and/or revenue from the groundfish fisheries under existing prohibited species bycatch restrictions.

Alternative 1. Status quo. The C. bairdi PSC limits established for Zones 1 and 2 would continued to be managed as separate and distinct PSC limits that when reached, would close fishing for groundfish in the respective zone. The current PSC limits established for C. bairdi in Zones 1 and 2 (1 million crab and 3 million crab, respectively) would remain unchanged.

Alternative 2. Increase the C. bairdi PSC limit established for Zone 1 and reduce the PSC limit established for Zone 2 by a corresponding amount to address fishery operational problems resulting from the increasing potential for fishery closures in Zone 1 as a result of C. bairdi bycatch restrictions. The management of the revised PSC limits would remain unchanged from status quo, i.e., the revised Zone 1 and Zone 2 PSC limits would be apportioned to fisheries as bycatch allowances that, when reached, would result in closure of those fisheries in the

respective zone.

Alternative 3. The C. bairdi PSC limits established for Zones 1 and 2 would be combined to a single annual limit equal to 4 million crab. When a fishery attains its bycatch allowance of the 4 million crab PSC limit within the combined Zone 1 and Zone 2 area, the fishery would be closed in the combined area.

Alternative 4. As in the status quo alternative, the current C. bairdi PSC limits would be maintained for Zone 1 and Zone 2 that would be apportioned to specified fisheries as bycatch allowances. If a specified fishery bycatch allowance in Zone 1 or Zone 2 is reached, the Director, NMFS, Alaska Region, may take inseason action to increase that fishery bycatch allowance by a specified percentage (e.g., 20 percent) through a transfer of unused bycatch allowance specified for that fishery from the other respective zone.

Alternatives 2 and 4 would be unlikely to raise significant conservation concerns for C. bairdi in Zone 1, given the degree of the bycatch limit revision or allowance transfer envisioned. However, the inseason adjustment of C. bairdi bycatch allowance under Alternative 4 would be most sensitive to potential conservation concerns by its ability to respond to specific groundfish fishery concerns, while taking into account inseason PSC bycatch rates. The combined, annual C. bairdi PSC limit established for Zones 1 and 2 under Alternative 3 presents the greatest potential concern to crab conservation efforts. The flexibility to trawl fisheries inherent in this alternative could allow C. bairdi bycatch in Zone 1 to increase up to the new, combined PSC limit of 4 million crab. C. bairdi mature male and female crab may be particularly vulnerable to a significant increase in trawling effort that may occur under this PSC limit revision. The widely held view that C. bairdi distribution in the BSAI is one population, may give less weight to these concerns of localized depletion and potential effects on reproductivity.

A significant increase in trawling effort under Alternative 3 would likely cause the red king crab PSC limit to be more fully utilized by groundfish fisheries. Given that the 1995 Red King Crab Savings Area trawl closure is not yet made permanent, the female component of the Bristol Bay red king crab population

could be negatively affected under Alternative 3, to the extent that the number of females taken increases before the red king crab or C. bairdi PSC limit closes Zone 1. The intensity of trawling activities under this scenario could therefore pose a conservation concern for the stock.

A model was developed to examine the potential impacts of a 20 percent increase in the C. bairdi bycatch limit established in Zone 1 for the groundfish trawl fisheries. The new model uses the activity of vessels delivering to processors that participated in the 1995 Pacific cod and yellowfin sole fisheries in Zone 1 during the two weeks prior to a bycatch closure of Zone 1 to these fisheries to estimate what would have happened had the Zone 1 bycatch allowance for the cod (yellowfin sole) fishery been larger. A 20 percent increase in the Zone 1 C. bairdi bycatch allowance specified for the 1995 Pacific cod trawl fishery could have resulted in one additional week of participation in the Zone 1 cod fishery by the group of processors that had participated in that fishery during the last two full weeks prior to its actual closure. The difference between the actual performance of this group of processors that week and the estimate of what their performance would have been in an extended Zone 1 cod fishery are an additional $2.98 million in gross product value; an overall increase in the bycatch of halibut, C. bairdi, and chinook salmon; a decrease in bycatch of C. opilio; and little change in bycatch of red king crab, herring, and other salmon (chum).

The impacts of a 20 percent increase in the Zone 1 C. bairdi bycatch allowance specified for the yellowfin sole fishery would provide only about 1 additional day of fishing and less than $0.5 million in additional gross product value to the processors which had participated in the Zone 1 yellowfin sole fishery during the two full weeks prior to the April 4 closure of the fishery. The model also projects that the associated impacts on bycatch of prohibited species would tend to be non-significant.

Table of contents

1.0 INTRODUCTION

The groundfish fisheries in Federal waters of the Bering Sea and Aleutian Islands management area (BSAI) are managed under the Fishery Management Plan for the Groundfish Fisheries of the Bering Sea and Aleutian Islands Area (FMP). The FMP was developed by the North Pacific Fishery Management Council (Council) under the Magnuson Fishery Conservation and Management Act (Magnuson Act). The FMP was approved by the Secretary of Commerce and became effective in 1982.

Actions taken to amend fishery management plans or their implementing regulations must meet the requirements of Federal laws and regulations. In addition to the Magnuson Act, the most important of these are the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), Executive Order (E.O.) 12866, and the Regulatory Flexibility Act (RFA).

NEPA, E.O. 12866 and the RFA require a description of the purpose and need for the proposed action as well as a description of alternative actions which may address the problem. This information is included in Section 1 of this document. Section 2 contains information on the biological and environmental impacts of the alternatives as required by NEPA. Impacts on endangered species and marine mammals are also addressed in this section. Section 3 contains a Regulatory Impact Review (RIR) which addresses the requirements of both E.O. 12866 and the RFA that economic impacts of the alternatives be considered. Section 4 assess the impact of the alternatives on small businesses under the RFA.

This Environmental Assessment/Regulatory Impact Review/(EA/RIR) addresses a proposed amendment to the FMP that would authorize greater flexibility in the management of the bycatch limits established for Chionoecetes bairdi Tanner crab in Zones 1 and 2 of the BSAI.

1.1 Purpose of and Need for the Action

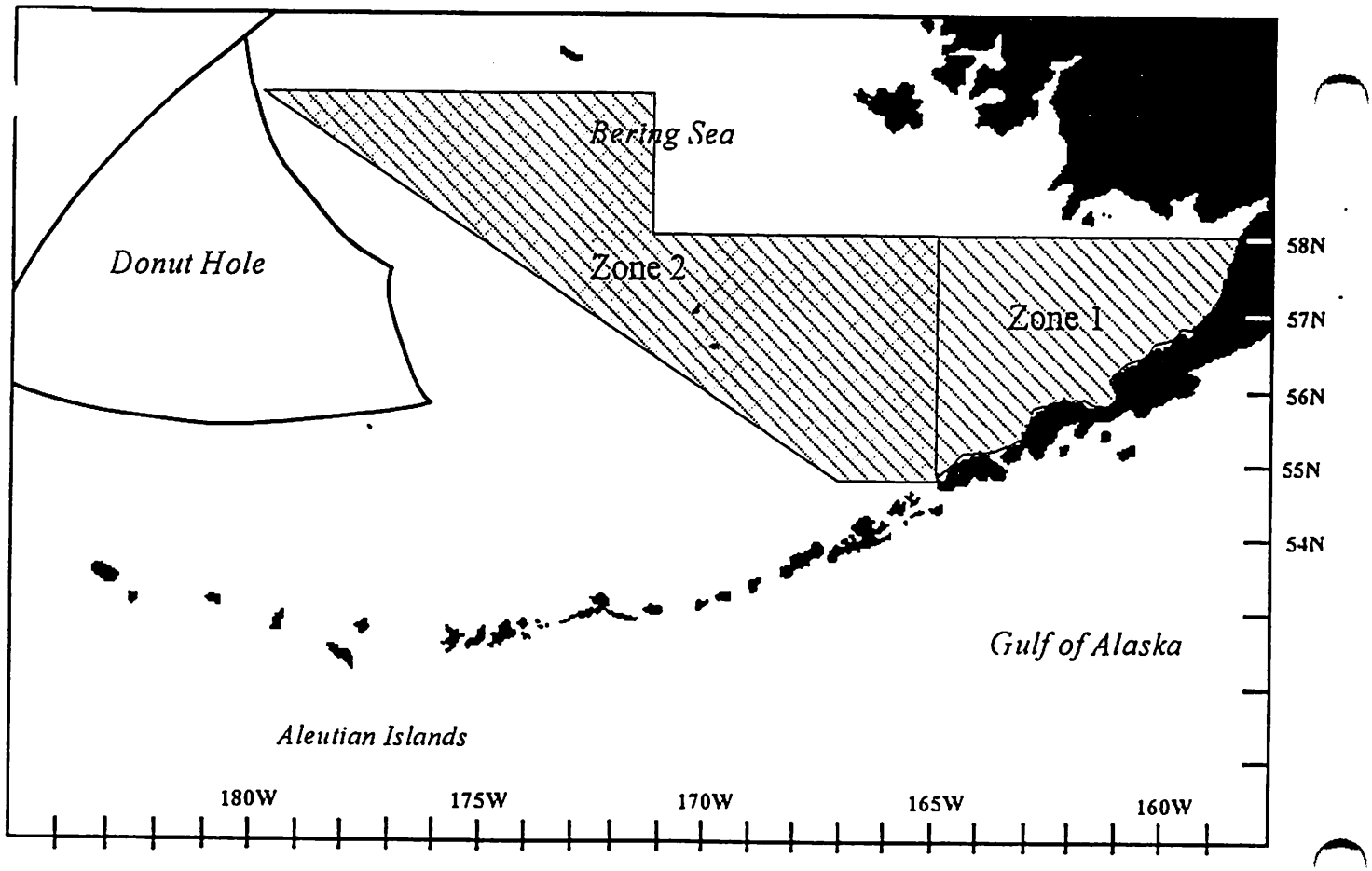
Fishing for groundfish with trawl gear often involves towing trawl gear in contact with the sea bottom. This nonselective harvesting technique catches nongroundfish species such as crabs

and halibut in addition to the target groundfish species. Such incidental catches are referred to as bycatches in fisheries targeting other species.

Some non-groundfish species that are taken as bycatch in the groundfish fisheries are fully used in other domestic fisheries. These species are listed in the FMP and its implementing regulations as prohibited species in the groundfish fisheries. The incidental catch of these species must be returned to the sea immediately with a minimum of injury (§ 675.20(c)). Annual prohibited species catch (PSC) limits are established for some prohibited species that, when reached, trigger the closure of specified groundfish fisheries. The FMP or regulations at § 675.21 and § 675.22(h) establish PSC limits for Pacific halibut, Pacific herring, red king crab in Bycatch Zone 1 of the Bering Sea, C. bairdi Tanner crab in Bycatch Zone 1 and Zone 2 of the Bering Sea (Figure 1), and nonchinook salmon in the catcher vessel operation area defined at § 675.22(g). The PSC limits generally reflect levels of bycatch negotiated by conflicting fishery interests and are intended to provide the groundfish fishery sufficient opportunity to harvest the total allowable catch of groundfish, while minimizing the bycatch mortality of crab, halibut, herring and salmon.

NMFS, in consultation with the Council, annually apportions the crab, halibut, and herring PSC limits among fisheries specified at § 675.21(b) as bycatch allowances. This process occurs as part of the annual groundfish specifications (§ 675.20(a)). These bycatch allowances may be seasonally apportioned. When a fishery reaches a bycatch allowance, fishery closures are implemented to maintain bycatch amounts within the specified allowance.

Fishery closures due to attainment bycatch allowances impose costs on the groundfish fishery. These costs can result from closure of preferred fishing grounds, increased operating costs if fishing operations must move to less preferable grounds with the attendant possibility of increased bycatch rates of other prohibited species, and ultimately, foregone opportunity to harvest groundfish if bycatch allowances are reached that close a fishery before groundfish TAC is reached. For species that may be harvested by trawl or fixed gear (e.g. Pacific cod) closure of a fishery to vessels using one gear type may transfer increased



Prohibited Species Bycatch Limitation Zones

Rationale for Closure: To allow for control of red king crab and C. bairdi Tanner crab bycatch.

Origin: Implemented under Amendment 10 on March 16, 1987.

Description of Area: Areas close to directed fishing when crab bycatch caps are attained in specified fisheries. Bycatch Limitation Zone 1 means that part of the Bering Sea Subarea that is south of 58° 00' N. latitude and east of 165° 00' W. longitude. Bycatch Limitation Zone 2 means that part of the Bering Sea Subarea bounded by straight lines connecting the following coordinates in the order listed:

North latitude	West longitude
54° 30'	165° 00'
58° 00'	165° 00'
58° 00'	171° 00'
60° 00'	171° 00'
60° 00'	179° 20'
59° 25'	179° 20'
54° 30'	167° 00'
54° 30'	165° 00'

FIGURE 1. ZONES 1 AND 2 OF THE BSAI

harvest opportunities to vessels using another gear type. As a result, groundfish TAC still may be achieved, although revenues are reallocated from one gear group to another.

At its June 1995 meeting, the Council received a request from representatives of the BSAI trawl industry to take action to allow increased management flexibility of the C. bairdi PSC limits established for trawl fisheries in Zones 1 and 2. Currently, the FMP establishes a 1 million crab PSC limit for Zone 1 and a 3 million crab limit for Zone 2. Attainment of a trawl fishery bycatch allowance of C. bairdi in Zone 1 forces the movement of fishery operations into Zone 2 where C. bairdi bycatch rates typically are higher. Similarly, Pacific halibut bycatch rates typically are higher in Zone 2, thus increasing the potential for attainment of a halibut bycatch allowance and closure of the entire BSAI to that fishery. This situation can occur for nonpelagic trawl fisheries early in the year because ice cover in the Bering Sea, poor weather, distribution of target species, and the desire to avoid high halibut bycatch rates in Zone 2 constrain preferable fishing grounds to Zone 1.

Although the majority of groundfish trawl fisheries do not reach their C. bairdi bycatch limits in either Zone 1 or Zone 2, the flatfish and Pacific cod trawl fishery have been affected in recent years. In 1994, the yellowfin sole fishery in Zone 1 was closed May 16 for the remainder of the year due to attainment of its Zone 1 C. bairdi bycatch allowance. Increased halibut bycatch rates experienced by this fishery as a result of the movement of fishing operations to Zone 2 resulted in the attainment of a seasonal halibut bycatch allowance with the result that the BSAI was closed to fishing for this species from July 5 until August 3. In 1995, the Zone 1 yellowfin sole fishery was closed April 4 for the remainder of the year because of C. bairdi bycatch; halibut bycatch closed the entire BSAI to the fishery on May 1 through the end of July. In 1995, the C. bairdi bycatch allowance specified for the Pacific cod trawl fishery in Zone 1 was reached March 20, forcing fishing operations into Zone 2. The halibut bycatch allowance for this fishery subsequently was reached April 24 when the entire BSAI was closed to this fishery.

The potential for closure of Zone 1 trawl fisheries due to attainment of a Zone 1 C. bairdi bycatch allowance may increase

if the Council adopts a trawl closure in a portion of Zone 1 to protect red king crab. Options under consideration by the Council for a red king crab trawl closure may force fishing fleets to operate in areas of higher C. bairdi bycatch rates and increase the potential for attainment of the C. bairdi bycatch allowances specified for Zones 1.

The current management regime allows for no flexibility in the management of the C. bairdi PSC limits between Zone 1 and Zone 2. Increased flexibility in the management of these PSC limits could provide additional harvest and/or revenue from the groundfish fisheries under existing prohibited species bycatch restrictions.

1.2 Alternatives Considered

1.2.1 Alternative 1. Status quo. The C. bairdi PSC limits established for Zones 1 and 2 would continued to be managed as separate and distinct PSC limits that when reached, would close fishing for groundfish in the respective zone. The current PSC limits established for C. bairdi in Zones 1 and 2 (1 million crab and 3 million crab, respectively) would remain unchanged.

The fishery operational problems described above that ensue from the inflexibility of the status quo management of the C. bairdi PSC limits would continue. The trawl bycatch of C. bairdi crab would be constrained in Zones 1 and 2 to the respective PSC limits established for those areas.

1.2.2 Alternative 2. Increase the C. bairdi PSC limit established for Zone 1 and reduce the PSC limit established for Zone 2 by a corresponding amount to address fishery operational problems resulting from the increasing potential for fishery closures in Zone 1 as a result of C. bairdi bycatch restrictions. For purposes of this analysis, the numerical adjustment of the PSC limits would be limited to 20 percent of the Zone 1 bycatch limit so that the revised Zone 1 PSC limit would equal 1.2 million crab and the revised Zone 2 PSC limit would equal 2.8 million crab. The management of the revised PSC limits would remain unchanged from status quo, i.e., the revised Zone 1 and Zone 2 PSC limits would be apportioned to fisheries as bycatch allowances that, when reached, would result in closure of those

fisheries in the respective zone.

1.2.3 Alternative 3. The C. bairdi PSC limits established for Zones 1 and 2 would be combined to a single annual limit equal to 4 million crab. When a fishery attains its bycatch allowance of the 4 million crab PSC limit within the combined Zone 1 and Zone 2 area, the fishery would be closed in the combined area.

This alternative would significantly reduce the potential for C. bairdi bycatch restrictions to limit fishing operations before either groundfish TACs or halibut or red king crab bycatch restrictions trigger fishery closures. Notwithstanding other fishery constraints, the number of C. bairdi Tanner crab taken as bycatch in either Zones 1 and 2 could increase up to the new combined PSC limit of 4 million crab. This alterative would provide the most flexibility to trawl fisheries for harvesting available groundfish within the BSAI under an overall C. bairdi PSC limit. However, bycatch of C. bairdi could increase significantly, particularly in Zone 1 where intensive trawl fisheries occur early in the fishing year. A significant increase in C. bairdi bycatch within Zone 1 could precipitate conservation concerns to the extent that crab mortality in the area becomes disproportionate to the relative abundance of crab in Zone 1 compared to the rest of the BSAI. This situation could create further concerns for localized depletion and the potential negative impact of increased trawl bycatch on commercial crab fisheries.

1.2.4 Alternative 4. As in the status quo alternative, the current C. bairdi PSC limits would be maintained for Zone 1 and Zone 2 that would be apportioned to specified fisheries as bycatch allowances. If a specified fishery bycatch allowance in Zone 1 or Zone 2 is reached, the Director, NMFS, Alaska Region, may take inseason action to increase that fishery bycatch allowance by a specified percentage (e.g., 20 percent) through a transfer of unused bycatch allowance specified for that fishery from the other respective zone. Any inseason transfer of C. bairdi crab between a fishery's Zone 1 and Zone 2 bycatch allowances would be based on one or more of the following considerations by the Regional Director:

1. Inseason and historical catch of groundfish per unit of effort and rate of harvest in Zones 1 and 2;

2. Inseason and historical bycatch rates of prohibited species in Zones 1 and 2;

3. Economic impacts of a transfer of C. bairdi between Zones 1 and 2; or

4. Any other factor relevant to the need to optimize the amount of total groundfish harvested under established PSC limits.

This alternative would allow inseason managers to transfer a limited amount of a fishery's C. bairdi bycatch allowance between zones to address fishery operation problems, including the avoidance of high halibut bycatch rates. Any overage or shortfall of a seasonal bycatch allowance that results from a transfer of crab between Zone 1 and Zone 2 would be added to, or deducted from, the respective fishery bycatch allowance for the next season during a current fishing year.

An example of the how this alternative would work follows. Assume the C. bairdi bycatch allowances specified for the Pacific cod trawl fishery were 225,000 crab and 260,000 crab in Zone 1 and Zone 2, respectively (the 1995 specifications). If the C. bairdi bycatch allowances in Zone 1 were reached and sufficient crab remain in the Zone 2 bycatch allowance, the Regional Director, pending his consideration of the factors listed above, could increase the fishery's bycatch allowance in Zone 1 by up to 20 percent, or 45,000 crab, through a transfer of crab from Zone 2 to Zone 1. The bycatch allowance in Zone 2 concurrently would be reduced by 45,000 crab to 215,000 crab.

Option 1: Timeliness of an inseason transfer of C. bairdi between a Zone 1 and Zone 2 fishery bycatch allowance would be enhanced by making such transfer non-discretionary. If a fishery reaches its C. bairdi bycatch allowance in either Zone 1 or Zone 2, the bycatch allowance automatically would be increased by a specified percentage (e.g., 20 percent) through a transfer of crab from the fishery's bycatch allowance specified for the other respective Zone.

2.0 NEPA REQUIREMENTS: ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

An environmental assessment (EA) is required by the National

Environmental Policy Act of 1969 (NEPA) to determine whether the action considered will result in significant impact on the human environment. The environmental analysis in the EA provides the basis for this determination and must analyze the intensity or severity of the impact of an action and the significance of an action with respect to society as a whole, the affected region and interests, and the locality. If the action is determined not to be significant based on an analysis of relevant considerations, 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 for major Federal actions significantly affecting the human environment.

An EA must include a brief discussion of the need for the proposal, the alternatives considered, the environmental impacts of the proposed action and the alternatives, and a list of document preparers. The purpose and alternatives were discussed in Sections 1.1 and 1.2, and the list of preparers is in Section 7. This section contains the discussion of the environmental impacts of the alternatives including impacts on threatened and endangered species and marine mammals.

2.1 Environmental Impacts of the Alternatives

The environmental impacts generally associated with fishery management actions are effects resulting from 1) harvest of fish stocks which may result in changes in food availability to predators, changes in the population structure of target fish stocks, and changes in community structure; 2) changes in the physical and biological structure of the benthic environment as a result of fishing practices, e.g., effects of gear use and fish processing discards; and 3) entanglement/entrapment of non-target organisms in active or inactive fishing gear. A summary of the effects of the 1995 groundfish total allowable catch amounts on the biological environment and associated impacts on marine mammals, seabirds, and other threatened or endangered species are discussed in the final environmental assessment for the 1995 groundfish total allowable catch specifications (NMFS 1995).

2.1.1 Crab Conservation Issues

Groundfish fishery operations in the Bering Sea often involve

towing trawl gear in contact with the sea bottom, exposing other bottom-dwelling species, such as crab, to capture, in addition to the target species. In the BSAI groundfish fisheries crab bycatch is predominated by Tanner Crab (C. bairdi); "other" crab, of which Snow Crab (C. opilio) comprises the majority, and red king crab (Paralithodes camtschaticus).

An annual trawl survey is conducted by NMFS in the eastern Bering Sea, encompassing Zones 1 and 2, to determine the distribution and abundance of crab resources. The distribution of C. opilio lies chiefly north-west of the Pribilof Islands. Any increased fishing time in Zone 1 under Alternatives 2 - 4 likely would not significantly increase the bycatch of this species in the BSAI trawl fisheries due to its very low abundance in Zone 1.

The level of C. bairdi bycatch in the BSAI trawl fisheries is estimated at about 1.3 percent of the total 1994 crab abundance. C. bairdi distribution comprises two centers of abundance, located in Bristol Bay and the Pribilof Islands area. Commercial size males are well-represented in Zone 1, comprising 62 percent of the total in this zone, in 1994 (Table 1). Mature females are less prevalent in this zone, at approximately 42 percent of the total, and the species as a whole lower still, at 25 percent. While commercial size male distribution is well contained in the survey area, females and sub-legal males are likely more prevalent in Zone 2 than the survey suggests. This may be attributed to deep-water areas along the continental shelf edge beyond the survey area, that are often inhabited by sub-legals and females (Robert Otto, NMFS, personal communication).

Alternatives 2 and 4 would be unlikely to raise significant conservation concerns for C. bairdi in Zone 1, given the degree of the bycatch limit revision or allowance transfer envisioned. However, the inseason adjustment of C. bairdi bycatch allowance under Alternative 4 would be most sensitive to potential conservation concerns by its ability to respond to specific groundfish fishery concerns, while taking into account inseason PSC bycatch rates. The combined, annual C. bairdi PSC limit established for Zones 1 and 2 under Alternative 3 presents the greatest potential concern to crab conservation efforts. The

TABLE 1. Summary of 1994 relative population indices[1] of C. bairdi Tanner crab and red king crab in the Eastern Bering Sea (percentage of crabs), in Zones 1 and 2.

Species	Zone 1	Zone 2	Total
C. bairdi			
Legal Males >109[2]	62	38	100
Large females >84	42	58	100
Species	25	75	100
Red king crab			
Legal males >109	84	16	100
Large females >89	82	18	100
Species	87	13	100

[1] These data reflect distribution within the NMFS trawl survey area only and the size groups chosen to represent mature males and females are approximate or representative rather than absolute.
[2] Carapace length determination for size groups (mm).

flexibility to trawl fisheries inherent in this alternative could allow C. bairdi bycatch in Zone 1 to increase up to the new, combined PSC limit of 4 million crab. C. bairdi mature male and female crab may be particularly vulnerable to a significant increase in trawling effort that may occur under this PSC limit revision. The widely held view that C. bairdi distribution in the BSAI is one population, may give less weight to these concerns of localized depletion and potential effects on reproductivity.

The number of red king crab in the Eastern Bering Sea is declining. The status of female populations in Bristol Bay is a concern for long term stock viability. To protect female red king crab from the winter trawl fisheries, an area of Zone 1 was closed to trawling in 1995, the Red King Crab Savings Area (RKCSA). The directed red king crab pot fishery was closed by the Alaska Department of Fish and Game in 1994, which resulted in an area closure east of 163 degrees longitude to the directed

C. bairdi fishery. These closures are to remain in effect for the 1995-96 season. Red king crab bycatch in the groundfish fisheries of the BSAI accounted for 0.8 percent of the total crab abundance estimate in 1994, the majority having been taken by trawl gear. The principal locus of the red king crab stock is Zone 1, comprising approximately 87 percent of the total, by 1994 data (Table 1). The remainder is located in the Pribilof Islands area and is protected by a habitat conservation area designated to protect blue king crab.

Zone 1 is more important with respect to red king crab than it is for the other species, and was established primarily on the basis of red king crab distribution. Federal Statistical Area 512 was closed to trawling by regulation in 1987 to protect approximately 90 percent of mature female red king crab. A seasonal extension of the area was later implemented that provided protection for females during the critical molting and mating period, when shells are soft and more vulnerable to damage by trawl gear. This measure was based on a 1988 red king crab survey, which indicated a significant movement of mature females into the area. The additional opportunity to fish in Zone 1 with trawl gear under Alternatives 2 and 4 would be unlikely to raise significant conservation concerns for red king crab populations in Zone 1 given the degree of the bycatch limit revision or allowance transfer envisioned. However, a significant increase in trawling effort under Alternative 3 would likely cause the red king crab PSC limit to be more fully utilized by groundfish fisheries. Given that the 1995 RKCSA trawl closure is not yet made permanent, the female component of the Bristol Bay red king crab population could be negatively affected under Alternative 3, to the extent that the number of females taken increases before the red king crab or C. bairdi PSC limit closes Zone 1. The intensity of trawling activities under this scenario could therefore pose a conservation concern for the stock. As mentioned above, a permanent implementation of the RKCSA trawl closure could result in a relocation of fishing effort from this area in a manner that compounds the problem of increased C. bairdi bycatch in Zone 1.

The primary ways in which trawling can affect crabs and benthic organisms comprising crab habitat, are: 1) scraping and plowing the sea-floor, (2) sediment re-suspension and redistribution of sediment layers, (3) damaging or removing non-target benthic

organisms, and (4) dumping of processing waste. Given the potential for increased trawling activity in Zone 1 of the BSAI, the alternatives could result in increased impacts to crab habitat. However, the extent of these effects is unknown, due to unquantified variables such as the amount of gear contact with the bottom, the nature of the seabed, and the strengths of currents or tides. Future research efforts should be directed at examining potential habitat alterations and impacts caused by trawl gear.

2.2 Impacts on Endangered, Threatened or Candidate Species

Listed and candidate species that may be present in the GOA and BSAI are discussed in detail in the EA/RIR/IRFAs conducted on the annual total allowable catch specifications.

The following species are currently listed under the ESA and could be present in the BSAI and GOA management areas are:

Endangered Species

Northern right whale	Balaena glacialis
Sei whale	Balaenoptera borealis
Blue whale	Balaenoptera musculus
Fin whale	Balaenoptera physalus
Humpback whale	Megaptera novaeangliae
Sperm whale	Pyseter macrocephalus
Snake River sockeye salmon	Oncohynchus nerka
Snake River fall chinook salmon	Oncorhynchus tshawytscha
Short-tailed albatross	Diomedea albatrus

Threatened Species

Steller sea lion	Eumetopias jubatus
Snake River spring/summer chinook salmon	Oncorhynchus tshawytscha
Spectacled eider	Somateria fischeri

Other species that are not presently listed but that are categorized by the U.S. Fish and Wildlife Service as candidate species are as follows:

Steller's eider	Polysticta stelleri
Marbled murrelet	Brachyramphus marmoratus
Red-legged kittiwake	Rissa brevirostris
Kittlitz's murrelet	Brachyramphus brevirostris

None of the alternatives considered would increase groundfish harvest amounts to levels that exceed the annual quotas that are considered under section 7 consultations initiated for the annual groundfish specifications. The distribution of fishing effort could change in a manner that slightly increases the bycatch of chinook salmon by vessels particpating in the Pacific cod trawl fishery. This increase (438 fish based in the modelling results in the Appendix to this EA/RIR) is not considered significant relative to the total number of salmon taken in the groundfish trawl fisheries. The proposed action, therefore, would not be anticipated to affect listed or proposed candidate species in a manner not already considered in previous consultations.

2.3 Impacts on Marine Mammals

Marine mammals not listed under the Endangered Species Act that may be present in the GOA and BSAI include cetaceans, [minke whale (Balaenoptera acutorostrata), killer whale (Orcinus orca), Dall's porpoise (Phocoenoides dalli), harbor porpoise (Phocoena phocoena), Pacific white-sided dolphin (Lagenorhynchus obliquidens), and the beaked whales (e.g., Berardius bairdii and Mesoplodon spp.)] as well as pinnipeds [northern fur seals (Callorhinus ursinus), and Pacific harbor seals (Phoca vitulina)] and the sea otter (Enhydra lutris).

A list of marine mammal species and detailed discussion regarding life history and potential impacts of the 1995 groundfish fisheries of the BSAI and GOA on those species can be found in an EA conducted on the 1995 Total Allowable Catch Specifications for the GOA and BSAI (NMFS 1995). None of the alternatives considered would be expected to adversely affect any listed or candidate marine mammals in a manner not already considered in

previous consultations.

2.4 Coastal Zone Management Act

Implementation of each of the alternatives considered would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of Section 30(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

2.5 Conclusions or Finding of No Significant Impact

None of the alternatives is likely to significantly affect the quality of the human environment, and the preparation of an environmental impact statement for the proposed action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

3.0 REGULATORY IMPACT REVIEW: ECONOMIC AND SOCIOECONOMIC IMPACTS OF THE ALTERNATIVES

This section provides information about the economic and socioeconomic impacts of the alternatives including identification of the individuals or groups that may be affected by the action, the nature of these impacts, quantification of the economic impacts if possible, and discussion of the trade offs between qualitative and quantitative benefits and costs.

The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following statement from the order:

> In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those

approaches that maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

Executive Order 12866 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be "significant". A "significant regulatory action" is one that is likely to:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

A regulatory program is "economically significant" if it is likely to result in the effects described above. The RIR is designed to provide information to determine whether the proposed regulation is likely to be "economically significant," as well as to provide estimates of the changes in both the magnitude and distribution of net benefits.

3.1 Description of simulation model

A new model was developed to examine relative costs and benefits that could result from increased flexibility to manage the fishery bycatch allowances specified for Zone 1 and Zone 2 C. bairdi. This approach was necessary because the existing

bycatch simulation model used in the past by the Council to examine relative impacts of prohibited species bycatch constraints is not designed to assess impacts when bycatch restrictions are relaxed, as would be the case under the proposed action. This model limitation occurs because no fishery data is available for periods of time that fisheries are closed under the current management regime. The new model developed by NMFS staff uses the activity of vessels delivering to processors that participated in the cod (yellowfin sole) fishery in Zone 1 during the two weeks prior to a bycatch closure of Zone 1 cod (yellowfin sole) fishery to estimate what would have happened had the Zone 1 bycatch allowance for the cod (yellowfin sole) fishery been larger.

This analysis examines the status quo alternative relative to Alternatives 2 through 4 that would allow a transfer between Zone 1 and Zone 2 of a portion of individual fishery bycatch allowances specified for C. bairdi. For purposes of this analysis, the model developed compares the relative change in groundfish harvest and value, as well as prohibited species bycatch that could occur through a transfer of C. bairdi between the Zone 1 and Zone 2 bycatch limits.

Specifically, this model assumes an increase in the Zone 1 C. bairdi cap by 20%, from 1 million crab to 1.2 million crab, while decreasing the zone 2 cap by the same number of crab. The model examines the 1995 Pacific cod and yellowfin sole trawl fisheries. All catch and production statistics are from the NMFS Alaska Regional Office blend and weekly production data sets.

For simplicity, the following explanation of the model is presented in terms of the Pacific cod fishery only. The model uses the mean weekly catch of groundfish and bycatch of prohibited species for processors active in the 1995 Pacific cod fishery during the last two complete weeks the Zone 1 fishery was open (the fishery closed on March 20, the last complete week was March 18). The mean weekly bycatch of Zone 1 C. bairdi crab is used to estimate the additional fishing days the cod fishery would have had in Zone 1 given a 20 percent increase in the Pacific cod bycatch allowance from 225,000 crab to 270,000 crab. In addition, the mean weekly bycatch of Zone 2 C. bairdi, BSAI halibut (mortality), Zone 1 red king crab, other BSAI king crab and Tanner crab species, salmon, and herring also are calculated

to estimate how the additional fishing time would impact bycatch of these species relative to any specified bycatch allowances. Once the estimate of additional fishing time is calculated, a set of catch and bycatch statistics is computed using the mean statistics described above. These 'modelled' data are then compared with the actual data for the same period for the set of processors that participated in the Zone 1 cod fishery during its last two full weeks. Because the blend and prohibited species catch statistics are reported at a weekly level, any partial weeks of fishing are simply that portion of the actual weeks catch. For example, if the increase in the bairdi cap allowed for an additional 0.75 weeks of fishing, the actual catch statistics would be estimated as 75% of the first week after the zone 1 closure (March 25 in this example).

3.2 Results of simulation model

Based on the model presented in section 3.1, a 20 percent increase in the Zone 1 C. bairdi bycatch allowance specified for the 1995 Pacific cod trawl fishery could have resulted in one additional week of participation in the Zone 1 cod fishery by the group of processors that had participated in that fishery during the last two full weeks prior to its actual closure. The difference between the actual performance of this group of processors that week and the estimate of what their performance would have been in an extended Zone 1 cod fishery are as follows (Table 2): 1) an additional $2.98 million in gross product value, 2) an increase in C. bairdi bycatch for Zone 1 of 52,000 crab, 3) a decrease in C. bairdi bycatch for Zone 2 of 2,300 crab, 4) small reductions in the Zones 1 and 2 bycatch of red king crab that were offset by approximately equal increases in red king in the rest of the BSAI, and 5) a 105 mt increase in BSAI halibut bycatch mortality.

Some vessels fishing for Pacific cod when Zone 1 was closed on March 20 moved into the Gulf of Alaska (GOA). Table 3 summarizes model results that compare the combined impact on BSAI and GOA prohibited species bycatch amounts under the status quo alternative and Alternatives 2 and 4, assuming the Pacific cod bycatch allowance for Zone 1 C. bairdi is increased by 20 percent, allowing for an additional week of fishing in this area. The combined BSAI and GOA bycatch of halibut, C. bairdi, and chinook salmon increased and bycatch of C. opilio decreased. The

bycatch of red king crab, herring, and other salmon species (chum salmon) showed little change.

Although some vessels and processors participating in the Pacific cod trawl fishery could benefit from the proposed action in terms of gross product value, a general statement about the overall net benefit relative to status quo is more difficult. This is because amounts of BSAI Pacific cod that cannot be harvested by the trawl fleet because of crab or halibut bycatch restrictions can be reallocated to the longline gear fleet during the same fishing year. Although product value may differ between the trawl and longline fleet, any costs incurred because of foregone trawl harvest opportunity can be minimized through a reallocation of Pacific cod to vessels using hook-and-line or pot gear.

Based on model results set out in the Appendix, the impacts of a 20 percent increase in the Zone 1 C. bairdi bycatch allowance specified for the yellowfin sole fishery would provide only about 1 additional day of fishing and less than $0.5 million in additional gross product value to the processors which had participated in the Zone 1 yellowfin sole fishery during the two full weeks prior to the April 4 closure of the fishery. The model also projects that the associated impacts on bycatch of prohibited species would tend to be non-significant.

The model results for the yellowfin sole fishery should be qualified relative to NMFS' ability to monitor crab bycatch during intensive fishing operations for flatfish when bycatch rates can be variable and high. In 1995, the Zone 1 C. bairdi bycatch allowance specified for the yellowfin fishery (225,000 crab) was exceeded by 15 percent before the fishery was closed April 4. In 1994, the bycatch allowance (175,000 crab) was exceed by 41 percent before the fishery was closed on May 16. The model results assume that bycatch could be monitored in a manner that avoids exceeding specified bycatch limits, and that 1 additional day of fishing in Zone 1 could have occurred in 1995 if the 225,000 bycatch allowance were increased 20 percent to 270,000 crab. In actuality, the Zone 1 yellowfin sole fishery had already taken almost 260,000 crab by the time the fishery was closed on April 4. Thus only about 10,000 crab would have remained to support additional fishing activity if the bycatch allowance had been increased to 270,000 crab. Conversely, if the bycatch actually increased by 45,000 crab, the estimated changes

would have increased by a factor of 4.5 to 1 (about 350 percent greater) compared to those estimated in this report. For example, groundfish product value would have increased by $2.2 million instead of $.5 million and Zone 1 C. bairdi bycatch would have increased by 66,000 crab instead of 14,800 crab. In summary, any statement about potential costs and benefits that could accrue as a result of increased management flexibility of the C. bairdi bycatch allowances should be qualified relative to NMFS' ability to monitor and manage bycatch allowances within specified amounts.

Table 2. Modelling results comparing actual and projected groundfish catch and prohibited species bycatch taken by vessels participating in the 1995 BSAI Pacific cod trawl fishery during the first week after the fishery was closed in Zone 1 relative to continued fishing in Zone 1 during that week if the C. bairdi bycatch allowance had been increased by 20 percent (from 225,000 crab to 270,000 crab). Model assumptions are presented in section 3.1 of the EA/RIR. Listed data is summarized from the model results presented in the Appendix to this EA/RIR. Crab bycatch is in numbers of animals; halibut bycatch is in metric tons of mortality.

	Groundfish (mt)	Retained G.F. value ($)	Zone 1 Bairdi	Zone 2 Bairdi	Zone 1 Red king	BSAI halibut
Actual	12,840	6,058,360	7,861	4,632	6	76
Model results	17,350	9,039,550	59,918	2,375	0	181
Difference	4,510	2,981,190	52,057	-2,257	- 6	105

Table 3. A comparison of the actual 1995 bycatch estimated for Pacific cod vessels during the week after closure of Zone 1 with modelled bycatch estimates for the same vessels if Zone 1 had remained open to fishing for Pacific cod for an additional week. This table present a summary of information set out in the Appendix to this EA/RIR and includes combined bycatch amounts in the BSAI and GOA.

	Actual	Modelled bycatch	Difference
Halibut mortality (mt)	82	200	118
C. bairdi (# crab)	13,240	62,856	49,616
Other Tanner crab (# crab)	16,452	7,395	- 9,057
Red king crab (# crab)	146	153	7
Other king crab(# crab)	106	92	- 14
chinook salmon (# salmon)	950	1,388	438
Other salmon (# salmon)	245	283	38
herring (mt)	2	0	- 2

3.2 Administrative, Enforcement and Information Costs

No new reporting or enforcement costs would occur under any of the alternatives considered. Administrative costs under Alternatives 1 - 3 would be less than those under Alternative 4. Alternative 4 would require that inseason notices be prepared and published in the Federal Register that present the determinations necessary to justify a transfer of C. bairdi between Zone 1 and Zone 2 fishery bycatch allowances. Option 1 under Alternative 4 would minimize these costs to the extent that such action would be nondiscretionary and implemented in a manner similar to routine fishery openings and closures. Increased administrative workload under any of the alternatives could be accomplished with existing staff resources, although the potential for increased workload under Alternative 4 may require that work priorities be shifted to implement inseason transfers of C. bairdi crab between Zones 1 and 2 in as timely manner as possible.

4.0 ECONOMIC IMPACT ON SMALL ENTITIES

The objective of the Regulatory Flexibility Act is to require consideration of the capacity of those affected by regulations to bear the direct and indirect costs of regulation. If an action will have a significant impact on a substantial number of small entities an Initial Regulatory Flexibility Analysis (IRFA) must be prepared to identify the need for the action, alternatives, potential costs and benefits of the action, the distribution of these impacts, and a determination of net benefits.

NMFS has defined all fish-harvesting or hatchery businesses that are independently owned and operated, not dominant in their field of operation, with annual receipts not in excess of $2,000,000 as small businesses. In addition, seafood processors with 500 employees or fewer, wholesale industry members with 100 employees or fewer, not-for-profit enterprises, and government jurisdictions with a population of 50,000 or less are considered small entities. A "substantial number" of small entities would generally be 20% of the total universe of small entities affected by the regulation. A regulation would have a "significant impact" on these small entities if it reduced annual gross revenues by more than 5 percent, increased total costs of

production by more than 5 percent, or resulted in compliance costs for small entities that are at least 10 percent higher than compliance costs as a percent of sales for large entities.

If an action is determined to affect a substantial number of small entities, the analysis must include:

(1) a description and estimate of the number of small entities and total number of entities in a particular affected sector, and total number of small entities affected; and

(2) analysis of economic impact on small entities, including direct and indirect compliance costs, burden of completing paperwork or recordkeeping requirements, effect on the competitive position of small entities, effect on the small entity's cashflow and liquidity, and ability of small entities to remain in the market.

Participants in the directed trawl fisheries that would be most likely affected by the proposed action (Zone 1 Pacific cod and yellowfin sole fisheries) generally are trawl catcher/processor or mothership operations, which are not considered small entities for purposes of the RFA. Furthermore, the potential impact of the proposed action on catcher vessels that participate in these fisheries would not be expected to reduce annual gross revenues by more than 5 percent. In fact, the intended effect of the proposed action would be to provide greater opportunity to the trawl fleet to optimize its groundfish catch and increase revenues from the groundfish fisheries under existing prohibited species catch restrictions. Therefore, this action would not be anticipated to affect any small entities.

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APPENDIX - Model results of value and bycatch impacts

1995 PACIFIC COD EXERCISE - This page gives the actual groundfish catch, modelled catch and the differences by desig (S = shoreside or P = catcher/processor & motherships combined), groundfish species groups and type (D= discarded or R = retained).

This run uses a 20% increase in the Zone 1 bairdi cap (1.0 million to 1.2 million) and an equal decrease in the Zone 2 cap. This increase allows for 0.99 additional weeks of fishing.

cod95a.sav

YR	DESIG	SPECGRP	TYPE	TONS	TONSH	TONSD	VALUE	VALUEH	VALUED
95	P	AMCK	D	253.60	170.26	-83.34	.00	.00	.00
95	P	AMCK	R	740.32	193.42	-546.90	175448.5	45837.81	-129611
95	P	ARTH	D	69.78	65.12	-4.66	.00	.00	.00
95	P	DEEP	D	.	2.59	2.59	.00	.00	.00
95	P	DEEP	R	18.08	41.72	23.64	44172.78	101949.3	57776.53
95	P	FLOU	D	308.70	423.73	115.03	.00	.00	.00
95	P	FLOU	R	77.59	19.25	-58.34	28937.13	7180.57	-21756.6
95	P	GTRB	D	5.12	2.52	-2.61	.00	.00	.00
95	P	GTRB	R	.	.06	.06	.	79.69	79.69
95	P	OTHR	D	239.47	152.14	-87.33	.00	.00	.00
95	P	OTHR	R	17.31	.20	-17.11	10045.32	114.71	-9930.61
95	P	PCOD	D	253.46	767.47	514.01	.00	.00	.00
95	P	PCOD	R	1996.20	4915.88	2919.68	1694377	4153115	2458739
95	P	PLCK	D	1092.04	1720.05	628.01	.00	.00	.00
95	P	PLCK	R	180.23	404.73	224.50	125454.8	280908.8	155454.0
95	P	ROCK	D	183.44	38.79	-144.66	.00	.00	.00
95	P	ROCK	R	1.20	19.22	18.02	2072.51	33082.27	31009.76
95	P	RSOL	D	544.91	1004.40	459.48	.00	.00	.00
95	P	RSOL	R	22.92	94.70	71.78	41370.90	172328.0	130957.1
95	P	SABL	D	.	1.47	1.47	.00	.00	.00
95	P	SABL	R	.	1.57	1.57	.	6497.38	6497.38
95	P	SHAL	D	.84	28.01	27.16	.00	.00	.00
95	P	SHAL	R	1.14	2.17	1.02	1539.19	2917.77	1378.58
95	P	YSOL	D	164.82	34.83	-129.98	.00	.00	.00
95	P	YSOL	R	261.06	13.10	-247.96	151898.5	7622.46	-144276
95	S	AMCK	D	1.59	4.41	2.82	.00	.00	.00
95	S	AMCK	R	3.64	1.20	-2.43	327.24	108.18	-219.05
95	S	ARTH	D	.58	12.20	11.61	.00	.00	.00
95	S	ARTH	R	.09	.10	.01	9.61	11.21	1.60
95	S	DEEP	D	.05	1.02	.97	.00	.00	.00
95	S	FLOU	D	106.72	179.97	73.26	.00	.00	.00
95	S	FLOU	R	1.45	2.61	1.16	109.10	196.01	86.91
95	S	OTHR	D	44.77	80.84	36.06	.00	.00	.00
95	S	OTHR	R	.42	.76	.35	169.88	313.01	143.14
95	S	PCOD	D	188.20	408.22	220.02	.00	.00	.00
95	S	PCOD	R	1300.69	3032.25	1731.55	1262934	2999161	1736228
95	S	PLCK	D	560.59	938.25	377.66	.00	.00	.00
95	S	PLCK	R	3888.62	1892.73	-1995.90	2518873	1226869	-1292004
95	S	ROCK	D	.31	3.60	3.30	.00	.00	.00
95	S	ROCK	R	6.51	.36	-6.15	505.43	27.78	-477.65
95	S	RSOL	D	300.98	638.40	337.42	.00	.00	.00
95	S	RSOL	R	.68	1.00	.33	50.49	74.99	24.50
95	S	SABL	D	.02	.47	.44	.00	.00	.00
95	S	SHAL	D	.87	23.18	22.31	.00	.00	.00
95	S	SHAL	R	.05	.90	.85	60.34	1092.21	1031.87
95	S	YSOL	D	4.32	13.31	8.99	.00	.00	.00
95	S	YSOL	R	.01	.01	.00	6.29	6.29	.00

The naming convention is as follows:
bairbc1 = actual bairdi Zone 1 bycatch
bair1h = modelled bairdi Zone 1 bycatch
baird1d = bair1h - bairbc1
redk = red king
halmort = halibut mortality
chin = chinook
oths = other salmon
herr = herring
otan = other tanner
othk = other king

The bairdi and red king numbers are in 3 pieces, Zone 1, Zone 2 and Zone 5 where Zone 5 is all BSAI less Zones 1 & 2. Therefore, the total bairdi catch in the BSAI would be bairbc1 + bairbc2 + bairbc5. The GOA bairdi catch is simply bairbc6. The halibut BSAI and GOA catch are halmort5 and halmort6 respectively. The chinook, other salmon, herring, other tanner and other king numbers and weights are not broken out by BSAI or GOA. Herring and halibut bycatch are in metric tons.

Table 1 - Zone 1 bycatch of C. bairdi and red king crab

YR	DESIG	Zone	BAIRBC1	BAIR1H	BAIR1D	REDKBC1	REDK1H	REDK1D
95	P	1.00	7861.39	57034.71	49173.32	5.74	.00	-5.74
95	S	1.00	.00	2883.11	2883.11	.00	.00	.00

Table 2 - Zone 2 bycatch of C. bairdi and red king crab

YR	DESIG	Zone	BAIRBC2	BAIR2H	BAIR2D	REDKBC2	REDK2H	REDK2D
95	P	2.00	4009.51	1540.12	-2469.39	139.86	.00	-139.86
95	S	2.00	622.95	834.89	211.95	.00	.00	.00

Table 3 - BSAI bycatch of C. bairdi and red king crab outside of Zones 1 and 2 and BSAI-wide bycatch of halibut

YR	DESIG	Zone	BAIRBC5	BAIR5H	BAIR5D	REDKBC5	REDK5H	REDK5D	HALMORT5	HAL5H	HAL5D
95	P	5.00	507.08	414.08	-93.00	.00	152.52	152.52	42.96	127.16	84.20
95	S	5.00	16.68	3.23	-13.44	.00	.00	.00	32.68	53.81	21.13

Table 4 - Gulf of Alaska bycatch of C. bairdi, red king crab and halibut

YR	DESIG	Zone	BAIRBC6	BAIR6H	BAIR6D	REDKBC6	REDK6H	REDK6D	HALMORT6	HAL6H	HAL6D
95	P	6.00	220.02	63.60	-156.78	.00	.10	.10	5.33	10.10	4.76
95	S	6.00	2.60	83.18	80.58	.00	.00	.00	.66	9.36	8.71

Table 5. Combined BSAI and GOA bycatch amounts of chinook, other salmon, herring, other tanner crab, and other king crab. Crab and salmon are in numbers of animals, herring and halibut bycatch are in metric tons.

YR	DES	CHINBC	CHINH	CHIND	OTHSBC	OTHSH	OTHSD	HERRBC	HERRH	HERRD	OTANBC	OTANH	OTAND	OTHKBC	OTHDH	OTHKD
95	P	622.23	971.93	349.70	14.86	170.86	156.00	1.50	.00	-1.50	16356.28	6640.47	-9715.81	106.44	92.02	-14.41
95	S	327.48	416.25	88.77	230.21	112.20	-118.01	.00	.00	.00	95.68	755.41	659.73	.00	.00	.00

Table 6. Actual bycatch, modelled bycatch and differences for all the prohibited species across all areas by processor type (desig).

YR	DES	HALMORT	HALH	HALD	BAIRBC	BAIRH	BAIRD	REDKBC	REDKH	REDKD	CHINBC	CHINH	CHIND	OTHSBC	OTHSH	OTHSD
95	P	48.29	137.26	88.97	12598.00	59052.51	46453.58	145.60	152.62	7.02	622.23	971.93	349.70	14.86	170.86	156.00
95	S	33.33	63.17	29.83	642.22	3804.42	3162.19	.00	.00	.00	327.48	416.25	88.77	230.21	112.20	-118.01

YR	DES	HERRBC	HERRH	HERRD	OTANBC	OTANH	OTAND	OTHKBC	OTHKH	OTHKD
95	P	1.50	.00	-1.50	16356.28	6640.47	-9715.81	106.44	92.02	-14.41
95	P	.00	.00	.00	95.68	755.41	659.73	.00	.00	.00

1995 YELLOWFIN SOLE EXERCISE

This page gives the actual groundfish catch, modelled catch and the differences by desig (S = shoreside or P = catcher/processor & motherships combined), groundfish species groups and type (D= discarded or R = retained).

This run uses a 20% increase in the Zone 1 bairdi cap (1.0 million to 1.2 million) and an equal decrease in the Zone 2 cap. This increase allows for 0.16 additional weeks of fishing.

YR	DESIG	SPECGRP	TYPE	TONS	TONSH	TONSD	VALUE	VALUEH	VALUED
95	P	AMCK	D	.	1.80	1.80	.00	.00	.00
95	P	ARTH	D	85.93	5.96	-79.97	.00	.00	.00
95	P	ARTH	R	.42	.	-.42	.	.	.
95	P	DEEP	D	6.74	.75	-5.99	.00	.00	.00
95	P	DEEP	R	32.03	.47	-31.56	78310.78	1140.39	-77170.4
95	P	FLOU	D	127.69	159.73	32.04	.00	.00	.00
95	P	FLOU	R	152.81	109.88	-42.93	113830.4	99221.73	-14608.6
95	P	GTRB	D	1.20	5.25	4.05	.00	.00	.00
95	P	GTRB	R	.10	.06	-.04	.	.	.
95	P	OTHR	D	70.18	33.85	-36.33	.00	.00	.00
95	P	OTHR	R	.32	8.02	7.70	25.17	631.74	606.57
95	P	PCOD	D	60.90	51.01	-9.89	.00	.00	.00
95	P	PCOD	R	61.28	115.13	53.85	44763.55	78710.63	33947.08
95	P	PLCK	D	127.09	137.96	10.87	.00	.00	.00
95	P	PLCK	R	28.51	101.31	72.80	8236.85	50663.51	42426.66
95	P	ROCK	D	15.33	6.80	-8.53	.00	.00	.00
95	P	ROCK	R	8.09	.01	-8.08	.	4.90	.
95	P	RSOL	D	80.28	47.91	-32.37	.00	.00	.00
95	P	RSOL	R	81.58	50.14	-31.44	22010.33	18594.03	-3416.31
95	P	SABL	D	.30	.	-.30	.00	.00	.00
95	P	SABL	R	3.78	.	-3.78	.	.	.
95	P	SHAL	D	2.34	.41	-1.93	.00	.00	.00
95	P	SHAL	R	.90	1.70	.79	1114.56	2093.78	979.22
95	P	YSOL	D	144.22	196.92	52.70	.00	.00	.00
95	P	YSOL	R	382.24	1308.15	925.91	193149.9	669610.5	476460.6
95	S	AMCK	D	.01	.34	.33	.00	.00	.00
95	S	FLOU	D	1.63	2.98	1.35	.00	.00	.00
95	S	FLOU	R	.30	21.98	21.68	.	.	.
95	S	GTRB	D	.09	.04	-.06	.00	.00	.00
95	S	OTHR	D	1.40	.92	-.49	.00	.00	.00
95	S	OTHR	R	.27	1.79	1.52	.	.	.
95	S	PCOD	D	2.29	4.00	1.70	.00	.00	.00
95	S	PCOD	R	58.45	48.54	-9.91	.	.	.
95	S	PLCK	D	16.59	13.23	-3.36	.00	.00	.00
95	S	PLCK	R	3.23	309.12	305.90	.	.	.
95	S	ROCK	D	.01	.00	.00	.00	.00	.00
95	S	RSOL	D	5.80	4.47	-1.34	.00	.00	.00
95	S	RSOL	R	4.52	1.99	-2.53	.	.	.
95	S	YSOL	D	.11	.82	.71	.00	.00	.00
95	S	YSOL	R	.03	173.29	173.26	.	.	.

The naming convention is as follows:
bairbc1 = actual bairdi Zone 1 bycatch
bair1h = modelled bairdi Zone 1 bycatch
baird1d = bair1h - bairbc1
redk = red king
halmort = halibut mortality
chin = chinook
oths = other salmon
herr = herring
otan = other tanner
othk = other king

The bairdi and red king numbers are in 3 pieces, Zone 1, Zone 2 and Zone 5 where Zone 5 is all BSAI less Zones 1 & 2. Therefore, the total bairdi catch in the BSAI would be bairbc1 + bairbc2 + bairbc5. The GOA bairdi catch is simply bairbc6. The halibut BSAI and GOA catch are halmort5 and halmort6 respectively. The chinook, other salmon, herring, other tanner and other king numbers and weights are not broken out by BSAI or GOA. Herring and halibut bycatch are in metric tons.

Table 1 - Zone 1 bycatch of C. bairdi and red king crab

YR	DESIG	Zone	BAIRBC1	BAIR1H	BAIR1D	REDKBC1	REDK1H	REDK1D
95	P	1.00	1290.19	16104.41	14814.22	.00	4.04	4.04
95	S	1.00	.00	1416.99	1416.99	.00	10.35	10.35

Table 2 - Zone 2 bycatch of C. bairdi and red king crab

YR	DESIG	Zone	BAIRBC2	BAIR2H	BAIR2D	REDKBC2	REDK2H	REDK2D
95	P	2.00	4228.55	4546.11	317.56	.00	13.10	13.10
95	S	2.00	36.00	285.02	249.02	.00	.00	.00

Table 3 - BSAI bycatch of C. bairdi and red king crab outside of Zones 1 and 2 and BSAI-wide bycatch of halibut

YR	DESIG	Zone	BAIRBC5	BAIR5H	BAIR5D	REDKBC5	REDK5H	REDK5D	HALMORT5	HAL5H	HAL5D
95	P	5.00	.00	.09	.09	.00	.00	.00	18.86	8.36	-10.49
95	S	5.00	.00	2.16	2.16	.00	.00	.00	1.35	1.27	-.08

Table 4 - Gulf of Alaska bycatch of C. bairdi, red king crab and halibut

YR	DESIG	Zone	BAIRBC6	BAIR6H	BAIR6D	REDKBC6	REDK6H	REDK6D	HALMORT6	HAL6H	HAL6D
95	P	6.00	.00	.08	.08	.00	.00	.00	4.60	.23	-4.37
95	S	6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Table 5. Combined BSAI and GOA bycatch amounts of chinook, other salmon, herring, other tanner crab, and other king crab. Crab and salmon are in numbers of animals, herring and halibut bycatch are in metric tons.

YR	DES	CHINBC	CHINH	CHIND	OTHSBC	OTHSH	OTHSD	HERRBC	HERRH	HERRD	OTANBC	OTANH	OTAND	OTHKBC	OTHDH	OTHKD
95	P	27.39	46.54	19.15	.00	.00	.00	.00	.05	.05	5144.71	2052.43	-3092.28	46.97	105.55	58.59
95	S	1.89	7.26	5.37	.95	8.65	7.70	.00	.00	.00	8.53	107.47	98.95	.00	4.07	4.07

Table 6. Actual bycatch, modelled bycatch and differences for all the prohibited species across all areas by processor type (desig).

YR	DES	HALMORT	HALH	HALD	BAIRBC	BAIRH	BAIRD	REDKBC	REDKH	REDKD	CHINBC	CHINH	CHIND	OTHSBC	OTHSH	OTHSD
95	P	23.46	8.60	-14.86	5518.74	20650.70	15131.88	.00	17.14	17.14	27.39	46.54	19.15	.00	.00	.00
95	S	1.35	1.27	-.08	36.00	1704.17	1668.17	.00	10.35	10.35	1.89	7.26	5.37	.95	8.65	7.70

YR	DES	HERRBC	HERRH	HERRD	OTANBC	OTANH	OTAND	OTHKBC	OTHKH	OTHKD
95	P	.00	.05	.05	5144.71	2052.43	-3092.28	46.97	105.55	58.59
95	S	.00	.00	.00	8.53	107.47	98.95	.00	4.07	4.07

D-4(d)

ALASKA MARINE CONSERVATION COUNCIL

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September 21, 1995

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

Dear Rick,

After reviewing the draft Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis for alternative trawl area closures to protect red king crab in Bristol Bay, the Alaska Marine Conservation Council has the following comments.

The initial emergency rule put in place last year served well to significantly reduce the observed red king crab bycatch taken by the rock sole fleet to approximately 10% of that of the previous year's. While the goal of reduced counts of red king crab warrants merit, we cannot rely merely on what is actually caught in a trawl net to truly indicate the total level of effects on red king crab stocks. In the 1995 Stock Assessment and Fishery Evaluation (SAFE) document chapter on Ecosystem Considerations, it has been suggested that crab habitat may be adversely affected by trawl gear: "If critical habitat is impacted by trawling and (scallop) dredging, crab settlement and survival could be reduced, thereby lowering recruitment". Even though the trawl net may select older aged, larger crab in what it actually collects, early stages of the king crab's life cycle may seriously disrupted in ways we are not accounting for. Juvenile red king crab depend on certain benthic fauna for their survival. Destruction of the benthic community by trawl doors, roller gear, and a heavy cod-end may all contribute to a level of crab mortality not reflected in the bycatch figures. The Bristol Bay red king crab season was again cancelled in 1995 due to insufficient number of females.

Through ripple effects asserted by industry, the red king crab closure in effect for 1995 may actually contribute to higher takes of other PSC species such as bairdi tanner crab and halibut. ADF&G's latest assessment show that Bering Sea bairdi tanner and opilio numbers are down again this year. No doubt there are environmental factors influencing these numbers, but we must recognize that our fishing practices could be a significant factor in the level of habitat disruption and destruction exacerbating these declines. It's true that when we narrowly focus on one species at a time instead of considering the whole, we may help one element while harming another. While we can look to this closure as having a huge degree of success for red king crab, we need to also consider other bycatch. With dwindling numbers for both bairdi tanner and opilio crab, consideration must be given to ways which will minimize any negative impacts to these populations as we conduct our fisheries.

We support alternative 7 of the EA/RIR for red king crab protection. It covers the greatest area and would provide the maximum protection to juvenile and adult king crab. It would also serve to protect habitat for other species of crab which may be present. We strongly endorse the most comprehensive approaches to all bycatch reduction. At the very minimum, we believe that alternative 3 which came into effect as an emergency rule and did most successfully serve to lower the amount of red king crab bycatch, must be made permanent to promote the recovery of red king crab stocks.

It's time to carefully weigh in the importance of habitat integrity and longterm sustainability for the many components of the marine ecosystem. If we are to truly exercise precautionary management in the face of uncertainties, we must consider not only today's "bottom line", but those conditions that will serve to provide not only for future revenues, but for future generations.

Sincerely,

Fran Bennis
Field Coordinator

UCB D-4d

Elements of the Proposed RKC Protection Action Relating to Seasonality in the YFS Fishery

1. Industry agrees to continue to administer a SeaState style bycatch control program for YFS.
- *industry action*

2. The eastern half of the proposed trawl closure area (between 162 - 163, area 516) remains closed between March 15 and June 15 under the status quo mating/molting closure.
- *status quo, no required action*

3. Seasonally apportion the Zone 1 Bairdi and RKC caps for YFS in December, such that they are not released until April 1st to provide for optimal utlization of those caps when YFS CPUEs are highest in Zone 1.
- *December Spec process*

4. Reduce the VIP standard from 2.5 RKC/MT to 1 RKC/MT for the YFS fishery.
- *Set by council at this meeting in Specs*

5. Set a trigger mechanism of 20,000 RKC (ie: 40% of the YFS RKC cap of 50,000), which if attained after the opening of Zone 1 for YFS, would result in a closure of the full area between 56 and 57 and between 162 and 164 for the remainder of the year to bottom trawl.
- *Do as part of the Plan Amendment at this meeting*

6. Undertake analysis of reopening the area north of the old pot sanctuary boundry east of 163 to YFS fishing.
- *Initiate consideration*

Proposed SE Trawl Closure - DRAFT

This proposal is the latest move in a series of attempts to exclude the trawl fleet from the Eastern Gulf of Alaska. The previous attempt in 1992 produced an analysis that did not support a closure. This action was therefore rejected by the Council in 1992.
Now that the longline fleet has sablefish ITQs, they would like to acquire the 5% trawl sablefish allocation, which would increase the overall quota share pool by approximately $1.5 million with very little effort on their part.

The threat of trawl preemption of the longline fleet is overstated. The trawl activity in SE has continued to decreased since the original analysis of Amendment 26 in 1992. This is due to in part to the current decrease in target fisheries in the Eastern Gulf. The POP rebuilding plan has decreased the TAC available to directed fishing until the stock is rebuilt. The Council has set the TAC for slope rockfish artificially low for the last two years in an effort to keep the trawl fleet out of the Eastern Gulf.

There is no question of preemption in the target fisheries between trawl and longline gear. The trawl fleet targets POP, pelagic rockfish, and pollock in the Eastern Gulf. None of these species can be commercially fished with longline gear.

These trawl fisheries are not "inconsequential", as Larry Cotter puts it, but quite important in distributing the temporal and spatial trawl effort into fisheries that are of a manageable size for NMFS. The vessels that have historically participated in the Eastern Gulf consider these species and fisheries to have enough value that they chose to fish them rather than fish in other fisheries and rather than tying up to the dock.

The EA/RIR does not adequately deal with the issue of the estimated value of catch and the possible foregone revenues if closed to trawling. Future foregone revenues should include potential increase in POP stocks as well as increased value from rockfish fillet products which are not part of the 1994 estimated values due to lack of directed fisheries in that area in 1994. We believe that the estimated values and foregone revenues are significantly understated in the analysis. The EA/RIR itself states "*it is difficult to predict the economic impacts of a fixed gear only designation in terms of foregone catch to the trawlers" (page 52).*

Although Larry Cotter's report on the Eastern Gulf claims that in 1991 SR/RE and thorny heads were declared prohibited species during the first quarter due to trawl bycatch, he provides no information on the bycatch and discard of these species by longliners. There is no discussion of how the longliners have preempted the trawlers on several occasions in the Gulf of Alaska with their high thornyhead bycatch. Since thornyhead is managed Gulf-wide, when the longliners bycaught thornyhead in amounts that caused the TAC to be exceeded in 1993, the 4th quarter rockfish opening for the trawl fleet was canceled by these thornyhead overfishing concerns. The risk that a similar closure will occur again is significant in view of the sablefish/halibut IFQ regulations which require that all longline Sablefish/Halibut vessels retain their thornyhead rockfish when it is not on prohibited status.

The discard and waste issue has not been adequately dealt with in the EA/RIR. There has been no analysis of regulatory discard (when retention of a species is prohibited or limited by NMFS). Due to lack of observer data from the longline fleet, it is not possible to compare the discard rates of the longline fleet with the discard rates of the trawl fleet. In fact, by excluding the trawl fleet, NMFS and the industry stand to lose what little observer coverage and biological data is currently available from this area. The trawl vessels in question have 100% coverage, while 95 % of the longline fleet in SE is under 60 feet and has 0% coverage.

The concern over benthic habitat and coral destruction was unsubstantiated in the 1992 EA/RIR and no further information or analysis was done for the current EA/RIR. Trawl gear has little or no marine mammal interaction and was reclassified in 1992 to not require a Marine Mammal Exemption Permit. The longline sablefish fleet continues to have interactions with marine mammals and NMFS continues to require those vessels to have a Marine Mammal Exemption Permit. There is no documentary evidence to verify that trawl gear has a negative impact on sea birds.

The only new data supporting the SE trawl closure contained in the current EA/RIR are catch and estimated value data for 1992 to 1994. There are no other new data since the 1992 analysis of the SE trawl closure. Even the SSC considered that the EA/RIR insufficient to justify a closure and was in favor of separating out this issue from license limitation so that more time could be spent producing an appropriate analysis.

There are a number of alternative management measures that could be instituted to more efficiently and fairly deal with those potential problems rather than a complete trawl closure. Indeed, NMFS has been fine tuning such measures for the last few years and the longline fleet prosecuted their fisheries in relative security during 1994 due to the success of such measures as returning redbanded rockfish from the demersal category to the slope category where it had been originally. Daily reporting, setting TACs sufficiently below overfishing, and directed fishing standards all help to maintain sufficient balance between the two gears in SE. Alternatively, the trawl fleet might agree to a no-trawl area east of 137 degrees rather than east of 140 degrees.

David Benson
Dir. Govt. Affairs
Tyson Seafood Group

F/V ZOLOTOI

DATE: September 28, 1995

TO: Mr. Richard Lauber, Chairman
North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, AK 99501

FROM: Gordon Blue, managing partner
F/V Zolotoi
F/V Ocean Cape

RE: AGENDA ITEM D-4(d) FINAL REVIEW OF CRAB PROTECTION CLOSED AREA. THE NEED FOR TIME AND AREA CLOSURES IN THE GROUNDFISH FISHERIES TO PROTECT KING AND TANNER CRAB STOCKS.

SUMMARY:
Russian red king crab stocks have remained in a highly productive state for decades, while U.S. stocks have risen and declined dramatically. To accomplish this, Russian fishery managers have used the following: Gear restrictions in the directed fishery; prohibited retention of females; minimum size limits for males; protection by time/area closure of molting stocks; reproductive area sanctuaries and large areas where trawling is banned.

DISCUSSION:
The fishery for Red King Crab *(Paralithodes camtschatica)* along the West Kamchatka Shelf (in the Sea of Okhotsk, Russian Republic) has compiled a record of sustained high levels of harvest for decades. This production has been the envy of American industry in an interval that has seen our stocks peak and plummet to a depressed state that has closed the directed fishery for three of the past twelve years. **(See Tables 1, 2 and 3, following.)**

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Table 1:
Historic US King Crab Catch (from NMFS publications; see my Letter to the North Pacific Fishery Management Council, Oct. 19, 1994)

	YEAR	CATCH (THOUSANDS OF POUNDS)
STOCKS/NURSERIES PROTECTED	1975	51,326.2
	1976	63,919.7
	1977	69,967.8
	1978	87,618.3
	1979	107,828.0
	1980	129,948.5
TRAWL CLOSURE LIFTED	1981	33,591.4
	1982	3,001.2
	1983	CLOSED
	1984	4,182.4
	1985	4,174.9
AMENDMENT 10	1986	11,393.9
	1987	12,289.1
	1988	7,387.8
	1989	10,264.8
	1990	20,362.3
	1991	17,177.9
	1992	8,043.0
	1993	14,600.0
	1994	CLOSED
	1995	CLOSED

Tables 2 & 3:
Historic USSR / Russia King Crab Catch off West Kamchatka.

Year	Catch (millions of ind.)			Year	Catch (millions of ind.)		
	USSR	Japan	Total		USSR	Japan	Total
1924	-	4.8	4.8	1954	15.5	0.5	16.0
1925	-	10.0	10.0	1955	18.5	5.0	23.5
1926	-	19.0	19.0	1956	19.3	9.5	28.8
1927	-	29.4	29.4	1957	19.3	10.2	29.5
1928	<1	29.6	29.6	1958	16.5	10.0	26.5
1929	<1	32.4	32.4	1959	16.6	9.1	25.7
1930	6.1	25.1	31.2	1960	15.6	8.7	24.3
1931	4.4	21.1	25.5	1961	14.5	8.9	23.4
1932	4.9	14.1	19.0	1962	16.2	8.4	24.6
1933	3.9	10.2	14.1	1963	16.5	8.4	24.9
1934	4.2	12.1	16.3	1964	21.6	4.0	25.6
1935	6.4	14.9	21.3	1965	21.6	6.9	28.5
1936	7.1	20.0	27.1	1966	23.4	4.9	28.3
1937	8.5	24.2	30.7	1967	20.7	6.3	27.0
1938	8.0	24.7	32.7	1968	19.1	7.6	26.7
1939	7.6	19.7	27.3	1969	16.8	7.3	24.1
1940	5.6	13.9	19.5	1970	14.2	6.2	20.4
1941	6.7	1.5	8.2	1971	13.5	3.9	17.4
1942	3.3	6.2	9.5	1972	10.8	3.5	14.3
1943	0.6	2.4	3.0	1973	11.0	2.4	13.4
1944	0.4	0.8	1.2	1974	13.3	1.2	14.5
1945	0.1	0.7	0.8	1975	9.8	-	9.8
1946	1.8	<1	1.8	1976	11.5	-	11.5
1947	2.7	0.2	2.9	1977	7.3	-	7.3
1948	5.8	0.1	5.9	1978	7.0	-	7.0
1949	8.9	0.2	9.1	1979	8.0	-	8.0
1950	10.2	0.1	10.3	1980	8.2	-	8.2
1951	12.2	0.2	12.4	1981	9.0	-	9.0
1952	12.5	0.3	12.8	1982	8.0	-	8.0
1953	11.4	0.3	11.7	1983	10.5	-	10.5

Year	Commerc stock (millions of ind.)	Forecast		Catch		Mean weight (kg)
		million ind.	thou. tons	million ind.	thou. tons	
1970				14.2	21.3	1.50
1971		15.5	25.0	13.5	21.7	1.61
1972		12.0	18.0	10.8	16.2	1.5
1973		14.0	21.0	11.0	16.5	1.5
1974		14.5	21.5	13.3	16.4	1.48/1.23
1975		9.0	11.0	9.8	13.0	1.22/1.32
1976		9.0	11.0	11.5	17.0	1.22/1.48
1977		9.0	13.5	7.3	15.0	1.50/2.05
1978	35.9	6.0	9.0	7.0	16.0	1.50/2.28
1979	44.1	6-7	12-14	8.0	15.2	2.0/1.9
1980	35.9	7.5	15.0	8.2	15.9	2.0/1.9
1981	44.1	8.0	16.0	9.0	16.6	2.0/1.96
1982	44.1	8.0	16.0	8.0	22.6*	2.0
1983	44.1	8.5	16-17	10.5	21.0	2.0
1984	34.1	11.0	20.0		30.46*	1.82
1985	37.2	12.0	23.0		32.72*	1.91
1986	37.2	12.0	23.1		28.2	1.92
1987	43.4	14.0	27.0		29.1	1.93
1988	41.5	13.4	30.0		30.2	2.24
1989	31.0	10.0	22.5		24.7	2.25
1990	31.0	9.8	22.0		25.0	2.25
1991	38.7	12.5	28.3		28.3	2.25
1992	43.7	14.1	31.7		38.8*	2.25
1993	43.7	14.1	31.7			2.25
1994	42.5	13.7	31.0			2.25

Note: * from Statistical Yearbook of FAO for Area 61 "North West Pacific".

Chekunova V.I. [Чекунова В.И.], 1974. Численность камчатского краба. Труды ВНИРО, т.49, с.38-45.

Shuntov V.P. [Шунтов В.П.], 1985. Биологические ресурсы Охотского моря. М, Изд-во "Агропромиздат", 224 с.

There are indications that the available catch figures may be underreported: Russian officials complained to me that prior to 1975, the Japanese directed harvest of Red King Crab was greatly underreported. Japanese market sources have reported a growing supply of product from the Russian zone since 1992. These sources also have reported that the average size crab section they see has diminished, from 1.2 kg. to 630 grams, indicating the fishery may be showing stress under a higher rate of exploitation. Domestic processors report that Japanese buyers have refused American product because of this saturation.

A number of domestic vessels have left our fishery and reflagged in order to take part in the Kamchatka fishery. Those that remain in the domestic fleet have had small comfort awaiting the recovery of Bristol Bay stocks: The trend of population data continues to remain low, while the paucity of knowledge about dynamics of the ecosystem indicates few clear directions for recovery of the stocks. (See: Preliminary Results of the 1995 Eastern Bering Sea Crab Survey, NMFS, Kodiak) While we have debated the relative importance of predation, climate change and fishing methods in contributing to this crisis, stocks remain low.

It may be, that the long series of years of high yields reported from the Kamchatka area are no accident - that there may be some knowledge of the resource that is critical to the success of the Russian management regime, and is not held by the U.S. The population dynamics and distributional structure of the red king crab populations of both the West Kamchatka area and the Bristol Bay area were examined in a paper presented at Anchorage in 1989. **SEE FIGURE 1.** (Rodin, V.E., Population Biology of the King Crab *Paralithodes camtschatica* Tilesius in the North Pacific Ocean, Proceedings of the International Symposium on King and Tanner Crabs, AK-SG-90-04, November 28 - 30, 1989, Anchorage, AK, pp.137-9.) The implication that management regimes were tied to this distributional structure was drawn, and scientists involved in study and management of the U.S. fishery, at NMFS and ADF&G and UW, have said that their colleagues from Russia have not been completely forthcoming in these matters.

Another course of action was initiated. It is likely that whatever is perceived to be of primary importance in management of a fishery will be embedded in the regulations promulgated to effect the management of the fishery. Therefore we began enquiries for a researcher to look at Soviet/Russian fishing law. In December, 1994, a contact in Moscow provisionally agreed to provide a survey of Russian fishery regulations. The materials quoted were "... no longer secret, but not officially released." One difference between the US and Russia is in numbers of attorneys. Another is in attitudes concerning the merits of publicity. A key condition of the agreement made with our contact was the condition of anonymity. Therefore, citations in this report are made directly to the applicable code, without credit to the individual that performed the research, but with gratitude for the information thus revealed.

Used as the basic document for the regulation was the International Geneva Convention on Continental Shelf (1958) ratified by the USSR Supreme Soviet Council on October 20, 1960. The UN convention on Marine Law confirmed the institution of 200 mile exclusive economic zones introduced by coastal states in 1976 to 1978. Since then, the USSR/Russia has been exercising sovereignty in the research and exploitation of crab resource within the 200 mile zone adjoining to the Russian coastline.

During the period of Japanese red king crab fishing activities off Kamchatka coast, regulation had to be performed on a negotiated basis... For example, at the SJFC 12th Session an agreement was achieved that since April till[sic] August both parties would not fish flatfish deeper than 100 m and further to the north than 56° N. Earlier, some other regulation measures were agreed upon (minimum legal size of 13 cm and a ban on fishing females).

Deep concern for the state of the stock and hazards involved in trawl fisheries of fish resulted in the 1962 creation of the Northern Closed Area where any fishing activities were prohibited. This area is still active. A Southern Closed Area was also established for a short period of time. Its boundaries coincided with Ozernovskiy fishing area. Later on, when Japanese crab fishing activities near Kamchatka were terminated regulation was performed indepently by the USSR/Russia.

According to the Russian law, natural water resources are held in federal ownership. Therefore, fisheries regulation, including crab fisheries, is effected by the State Fisheries Committee (Roskomrybolovstvo), *the former Fisheries Ministry abbreviated as* Minrybkhoz.

Roskomrybolovstvo *is authorized to regulate the following areas:*
(1) Allocation of quotas;
(2) The development and adoption of Fisheries Regulation and control over its observance.

(1) Quotas are allocated in accordance with the ... Forecast of Commercial Fish, Seaweed, Shellfish and Marine Mammal Catches in Seas and Fresh Water Reservoirs of the Russian Federation...

.....
.....

(2) The development of Fisheries Regulation is carried out on the basis of proposals put forward by fisheries research institutes and with due attention to opinions voiced by other organizations involved (including fishing enterprises). Regulation can be amended only in case a biological validation of such change is supplied. Such a validation has to be approved by the Scientific Board of VNIRO. It

is only after this procedure takes place that any amendment or addition[sic] are included in the Regulation...

Given below are regulation measures that are relevant to red king crab fisheries at West Kamchatka coast and are active at present (as for May 1995). These rules were approved in the USSR Fisheries Ministry Regulation No 458 dated November 17, 1989 (enumerated below are the most significant restrictions and bans):

Article 7.6. ...shelf items [including the red king crab] shall only be used for food producing purposes...

Article 12. It shall be prohibited:

.....

.....

Article 12.7. Red king crab fisheries using any other fishing gears except pots.

Article 13. On the territory of the USSR [now Russia] it shall be prohibited:

.....

.....

Article 13.2. Commercial fisheries:

.....

.....

...of red king crab during the period of mass scale molt. Time of prohibition for each species shall be established for each species by research organization on site.

Article 14. In the USSR zone, the fisheries shall be banned:

Article 14.1. Of fish resource in West Kamchatka region:

- in the area between 57° N and 58° N using trawling fishing gears at the depth of 200 m and less except for a fishing area between 57° 04' N and 57° 14' N, between 56° 20' N and 57° 00 N using any fishing gears except longlines at the depth of 300 m and less;
- using trawls and bottom nets in the area between 54° N and 56° 20' N at the depth of 400 m and less, except for areas between 54° N and 54° 10' N and 55° 15' N and 55° 30' N.

Article 14.2. Directed pollock fisheries using trawls off the West Kamchatka coast in the area of Lopatka Cape latitude to 54° N at the depth of 100 m and less;

Article 14.3. Of pollock off the Western Kamchatka coastline to the North of 57° N during the period from May 15 to October 30, to the south of 54° N during the period from May 15 to December 31.

Article 15. On the USSR territory, it shall be forbidden to carry out fisheries, commissioning, landing, processing, storage and trading fisheries items whose length, while fresh, is shorter than as specified below 9the minimum

allowable commercial size):

.....

.....

red king crab (except for Ayano-Shantarsky area of the Sea of Okhotsk where 13 cm legal size is permitted)

.....

15 cm

Article 15.2 In fisheries using trawls and other fishing gears incidental catch of crab shall be allowable not exceeding 2% by weight of the allowed species catched.[sic] In directed crab fisheries, sublegal and incidental catch shall be allowable within 0.2% of daily catch.

Article 15.3. Crabs shall be measured by maximum carapace widths.

Areas with varying fisheries restrictions off West Kamchatka coast (as for May 1995) are represented in [SEE FIGURE 2].

.....

To conclude... regulation measures take account of scientific recommendations and are directed at the protection of female crabs (Article 15.2) and sublegal males (Article 15) as well as molting crabs (Article 13.2) and reproduction areas against any fisheries activities. At the same time they tend to protect crab fishing areas against trawling (Article 14.1-3) and against fisheries techniques that are hazardous for the king red[sic] crab.

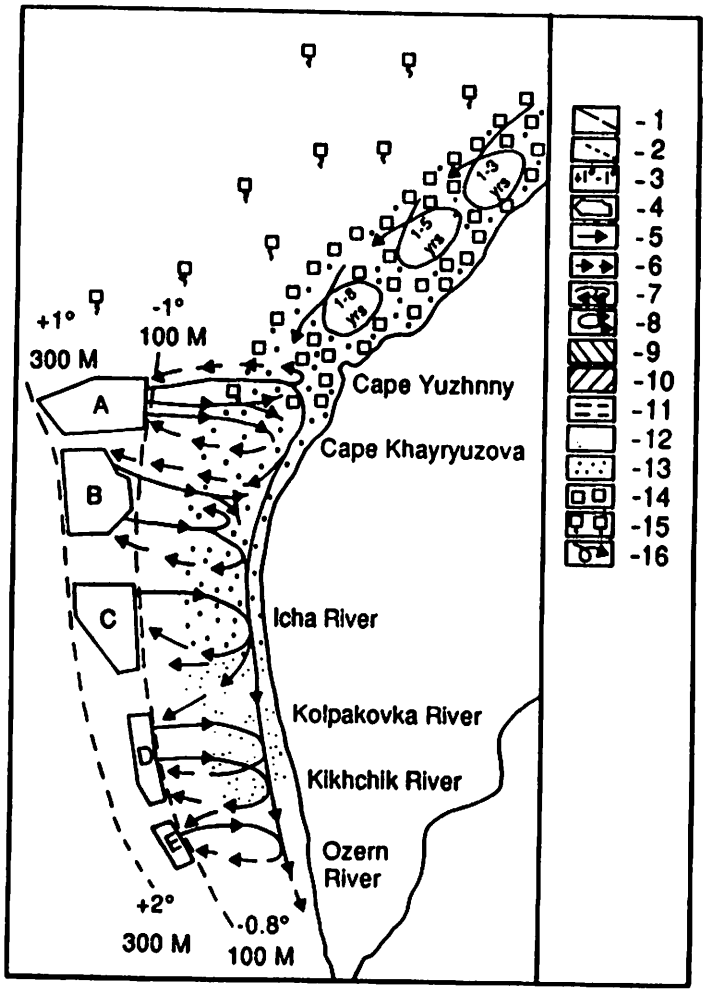

Diagram of the distributional structure of the West Kamchatka red king crab population. 1. isobaths, 2. currents, 3. bottom water temperature in the overwintering area, 4. overwintering area of subpopulations: A and B - Khayryuzovskiy independent; C - Ichinskiy semi-independent; D - Kolpakovskiy and Kikhchiskiy dependent; E - Ozernovskiy pseudopopulation; 5. spring spawning migration, 6. fall migration to the winter habitat, 7. migrational links between subpopulations, 8. individual pods of adult males, 9. summer distribution of adult males (frequency of 1-23 individuals per catch), 10. egg bearing females, 11. undersize males, 12. pelagic larvae rarely seen, 13. concentrations of zoea stages I and II, 14. drift and concentrations of zoea III and IV, 15. larval settlement zone, 16. migration of juveniles of age 1-8

Figures 1 & 2
The Distributional Structure of West Kamchatka Red King Crab populations and the corresponding Russian regulatory closure areas (see Rodin, V.E., Population Biology of the King Crab *Paralithodes camtschatica* Tilesius in the North Pacific Ocean, Proceedings of the International Symposium on King and Tanner Crabs, Anchorage, Alaska, 1989, p137.)

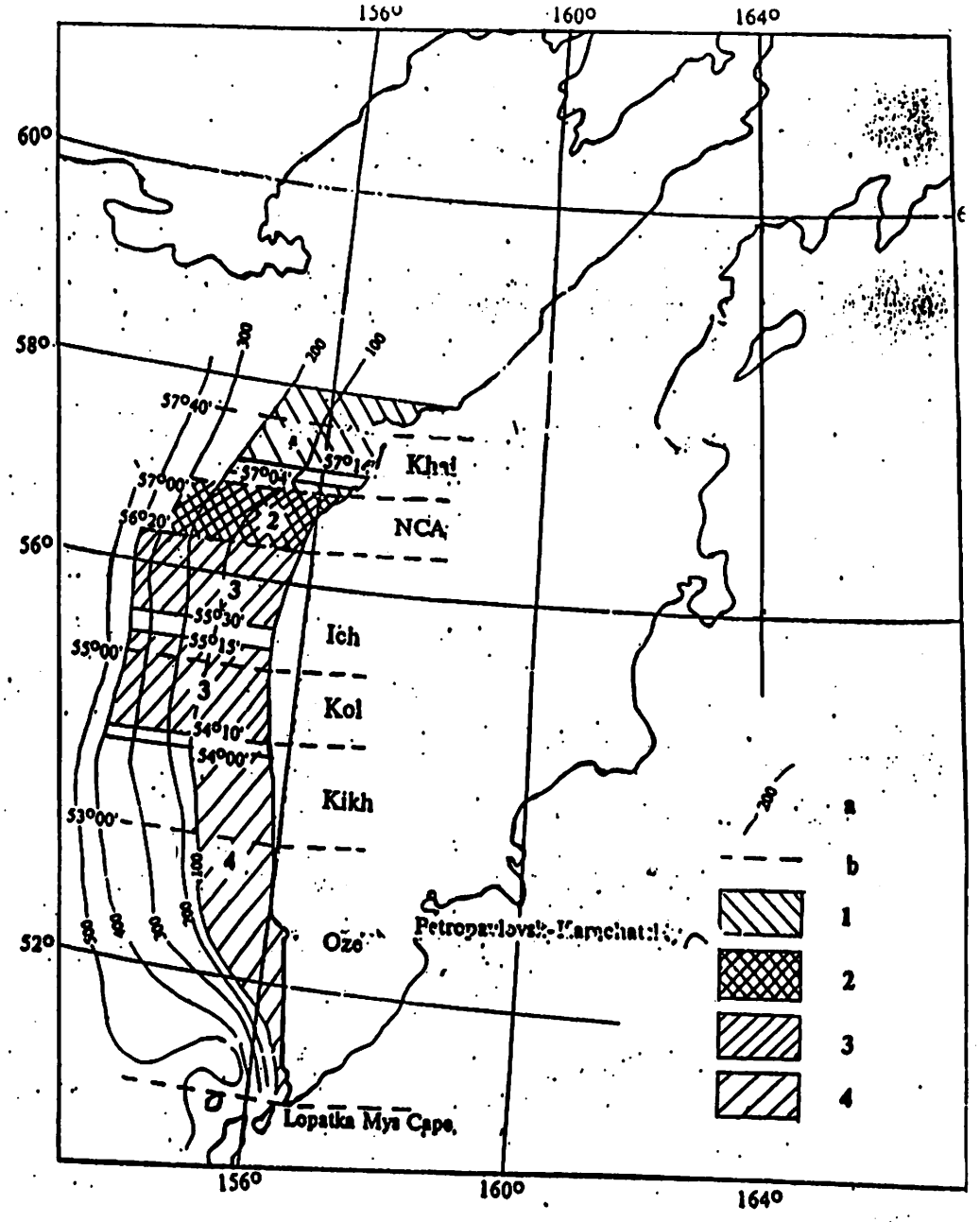

Fig. Fishery restrictions in the areas of the red king crab harvesting off West Kamchatka (as for May, 1995).

a, depth contours (m): b, borders of fishing areas: Khal, Khalryuzovskiy; NCA, Northern closed area; Ich, Ichinskiy; Kol, Kolpakovskiy; Kikh, Kikhchinskiy; Oze, Ozernovskiy.

1, prohibition on trawl gears for fish harvesting at <200 m deep; 2, prohibition on all kinds of fisheries excluding long lines at the depths of <300 m; 3, prohibition on harvesting of fishes by trawls and nets at the depth of <400 m; 4, prohibition on directed fishery for pollock by trawl gears at the depth of <100 m

D-4d

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HALIBUT • SABLEFISH • PACIFIC COD • CRAB

September 23, 1995

RED KING CRAB CONSERVATION AND BERING SEA TRAWL CLOSURE AREA

The Kodiak Vessel Owners' Association represents fixed gear fishermen involved in the crab and groundfish fisheries in the North Pacific, the Gulf of Alaska, and the Bering Sea/Aleutian Islands. In our efforts to promote conservation efforts in the crab and groundfish fisheries, we prefer and support Alternative 7 - a closure restricting trawl activities from 58° North latitude to 55° 45' North latitude and bounded by 162° and 164° West longitude. This alternative represents the most conservative effect on red king crab bycatch, habitat and spawning area.

Conservation or Bycatch?

Unfortunately, the focus of discussion regarding the proposed Bristol Bay trawl closure has become myopic, degenerating into yet another bycatch argument. A trawl closure represents a great deal more than a reduction in bycaught king crab in Bristol Bay. This is a very real and imminent conservation issue.

To maintain that the only impacts on king crab are those measurable as large, bycaught animals is naive. To argue that the impact of trawl gear on crab habitat is not relevant to this issue, simply because it is not quantifiable or directly observed, would be absurd. To persist in the belief that crab which "pass through trawl mesh" are somehow magically immune to any impact by this interaction is aggravating.

Although reduction of king crab bycatch is an admirable goal, it is only one of several conservation concerns associated with the proposed trawl closure. The EA/RIR/IRFA fails to address:

- Lack of a directed commercial fishery for Bristol Bay red king crab
- Relationship between trawl fisheries and the decline of king crab stocks
- Impacts of trawl activity on breeding behavior, season and molting of king crab
- Unobserved effects of trawl activity on non-retained crab
- Impacts of trawl activity on king crab habitat

The reality is that red king crab stocks in Bristol Bay are in decline to such an extent that there will be no directed commercial fishery for the second consecutive year. Additionally, due to the closure of the red king crab fishery the c. bairdi fishery will be restricted from accessing the entire

area east of 163° W. It is completely unjustifiable to limit directed fishing efforts for crab in Bristol Bay so restrictively, while allowing trawl activities to continue in all (Alt.1) or the majority (Alt.2-3) of this area.

Benefits to the Nation

If the net benefit to the Nation (Table 8) is considered relative to bycatch savings of king crab, Alternative 7 achieves the greatest benefit with only a slight decrease to the net benefit to the Nation (1.2% - 2.6%) and an incredible king crab bycatch reduction of 87% from status quo. Considering that the "Total Net minus Bycatch Net" column of this table fails to note the lack of the directed red king crab fishery in deriving the dollar value, the $61.9 million dollar (average 1990-1993, ADF&G) might improve the net benefit to the Nation if stocks are allowed to rebuild. Though tanner crab bycatch increases under any of the alternatives other than status quo, only incremental differences (1.4% - 3.3%) exist between Alternatives 3/4 and 6/7 in both 1993 and 1994 data sets.

Rock Sole Fishery Closures

Utilizing the 1993 data set (table 9) Alternatives 4 and 7 do not affect a closure on the rock sole fishery. The 1994 data set (table 10) reveals fishing would continue until week 10 under either Alternative 4 or 7. Assuming the PSC cap on red king crab had been enforced in 1994, alternatives 4 and 7 would represent an increase of 3 weeks fishing time over actual PSC cap attainment taking the fishery well past the third week in February, at which point rock sole roe is perceived to decline in quality. Therefore, it seems that the rock sole fishery would benefit from such restrictions as represented by Alternatives 4 and 7 by extending fishing time.

Bottom Trawl Pollock

In 1994 nearly 85% of the observed bycatch in the bottom trawl pollock fishery occurred in Zone 1. Of that 85%, more than 81% occurred in the area represented by Alternative 4, an increase of more than 11% from Alternative 3. It is important to protect the area from 55° 45' N to 56° N from the efforts of the bottom trawl pollock fishery.

The Ice Edge

The need to extend the trawl closure area to a northern boundary of 58° North is relative to the ice edge and how far south it extends. Little effort is evidenced in the area represented by 57° N to 58° N because typically the ice edge extends far enough south to protect that area from trawl effort. However, in years when the ice edge is not restricting access to this area king crab observed bycatch rates increased by as much as 68% (Table 4), with an increase of almost 17% over Alternative 4. During 1994 all of the observed king crab bycatch for the yellowfin sole fishery was taken in Zone 1. Assuming that the ice edge will continually defend this area from trawling effort is inadvisable.

From the Beach

Often the data, graphs, tables, analysis and discussions associated with Council action can become quite cumbersome and confusing. Often fishermen only see a handful of numbers, or from the beach, a fleet of boats fishing where their boat once fished. To a crab fisherman on the beach, the bycatch of red king crab in the rock sole fishery in 1994 represents approximately 24%

of the 900,000 crab below threshold which resulted in a closed fishery last year. To this same fisherman, the potential "domino effect" on other same-gear fisheries is an envious dilemma, switching effort to another directed fishery an option not available to him.

Conclusion

In deciding which alternative is most appropriate, the Council has a rare opportunity to make incredible advances in conservation efforts. Enactment of Alternative 7 will be a strong statement advocating conservation in all North Pacific fisheries.

ALASKA CRAB COALITION

3901 Leary Way (Bldg.) N.W., Suite #6 • Seattle, WA 98107 • (206) 547-7560 • FAX (206) 547-0130

DATE: October 2, 1995

TO: Rick Lauber, Chairman
North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, Alaska 99510

FROM: Arni Thomson, Executive Director
Alaska Crab Coalition

RE: AGENDA ITEM D-4(d), FINAL REVIEW OF BRISTOL BAY RED KING CRAB PROTECTION AREA

ACC RECOMMENDATION:
The ACC supports the adoption of Alternative 3, implementation of a permanent rule that is identical to the emergency rule adopted in 1995. This rule would close the area from 56 N latitude to 57 N latitude and from 162 W longitude to 164 W longitude to bottom trawling year round. This rule would allow for mid water trawling in the protection area provided there is 100% observer coverage.

In addition, ACC recommends 100% observer coverage in the yellowfin sole fishery in the Zone 1 area, a condition of the emergency rule in 1995.

NPFMC CRAB PLAN TEAM RECOMMENDATION:
The Team concluded that an area closure will reduce king crab bycatch. The emergency rule did reduce king crab bycatch (from 216,000 king crabs in 1994 to 19,000 king crabs in 1995). The EA/RIR projects bycatch reductions in all alternatives to the status quo.

The recommendation for a year-round closure is supported by the NPMFC Crab Plan Team for conservation reasons related to unobserved gear contact to non retained crabs and concern for disruption of crab habitat. Additonal conservation concerns include estimated removals from the mature crab stock range from .75% to 1.5% of the mature crab stock each year, in addition to natural mortality that removes 25% of the stock each year. The Bristol Bay red king crab stock is depressed and stable. A seasonal closure will not protect king crab during the spring mating and molting period.

DISCUSSION:

1. In making these recommendations, the ACC wishes to remind the NPFMC that for the second year in a row, the Bering Sea crab fleet has essentially been allowed no withdrawals of king crab in the Bristol Bay area for conservation. In addition, the Board of Fisheries took action in 1993 that disallows bairdi fishing east of 163 W longitude. Last year this resulted in the fleet foregoing $30 million in revenue from the bairdi fishery as a condition to protect king crab from handling mortality.

2. The Crab Plan Team recommendations relative to crab habitat disruption and impacts to larval settlement areas are supported by the scientific investigations of Dr. David Armstrong et al. 1993 as referenced in the EA/RIR, page 5. There are additional references to habitat concerns referenced in David Witherell and Gretchen Harrington's discussion paper prepared for the NPFMC, September 14, 1995.

3. Industry concerns about the overriding impacts of groundfish, and in particular yellowfin sole predation on king crab stocks and the need to harvest those stocks to encourage crab rebuilding is not supported in the EA/RIR. Note page 5; Jewett and Onuf 1988; Haflinger and McRoy 1983; Livingston 1989. The general conclusions based on the little information that is available indicate that predation is insignificant and not responsible for observed declines from 1981 to 1985.

Yellowfin sole stocks are in abundance in several areas in the Eastern Bering Sea, it does not seem necessary to harvest them in areas of high crab abundance. Area 514, north of 58 N latitude is an area of high abundance of yellowfin sole, with few concentrations of crab or halibut.

4. The Bering Sea simulation model estimating economic benefits to the nation does not take into account the benefits to the crab stocks from the crab saved by the Emergency Rule in 1995 and the future benefits to stock rebuilding that will occur from the continuation of the crab protection area. It should also be noted that this particular area has in recent years, been the prime area for harvest of the majority of the king crab quotas. This is supported by ADF&G records of catch reported by statistical areas.

5. Gordon Blue, a Bering Sea crab fishermen has prepared a paper for the NPFMC providing scientific information on the management and regulations of the king crab stocks off Western Kamchatka in the Sea of Okhotsk. The USSR/Russia has experienced sustained yields of over 30 million pounds for the past two decades. Regulations include large areas off the coast of Kamchatka closed to bottom trawling for many years.

CONCLUSION:
Although some in the industry point to the experience of protection for crab refuges around Kodiak Island as having no benefit to crab rebuilding, this argument does not apply to the Bering Sea. King and tanner crabs have experienced some measure of rebuilding in Bristol Bay and around the Pribilof Islands as a result of area closures to both trawl gears and directed crab fishing with pot gear. There was a small rebound of Bristol Bay king crabs prior to the 1994 directed fishing closure. A dynamic rebound of bairdi has occurred in Bristol Bay since the inception of the Zone 1 closure area and caps, although these stocks are now in sharp decline. In the case of king crab, likely the trawl closure protection zone was not large enough.

In 1993, 1994 and 1995 we have experienced a reopening of Pribilof Islands king crab fisheries. The ACC supported a lengthy closure of the directed fishery for rebuilding, beginning in 1990 that was finally supported by implementation of a no trawl zone in January 1995 that is now providing protection for an estimated 90% of the Pribilofs Islands king crab habitat defined by Dr. David Armstrong.

With current scientific information leading more and more to the conclusion that crab refuges are important to the survival of not only mature king crabs, but to king crab in their early life history stages, it is important to maintain the Bristol Bay king crab protection area adopted in 1995 as a permanent protection area and an integral part of a long term king and tanner crab rebuilding program.

Tom Casey

Alaska Fisheries Conservation Group

Bering Sea and Aleutian Islands Crab Vessel Owners
from Washington, Oregon and Alaska

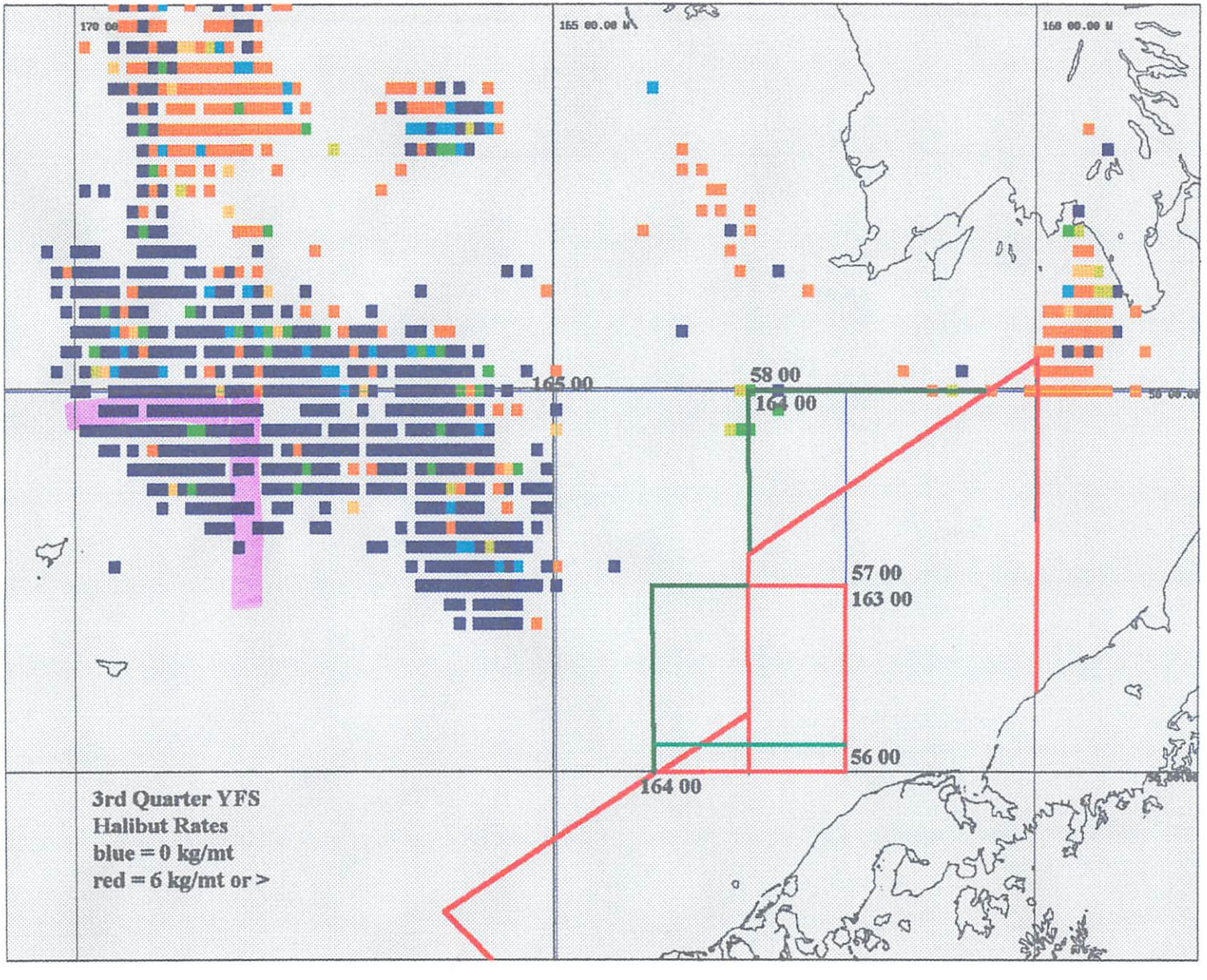
P.O. Box 910 Woodinville, WA 98072 (206) 488-7708 Fax (206) 823-3964

To: Members of the North Pacific Council
From: Tom Casey and Gary Painter
Date: 29 September 95
Re: D4: Crab bycatch in the BSAI trawl fisheries

Recommendations:

1. Tanner crab PSC bycatch management: **Alternative 5***
   - A. ADFG Outlook: Population still declining, but may be leveling out
   - B. No on-bottom trawling East of 163W matches directed fishery prohibition
   - C. Shift 250,000 PSC from Zone 1 to Zone 2 since all trawl TAC's were taken despite Zone 1 closure in 1995
   - D. Adopt individual vessel bycatch accounting
   - E. Discount AP-recommendation because no full-time crabber voted on it

2. Bristol Bay Red King Crab Closure Area: **Alternative 4**
   - A. ADFG Outlook: Total population index continues at low levels. Fertilized female abundance is at or below threshold.
   - B. Anticipate that ADFG will raise the female threshold and reduce the male exploitation rate at the March meeting of the Alaska Board of Fisheries.
   - C. No directed fishery for the second year in a row
   - D. Reduce PSC to 100,000 in Zone 1 until directed fishery resumes. Shift 100,000 PSC to Zone 2
   - E. Red King Crab Savings Area expands to 55-45N to 57N between 162W-164W (Original council position)
   - F. Use ADFG population estimates for all Council deliberations (LBA-basis) not NMFS estimates
   - G. Adopt individual vessel bycatch accounting
   - H. Discount AP-recommendation because no full time crabber voted on it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Halibut Rates
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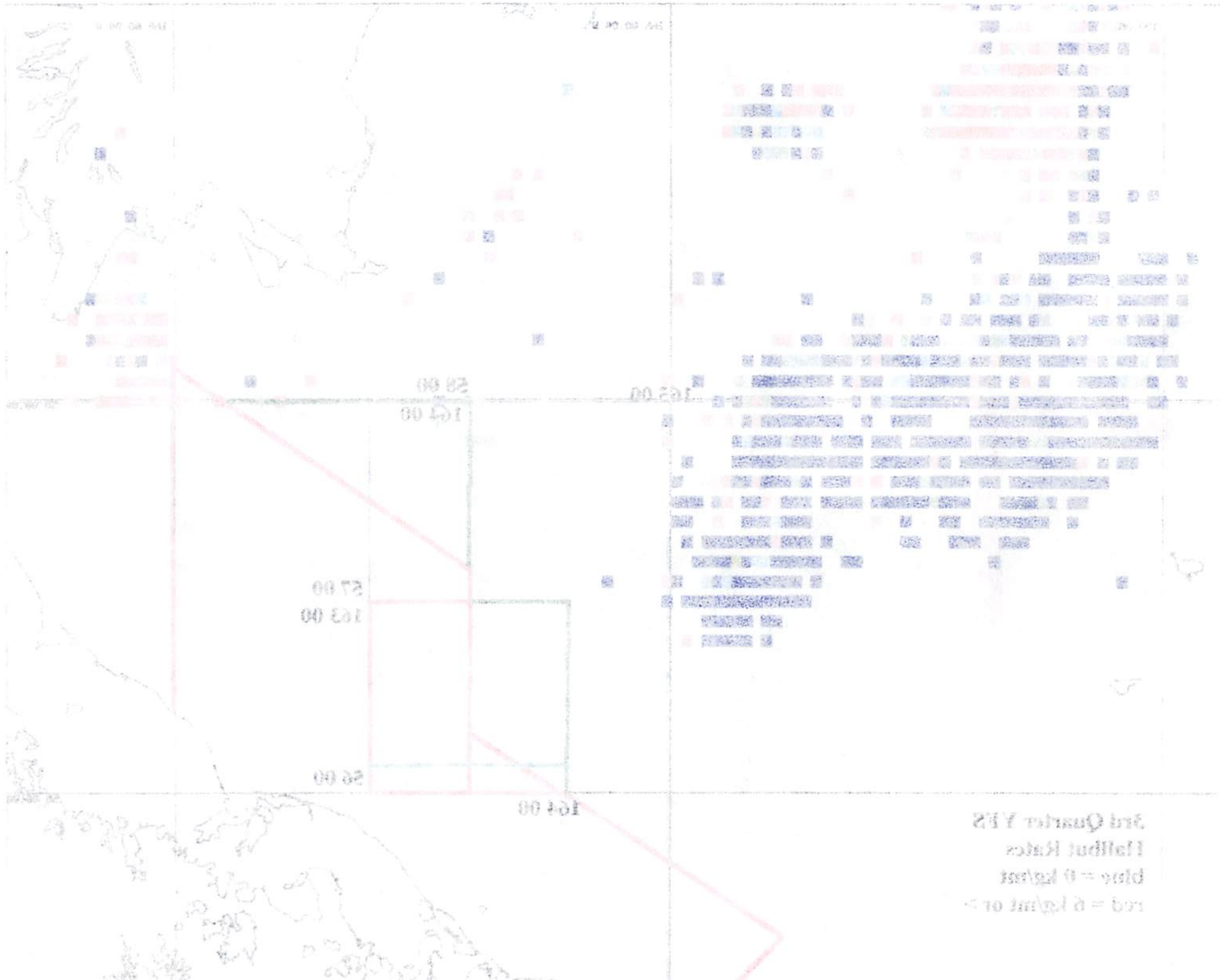
red = 6 kg/mt or >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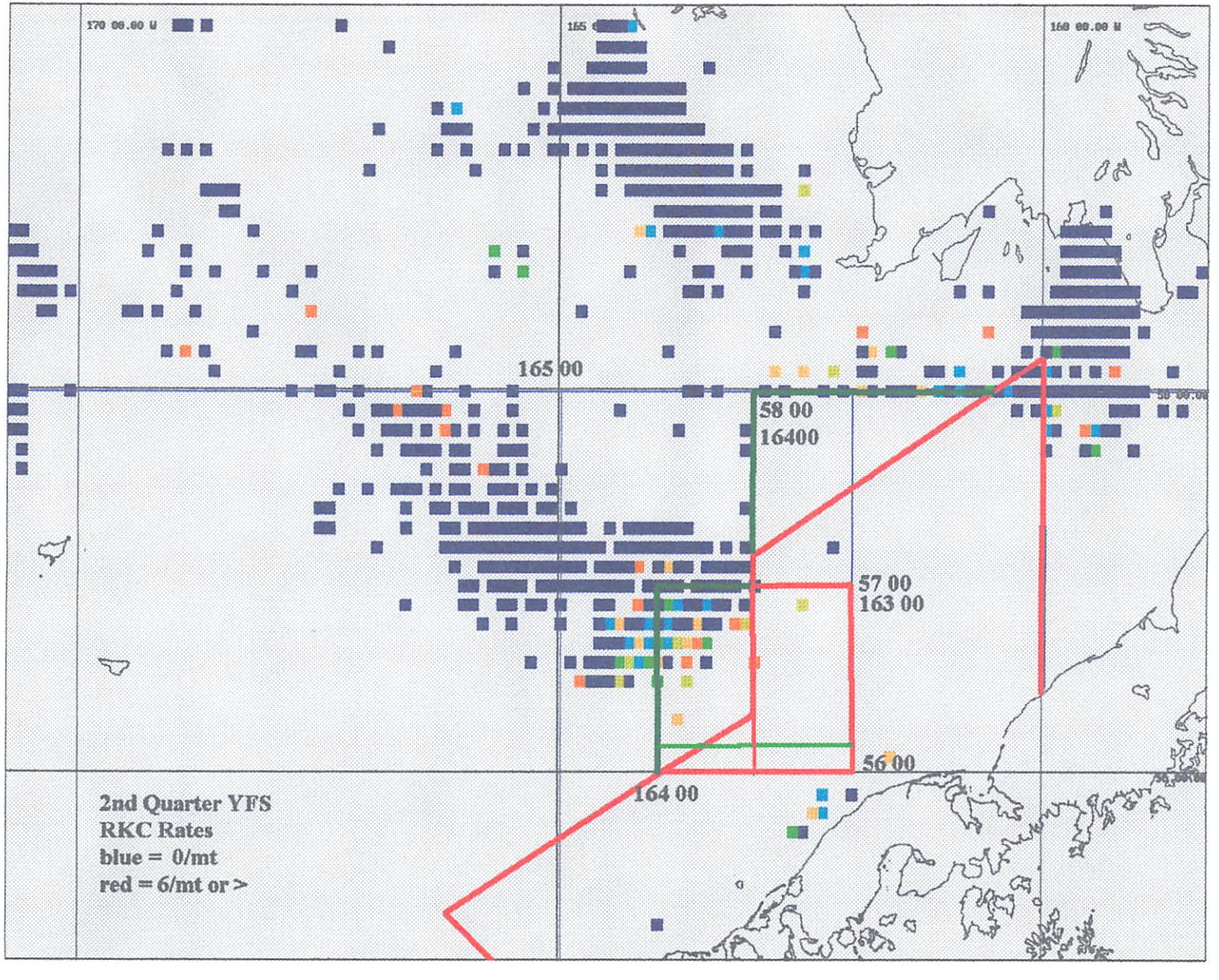
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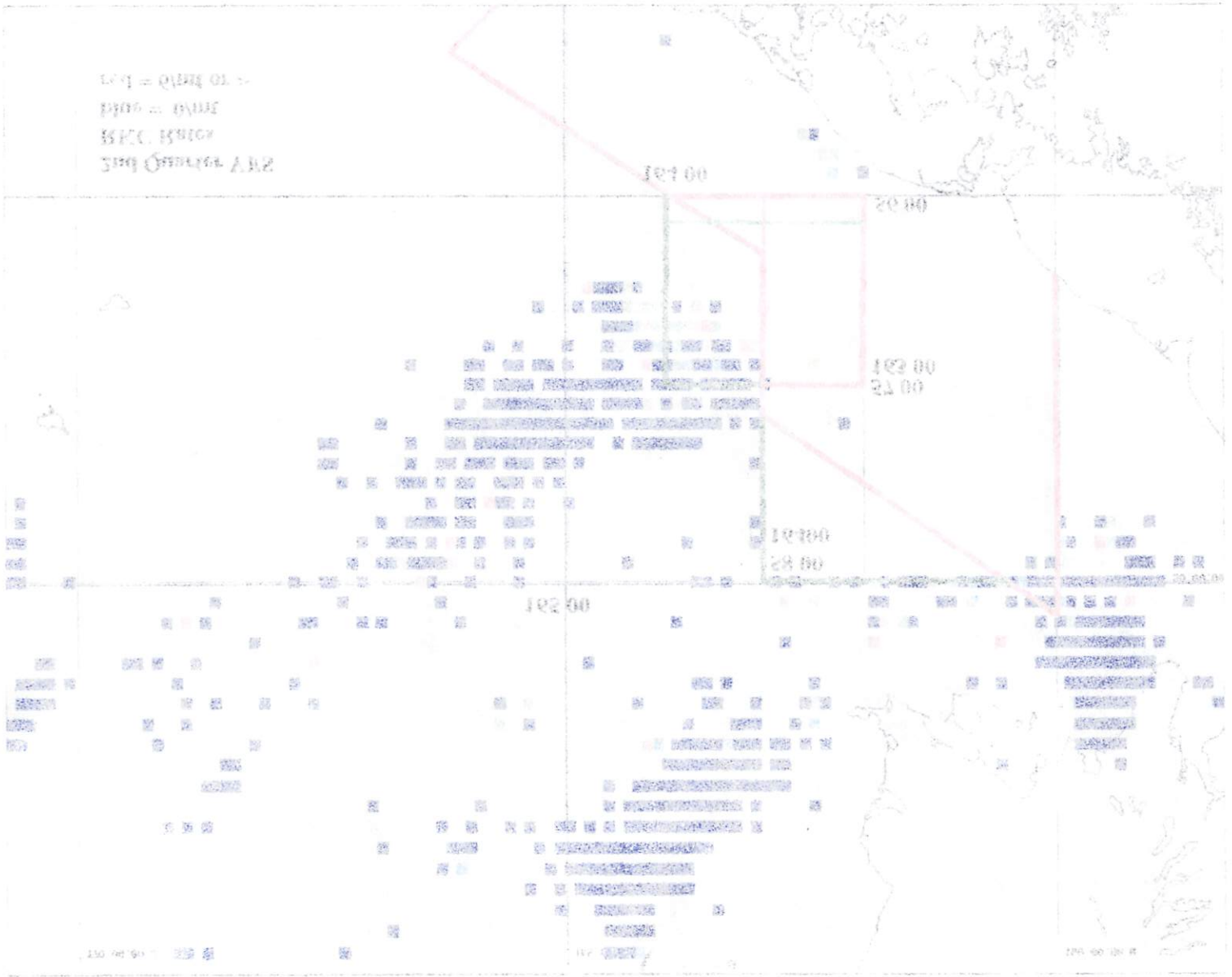

Date: Aug. 11, 1995
To: SSC members
From: dave fraser

Re: RKC closure plan amendment

The following letter is a somewhat revised version of a memo i e-mailed to most SSC members last week.

The Aug. 17 teleconference review of the proposed RKC Area Closure provides minimal time for the SSC to give proper consideration to the completeness of the analysis and to ground truth the revised model that underlies the findings of the analysis. i will be fishing the B-season pollock opening, and so i wanted to provide SSC members with some thoughts on what should be covered in a proper analysis of the proposed action and the adequacy of the alternatives.

Alternative Management Tools - Hot Spot Authority

Part of the pressure being place on the SSC to conduct its review in this pressure cooker atmosphere, is the assumption that if the document is not sent out for public review immediately, then no final action can be taken in time to have some measure in place for additional RKC protection during the '96 rocksole fishery. This stems from the opinion of NOAA-GC at the last council meeting that the MFCMA precludes the renewal of an ER past 180 days. However, there is an alternative to either an ER or a Plan Amendment to deal with this problem through inseason management action in the form of "hot spot" authority, defined at 675.20-e-1-iv, as detailed in e-3, e-6, f, and g.

Given this alternative management tool, the SSC should not be rushed into sending out either an incomplete analysis or one based on a model which has not been subject to review and groundtruthing.

Adequacy of the Alternatives

Like the SSC, i have not yet seen the revised EA/RIR, however i would like to identify a number of areas which i believe are essential to the completeness of the analysis, which were missing from the April 7th document.

The fishery which was the primary cause for concern was the winter roe-rocksole fishery. 50% of the area within the proposed closure is covered by a closure of 516 which occurs annually from March to June. The EA/RIR should include an alternative which is specific to the 1st quarter of the year. This would alleviate some of the domino effects on the YFS fishery which has not been a problem for RKC.

The overall RKC cap is not effected by any of the proposed alternatives. When it was adopted the SSC indicated that removal of RKC at the 1/2% level was not a

biological concern, particularly when the permanent closure of 512 encompasses most of the female population. The impetus for the ER closure last year was that female RKC had dropped below a threshold level. It would seem to follow that a closure such as those proposed in the EA/RIR ought to be triggered by a index of the population of (female) RKC, as determined from the annual survey. If at "normal" levels of abundance, the 512 and 516 closures and the cap provide adequate protection, it would be easier to measure the cost/benefits of an additional measure if it only applied at low levels of abundance, since unnecessary cost would not be imposed on the groundfish fishery.

Inclusion of impacts on non-rocksole groundfish fisheries

The ER was extremely effective in reducing RKC bycatch just as predicted in the EA, however there were numerous unintended consequences which were not considered or predicted by the EA.

The first of a chain of dominoes was increased Bairdi and halibut bycatch in the rocksole fishery. This in turn resulted in a premature closure of the rocksole fishery based on halibut, not crab. The next domino to fall was the zone one P. Cod fishery, this occurred in large measure because rocksole vessels shifted into a mixed target cod/rocksole mode, fishing further north in zone one than the traditional cod vessels. The mixed target fishery had a much higher Bairdi rate and so triggered the zone one Bairdi cap. This in turn forced the traditional cod fleet fishing Unimak Pass to move west into deeper water in zone two, which has a higher halibut rate. Thus, the cod fishery closed prematurely when the Bering sea wide halibut cap was triggered.

The next major impact was in the YFS fishery. Shifting effort west within zone one due to the ER closure, increased the Bairdi rate in this fishery as well, which quickly triggered the zone one closure based on Bairdi. This moved the YFS fleet further west as the YFS themselves were migrating to the northeast. Combined with the advancing ice edge which pushed effort south into deeper water, the zone two YFS fishery turned into a halibut fiasco, with much higher halibut rates than normal, and the Bering sea wide halibut closure was triggered by the end of April, precluding the almost crab free window of fishing near Round Island in early May.

The dominoes kept falling. The O-flat fishery share a PSC cap with rocksole. Normally, rocksole closes due to crab in zone one and the balance of the halibut cap supports the O-flat fishery in other areas. The lack of halibut PSC meant there was no O-flat fishery until the July 1st second semester release. Meanwhile, faced with closures in all the flatfish fisheries in the Bering, effort shifted into the mackerel fishery in the Aleutians and into GOA fisheries, accelerating those fisheries and shifting income away from the other participants in those fisheries.

Refined GIS presentation of CPUE and Bycatch Data.

Lacking a Bycatch Simulation Model in the analysis for the ER, the council presumably attempted to use the mapped data in the discussion paper to analyze and

predict the bycatch consequences of its decision. The use of GIS mapped data can be very useful, however the black and white presentation in the discussion paper was a very limited means of presenting such complex data. At the June council meeting Dave Ackely showed me some bycatch rate contours he had prepared but which had not been incorporated into the EA/RIR at that point. This format was a great improvement in the display of bycatch and effort patterns and should be incorporated in the EA/RIR. Because the closure had such major impacts on other fisheries and other PSC species beyond RKC in the Rocksole fishery, it is important to produce mapped contour plots of bycatch rates and CPUE (both in terms of MT/hr of catch , and of target catch as % of overall catch) for each effected fishery and PSC species. (Targets: Rock Sole, O-Flat, YFS, P. Cod - PSCs: RKC, Halibut, Bairdi, Opilio, Herring)

Because bycatch and CPUE vary dramatically as a function of season it is necessary to produce the plots on a monthly time step basis. (This was done for JV and Foreign data for the '80's by Norris, et al, in the series of AFSC Processed Reports 91-07 through 91-12).

Other important caveats include the need to segregate tanner bycatch by species and to treat halibut rates in the form of kg/MT not #/MT. The species distinction on tanners (Opilio vs. Bairdi) is necessary because Bairdi bycatch is governed by a cap which closes target fishing for groundfish, triggering the effort redistribution outlined above, while there is no cap on Opilio. Opilio and Bairdi also have differing area distributions, so that while the ER may not have increased overall tanner rates, it did have a dramatic effect on Bairdi rates. The need to deal with halibut on a kg/MT basis arises both from the fact that the cap is accounted on a weight basis, and that the average size and weight of halibut taken as bycatch varies significantly by area, season, depth and target fishery. Whether it is correct or not, our current management strategy assumes that it is more important to limit the overall tonnage of halibut mortality than the number of animals impacted. The presentation in the EA/RIR as it existed in June did not allow the reviewer to make a judgment about which alternative would result in the least tonnage of halibut mortality because of the format in which it was presented.

The Model

The fundamental test of the Bycatch Simulation Model necessary to ground truth it, would be to run it with fishery data from '94 and earlier, but with all the closures (including Am. 21 Pribilof and sea lion rookery areas, as well as the ER closure) which were in place in 95. Such a run should be able to predict the actual fishery experience in '95 if the model is a valid tool. (Note that to capture the impacts on YFS there is a need to include pre-1990 data, because between 1990 and 1993 there was no YFS fishery opened prior to May 1)

Included below is an excerpt of a letter i submitted to the council and SSC relative to the model when the ER was being considered. It includes both the general parameters which are important elements of a bycatch simulation model, and some observations of factors within those parameters which exist within the real fishery. i have also included

below an excerpt from a letter related to the extension of the ER beyond the rocksole fishery into the subsequent YFS fishery, which made predictions about the impact of the closure on that fishery. Again, a predictive model should capture those causes and effects, and if it does not, then the analysis which rests upon the simulation model should not be sent out for public review.

Excerpt from Dec. 94 letter

In order for time area closures to achieve the maximization of groundfish harvests within a fixed PSC cap it is necessary to use an optimization model to examine the impacts of efforts redistribution resulting from an area closure. Such a model was written for the council by Terry Smith in the late 1980's. It has subsequently been refined by the author and others and is available to the council, but it has not been used in this analysis.

Parameters required by a bycatch simulation/optimization model include:

1. ***Bycatch rates*** for each PSC species by area. Area resolution should be as small as possible, probably 1/4 by 1/2 degree blocks. *(Certainly not by 3 digit statistical areas)*
2. Target catch ***CPUE*** by species on the same area resolution.
3. Target catch ***species composition*** on the same area resolution.
4. Knowledge of other ***area closures*** which constrain choices relating to effort redistribution.
5. Presumably the council has as one of its goals for optimization the reduction of waste, as well as the efficient utilization of PSC caps. This requires information in the model concerning size, sex and maturation differences in target species by area and time as they impact ***utilization*** of groundfish catch..
6. The model must predict the likely choices by fishers relative to ***effort redistribution***. Because such choices are likely to be made primarily on the basis of CPUE of target species in an open access derby, there will be a feedback loop in the model with other closures being triggered. To accommodate the speed at which the fisheries now occur the model must employ ***weekly or daily time steps***. It must also predict changes in total effort in the rock sole fishery as other fisheries open or close. *(Using short time steps is particularly important to capturing impacts, under previous versions of the model, fisheries which made it into the first day of a time step were assumed to remain open even if they exceeded the cap on that day. With a fishery like rocksole, where nearly a 1/4 of the harvest occurs during the peak week , even weekly time steps can fail to capture impacts of closures.)*

Though such a model exists and has been employed in most other cap and closure analyses in the past it has not been used in this analysis. If it were to be used the data base relating to the above parameters would need to be updated and incorporated into the model.

Certain general observations emerge from a review of the data and from fishing experience with reference to the parameters outlined above.

1. - ***Bycatch Rates*** - There are clear trade-offs between RKC rates versus halibut and tanner crab rates. The latter are higher to the SW of 56/164 degrees and the former

are higher to the NE. Therefore closures of the area of RKC bycatch will result in effort shifts which will in turn raise halibut and tanner crab rates.

2. - ***CPUE*** - During the Jan. - Mar. rocksole fishery between 1990 and 1994, the most concentrated effort has been in the two 1/2 by 1 degree blocks between 56 and 56.30, and between 162 and 164, which together have accounted for over 50% of the tows in the fishery (exclusive of the effort in the now closed Pribilof area). Redeployment of this much effort into areas of lower CPUE inevitably has negative bycatch implications for other species.

3. - ***Species Composition*** - Bycatch of cod and pollock is generally unwanted in a rock sole fishery and tends to be higher to the south of 56 degrees.

4. - ***Area Closures*** - Alternative areas utilized by the rock sole fishery in the past are no longer available. The twenty mile rookery closure around Amak and the new Pribilof closure both remove the next best choices of fishing grounds. Any redeployment of effort will be into areas with significantly lower rock sole CPUE.

5. - ***Utilization*** - Utilization of total groundfish catch will be negatively impacted by redeployment from areas of higher rock sole percentage and CPUE into areas that tend to have higher percentages of male rock sole, yellowfin, other flats and pollock bycatches.

6. - ***Effort Redistribution*** - Redeployment of effort may well result in early closure of rock sole fishing due to Bairdi or Halibut PSC caps being reached. Effort would then shift into other fisheries including P. Cod in the BSAI, and flatfish in the GOA, accelerating the pace of those fisheries.

(end - Dec. 94 excerpt)

Excerpt from Apr. 95 Letter

B. The RKC cap in the YFS fishery is much smaller than in the rock sole fishery, but is essential to the attainment of OY for YFS.

1. In 1994 the YFS fishery came close to attaining OY. It closed when the halibut PSC cap was reached. It is the halibut PSC which is the primary determinant as to whether the TAC will be reached.

2. In order for the halibut cap to be optimized, it is essential that the YFS fishery be pursued during times and areas where halibut by catch can be kept at or below the VIP rate of .5 kg/MT.

3. There are two key time/area windows of opportunity to fish YFS at very low halibut rates, which if not utilized will result in a halibut based closure of YFS before the TAC is reached. This is a function of the migration patterns of YFS and halibut in the spring. YFS migrate out of the deeper water, traveling NE toward Togiak, Bristol Bay and the Kuskokwim delta. This pattern can be seen by reviewing the JV. effort during the mid-80's and tracking the tows by location during April and May. This movement of YFS occurs just ahead of a similar migration of halibut, which seem to wait about a couple weeks or a month later for water temperatures to warm up slightly. This phenomenon can be verified by comparing bycatch rates in a given location by one month (or less) intervals during the spring YFS fishery.

a. One of these time area windows is from about May 10 through early June in the area north of 58 , primarily in the Round Island area.

b. The other time/area window occurs in late April and the first week of May in the area between 163-164 and between 56-40 and 57-00.

c. A third time/area window has been precluded by previous management actions which close the area between 57 and 58 and 160 and 163. Access to the area would allow the fishery to move with the movement of the fish, and thus avoid scratch fishing which is almost always associated with higher by catch rates.

d. Another time/area windows occurs in late April - early May in the NW portion of the new Pribilof closure area. That closure extended unnecessarily far to the NW (as it is an area with no King crab bycatch problem).

4. If the emergency rule is renewed, one of the primary time/area windows of low halibut bycatch will be foregone. Together with the Pribilof closure and the constraints of the ice edge, this leaves the fleet with only very limited area to fish YFS during late April and early May. The remaining areas have low YFS CPUE and high tanner crab and halibut bycatch rates.

The likely result is a premature closure of the YFS fishery due the halibut PSC apportionment for the first semester being attained. Such a closure may well occur just about the time in early May that the YFS arrive in the area north of 58, toward Round Island. This in turn means the second primary time/area window of low halibut PSC will be foregone as well.

5. The next window of opportunity to avoid halibut does not occur until late summer early fall when the YFS and halibut segregate as the YFS move back out toward the mid shelf. This segregation usually lasts until sometime in October when the halibut begin to "catch up" with the sole as they too move back to their deeper wintering grounds. The ability of the fleet to "stay ahead" of the halibut will be constrained in '95 by the excessive northerly extent of the new Pribilof area.

The combination of these factors make it absolutely critical that the harvest of YFS be maximized during the times/area that halibut PSC rates are lowest (i.e. the northern west 1/2-1 degree block of the ER closure area in late April, early May and the Round Island fishery in mid May to early June.)

C. The RKC stocks are protected by the mating/molting closure that expands the primary RKC protection zone between 160-162 out to 163 during the second quarter. The 160-162 area was believed to encompass 75% or more of the female RKC population distribution according to the council's analysis upon which the original closure was based. The additional seasonal expansion out to 163 provides further protection.

Any incremental gains from extending the ER in order that the area from 163 to 164 also be closed during the second quarter, are very small compared to the other consequences of such and extension.

Those consequences are twofold:

First is the premature closure of YFS due to increased halibut bycatch outlined above. This does not change the absolute amount of the halibut cap that closes YFS, however it does mean the failure to attain OY for YFS.

The second consequence will be a much higher number of Bairdi and Opilio taken as bycatch if second quarter effort is redistributed into the area between 164 and 168-30 (as has all ready occurred triggering the premature closure of Zone One). This will quite likely be an absolute and unnecessary increase in tanner bycatch.

D. A proper analysis of and extension of the ER would include a quantitative modeling of the factors outlined above. The original analysis did not contain such information relative to a second quarter YFS fishery. The SSC has repeatedly outlined the appropriate methodology for such analysis but no such analysis has been submitted to the SSC by the agency for its review.

i personally conducted a modeling exercise along the lines proposed by the SSC for the first quarter rock sole fishery and submitted the results and documentation of the methodology both to the agency and to the SSC. A post facto review and comparison of the 94 and 95 season's bycatch of halibut, bairdi and RKC validate the predictions of that modeling.

An analytical modeling of the YFS fishery in the second quarter shows even more dramatic bycatch consequences than occurred in the first quarter rock sole fishery.

E. A premature second quarter YFS closure will likely result in a transfer of effort into the GOA flatfish fisheries compounding management problems there. Based on the foregoing, it is inappropriate to renew the ER in its current form.

(end - Apr. 95 excerpt)

Thanks for reviewing my comments. i hope many of these point have all ready been dealt with in the current EA/RIR, however i have to leave to go fishing without having the opportunity to review the new version.

dave fraser

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