

MEMORANDUM

TO: Council, SSC and AP Members

FROM: Clarence G. Pautzke  
Executive Director



ESTIMATED TIME

3 HOURS

DATE: November 25, 1996

SUBJECT: BSAI Opilio PSC Caps

**ACTION REQUIRED**

Final action on PSC limits for Bering Sea Snow Crab.

**BACKGROUND**

Final Review of Opilio Crab PSC Limits

In September, the Council approved the agreement negotiated by affected industry groups regarding PSC limits for C. bairdi Tanner crab taken in BSAI trawl fisheries. Under Amendment 41, PSC limits for bairdi in Zones 1 and 2 will be based on total abundance of bairdi crab as indicated by the NMFS trawl survey. Based on 1996 abundance (185 million crabs), the PSC limit for C. bairdi in 1997 will be 750,000 crabs in Zone 1 and 2,100,000 crab in Zone 2. Crab bycatch accrued from January 1 until publication of the final rule (expected by April 1997) will be applied to revised bycatch limits established for specified fisheries.

**Amendment 41 PSC limits adopted for bairdi Tanner crab.**

<u>Zone</u>	<u>Abundance</u>	<u>PSC Limit</u>
Zone 1	0-150 million crabs	0.5% of abundance
	150-270 million crabs	750,000
	270-400 million crabs	850,000
	over 400 million crabs	1,000,000
Zone 2	0-175 million crabs	1.2% of abundance
	175-290 million crabs	2,100,000
	290-400 million crabs	2,550,000
	over 400 million crabs	3,000,000

The Council did not make any recommendations regarding PSC limits for snow crabs at the September meeting. Rather, the Council requested that the committee meet again and attempt to negotiate an agreement for opilio. The committee members are listed below:

Dave Hanson, Moderator  
Vince Curry  
Kris Fanning  
Dave Fraser

Teressa Kandianis  
Brent Paine  
Gordon Blue

The Committee met on November 6-7, and agreed upon acceptable PSC limits for C. opilio snow crabs taken incidentally in trawl fisheries. The terms of the negotiated agreement are included as Item C-4(a). The negotiated PSC limits are based on total abundance of C. opilio crab as indicated by the NMFS trawl survey. Based on 1996 abundance (5.4 billion crabs), the PSC limit for C. opilio in 1997 would be 6,147,000 crabs in the Snow

Crab Bycatch Limitation Zone (SCBLZ) under the negotiated agreement. Note that in item C-4(b), NMFS requests a change in configuration of the SCBLZ to conform to reporting areas.

At this meeting, the Council is scheduled to take final action on PSC limits for snow crab. An executive summary from the EA/RIR is included as Item C-4(c). In June, the AP recommended adoption of Alternative 1, status quo, for snow crab. The crab plan team recommended a PSC limit for snow crab of 11 million crab in Zone 2. A summary of snow crab bycatch in groundfish fisheries is provided in the table below.

<b>Snow crab bycatch in the 1992-1996 BSAI groundfish fisheries, by zone (all gears/targets). Preliminary 1996 data through 10/96.</b>				
	<u>Zone 1</u>	<u>Zone 2</u>	<u>Other areas</u>	<u>Total</u>
1992	104,844	11,996,347	5,561,358	17,662,549
1993	40,611	8,922,155	5,797,956	14,760,722
<u>1994</u>	<u>25,334</u>	<u>11,424,057</u>	<u>1,032,736</u>	<u>12,482,127</u>
92-94 Ave	56,930	10,780,853	4,130,683	14,968,466
1995	94,307	4,338,013	963,469	5,395,789
1996	267,145	2,747,141	127,187	3,141,473

On November 7, 1996, the following agreement was reached by the negotiating committee on PSC caps for C. opilio in the Bering Sea trawl fisheries.

### PSC caps for C. opilio

The PSC limit for snow crab (*C. opilio*) taken in Bering Sea trawl fisheries will be based on total abundance of C. opilio as indicated by the NMFS annual bottom trawl survey. **The PSC cap will be set at 0.1133% of the total Bering Sea abundance, with a minimum PSC of 4.5 million snow crabs and a maximum PSC of 13 million snow crabs.** Snow crab taken within the "Snow Crab Bycatch Limitation Zone" (SCBLZ) would accrue towards the PSC limits established for individual trawl fisheries. Upon attainment of a snow crab PSC limit apportioned to a particular trawl target fishery, that fishery would be prohibited from fishing within the SCBLZ.

Coordinates of the Snow Crab Bycatch Limitation Zone, as agreed upon by the negotiating committee.

<u>North latitude</u>	<u>West longitude</u>
56°30'	Donut Hole
56°30'	165°00'
58°00'	165°00'
59°30'	170°00'
US-Russia Line	170°00'

Note that this agreement would yield a snow crab PSC limit of 6,147,000 snow crab for 1997. This number is 0.1133% of the total 1996 NMFS survey abundance of 5,424,886,000 snow crab (both sexes, all size groups).

### Caveats and Recommendations:

1. If area 517 bycatch exceeds 500,000 snow crab in any one year, the Council should consider moving the southern boundary of the snow crab bycatch limitation zone from 56°30' to 56°00'.
2. These snow crab PSC limits will be subject to a 5 year review.

### Industry Support:

All parties here below signed will support this agreement at the North Pacific Fishery Management Council meeting through Secretarial review and approval. The Committee strongly recommends that the NPFMC approve this agreement without change. Any substantive change from this agreement releases the parties from supporting said agreement.

Vic Fanning

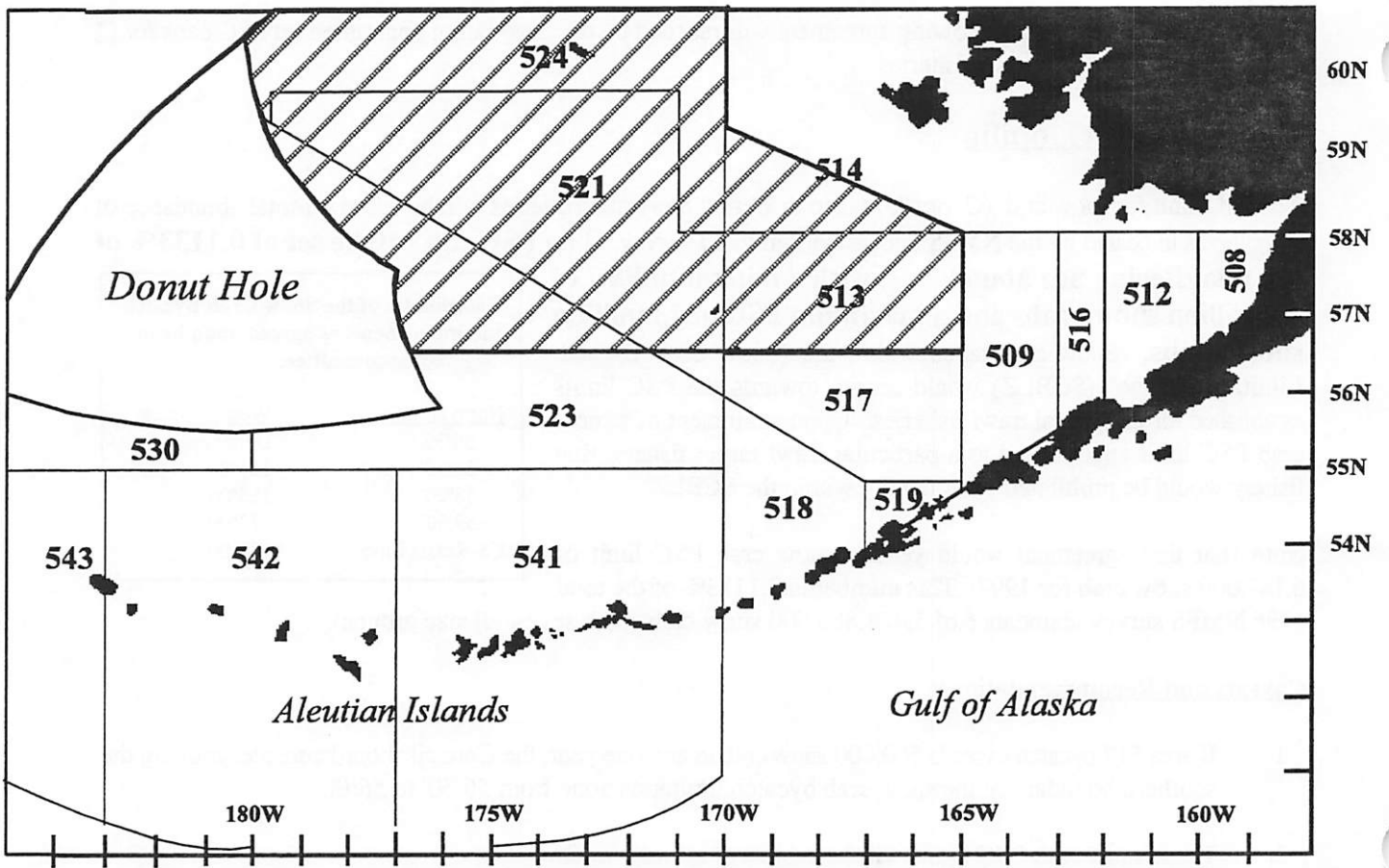
Deanna Landreth

Paul Cairn

[Signature]

Vincent A. Curry

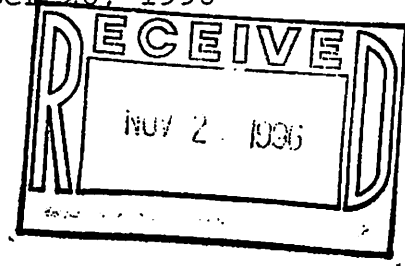
Garland Blue





UNITED STATES DEPARTMENT ( AGENDA C-4(b)  
National Oceanic and Atmospheric DECEMBER 1996  
National Marine Fisheries Service  
P.O. Box 21668  
Juneau, Alaska 99802-1668

November 26, 1996



Mr. Richard B. Lauber  
Chairman  
North Pacific Fishery Management Council  
605 West 4th Avenue, Suite 306  
Anchorage, Alaska 99501-2252

Dear Rick:

On November 6-7, 1996, a Council-appointed industry negotiating committee met and agreed upon a recommendation for a C. opilio (snow) crab prohibited species catch (PSC) limit equal to 0.1133 percent of the total Bering Sea abundance, with a minimum PSC limit of 4.5 million snow crab and a maximum PSC limit of 13 million snow crab. Snow crab taken within a new "Snow Crab Bycatch Limitation Zone (SCBLZ)" would accrue towards the snow crab bycatch allowances established for individual trawl fisheries. Upon attainment of a snow crab bycatch allowance, that fishery would be closed within the SCBLZ.

NMFS staff has noted that the new SCBLZ does not conform to established reporting areas. Our existing PSC estimation system computes estimates of PSC at the level of the reporting area (e.g. 514, 521). Within the limits of the current recordkeeping and reporting system, NMFS cannot produce estimates of PSC based on areas other than reporting areas.

We suggest that the Council consider a management option in which all snow crab bycatch from statistical areas 513, 514, 521, and 524 would accrue to the PSC limit, which if reached, would close the SCBLZ.

Sincerely,

Steven Pennoyer  
Administrator, Alaska Region



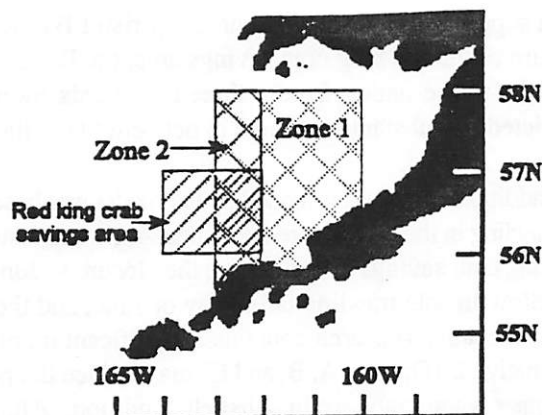
## Executive Summary

Bering Sea crab stocks are currently at relatively low levels based on recent National Marine Fisheries Service (NMFS) bottom trawl surveys. Crab fisheries have been impacted by these low stock sizes, such that no Bristol Bay red king crab fishery occurred in 1994 or 1995, and harvests of Tanner and snow crabs have been much reduced. In January 1995, the Council initiated analysis of several proposals designed to reduce impacts of trawling on crab stocks and thus promote rebuilding of crab resources. The Council is considering three management measures for the current crab bycatch management regime for Bering Sea trawl fisheries. Specifically, these management measures are:

1. Revise the trawl closure time period for the Bristol Bay Red King Crab Savings Area;
2. Modify existing crab PSC bycatch limits, and initiate bycatch limits for snow crab; and
3. Close nearshore waters of Bristol Bay to trawling.

The Council requested that staff examine the suite of management measures in one package, so that the impacts of these measures can be analyzed in a comprehensive manner. These measures, and potential impacts and interactions, are described below.

**Bristol Bay Red King Crab Savings Area:** The non-pelagic trawl closure period adopted by the Council in September 1995 for Amendment 37 (Bristol Bay Red King Crab Savings Area) does not encompass the entire molting and mating period of red king crabs. The Bristol Bay red king crab stock remains at low abundance levels, and the Council recommended that NMFS implement an emergency rule to continue the closure through June 15, 1996. Because unobserved impacts of trawling on softshell crab may impact crab rebuilding and future crab harvests by pot fisheries, the Council requested additional information be examined before they reconsider the previous preferred alternative (January 1 - March 31) for Amendment 37.



Three alternatives were examined. In addition to the status quo, Alternative 1, additional impacts of seasonal closures were examined as well as a modified closure area. These alternatives and options are detailed below.

**Alternative 1:** Status quo, no action. Amendment 37 would be submitted to the Secretary based on the closure period adopted by the Council in September 1995. The Bristol Bay Red King Crab Savings Area (162° to 164° W longitude, 56° to 57° N latitude) would be closed to non-pelagic trawling from January 1 through March 31. The area bounded by 56° to 56°10' N latitude would remain open during the years in which a guideline harvest level for Bristol Bay red king crab is established.

**Alternative 2:** Extend closure period for the Bristol Bay Red King Crab Savings Area to provide increased protection for red king crab. Amendment 37 would be submitted to the Secretary based on one of the closure period options considered. [Note: The area bounded by 56° to 56°10' N latitude would remain open during the years in which a guideline harvest level for Bristol Bay red king crab is established.]

Option A: Six month closure. Close the Bristol Bay Red King Crab Savings Area to non-pelagic trawling from January 1 through June 15. The June 15 date corresponds to the opening date for Area 516, which is the area from 162° to 163° W longitude that is closed March 15 to June 15 annually.

Option B: Year-round closure. Close the Bristol Bay Red King Crab Savings Area to non-pelagic trawling from January 1 through December 31.

Option C: Seven month closure. Close the Bristol Bay Red King Crab Savings Area to non-pelagic trawling from January 1 through August 1.

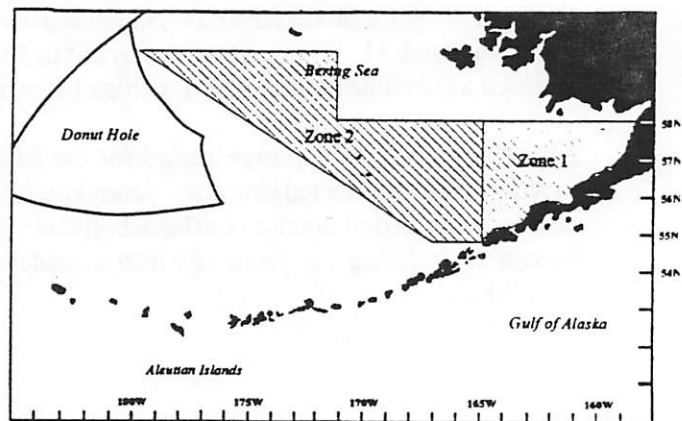
Alternative 3: Close the area based on a modified version of the old pot sanctuary. Boundaries of the closure would close all waters in the Bering Sea east of a line originating at Cape Constantine, extending to 58°10' N, 160°W to 57°10'N, 163°W to 56°30'N, 163°W to 56°30'N, 164°W, then south to 56°N. After April 1, this closure would extend south to the Alaska Peninsula. This option would require 100% observer coverage for fishing north of 58°N and east of 162°W and would be limited to May and June. Further, the area between 163° and 164°W between 56°30'N and 57°00'N would not open until April 1 and would be closed upon reaching a red king crab cap in a range of 5,000 to 15,000 red king crab. (Note this alternative deals with both Bristol Bay Red King Crab Savings Area and nearshore Bristol Bay Trawl Closure Area.)

As a supplement to Amendment 37 (Bristol Bay Red King Crab Savings Area) which examined a year round closure of the red king crab savings area, the Bering Sea Fishery Simulation model was run to estimate the net benefits to the nation from a three-month, six-month, or a seven-month closure to all trawling. Model runs predicted no substantial change in net benefits to the nation under any closure option.

The additional analysis provided by the model was based on data from 1993 and 1994 when there was essentially no trawling in the closure area between April and June. Thus the model was unable to predict the magnitude of red king crab savings by extending the closure to June 15. However, in some years, Zone 1 has remained open to yellowfin sole trawling until May or June, and there remains a potential for vessels to trawl in the proposed area. Because this area contains a significant number of molting adult red king crab during this time period, Alternative 2 (Options A, B, and C) may reduce the potential for bycatch and unobserved mortality, which may be higher when crabs are in softshell condition. Alternative 2, Option C (7-month closure) covers the duration of the molting period and an additional month to allow for shell hardening. Alternative 2, Option B (year-round closure) provides the maximum protection of crab and habitat.

Alternative 3 would provide more fishing opportunities for the yellowfin sole and rock sole trawl fisheries, as well as provide habitat protection for red king crab in nearshore areas. However, because areas containing a sizable portion of the mature red king crab stock would be open to trawling, Alternative 3 may result in increased impacts on red king crab.

**Modify Existing Crab PSC Bycatch Limits, and Initiate Bycatch Limits for Snow Crab:** Bycatch limits for red king crab and Tanner crab established for Bering Sea fisheries may be too high given current status of crab stocks, and bycatch may impact crab rebuilding and future crab harvests by pot fisheries. Bycatch limits for snow crab have not been established. Three main alternatives, developed by



the Council's Advisory Panel and the State of Alaska, were examined for each crab species separately. An additional option for stairstep PSC limits for Tanner crab, proposed by the Alaska Crab Coalition in January 1996, was also examined at the request of the Council. The alternatives to the status quo included a reduced bycatch limit for crab and a crab PSC limit that fluctuates with crab abundance. Potential impacts of instituting a new bycatch limit for snow crab were also examined. The alternatives and options were as follows:

### RED KING CRAB

Alternative 1: Status quo, no action. PSC limits would remain at 200,000 red king crab in Bycatch Limitation Zone 1.

Alternative 2: Reduce PSC limits of red king crab. PSC limits would be reduced to a fixed level at 180,000 red king crab based on a three year average (1992-1994)

Option A: Further reduce the red king crab PSC limit in Zone 1 to 35,000 crab, which was the number of red king crab bycaught in 1995 within Zone 1.

Alternative 3: Establish PSC limits for crab that fluctuate with crab abundance. Annual PSC limits would be set as a percentage of the total population indexed by the NMFS bottom trawl survey. Limits would be established based on a rate specified, within the range 0.1-1.0% of red king crab in the Bristol Bay District.

Option A: Set a fixed upper limit for crab PSC at 200,000 red king crab in Zone 1.

### TANNER CRAB

Alternative 1: Status quo, no action. PSC limits would remain at 1,000,000 Tanner crab in Zone 1, and 3,000,000 Tanner crab in Zone 2.

Alternative 2: Reduce PSC limits of Tanner crab. PSC limits would be reduced to a fixed level of 900,000 Tanner crab in Zone 1, and within the range of 1,500,000 to 2,100,000 Tanner crab in Zone 2.

Alternative 3: Establish PSC limits for crab that fluctuate with crab abundance. Annual PSC limits would be set as a percentage of the total population indexed by the NMFS bottom trawl survey. Limits would be established based on a rate specified, within the range 0.10-2.0% of Tanner crab in the Eastern District, as indexed by the survey. PSC limits for each zone would be set either by apportioning the overall cap among the zones (25% to Zone 1 and 75% to Zone 2) or by setting separate PSC rates for each zone, rather than apportionment of a single rate.

Option A: Set a fixed upper limit for crab PSC at 1,000,000 Tanner crab in Zone 1, and 3,000,000 Tanner crab in Zone 2.

Option B: Establish PSC limits for Tanner crab based on abundance thresholds. Limits would be set as a percentage of population when abundance is less than 100 million crab. In years when Tanner crab abundance is more than 100 million, but less than 250 million, PSC limits would be established at 850,000 Tanner crab in Zone 1, and 1,500,000 in



Zone 2. In years when Tanner crab abundance is more than 250 million, but less than 500 million, PSC limits would be established at 900,000 Tanner crab in Zone 1, and 2,300,000 in Zone 2. In years when Tanner crab abundance exceeds 500 million, PSC limits would be established at 1,000,000 Tanner crab in Zone 1, and 3,000,000 in Zone 2.

## SNOW CRAB

Alternative 1: Status quo, no action. No PSC limits would be set for snow crab.

Alternative 2: Establish a fixed PSC limit for snow crab. Based on a three year average (1992-1994), a PSC limit would be established at a fixed level of 11,000,000 snow crab in Zone 2. No snow crab PSC limit would be established for Zone 1, as bycatch in this area has been minuscule by comparison.

Option A: Establish PSC limit at 6 million snow crab in Zone 2.

Alternative 3: Establish PSC limits for snow crab that fluctuate with crab abundance. Annual PSC limits would be set as a percentage of the NMFS bottom trawl survey index. Limits for Zone 2 would be set at a percentage within the range 0.005 to 0.25% of the snow crab total population index (all districts combined). No snow crab PSC limit would be established for Zone 1.

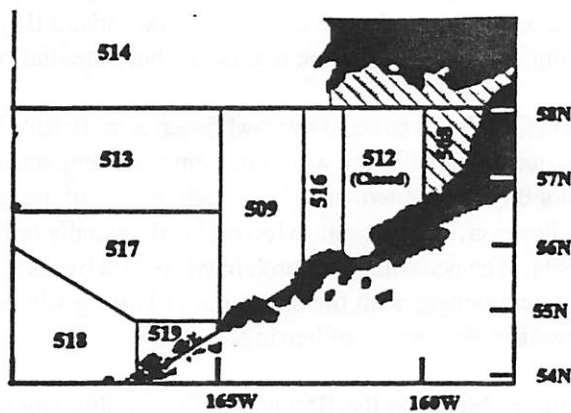
Option A: Set fixed upper limit for PSC at 12 million snow crab in Zone 2.

The biological impacts of this management measure on crab populations were measured on the basis of adult equivalents. The adult equivalent formula incorporated data from groundfish and crab fisheries including bycatch numbers, size and sex of catch and bycatch, discard mortality, and natural mortality. Results indicated that, assuming only observed crab are impacted, bycatch in groundfish fisheries has relatively small impact on crab populations, and therefore reducing PSC limits as proposed under Alternatives 2 and 3 may not drastically improve or rebuild crab stocks. For example, under the most restrictive PSC limit considered for red king crab (red king crab Alternative 2, Option A), the abundance of female spawning stock would be expected to be about 0.75% higher than under Alternative 1, based on average bycatch 1993-1995. It should be noted, however, that any reduction in mortality would slow the decline of the Bristol Bay stock. PSC limits for Tanner crab proposed under Tanner crab Alternative 2 would increase female spawning stock by about 0.38%.

The economic impacts of this management measure depend on the alternative chosen. If the Bristol Bay Red King Crab Savings Area is approved as an FMP amendment, reduced PSC limits for red king crabs in Zone 1 (as proposed under Alternative 2) may not further impact trawl fisheries, as bycatch was at or below this level in 1995 and 1996. For Tanner crab, recent data indicated that the current PSC limits (status quo) could be reduced from existing levels, yet not impact groundfish fisheries if the available PSC is optimally allocated. However, because PSC allocation becomes fixed for the year during the annual specification process, optimal allocation may be impossible to achieve. Bycatch of Tanner crab was much reduced in 1995, suggesting that the PSC limit proposed under Alternative 2 may be achievable without substantially impacting trawl fisheries. One major assumption regarding assessment of impacts for Alternative 2 is that crab stock abundance will remain relatively stable in future years.

The impacts of Alternative 3 depend on the PSC rate chosen for each crab species. On average 1992-1995, groundfish fisheries bycaught crab at the following rates (bycatch as percentage of total crab survey abundance): red king crab (Zone 1, 0.40%), Tanner crab (Zone 1, 0.39%; Zone 2, 0.79%), snow crab (Zone 2, 0.10%). As with other alternatives, PSC limits set at these rates (current bycatch use) would not impact groundfish fisheries if the available PSC is optimally allocated. Fixed upper limits would further constrain trawl fisheries when crab abundance is high. The threshold limits proposed for Tanner crab may also do the same. The potential benefit of threshold limits is that while they allow bycatch levels to fluctuate with crab abundance, they also would temper year-to-year variability in PSC limits caused by trawl survey abundance estimates. Some stability may also be beneficial to long-term financial planning for trawl companies.

**Nearshore Bristol Bay Trawl Closure Area:** Existing trawl closure areas in Bristol Bay were designed to protect adult and sub-adult red king crab from trawling. However, protection of juvenile habitat, which may be negatively impacted by trawling, may provide for improved recruitment and subsequent stock rebuilding. A trawl closure area may also provide additional protection for Pacific herring and Pacific halibut. In addition to the status quo, Alternative 1, the impacts of prohibiting trawling in three areas were examined.



**Alternative 1:** Status quo, no action.

**Alternative 2:** Establish a Northern Bristol Bay Closure Area, which would prohibit all trawling, on a year-round basis, in the area east of 162° W longitude and north of 58° N latitude.

**Option A:** Continue to allow bottom trawling within the area north of 58° N and bounded by 159° and 160° W longitude. This option may require 100% observer coverage for trawl vessels fishing in the area.

**Alternative 3:** Prohibit all trawling in Bristol Bay, on a year-round basis, in the area east of 162° W longitude. Because much of Bristol Bay (statistical area 512) is already closed to trawling year-round, the additional area encompassed by this alternative is statistical area 508 in eastern Bristol Bay and the area described under Alternative 2.

**Option A:** Continue to allow bottom trawling within the area north of 58° N and bounded by 159° and 160° W longitude. This option may require 100% observer coverage for trawl vessels fishing in the area.

**Alternative 4:** Prohibit all trawling on a year-round basis the area north of 58°43' N and east of 162° W longitude. The area north of 58° N and east of 162° W longitude, exclusive of the area closed year-round, would be open to trawling during the period April 1 to June 15 each year. This alternative may require 100% observer coverage for trawl vessels fishing in the area.

**Option A:** Also prohibit all trawling on a year-round basis in Statistical Area 508, which is the area east of 160° W longitude and south of 58° N latitude.

All Alternatives to the status quo would include a regulatory amendment change that would rescind the trawl closure exemptions for the Pacific cod fishery off Port Moller (§ 675.22, paragraphs c,d,e). These regulations appear to be out-of-date given the current best scientific information on juvenile crab habitat and status of the Bristol Bay red king crab stock.

This analysis suggests that a nearshore trawl closure area designed to protect juvenile red king crab habitat may be a significant action managers can take to maintain and possibly increase recruitment of red king crab. Young-of-the-year red king crab require cobble or living substrate (such as sea onions and bryozoans) on which to settle and provide protection from predators. Much of this habitat is already protected by the area 512 trawl closure. Additional habitat for age-0 red king crab has been found to occur in the shallow waters (<50 m) of Area 508, and in the area north of 58° N latitude. By age 2, juvenile red king crab begin to form pods in deeper water (>50m) adjacent to settlement areas in Bristol Bay. Although Alternative 2 encompasses some habitat and podding areas, Alternative 3 would provide maximum habitat protection for young red king crab of the Bristol Bay stock. A trawl closure area in nearshore Bristol Bay may also provide some additional benefits for seabirds, herring, halibut, and marine mammals, but potential benefits remain unquantified.

Yellowfin sole are targeted by trawl fisheries in Bristol Bay (concentrated to the west of Cape Constantine), and consequently this fishery would be somewhat impacted by the proposed closure areas, particularly the northern Bristol Bay area (Alternative 2). A high of 50% of the yellowfin sole observed catch was taken in 1991 in Bristol Bay, however, this percentage has declined annually until only 2% of the directed catch was taken in Bristol Bay in 1994. The percentages of prohibited species bycatch taken in the Bristol Bay area are generally similar to the catch percentages with the exception of herring which generally constitutes a very high percentage of the total yellowfin sole bycatch of herring.

Estimates based on the Bering Sea fishery simulation model indicate that adoption of any of the Alternatives would lead to a slight decrease in the net benefits to the Nation over status quo based on both the 1993 and 1994 data. The approximately \$1.1 million decrease in net benefits (1993 data) and \$1.3 million decrease in net benefits (1994 data) result in approximately a 0.4% and a 0.5% decrease of the net benefits to the Nation under status quo from 1993 and 1994 data, respectively. Given the accuracy inherent in the data, and in the model procedures, these predicted changes in net benefits to the nation are probably not great enough to indicate an actual change from status quo. As with any closure, the tradeoffs between foregone groundfish catch, and savings in bycatch species are apparent in the model results. A closure of northern Bristol Bay would result in a slight decrease in retained catch and herring bycatch and an increase in Tanner crab bycatch. The minimal directed fishing activity in Area 508 during 1993 and 1994 resulted in minute changes in the model results due to the closure of this area.

**Draft Minutes of the  
Bering Sea/Aleutian Islands Crab Plan Team  
Meeting, November 12, 1996**

Members Present:

*Ken Griffin (ADF&G-Juneau)*  
*Rance Morrison (ADF&G-Dutch)*  
*Peggy Murphy, (ADF&G-Juneau)*  
*Bob Otto (NMFS-Kodiak)*  
*Doug Pengilly (ADF&G-Kodiak)*

*Jerry Reeves (NMFS-AFSC)*  
*Kim Rivera (NMFS-AKRO)*  
*Tom Shirley (UAF)*  
*Dave Witherell (NPFMC)*

The Bering Sea/Aleutian Islands (BSAI) Crab Plan Team met by teleconference at 11:00 a.m. Tuesday November 12, 1996. Public listening stations were provided in Anchorage, Kodiak, Juneau, and Seattle. A packet of materials was distributed to team member prior to the meeting; papers included: a summary report of the 1996 prohibited species catch estimation system by Galen Tromble; correspondence between David Witherell and William Karp concerning crab bycatch sampling issues; a summary sheet of crab bycatch in the BSAI Pacific cod pot fishery by Dave Witherell; a copy of the groundfish amendment proposal to implement a red king and Tanner crab PSC in the Bering Sea groundfish pot fishery; written public testimony on crab bycatch received at the September Council meeting; and a summaries of September Council, SSC, and AP actions related to crab. The team meeting was conducted based on the following agenda:

- Introductions, review and approve agenda.
- Review and adopt September 5 minutes.
- Discuss NMFS In-season Management Office estimation of PSC in trawl fisheries.
  - Estimation and extrapolation of PSC.
- Discuss with the North Pacific Groundfish Observer Program concerns for accounting of bycatch.
  - Estimation and sampling issues with numbers based management system
  - Alternative basis for crab bycatch management systems.
- Review of September Council motions.
  - *C. bairdi* Tanner crab PSC limits.
  - Crab bycatch in the Bering Sea Pacific cod pot fishery.
- Review industry negotiation of *C. opilio* PSC limits.
- Upcoming meetings.

Following introductions, the team reviewed the draft agenda and agreed to modify the schedule to accommodate Galen Tromble, who was participating from Washington, D.C. The September 5, 1996 minutes were approved without changes.

Galen Tromble (NMFS-AKRO) provided the team with an overview of the NMFS PSC estimation system (see attached summary). He noted that all PSC catch (including salmon) was based on rates, not actual counts. Whole-haul sampling is not done unless the haul is very small. Essentially, the PSC estimation system was developed to monitor caps, not to provide the best possible estimate of crab bycatch in all fisheries. The fisheries with highest crab bycatch were also the fisheries with the highest observer coverage. Galen noted the area most in need of improvement was shorebased processors with mixed species fisheries and minimal observations. Additionally, these processors are only assigned one target each week based on the aggregate of deliveries.

Martin Loefflad (NMFS-AFSC) reviewed changes the observer program was making to satisfy some of the crab plan team's concerns regarding crab bycatch data. Beginning in 1997, observers will measure up to 20 crab per species per haul. The Team estimated this would require an additional 5 minutes of work for each species on the part of the observer. All crab taken will continue to be sexed and total weight of all crab landed recorded. This data will improve estimates of the sizes of crab taken as bycatch in groundfish fisheries. The team remains interested in additional data on bycaught crab, such as injuries, shell condition, and ovigarity, but recognized potential tradeoffs given other observer responsibilities. The team discussed potential for special projects for some observers to collect these more detailed data and alleviate concerns for impact on other observer duties. The Team felt notation of live vs. dead would also provide at least give some indication of overall crab condition. The team agreed that injury and shell condition criteria would need to be explicitly defined to provide efficient assessment. A committee of Tom Shirley, Bob Otto, and Doug Pengilly was formed to draft crab injury and shell condition criteria and list and prioritize special project needs. The team thanked the observer program for accommodating the teams request for increased crab bycatch sampling.

The team questioned Martin on when the contracted study of observer bycatch sampling methodology would be available and the extent of the review and analysis. The team noted that the contracted study should be available at the first of the year but that it only addressed sampling on catcher/processor vessels targeting yellowfin sole and pollock. The team debated whether they should embark on review of catcher vessel and shoreside sampling programs given the more limited nature of the contracted review. Given potential application of the studies conclusions to other aspects of the observer program, the team agreed to wait for the contracted study prior to embarking on any review.

The team again discussed advantages and disadvantages of crab bycatch accounting measures. The Team discussed use of spawning biomass for Tanner and snow crab PSC limits would be desirable. However, PSC limits based on the current observer information on total biomass and average weight of crab bycatch in trawls would be confounded by crab size, shell age, injury, molt cycle, and reproductive condition. Studies underway on terminal molt, sex ratio, size at maturity, and management thresholds should provide better information for new PSC accounting methods in the future. A length based model and harvest strategy for Tanner crab have been completed and are under review by ADF&G. Given a few more years survey estimates of snow crab population abundance and progress on the above studies of biological parameters, similar modeling of snow crab abundance and harvest should be possible to identify appropriate spawning biomass for corresponding PSC limits.

Dave Witherell reviewed the negotiated Tanner crab PSC limits the Council adopted at the September meeting.

At the Council's request, the team reviewed information on crab bycatch in the BSAI Pacific cod pot fishery. The team reviewed the proposal to institute bycatch limits, the projected catch of Pacific cod in the pot fishery, crab bycatch taken in the pot fishery in recent years (see attached handout), and crab bycatch by vessel by week for the cod pot fishery in 1996. It was noted that in 1996, about 75,000 red king crab and 260,000 bairdi crab were taken in this fishery. Higher bycatch rates are apparent for a few vessels at the beginning of the fishery and may be attributed vessels entering the fishery for the first time. Several vessels appear to have higher bycatch than others over time. About 1/3 of the red king crab bycatch occurred during 2 weeks in October, it appeared that some fishermen were using the Pacific cod pot fishery to prospect for crab prior to the crab opening on November 1. The team discussed concern for bycatch of crabs during the molting and mating seasons in spring and summer, potential gear conflicts, and gear modifications to exclude crab. Although the mortality of crab discarded from pot gear may be relatively low, concern exists for the high ratio of target to bycatch crab and potential for higher bycatch as crab stocks rebuild in coming years. Therefore, the Team reiterates its previous recommendation that analysis of this proposal is warranted. Further, the Team recommends that the alternatives include season

closures, gear modifications, closure areas, and PSC limits.

The team reviewed the industry negotiated agreement for *C. opilio* bycatch limits in trawl fisheries. The team noted that the negotiated area does not exactly match the standard NMFS survey area. In some years, the NMFS survey effort ventures further north for special projects which could inflate a year's estimate of total snow crab abundance. Therefore, the Team suggests that the total abundance that the PSC limit is based on be derived from the standard NMFS survey area south of 62°N. The team noted that the snow crab bycatch limitation zone doesn't conform to current NMFS reporting areas either. The team supports the agreement in that it addresses the team's conservation concerns for *C. opilio*.

Public testimony was received from John Gauvin, Vince Curry, and Arni Thomson.

The meeting adjourned at about 3:40 p.m.

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*Others listening in were:*

*Arni Thomson  
Larry Byrne  
Vince Curry  
Laure Jansen  
Martin Loefflad  
John Gauvin*

*Tom Casey  
Galen Tromble  
Dick Tremaine  
Donn Tracy  
Brent Paine*

## **Summary of the 1996 Prohibited Species Catch (PSC) estimation system**

Galen R. Tromble, NMFS Alaska Region

October 1, 1996

Prohibited species catch estimates are made by multiplying a PSC rate, expressed in weight or number of a PSC species per metric ton of groundfish catch, by the total amount of groundfish. PSC rates are based on data collected by observers. The total groundfish catch comes from the 'blend' system, which utilizes both observer and industry reports for each processor. The estimation programs are run weekly, and process year-to-date files, so estimates are constantly revised as previous data are updated. The sequence of steps is outlined below.

1) The Observer program sends PSC data to the NMFS Alaska Region weekly. These data contain the official total catch (OTC), weight of sampled hauls, and numbers or weights for each prohibited species (expanded from the sample up to the haul) with unique reports categorized by vessel, week, reporting area, gear, and CDQ number. Each report identifies the vessel permit number and the processor ID code, which, in the case of catcher-processor vessels, identify the same entity..

2) Target fishery codes are assigned to the observer records, based on observed groundfish catch. From these data, NMFS generates several types of PSC rates, with different levels of aggregation, ranging from rates specific to a processor to annual average rates for a target fishery. The number of reports incorporated into each rate is recorded.

### **PSC rate types:**

a) Processor-specific rates. For the processor-specific rate, the key is week, processor ID, reporting area, gear. All catcher-processor and mothership vessels over 125 feet length overall carry an observer at all times, so it is easy to match observer PSC data with total groundfish catch from the processor.

b) Sector-specific 3-week average rates. The sectors are catcher-processor, mothership, and shoreside. These rates average all observer data for the sector, gear, reporting area, and target fishery for a three week period centered on the week for which the rate is assigned. In other words, data from the previous week, current week, and subsequent week are used. For the most recent week, only the previous and current week data exist, so the average is over 2 weeks. In some cases, where fisheries are very short, the rate may represent data from a single week.

In most mothership operations, where unsorted cod-ends are delivered, the observer is onboard the mothership and samples deliveries from all catcher vessels. For shoreside processors, and motherships which receive sorted catch, the observer reports come from the catcher vessel observers. Some shoreplants also have observers, but they do not collect data

used for PSC monitoring.

c) Overall 3-week average rates. These rates are generated in the same way as the sector-specific rates, but utilize all observer data regardless of sector.

d) Prior-year rates. A file of 'substitute' rates is based on data from prior years. The key for this file is reporting area, gear, and target.

e) Annual FMP Area rates. These rates pool all observer data for the current year for each gear and target fishery in an entire management area -- GOA or BSAI. These represent the maximum level of pooling, and are used only as a last resort.

3) The blend data are split into two files, one for the GOA and one for the BSAI, named GOAHAL and BSAHAL, respectively. Each file is indexed on a key consisting of week, processor ID, reporting area, gear, target, and CDQ number. The groundfish weight field, TONS, is totaled creating one record for each distinct key with the sum of all allocated groundfish species in the TONS field.

4) Bycatch rates are assigned to each record, and a field, named QUART, is assigned a code denoting the type of rate which is assigned. Assignment of these rates is sequential, from rates with the least amount of aggregation to those with the most aggregation. Once a rate is found that can be assigned to a record, the program skips to the next record and begins searching for a rate to assign.

a) First, a processor-specific rate is searched for. If a C/P or mothership has an observer report, those rates are applied, and the QUART field is filled with a 'P'. Processor-specific rates are not used for shoreplants. Previous attempts to use shoreplant processor-specific rates caused many estimation problems. Problems exist with mixtures of landings from different fisheries and assignment of a single target to the processor for each gear and reporting area. Until we are able to obtain individual landing specific information for shoreplants inseason -- similar to the level of detail available on a fish ticket, we do not anticipate being able to significantly improve PSC estimates for the shoreside sector.

b) For remaining records, the sector-specific 3-week average rates for shoreplants (QUART = 'F'), motherships (QUART = 'M'), and catcher-processors (QUART = 'C'), respectively) are applied if the number of observer reports used to generate the rate is 10 or more.

c) Next, the overall 3-week average rate, is applied (QUART = 'A'), based on week, reporting area, gear, and target fishery..

d) For any remaining records, not yet assigned a rate, the prior-year rate (QUART = 'S'), or as a last resort, the annual FMP-area rate (QUART = 'Z') is assigned.

e) In a few cases, most notably Southeast demersal shelf rockfish, and jig Pacific cod



fisheries, no observations have ever occurred, and no substitute rate is available. No PSC estimate is made in these cases.

Once a PSC rate has been assigned for each groundfish record, by processor ID, week, reporting area, gear, and target fishery, the PSC estimates are computed by multiplying the PSC rate for each prohibited species times the total groundfish weight (TONS). For PSC limits which are expressed in terms of mortality, the estimated bycatch is multiplied by the mortality rate to obtain an estimate of mortality.

The PSC estimation system was developed to function as a real-time estimation system, using data available as the season progresses to generate estimates for quota monitoring, applying common methodology to all fisheries. It may not produce the best estimate possible for every fishery, when compared with results of a fishery-specific analysis using all available data after the season is over. The 3-week averaging method, for example, was developed to smooth out the inseason estimates. Without it, bycatch estimates from week to week were much more variable, trends were hard to discern, and the smaller number of observer reports used for each rate meant that the appearance of an unusually high or low rate would dramatically affect the weekly rate.

## Crab Bycatch in the BSAI Pacific Cod Pot Fishery

**Background:** In August 1996, Tyson Seafoods Group submitted a proposal to the NPFMC to institute crab bycatch limits for pot gear fisheries targeting Pacific cod in the Bering Sea. The proposal suggests that all groundfish fisheries that have crab bycatch should be regulated to reduce impacts on crab stocks and promote crab rebuilding. The Council requested the Crab Plan Team to review available information on crab bycatch in this fishery and recommend whether to take further action.

**Fishery Management:** Pacific cod TAC is allocated among gear types in the BSAI. From 1994-1996, 54% of the TAC was allocated to trawl gear, 44% to fixed gear (longline and pot gear), and 2% to jig gear. Beginning in 1997 under Amendment 46, the allocation will be 47% trawl gear, 51% fixed gear, and 2% jig gear. Regulations have been established to reduce the bycatch of crab in pot fisheries. Pots must have rigid tunnel openings less than 9" wide and 9" high, or soft tunnel openings less than 9" diameter. Pots must also be equipped with biodegradable panels constructed of 30# cotton thread (or smaller), a minimum of 18" long and within 6" of the bottom.

**Pacific Cod Population Status:** In 1996, exploitable biomass (age 3+) was estimated at 1.129 million mt. Catch specifications were the following: OFL=420,000 mt, ABC=305,000 mt, TAC=270,000 mt. It is expected that the stock will increase slightly with recruitment of a strong 1992 year-class, but preliminary information suggests that the 1993 year class is average and 1994 year-class is below average.

**Pacific Cod Catch:** The adjacent table shows the catch of Pacific cod by gear type in recent years. Note that the catch by pot gear has increased each year since 1993. It is projected that pot gear will take a larger portion of the TAC under Amendment 46.

Catch of Pacific cod in the BSAI by gear type, 1992-1996 (through November 26).

Year	Pot	Longline	Trawl	Jig	Total
1992	13,681	102,071	90,377	na	206,130
1993	2,098	66,153	98,844	na	167,095
1994	8,236	87,139	99,748	732	195,856
1995	18,782	94,163	118,745	571	232,261
1996	32,064	92,354	110,391	213	235,022

**Crab Population Status:** Both red king crab and Tanner crab (*C. bairdi*) populations in the BSAI are near historically low levels. The 1996 survey indicated the red king crab stock was above threshold, however, and a GHF of 5 million pounds was established. The Tanner crab population is projected to decline further as few juveniles were observed.

**Crab Bycatch:** Crab bycatch in the groundfish pot fishery is shown in the adjacent table. Bycatch of red king crab occurs almost entirely in Zone 1. Crab bycatch in the 1996 pot fisheries by regulatory areas was follows: Area 516=35,240 crabs, Area 512=12,639 crabs, and Area 509=21,740 crabs. Very few crabs were taken in other areas. Most *bairdi* bycatch occurs in Area 509 (146,648 crabs) and Area 521 (81,695 crabs). Average size of *bairdi* bycatch is 110 mm, as indicated by scant observer data.

Number of crabs taken in BSAI groundfish pot fisheries, 1992-1996 (through 10/26).

Year	Red King	Bairdi	Opilio
1992	10,074	230,274	130,206
1993	11	1,535	1,138
1994	635	23,675	23,363
1995	2,976	63,038	153,461
1996	74,129	261,378	not avail

**Bycatch Mortality:** The impact of bycatch depends directly on discard mortality. Numerous laboratory studies have been done to determine bycatch mortality in crab fisheries, but no studies have been conducted for groundfish pot fisheries. The observer program has collected data on condition of bycaught crabs, however, these numbers are conservative in that they do not take into account delayed mortality. Previous analysis have assumed bycatch mortality rates of 8% for red king crab and 30% for Tanner crabs.

## BERING SEA FISHERY SIMULATION MODEL RESULTS FOR VARIOUS CRAB CAPS

As provided in Amendment 41 pp. 64-66 with supplemental information and updated tables.

The Bering Sea fishery simulation model was employed to estimate the economic impacts of reducing crab caps in the Bering Sea. A general discussion of the model follows in the next section, and a detailed discussion can be found in Amendments 21a and 21b, as well as in Amendment 37 and Appendix 8. Detailed output from the model was not provided for this section in order to conserve space, and because the output is similar to other model runs in this amendment.

The Bering Sea fishery simulation model was modified to include the bycatch of *Chionoecetes opilio* crab and assign caps for this species. The value data for *C. bairdi*, *C. opilio* and red king crab were updated for this analysis as well. The model was run with the most constraining options in place to examine the greatest expected changes from Status Quo. Model runs using both the 1993 and 1994 data sets included the following options: (1) Status Quo which included a three month closure of the Red King Crab Savings Area; (2) a Zone 1 cap for bairdi crab of 850,000 and a Zone 2 bairdi crab cap of 1.5 million crab; (3) a Zone 1 cap of 35,000 red king crab; (4) a Zone 2 cap of 11 million opilio crab; (5) a run with all of the above caps in place (850,000 Zone 1 bairdi, 1.5 million Zone 2 bairdi, 11 million Zone 2 opilio, and 35,000 Zone 1 red king crab) as well as the closure of the Red King Crab Savings Area; (6) a run with all of the above caps, the Red King Crab Savings Area closure, and the Northern Bristol Bay closure (7) the caps and closures as above in (6) with the additional constraint of a 6 million opilio crab cap in Zone 2; and (8) The June 1996 Council action to close the Red King Crab Savings Area on an annual basis, close Northern Bristol Bay to trawling (the 2 block opening not included in this analysis), and based on population size, set the Zone 1 cap of red king crab at 100,000 crab. In addition (8) applies a Zone 1 cap on bairdi at 750,000 crab and the Zone 2 bairdi cap at 2.1 million crab.

Option (8) above served as a new Status Quo for five additional runs which varied the opilio crab bycatch cap and added the options for a cap-based closure of Zone 2, or of the entire Bering Sea outside of Zone 1. The four additional runs were as follows: (9) a run with a Zone 2 opilio cap of 11 million crab; (10) the four-year average bycatch (12.45 million crab) was apportioned among fisheries, and Zone 2 was closed when the cap was attained; (11) a run which applied a cap of 7.32 million crab (.135% of the 1996 abundance estimate of 5.42 billion crab) with a Zone 2 closure; (12) a run which had a cap of 12.45 million crab with a closure of all areas except Zone 1 when the cap was attained; and (13) a run with a cap of 7.32 million crab which also closed the Bering Sea exclusive of Zone 1 when the cap was attained.

The model runs which examined the impacts of various area alternatives for the Red King Crab Savings Area were presented in Amendment 37. The impacts of the Northern Bristol Bay Closure were estimated by model runs and presented in sections 4.0 and 6.0 of Amendment 41. The results of the cap analysis runs presented here can be compared with the previous runs with the caution that splitting Tanner crab into bairdi and opilio separately may have changed the bycatch rates of areas, and that the crab values have been updated. Details of the model and assumptions are available in Amendment 41.

### Initial Analysis

The bycatch of the crab species in 1993 and 1994, largely because of existing caps, were not generally in excess of the most restrictive options used in the model runs, and often were below the more restrictive caps. For instance, under Status Quo in the 1993 data, 7.5 million opilio crab were estimated to be bycaught in Zone 2 in the absence of a cap, and in 1994 approximately 10 million opilio crab were estimated to be bycaught in Zone 2. The cap used for opilio crab was 11 million, so that only specific fisheries might be affected by the opilio cap, since the overall cap of 11 million exceeded the bycatch from all fisheries in each year. Thus the model does not capture the impacts of years in which the bycatch rates for any of the species might be higher. Similarly, the impacts of a cap might be less than the model predicts if crab were caught at a higher rate in 1993 or 1994 than would happen in future fisheries, as was the case in 1994. The bycatch of red king crab predicted by the model from 1994 data was approximately 90,000 red king crab with the 3 month Red King Crab Savings Area closure in place, while in 1995 the

actual number bycaught was approximately at the most restrictive cap of 35,000 crab.

The constraints on the fishing fleet by the individual crab caps (Alternatives Bairdi (850,000 Zone 1, 1.5 million Zone 2); Red (35,000 Zone 1); and Opilio (11 million Zone 2) resulted in changes in net benefits to the Nation from Status Quo of less than approximately \$500,000 under the 1993 data set (attached Tables 1 and 2). This is because the bycatch of each crab species available to the model was similar to the caps in that year. The model runs based on the 1994 data estimated decrements to the net benefits to the Nation of from approximately \$1 million to \$4.8 million. The reduction of the red king crab cap to 35,000 resulted in the greatest change from Status Quo under both the 1993 and 1994 data.

Model runs to estimate the impacts of all three management measures in place concurrently were also made using the 1993 and 1994 data. These runs simulated a closure of the Red King Crab Savings Area for the first three months of the year, a closure of the Northern Bristol Bay area, and caps of 850,000 bairdi crab in Zone 1, 1.5 million bairdi crab in Zone 2, 11 million opilio crab in Zone 2, and 35,000 red king crab in Zone 1 (indicated as RKC,Caps,N.BB in the attached Tables 1 and 2). With these constraints in place, the estimated net benefits to the Nation decreased by approximately \$1.4 million using the 1993 data set and by approximately \$3.9 million using the 1994 data set.

Reducing the opilio cap to 6 million crab in addition to all of the proposed closures and caps above reduced the estimated net benefits to the nation from status quo by approximately \$1.4 million using the 1993 data and by approximately \$11.1 million using the 1994 data (indicated as RKC,Cap,BB,6 mil.Op in the attached Tables 1 and 2). The reason there was no change from all proposed closures and caps in place using the 1993 data and decreasing the opilio cap by 5 million crab was that the bairdi caps closed the Zone 2 fisheries which would have been impacted by the reduced caps. Using the 1994 data, it was the opilio cap rather than the bairdi cap which was more constraining. The overall bycatch of opilio crab was not greatly reduced in 1993 from status quo because the bairdi crab closure caused fishing to occur outside of Zone 2 where opilio crab bycatch is still substantial.

#### Bairdi Caps

Additional runs to estimate the impacts of measures taken in June 1996 with the most recent (September 1996) suggested caps for bairdi crab in place were also made (indicated as RKC,current,BB in the attached Tables 1 and 2). Under these runs with the 1993 and 1994 data the following assumptions applied: (1) Annual closure of the Red King Crab Savings Area; (2) Annual closure of Northern Bristol Bay (due to programming difficulty and time available, the summer opening of two blocks for yellowfin sole fishing was not included as an option); (3) a 100,000 red king crab cap in Zone 1 based on current population estimates for 1996; (4) a Zone 1 cap of 750,000 bairdi crab and a Zone 2 cap of 2.1 million bairdi crab. The estimated net benefits to the nation decreased by approximately \$1.2 million using the 1993 data set and by approximately \$2.2 million using the 1994 data set. These decrements in net benefits to the Nation represent changes from Status Quo of 0.4% and 0.8% in the 1993 and 1994 data sets, respectively.

#### Opilio Caps

In order to provide background for possible action to address C. opilio caps, the above run (RKC,current,BB) was assumed to be the new Status Quo with the following measures in place for 1997: an annual closure of the Red King Crab Savings Area; the Northern Bristol Bay closure; a cap of 100,000 red king crab in Zone 1; and a Zone 1 cap for bairdi crab of 750,000 crab and a Zone 2 cap of 2.1 million bairdi crab. Five model runs using the 1993 and 1994 data sets included the following assumptions: a Zone 2 cap for opilio of 11 million crab (indicated in Tables 1 and 2 as Opilio11.0,Zn2); a Zone 2 cap for opilio of 12.45 million (Opavgcap(12.45),Zn2 in Tables 1 and 2); a Zone 2 cap for opilio of 7.32 million (Op96cap(7.32),Zn2 in Tables 1 and 2); a cap for all areas outside of Zone 1 of 12.45 million opilio (Opavgcap(12.45),BS in Tables 1 and 2); and a cap for all areas outside of Zone 1 of 7.32 million opilio (Op96cap(7.32),BS in Tables 1 and 2). The cap of 11 million was as suggested by the Crab Plan Team, 12.45 million crab was the average bycatch of opilio crab for the years 1992 - 1995, and 7.32 million crab was equal to .135% of the 1996 opilio crab abundance estimate of 5.43 billion opilio crab. Between 1992 and 1995, the average bycatch as a percentage of the total estimated opilio abundance was .135%.

The bycatch of opilio crab in 1993 was higher than in 1994 (14.8 million crab and 12.5 million crab in 1993 and 1994, respectively). However, in 1993 approximately 60% of the opilio crab bycatch was taken in Zone 2 whereas in 1994 approximately 92% of the opilio crab were taken within Zone 2 so that the Zone 2 bycatch of opilio crab was actually higher in 1994. The application of a Zone 2 cap using the 1993 data showed little impact because of the smaller proportion of crab (60%, or approximately 9 million crab) taken in Zone 2. In 1994, on the other hand, a much higher proportion and number of crab were taken in Zone 2 (92% or approximately 11.5 million crab), and thus the Zone 2 caps would have a much greater impact using the 1994 data set.

A Zone 2 cap of 11 million crab resulted in a net decrement in benefits to the nation of approximately \$34,000 due to late attainment of the cap by the flatfish/rocksole fisheries using the 1993 data set. Note that the opilio cap was not attained under the Zone 2 cap of 12.45 million crab using the 1993 data. Yellowfin sole attained their portion of the 11 million Zone 2 opilio cap using the 1994 data for a net decrement in benefits to the nation of approximately \$1.6 million. Again, the 12.45 million Zone 2 cap showed no impact. Reduction of the opilio cap to 7.32 million crab in Zone 2 resulted in a reduction of net benefits to the nation of approximately \$118,000 using the 1993 data set and a reduction of net benefits to the nation of approximately \$8.75 million using the 1994 data set. The effect of the Zone 2 closure is especially apparent in 1994 due to the concentration of effort and bycatch within Zone 2 in 1994. Without effort in areas outside of Zone 2, the model had no areas to transfer effort to when Zone 2 was closed to fisheries. The model therefore overestimates the impacts in cases when target is actually available outside of Zone 2, and is more representative of cases where the target is only available in Zone 2.

Closure of the entire Bering Sea outside of Zone 1 upon fishery attainment of opilio caps showed small impacts with a high cap, such as 12.45 million, but large impacts with a lower cap of 7.32 million. Using the 1993 data set, the loss of net benefits to the nation was approximately \$771,000 with a Bering Sea cap of 7.32 million crab. Using the 1994 data set, the loss in net benefits to the nation reached approximately \$11.5 million with a 7.32 million opilio cap. The fishery which attained its portion of the cap and was most impacted by the reduced cap was the yellowfin sole fishery. Under this model run the overall bycatch of opilio crab was reduced by approximately 4.6 million crab, but the total catch of groundfish was reduced by approximately 115,000 metric tons due to the attainment of caps.

#### Opilio Negotiations 11/6/96-11/7/96

As additional analyses for the opilio crab cap negotiations, model runs using the 1993 and 1994 data were made with a Bering Sea wide cap of 4,464,693 crab (indicated in Tables 1 and 2 as Op96cap(4.46),BS). This cap is equivalent to 0.0823% of the 1996 abundance estimate of 5.4249 billion opilio crab. The results of these runs indicated a greater impact to groundfish fisheries than those runs with a Bering Sea cap of 7.32 million crab. Under the 4.46 million crab cap, the model projected a greater decrease in net benefits to the Nation of \$2.5 and \$13.7 million using the 1993 and 1994 data, respectively. It should be noted that in 1993 and 1994, between 12 and 14 million crab were bycaught. Using 1995 or 1996 data when fewer crab were bycaught the model would be expected to estimate lower impacts (e.g. fisheries would catch crab at a lower rate and be closed later in the season due to caps).

**Table 1. Summary of total catch, bycatch, total gross and net values of catch and bycatch, and estimated total net benefits to the Nation under status quo and combinations of bairdi, opilio and red king crab caps - 1993 and 1994 data.**

**Model runs based on 1993 data**

Alternative	Total Catch	Total Retained Catch	Total Gross Value	Total Net Value	Tanner Crab	Opilio Crab	Red King Crab	Hallibut	Chinook Salmon	Other Salmon	Herring	Gross Value Bycatch	Net Value Bycatch	Total Gross minus Bycatch Gross	Total Net minus Bycatch Net
Status Quo	1,809,778	1,552,688	\$847,189,115	\$315,373,429	2,278,571	14,941,488	63,692	3,708	50,506	98,496	746	\$46,719,083	\$20,923,772	\$800,470,032	\$294,449,657
Bairdi	1,807,370	1,551,953	\$846,410,232	\$315,091,474	2,093,271	14,238,044	61,082	3,663	50,506	98,496	746	\$44,882,729	\$20,103,812	\$801,727,503	\$294,987,662
Red	1,812,070	1,552,768	\$846,815,608	\$315,238,220	2,330,484	15,029,742	63,987	3,691	50,549	98,496	746	\$47,071,607	\$21,050,105	\$799,744,001	\$294,188,114
Opilio	1,809,264	1,552,380	\$846,974,451	\$315,295,721	2,268,976	14,873,835	63,692	3,708	50,506	98,496	746	\$46,604,656	\$20,879,579	\$800,369,795	\$294,416,142
Bairdi,Red,Opilio	1,800,044	1,548,209	\$843,358,584	\$313,986,781	2,084,468	13,248,501	56,844	3,638	50,549	98,496	746	\$43,699,035	\$19,701,343	\$799,659,559	\$294,285,438
RKC,Caps,N,BB	1,792,522	1,543,523	\$839,924,271	\$312,743,556	2,115,971	13,416,553	54,936	3,601	50,403	98,496	631	\$43,686,418	\$19,651,917	\$796,237,853	\$293,091,639
RKC,Cap,BB,6 mil.Op	1,792,522	1,543,523	\$839,924,271	\$312,743,556	2,115,971	13,416,553	54,936	3,601	50,403	98,496	631	\$43,686,418	\$19,651,917	\$796,237,853	\$293,091,639
<b>New Status Quo</b>															
RKC,current,BB	1,802,213	1,547,967	\$843,711,202	\$314,114,888	2,304,461	15,166,112	60,923	3,672	50,436	98,953	634	\$46,698,720	\$20,871,349	\$797,012,482	\$293,243,539
Opilio11.0,Zn2	1,801,698	1,547,659	\$843,496,538	\$314,037,179	2,294,866	15,098,459	60,923	3,672	50,436	98,953	634	\$46,584,293	\$20,827,155	\$796,912,245	\$293,210,024
Opavgcap(12.45),Zn2	1,802,213	1,547,967	\$843,711,202	\$314,114,888	2,304,461	15,166,112	60,923	3,672	50,436	98,953	634	\$46,698,720	\$20,871,349	\$797,012,482	\$293,243,539
Op96cap(7.32),Zn2	1,799,951	1,546,598	\$842,822,785	\$313,793,281	2,290,015	14,617,041	59,978	3,672	50,436	98,953	632	\$46,177,334	\$20,667,986	\$796,645,452	\$293,125,295
Opavgcap(12.45),BS	1,802,213	1,547,967	\$843,711,202	\$314,114,888	2,304,461	15,166,112	60,923	3,672	50,436	98,953	634	\$46,698,720	\$20,871,349	\$797,012,482	\$293,243,539
Op96cap(7.32),BS	1,790,400	1,542,213	\$840,014,266	\$312,776,597	2,276,205	14,108,941	53,833	3,623	50,436	98,953	625	\$45,344,849	\$20,303,750	\$794,669,417	\$292,472,847
Op96cap(4.46),BS	1,768,009	1,529,579	\$830,596,755	\$309,367,458	2,003,722	12,088,011	45,638	3,504	50,371	98,953	624	\$41,302,367	\$18,652,559	\$789,294,388	\$290,714,899

**Model runs based on 1994 data**

Alternative	Total Catch	Total Retained Catch	Total Gross Value	Total Net Value	Tanner Crab	Opilio Crab	Red King Crab	Hallibut	Chinook Salmon	Other Salmon	Herring	Gross Value Bycatch	Net Value Bycatch	Total Gross minus Bycatch Gross	Total Net minus Bycatch Net
Status Quo	1,803,803	1,536,805	\$827,694,490	\$305,508,379	2,597,799	10,914,052	90,030	4,576	42,216	49,528	1,600	\$51,225,167	\$23,341,231	\$776,469,322	\$282,167,148
Bairdi	1,786,906	1,528,925	\$821,268,068	\$303,180,458	2,344,868	11,808,740	90,900	4,743	41,992	49,531	1,612	\$50,915,043	\$23,329,385	\$770,353,025	\$279,851,073
Red	1,784,587	1,530,065	\$809,049,182	\$298,758,777	2,401,238	10,234,614	45,766	4,266	41,987	49,528	1,611	\$46,965,008	\$21,420,894	\$762,084,174	\$277,337,884
Opilio	1,803,653	1,535,686	\$827,078,518	\$305,285,397	2,500,570	11,349,426	89,894	4,870	42,216	49,528	1,600	\$52,179,102	\$23,896,895	\$774,899,416	\$281,388,502
Bairdi,Red,Opilio	1,785,714	1,546,466	\$818,242,868	\$302,471,879	1,970,888	11,871,255	45,950	4,487	42,273	49,531	1,612	\$46,202,502	\$21,268,206	\$772,040,366	\$281,203,674
RKC,Caps,N,BB	1,764,899	1,533,632	\$809,665,495	\$299,366,870	1,914,034	12,042,346	46,873	4,459	42,295	49,531	1,586	\$45,807,519	\$21,095,858	\$763,857,976	\$278,271,012
RKC,Cap,BB,6 mil.Op	1,694,281	1,501,448	\$784,411,138	\$290,224,793	1,483,508	9,607,004	46,473	4,416	42,295	49,531	1,580	\$40,906,334	\$19,174,679	\$743,504,804	\$271,050,114
<b>New Status Quo</b>															
RKC,current,BB	1,791,207	1,529,788	\$822,715,053	\$303,705,815	2,545,413	11,058,963	91,518	4,796	42,009	49,529	1,588	\$51,965,200	\$23,767,063	\$770,749,853	\$279,938,753
Opilio11.0,Zn2	1,780,514	1,522,806	\$817,485,930	\$301,812,873	2,370,402	12,219,088	91,064	4,749	42,009	49,529	1,588	\$51,388,474	\$23,512,940	\$766,097,455	\$278,299,932
Opavgcap(12.45),Zn2	1,791,207	1,529,788	\$822,715,053	\$303,705,815	2,545,413	11,058,963	91,518	4,796	42,009	49,529	1,588	\$51,965,200	\$23,767,063	\$770,749,853	\$279,938,753
Op96cap(7.32),Zn2	1,710,809	1,491,667	\$792,920,466	\$292,920,175	1,938,266	10,607,104	90,427	4,672	42,009	49,529	1,581	\$46,912,423	\$21,733,354	\$746,008,044	\$271,186,821
Opavgcap(12.45),BS	1,784,583	1,525,548	\$819,713,598	\$302,619,289	2,545,413	10,327,711	91,518	4,485	42,009	49,529	1,588	\$50,059,037	\$22,833,075	\$769,654,561	\$279,786,213
Op96cap(7.32),BS	1,676,254	1,465,564	\$779,036,947	\$287,894,341	1,938,266	6,456,225	90,427	4,219	42,009	49,529	1,581	\$41,911,676	\$19,515,386	\$737,125,272	\$268,378,955
Op96cap(4.46),BS	1,650,336	1,453,149	\$770,706,671	\$284,878,781	1,830,884	4,624,016	90,188	4,193	42,009	49,529	1,578	\$39,733,959	\$18,657,714	\$730,972,712	\$266,221,068

Bairdi = 850,000 Zone 1 cap, 1.5 million Zone 2 cap; Opilio = 11 million Zone 2 cap; Red = 35,000 Zone 1 cap, 6 mil. Op = Zone 2 Opilio cap of 6 million crab.

Current = 100,000 RKC, annual RKC closure;750,000 Zone 1 Bairdi; 2.1 million Zone 2 Bairdi.

Opilio11.0 = 11 million opilio cap; Opavgcap = 92-95 average opilio bycatch (12.45 million); Zn2 = Zone 2 closure only; BS = closure of all but Zone 1; Op96cap = 7.32 million or .135% of 5.42 billion opilio estimated for 1996.

**Table 2. Summary of total catch, bycatch, total gross and net values of catch and bycatch, and estimated total net benefits to the Nation under status quo and combinations of bairdi, opilio and red king crab caps - 1993 and 1994 data.**

**DIFFERENCE FROM STATUS QUO**

**Model runs based on 1993 data**

Alternative	Total Catch	Total Retained Catch	Total Gross Value	Total Net Value	Tanner Crab	Opilio Crab	Red King Crab	Halibut	Chinook Salmon	Other Salmon	Herring	Gross Value Bycatch	Net Value Bycatch	Total Gross minus Bycatch Gross	Total Net minus Bycatch Net
Status Quo															
Bairdi	-2,408	-735	-\$778,883	-\$281,956	-185,300	-703,444	-2,610	-46	0	0	0	-\$2,036,354	-\$819,961	\$1,257,471	\$538,005
Red	2,292	80	-\$373,507	-\$135,210	51,913	88,254	288	-17	42	0	0	\$352,524	\$126,333	-\$726,031	-\$261,543
Opilio	-514	-308	-\$214,664	-\$77,708	-9,595	-67,653	0	0	0	0	0	-\$114,427	-\$44,193	-\$100,237	-\$33,515
Bairdi,Red,Opilio	-9,734	-4,479	-\$3,830,521	-\$1,386,649	-194,103	-1,692,988	-6,847	-70	42	0	0	-\$3,020,047	-\$1,222,429	-\$810,473	-\$164,220
RKC,Caps,N,BB	-17,256	-9,165	-\$7,264,844	-\$2,629,874	-162,600	-1,524,935	-8,756	-107	-104	0	-115	-\$3,032,665	-\$1,271,855	-\$4,232,179	-\$1,358,018
RKC,Cap,BB,6 mil.Op	-17,256	-9,165	-\$7,264,844	-\$2,629,874	-162,600	-1,524,935	-8,756	-107	-104	0	-115	-\$3,032,665	-\$1,271,855	-\$4,232,179	-\$1,358,018
RKC,current,BB	-7,566	-4,721	-\$3,477,913	-\$1,258,542	25,890	224,624	-2,769	-36	-71	457	-112	-\$20,362	-\$52,424	-\$3,457,550	-\$1,206,118
<b>New Status Quo</b>															
RKC,current,BB															
Opilio11.0,Zn2	-514	-308	-\$214,664	-\$77,708	-9,595	-67,653	0	0	0	0	0	-\$114,427	-\$44,193	-\$100,237	-\$33,515
Opavgcap(12.45),Zn2	0	0	\$0	\$0	0	0	0	0	0	0	0	\$0	\$0	\$0	\$0
Op96cap(7.32),Zn2	-2,262	-1,371	-\$888,417	-\$321,607	-14,446	-549,071	-944	0	0	0	-2	-\$521,387	-\$203,362	-\$367,030	-\$118,244
Opavgcap(12.45),BS	0	0	\$0	\$0	0	0	0	0	0	0	0	\$0	\$0	\$0	\$0
Op96cap(7.32),BS	-11,812	-5,754	-\$3,696,936	-\$1,338,291	-28,256	-1,057,171	-7,090	-49	0	0	-9	-\$1,353,871	-\$567,599	-\$2,343,064	-\$770,692
Op96cap(4.46),BS	-34,203	-18,388	-\$13,114,447	-\$4,747,430	-300,739	-3,078,101	-15,285	-168	-65	0	-10	-\$5,396,353	-\$2,218,790	-\$7,718,094	-\$2,528,640

**Model runs based on 1994 data**

Alternative	Total Catch	Total Retained Catch	Total Gross Value	Total Net Value	Tanner Crab	Opilio Crab	Red King Crab	Halibut	Chinook Salmon	Other Salmon	Herring	Gross Value Bycatch	Net Value Bycatch	Total Gross minus Bycatch Gross	Total Net minus Bycatch Net
Status Quo															
Bairdi	-16,897	-7,881	-\$6,426,422	-\$2,327,921	-252,831	894,688	870	168	-224	2	12	-\$310,124	-\$11,846	-\$6,116,298	-\$2,316,075
Red	-19,216	-6,740	-\$18,645,308	-\$6,749,601	-196,561	-679,438	-44,265	-310	-228	0	11	-\$4,260,160	-\$1,920,337	-\$14,385,148	-\$4,829,264
Opilio	-151	-1,140	-\$615,972	-\$222,982	-97,229	435,374	-137	295	0	0	0	\$953,935	\$555,664	-\$1,569,907	-\$778,646
Bairdi,Red,Opilio	-18,089	9,661	-\$9,451,621	-\$3,036,500	-626,911	957,203	-44,080	-88	58	2	12	-\$5,022,665	-\$2,073,026	-\$4,428,956	-\$963,474
RKC,Caps,N,BB	-38,905	-3,173	-\$18,028,995	-\$6,141,509	-683,766	1,128,294	-43,157	-116	79	2	-14	-\$5,417,648	-\$2,245,373	-\$12,611,347	-\$3,896,136
RKC,Cap,BB,6 mil.Op	-108,522	-35,358	-\$43,283,351	-\$15,283,586	-1,114,291	-1,307,047	-43,558	-159	79	2	-20	-\$10,318,833	-\$4,166,552	-\$32,964,518	-\$11,117,034
RKC,current,BB	-12,586	-7,017	-\$4,979,436	-\$1,802,564	-52,386	144,911	1,488	221	-206	1	-12	\$740,033	\$425,831	-\$5,719,469	-\$2,228,395
<b>New Status Quo</b>															
RKC,current,BB															
Opilio11.0,Zn2	-10,693	-6,982	-\$5,229,124	-\$1,892,943	-175,011	1,160,125	-454	-47	0	0	0	-\$576,726	-\$254,122	-\$4,652,398	-\$1,638,820
Opavgcap(12.45),Zn2	0	0	\$0	\$0	0	0	0	0	0	0	0	\$0	\$0	\$0	\$0
Op96cap(7.32),Zn2	-80,398	-38,121	-\$29,794,587	-\$10,785,640	-607,147	-451,859	-1,091	-124	0	0	-7	-\$5,052,778	-\$2,033,708	-\$24,741,809	-\$8,751,932
Opavgcap(12.45),BS	-6,624	-4,240	-\$3,001,456	-\$1,086,527	0	-731,252	0	-311	0	0	0	-\$1,906,163	-\$933,988	-\$1,095,292	-\$152,539
Op96cap(7.32),BS	-114,953	-64,224	-\$43,678,106	-\$15,811,474	-607,147	-4,602,738	-1,091	-577	0	0	-7	-\$10,053,525	-\$4,251,676	-\$33,624,582	-\$11,559,798
Op96cap(4.46),BS	-140,871	-76,639	-\$52,008,382	-\$18,827,034	-714,528	-6,434,948	-1,330	-603	0	0	-10	-\$12,231,241	-\$5,109,349	-\$39,777,141	-\$13,717,685

Bairdi = 850,000 Zone 1 cap, 1.5 million Zone 2 cap; Opilio = 11 million Zone 2 cap; Red = 35,000 Zone 1 cap, 6 mil. Op = Zone 2 Opilio cap of 6 million crab.

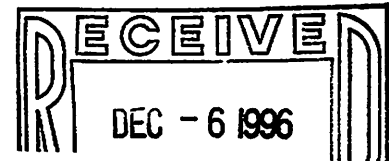
Current = 100,000 RKC, annual RKC closure; 750,000 Zone 1 Bairdi; 2.1 million Zone 2 Bairdi.

Opilio11.0 = 11 million opilio cap; Opavgcap = 92-95 average opilio bycatch (12.45 million); Zn2 = Zone 2 closure only; BS = closure of all but Zone 1; Op96cap = 7.32 million or .135% of 5.42 billion opilio estimated for 1996.

Groundfish Forum Inc.  
4215 21st Avenue West  
Seattle, WA 98199-3110

December 6, 1996

Mr. Richard Lauber  
Chairman  
North Pacific Fishery Management Council  
605 West 4th Avenue, Suite 306  
Anchorage, AK 99501-2252



RECEIVED AFTER  
COMMENT DEADLINE

RE: Proposed Opilio Cap

Dear Mr. Chairman:

As you know, the negotiations between the trawl and crab industries successfully concluded with an agreement for a floating cap specific to a portion of the Bering Sea. The area to which the cap will apply falls within several NMFS statistical areas but is not encompassed by those areas. In my opinion, the factor that proved most important for arriving at a formerly elusive compromise between the two groups was an area-specific approach based on data demonstrating that an area exists where approximately 90% of the opilio bycatch occurs from year to year. This allowed the cap to be crafted to address the principle areas of concern to the crabbers while leaving out areas (and in essence fisheries) that have proven to have very low opilio bycatch rates historically.

The crux of the matter is that from the perspective of the trawl industry, this approach means that the industry can live with the relatively low cap that was agreed upon because some trawl fisheries will not need to have opilio bycatch apportioned to them. This is why the suggestion that NMFS has made to count all opilio bycatch Bering Sea-wide against the cap is problematic, even if the rate upon which the cap is based is adjusted to reflect 100% of the historical bycatch.

An abstract way of viewing the problem is to imagine that that the sum of the parts is greater than the whole. Under the NMFS alternative approach, even if a fishery has historically low bycatch of opilio, it will be forced in the annual PSC negotiations to ask for more than its historical share of opilio bycatch to buffer against the chance occurrence that bycatch is slightly higher than anticipated. However, if the overall opilio cap applies only to the area the industry has proposed and only bycatch within that area is counted against the cap, then some fisheries that do not fish in that area to any great degree and do not take many opilio will not be obligated to ask for a buffer amount of opilio bycatch. So the trawl industry can make do with less under the approach that was agreed upon in the negotiations because we won't be loading up considerable sums of the scarce cap into buffers for unlikely events.



Based on my observations during the negotiations, there probably isn't a lot of flexibility on the part of the crab industry for a higher rate (a larger fraction of the population) for the floating cap than the negotiated rate. The area-based approach that was arrived at was probably the only means of finding a way of finding a compromise. The suggestion that all that needs to occur is that the rate needs to be upwardly adjusted ignores the fact that the upward adjustment that would be needed by the trawl industry to sign off on the modified deal may be unacceptable to the crab industry.

We hope, Mr. Chairman, that this explanation is useful for understanding the tenuous balance that has been arrived at in the negotiations. We also hope NMFS will be willing instead to adjust their statistical areas around the portion of area 514 that falls within the area of the opilio cap area. Dividing the area into 514a and 514b seems appropriate to us, but NMFS may have a better solution.

Thanks in advance for your consideration. Please call me if you have any questions or need further explanation.

Sincerely,



John R. Gawwin

cc: Earl Krygier, ADF&G