

MEMORANDUM

TO: Council, SSC and AP Members

FROM: Clarence G. Pautzke
Executive Director



ESTIMATED TIME
(6 Hours)

DATE: January 2, 1996

SUBJECT: Crab Management Issues

ACTION REQUIRED

- (a) Summary of Board-Council Consultation.
- (b) Discussion of issues raised by PNCIAC.
- (c) Initial Review of plan amendment to increase Tanner Crab PSC flexibility among Bycatch Zones.
- (d) Further direction to Crab Rebuilding Committee.

BACKGROUND

Council and Board of Fisheries Meeting

In October 1993, NMFS and ADF&G approved a "State/Federal Action Plan for Management of Commercial King and Tanner Crab Fisheries" to foster improved coordination and cooperation with respect to crab management. As a result of the plan, a consultation group consisting of Council and Board members was formed to meet publicly on an annual basis to discuss crab issues. Minutes from the last meeting in January 1995 are attached. The Council and Board will meet again on January 9.

PNCIAC Issues

The Pacific Northwest Crab Industry Advisory Committee provides a special means of access to the regulatory process for non-residents of Alaska. The PNCIAC operates under the authority of the Council, and, under the Crab FMP, occupies the same consultative role on pre-season and in-season management measures as all other existing State of Alaska Fish and Game advisory committees. Minutes of the October 16 meeting with ADF&G are included as Item C-3(a). Chairman Garry Loncon or Secretary Arni Thomson will be on hand to discuss PNCIAC concerns and recommendations.

Tanner Crab PSC Flexibility

In June, 1995, the Council initiated analysis of an industry proposal for a BSAI groundfish plan amendment that would allow greater flexibility in management of Tanner crab PSC 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 examined 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.

The analysis was distributed for Council review in September, but was not taken up at that meeting due to time limitations. A copy of that document is included in your supplemental folders for reference. Both the BSAI groundfish and crab Plan Teams reviewed the analysis, and excerpts from their minutes are attached (Item C-3(b,c)). NMFS analysts will be available to present their findings. If the document was released for public review at this meeting, with final action in April or June, regulations could be in place for 1997.

Crab Rebuilding Committee

In January 1995, 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 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.

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 was a trawl closure area in central Bristol Bay to protect adult red king crabs, and was adopted by the Council in September as Amendment 37. A second analysis examines the effects of instituting a trawl closure area in the northeast section of Bristol Bay to protect juvenile red king 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 (NPFMC intern) prepared a discussion paper that made a preliminary evaluation of these proposed management measures from a crab rebuilding perspective. Their paper was distributed in September.

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

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

At this meeting, the Council needs to determine how to proceed with crab rebuilding. I suggest that the Rebuilding Committee meet in March to review the draft EA/RIR analysis for the northern Bristol Bay Trawl Closure and the analysis of Crab PSC Limit Reduction. The analyses are scheduled for initial review by the Council in April or June.

DATE: October 16, 1995

MINUTES OF THE ALASKA DEPT. OF FISH & GAME ANNUAL MEETING
WITH THE BERING SEA CRAB INDUSTRY, HOSTED BY THE PACIFIC
NORTHWEST CRAB INDUSTRY ADVISORY COMMITTEE

Seattle, Washington

Area/Species: Bering Sea/Aleutian Islands king and tanner
crab fisheries.

Committee present: Gary Loncon, Chair., Rich White, Robert
W. Miller, Kevin Kaldestad, Dave Benson, Arni Thomson, Secy.

Committee not present: Konrad Uri, Bart Eaton, Don Giles,
Gary Painter, Bruce Joyce

ADF&G staff: Bob Clasby, Dir. Com. Fish; Pete Probasco,
Suprvsr. Westward Region; Earl Krygier; Ken Griffin; Peggy
Murphy; Rance Morrison; Al Spallinger; Doug Pengilly; Donn
Tracy.

NMFS staff: Bob Otto, Jerry Reeves

Industry present: See attached sign in sheets, 40 persons,
on 10/16 and 38 on 10/17.

Convene: 9:30 AM

Introduction: Garry Loncon, Chair

Welcome to ADF&G and NMFS staff and the industry. Apprecia-
tion to ADF&G for their commitment of time and expenses
necessary for preparation and attendance at this meeting.

REPORT ON ADF&G BUDGET: Bob Clasby, Dir. Comcl. Fisheries

ADF&G is faced with declining budgets as a result of cost
reduction measures being explored by the Alaska Legislature
to reduce the \$500 million deficit. The Legislature will
likely be proposing new taxes on the fishing industry and
looking at royalty fees on limited entry fisheries. The
concept of user fees are also being discussed.

The ADF&G budget has increased from \$1.1 million in 1991 to
\$1.8 in 1995. In addition, the State received an additional
\$90,000 for FMP management costs and \$230,000 for research
funds from the NMFS budget. In FY 1996, the ADF&G budget
will total \$2.7 million plus \$660,000 for research. The ACC
is greatly responsible for the budget and research
allocation increases through its lobbying efforts in Juneau
over the last four years.

ADF&G is anticipating an overall decrease in the Commercial
Fisheries budget from \$40 million to \$38 million this coming

year and there is likely to be significant reductions in the Westward Shellfish research and management budget this coming year and in the years to come.

REPORTS ON ADF&G RESEARCH PROJECTS: Pete Probasco, Westward Regional Supervisor, introducing biologists.

*PEGGY MURPHY, SUMMARY: She identified several research projects that have been completed during 1994 and 1995 and she also listed several projects that are planned for 1996. See the attached lists-Murphy.

**CRAB RESEARCH SUPPORTED BY ADF&G IN 1995: (Copies of the completed 1995 reports are available by contacting Rance Morrison (D.H.), Al Spallinger (Kodiak) or Peggy Murphy (Juneau).

1. Shell condition and breeding success in Tanner crab
2. Effects of handling on feeding, activity and survival of red king crabs.
3. Crab genetics
4. Long term dynamics of Alaskan crab stocks
5. Lenth Based Analysis for Tanner crab in Bristol Bay.
6. Catch length analysis for crab populations
7. Updated LBA and stock-recruitment relationship
8. Revised and completed harvest strategies
9. Initial analyses of Bristol Bay red king crab rebuilding strategies
10. Comparison of methods to estimate abundance of red king crabs in Bristol Bay and Kodiak
11. Changes in red king crab and Tanner crab population dynamics, a function of density or environmnet
12. Biological reference points for red king crabs in Bristol Bay, Kodiak and Norton Sound
13. ADF&G shellfish literature database
14. Annotated bibliography on capture and handling
15. Density dependence in red king crab collectors

**ADF&G CRAB RESEARCH PLANNED FOR 1996:

1. Breeding success of legal sized male red king crab
2. Genetic stock identification, S. Merkouris and L. Seeb
3. Relative roles of fishing, predation, and environment on long-term dynamics of Alaskan crab stocks, A. Tyler
4. Population estimates and alternative crab harvest strategies. J. Zheng, M. Murphy, and G. Kruse
5. Red king crab pot design and catch efficiency. S. Zhou

****RESEARCH RECOMMENDATIONS FROM ADF&G/NMFS INTERAGENCY MEETING**

1. Larval ecology and oceanography
2. Crab collectors
3. Image processing
4. St Matthew blue king crab harvest strategy
5. Chionoecetes tag
6. Gear studies
7. Review biological seasons
8. Industry input to review of proposals for funding
9. Interaction between crab and groundfish plan teams

Crab plan team will continue to be involved in the issue of crab bycatch in groundfish fisheries

***DOUG PENGILLY:**

Doug has recently been charged with the responsibility for developing a Bering Sea crab research program that will be coordinated with the research identified by Peggy Murphy. See attachment, Westward Region Bering Sea/Aleutians Crab Crab Research; Pengilly.

***PEGGY MURPHY:** Length based model use, harvest rates, thresholds. Paper available from Morrison, Spallinger or Murphy.

Reference paper: Overview of Population Estimation Methods & Robust Long-term Harvest Strategy, Red King Crabs in Bristol Bay

Previous method, outdated and less accurate

New LBA method averages multi year abundance estimates

Recruit curve/effective spawning biomass: Used for projecting; spawning most effective with modest spawning biomass, not either high or low spawning biomass

Introduces a new definition of handling mortality, to encompass all types of mortality and estimates that it is 20 to 50% overall.

DISCUSSION:

Questions about data source for 50% handling mortality rate. Murphy says that 20-50% mortality rates are lab estimates. Materials to be reviewed by the Board of Fish in March, 1996.

Tom Casey raised his members concerns that implementation of the new strategy and minimum thresholds could result in protracted closure periods and no income for fishermen. Raises questions about scientific assumptions and conclusions in the new strategy.

P. Murphy responds that the strategy has already been reviewed by scientific peers extensively and it has already been implemented. However, it is subject to modification and refinement.

K. Kaldestad: Concern that the new definition for handling mortality could be misinterpreted and severely impact bycatch rates in the crab fisheries.

*DONN TRACY: Tanner board study, 3" vs. 5" openings
Copies available from Tracy.

Preliminary results:

Study focuses on size of crabs, not the total number of crabs caught in each pot. The study is therefore somewhat inconclusive. However, the survey showed that there is a substantial bycatch of juvenile king crabs caught in the pots, even with the restrictive 3 inch tunnel opening and this gives ADF&G cause for concern.

BOB OTTO: NMFS research projects

Handling mortality: After the completion of its recent studies by Macintosh and Stevens, NMFS has come to the conclusion that handling mortality in directed crab fisheries is non significant, less than 3%. The new study will be available soon for distribution.

In regards to predation by cod, NMFS feels that predation by cod (from stomach analysis, P. Livingston) shows very little signs of predation on mature size crabs, only small

crabs.

*EARL KRYGIER: License limitation program

Addressed questions about crossover provisions for pot boats.

Strong opposition to CDQ program, placed a heavy burden on industry in light of declining crab stocks.

Question about future superexclusive areas:

Bob Clasby stated that on behalf of ADF&G, this is an allocation issue, ADF&G would be neutral. Do not foresee future superex areas under the license program.

*RANCE MORRISON: St. Matthew/Pribilof fishery review

**PRIBILOF RED AND BLUE CRAB:

GHL, combined, 2.5 million lbs.

Red crab: catch .9 million lbs.; 130 boats; 5,400 pots; 3.2 CPUE; \$3.50/lb.; \$3.1 million value.

Blue crab: catch 1.2 million lbs.; same # boats and pots; 4.8 CPUE; \$3.00/lb.; \$3.6 million value.

Average number of pots pulled per day, 4,852.

**ST. MATTHEW BLUE CRAB:

GHL, 2.4 million; catch, 3.2 million lbs.; 90 boats; 5,970 pots; CPUE 15; \$2.30/lb.; \$7.36 million value.

Average number of pots pulled per day, 9,000.

October 17, 1995

PNCIAC PRESENT: G. Loncon, B. Miller, R. White, K. Kaldestad, D. Benson, A. Thomson.

ADF&G & NMFS PRESENT: Same as October 16th. Jerry Reeves not present.

RANCE MORRISON: King crab management reports

Upcoming seasons, new information:

No 14 day wait switching from bairdi to hair crab, invalidate bairdi registration and then vessel can immediately enter hair crab fishery.

Tank inspections will be conducted in the Pribilofs 24 hours in advance of the Nov. first bairdi fishery opening.

No wet storage of gear east of 166 W. longitude prior to bairdi season. An emergency rule will be coming out very soon.

REVIEW OF BOARD OF FISHERIES PROPOSALS:

#455: ADF&G feels that the westward line for DH area should be moved west or eliminated, possibly consolidating the Adak and DH areas. Concern about DH red crab. This makes a lot of sense for the brown crab fishery. DH would-become another sub district of the Adak area. There are already other subdistricts in the Adak area. ADF&G looking at simultaneous opening date, either, September 1 or November 1. ADF&G will not finalize recommendations until the Board meeting in March.

R. Miller: Concern about gear conflict between single and longlining pots for Pacific cod --above the 100 fathom line, if Adak and DH brown crab registration areas are combined. This needs to be resolved if the areas are to be combined. Presently, longlining of pots for cod is legal in the Adak area. Maybe single line gear should remain the only legal pot gear for P. cod, above 100 fathoms, in the DH area. Also need to consider standardizing brown crab gear requirements in the area, presently they are not the same for the two areas.

#473: Opening the area east of 163 to bairdi fishing.

ADF&G, Spallinger: Ref. D. Tracy tunnel height experiment. As noted, small king crab are still able to enter 3" tunnel opening. ADF&G could look at eliminating the 163 line, but leave selected areas east of 163 closed. Still have to do the analysis.

Morrison: Would have to design the closed area so it would be easy to enforce.

D. Tracy: Area of 161-30 and 56-30, abundance of large bairdi overlapping with large concentrations of small red king crab. There is large bytch of king crab in pots, even with 3" tunnel opening. Fishery east of 163 would be a problem, but we will be taking a hard look at it.

B. Otto: A large number of the mature crabs east of 163 are old shell crabs that will not likely molt again and recruit into the fishery. They are just below the legal size. He also states that large females and small juveniles are found in large concentrations west of 163 and there are impacts to these stocks from conducting the entire fishery in the area west of 163.

T. Parks: Critical of ADF&G for not having come up with the answers to the stock recruit problems, despite the passage of ten years since the collapse of king crab. The fishermen are not the problem, we have not had an opportunity to fish in the area east of 163. However, the draggers are still allowed to fish there and take crab as bycatch.

D. Pengilly: In response to industry concerns, he expressed very low confidence in the bycatch estimates of the ground-fish observer program.

G. Loncon: Asked Pengilly what he meant by low confidence in estimates--did he mean understated?

D. Pengilly response: Yes.

Discussion ensues about the problem of bycatch in the trawl fisheries and the bifurcation in management of crab and bycatch. Request from industry reiterated that ADF&G and Board of Fisheries get aggressively involved in the issue of bycatch.

G. Loncon: Recommends that the Crab Plan Team become strong advocates of the crab industry, with a focus on the issue of bycatch. The crab industry and ADF&G have done what they can.

There was also a lot of discussion about the recent NPFMC vote on the expanded Bristol Bay trawl closure, from 162 - 164 W. longitude and 56 - 57 N. latitude. The Council modified the 1995 emergency rule, providing for a year-round closure, such that the recently adopted permanent rule will be a seasonal closure from Jan. 1 - March 31, by a 6/5 vote.

All three Washington State representatives voted against it, including Dr. David Fluharty, U.W., Chairman of the Crab Rebuilding Committee.

Dr. Fluharty was present at the meeting and provided no substantial reasons for his position, other than a need to maintain communication with the affected sectors of the industry and the need for more information on yellowfin sole predation on king crab larvae. He also stated that the Crab Rebuilding Committee does not support adoption of new permanently closed protection areas.

R. Miller: Noted that predation is no doubt a factor, but sole and cod can be harvested outside of the expanded no trawl zone with less damage to critical crab habitat.

At the close of the discussion, the Chairman reiterated the PNCIAC support for aggressive action to develop additional protection areas and restraints on the trawl industry in regards to bycatch of crabs. The Chairman also noted for

the record of this meeting, that this is an issue of grave concern to the Bering Sea crab industry and they want reductions of crab bycatch in the groundfish industry as soon as possible.

#462: ADF&G supports removing September 22, closure date for the St. Matthews blue king crab fishery and going to closure by emergency order. The date is too restrictive and it makes sense to close by emergency order.

#461: Industry concerned about uncertain implications of 20-50% handling mortality rate in the harvest strategy and the new minimum thresholds being proposed for females. High thresholds equate to protracted closure periods in crab fisheries and resultant impacts to the livelihoods in the fishing community.

P. Murphy: Clarifies that the LBA harvest strategy is not static, but something ADF&G will continue to evolve as we move along with implementation. We are willing to adjust mortality rates as fishermen improve on their mortality.

Industry identifies that there are problems with the definition of handling mortality as used in LBA strategy versus common usage of the term.

Gretar Gudjonsson: Suggestion that ADF&G use their mortality percentage as a "percentage of total population," because that appears to be what it means. 20% handling mortality seems to equate to 2% of the total population.

Industry also adamantly disagreed with ADF&G on their estimation of mortality rates in the directed fisheries, and makes reference to recently completed studies by Macintosh (NMFS) and S. Zhu (ADF&G/U. of A.)--nonsignificant mortality, 3-5%.

Industry also noted that capture of small crabs has decreased considerably since implementation of the 7.75 inch mesh in Area T king crab fishery.

#471: Tanner crab harvest strategy: ADF&G intends to withdraw this proposal from the Board of Fish. agenda. Analysis not ready yet.

#479: Modify the size limit for *c. opilio* tanner crab. Preliminary recommendations.

B. Otto: Current size limit of 3.1 is based on old information about size at maturity. New information leads us to recommend revising the size limit to 88 - 90 mm. I would foresee that based on new information we would recommend that the minimum size be increased to 90 mm (3.5 inches). The objective is to insure a molt after maturity.

ADF&G: No enforcement concerns with an increase in size limit to 3.5 inches. If this meets biological concerns for size at maturity, that would satisfy us. We would only be concerned if the market size dropped to 3.5 or less.

Question: What might GHJ be for opilio if based on 3.75 minimum size instead of 4 inch?

Otto: 50.7 to 82 million lbs. GHJ.

R. Morrison: Concerned that if GHJ based on 3.75 that industry will still be harvesting 4 inch crab and overharvest that age group. (Assumption is made here that ADF&G will still be estimating GHJ based on 4 inch size limit even if size limit is increased to 3.75, just as they are presently doing under the 3.1 inch minimum size limit with 4 inch industry standard.)

#465 and 486: ADF&G supports additional running time to ports east of King Cove.

#498: ADF&G, allow observers on floaters to board and inspect catches of vessels delivering to floaters. Observers presently do not have authority to board. Samples can only be taken while on board floaters. ADF&G supports this proposal.

#478: Create a Northern district, north of 60 degrees, with its own GHJ.

Griffin and Morrison: Present GHJ for opilio based on the entire range of stocks, including north of 60 degrees.

B. Otto: Does not agree that creating a new district would result in an increase in GHJ. Only a small portion of the stocks are above 60 degrees.

ADF&G: In response to a question from ACC/Thomson states that they have in season management authority to have a split season and they have offered to manage in this fashion if industry can come to a consensus on the opening date for the second part of the season in the northern area. However industry and the PNCIAC have not been able to come to a consensus the reopening date for the second season in the Northwestern subdistrict.

#496 and #497: Proposals to authorize longlining of pots for deep water crab species, tanneri, angulatus and cousei in Area M and K.

ADF&G doesn't seem to have objections to longlining, other than possible gear conflicts.

1 million lbs. caught thus far this year in Area M, 5 boats. They are using single line gear.

R. White: Concerns, not a lot of fishable ground in Area M, patchy concentrations of crabs; existing regulations restrict gear to single line pots and 150 pot limit. There should definitely be a pot limit.

A. Thomson: Noted that he had preliminary discussion with FVOA in Seattle about potential conflicts with sablefish hook and line boats and that it seems that if pot fishing were done after the close of the hook and line season, that this should not be a problem. Also, 100% observer coverage is required in the deep water permit fisheries, so there would be close monitoring. Board of Fish has a lot of latitude in terms of pot limits, to control the amount of gear, as these areas are managed solely by the State of Alaska, without a federal FMP. This means the Board could set a single tiered pot limit for the fleet, as in other areas around the State.

#470: Standardize king and tanner crab pot definitions for deep water tanneri, cousei and angulatus crab. ADF&G supports this proposal.

#465: Additional running time for delivery in King Cove.

Dale Schwartzmiller speaks to the problem on behalf of the fleet that fishes out of King Cove.

P. Probasco: ADF&G willing to work with industry to come up with a reasonable extension of time for delivery to King Cove.

#475 and #476: Change opening date of opilio for safety reasons. What date would be satisfactory?

G. Loncon: Whatever change is made, consider the impacts of the trawl fleet entering the fishery if they are idle.

R. White: Some in the industry have suggested November, but this raises quality concerns for processors. April 15th, another date that has been suggested, may not give us enough time to harvest GHL.

R. Miller: ADF&G supports opening the opilio season at varied times to avoid heavy icing conditions and unnecessary loss of lives from fishing in these conditions. Crab quality is consistently good March 15th through June 20th, for seasons of low GHL.

G. Loncon: January 15th season has acquired a quality reputation in the market. Need to seriously consider this before making any changes. A change could affect the price.

#500: 30% observer coverage for catcher boats

G. Loncon: Need for cost-benefit analysis. This program

will be costly. Will the data and information justify the costs to the industry?

R. Miller: It seems that 30% observer coverage would be impossible to implement in a fair and equitable way unless, there is a fixed number of days in a fishery. It also seems as if the industry-wide tax based program would have to be in place and the NPFMC rejected that at their September meeting.


ADF&G: We have no idea how to devise such a program for the short king crab seasons. The opilio fishery might be the only fishery which could accommodate a rotating observer program. Not ready to respond to this. Have to look at what level of coverage is needed for statistical validity. It is unlikely that staff will have the time before the meeting to conduct the analysis needed to determine what level of coverage is needed for statistical reliability as a random sample of fleet coverage.

The meeting closed with the PNCIAC chairman, Garry Loncon, noting that on behalf of the committee, he felt that the two day workshop had been very productive and a worthwhile exchange between the managers and biologists and the industry. He also reiterated the PNCIAC's appreciation of the strong commitment in time and expenditures by ADF&G to participate and encouraged ADF&G to continue this kind of industry liaison in the years to come.

Mr. Loncon also announced that the PNCIAC would be meeting sometime in early December to formulate its recommendations for the Board of Fisheries proposals, in order to give vessel operators and processing representatives involved in the opilio fishery ample opportunity to participate in the discussions.

The meeting adjourned at 3:45 pm.

(Since the PNCIAC adjourned, the Board of Fisheries conducted their fall workshop and confirmed that the Statewide Shellfish Meeting will be held the week of March 9-18, 1996, not in Dutch Harbor as previously planned, but in Anchorage.)

Garry Loncon, Chairman, PNCIAC 
c/o Royal Aleutian Sfds., 701 Dexter Avenue N., Ste. 403
Seattle, WA 98109
206 283 6605 Fax: 206 282 4572

Please copy correspondence and notices to:
Arni Thomson, Secretary, PNCIAC
c/o Alaska Crab Coalition, 3901 Leary Way NW, Ste. 6,
Seattle, WA 98107
206 547 7560 Fax: 206 547 0130

Attachments:

**cc: Pete Probasco, Westward Regional Supervisor, Kodiak
Al Spallinger, Westward Shellfish Biologist, Kodiak
Rance Morrison, Regional Biologist, Dutch Harbor
Bob Clasby, Director, Com. Fish./Mgmt., Juneau
E. Krygier, K. Griffin, Extended Jurisdiction, Juneau
Laird Jones, Executive Director, AK, BOF, Juneau
David Witherell, Crab Plan Team Coordinator, NPFMC,
Anchorage
Ron Berg, Chief, Fisheries Management, NMFS, Juneau**

AGENDA
ADF&G STAFF/CRAB INDUSTRY MEETING
9:00 AM OCTOBER 16-17, 1995
HOSTED BY
PACIFIC NORTHWEST CRAB INDUSTRY ADVISORY COMMITTEE
SEATTLE, WASHINGTON
LEIF ERIKSON HALL
2245 NW 57th, BALLARD

OCTOBER 16

- I. Opening Remarks - Clasby
 - a. Department funding levels
 - b. Bering Sea crab increment
- II. Staff Introductions - Clasby/Probasco
- III. Crab Research Projects (up date from 1994 meeting)
 - a. ADF&G Research Project Updates - Pengilly and Murphy
 - b. Specific Project Updates:
 - 1. Bristol Bay red king crab harvest strategy - Murphy, Pengilly
 - a. Length-based model use
 - b. Harvest rates
 - c. Thresholds
 - 2. Bristol Bay test fishery - Pengilly/Tracy
 - a. St. Matthew Tagging Study - Pengilly & Tracy
 - b. Bering Sea Tanner crab pot tunnel restriction study - Tracy
 - 1. will information be used for 95/96 fishery
- c. NMFS Research Project updates - Otto/Stevens

IV. Crab Management

- a. Crab License limitation discussion - Griffin/Krygier
- b. St. Matthew/Pribilof fishery review - Morrison
- c. Bristol Bay/Bering Sea Tanner crab management - Spalinger/Morrison

- 1. Bristol Bay red king crab GHL

- a. Augmented Survey results & usage -
Otto/Pengilly

- b. No fishery (female threshold)

- 2. 163 degree closure line (closure/baridi quota)

- 3. East/West BS opilio quotas & management

- a. GHL

- 4. Nine inch mesh requirement

- d. King crab management

- 1. Adak

- a. use of observers

- b. red king crab fishery

- c. brown king crab fishery

- 2. Dutch Harbor

- a. use of observers

- b. brown king crab fishery

- e. other fisheries

- 1. Haircrab

- 2. Tanneri/cousi

V. Status of North Pacific Fisheries (observer) Research Plan -
(NMFS regional staff)

OCTOBER 17

- I. BOF Proposal Discussions
 - a. staff positions on each (IF available)
 - b. Agenda change requests
- II. Announcement of joint BOF/Council meeting on January 9, 1996
in Anchorage.

OCTOBER 16TH & 17TH, 1995

**PACIFIC NORTHWEST CRAB INDUSTRY
ADVISORY COMMITTEE
PNCIAC HOSTS ANNUAL ADF&G MEETING**

LEIF ERIKSON HALL, SEATTLE (BALLARD), WA

NAME	BOAT/COMPANY NAME
Robert Roth	MMFS
Bob W Miller	PNWCIAC
Bill Osburn	Trident
David McCallie	Isle Seafoods Inc.
Greg Gudmundson	Notorious Port.
Carson Gustafson	" "
Richard Morton	Viking Queen
Leif Nordbo	Scandal's Rose
Gary Stewart	Polar Lady
Yvon Vedstad	PNCIAC
Walt Christen	ARCTIC MARINER
Steve Hall	Spirit of the North
Jake Jensen	Jennifer A
Ozzie Nordheim	Alaska Sea

NAME

BOAT/COMPANY NAME

JAN [unclear]	AFCEG
Gunnar Loklinghol	"Alaskan Beauty"
JAN Kristiansen	Confidence
Stig Hansen	NORTHWESTERN
Thomas R. Parks	F/V KATIE K
Rich White	Dutch Harbor Seafoods
PHIL HANSON	V N1 SEA
Jim Stone	Retriever
John Lemar	Retriever
Pete Hansen	WEST POINT
Moe Voshike	OFCF
Ken Tippet	ALASKA BOAT CO.
Bob Scottiel	DORIAN METAL FAB
Tom Adams	Norquest Seafoods
Clyde Sterling	Peter Pan Seafoods
DALE SCHWARZMILLER	PETER PAN SEAFOODS
STELE SVEINSSON	PARAGON
Steve Toomey	EXITO
Gudjon Gudjonsson	AUTUMN DAWN
Jim E L	Keuleen K
JERRY REEVES	AFSC

NAME

BOAT/COMPANY NAME

Kari Torvold	F.V. Deception
Neil Anderson	Palmar
Joe Wabey	F.V. Arctic Escape
Dave Benson	TYSON
JEFF STEPHAN	UFMA
Scott Morka	SNOPAC
Kris Fanning	Enterprise/Krist
Garda Birk	Ocean Cape/Eolotoi
DAN WEISS	FREIGHT MANAGEMENT
JOSTEIN KARLSEN	ALEUTIAN NO. 1
Ed Paulsen	Kris Paulsen & Assoc.

OCTOBER 16TH & 17TH, 1995

PACIFIC NORTHWEST CRAB INDUSTRY
ADVISORY COMMITTEE
PNCIAC HOSTS ANNUAL ADF&G MEETING

LEIF ERIKSON HALL, SEATTLE (BALLARD), WA

NAME	BOAT/COMPANY NAME
PETE PROBASCIO	ADF&G
William Brown	Lady Ann
Dan McHollis	Iceberg Seafood
Gary Stewart	Polar Lady
Digby Ingham	POLAR SEA
Bill Osborne	Trident
Gregory Gudjonsson	Autumn Dawn
Gregory Gudjonsson	Notarius
Walt Christensen	ARCTIC MARINER
Jan O. Medvig	Silver Wave
Clyde Sterling	Peter Pan
Erving SKAR	North American
Steve Toomey	Exito
Steve Shapiro	Pacific Fishing
Leslie Thomson	A.C.C./PNCIAC

BOAT/COMPANY NAME

NAME

YOUTH VOLUNTEER

PNCIAC

Jerry Nelson

Computer Sofware

Ken Tippitt

Alaska Boat Co.

Thomas R. Barnes

FN KATTEK

Blue in milk

PNCIAC

Ryan Munk

Alaskan Youth / Northwest
North Pacific

Ang Huan

NORTHWESTERN

Donald G. Galt

U.W. S.M.A.

Sharl Brillon

Silver Dolphin

JEFF STEPHAN

UTWA / Kodiah

Joe E. J.

Keelhaul K

Jim Stone

Refrieger

John Lang

Refrieger

Jan Kristensen

Confidence

Mimi Brown

Seaview Rose

Leak Lures

Alia M. Black

Blair Benson

Tyson

Tom Szymon

Crizzly

NAME

BOAT/COMPANY NAME

Kris Fanning	Entrance Point
Michael Lusk	Alaskan Observers
Dan Mattson	F/V Shaman
JORD KONGE	ARCTIC SEA
Paul Duffy	PRO SURVEYS
Johan Wanner	POLAR SEA
Jacobs Mikkelborg	LAWYER
Ryan O	F/V American Star
Gary Larson (AT)	PNCIAC
Richard L. White (AT)	PNCIAC

(38)

NAME

BOAT/COMPANY NAME

Mimi Brown	SCANDIES ROSE
Dave Finkler	UW.

FY 96 ALLOCATION - BERING SEA/ALEUTIAN ISLANDS EEZ CRAB (General Funds and Program Receipts only)

Commercial Fisheries Management and Development Division

Project	Salaries	Travel	Contracts	Supplies	Equipment	Total	General Funds	Test Fish	Adj. Months	PFT Equivs.
Norton Sound Crab	5.2	0.0	2.0	11.4	0.0	18.6	18.6	0.0	0.9	0.1
Westward Vessels	27.5	0.1	2.8	8.5	0.3	39.2	39.2	0.0	3.6	0.3
Bering Sea Crab	826.6	60.3	347.3	202.7	28.0	1,464.9	832.1	632.8	143.0	11.9
Westward Region Administration	231.3	10.2	36.2	11.3	10.3	299.4	299.4	0.0	42.5	3.5
Headquarters Planning & Review	60.0	3.3	30.4	1.5	0.9	96.1	96.1	0.0	13.0	1.1
Chief Fisheries Scientist	46.3	2.1	3.6	0.8	1.3	54.1	54.1	0.0	7.6	0.6
FY 96 TOTALS	1,197.0	76.1	422.3	236.2	40.8	1,972.3	1,339.5	632.8	210.6	17.5
FY 95 TOTALS	1,198.9	60.7	307.1	200.4	24.3	1,791.4	1,150.8	640.5	202.6	16.9
FY 94 TOTALS	1,131.9	64.7	306.2	243.0	17.6	1,763.4	1,118.1	645.2	197.6	16.5
FY 93 TOTALS	1,099.1	65.1	400.5	250.4	17.6	1,832.7	1,089.4	743.2	194.1	16.2
FY 92 TOTALS	913.9	64.9	467.1	88.5	134.7	1,669.1	1,001.4	667.7	160.5	13.4
FY 91 TOTALS	960.3	41.1	108.1	59.5	12.6	1,181.6	1,181.6	0.0	186.1	15.5
FY 90 TOTALS	718.5	30.3	66.8	51.8	14.5	881.9	881.9	0.0	147.6	12.3
FY 89 TOTALS	714.2	26.7	182.1	49.6	11.2	983.8	867.8	116.0	151.3	12.6
FY 88 TOTALS	586.4	13.3	243.3	39.9	3.1	886.0	686.0	200.0	115.1	9.7

Division Of Fish And Wildlife Protection

Project	Salaries	Support	Shipyard	Vessel Insurance	Total	General Fund	Test Fish	Adj. Month	PFT Equivs.	
Dutch Harbor Enforcement	54.6	2.7	0.0	0.0	57.3	57.3	0.0	0.0	0.7	
Kodiak Enforcement	30.3	1.6	0.0	0.0	31.9	31.9	0.0	0.0	0.4	
P/V Wolsted and Trooper	266.5	113.2	189.2	51.6	620.5	620.5	0.0	0.0	3.2	
King Air Support	6.2	62.2	0.0	0.0	68.4	68.4	0.0	0.0	0.5	
FY 94 TOTALS	357.6	179.7	189.2	51.6	778.1	778.1	0.0	0.0	4.8	
FY 89 TOTALS	424.5	120.2	150.0	52.0	746.7	746.7	0.0	49.2	4.1	
FY96 CF & FY94 F&WP Allocation	1,554.6	255.8	611.5	287.8	40.8	2,750.4	2,117.6	632.8	210.6	22.1

NOTES: PFT Equivalents = total adjusted man months divided by 12

Adjusted Months = total personnel months in each unit multiplied by the percentage allocated to EEZ crab.

NOTE: FY 95 and 96 funds respectively, do not include federal research funds of \$300,000 and \$600,000. A.T.

Pacific Northwest Crab Industry Advisory Committee

20 October, 1995

Garry M. Loucon
Chairman

Larry J. Engel
Chairman
Alaska Board of Fisheries
P.O. Box 25526
Juneau, Alaska 99802-5526

Re: Request For Board of Fisheries To Support Year-Around Closure To Bottom
Trawling In The Bristol Bay King Crab Protection Area

Dear Larry:

The Pacific Northwest Crab Industry Advisory Committee hosted a well attended and rather successful Annual Meeting of the Alaska Department of Fish & Game with the Bering Sea crab industry October 16 and 17 of this week.

During the course of discussions on a wide range of issues, the subject of bycatch of king crab in the trawl fisheries surfaced a number of times. The bycatch discussion focused on the inequity between the conservation measures being practiced by crabbers and the NPFMC permissiveness in regards to trawlers continuing to be allowed king and tanner crab bycatch quotas and to use bottom trawl gear in the Bristol Bay area.

There was also considerable discussion and vehement opposition to the NPFMC recent action to modify the 1995 emergency rule regarding the expanded Bristol Bay king crab protection area, making the bottom trawl closure, merely a seasonal measure from January 1, to March 31st.

After polling the members of the PNCLAC, I wish to state for the record that the PNCIAC reiterates its support for the year-around closure in the Bristol Bay Protection area. The area in question, from 162 to 164 W. and 56 to 57 N. is a historic habitat for mature king crabs, not just during the winter season, but on a year-around basis.

At this time, the PNCIAC respectfully requests the Board of Fisheries to comment to the NMFS to change the final rule to a year-around closure.

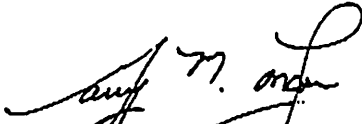
In closing, I wish to point out to the Board of Fisheries, that the House version of the MFCMA amendments was approved by a vote on the floor of the House yesterday. HR 39 has just been amended to include significant bycatch and habitat restrictive

Pacific Northwest Crab Industry Advisory Committee

20 October, 1995

language. Prior to this, the NMFS had already proposed substantive habitat protection language. Thus the NMFS has the opportunity to take timely action in recognition that habitat protection, as it applies to fishing gear, is not just the concern of a few isolated sectors of the fishing industry and some environmentalists, it is now an issue of widespread national significance.

Sincerely,



Garry M. Loncon, Chairman
Pacific Northwest Crab Industry Advisory Committee
c/o Royal Aleutian Seafoods, Inc.
701 Dexter Avenue, Suite #403
Seattle, WA 98109
(206) 283-6605 fax (206) 282-4572

cc: Frank Rue, Com. ADF&G
Mary McDowell, Office of the Governor of Alaska
Steve Pennoyer, RD, NMFS, AKR
Rollie Schmitten, Asst. Admin. NMFS

STATE OF ALASKA

TONY KNOWLES, GOVERNOR

DEPARTMENT OF FISH AND GAME

COMMERCIAL FISHERIES MANAGEMENT AND DEVELOPMENT DIVISION

P.O. BOX 25526
JUNEAU, ALASKA 99802-5526
PHONE: (907) 465-4210

ADF&G ESTIMATION OF 1995 BRISTOL BAY RED KING CRAB ABUNDANCES

The Alaska Department of Fish and Game (ADF&G) estimates abundance of red king crabs in Bristol Bay using a length-based analysis (LBA). The LBA uses all historic and current survey and fishery data coupled with knowledge of crab growth and mortality. Annual survey data are provided by the National Marine Fisheries Service (NMFS) to ADF&G as area-swept estimates of abundance. The LBA estimates of abundance fit well with the NMFS area-swept estimates of abundance and have been very similar in recent years (Fig 1). The LBA adjusts the annual area-swept estimates of abundance to values that are more consistent with the historical survey data, past fishery harvests and what is known of red king crab growth-per-molt and natural mortality. Large discrepancies between the LBA and area-swept estimates can usually be attributed to the influence of atypically high catches in one or a few individual survey tows.

Typically, the NMFS survey performs one tow in each of the 20-by-20 nm survey stations that comprise the systematic survey grid. In 1995, the standard NMFS survey effort was increased by adding three random systematic tows to each of 20 stations in Bristol Bay that were specially chosen on the basis of high abundance of mature female red king crabs. The goal of replicating tows in each of the 20 stations was to improve estimation of mature female abundance relative to threshold value of 8.4 million mature female crabs. The standard statistical treatment of these data is to consider them as four replicate surveys that must be analyzed separately resulting in four estimates of abundance. Our analysis has indicated that the median, rather than the mean, of the individual abundance estimates for the four replicate surveys provides the most appropriate final estimator of abundance.

The four LBA estimates of mature female (>89 mm) abundance provided by the four replicates of the survey (7.9, 7.9, 8.9, and 11.6 million crabs) do not indicate that the abundance of mature female crabs is above the fishery threshold of 8.4 million crabs: half of the estimates are below the threshold value and one is only marginally above the threshold value. The final mature female abundance estimate, the median of those four estimates, is 8.4 million crabs (Table 1). LBA estimates for mature males (>119 mm) and legal males (>134 mm) are 8.4 and 5.3 million crabs, respectively. LBA estimates of abundance for pre-recruit males (95-134 mm) and for male and female recruits to the LBA model remain near historic low levels (Table 1). The LBA does not provide estimates of abundance for juvenile male < 95 mm or female < 90 mm crabs; area-swept estimates for these two classes are 7.5 and 6.6 million crabs, respectively.

Questions concerning estimation of Bristol Bay red king abundance can be directed to Doug Pengilly at 907-486-1865.

Table 1. LBA estimation of annual abundance (millions of crabs) for red king crab in Bristol Bay. Male recruits to the LBA model are >94 mm and female recruits are >89 mm.

Year	Males					Females	
	Recruits to LBA Model	Small 95-119mm	Pre-rec 110-134mm	Mature >119mm	Legal >134mm	Recruits to LBA Model	Mature >89mm
1972	NA	13.755	15.315	18.831	10.176	NA	59.845
1973	33.704	21.445	28.900	24.020	10.661	32.500	69.545
1974	22.108	14.837	37.007	36.262	15.393	28.333	71.418
1975	34.166	21.692	38.033	43.461	21.423	21.753	66.030
1976	49.794	31.673	49.215	52.031	26.252	34.526	75.490
1977	57.467	36.987	65.383	66.623	31.508	72.017	118.791
1978	23.749	16.835	61.964	79.476	41.619	46.032	119.528
1979	12.816	8.810	38.689	76.172	48.865	18.889	93.001
1980	24.901	15.674	27.210	61.185	44.665	35.703	93.470
1981	17.582	11.703	17.836	18.874	9.505	13.330	71.286
1982	23.918	15.290	17.184	10.935	2.889	17.141	29.837
1983	13.003	8.896	13.936	9.316	2.460	4.850	10.144
1984	18.756	11.970	13.463	8.609	2.287	12.076	13.878
1985	11.127	7.540	11.273	7.252	1.766	5.004	7.459
1986	6.923	4.807	13.476	12.216	4.376	4.017	9.394
1987	7.320	4.821	12.058	14.371	6.734	9.017	15.805
1988	6.792	4.510	10.965	15.063	8.352	5.769	17.173
1989	5.620	3.772	9.971	16.012	9.832	5.556	17.975
1990	1.524	1.224	7.381	15.316	10.293	0.877	13.881
1991	3.997	2.518	5.235	12.141	8.617	3.652	13.718
1992	6.419	4.103	6.325	10.155	6.774	3.342	13.269
1993	2.446	2.087	7.150	10.078	5.892	1.957	11.561
1994	1.088	0.960	5.625	8.539	4.625	0.372	8.746
1995	3.048	1.988	4.660	8.484	5.337	2.108	8.451
95% Limits ¹ in 1995:							
Lower	2.416	NA	3.722	6.604	3.997	1.523	6.770
Upper	3.696	NA	5.249	9.287	5.955	3.270	11.354

¹All sizes are measures of carapace length in millimeters (mm).
²Estimated by bootstrapping.

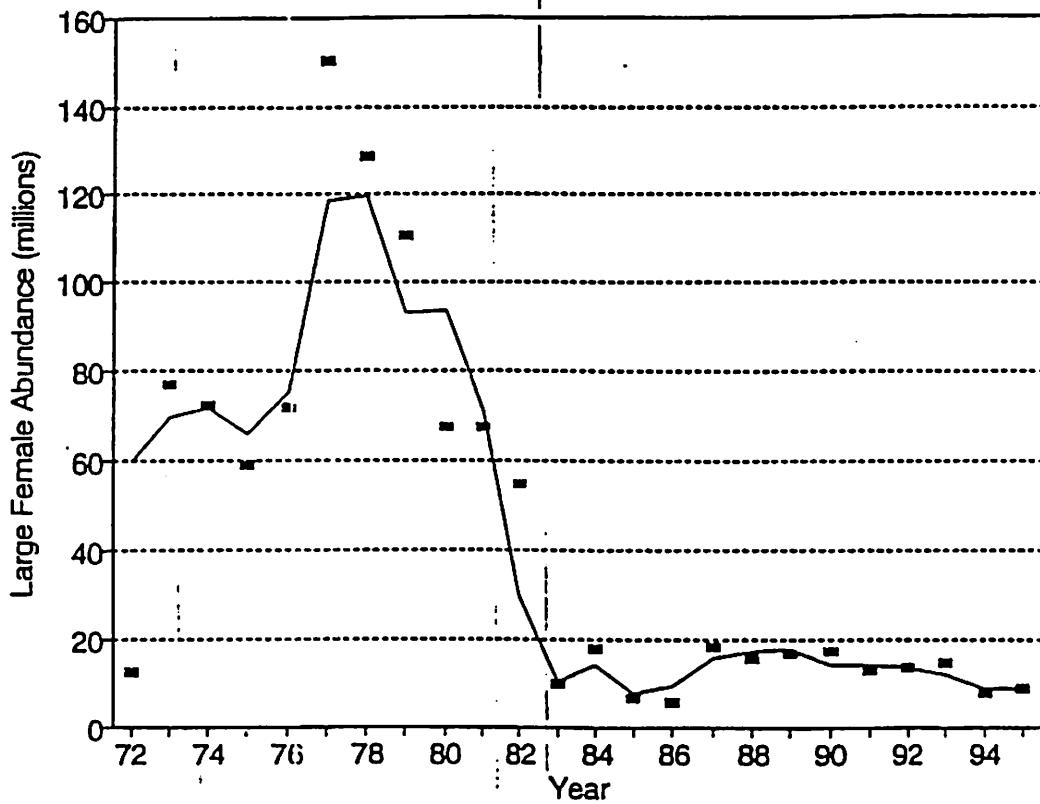
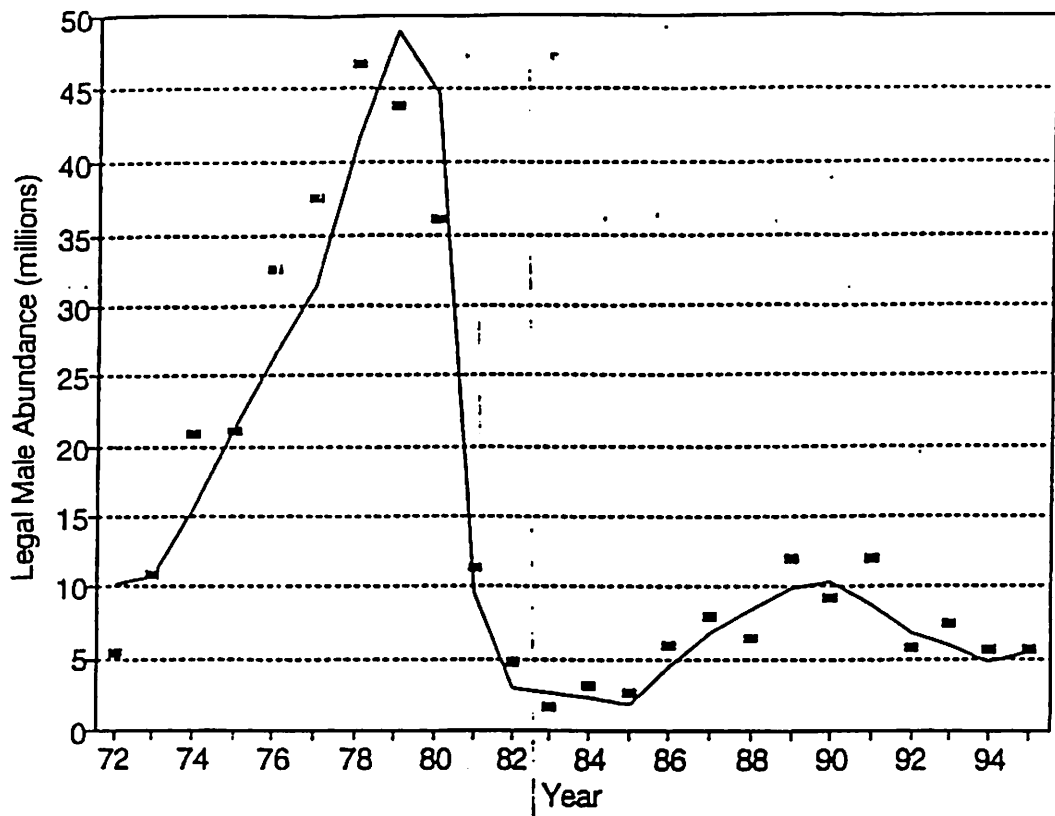


Figure 1. Comparison of NMFS survey (dots) and LBA (solid line) estimates of legal male (top panel) and large female (lower panel) red king crab abundances in Bristol Bay from 1972 to 1995.

Crab Research supported by ADF&G in 1995

- +Shell condition and Breeding success in Tanner crab. A.J. Paul, J.M. Paul & W.E. Donaldson
- +Effects of handling on feeding, activity and survival of red king crabs. S. Zhou & T. Shirley
- +Crab genetics. S. Merkouris & L. Seeb
- +Long-term dynamics of Alaskan crab stocks.
A. Tyler
- +LBA for Tanner crab in Bristol Bay.
- +Catch-length analysis for crab populations.
- +Updated LBA and stock-recruitment relationship.
- +Revised and completed harvest strategies.
- +Initial analyses of Bristol Bay red king crab rebuilding strategies.
- +Comparison of methods to estimate abundance of red king crabs in Bristol Bay and Kodiak.
- +Changes in red king crab and Tanner crab population dynamics - a function of density or environment?
- +Biological reference points for red king crabs in Bristol Bay, Kodiak and Norton Sound.
- +ADF&G shellfish literature database.
- +Annotated bibliography on capture and handling.
- +Density dependence in red king crab collectors.

1-2W8TCL
MURPH

Research Recommendations from ADF&G/NMFS

Interagency Meeting

- +Larval ecology and oceanography
- +Crab collectors
- +Image processing
- +St. Matthew blue king crab harvest strategy
- +Chionoecetes tag
- +Gear Studies
- +Review biological seasons
- +Industry input to review of proposals for funding
- Interaction between crab and groundfish PTs

Crab Research Planned for 1996

- +Breeding success of legal-size male red king crabs. A.J. Paul
- +Genetic stock identification. S. Merkouris and L. Seeb
- +Relative roles of fishing, predation, and environment on long-term dynamics of Alaskan crab stocks. A. Tyler
- +Population estimates and alternative crab harvest strategies. J. Zheng, M. Murphy, and G. Kruse
- +Red king crab pot design and catch efficiency. S. Zhou

Westward Region Bering Sea/Aleutians Crab Research:

~~THORNTON~~
PENWILLY

Funding: Bering Sea Test Fish
Bering Sea Crab Assessment Increment (new)
NOAA Bering Sea King and Tanner grant (new)
Existing General Funds for some permanent staff

What's new:

- new program supervisor
- new Bering Sea Crab Research Biologist (Donn Tracy)
- new Mandatory Observer Database Manager (Larry Boyle)
- new position: Biometrician for Bering Sea/Aleutians crab (especially observer data; Larry Byrne)

Program components:

1. Surveys on three year rotation; currently planned as:
 - Norton Sound trawl survey ('96)
 - Adak/Dutch pot survey -- limited area of interest ('97)
 - St. Matthew and Pribilofs ('98)
2. Observer data entry, database-management and analysis
 - under Research Program (but not Observer Program Administration)
 - better tie-in into stock assessment analysis and research ; better provide input on observer sampling design
 - increased analysis of observer data (e.g., analysis of stock and fishery trends, basic biological data): new Biometrician; use of mapping ("GIS") software
3. Directed research projects
 - include at-sea as part of Test Fish charter, other charters, off-site (e.g., laboratory or Chiniak Bay), contract work
 - e.g., gear studies, opilio-bairdi hybridization/ID, new technology for assessment, mating/reproductive biology

Westward Crab Research '95

PENGILLY

- Reports/publications relevant to BS/AI crab:
 - "Effects of release method on recovery rates of tagged red king crab...". Watson and Pengilly. ADF&G RIR
 - "Summary of biological data collected during 1994 Bristol Bay red king crab test fishery charter". Byersdorfer. ADF&G RIR
 - "Summary of 1994 Mandatory Shellfish Observer Program database". Tracy. ADF&G RIR
 - "Shell condition and breeding success in Tanner crab". Paul, Paul, and Donaldson. J. Crustacean Biology
 - "Aggregative mating of Tanner crabs". Stevens, Haaga, and Donaldson. Can. J. Fish. and Aquatic Sci.
- Submitted papers:
 - "Contributions to biology of C. tanneri and C. angulatus in Eastern Bering Sea". Somerton and Donaldson. Fishery Bulletin
 - "Pot limits in Bristol Bay red king crab fishery: effects on fishery performance, utility as management tool". '95 Lowell Wakefield Symp.
 - "Development of expert computer vision based crab classification system". Donaldson. '95 L.W. Symp.
 - "Comparison of Adak/Dutch Harbor golden king crab survey and observer data: composition and depth distribution". Blau, Pengilly, and Tracy. '95 L.W. Symp.
 - "Application of kriging trawl survey data to estimate red king crab abundance in Bristol Bay". '95 L.W. Symp.
 - "Reproductive biology of female Tanner crab in Chiniak Bay". Stevens, Haaga, and Donaldson. '95 L.W. Symp.
- Reports in prep
 - "Trends in tag recoveries from the 1990, 1991 Bristol Bay red king crab fishery". Watson and Pengilly
 - "PIT tag retention in and effects on survivorship on red king crabs". Watson and Pengilly

EXCERPTS FROM:

**Draft Minutes of the
Bering Sea/Aleutian Islands Groundfish Plan Team
Meeting, November 13-17, 1995**

Members Present:

Ellen Varosi (NMFS-AKRO)
Dave Ackley (ADF&G-Juneau)
Loh-lee Low (NMFS-AFSC, Chairman)
Richard Merrick (NMML)
Farron Wallace (WDF)

Grant Thompson (NMFS-AFSC)
Brenda Norcross (UAF)
Dave Colpo (NMFS -AFSC)
Ivan Vining (ADF&G -Kodiak)
Dave Witherell (NPFMC)

The team reviewed a draft environmental assessment/regulatory impact review (EA/RIR) for a proposed plan amendment that would allow additional flexibility in allocating bairdi PSC among bycatch limitation zones. Dave Colpo summarized the impacts of the four alternatives, based on his modeling. Analysis indicated that a 20% increase in the Zone 1 bairdi limit would result in the following:

1. increase in fishing time for the cod trawl fishery (1 week) and yellowfin sole trawl fishery (1 day);
2. may increase income in cod trawl fishery (\$ 3 million), but not to the nation as all cod would be caught by other gears anyway;
3. would have no impacts on groundfish stocks;
4. may slightly increase bycatch of bairdi (50,000) and halibut mortality (100 mt) in the trawl fishery.

The team did not recommend a specific alternative, but noted that biological impacts of the proposed amendment were minor.

EXCERPTS FROM:

**DRAFT Minutes of the
Bering Sea/Aleutian Islands Crab Plan Team
Meeting, December 14, 1995**

Members Present:

Ron Berg / Sue Salveson (NMFS)
Josh Greenberg (UAF)
Ken Griffin (ADF&G)
Rance Morrison (ADF&G)
Peggy Murphy (ADF&G, chair)

Bob Otto (NMFS)
Doug Pengilly (ADF&G)
Jerry Reeves (NMFS)
Tom Shirley (UAF)
Dave Witherell (NPFMC)

Tanner Crab PSC Flexibility

The Team reviewed an EA/RIR for a proposed BSAI groundfish FMP amendment that would allow greater flexibility in management of Tanner crab PSC trawl 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.

Team members were concerned about impacts of allowing increased trawling on certain areas where crab occur. The alternatives would allow higher bycatch to be taken in Zone 1, which is an area inhabited by mature bairdi and red king crab. Team members emphasized that bairdi stocks are in poor shape, and fishery performance data suggested that the stock condition is even worse than indicated by the NMFS bottom trawl survey. ADF&G staff noted that given the 1995 survey results and fishery performance, but subject to the 1996 survey results, there is a high probability that the directed commercial fishery for *C. bairdi* in the Bering sea may be closed for the next few years.

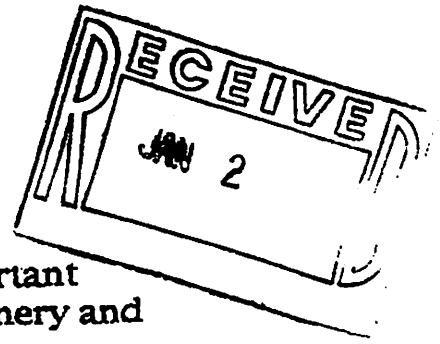
The Plan Team has serious conservation concerns for the bairdi stock. Therefore, **the Crab Plan Team recommends that any amendment to reapportion bairdi among bycatch limitation zones be tabled at this time.** The Team further noted that the trawl industry currently had flexibility to apportion more Zone 1 bairdi to the Pacific cod and yellowfin sole trawl fisheries during the annual specification process.

The Team suggested if the Council should move forward with this EA/RIR, that prior to public review, additional information should be added to determine impacts of proposed measures on crab stocks. First, the current status of bairdi crab stocks should be included in the analysis. Second, the origin of crab PSC limits should be discussed. Third, it was noted that information on size and sex of bairdi taken as bycatch was not included in the analysis, and the Team wants this information included to determine impacts of the analysis on the eastern Bering Sea Tanner crab stock. Sue noted that some sex and weight information for 1994 and undebriefed sex and length data for 1995 was available. Lastly, the Team recommended that the analysis include an estimate of cost to the crab industry caused by additional bycatch.

Public testimony was taken from Jeff Stephan and Lisa Polito. Jeff felt that the analysis was not ready for public review, as it did not contain information on the status of eastern Bering Sea Tanner and red king crab stocks or information on the impacts of trawl gear to crab and crab habitat. Jeff further noted that the current crab PSC limits were set when the stocks were healthy and that groundfish TACs are taken even under the existing crab bycatch limits. Based on the condition of *C. bairdi* stocks and impacts of trawling on crabs, Lisa felt the Team should recommend that this proposal not go out for public review at all.

DAVID HILLSTRAND
BOX 1500
HOMER, ALASKA 99603
(907) 235-8706

NORTH PACIFIC FISHERIES MANAGEMENT COUNCIL
Attention: RICHARD LAUBER



AGENDA ITEM C-3 Crab Management Issues:

1. The over harvest of crab is by far the most important issue to discuss. This happens both in the directed fishery and in bycatch of crab by other fishers.

a. The new information that is coming out and the changing in our fishing practices are ensuring that those fishing are having as little affect as they can on crab.

b. I would encourage the NPFMC along with the ADFG to reconsider the quotas or TAC that are allowed. The health of the crab stocks I feel has to do with a large enough biomass to ensure repopulating and to replace what has been exploited. It is recommended that you have flexibility in exploitation rates and to have a Guide Line Harvest with inseason management to close the fishing down as you do now. To lose this management tool in future management plans would not be prudent. IFQ's or ITQ's may not be in the best interests of the crab stocks, and management. It may be in the fishers best interest.

c. Over harvests can affect crab and groundfish, an overharvest of crab in the Berring Sea has lead to increased groundfish stocks, which compete for food as well as eat crab. Crab rely off of vegetation and groundfish for food also. It is good to see the NPFMC try to bring a balance in healthy biomass for each stock.

2. Protecting habitat is by far the greatest management tool used in preserving crab and groundfish populations. I thank the NPFMC and the ADFG for doing so.

10-207-7 C.2

3. PSC's should be encouraged for the opilio stocks. The PSC's should be considered as a harvest of crab as long as critical areas for habitat and areas of high crab bycatch are closed; this is especially so during the molting times of year; April and May. Areas of high crab bycatch should be monitored closely and closed if the recovery of the crab stocks are needed. The NPFMC has done well in the Pribilof Island area closure and is working to protect the Bristol Bay crab stocks as well.

a. With the condition of the stocks it is prudent to have a different system than we have. A fluctuating scale should be used. With a overall cap not to exceed what is currently in place. That being set when the stocks were at relatively healthy conditions. A model approach may have to be worked out because of the current crab stocks, and the percentages of crab taken from the biomass.

b. The Red King crab PSC may need to be on the legal male abundance estimates that are determined by NMFS trawl data. Not all of the area of crab abundance is fished for in the directed trawl fishery. Therefore an unbalanced percentage is taken from one portion of the stock; large male crab or female or juvenile. It may be needed to have the PSC for Red crab divided up into three parts; males, females, and small with a percentage for each and if any one is met the fishery is closed. This is true because of the ability to catch any of the three species. In the same regard as the pot fisheries is stopped because of a low female abundance, while there are still legal crab to catch. There is a division in the management's ability to close the directed fishery; they are not limited to a certain number of animals to be taken from the grounds but have the ability to use several management tools.

4. It may further be argued that we need a more direct and specific area placement of PSC and not an all encompassing area such as Zone #1, and #2. A recent example may be the area considered for closer in the Bristol Bay area. What is the current biomass for that area, and what is a health percentage to take out of that area specific. This may help to accommodate the trawlers wanting to bring PSCs into more directed areas; while still having the ability to keep the bycatch limited. An areas of 30 or 60 square miles should be considered.

a. The desire to transfer PSC's from zone #2 to zone #1 is and should be minimal; I have hear it to be 20,000 Baridi. If the trawl industry is not able to harvest their quota with a 1 million crab PSC right now. Will they be able to accomplish this with a two percent increase? $1 \text{ million} * .02\% = 20,000 \text{ Baridi}$. VBA's may need to be discussed or some other issue. But this should be dropped if the desired quota is not meet already and if the 2% is not enough to meet that need. If it is just an argument to achieve more of a PSC limit, we should return to that topic and the health of the crab stocks and drop this issue.

Summary:

1. Stop over harvesting and fishing by reducing exploitation rates and PSC %.
2. Protect habitat
3. Fluctuating PSC's with a cap at today's numbers.
 - a. An opilio PSC put in place.
4. Area defined more specific with % on male, female and small crab for PSC. There by allowing a transfer of PSC's to area specific; 30-60 square mile areas.

David Hillstrand

David Hillstrand

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.

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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

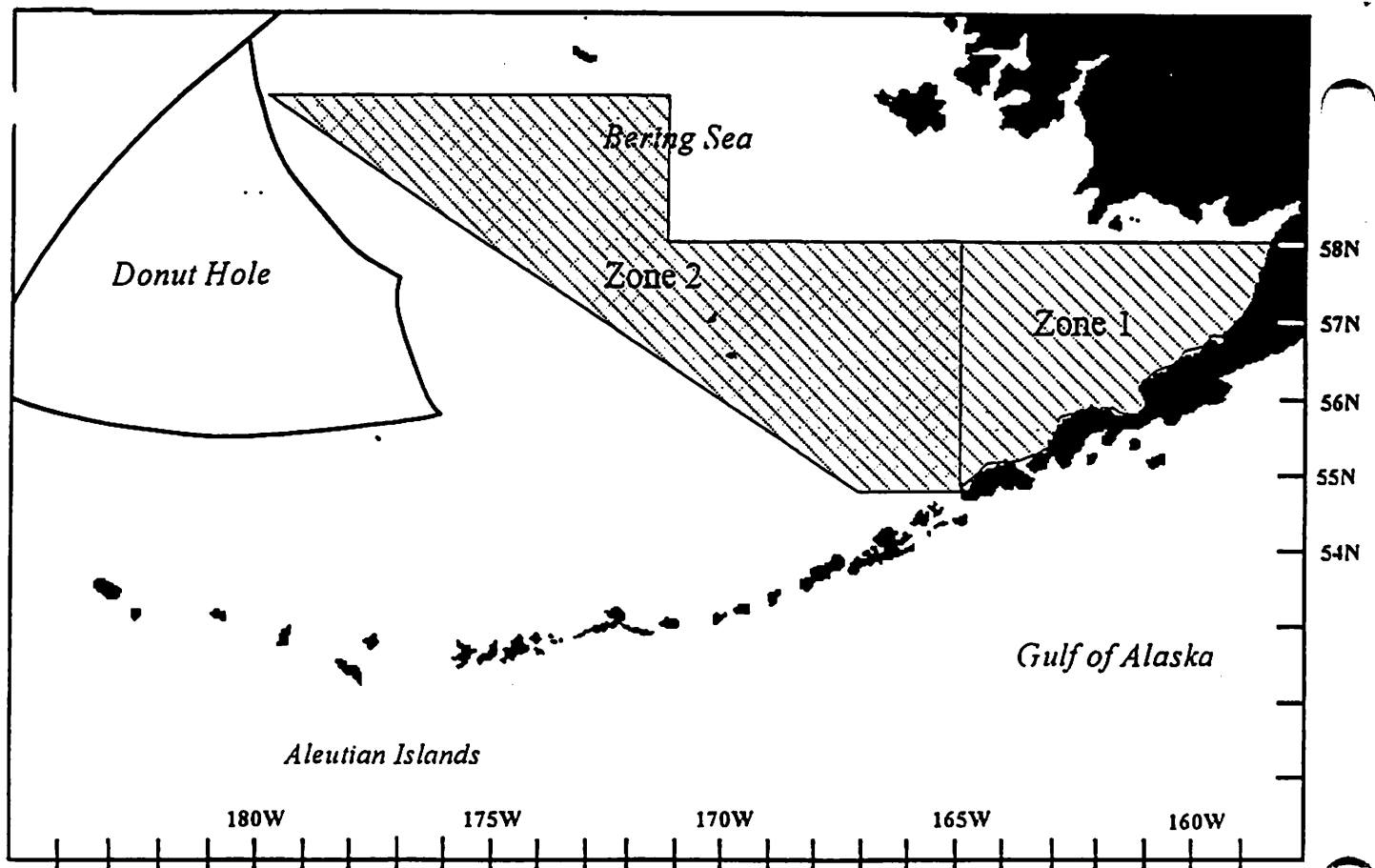
Fishing for groundfish with trawl gear often involves towing trawl gear in contact with the sea bottom. This nonselective harvesting technique catches nongroundfish species such as crabs

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 alternative 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 indices¹ 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
<u>C. bairdi</u>			
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	<u>Balaena glacialis</u>
Sei whale	<u>Balaenoptera borealis</u>
Blue whale	<u>Balaenoptera musculus</u>
Fin whale	<u>Balaenoptera physalus</u>
Humpback whale	<u>Megaptera novaeangliae</u>
Sperm whale	<u>Pyseter macrocephalus</u>
Snake River sockeye salmon	<u>Oncorhynchus nerka</u>
Snake River fall chinook salmon	<u>Oncorhynchus tshawytscha</u>
Short-tailed albatross	<u>Diomedea albatrus</u>

Threatened Species

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

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	<u>Polysticta stelleri</u>
Marbled murrelet	<u>Brachyramphus marmoratus</u>
Red-legged kittiwake	<u>Rissa brevirostris</u>
Kittlitz's murrelet	<u>Brachyramphus brevirostris</u>

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 participating 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
<i>C. bairdi</i> (# 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.

5.0 REFERENCES

- National Marine Fisheries Service (NMFS). 1995.
Final Environmental Assessment for 1995 Groundfish Total Allowable Catch Specifications. NMFS, PO Box 21668, Juneau, AK 99802-1668.
- National Marine Fisheries Service (NMFS). 1995.
Crab Rebuilding Committee Report: Minutes of the BSAI Groundfish and Crab Plan Team Meeting. March 1995. North Pacific Fishery Management Council, 605 West 4th Avenue, PO Box 103136, Anchorage, AK 99510.
- National Marine Fisheries Service (NMFS). 1994.
Discussion Paper: Snow Crab (*C.opilio*) Bycatch in the Groundfish Trawl Fisheries. September 1994. North Pacific Fishery Management Council, 605 West 4th Avenue, PO Box 103136, Anchorage, AK 99510.
- National Marine Fisheries Service. 1994.
Biological opinion on the effects of the North Pacific Groundfish Fisheries on Salmon. January 19, 1994. 28 p.
- Stevens, B.G., J.A. Haaga, and R.A. MacIntosh. 1994.
Report to Industry on the 1994 Eastern Bering Sea Crab Survey. NOAA-MNFS/AFSC Processed Report 94-07. November 1994. National Marine Fisheries Service, Alaska Fisheries Science Center, Kodiak Facility, PO Box 1638, Kodiak, AK 99615.
- Stevens, B.G., R.A. MacIntosh, J.A. Haaga, and J.H. Bowerman. National Marine Fisheries Service (NMFS). 1993.
Report to Industry on the 1993 Eastern Bering Sea Crab Survey. NOAA-NMFS/AFSC Processed Report 93-14. November 1993. National Marine Fisheries Service, Alaska Fisheries Science Center, Kodiak Facility, PO Box 1638, AK 99615.
- Stevens, B.G., J.H. Bowerman, R.A. MacIntosh, and J.A. Haaga. National Marine Fisheries Service (NMFS). 1992. Report to Industry on the 1992 Eastern Bering Sea Crab Survey. NOAA-NMFS/AFSC Processed Report 92-12. November 1992. National Marine Fisheries Service, Alaska Fisheries Science Center, Kodiak Facility, PO Box 1638, AK 99615.

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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

1995 COD EXERCISE (page 2)

The naming convention is as follows:

bairbc1 = actual bairdi Zone 1 bycatch
 bair1h = modelled bairdi Zone 1 bycatch
 bair1d = 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

1995 PACIFIC COD EXERCISE (page 3)

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	OTSHS	OTHSB	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	OTSHS	OTHSB
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	.	.	.

1995 YELLOWFIN SOLE EXERCISE (page 2)

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

1995 YELLOWFIN SOLE EXERCISE (page 3)

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	OTSHH	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	OTSHH	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

Bristol Bay red king crab catch, effort and value, by season, 1985 - 1995.

YEAR	SEASON TOTAL ^a	NUMBER		VALUE		SEASON LENGTH	
		VESSELS	LANDINGS	EXVESSEL	TOTAL ^b	DAYS	DATES
1985	4.2	128	130	\$2.90	\$12.1	8	09/25-10/02
1986	11.1	159	230	\$4.05	\$45.0	13	09/25-10/07
1987	12.2	236	311	\$4.00	\$48.7	12	09/25-10/06
1988	7.4	200	201	\$5.10	\$37.6	8	09/25-10/02
1989 ^c	10.2	211	287	\$5.00	\$50.9	12	09/25-10/06
1990	20.2	240	331	\$5.00	\$101.2	12	11/01-11/13
1991	17.1 ^c	302	325	\$3.00	\$51.2	7	11/01-11/08
1992	8.0 ^c	281	289	\$5.00	\$40.0	7	11/01-11/08
1993	14.6 ^c	292	361	\$3.80	\$55.1	9	11/01-11/10
1994				NO COMMERCIAL FISHERY			
1995				NO COMMERCIAL FISHERY			

^a Millions of pounds, deadloss not included.

^b Millions of dollars.

^c Includes test fishery.

ALASKA MARINE CONSERVATION COUNCIL

Box 101145 Anchorage, Alaska 99510
(907) 277-5357; 277-5975 (fax); amcc@igc.apc.org

January 29, 1996

Rick Lauber, Chairman
North Pacific Fishery Management Council
605 W. 4th Avenue, Suite 306
Anchorage, Alaska 99501

Dear Rick,

The Alaska Marine Conservation Council strongly endorses the Crab Plan Team's recommendations regarding protection of the Bering Sea red king crab stocks. A broadscale approach is essential to address not only bycatch of crab in the groundfisheries, but also disruption and destruction of habitat vital to all stages of crab life cycles. We also support thorough examination of 4 million *C. bairdi* tanner crab bycatch in Zones 1 & 2 before any further decision on bycatch apportionment is made. This number was set in the 1980's when tanner crab stocks were higher than they are currently.

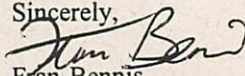
The fisheries of the North Pacific suffer nearly a billion pounds of bycatch a year, as National Marine Fisheries Service observer information indicates. The effects of this level of removal and waste coupled with habitat disruption are not fully understood.

As you're well aware, the red king crab stocks of Bristol Bay are depressed to a point where the Alaska Department of Fish & Game has canceled the fishery two years in a row. The number of females in the stock assessments remains below the threshold, and total number of males is low. As stated in our letter of September 21, 1995, we strongly endorse the maximum amount of protection for crab populations necessary for stock rebuilding. We endorsed Alternative 7 of the draft Environmental Assessment /Regulatory Impact Review (EA/RIR) which would have provided protection to a large area of critical red king crab grounds and the crab themselves, especially during particularly vulnerable times such as molting. We maintain that, *at the very least*, the depressed stock of red king crab and their habitat warrant the area described in Alternative 3, the area defined between 162 and 164 degrees W. longitude, and 56 to 57 degrees N. latitude, to be closed year round to all trawling.

In October of 1995, the North Pacific Fishery Management Council (Council) chose an option not included in the draft EA/RIR to apply a seasonal closure to the area described in Alternative 3. The year round closure of the area described in Alternative 3 is necessary to assist the rebuilding of red king crab stocks.

Significant bycatch reduction, alleviation of directed fishing pressure, and habitat protection are the most important things we as humans can contribute to a crab stock rebuilding. Shifts in climate, ocean temperatures and currents may strongly influence the numbers. Management practices for a stock in rebuilding can help or hinder whatever natural processes are affecting the crab. This places the importance of habitat protection to safeguard all stages of the crab life cycle in the hands of managers charged with conservation of the fisheries. Ways to harvest our groundfish in a manner which are not deleterious to crab or other fish stocks, including the delicate web and balance of benthic organisms, must be employed.

We request the Council reconsider its action of last October, and provide a meaningful, year-round closure to trawl in the waters described in Alternative 3 of the EA/RIR for protection of red king crab stocks. Also, the Council must conduct a comprehensive evaluation of stock and bycatch figures for any reapportionment of existing Prohibited Species Cap levels for tanner crab.

Sincerely,

Fran Bennis
Field Coordinator

People throughout Alaska working to protect the health and diversity of our marine ecosystem
A program of Alaska Conservation Foundation

BRISTOL BAY RED KING CRAB

**SUPPLEMENT TO
HISTORIC OVERVIEW AND PRELIMINARY
SUMMARY OF 1995/96 FISHERIES**

**Prepared for the joint meeting of the
Alaska Board of Fisheries and
The North Pacific Fishery Management Council**

**Anchorage Hilton Hotel
January 30, 1996**



Prepared by

**Rance Morrison and
Shellfish Management Staff**

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KING CRAB REGISTRATION AREA T BRISTOL BAY

Introduction

The Bristol Bay king crab Area T includes all waters north of Cape Sarichef, east of 168° West longitude and south of the latitude of Cape Newenham and includes all waters of Bristol Bay (Figure 1).

Historic Background

Commercial king crab fishing in the Bering Sea began with the Japanese in 1930 and continued until 1940. They returned to the fishery in 1953 and remained until 1974. The Russian king crab fleet operated in the eastern Bering Sea from 1959 through 1971. United States fishermen entered the eastern Bering Sea fishery with trawl gear in 1947. Effort and catches declined in the 1950's with no catch being reported in 1959. A period of fluctuating low catches followed through 1966 before expanding to the full scale fishery of the mid to late 1970's. As in other areas of the state, the stocks crashed in the early 1980's and are currently assessed as low.

With the decline of king crab stocks in other areas of the state in 1968, U. S. effort continued to increase in the eastern Bering Sea with a record catch of 129.9 million pounds landed during the 1980 season (Table 1). The eastern Bering Sea king crab fishery traditionally harvested red king crab from the Bering Sea and Bristol Bay waters north of Unimak Island and the Alaska Peninsula from Cape Sarichef to Port Heiden.

In 1980 the Board of Fisheries made the Southeastern District of the Bering Sea (the major red king crab grounds) an exclusive registration area. It was named Bristol Bay, Registration Area T. Vessels registering for and fishing in this area are prohibited from fishing in any other exclusive registration area leaving only the Bering Sea (Area Q) and Adak (Area R) as alternative fishing areas.

As a result of the NMFS trawl survey, Area T remained closed during the 1983 season due to the lowest number of recorded legal males as well as the lowest total king crab population ever recorded. Small females carrying fewer eggs and high predator abundance also contributed to the closure decision.

Since the reopening of the fishery in 1984, catches have slowly increased to over 20.3 million pounds harvested during the 1990 season. Due to the large number of catcher-processors and floating processors in the fishery and the inability of the Department to monitor these catches, an observer program was initiated in 1988. Fishing effort has increased dramatically from 89 vessels in 1984 to over 300 vessels in 1991. With the increase in fishing effort, the amount of pots being used by the fleet has also increased, with over 90,000 registered in 1991.

In 1992, the Board of Fisheries established a 250 pot limit for the Bristol Bay red king crab fishery. This measure was to assist the manager's ability to monitor the fishery and control the harvest. These pot limits, which were to be applied through a buoy sticker program, were designed to assist in-season management of the fisheries and reduce the potential for pot loss.

Immediately following the 1992 Bristol Bay red king crab fishery, buoy sticker requirements were suspended due to a high failure rate of the stickers adhering properly to buoys. Despite suspension of the buoy sticker requirement, the 250 pot limit remained in effect until repealed by the National Marine Fisheries Service (NMFS) on November 30. This action by NMFS was due to perceived inconsistencies with provisions of the Bering Sea/Aleutian Island king and Tanner crab Federal Management Plan (FMP) which mandated application of pot limits in a nondiscriminatory manner.

In the spring of 1993 the Alaska Board of Fisheries passed new regulations which set pot limits on all vessels fishing king and Tanner crab in the Bering Sea based on overall vessel length. For the king crab Area T fishery, vessels in excess of 125 feet in overall length were limited to 250 pots and vessels less than 125 feet in length overall were allowed 200 pots total. These pot limits were to be applied through a buoy tag program from the Dutch Harbor and Kodiak ADF&G offices.

Harvest shortfalls in both the St. Matthew blue king and Pribilof Islands red king crab fisheries in mid-September 1993 prompted a meeting in Seattle between fishermen, industry representatives and staff from ADF&G and NMFS to discuss methods to improve in-season data collection and management. At that meeting, a sales representative from MCI Communications Incorporated presented information about satellite communications software currently available for confidential communication between ADF&G and vessels at sea, which could be used for daily in-season catch reporting. As a result of this meeting, ADF&G purchased the necessary computer hardware and software for retrieval of daily satellite transmitted catch messages from vessels at sea. Historic fishery data is summarized in Tables 1,2 and 3.

Results of the NMFS 1994 summer trawl survey of the Eastern Bering Sea indicated declines in all size classes of both male and female red king crab in the Bristol Bay area. Compared to observations made during the 1993 survey, the abundance index of large male crab declined 25%. Based on 1994 survey results, large female abundance was estimated at 7.5 million crabs, which was below the minimum threshold of 8.4 million crab. As a result, the Bristol Bay area was not open to fishing for the 1994 season.

1995 Fishery

The Bristol Bay red king crab fishery did not open for the 1995 season.

Status of stocks

The 1995 NMFS summer trawl survey of the Eastern Bering Sea indicated no significance difference in the abundance of mature male and female red king crab from estimates made from the 1994 survey. Although the 1995 survey indicated a slight increase in the number of immature, prerecruit and legal sized crabs relative to 1994, the stock remains in a depressed condition. The abundance of large females remains at 8.4 million animals. This is equal to the threshold level of large female crab which

must be exceeded in order to allow for a commercial harvest of male crab. As a result, the fishery remained closed for the 1995 season, the second consecutive closure of the area due to insufficient numbers of large mature female crab.

Table 1. Bristol Bay, Area T of the Bering Sea, historic red king crab catch statistics, 1966-1995

Year	Number of		Crab ^a	Harvest ^{a,b}	Pots Pulled	Average		CPUE ^d	% Old Shell	Deadloss ^b
	Vessels	Landings				Weight ^b	Length ^c			
1966	9	15	140,554	997,321	2,720	7.1		52		
1967	20	61	397,307	3,102,443	10,621	7.8		37		
1968	59	261	1,278,592	8,686,546	47,496	6.8		27		
1969	65	377	1,749,022	10,403,283	98,426	5.9		18		
1970	51	309	1,682,591	8,559,178	96,658	5.1		17		
1971	52	394	2,404,681	12,955,776	118,522	5.4		20		
1972	64	611	3,994,356	21,744,924	205,045	5.4		20		
1973	67	441	4,825,963	26,913,636	194,095	5.6		25		N/A
1974	104	605	7,710,317	42,266,274	212,915	5.5		36		N/A
1975	102	592	8,745,294	51,326,259	205,096	5.7		43		1,639,483
1976	141	984	10,603,367	63,919,728	321,010	6.0	148	33	27.4	875,327
1977	130	1,020	11,733,101	69,967,868	451,273	5.9	148	26	13.0	730,279
1978	162	926	14,745,709	87,618,320	406,165	5.8	147	36	6.9	1,273,037
1979	236	889	16,808,605	107,828,057	315,226	6.4	152	53	10.4	3,555,891
1980	236	1,251	20,845,350	129,948,463	567,292	6.2	151	37	11.0	1,858,668
1981	177	1,026	5,307,947	33,591,368	542,250	6.3	151	10	47.4	711,289
1982	90	255	541,006	3,001,210	141,656	5.6	145	4	24.6	95,834
1983			NO	C O M M E R C I A L	F I S H E R Y					
1984	89	137	794,040	4,182,406	112,556	5.2	142	7	26.5	35,601
1985	128	130	796,181	4,174,953	85,003	5.5	142	9	25.8	6,436
1986	159	230	2,099,576	11,393,934	178,370	5.4	142	12	25.5	284,127
1987	236	311	2,122,402	12,289,067	220,871	5.8	145	9	19.0	120,388
1988	200	201	1,236,131	7,387,795	153,004	6.0	147	8	15.1	23,537
1989	211	287	1,684,706	10,264,791	208,684	6.1	148	8	17.7	81,334
1990	240	331	3,120,326	20,362,342	262,131	6.5	152	12	14.7	116,527
1991*	302	324	2,630,446	17,177,894	227,555	6.5	152	12	12.1	119,670
1992*	281	289	1,196,958	8,043,018	205,940	6.7	153	6	22.3	9,000
1993*	292	361	2,261,287	14,628,639	253,794	6.5	152	9	15.2	133,442
1994			NO	C O M M E R C I A L	F I S H E R Y					
1995			NO	C O M M E R C I A L	F I S H E R Y					

^aDeadloss included.

^bIn Pounds.

^cIn millimeters.

^dDefined as catch per pot pull.

^eIncludes Test Fishery.

Table 2. Historic Bristol Bay red king crab economic performance.

Year	GHL ^a	Season Total ^b	Number of		Number of Pots		Value		Season Length	
			Vessels	Landings	Registered	Pulled	Exvessel	Total ^c	(Days)	Dates
1980	70 - 120	128.1	236	1,251	78,352	567,292	\$ 0.90	\$115.3	(40)	09/10-10/20
1981	70 - 100	33.6	177	1,026	75,756	542,250	\$ 1.50	\$ 49.3	(91)	09/10-12/15
1982	10 - 20 ^d	2.9	90	255	36,166	141,656	\$ 3.05	\$ 8.8	(30)	09/10-10/10
1983				N O C O M M E R C I A L F I S H E R Y						
1984	2.5 -6.0	4.1	89	137	21,762	112,556	\$ 2.60	\$ 10.8	(15)	10/01-10/16
1985	3.0 -5.0	4.2	128	130	30,117	85,003	\$ 2.90	\$ 12.1	(8)	09/25-10/02
1986	6.0-13.0	11.1	159	230	32,468	178,370	\$ 4.05	\$ 45.0	(13)	09/25-10/07
1987	8.5-17.7	12.2	236	311	63,000	220,871	\$ 4.00	\$ 48.7	(12)	09/25-10/06
1988	7.5	7.4	200	201	50,099	153,004	\$ 5.10	\$ 37.6	(8)	09/25-10/02
1989	16.5	10.2	211	287	55,000	208,684	\$ 5.00	\$ 50.9	(12)	09/25-10/06
1990	17.1	20.2	240	331	69,906	262,131	\$ 5.00	\$101.2	(12)	11/01-11/13
1991	18.0	17.1 ^e	302	324	89,068	227,555	\$ 3.00	\$ 51.2	(7)	11/01-11-08
1992	10.3	8.0 ^e	281	289	68,189	205,940	\$ 5.00	\$ 40.0	(7)	11/01-11/08
1993	16.8	14.6 ^e	292	361	58,881	253,794	\$ 3.80	\$ 55.1	(9)	11/01-11/10
1994				N O C O M M E R C I A L F I S H E R Y						
1995				N O C O M M E R C I A L F I S H E R Y						

^aGuideline Harvest Level (millions of pounds).

^bMillions of pounds, deadloss not included.

^cMillions of dollars.

^dInseason revision to 4.7 million pounds.

^eIncludes test fishery.

Table 3. Bristol Bay red king crab harvest composition by fishing season.

Season	<u>Date</u> Opened-Closed	Harvest ^a	Percent Recruit ^b	Percent Postrecruit ^b	Size Limit ^c	Price Per Pound
1973	06/15-09/09	26.9	63	37	6½	\$0.84
1974	07/29-10/12	42.2	60	40	6½	\$0.38
1975	08/01-11/16	51.3	21	79	6½ ^d	\$0.38
1976	08/15-12/07	63.9	56	44	6½	\$0.58
1977	09/15-12/08	70.0	67	33	6½	\$1.11
1978	09/10-10/23	87.6	75	25	6½	\$1.23
1979	09/15-10/14	107.8	47	53	6½	\$1.01
1980	09/10-10/20	129.9	44	56	6½	\$0.90
1981	09/10-10/20	33.6	-	-	6½	-
	10/25-12/15	1.5	14	86	7	\$1.50
1982	09/10-10/10	3.0	68	32	6½	\$3.05
1983		N O	C O M M E R C I A L	F I S H E R Y		
1984	10/01-10/16	4.2	59	41	6½	\$2.60
1985	09/25-10/02	4.2	66	34	6½	\$2.90
1986	09/25-10/07	11.4	65	35	6½	\$4.05
1987	09/25-10/06	12.3	77	23	6½	\$4.00
1988	09/25-10/02	7.4	59	41	6½	\$5.10
1989	09/25-10/06	10.3	58	42	6½	\$5.00
1990	11/01-11/13	20.4	49	51	6½	\$5.00
1991	11/01-11/08	17.2	44	56	6½	\$3.00
1992	11/01-11/08	8.0	33	67	6½	\$5.00
1993	11/01-11/10	14.6	33	67	6½	\$3.80
1994		N O	C O M M E R C I A L	F I S H E R Y		
1995		N O	C O M M E R C I A L	F I S H E R Y		

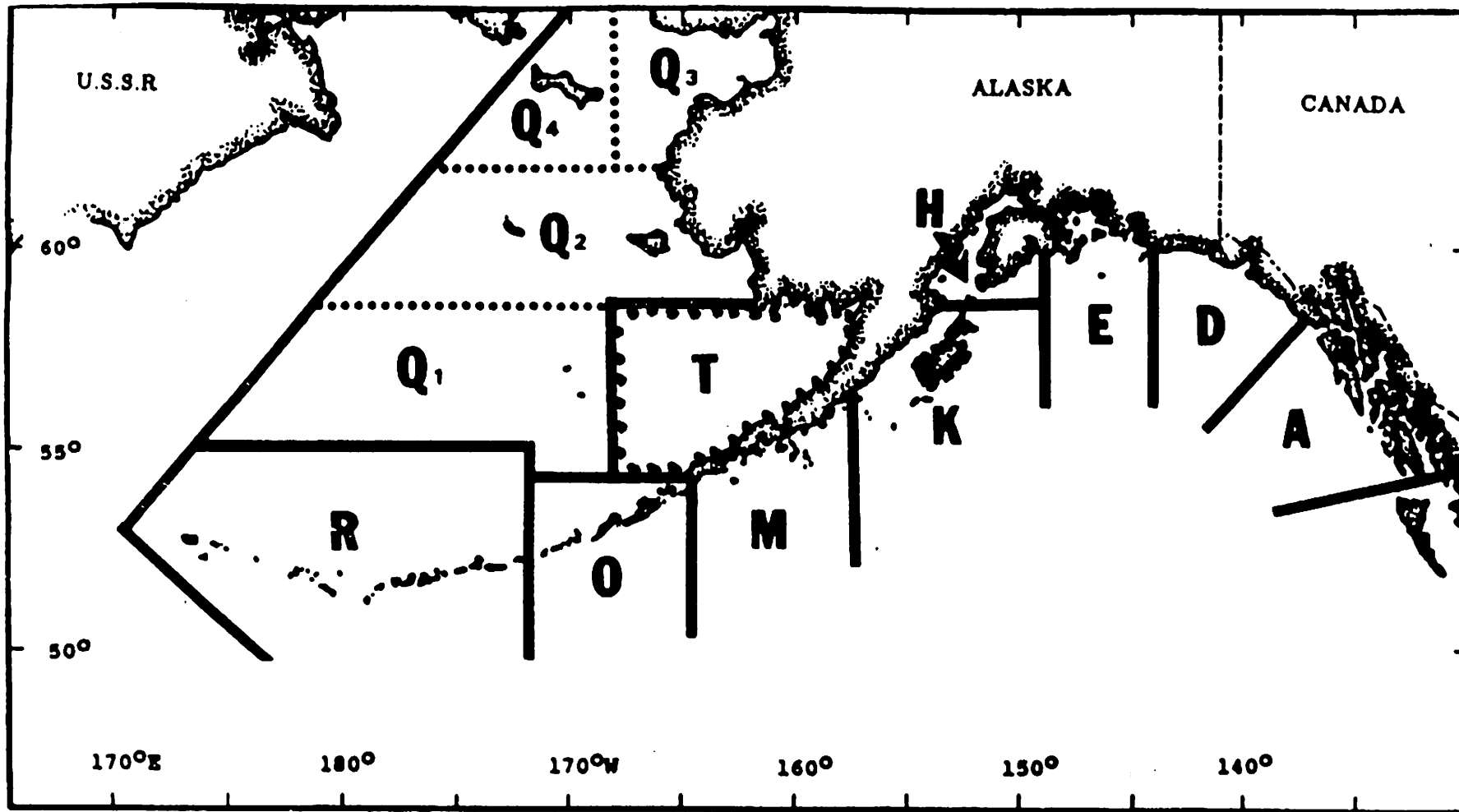
^aDeadloss included, millions of pounds.

^bRecruits figured at 149 mm - all previous years, 155 mm.

^cMinimum carapace width in inches.

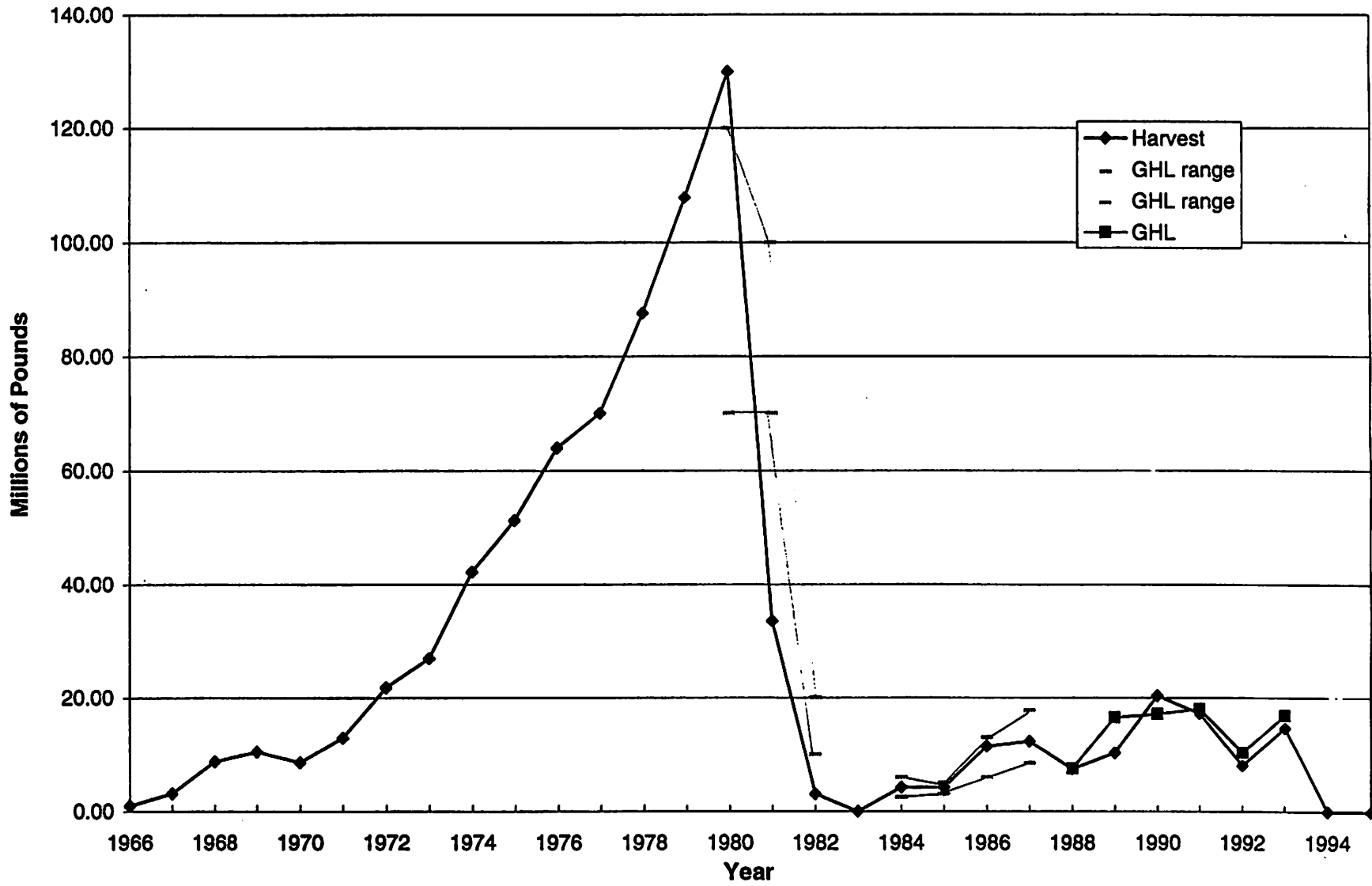
^d6½ inches after 11/01.

Bering Sea Aleutian Islands Crab Management Areas



..... Bristol Bay King Crab Management Area "T"

Bristol Bay Red King Crab Harvest 1966 - 1995



Bristol Bay red king crab catch, effort and value, by season, 1985 - 1995.

YEAR	SEASON TOTAL ^a	NUMBER		VALUE		SEASON LENGTH	
		VESSELS	LANDINGS	EXVESSEL	TOTAL ^b	DAYS	DATES
1985	4.2	128	130	\$2.90	\$12.1	8	09/25-10/02
1986	11.1	159	230	\$4.05	\$45.0	13	09/25-10/07
1987	12.2	236	311	\$4.00	\$48.7	12	09/25-10/06
1988	7.4	200	201	\$5.10	\$37.6	8	09/25-10/02
1989 ^c	10.2	211	287	\$5.00	\$50.9	12	09/25-10/06
1990	20.2	240	331	\$5.00	\$101.2	12	11/01-11/13
1991	17.1 ^c	302	325	\$3.00	\$51.2	7	11/01-11/08
1992	8.0 ^c	281	289	\$5.00	\$40.0	7	11/01-11/08
1993	14.6 ^c	292	361	\$3.80	\$55.1	9	11/01-11/10
1994			NO COMMERCIAL FISHERY				
1995			NO COMMERCIAL FISHERY				

^a Millions of pounds, deadloss not included.

^b Millions of dollars.

^c Includes test fishery.

Bristol Bay red king crab population assessment: “Area-swept” and “LBA”

Area-swept estimates of abundance from trawl survey:

From Each Survey Tow:

- **Count crabs caught**
- **Estimate density = crabs caught per area swept by tow**
- **Estimate station abundance by expansion to station area**

Using All Survey Tows:

- **Expand to total area of surveyed region (e.g., Bristol Bay)**
 - **Sum up within-station abundance estimates**

Example: Area-swept estimates of Bristol Bay red king crab from annual National Marine Fisheries Service (NMFS) Eastern Bering Sea (EBS) trawl survey.

If catch 1 crab in station tow,

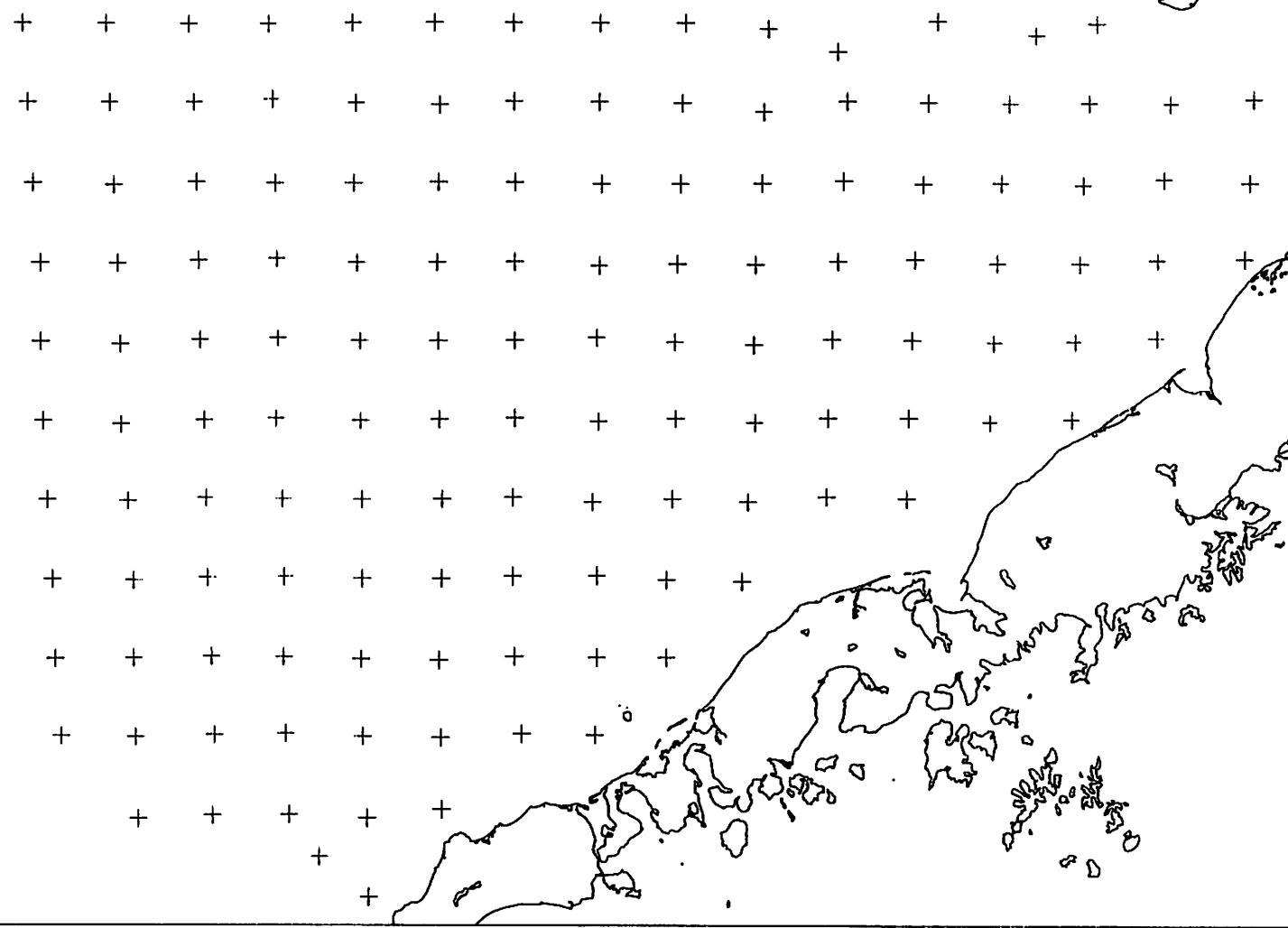
- **Estimated density**
 - = (1 crab)/(1/80 nm² swept)**
 - = 80 crabs/nm²**
- **Expanded station abundance**
 - = (80 crabs/nm²) X (400 nm²/station)**
 - = 32,000 crabs/station**

Repeat procedure for each station's tows.

Estimate Bristol Bay red king crab abundance by size and sex.

ADF&G has until recently used the annual EBS trawl survey estimates to determine if Bristol Bay red king crab stock is above the fishery threshold level and to set fishery guideline harvest level (GHL).

**"Standard" NMFS EBS trawl survey tow
locations in Bristol Bay.**
Area swept/tow = 1/80 nm²
Station area = 400 nm²



A problem with area-swept estimates for crabs:

Estimation, or Survey Measurement, Error.

Any estimated quantity is associated with some level of uncertainty due to estimation or measurement error, but the distributional patterns of crabs and the available survey resources pose particular problems when estimating crab abundance.

- Crabs tend to have highly aggregated distributions.

Tow hits an aggregation => abundance over-estimated
Tow misses an aggregation => abundance under-estimated

=> Poor precision of abundance estimates
=> Low confidence in abundance estimates

- Problem with “outliers”: Occasional single tow with a large catch of crabs.
Can have a substantial effect on the total abundance estimate.
- Estimation/measurement error can lead to poor tracking of abundance estimates from year to year.
Inexplicable increases/decreases in abundance estimates between years.
- One approach to solving problem: increase number and density of tows performed.
But that approach has not been feasible.

Statement: “Nonetheless, this year’s survey data provides the most recent and, therefore, the best available information on this year’s abundance of crabs.”

Response: “Not necessarily...”

Dependence of stock abundance and size distributions between years.

For a given sex and size range of crabs considered, this year's abundance and size distribution is dependent on last year's:

- **This year's abundance = Last year's abundance,**

Minus

**last year's commercial harvest
"natural mortality" through last year**

Plus

this year's recruitment into the size range.

- **This year's size distribution = Last year's size distribution,**

**"Shifted" by size-dependent growth of molting crab
over the last year**

**with "shift" moderated by size-dependent skip-
molting in males last year**

Plus

**new additions to this year's size distribution due
to recruitment.**

Given that dependence:

If last year's survey data provided "best possible estimates" of last year's abundance and size distribution,

How can we ignore last year's data when estimating this year's abundance and size distribution?

Point is: Abundance and size distribution estimates from one year contain information on abundance and size distribution in a preceding/following year.

- ⇒ Area-swept estimates from multiple years contain more information on any single year than the area-swept estimates for that year alone.**
- ⇒ Area-swept estimates based on a single year's trawl survey data are not the "best estimates based on the best available data" for that year.**
- ⇒ Given sufficient years of data, multiple years of area-swept estimates coupled with known fishery removals can, if properly modeled, provide:**
 - 1. More precise estimates of annual abundance and size distribution than single year area-swept estimates**
 - 2. Estimates of natural mortality rates**
 - 3. Estimates of annual recruitment and the size distribution of recruits**
 - 4. Estimates of size-dependent growth and molting probability**

The Length-Based Assessment (LBA) model for Bristol Bay red king crab:

Model developed by ADF&G to use multiple years of trawl survey data to estimate annual abundance, size distribution, recruitment, and other stock dynamics parameters.

Data:

- **Area-swept estimates of annual abundance of male and female Bristol Bay red king crab from the 1972 through the most recent NMFS EBS trawl surveys.**
 - **Males > 94 mm carapace length (cl) grouped by 5 mm cl size-classes (males > 159 mm cl are pooled into one class)**
 - **Females > 89 mm cl grouped by 5 mm cl size-classes**
- **Annual commercial catch by length and shell condition from fish tickets and catch sampling, 1972 through latest year.**
- **Estimates of growth increment per molt and probability of molting by size and shell condition from tag-recovery data.**
- **Estimate of trawl survey gear catchability.**
 - **Assumed = 1 for males > 94 mm and females > 89 mm**

Assumptions:

- **Lognormal distribution of area-swept estimates.**
- **Growth-per-molt distribution for size-class constant over time.**

Output:

- **Abundance estimates by sex, 5 mm cl size-class, shell condition, year.**
- **Estimates of recruitment, size distribution of recruits to modeled size classes by year.**
- **Estimates of “effective spawning biomass” by year.**
- **Estimates of natural mortality, molting probability.**

Estimates are updated annually with each year’s trawl survey and fishery data.

Example (Figure 1): Comparison of area-swept and LBA abundance estimates of males by 5 mm cl size-classes from 1990 through 1993.

Note features in single-year area-swept estimates (Figure 1a) that are likely due to survey measurement error:

- **“Peaks” and “valleys” in size-distributions that don’t track between years.**

Poor tracking of size-distributions between years of single-year area-swept estimates leads to poor confidence in estimates:

- **Are one year’s estimates right, other year’s wrong?**
- **True values fall somewhere in between the two year’s estimates?**

Compare with LBA estimates of size distributions (Figure 1b):

- **Not as “noisy” -- filter out measurement errors**
- **Better year-to-year tracking between size distribution estimates - “peaks” not so high, “valleys” not so low**

Better year-to-year tracking of LBA abundance estimates leads to greater confidence in those estimates.

The LBA model has been reviewed by ADF&G staff, NMFS staff, and University staff, and peer-reviewed prior to publication in scientific fishery journals.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1995. A length-based population model and stock-recruitment relationships for red king crab, *Paralithodes camtschaticus*, in Bristol Bay, Alaska. Canadian Journal of Fisheries and Aquatic Sciences 52:1229-1246.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1995. An update of the length-based population model and stock-recruitment relationships for red king crab, *Paralithodes camtschaticus*, in Bristol Bay, Alaska. Alaska Fishery Research Bulletin 2(2), in press.

LBA-estimates of biological parameters (e.g., growth, mortality, molting probability) conform well with independently derived estimates (e.g., from tagging studies).

Uses of LBA:

- 1. Estimate Bristol Bay red king crab stock abundance for fishery management (since 1994).**
 - Appraise status of stock relative to fishery thresholds that determine fishery opening closures**
 - Set commercial harvest guideline levels**
 - Provide confidence bounds on stock abundance estimates**
 - Provide guidance in judging data from individual survey tows as “outliers”**
- 2. Model and estimate parameters for spawner-recruitment relationships.**
- 3. Provide estimates of stock dynamics parameters for population modeling, harvest strategy modeling.**

Examples of use of LBA:

- 1. Estimates of legal male, mature female abundance, 1973-1994 (Figures 2a, 2b): Confidence intervals, comparison with area-swept estimates.**
- 2. Estimates of recruitment, 1973-1995 (Figure 3).**
- 3. Spawner-recruitment relationship (Figure 4).**
- 4. Population/Harvest strategy modeling.,**

Zheng, J. M.C. Murphy, and G.H. Kruse. MS. Analysis of the harvest strategies for red king crab, *Paralithodes camtschaticus*, in Bristol Bay, Alaska. Submitted to the Canadian Journal of Fisheries and Aquatic Sciences.

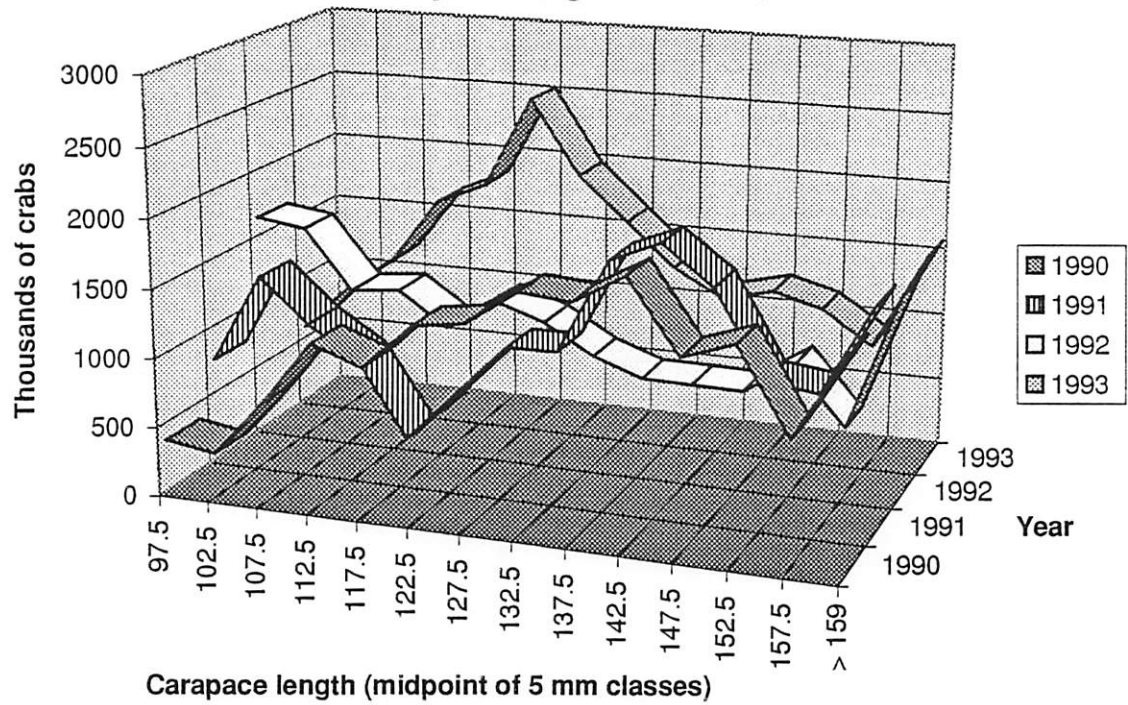
Zheng, J. M.C. Murphy, and G.H. Kruse. MS. Alternative rebuilding strategies for the red king crab, *Paralithodes camtschaticus*, fishery in Bristol Bay, Alaska. Unpublished manuscript.

Simulations of population under alternative harvest strategies to predict performance relative to:

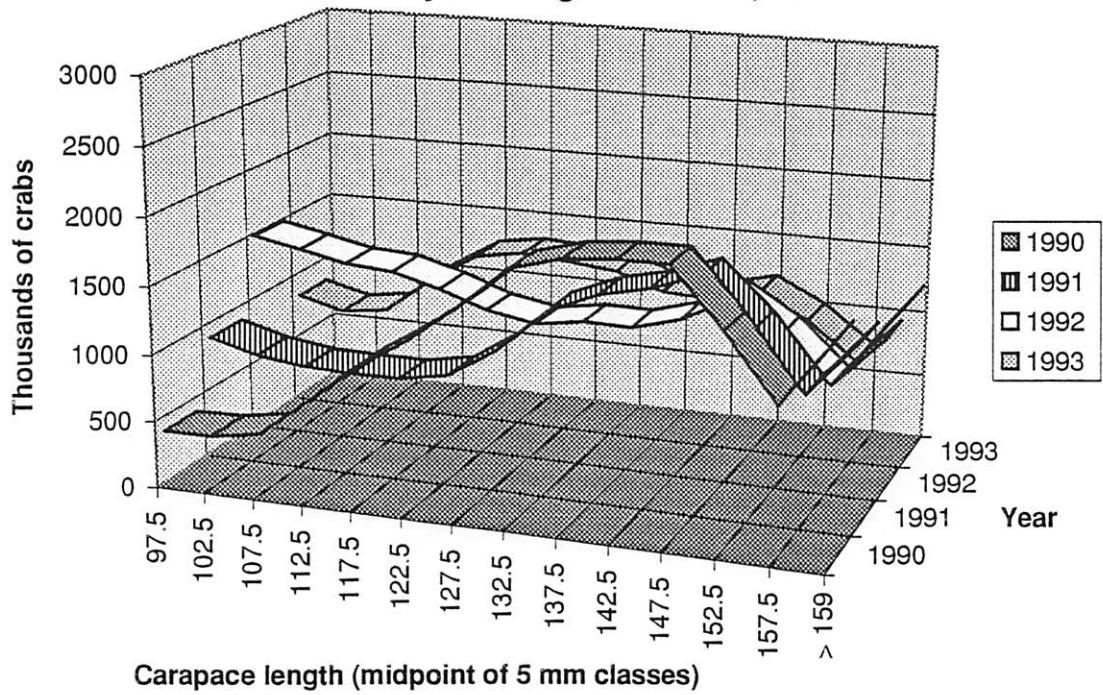
- average yield**
- long term yield**
- stability of yield**
- expectation of fishery closures, duration of fishery closures**
- average and long-term indices of reproductive potential**

Assess robustness of strategy, sensitivity of conclusions to model assumptions by varying “background” parameters (e.g., natural mortality, handling mortality, spawner-recruit relationship).

**Figure 1a. Area-swept estimates
Bristol Bay red king crab males, 1990-1993**



**Figure 1b. LBA estimates
Bristol Bay red king crab males, 1990-1993**



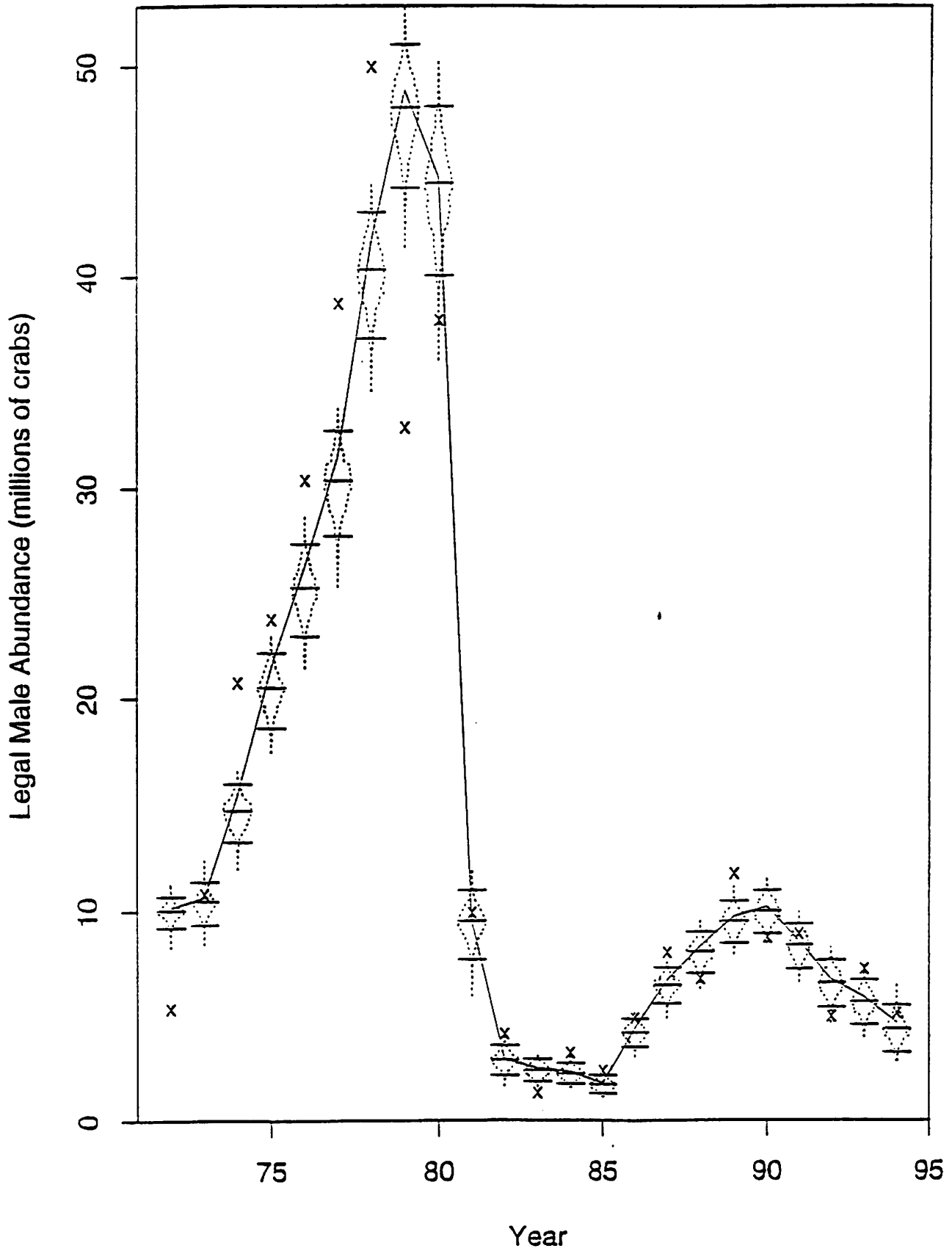


Figure 2a.

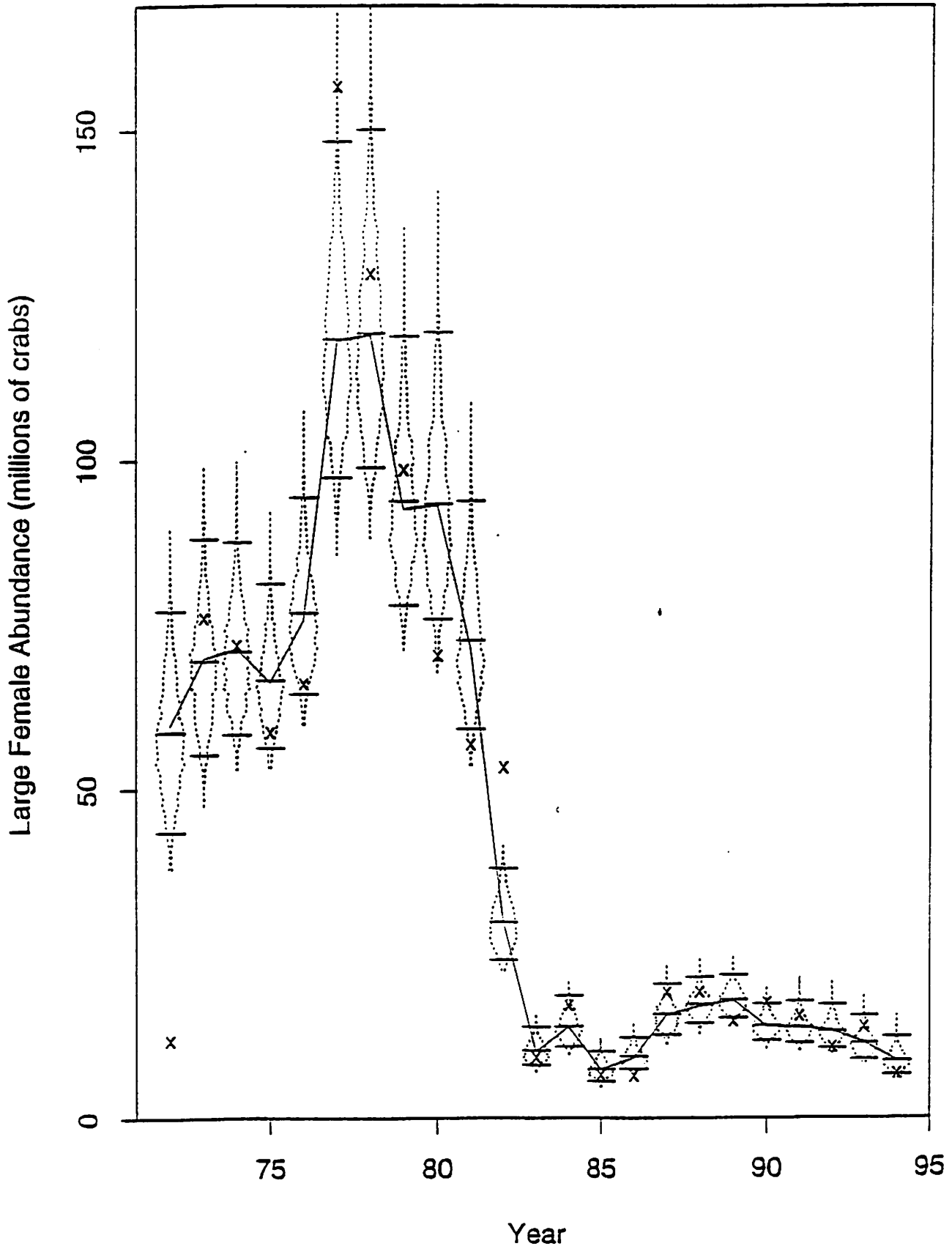
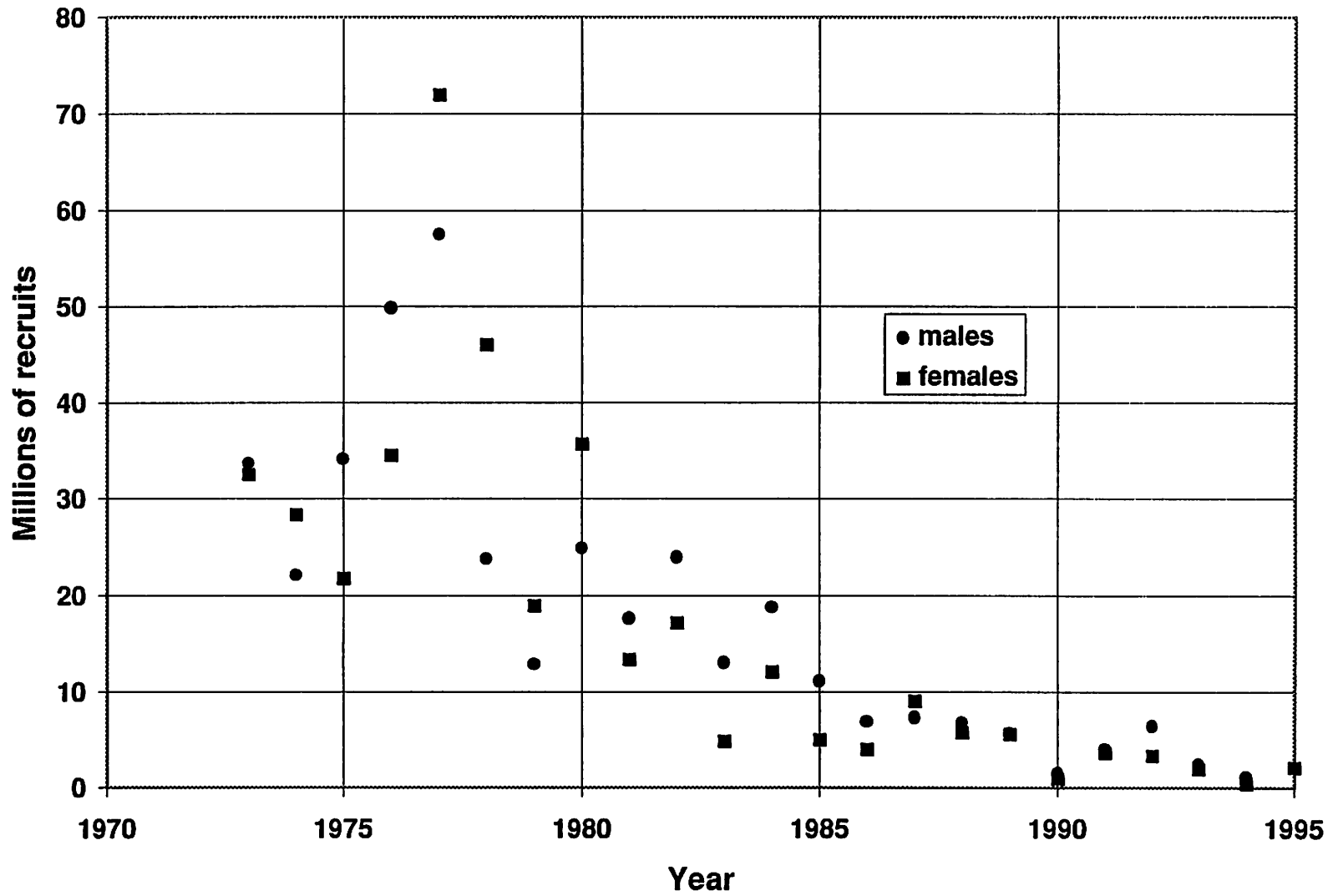


Figure 2b.

Figure 3. LBA estimates of Bristol Bay red king crab recruitment, 1973-1995
Males > 94 mm cl, Females > 89 mm cl



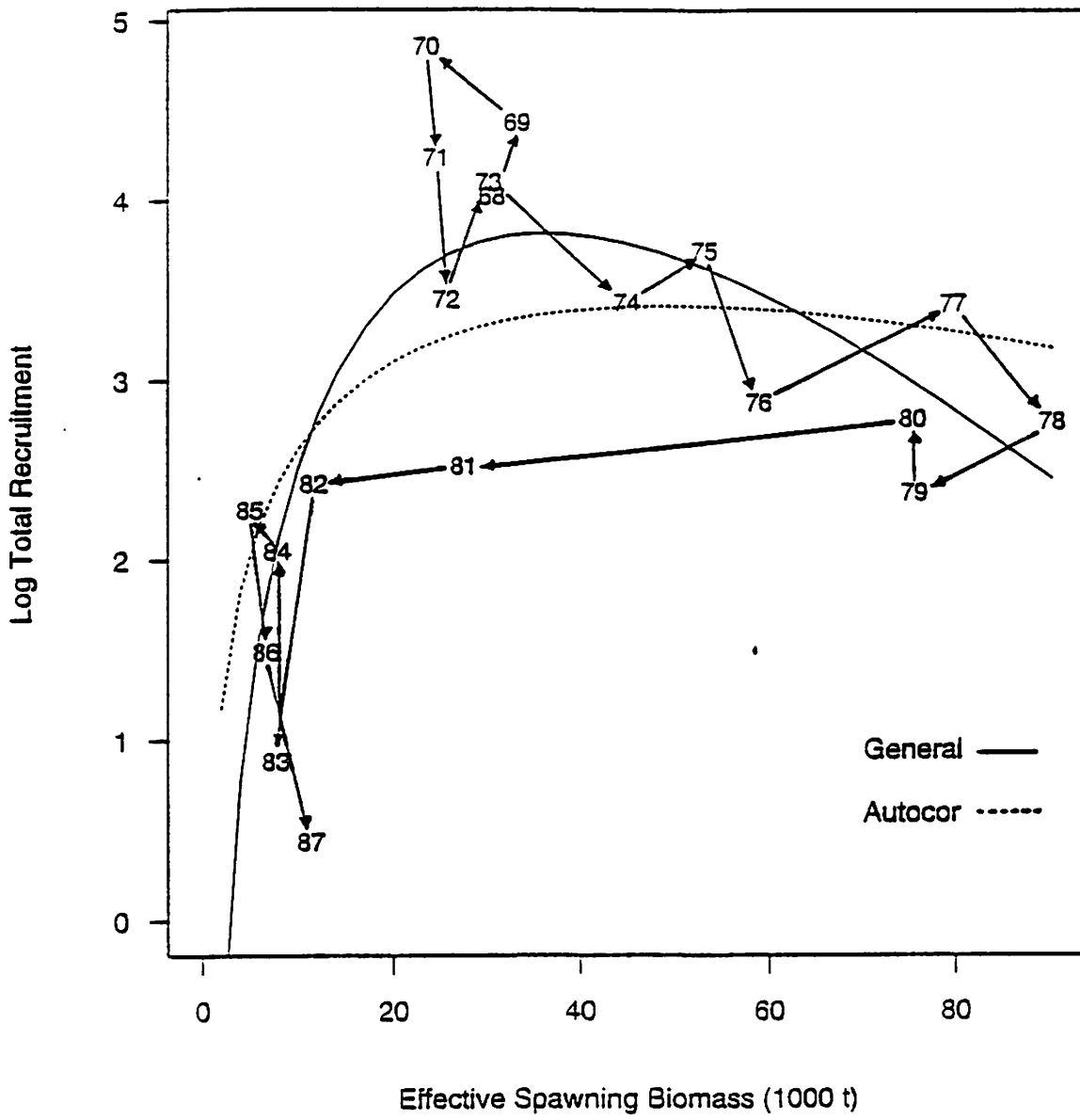
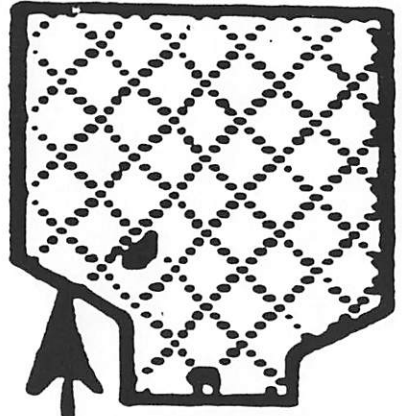


Figure 4.

CASEY C-1
5/05

Bering Sea

Year-round closure



**Pribilof Islands
Habitat Conservation
Area**

**Red King Crab
Survings Area**

1-1-96
to
3-30-96
CLOSURE

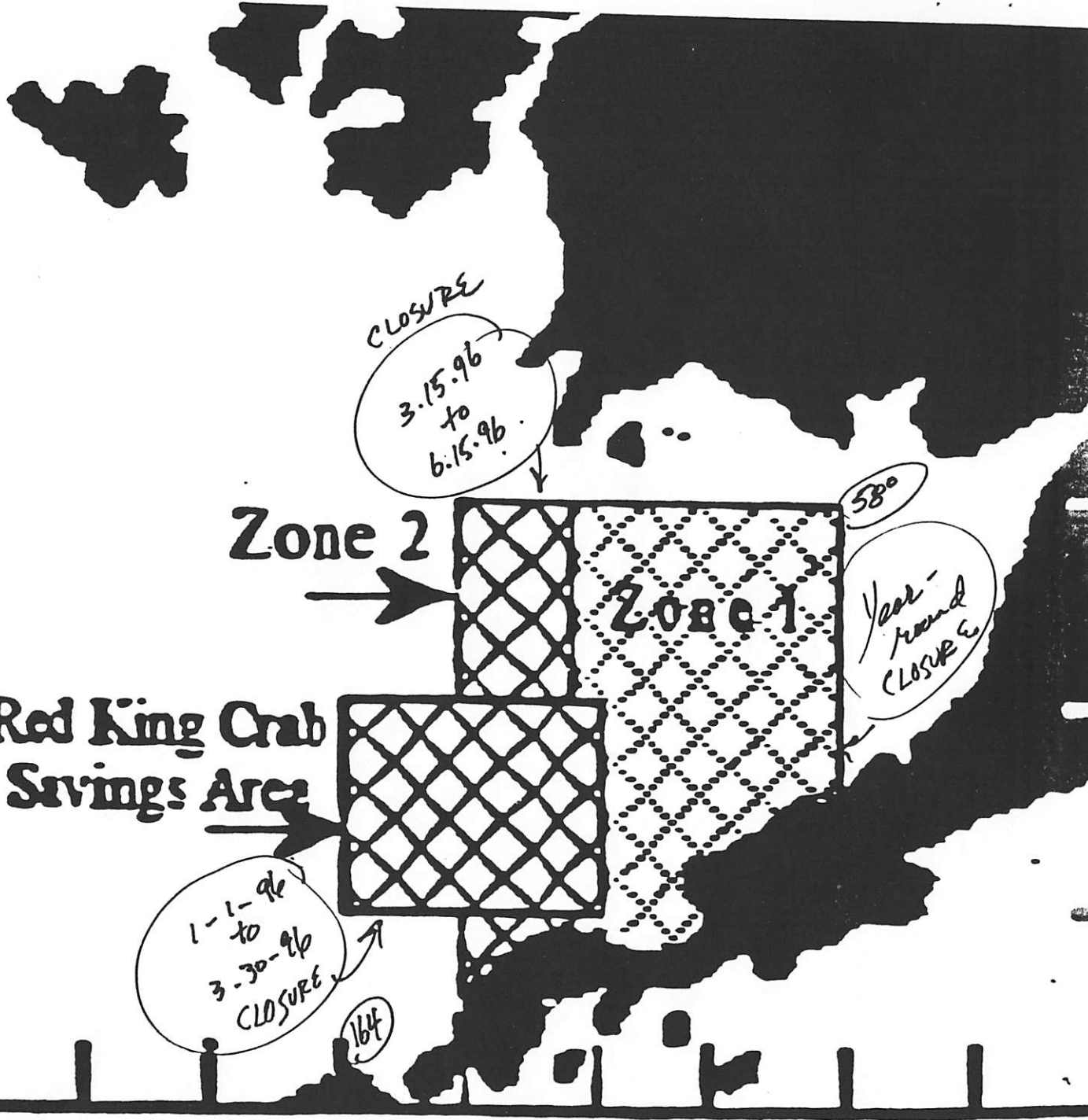
CLOSURE
3-15-96
to
6-15-96

Zone 2

Zone 1

58°
*Year-round
CLOSURE*

164



John Dawin

Facts to Consider Regarding Emergency Action For A Year-Round Closure of the Red King Crab Savings Area.

Crab Bycatch in Yellowfin Sole Target 1993-1995

<u>year</u>	<u># RKC (# of animals)</u>	<u>bairdi (# of animals Zs 1&2)</u>
1993	18,205	995,273
1994	16,881	1,142,134
1995	6,452	1,366,754

Source: EARIR for RKC Savings Area August 24, 1995

Catch of Yellowfin Sole Within Area Comprising RKC Savings Area 1993-1995.

1993	4,100 mt
1994	< 500 mt
1995	0

Source: EARIR for RKC Savings Area August 24, 1995

Fact: Prior to 1995, the directed yellowfin sole fishery was closed by regulation until May 1st. This explains why the area in question has had relatively minor yellowfin sole catches over the period in the table above. As Dave Fraser has testified to the NPFMC, the area in question was relatively important to catcher boats during the JV fishery for yellowfin sole. Mr. Fraser has testified that the area represents an opportunity to target yellowfin sole during the month of April where crab and halibut bycatch rates are low and CPUEs are good.

Fact: The area within statistical area 516 (from 163° W to 162° W or one-half of the area in question) is closed starting April 1st.

Fact: The bottom trawl industry has agreed to close the RKC area to flatfish fishing of all targets if the overall bycatch of RKC in any flatfish fisheries within the area in question reaches 15,000 animals. Sea State will be used to carry out this agreement. This has been incorporated into the 1996 annual specifications which the council approved last December, thus yellowfin sole has a cap of 15,000 animals for the second semester, the semester where fishing within the RKC savings area would occur.

Consideration: Available data on bairdi bycatch reveal that if the yellowfin sole fishery cannot fish within the RKC savings area, bairdi bycatch will likely be increased,

Bill Alwert
FV Buccaneer

P.O. Box 1711 Kodiak, Alaska 99615
486-5511

(907)

February 1, 1996

Mr. Rick Lauber, Chairman
North Pacific Fishery Management Council
Anchorage, Alaska

Dear Rick,

As I stated during my testimony to the Council and the Alaska Board of Fisheries two days ago, I formally request that the Council form a bycatch negotiating committee for the Gulf of Alaska to establish a cap on Bairdi Tanner crab.

The trawl closure areas around Kodiak Island that are designated in the Gulf Groundfish Plan have been a good first step. But more and more of us feel that Bairdi Tanner crab remain vulnerable beyond these areas. Since we have not had a directed Bairdi fishery for two years now, reports of cod-ends full of Bairdi being dumped by trawlers (particularly around the Horse's Head) bother us like crazy. These reports make us think we'll never see the Bairdi stock rebound and support a directed fishery in our lifetime.

So I thank the Council for considering my request to conserve what's left of the Bairdi stock and I ask that we begin the formal process to have a negotiated, Bairdi bycatch cap in place for the 1997 season.

Sincerely,

William Alwert

P.02
Bob Scofield c-3

Dorian Metal Fabricating, Inc.

3950 6th Ave. N.W. / P.O. Box 70405 / Seattle, WA. 98107
(206) 547-8585 / FAX (206) 547-8553

1995 YEAR-END SUMMARY BERING SEA CRAB POTS

<u>POTS</u>	<u>QTY</u>
6.5X32E	30
6.5X32R	170
6.5X34E	55
6.5X34R	350
* 6.5X7.5X33	60
* 6.5X7.5X34	250
6.5X7X32E	70
6.5XED	25
7.5X7.5X34.5	25
* 7.5X7E	85
7X7X33R	200
7X7X34E	455
7X7X34R	265
* 7X8 END	215
* 7X8 RET	60
* 7X8X34 RET	840
8X36R	30
8X8X33	101
8X8X36E	50
<hr/>	
SUB-TOTAL	3336
	-755 *
<hr/>	
TOTAL REPLACEMENT POTS MANUFACTURED BY DMFI:	2581
ESTIMATED REPLACEMENT POTS BUILT BY OTHER POT MANUFACTURERS:	3880
<hr/>	
TOTAL REPLACEMENT POTS BUILT IN YEAR 1995:	6461

* 50% OF THESE POTS WERE FOR VESSELS
UPGRADING TO LARGER POTS

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

January 30, 1996

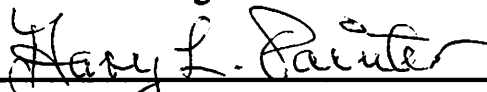
Steve Pennoyer, Regional Director
National Marine Fisheries Service
Juneau, Alaska

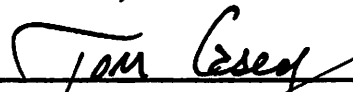
Dear Steve,

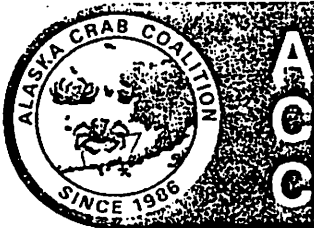
We formally request that NMFS issue an emergency regulation closing the King Crab Savings Area (KCSA) in the Eastern Bering Sea year-round for the following reasons.

First, the Council was never told that its own Crab Plan Team advised against on-bottom trawling in the KCSA, especially during the molting and mating season. **Second**, mating, molting and soft-shell red king crab in this area are especially vulnerable to hard-on-bottom trawls as your NMFS trawl specialist showed in his Bristol Bay red king crab/ trawl foot-rope impact video during the September Council meeting. **Third**, Pacific cod and sole fishermen proved in 1995 that they could harvest their entire TAC's outside of this area. **Fourth**, the burden of proof about the importance of the KCSA for red king crab conservation should not fall on crab fishermen, who have already been denied two commercial seasons in a row. **Fifth**, the Alaska Board of Fisheries contends that the Council has not done enough to protect red king crab in this area. **Sixth**, as you remember from your involvement in Bilateral negotiations with Japan and Russia in the 1970's, foreign fleets harvested as much as 4 million metric tons of groundfish a year without going anywhere near these crab grounds.

We appeal to your judgment as a former ADFG biologist and fishery manager. Please extend further protection from on-bottom trawling to the red king crab in the KCSA by March 31, 1996.


Gary Painter, Founding Member


Tom Casey, Executive Director



ALASKA CRAB COALITION

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

October 5, 1995

Mary McDowell,
Special Assistant to the Governor
Office of the Governor of Alaska
P.O. Box 110001
Juneau, Alaska 99811

Dear Mary:

I am writing to draw your attention to a recent NPFMC decision that has modified the emergency rule to protect Bristol Bay red king crab.

The Council's action for a seasonal closure was taken despite strong support from not only the ACC, but Kodiak Vessel Owners Assn., UFMA, NPFA and AMCC for a year-round closure.

The NPFMC Crab Plan Team and ADF&G also supported the year-round closure concept and ADF&G supported adoption of a permanent amendment that essentially mirrored the 1995 emergency rule described in the attached ACC letter.

I am also enclosing a copy of ACC Board member, Gordon Blue's comments on the closure area and a copy of the ACC news bulletin describing the Council action.

ACC is hopeful the Governor's Office will consider supporting a year-round closure in the proposed protection area, in the process of NMFS developing the final rule.

In closing, I wish to commend the staff of ADF&G for their work on development of the NPFMC analysis and for their overall support during deliberations on this important conservation issue. Without ADF&G staff assistance on prohibited species bycatch issues, significant bycatch protection regulations for not only crab, but herring, salmon and halibut would not be in place today.

Sincerely,

Arni Thomson
Executive Director

cc: ADF&G - D. Benton, P. Probasco, R. Morrison, E. Krygier

Pacific Northwest Crab Industry Advisory Committee

20 October, 1995

Garry M. Loucon
Chairman

Larry J. Engel
Chairman
Alaska Board of Fisheries
P.O. Box 25526
Juneau, Alaska 99802-5526

Re: Request For Board of Fisheries To Support Year-Around Closure To Bottom
Trawling In The Bristol Bay King Crab Protection Area

Dear Larry:

The Pacific Northwest Crab Industry Advisory Committee hosted a well attended and rather successful Annual Meeting of the Alaska Department of Fish & Game with the Bering Sea crab industry October 16 and 17 of this week.

During the course of discussions on a wide range of issues, the subject of bycatch of king crab in the trawl fisheries surfaced a number of times. The bycatch discussion focused on the inequity between the conservation measures being practiced by crabbers and the NPFMC permissiveness in regards to trawlers continuing to be allowed king and tanner crab bycatch quotas and to use bottom trawl gear in the Bristol Bay area.

There was also considerable discussion and vehement opposition to the NPFMC recent action to modify the 1995 emergency rule regarding the expanded Bristol Bay king crab protection area, making the bottom trawl closure, merely a seasonal measure from January 1, to March 31st.

After polling the members of the PNCIAC, I wish to state for the record that the PNCIAC reiterates its support for the year-around closure in the Bristol Bay Protection area. The area in question, from 162 to 164 W. and 56 to 57 N. is a historic habitat for mature king crabs, not just during the winter season, but on a year-around basis.

At this time, the PNCIAC respectfully requests the Board of Fisheries to comment to the NMFS to change the final rule to a year-around closure.

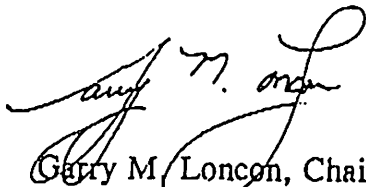
In closing, I wish to point out to the Board of Fisheries, that the House version of the MFCMA amendments was approved by a vote on the floor of the House yesterday. HR 39 has just been amended to include significant bycatch and habitat restrictive

Pacific Northwest Crab Industry Advisory Committee

20 October, 1995

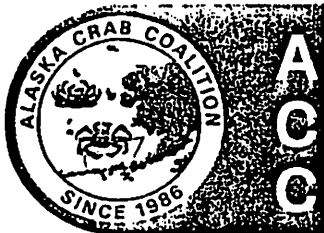
language. Prior to this, the NMFS had already proposed substantive habitat protection language. Thus the NMFS has the opportunity to take timely action in recognition that habitat protection, as it applies to fishing gear, is not just the concern of a few isolated sectors of the fishing industry and some environmentalists, it is now an issue of widespread national significance.

Sincerely,



Garry M. Loncon, Chairman
Pacific Northwest Crab Industry Advisory Committee
c/o Royal Aleutian Seafoods, Inc.
701 Dexter Avenue, Suite #403
Seattle, WA 98109
(206) 283-6605 fax (206) 282-4572

cc: Frank Rue, Com. ADF&G
Mary McDowell, Office of the Governor of Alaska
Steve Pennoyer, RD, NMFS, AKR
Rollie Schmitten, Asst. Admin. NMFS



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

*(REVISED 11/22/95
FOR RESUBMISSION)*

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. Additional 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.

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

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 region as a result of 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 a substantial portion of the king crab quotas. This is supported by ADF&G records of catch reported by statistical areas.
5. Although the trawl fleet and their supporters claim lost revenues as a result of being closed out of high abundance areas, this should only be considered one of a number of annual variations. As the EA/RIR shows (Table 1, page 7) the rock sole value for 1995 is similar to that for 1992 and 1993. The higher value for 1994 is only comparable to one previous year in the analysis, 1991. To conclude that the Emergency Rule protection zone has a direct cause and effect relationship with foregone revenues by making comparisons with one previous year's catch is a very

questionable economic conclusion upon which to even begin to formulate as critical a decision as the one facing the NPFMC on king crab conservation.

The EA/RIR makes no allowance for the net benefits to the nation and the region, if king crab stocks are allowed to rebuild with protection measures from the notoriously destructive impacts of the hard on bottom trawl gear employed in the rock sole fishery. According to ADF&G, average exvessel revenue for 1990-1993 for the Bristol Bay king fishery exceeded \$60 million.

6. 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:

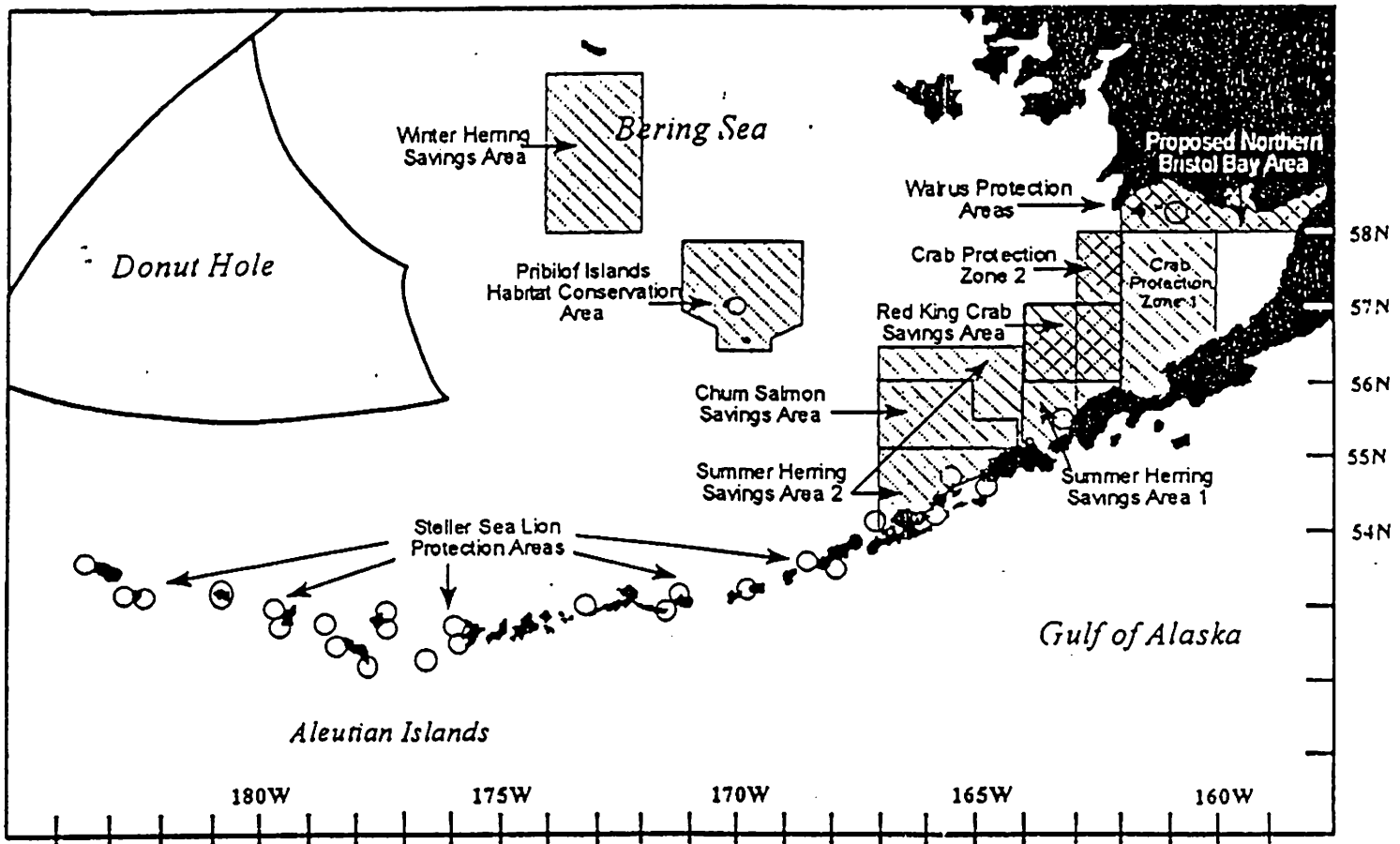
Although some in the industry point to the dismal experience of crab refuges around Kodiak Island as a rationale for abandoning protection areas in the Eastern Bering Sea, this is not the case. King and tanner crabs have experienced some measure of rebuilding in Bristol Bay and around the Pribilof Islands as a result of area closures to both trawl gears and directed crab fishing with pot gear. There was a small rebound of king crab in Bristol Bay prior to the 1994 directed fishing closure. A dynamic rebound of bairdi has also 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, the trawl closure area was likely 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 in the Eastern Bering Sea.

Enclosure: Bristol Bay red king crab protective area, NPFMC

Bering Sea Species Protection Areas



Proposed Northern Bristol Bay Area: closed year-round to all trawling (proposed).

Chum Salmon Savings Area: closed to all trawling August 1-31 with provisional extension to October 5.

Bristol Bay Red King Crab Area: closed ^{1/1 - 3/31} ~~year-round~~ to non-pelagic trawling (proposed). → *year-round*

Pribilof Islands Habitat Conservation Area: closed year-round to all trawling.

Crab Protection Zones: Zone 1 closed to trawling year-round (with exceptions).
Zone 2 closed to trawling March 15 - June 15 (with exceptions).

Walrus Protection Areas: closed to all fishing April 1 - September 30.

Steller Sea Lion Protection Areas: closed to all trawling year-round with some extended seasonally on January 20.

Herring Savings Areas: closed to all trawling when trigger reached.
Summer Area 1 closed June 15 - July 1
Summer Area 2 closed July 1 - August 15.
Winter Area closed September 1 - March 1.

North Pacific Fishery Management Council, March 3, 1995



UNITED FISHERMEN OF ALASKA

October 20, 1995

211 Fourth Street, Suite 112
Juneau, Alaska 99801
907/586-2820
Fax: 907/463-2545

FAX: 907/465-6094

Mr. Larry J. Engel, Chairman
Alaska Board of Fisheries
Post Office Box 25526
Juneau, Alaska 99802-5526

FOR YOUR INFORMATION
From: Arni Thomson

RE: Recent NPFMC Decision to Modify Bristol Bay King Crab Protection Area,
From Year-Round -- to Seasonal -- Closure to All Bottom Trawling


Dear Chairman Engel:

At its recently concluded Fall Board of Directors Meeting in Anchorage, the Alaska Crab Coalition (ACC) and the Bristol Bay Driftnetters Association (BBDA) provided the UFA Board with a copy of an ACC letter explaining the recent Council decision regarding the Bristol Bay trawl closure zone and requesting the State of Alaska to comment to the NMFS during preparation of the final rule.

After reviewing the request of the ACC, the UFA Board adopted a motion in support of the ACC position calling for a year-round closure to bottom trawling in the area 162 W. to 164 W. and 56 N. to 57 degrees N. (see the attached copies of ACC correspondence to the Office of the Governor and to the NPFMC). UFA also requests the Alaska Board of Fisheries to comment to the NMFS in support of improving the proposed rule to close the protection area year-round to bottom trawling. King crab stocks are very depressed and the king crab fishery has been closed for two years as the stock level of mature females is below the minimum threshold for conducting a commercial fishery.

In supporting this action, UFA is aware that the seasonal closure ignores considerations of habitat and that the area in question is a year-round habitat for large aggregations of king crab. Bottom trawl gear impacts sensitive habitat and also results in a substantial, but unquantified unobserved mortality to benthic organisms and king and tanner crabs. The seasonal closure will enable large scale bottom trawling for yellowfin sole in this area and it will be a setback to the protection efforts started under the emergency rule adopted for 1995.

Thank you in advance for your consideration.

Sincerely,

Jerry McCune
UFA President

cc: Frank Rue, Commissioner, ADF&G
Mary McDowell, Office of the Governor of Alaska
Steve Pennoyer, Regional Director, NMFS, AKR
Rollie Schmitt, Assistant Administrator, NMFS

MEMBER ORGANIZATIONS

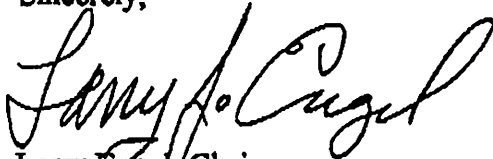
Alaska Crab Coalition • Alaska Longline Fishermen's Association • Alaska Trollers Association • Area K Seiners Association
Bristol Bay Driftnetters Association • Concerned Area "M" Fishermen • Cook Inlet Aquaculture Association
Cordova District Fishermen United • Kani Peninsula Fishermen's Association • Kodiak Regional Aquaculture Association
North Pacific Fisheries Association • Northern Southeast Regional Aquaculture Association • Peninsula Marketing Association
Petersburg Vessel Owners Association • Prince William Sound Aquaculture Corporation • Purse Seine Vessel Owners Association
Seafood Producers Cooperative • Southeast Alaska Seiners Association • Southern Southeast Regional Aquaculture Association • United Cook Inlet Drift Association

The department scientists and managers, the crab industry, and this board believes a comprehensive year round closure of non-pelagic trawling in this area is essential for protecting crab stocks during their sensitive life history periods and migration cycles.

The Board of Fisheries wants to discuss this subject with the council at our joint meeting on January 9, 1996. We understand that the council can not revisit this issue at its December meeting without jeopardizing protective regulations which will be in effect for the 1996 "A" season.

I look forward to your consideration of this issue.

Sincerely,



Larry Engel, Chairman
Alaska Board of Fisheries

cc: David Benton
Earl Krygier
Steve Pennoyer

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.

STATE OF ALASKA

TONY KNOWLES, GOVERNOR

DEPARTMENT OF FISH AND GAME

BOARD OF FISHERIES

P.O. BOX 25526
JUNEAU, ALASKA 99802-5526
PHONE: (907) 465-4110
FAX: (907) 465-6094

November 7, 1995

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

Dear Mr. Lauber:

During our October work session, the Alaska Board of Fisheries (board) received a staff report on the recent North Pacific Fishery Management Council (council) action regarding the non-pelagic trawl gear closure to protect Bristol Bay red king crab. The board is concerned that the alternative selected by the council may have adverse impacts on these already depressed king crab stocks.

According to the Alaska Department of Fish and Game (department), 1995 estimates of pre-recruit male and mature male and female red king crab abundance remains low and has declined from 1994. More importantly, the mature female red king crab population at or below the threshold level of 8.4 million animals for the second consecutive year. Concurrent with the decline in abundance, the distribution of red king crab has geographically contracted. Most of the stock now resides within Area 512 and the non-pelagic trawl closure area. Based on this information, we believe the stock remains in a depressed condition. A closure of the 1994 and 1995 directed king crab fishery and restrictions on *C. bairdi* Tanner crab east of 163 degrees W. longitude was necessary in accordance with Board's Policy on King and Tanner Crab Resource Management and the Council's Fishery Management Plan for Commercial King and Tanner Crab Fisheries in the Bering Sea and Aleutian Islands.

The board is very concerned with the continued protection and rebuilding strategy for Bristol Bay red king crab stocks, and that the less conservative trawl closure option chosen by the council may not afford the necessary protection. In 1994, the council adopted an Emergency Rule which closed red king crab habitat sensitive areas to all non-pelagic trawling. This closure, coupled with a closure of the directed crab fishery, prevented a further decline in the stocks. A less restrictive closure at this time may undo these conservation savings.



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%

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

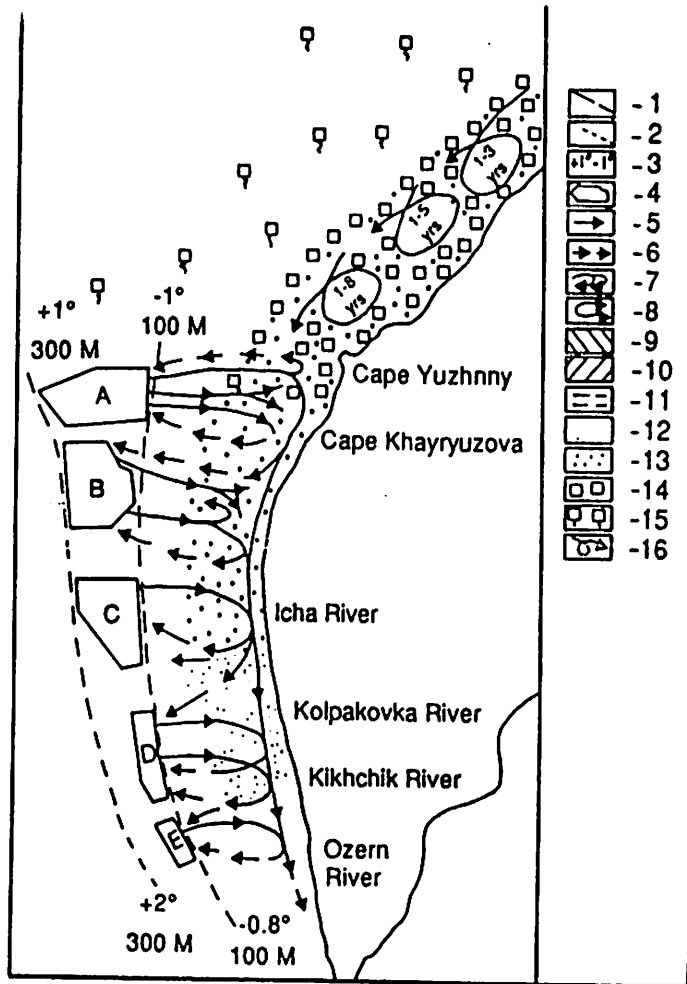
Year	Catch (millions of ind.)			Year	Catch (millions of ind.)		
	USSR	Japan	Total		USSR	Japan	Total
1924	-	4.8	4.8	1954	15.5	0.5	16.0
1925	-	10.0	10.0	1955	18.5	5.0	23.5
1926	-	19.0	19.0	1956	19.3	9.5	28.8
1927	-	29.4	29.4	1957	19.3	10.2	29.5
1928	<1	29.6	29.6	1958	16.5	10.0	26.5
1929	<1	32.4	32.4	1959	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						
1971		15.5	25.0	14.2	21.3	1.50
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".

Чекинова В.И. [Чекинова В.И.], 1974. Численность камчатского краба. Труды ВНИРО, т.49, с.38-45.

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



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.)

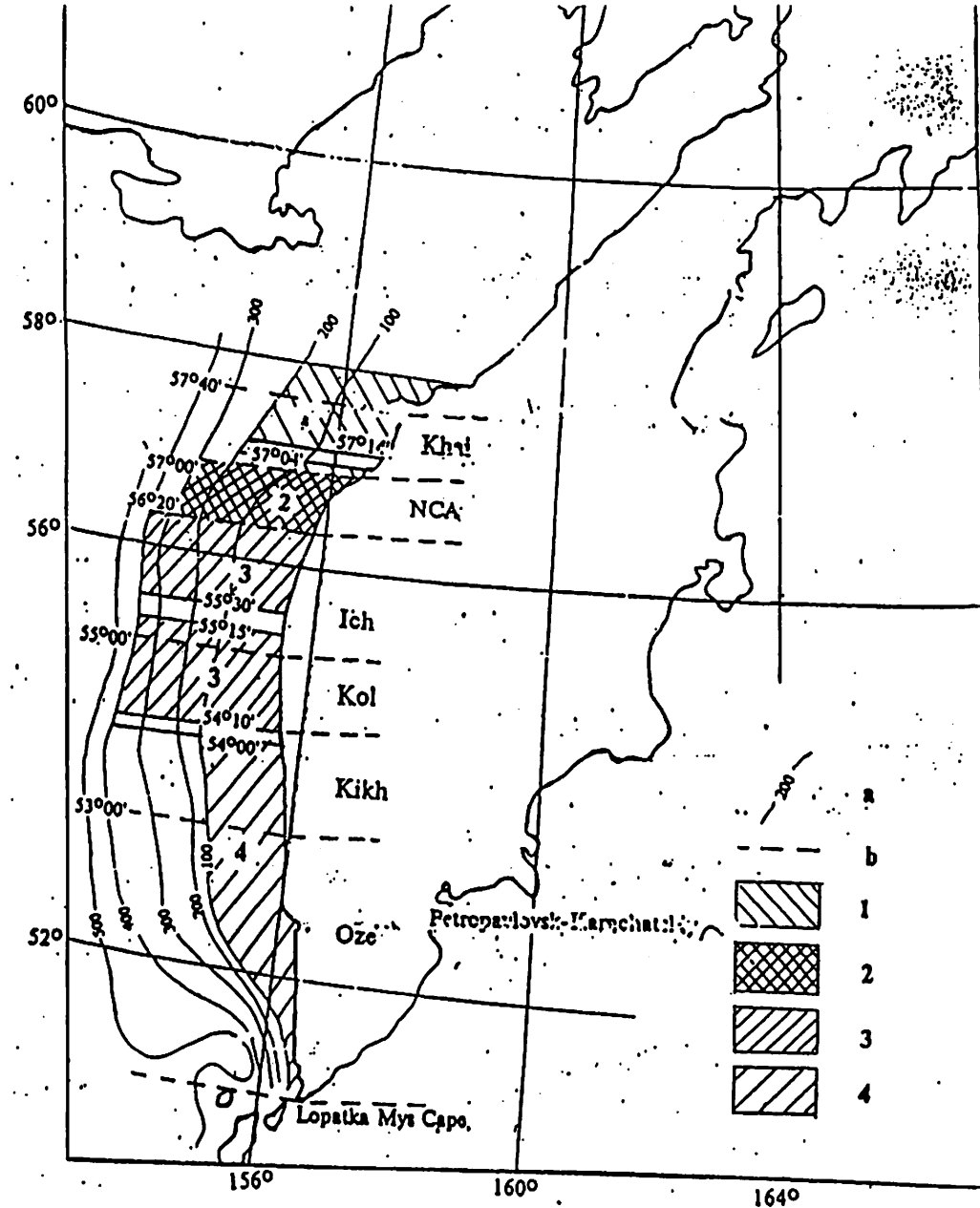


Fig. Fishery restrictions in the areas of the red king crab harvesting off West Kamchatka (as for May, 1995).

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.

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 Kikhchinskiy 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.



HALIBUT • SABLEFISH • PACIFIC COD • CRAB

September 23, 1995

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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)
<u>STOCKS/NURSERIES</u>	1975	51,326.2
PROTECTED	1976	63,919.7
	1977	69,967.8
	1978	87,618.3
	1979	107,828.0
	1980	129,948.5
<u>TRAWL CLOSURE</u>	1981	33,591.4
LIFTED	1982	3,001.2
	1983	CLOSED
	1984	4,182.4
	1985	4,174.9
<u>AMENDMENT 10</u>	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

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.

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 caught.[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].

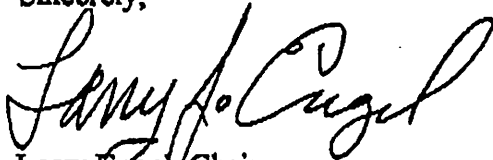
To conclude... regulation measures take account of scientific recommendations and are directed at the protection of female crabs (Article 15.2) and sublegal males (Article 15) as well as molting crabs (Article 13.2) and reproduction areas against any fisheries activities. At the same time they tend to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

The department scientists and managers, the crab industry, and this board believes a comprehensive year round closure of non-pelagic trawling in this area is essential for protecting crab stocks during their sensitive life history periods and migration cycles.

The Board of Fisheries wants to discuss this subject with the council at our joint meeting on January 9, 1996. We understand that the council can not revisit this issue at its December meeting without jeopardizing protective regulations which will be in effect for the 1996 "A" season.

I look forward to your consideration of this issue.

Sincerely,



Larry Engel, Chairman
Alaska Board of Fisheries

cc: David Benton
Earl Krygier
Steve Pennoyer

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.

December 26, 1995

North Pacific Fisheries Management Council
State of Alaska Board of Fish

Dear Council Members & Board of Fish,

We the undersigned are crab fisherman located in Dutch Harbor, getting ready for the 1996 Opilio Crab season. Due to the timing of the meetings in anchorage we are not able to attend in person. That does not mean we are not interested or concerned about what is being discussed at those meeting such as the following issues:

Conservation of the "King Crab Saving Area" between 162W-164W & 56N-57N. This is an area that has been closed to the crab fleet the last two years, yet in September the council voted to allow bottom trawling in the area.

We can not understand the rational for allowing trawlers, who do the most damage to habitat, to fish in an area closed to crab gear. Pot fishing is already the cleanest form of fishing. We fisherman have changed our gear to eliminate by-catch "3 tunnells", ghost fishing, "biodegradable twine", and pot limits to reduce gear loss and help management better utilize the resource.

Even if the trawl fleet is not allowed to fish in this area, they will still be able to harvest all of their two million metric ton groundfish quota as they have done every year. We are very concerned about our resource and feel that at least this portion of the Bering Sea, if not a larger portion, needs to be set aside exclusively for fixed gear. By doing so the crabbers may be able to go back to work sooner.

A second matter that is a big concern to the crab fleet is the crab "by-catch" limits for the trawl fleet. The way it stands now the trawlers "by-catch" of King and Bairdi crab is larger than the allowable catch of the entire crab fleet. We as crab fisherman feel that the trawlers crab "by-catch" allotment needs to be addressed as soon as possible.

Also at this time there is no trawl by-catch limit for Opilio crab. The crab fleet keeps seeing our Opilio quotas getting smaller. Yet the trawlers can kill as many animals as they want. If you are concerned enough about the Opilio stocks to lower our quota we feel you need to implement a trawl "by-catch" quota immediately.

The last issue of great importance to the crab fleet is the cod allocation for 1997, '98, '99. Due to the dependency of the crab fleet on cod fishing, we feel the fixed gear allocation should be raised proportionately.

Sincerely, The Undersigned Crab Fisherman

NAME	VESSEL	ADDRESS
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John Peterson	Mystery Bay	5.1519 Polina, Cordova AK
John Peterson	Mystery Bay	5th Cordova AK
John Peterson	Mystery Bay	100 Calhoun RD Aberdeen WA
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John Peterson	Auriga	831 E. Allen Ave. Seward AK 99944
John Peterson	Auriga	3079 118 Ave SE Bellevue WA
John Peterson	ICY BAY	10915 59th AVE W. MUKILTEO WA 981
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John Peterson	JENNIFER A	4217 East 12th A
John Peterson	JENNIFER A	Dodge City AK 99501
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John Peterson	FLY ALASKA ROVER	8725 222nd SW Edmonds WA 98026
John Peterson	FLY ALASKA ROVER	1533 Sun Set Dr. Tualuma WA 98456
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John Peterson	FLY Constellation	23571 28 Ave W Brier WA 98036
John Peterson	FLY constellation	12105 NE 151st Street Kirk. WA 980
John Peterson	FLY constellation	5921 11th Av NW. Seattle WA 98107
John Peterson	CONSTELLATION	P.O. BOX 935 PORT ANGELES WA 98362
John Peterson	Constellation	Box 9210 Kirkwall Cir Anch 99515

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Sincerely,

The Undersigned Crab Fisherman

NAME	VESSEL	ADDRESS
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Robert Shields	Renegade	GENERAL DELIVERY KODIAK AK
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Jim Hansen	Big Blue	Box 77303 E.S. AK 99615
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John	Kodiak	Box 2024 Kodiak 99615
TIM CHOUTAER	PS. Kodiak	211 3415 Kodiak 99615
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Mike Johnson	KODIAK QUEEN	152 2ND AVE BEST AK 99701
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James Clancy	Provider	20 Parkwood Ct Bldg C 86405 203 4880
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Sincerely,

The Undersigned Crab Fisherman

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Billy Gites	F/V Icy Bay	23106 61st Ave W. Mt Lk Terrace, WA. 98103
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Dennis Black	Saga	11336 Elizabeth St Anch AK 99516
JOHN OHMANN	Saga	Box 878126 Wasilla AK 99687
Ryan Fletcher	SAGA	Box 621 Kodiak AK 99615
Ramin Cortez	SAGA	501 W 89th AVE 99115
Steve Herlingway	SAGA	GENERAL NETWORK Kodiak AK 99615
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Unidentified	Kodiak Queen	618 N. A. Street Grangerville ID 83530

ID 83530

The last issue of great importance to the crab fleet is the cod allocation for 1997, '98, '99. Due to the dependency of the crab fleet on cod fishing, we feel the fixed gear allocation should be raised proportionately.

Sincerely, The Undersigned Crab Fisherman

NAME	VESSEL	ADDRESS
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Wm. J.	Rogue	1718 Selief Kodiak
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Joel Brown	Lady Kodiak	P.O. Box 3602
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Joe Wright
~~Stanley~~
Harold Gibbons
Eric Malloy
M. Williams
R. J. B. Z. L.
Noyce Emery
Tom Russell
John Maguonon
Ernesto Sambuc, Jr.
Erich Berhara
Vito Ponzio
SEAN McLEAN
BRIAN FARROW
DEB MULLER
Walt VanDeroy
Paul Antero

Susiana
Susitas
Susit Mt
JUSTINA
Furcuden
Faman Sea
FOMER SEA
Foster Sea
Lody Jessie
Lady Jessie
LADY JESSIE
Lody Jessie
SEA ERN
SEA ERN
BERING STAR
SEA ERN
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NAME

VESSEL

ADDRESS

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 Dean Harker
 Dennis Harker
 [unclear]
 [unclear]
 Peter Kelly

F/V LADY ALASKA
 F/V MARCO
 F/V [unclear]
 F/V [unclear]
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 Gustafson
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 Seattle

The last issue of great importance to the crab fleet is the cod allocation for 1997, '98, '99. Due to the dependency of the crab fleet on cod fishing, we feel the fixed gear allocation should be raised proportionately.

Sincerely,

The Undersigned Crab Fisherman

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Huck Fehed	Aleutian #1	2731 211th Pl. S.W. Lynnwood Wa.
1433K Coif Co. this	Aleutian #1	14521 52nd Ave W Edmonds WA
Ramon Mon	Aleutian #1	403 W LATHAM Hemet California
Charles G. Finney	Aleutian #1	3037 NW 74 Ave WA
James Ray Johnson	Herkon #1	141 Sifers Ln. Sequim, Wa.
<i>[Signature]</i>	Isafjord	12922 50th Pl NW Muk. 1400 WA
<i>[Signature]</i>	GRAND DUCHESS	434 NW 21st PL NEAPORT OR
<i>[Signature]</i>	North American	15008 NW 200th Seattle WA
But Stephens	Alaska Sea	N 2011 Canon Spokane WA
John C. Wade III	FRANCES M	3720 Beaver Rd Bellingham 98220
Mike Don	PENGUIN	1621 10th 4155 TEMBUKLEAR RD. COVINGTON LA
Shawn Moore	Shellfish	1621 10th AVE NE BOTHELL WA 98011
B. J. Smith	ALASKA SEA	POUCH 515 DUTCH HARBOR AK
<i>[Signature]</i>	CONSTELLATION	1108 NW BALLARD WY SEB WA 980
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Ken Stultz	Pengwin	29724 NE 173rd Duvall Wa. 98019
M. T. Gussow	Sea Setter	12025 NE 51st PL Kirkland Wa. 98033
<i>[Signature]</i>	Isafjord	1000 P.O. Box 1305 Kingston WA 98346
<i>[Signature]</i>	FRANCES M	723 WALKER ST WENATCHEE
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<i>[Signature]</i>	Enla - N	1000 860 14th ST SW EDMONDS WA 9802
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<i>[Signature]</i>	PAC. Setter	750 Woods & Stone Rd Clifton WA 98
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The last issue of great importance to the crab fleet is the cod allocation for 1997, '98, '99. Due to the dependency of the crab fleet on cod fishing, we feel the fixed gear allocation should be raised proportionately.

Sincerely,

The Undersigned Crab Fisherman

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January 10, 1996, Revised Draft

DRAFT DISCUSSION PAPER CONCERNING REDUCTION OF THE MINIMUM SIZE LIMIT FOR BRISTOL BAY AND PRIBILOFS KING CRAB TO BE CONSISTENT WITH SIZE AT MATURITY

Arni Thomson, Executive Director, Alaska Crab Coalition

* BACKGROUND:

The Alaska Department of Fish and Game is in the process of developing a revised harvest strategy for the management of Bering Sea Aleutian Islands king crab fisheries. A paper entitled "Overview of Population Estimation Methods and Robust Long-Term Harvest Strategy for Red King Crabs in Bristol Bay," (Zheng, Murphy, Kruse, ADF&G No. 5J95-21, 9/14/95) has been presented to the industry for public comments. The Board of Fisheries will review the proposed strategy and public comments at the March shelfish meeting in Anchorage. The revised harvest strategy is to be fully implemented in the fall of 1996.

The new harvest strategy recommends adjustment of the minimum threshold level of mature females for opening a commercial fishery and adjustment of the overall mortality estimates. The change in harvest strategy concepts is being proposed to update harvest strategy and bring it in line with new scientific information and to set up a framework for developing a king crab rebuilding program and to assist in stabilizing landings in the face of variable recruitment.

It is within the context of the proposed new harvest strategy and the need to implement active measures that will encourage rebuilding with a minimal amount of economic disruption to the industry that it is suggested the industry and ADF&G consider reducing the size limit on king crab, in incremental stages, to be consistent with size at functional maturity.

Prevailing scientific opinion sets size at functional maturity for Bristol Bay and Pribilof Islands king crab at 5.6 - 5.8 inches. Setting harvest size a little above size at functional maturity allows for mature males to reproduce at least once or twice before being harvested. Basing minimum size limits on this principle assures future recruitment to the stock will not be jeopardized by a reduction in the minimum legal size limit.

A parallel to this is found in ADF&G and NMFS current recommendation to the Board of Fisheries to increase the minimum legal size limit of c. opilio from 3.1 inches to 3.5 inches to incorporate the most recent scientific information about the size at maturity of male opilio and to assure that the minimum size limit provides adequate protection for stock reproduction. In effect, the 4 inch "industry standard size" at harvest presently protects

stock reproduction needs; however, it is a voluntary industry standard.

In the case of red king crab, the 6.5 inch minimum legal size limit is market driven, not based on biological stock reproduction needs, thus reducing it to size at functional maturity, or a little above that, i.e. 6 inches, would provide the necessary buffer for stock reproduction.

In the case of king crab, the market has changed dramatically in recent years. There is an abundance of golden king crab and Russian king crab being harvested at less than 6 inches carapace width that is being marketed successfully in both Japan and the U.S.

* RATIONALE FOR LOWERING SIZE LIMIT TO SIZE AT MATURITY:
The rationale for lowering the minimum harvest size of king crab has a basis in ADF&G and NMFS scientific yield per recruit studies and previous harvest strategy investigations.

Doug Pengilly and Dana Schmidt, ADF&G, Kodiak, provide a lengthy discussion of varying size limits on (Kodiak) king crab in their paper "Alternative Red King Crab Fishery Management Practices: Modelling the Effects of Varying Size Sex Restrictions and Harvest Rates," 1989. This paper became the basis for revising the Board of Fisheries harvest strategy in 1990 and incorporated variable harvest rates for different levels of population abundance. This was a major diversion from the fixed harvest rate strategy that was used for many years and it was intended to assist in stabilizing landings over the long term.

Of significance to this discussion paper, Pengilly explains the interaction between the population estimates for animals above the size at maturity and that portion of the population above the legal size limit, a sub set of those above size at maturity. As the discussion shows, the basis for determining the GHL is size at maturity and the estimate of the number of males above this size.

Notably, Pengilly and Schmidt define the two rates used in developing the GHL, terms that are central to understanding variation in size limits and harvest rates.

** The term "exploitation rate" is used when referring to the percentage of breeding males that are (or could) be harvested.

** The term "harvest rate" is used when referring to the percentage of legal crabs that are to be harvested.

Pengilly and Schmidt also analyze yield per recruit for variable and fixed harvest rates and look at the implications for stability in yearly landings. Within this part

of their analysis, they also looked at variations in size limits and noted that there would be little or no gain in yields from reducing size limits. But in the case of increasing the 7 inch size limit, would reduce yields.

Pengilly and Schmidt also present for the first time a graphical frequency distribution showing the size at which males become important components of breeding pairs under natural conditions. For Kodiak Island king crabs this size was determined to be 130 mm in carapace length. "Overall, the data strongly suggests that the breeding population of males is dominated by legal-sized crabs, including those that have been legal-sized for over a year. The grasping pairs data indicate that breeding males are substantially larger than the minimum size to maturity cited in earlier publications (Powell et al., 1973)...."

Jerry Reeves in his paper, A Biological Assessment of the Minimum Size Limit for Bristol Bay Red King Crab (NOAA/NMFS F/NWC-133, 1988), provides us with an explanation of yield per recruit theory that lends further understanding to the significance of lowering the minimum size limit on red king crab.

The yield to be harvested from a year class of crabs as it passes through the population, which is composed of this and other year classes, is dependent on the biomass of that year class at any given time. Yield occurs when the year class recruits to the fishable part of the population at some particular size limit and exploitation is applied to the fishable stock. As a year class ages, its members diminish in numbers due to mortality but the survivors grow in size. This interaction of growth and mortality results in a peak biomass of the year class at some point intermediate in its lifespan. The maximum yield per recruitment occurs if exploitation can be applied rapidly at the age (or size) of peak biomass. This situation occurs infrequently because of economic constraints or due to the reproductive requirements of the stock. ... However, under yield-per-recruit theory, for any given rate of exploitation there is a minimum size limit that will provide the maximum yield from a year class.

Under the 6.5 inch limit regulation for Bristol Bay, red king crab males become subject to commercial exploitation at approximately 8 or 9 years of age.

Reeves goes on in his paper to evaluate age composition data from 1968 to 1986. Calculated average mortality over age for the period 1970 to 1986 shows an increasing trend

through 1985.

Mortalities occurring in the 1980s are substantially higher than those during the 1970s. Mortality for ages 4-8 was around .4 for the 1970-80 period, and about .7 for the 1981-86 period, exhibiting a 75% increase. Natural mortality for ages greater than 8 years was set at .6 based on estimates in Alverson (1980).

...Biomass peaks at age 6 for the population during the 1970-1980 period, and at an earlier age, for which mortality estimates are unavailable, during the 1980-1986 period. This difference in age of peak biomass reflects the increased mortality in recent years. The practical implication for size limit regulation is that maximum yield per recruit can only be achieved at a lower minimum size limit than that now in effect.

Pengilly and Schmidt disagree with Reeves estimates of mortality and view them as being somewhat lower.

Nonetheless, the essence of the yield per recruit theory within the context of the 6.5 inch minimum size limit for king crab is that the industry is failing to optimize year class strength since males do not recruit into the fishery until they are eight or nine years of age. Under a reduced size limit, they could recruit into the fishery at the age of six and seven.

Overall, long term harvests will increase through reduced exposure to predation, and other natural and fishing mortality sources that will occur during the additional two year span required for growth to 6.5 inches.

Reeves conclusions regarding stock reproductive benefits from reducing size limits for king crab are illustrated in the Pengilly and Schmidt paper in their analysis of breeding pairs.

Albert Tyler and Gordon Kruse in their recent paper, "Conceptual Modeling of Brood Strength of Red King Crab in the Bristol Bay Region of the Bering Sea," recognize the significance of maintaining an abundance of large males in the population to fertilize and protect large females from predation during the soft shell molting period.

A.J. Paul and J.M. Paul in their paper "Breeding Success of Sublegal Size Male Red King Crab *Paralithodes Camtchatica*," recognize the ability of larger males to mate with several females.

**** CONCLUSIONS:**

The potential stock reproductive benefits to be derived from reducing the size limit have not yet been scientifically analysed.

However, it appears that the current 6.5 inch size limit is tending to remove larger males from the stocks and, consequently, increase the proportion of smaller males in mating pairs-while it is the larger males that are the most successful breeders. Thus the industry/market driven 6.5 inch legal size limit could be adversely affecting the ability of the stocks to recover, particularly at very depressed levels of mature male and female abundance.

Reducing the minimum size limit could provide a means for allowing limited commercial harvests while establishing a framework for enhancing the protection of females and in a few short years increasing the overall reproductive ability of the stock. Reducing the minimum size limit i.e. 6.0 inches, would spread the harvest out to younger male year classes (possibly reducing overall yield in the short term because GHJ is based on number of animals, not pounds); reduce removals of the larger breeding males; while reducing handling mortality to females and juveniles through increased CPUE.

Scott Mattulich and Sarah Bibb conducted an economic analysis of reducing the size limit of king crab in "Pricing By Size: Some Implications of Reducing the Size Limit on King Crab" (Washington State University, Dept. of Agricultural Economics, A.E. 91-2, 1991).

Mattulich and Bibb summarized the potential benefits of reducing the size limit, acknowledged by the advocates. These are:

1. Reduced harvest pressure on larger males;
2. Decreased bycatch/handling mortality in the directed fishery by increasing catch per unit effort (CPUE);
3. And enhanced economic performance of fishermen from increased CPUE. A lower size limit means less fishing effort which reduces harvest costs and could balance out a lower market price for lower average size of crabs.

Long term economic performance of fishermen and the industry should also be enhanced as this measure and other strategies are employed that lead to stock rebuilding and recovery.

Recent information obtained from Russian scientists indicates that a 5.9 inch minimum size limit has been employed in the management of the red king crab fisheries off the

West Kamchatka Coast since 1977, without adverse biological impacts to the reproductive ability of the stock. During this period of time, Russians have had a sustained yield of 30 to 60 million pounds per year. (Personal communication, ACC Board member, Gordon Blue and Russian scientists.)

Biological justification for reducing the size limit is somewhat speculative and consultation with Gordon Kruse, Doug Pengilly, Bob Otto, Jerry Reeves, Peggy Murphy, Al Spallinger and Tom Shirley is essential in the process of considering the reduction of the minimum size limit.

This paper also assumes industry discussion of the potential market impacts of reducing the minimum size limit and the need for substantial industry concensus before the size limit can be reduced.

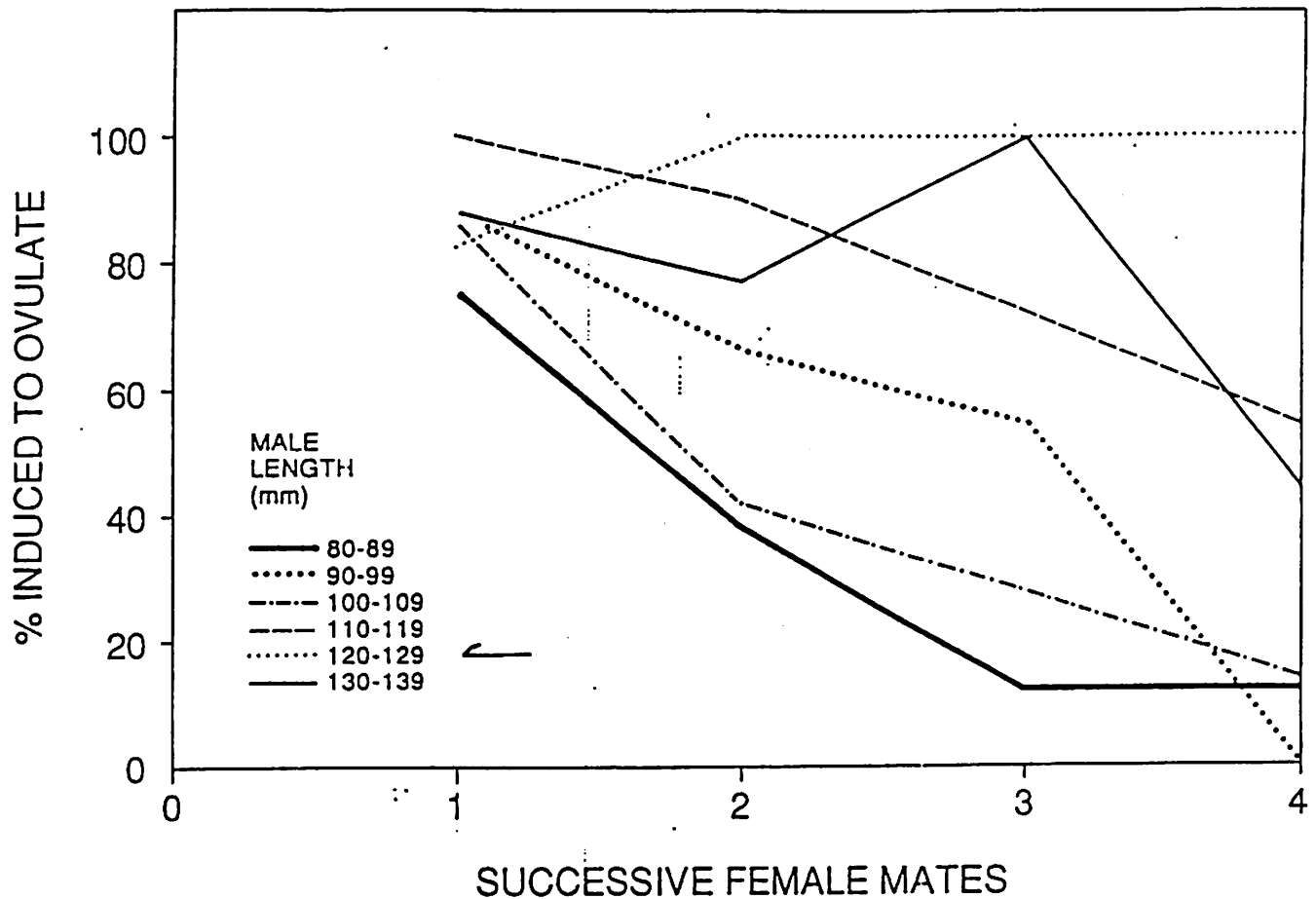


Figure 1. The percentage of successive females induced to ovulate by male *Paralithodes camtschatica* of a given carapace length (mm). Each male had access to four potential mates.

and Nickerson 1965, Gray and Powell 1966, Somerton 1980) while others suggest that smaller males are mature (Powell et al. 1972). Powell et al. (1972) reported that 50% of six 84–89 mm males mated a single female successfully but egg viability was not estimated. In our observations with 80–89 mm males, their first mate extruded normal appearing clutches but only an average of 68% of these eggs initiated division. The majority of males in this size class are not capable of fertilizing a second mate, only an average of 18% of eggs in clutches of their second mates were viable (Table 1).

In nature males in grasping pairs are typically larger than 120 mm (Powell and Nickerson 1965, Powell et al. 1972, 1974). Perhaps larger males exclude smaller ones from breeding (Powell et al. 1972).

Several studies report multiple matings with king crabs. In an early report 11 new shell males, 120–144 mm, bred 51 females held with them in a boats live well for ten days, and they all extruded full clutches (Powell and Nickerson 1965). Males near legal size (140 mm CL) have been reported to mate as many as 13 successive times, but their mating ability decreased after the sixth or seventh mating

(Powell et al. 1972, 1974). None of those reports quantified egg viability and it is possible that the reproductive capacity of those red king crab males was overestimated since females can have clutches that appear normal to the unaided eye but contain only unfertilized eggs (Table 1). Our contrasting results indicate that mating experiments with legal size males should be redone and egg viability monitored to verify the existing observations.

Results of this study indicated that smaller sublegal male king crab can not be counted on to breed more than one or two females without reduced reproductive output. But, several authors (Gray and Powell 1966, Powell et al. 1972, 1974) have noted that male size is not the only factor modifying breeding success. Geographic sex segregation, male molting during the mating season, inability of males to mate for approximately 10 days after molting, and naturally occurring and fishery caused differences in sex ratios have been identified as variables that might affect the reproductive success of king crab. While laboratory studies will continue to provide insight into the reproductive process for king crab, future studies should emphasize intensive *in situ* observations of reproductive success. Perhaps some of

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

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

Чекункова В.И. [Чекункова В.И.], 1974. Численность камчатского краба. Труды ВНИРО, т.49, с.38-45.

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