AGENDA B-7
SEPTEMBER 1985

M E M O R A N D U M

TO: Council, AP, and SSC Members

FROM: Jim H. Branson
Executive Director

DATE: September 18, 1985

SUBJECT: Salmon/Crab bycatch in joint ventures

ACTION REQUIRED

Review bycatch figures and issues.

BACKGROUND

(a) Salmon Bycatch

The Bering Sea pollock joint ventures caught 23,940 chum salmon in 1983 and 60,400 in 1984 incidentally in trawl operations. During the 1985 amendment cycle the Council considered an FMP amendment to limit joint venture salmon bycatch but instead agreed to allow the industry one year to find their own solution. Apparently chum salmon did not enter the fishing area in the manner they had during the past two summers, and trawlers did not encounter them in substantial numbers. Only 4874 chum salmon were taken as of August 31.

The Gulf of Alaska joint venture fisheries have not taken king salmon as they did in 1984. Fishing patterns have changed in 1985, and little if any pollock fishing will take place during the critical period of October-December. Catch to date (August 31) is approximately 4168 king salmon and 97 other salmon. Aug 31 – 9,000

(b) Bycatch in the Yellowfin Sole Fishery

The Council also addressed the issue of joint venture crab and halibut bycatch during the 1985 amendment cycle. The Industry Incidental Catch Workgroup proposal was approved with the intent of reviewing the issue in the 1986 amendment cycle. The proposed and approximate 1985 rates are shown below:

	Halibut	King Crab	Tanner Crab
Proposed	3.0	7.75	5.75
1985	2.3	5.2	3.3

As was stated in the industry proposal, these rates are per metric ton of all groundfish species taken in the yellowfin sole fishery, not just yellowfin sole or flatfish.

Yellowfin sole operations by joint ventures took 911,777 king crab and 598,000 Tanner crab as of August 31. The overall bycatch rates were below the rates proposed by the industry, but the cumulative bycatch of king crab has greatly concerned crab fishermen and joint venture fishermen alike. Because the bycatch issue is so closely tied to the establishment of TAC for yellowfin sole, it will be necessary to address this problem prior to setting 1986 TACs.

Several options to reduce bycatch are available, among which are the following:

1. Reduce directed TACs for yellowfin sole, other flounders, and other species.
2. Close areas to trawling.
3. Establish bycatch ceilings.
4. further reduce bycatch rates.
5. Combinations of above, example: reduce bycatch rate, set overall bycatch ceiling, when reached some portion of area would close to further trawling.

A report on crab concentration areas and yellowfin sole fishing areas will be ready for the December meeting.

(c) Trawl Efficiency Research

Industry representatives have requested that NMFS conduct a study of trawl efficiency and effect of trawls on king crab with the use of submersibles or underwater cameras. Bill Aron has informed us that he has already submitted a proposal to NOAA's Office of Undersea Research to charter of a remote operated MANTA-type vehicle in the spring of 1985. A copy of the proposal is available at the Council office. Item B-7(a) is a copy of Aron's letter to Bert Larkins, which also mentions that the observer program has begun monitoring the viability of king crab taken in groundfish trawls.

In addition we received a letter from Don Rosenberg regarding a recently approved Sea Grant proposal to study methods to reduce incidental catch [Agenda B-7(b)]. Don indicates that the project concentrates on cod and halibut but could also examine other areas of interest. They will also be using a Canadian MANTA vehicle, primarily near Kodiak in the summer of 1986.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Northwest and Alaska Fisheries Center
7600 Sand Point Way N. E.
BIN C15700, Bldg. 4
Seattle, Washington 98115

F/NWC2:RJM

RECEIVED SEP 16 1985

ACTION	ROUTE TO	INITIAL
		B
		J

Mr. H. A. Larkins
General Manager
Marine Resources Company International
192 Nickerson
Suite 307
Seattle, WA 98109

Dear Bert:

I am taking this opportunity to respond to your inquiry addressed to Bob McVey and myself concerning NMFS activity directed at determining the unobservable effects that trawls have on crabs. The Center has made a request to NOAA's Office of Undersea Research to support the charter of a remote operated vehicle (ROV) in the spring of 1985. The focus of this research effort will be on studying the performance, selectivity, and impact of trawls in the eastern Bering Sea. We have proposed that a ROV such as MANTA or OCEAN ROVER and operators be chartered for about 30 days by NOAA. Arrangements for the fishing vessel to deploy the unit, as well as scientific support for the effort will be provided by the Center. Detailed plans for this research will be developed in the Winter. It is our intention to include Industry in this endeavor to ensure valid observation of commercial trawls.

We have sent a copy of your letter to the NOAA Office of Undersea Research in support of the Center's proposal. Should the proposal be rejected, we will need to consider other sources of funding to charter the ROV. (Costs are estimated to be about $100k.)

In addition to this proposed activity, you might be interested in knowing that four observers, each in the July and August observer classes, have been assigned to collect data on the viability of king crab, according to the directions given on the enclosed sheet. Most of these observers were assigned to yellowfin sole joint ventures. The July observers will be returning at the end of September and the August observers, at the end of October. Summaries of the results of these efforts will be prepared as quickly as possible. Selected observers from succeeding classes will also be assigned to this project.

Both Bob and I want to express our appreciation to you for your willingness to cooperate with us in research activities directed at determining the impact of trawls on fishery resources. We will keep you informed as our activity in this area evolves. You can expect to hear from us as we begin development of plans for the undersea research project.

Sincerely,

Bill

William Aron
Center Director

cc. Jim Branson
Robert Alverson
Steve Hughes
Rodger T. Davies
Thorme Smith
Mick Stevens
Clint Atkinson
Sara Hemphill
Peter Block

KING CRAB VIABILITY PROJECT

Observers assigned this project should use the criteria in the table below to record the king crab condition. Just as with halibut condition, the observer should avoid having the sampling procedure affect the condition of the king crab. The viability estimate should be the estimate of the king crab's condition upon release to the sea under ordinary shipboard handling conditions.

Record the king crab viability information on a separate set of Form 4's used specifically for this purpose. On the top of the first sheet, label the set as "King crab viability study". Fill out the form as shown in the example below, dividing the king crab first into species and sex before determining the condition. Record the condition in the "halibut condition" columns. For this study you do not have to bother with the probability of sea lion predation, so leave that column blank.

Definition of King Crab Condition:

1) Excellent: No sign of stress or dismemberment

2) Poor: Alive but showing signs of stress--a few limbs may be missing; minor mouthpart movement may be the only sign of life

3) Dead: No sign of life or, if alive likely to die from major carapace fracture or dismemberments

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King Crab Viability Project John Borden - The Rising Star

Form 4 – SPECIES COMPOSITION OF SALMON, KING CRAB, TANNER CRAB; VIABILITY OF HALIBUT

Page 1 of ___

Cruise No.			Vessel code				Date					
							Year		Mo.		Day	
1	2	3	4	5	6	7	8	9	10	11	12	13
5	3	0	N	S	7	8	8	5	0	9	2	0

1. Record all individuals from form 3(1) or a random subsample.
2. Leading zeros in columns 1,2,10 and 12 only as needed.
3. Sex: male = M; female = F; unknown = U.
4. Probability of predation; none (0 sea lions) = 1; moderate (1-3) = 2; high (≥4) = 3.
5. Skip a line after each haul/set sample.

Keypunchers: right-adjust all columns.

Set	Haul or sample number		Species Name	Species code			Sex	No. of indiv.			Total weight with decimal point	Halibut condition: Number excellent			Halibut condition: Number poor			Halibut condition: Number dead			Probability of sea lion predation
14	15	16		19	20	21	22	23	24	25	26–34	35	36	37	38	39	40	41	42	43	44
1	1	5	Red king crab	1	3		M					1	5		3	0		2	2		
	↓		Red king crab	1	3		F					1	0			3					
1	1	5	Blue king crab		6		F						2			1			1		
1	1	7	Red king crab	1	3		M						2		2	3		3	2		
	↓		Red king crab	1	3		F					1	6			3			1		
			Blue king crab		6		M												2		
1	1	7	Blue king crab		6		F									2					

University of Alaska

Statewide System of Higher Education

ALASKA SEA GRANT COLLEGE PROGRAM

590 University Avenue
Suite 102
Fairbanks, AK 99701

September 16, 1985

Jim H. Branson
Executive Director
North Pacific Fishery Management Council
P. O. Box 103136
Anchorage, AK 99510

Dear Jim:

I read with interest Bob Alverson's letter of August 29 regarding gear research to reduce incidental catch. I am enclosing a copy of Sea Grant project proposal R/30-E entitled, "Trawl Rigging for Incidental Catch Minimization (TRIM)." This project has just been approved by the National Sea Grant College Program and should be underway by January 1, 1986.

This particular project concentrates on separating the cod and halibut resources, but could be expanded to examine other areas of interest. The University of Alaska will be leasing the MANTA system from a Canadian firm and our lease could be extended.

Would you please see that this approved proposal gets appropriate distribution to the Council family.

Sincerely,

Don R 16-

Donald H. Rosenberg
Director

DHR:lbd
Enclosure
cc: Bob McVey w/enc.
Bill Aron w/enc.
Bob Alverson w/enc.
Bert Larkins w/enc.
Jong Lee wo/enc.
Chris Bublitz wo/enc.

NEW PROJECT

Program:	RENEWABLE MARINE RESOURCES RESEARCH
Project:	R/30-E
Title:	Trawl Rigging For Incidental Catch Minimization (TRIM)
Principal Investigators:	Christopher G. Bublitz Fishery Industrial Technology Center University of Alaska, CCREE
	Robert M. Fagen School of Fisheries and Science University of Alaska, Juneau
	Duncan Amos Marine Advisory Service University of Rhode Island, Narragansett
Funding Information:	
Date Initiated:	1 January 1986
Estimated Completion Date:	31 December 1987

Level:	Present	1986	1987
Sea Grant:	$ 0	$80,400	$109,500
Institutional:	$ 0	$ 0	$ 0

BACKGROUND AND NEED

The impact of incidental catch by the expanding domestic groundfish fishery is generating considerable concern among fisheries groups. Longliners, gillnetters, pot fishermen and trollers are questioning the economic impact of trawl fisheries on their sector of the industry. The 1982 estimate of the ex vessel loss to Alaska's fishing industry through incidental catch of king and tanner crab, salmon and halibut exceeded $20 million (Natural Resource Consultants 1984).

Controversy over the use of trawls in commercial fisheries is nothing new. Their use has generated concern and conflicts since their introduction to Europe in the thirteenth century. The objections then and now are basically the same, centering on the indiscriminate nature of trawl fisheries, from taking undersized and prohibited fish to destructive effects on the environment. New observation and recording technology and data analysis techniques can now be applied to these problems and are the basis for this project.

Large-scale foreign trawl fisheries developed in the Bering Sea and Gulf of Alaska during the late 1950s and early 1960s. These fisheries were largely unregulated during their development and became the subject of considerable controversy during the 60s and 70s. This time period saw Alaska's fishing industry unite in efforts to promote legislation minimizing the effects of foreign trawling on domestic fisheries. Halibut, crab and salmon fishermen

saw trawling as a major source of mortalities on species of interest to them. Among the industry's concerns were the effects on mortality of legal and sub-legal sized animals, effects on spawning stocks, targeting on traditional species and socioeconomic issues.

These lobbying efforts produced agreements with the Soviets and Japanese closing certain areas to foreign trawling. The initial area closures were designed mainly to prevent gear conflicts and minimize the capture of juvenile halibut. Following the implementation of the Magnuson Fishery Conservation and Management Act (MFCMA) limits were also placed on the quantities of major trawl species available to foreign fisheries. These limits were imposed to protect the developing domestic trawl fishery and minimize the incidental catches of traditional U.S. fishery species.

As long as large-scale trawling was done by foreign fleets, any conflicts with domestic interests tended to be resolved in favor of the domestic fishery. The development of a domestic bottomfish industry off Alaska has complicated the problem and intensified the incidental catch controversy. The resultant conflicts between user groups represent one of the most explosive and complex challenges facing management agencies. With the continuing growth of the domestic bottomfish industry, conflicts among the various user groups will continue to intensify.

Scientific organizations have also identified incidental catch of prohibited species as a major problem. The International Pacific Halibut Commission has expressed concern about the impact of trawl fisheries on the halibut resource. They have identified fisheries that target on cod, flounder and sole as causing the most concern. The North Pacific Fishery Management Council's (NPFMC) Gulf of Alaska Prohibited Species Working Group has recommended that management measures be implemented for the expressed purpose of reducing incidental catch. The NPFMC has stated in its Comprehensive Fisheries Management Goals that management practices should "minimize the catch, mortality, and waste of non-target species, and reduce the adverse impacts of one fishery on another." The NPFMC further states that the intent of this goal, is in part, "to encourage the development of gear and techniques that reduce the catch on non-target species" (North Pacific Fishery Management Council, Council Policies and Procedures, tab 11, section (i), page 8).

The estimated incidental catch of commercially important species taken in foreign and joint venture fisheries is given in Table 1. With the exception of halibut, a general reduction in incidental catch of prohibited species can be seen since the implementation of the MFCMA. Since 1980, the incidental catch of halibut has been in excess of 1 million fish, and the catch of tanner crab is currently in excess of 3 million crab. The estimated ex vessel value loss to Alaska's fishing industry from the incidental trawl catch of prohibited species in 1983 is in excess of $14 million (Table 2). Similar values for 1982 are also given. The method used in this evaluation is that of Marasco and Terry (1981). The estimates are based on 1983 catch and value data, the latest year for which complete data were available. Low values were calculated using the lowest documented handling mortality rate and a 10 percent discount factor. High values were calculated using the highest documented handling mortality rate, in conjunction with a 5 percent discount factor.

Handling mortality rates of 50 percent and 100 percent were used for halibut in these calculations. Based on tag recovery data, Hoag (1975) concluded that 50 percent represented the survival rate for all sizes of halibut taken in domestic trawl fisheries. The estimated handling mortality rate in large

Table 1. Estimated incidental catch of prohibited species (in 1000s) by foreign and joint venture fisheries in the Bering Sea and Gulf of Alaska (Data from National Marine Fisheries Service).

	Year							
Species	1977	1978	1979	1980	1981	1982	1983	1984*
Salmon	53	90	129	158	74	30	56	146
Halibut	757	893	838	1,695	1,509	1,400	1,577	1,292
Tanner crab	17,600	17,323	18,017	11,485	6,396	2,463	3,133	3,005
King crab	599	1,371	1,032	1,160	1,823	577	1,040	671

* Preliminary data

Table 2. Summary of estimated ex vessel losses from incidental catch of prohibited species 1982 and 1983. Data for 1982 from Natural Resource Consultants (1984).

	Year			
	1982		1983	
Species	High	Low	High	Low
Salmon	$537,000	$497,000	$546,000	$515,000
Halibut	10,379,000	4,222,000	10,274,000	4,083,000
Tanner crab	2,101,000	1,376,000	3,115,000	1,937,000
King crab	8,726,000	5,446,000	12,825,000	7,976,000
TOTAL	$21,743,000	$11,541,000	$26,760,000	$14,511,000

foreign trawl operations is considered to be 100 percent (Terry and Hoag 1983, and Natural Resource Consultants 1984). A natural mortality of 27 percent was used in these calculations (D.A. McCaughran, International Pacific Halibut Commission, personal communication).

The same procedures were used to determine the losses to the domestic crab fisheries from incidental trawl catches. Handling mortality rates of 75 percent and 100 percent were used by Anderson (1983) and Natural Resource Consultants (1984) in their evaluation of the economic loss to the domestic crab industry. An annual natural mortality rate of 10 percent was used for king crab and 18 percent for tanner crab (Natural Resource Consultants 1984).

Estimating the value of incidentally caught salmon is complicated by the presence of several species of salmon taken by trawls. The 1983 foreign trawl fishery from the Gulf of Alaska had an incidental salmon catch consisting of 61.8 percent king and 37.1 percent chum. In the joint venture fishery, king salmon accounted for 84.6 percent of the salmon caught with chum salmon making up 14 percent. The species composition of the incidental salmon catch from the Bering Sea foreign trawl fishery was 54 percent king and 45.1 percent chum with the other species together comprising less than 1 percent. The joint venture fishery took 97.7 percent chum and 2.1 percent king. Handling mortality rates are considered to be 100 percent (Queirolo and Didier 1983, and Natural Resource Consultants 1984).

The first underwater observations of fishing gear were undertaken in 1951 by the Fisheries Laboratory, Lowestoft, England. The observations were filmed by a stationary diver while a net was towed past him. In 1952 the Marine Laboratory at Aberdeen, Scotland recorded the first fish reactions to a net while studying the Danish seine in the Moray Firth (Wardle 1984). These initial observations began to change the attitudes of both fishermen and scientists about actions of fishing gear and how fish are captured.

Since this beginning a wide variety of methods have been used to determine fish behavior and the towing characteristics of nets. Scuba diving techniques (Dickson 1961) and time lapse photography (Beamish 1967, Parrish et al. 1967 and Hemmings 1973) gave an indication that different species exhibited different behavior patterns during the capture process. A quantitative approach to evaluate the behavioral patterns was not developed until 1976 when a towed underwater vehicle (TUV) carrying a television camera was used to observe a commercial trawl under actual fishing conditions (Main and Sangster 1979).

Several concurrent advances in understanding the biology of fish have also contributed to understanding the capture process. Information has been gathered on the use of red and white muscles during swimming (Bone et al. 1978), exhaustion and endurance characteristics (Beamish 1967 and 1968), the sound of boats and nets related to hearing (Buerkle 1967, Chapman and Hawking 1969, and Chapman 1970) and underwater light and the visual field (Blaxter et al. 1964).

The use of a TUV allows for prolonged observations and the accumulation of data which can be analyzed to determine the catching efficiency of each part of the trawl in relation to species and size group. These data analyses can

be applied as guidelines for trawl rigging and net modifications to limit the incidental catch of unwanted or prohibited species.

This project is the first effort to quantitatively measure the interaction between fish and fishing gear off Alaska.

Although this initial effort will target on the reduction of the incidental catch of a flatfish (halibut) in a roundfish (cod) fishery, it is expected that the data collected will lead to gear or fishing strategy modification which will reduce other prohibited or non-target species (crab, salmon and sablefish) in trawl fisheries.

OBJECTIVES

The objective of this project is to develop and demonstrate cost-effective ways to reduce incidental catch of halibut in commercial cod trawl fishing by adjusting gear geometry and modifying trawl net design.

Specific objectives by grant year are:

1986

1. Determine from existing video data obtained from the DAFS Marine Laboratory in Aberdeen, Scotland the most productive method of determining the condition of fish at the beginning of the capture process, at what stage of exhaustion a fish will enter the trawl net and, finally, what behavioral aspects prompt a fish to proceed down to the cod end and what position it assumes in the net.

2. Gather and analyze a video record of various fish species' behavior as they enter the harvesting area of a commercially rigged ground fish trawl and pass to the mouth of the net and down the net to the cod end.

3. Establish by measuring devices the actual performance parameters of a commercially rigged groundfish trawl (i.e. the trawl door spread, wing end spread, headline height and ground wire attack angle).

1987

1. From analysis of the previously gathered video data; modify, by changing front end geometry, a commercially rigged groundfish trawl to reduce the incidental catch of the specified species.

2. Deploy and fish a commercially rigged groundfish trawl and the modified trawl to determine percentage reduction in incidental and target species catch.

3. Write project report of results and release of edited video material to fishing organizations.

APPROACH

Data Collection

Underwater behavioral observations will be made using the MANTA unmanned towed vehicle available through Sea-I Research Canada Ltd. This vehicle is capable of operating at speeds between 0.5 and 5.0 knots and at depths up to 100 fathoms. The MANTA locks on and tracks the fishing gear using a computer operated system of side scanning and forward avoidance sonar. This system provides complete maneuverability within 3 feet of the bottom and trawl allowing for gear inspection and monitoring fish behavior in all sectors of the gear.

The MANTA is equipped with a low light-level silicon intensified target video camera which will produce clear images at 10^{-5} foot candles; lights are also provided for operation at lower light levels. The camera has a 360° pan and 90° tilt, enabling complete observation ability within the net from a variety of positions. Video images are transmitted to the operating vessel and recorded for future analysis.

Sampling Area

Observations and gear trials will be carried out aboard a commercial fishing vessel in the Marmot Flats area (Kodiak) during the early summer of 1986. A minimum of four tows per day will be made. These tows will be conducted at dawn, mid-day, dusk and mid-night.

Initial observations will be conducted at 3 knots (standard used in trawl operations). Trawl speed will then be varied as a result of the initial on-board analysis and to allow collection of fish behavior data at different speeds.

A second year sampling will be carried out aboard a commercial fishing vessel in the same area during the early summer of 1987. Gear and fishing strategy modification resulting from the detailed analysis of the 1986 videotapes will be tested during this sampling period.

Data Analysis

Videotapes obtained from the MANTA will be analyzed onboard to summarize obvious behavioral patterns. Patterns obtained from these analyses will be used as the basis for initial modifications to gear geometry. These initial modifications will be carried out onboard the vessel and trial runs will then be conducted to determine their success. These trials will also be monitored to determine any changes in fish behavior patterns due to the gear modifications. If significant changes occur, corresponding changes in gear geometry will also be made.

A complete, detailed analysis of the 1986 data will be undertaken in the laboratory. We will analyze:

(a) how fish gather in front of the net;
(b) how fish enter the net and at what level; and
(c) how fish behave in the net.

Main emphasis will be on collection of behavioral data needed to produce recommendations for low-cost modifications to current trawling practices. Other kinds of behavioral data might be required should these initial exercises indicate a necessity for engineering changes to the gear itself.

It is expected that the total amount of useful data collected and recorded for subsequent analysis on videotape may range anywhere from 10 to 100 hours depending on achievement of nominal performance characteristics on station, underwater observation conditions and abundance of halibut at the study site. The analysis procedures will be divided into three stages:

1. Analysis of videotapes from the DAFS Marine Laboratory, Aberdeen, Scotland, to establish procedures and methods.

2. Analysis of the first three hours of ship data: can we summarize the crucial observable parameters of behavior in concise checksheet form or in terms suitable for real-time dictation by an observer? If so, this less fine-grained but less tedious approach may serve as a useful prelude to detailed analyses of videotapes.

3. Analysis of the balance of the ship data: by reviewing the videotapes at slow speed and speeded up as well as in real time, it will be possible to begin to recognize aspects of fish reactions that may escape note by an observer as the events are actually occurring, or that are sufficiently subtle to require repeated viewings before they become evident.

A complete quantitative description of every event occurring in 10 to 100 hours of videotaped observations is beyond the limits of feasible analysis. Instead, we will single out specific questions for detailed study and data exploration, such as:

1. What paths do halibut take after their first encounter with the gear?
2. At what spatial position do halibut enter the net?
3. At what velocity do halibut swim within the net?
4. What spatial position do halibut occupy once within the net?
5. How do the answers to the preceding four questions for target species (cod) contrast with those for halibut?

Past behavioral analyses in fisheries gear research, although of undeniable utility, have at times been less than compelling through lack of quantification and statistical analysis. We propose an approach based on quantitative ethological methods, as outlined in standard professional handbooks (Colgan 1978, Hazlet 1977, and Lehner 1979). We further adopt an approach to data analysis based on effective graphical and tabular presentations of data, on exploratory methods for revealing patterns in data, and on judicious use of hypothesis testing and estimation techniques (Sokal and Rohlf 1981, Tufte 1983, and Tukey 1977). This approach to data analysis and presentation is fully implemented in a system of statistical computer programs known as S (Becker and Chambers 1984 and 1985) currently available on the University of Alaska Computer Network.

Specialized quantitative ethological methods to be used on this project are: focal-animal, ad lib and scan sampling (Altman 1974), repertoire analysis (Fagen 1978), quantification of behavioral probabilities (Hazlet 1977), analysis

of behavioral durations and latencies, Markov chain analysis and similar methods from the theory of stochastic processes (Fagen and Young 1978).

A narrative of expected behavior and variations will serve to specify what is actually to be observed. Here, description of basic reactions forms the basis for subsequent quantification and analysis. Free-swimming fish will be observed as they first encounter gear. Their position, velocity, and orientation relative to the gear will be recorded. Tail beat frequencies, passage over or under parts of the gear, swimming styles such as cruise versus burst swimming, and specific behavioral reactions to peripheral sections of the gear will be detailed. Under especially favorable observation conditions, it may also prove possible to record respiration frequencies by recording brachial, gill cover, or mouth movements. Movements of the whole body and of body parts such as fins and tail will be specified as functions of time and of position relative to gear. Behavior in groups of fish and of groups of fish with respect to other groups and the gear will be recorded for observation sequences involving several individuals simultaneously. The spacing and orientation of fish relative to each other is a relevant parameter.

Entry to the net may occur at any one of several spatial positions. These positions will be measured in linear units relative to reference points on the net. Entry position could later be summarized for brevity in terms of ordinal variables such as upper entrance, mid entrance, or lower entrance. Once in the net the fish may continue to swim steadily, turn, or traverse the interior volume of the net. When entering the net, they may use one or more of several possible swimming styles. They may exhibit additional reactions and even begin to show behavioral signs of exhaustion or disorientation. For example, a fish may begin to swim less rhythmically or may even tumble backwards into the cod end.

It will be of particular interest to record and compare positions within the net preferentially occupied by the target species and by halibut, whether particular species remain low inside the net, or whether fish move horizontally or vertically relative to the net, once they are inside it.

The preceding narrative suggests specific ways of interpreting and predicting fish reactions in moving trawl gear. Following Wardle (1984), we may identify two basic fish reactions. The first is maintenance of a fixed station relative to the herding devices, the net or its parts. The second is a sequence of one or more turns off station, allowing the gear to pass around the fish. Quantifying the swimming performance of the fish in these contexts is critical for predicting their subsequent behavior. The sufficient behavioral parameters for quantifying swimming performance are maximum swimming speed (the greatest possible speed attainable by a fish, if only for a short time) and maximum cruising speed (the maximum speed at which a fish can swim without becoming exhausted). Maximum swimming and cruising speeds of fish obey simple predictive rules as a function of fish size and water temperature. For example (Wardle 1984), a small halibut 0.3m in length in 10°C water would be expected to have a maximum cruising speed of approximately 2 meters per second and a maximum swimming speed of approximately 2.5 meters per second. As gear is typically towed at speeds of 3 meters per second in the North Pacific trawl fisheries, these small halibut may show strong contrasts in behavior, reactions and catchability over the operating range of towing speeds depending on whether the gear is moving slower or faster than their maximum cruising speed or faster than their maximum swimming speed.

Water clarity or turbidity may influence fish reactions to gear (Main and Sangster 1981a). Accordingly, subjective assessment of water transparency will be made on a four-point scale (clear, indistinct, turbid, and obscured by suspended matter). In addition, local inhomogeneities due to transient gear-bottom contact will be noted. Fish that normally swim under or around herding devices may not do so if by so doing they enter a cloud of suspended particles.

Gear and Net Modifications

Modifications to trawl gear will be done on the basis of the behavior analysis. Simple changes to trawl geometry will be attempted as the initial approach to gear modification, followed by (if necessary) more complex changes in trawl net design.

The efficiency of the fish capture process is determined by how the gear lies on or trawls the bottom. Efficiency and performance can be determined by monitoring the front end geometry of the trawl gear. The major indices of front end geometry are angle of attack of the ground wire and headline height. The headline height, door spread and wing end spread will be monitored to within 20 cm using the MANTA side scanning sonar. The ground wire angle of attack will be calculated from these parameters using the formula:

$$\text{Sin angle of attack} = (D-d/2)/L$$

Where: D = distance between doors
d = distance between wing ends
L = ground wire length

The recommended ground wire angle of attack is 10° to 12° for roundfish and 12° to 14° for flatfish. The increased angle of attack for flatfish widens the shepherding or ground contact zone and is based on the reactions of some North Atlantic flounder species established by Main and Sangster (1981b). The growing use of an increased shepherding zone in flatfish fisheries has produced a tendency for other trawl fishermen to overspread their gear. The groundwire on typical Alaskan trawl gear can be from 25 to 50 fathoms in length. An increase in the angle of attack from 10° to 14° will produce a 1.4 increase in the area of ground contact. This tendency may contribute greatly to the capture of prohibited flatfish species such as halibut.

Rigging the gear to fly is an option which can be accomplished without a major change in the net design. This option would produce little ground contact and provide an escape route for flatfish below the footrope. The addition of a third bridle connected to the footrope attachment point in conjunction with an increased length in the dropper chain can be used to provide an escape route between the footrope and the ground gear line. The third bridle is attached so that it pulls the net forward over the roller gear maximizing the escape area.

Major net changes will be done if modifications to the gear's front end geometry do not produce the desired results. Changes in the net's design will include separator panels, leader ropes, escape holes and panels, square mesh cod end and extension, twine color, over-sized mesh panels and fish barriers.

Separator panels have been used successfully to separate shrimp and finfish and experimental work has been carried out which has successfully separated species of finfish (Main and Sangster 1982). The use of full length separator panels, however, changes the structure and fishing characteristics of the net and requires considerable refinement and testing before commercial application. Limited separator panels leading to escape holes have not been tried for the exclusion of one finfish species from the catch. Limited separator panels would be used only in a small portion of the net at critical points which reflect behavioral differences. This type of application would not cause major changes in the structure and fishing characteristics of the net and could be more easily adapted to existing gear.

Leader ropes would be used in applications similar to the limited separator panels. These are a series of ropes or colored twine introduced in the net at critical behavioral points to guide a selected species to an escape hole or panel. Wardle (1984) has found that certain gadoid species will follow regular lines of colored twine up or down in the trawl. The reactions of other fish species to colored twine is not documented.

Square mesh cod ends and extensions have been used successfully in the North Sea's groundfish fishery to reduce the bycatch of immature fish and trash (Robertson 1983). Besides reducing the bycatch of immature fish this webbing has been shown to reduce turbulence and trawl distortion producing a better quality catch from reduced abrasion and fewer discards. The effect of large sized meshes hung on the square in the belly panel and other areas of the trawl is unknown; however, this type of application may assist in the escape of juvenile and unwanted species.

Success was achieved using a fish barrier type of device in the southern states' shrimp fishery. Originally designed for the exclusion of turtles from shrimp nets it was ultimately named the trawl efficiency device because of its ability to remove unwanted species from the net. A similar application using larger mesh webbing fitted in the net in conjunction with an escape hole may serve to eliminate bycatch of flatfish while not gilling wanted species.

BUDGET

This project is not requesting full support from the Alaska Sea Grant College Program. Additional support for the project will be provided by the Fishery Industrial Technology Center with appropriations by the State of Alaska. Due to the complex nature of the fiscal system, these funds are not being used as matching to the federal grant. They therefore are not included in the Sea Grant 90-4 budget format. In order to allow a reviewer to comment on the cost estimates for the total project, the total estimated budgets by year are provided in Tables 3 and 4.

ADVISORY GROUP

An advisory group has been established to provide researchers with input from both industry and state. Members are:

A. Burch, President, Alaska Draggers Association
M. Serwold, Skipper, F/V Royal Baron

TABLE 3

ESTIMATED BUDGET R/30-E
1986

Senior Personnel:		
C.G. Bublitz	6 mo.	$20,883
R.M. Fagen	1 mo.	3,374
Other Personnel:		
TBN Graduate Assistant	6 mo.	$ 8,726
TBN Technician	3 mo.	3,480
Staff Benefits		$ 7,006
Equipment		$ 0
Expendable Supplies and Equipment		$ 5,500
Travel - Domestic		$ 6,600
Publication and Documentation Costs		$ 0
Other Costs:		
Computer		500
Communication		500
Remote vehicle charter (11 days)		38,400
Fishing vessel charter (11 days)		25,500
Freight		4,600
University of Rhode Island sub-contract		5,000
Total Direct Costs		$130,069
Indirect (50% of S&W)		18,231
Total Project Costs		$148,300

TABLE 4

ESTIMATED BUDGET PROJECT R/30-E
1987

Senior Personnel:		
C.G. Bublitz	7 mo.	$24,364
R.M. Fagen	1 mo.	3,374
Other Personnel:		
TBN Graduate Assistant	6 mo.	$ 9,142
TBN Technician	12 mo.	10,005
Staff Benefits		$10,510
Equipment		$ 0
Expendable Supplies and Equipment		$ 6,000
Travel - Domestic		$ 5,900
Publication and Documentation Costs		$ 0
Other Costs:		
Computer		$ 2,000
Drafting and duplicating		1,000
Communications		1,000
Remote vehicle charter (11 days)		38,400
Fishing vessel charter (11 days)		25,500
Freight		5,000
University of Rhode Island sub-contract		7,000
Total Direct Costs		$149,195
Indirect (50% of S&W)		23,443
Total Project Costs		$172,638

S. Patterson, Manager, Nor'Eastern Trawl, Kodiak
J. Blackburn, Ground Biologist, ADF&G, Kodiak

MILESTONES

1986

April/May	Initial data collection and sea gear modification experiment.
June	Complete analysis of DAFS Marine Laboratory, Aberdeen videotapes to establish methods and procedures for detail behavioral analysis.
September	Start analysis of trawl performance and fish behavior in the path of a trawl net.
November	Prepare informational report.

1987

April/May	Final data collection.
September	Complete the analysis of modified trawl on a comparison basis with a conventional trawl.
November	Prepare informational report.
December	Issue final report of results and release an edited videotape of fish behavior entering trawl gear.

EQUIPMENT REQUESTED

None.

INTERACTIONS

This project interacts with gear program and fishing management programs of the National Marine Fisheries Service, the North Pacific Fishery Management Council, the Alaska Department of Fish and Game and the International Pacific Halibut Commission. Contact will be maintained with research programs of the DAFS Marine Laboratory, Aberdeen, Scotland; the Massachusetts Institute of Technology; Nor'Eastern Net Company; the Institute of Fishery Technology Research, Bergen, Norway; and the University of Rhode Island. Direct contact is maintained with the Alaska Draggers Association and with other commercial trawl fisheries.

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AGENDA B-7
SUPPLEMENTAL

MARINE RESOURCES COMPANY INTERNATIONAL

A Washington Partnership

HEAD OFFICE:
192 Nickerson
Suite 307
Seattle, WA 98109
Phone: (206) 285-6424
Telex: 277115 MRC UR

NAKHODKA OFFICE:
Verkhne-Morskaya, 134
Nakhodka 17
Primorski Krai
692900 U.S.S.R.
Telex: 213818 MRK SU

September 13, 1985

ACTION	ROUTE TO	INITIAL
	Exec. Dir.	
	Deputy Dir.	

Mr. Jim Branson
Executive Director
North Pacific Fishery Management Council
P. O. Box 103136
Anchorage, AK 99510

Dear Jim:

To comply with any industry agreement or Council regulation aimed at sharply reducing the incidental king crab catch, we foresee conducting a large portion of our flounder fishery next year outside the traditional fishing area within the pot sanctuary.

To the extent that joint venture fisheries are displaced from the Sanctuary, they will be fishing in areas which have, in our experience, provided lower catch rates and in areas where we will be in direct competition with foreign trawlers targeting on yellowfin sole and other flounders. These species have become very important to many U.S. fishermen (20 million dollars per year to MRCI's fleet of 35 to 40 trawlers alone) and judging from the accelerated harvest this year by all joint venture fisheries they offer a good potential for increased markets to U.S. fishermen.

During the recent past, we estimate that 75 percent of the yellowfin sole and "other flounders" JVP has been taken from the Pot Sanctuary. There are several reasons for this: good trawling bottom; high, sustainable catch rates; relatively good sea conditions; and proximity to ports to avoid storms, resupply, work on gear, and exchange crews.

To the extent that as a crab-savings measure less than 75 percent of the flounder JVP is taken in the Pot Sanctuary -- whether through regulation or voluntary restraint -- a portion of the most efficiently exploitable (by U.S. trawlers) flounder stocks will have, in effect, been removed from production.

As a countermeasure to the loss of efficiency that would result from having less than 75 percent of the JVP come from the Pot Sanctuary, we propose the following for 1986: the initial TALFF (as normally calculated) be reduced by 75 percent of the initial JVP. Then, quarterly during the year, increase TALFF (if there is any) by any amount of JVP estimated to have come from within the Sanctuary during the preceeding quarter. The net result of this proposal would be a full TALFF if the "normal" 75 percent of the JVP comes from the Sanctuary (reflecting the fact that the entire flounder stock was being utilized); and, at the other extreme, a TALFF reduced by an amount equal to 75 percent of JVP if no JVP comes from the Sanctuary (reflecting a de facto removal of a portion of the exploitable stock from utilization). Any such reduction in TALFF might be kept in an unallocated reserve.

We do not support adjusting the TAC downward to accomplish the above because that could result in a TAC lower than DAH even though the EY of the flounder populations in question would not have declined because the underutilized portion of those populations within the Sanctuary would still be a biologically productive part of the whole.

We would be pleased to work with the Council to further develop this proposal or a suitable variant. By copy of this letter, we are passing our suggestions to other joint venture companies for their reaction.

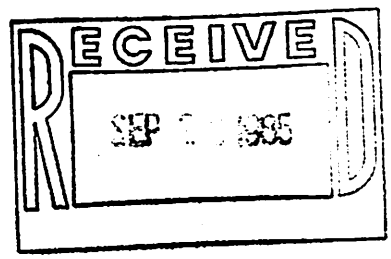
Best regards,

P.E. Chitwood
Director, Operations Dept.

PEC:ko

cc: McVey
NPFVOA
Other j-v companies

AGENDA B-7
SUPPLEMENTAL



KODIAK LONGLINE ASSOCIATION
BOX 3406
KODIAK, AK 99615 486-3638
486-6957

TO THE NORTH PACIFIC FISHERIES MANAGEMENT COUNCIL :

WE ARE SATISIFED WITH THE COURSE OF THE HALIBUT SEASON THIS YEAR. IT WAS GENERALLY QUITE PROFITABLE AND THE OVERALL QUALITY OF PRODUCT LANDED WAS EXCELLENT.

HOWEVER, IT IS TIME THAT THE NPFMC TAKE CONCRETE ACTION REGARDING THE INCIDENTAL CATCH PROBLEM. WHILE THE KING CRAB INCIDENTAL CATCH IS REACHING CRISIS PROPORTIONS, THE COUNCIL MUST NOT LOSE SIGHT OF THE AFFECT THE SAME TRAWL FISHERY HAS ON HALIBUT. WE SUPPORT THE CONCEPT OF A CORE AREA OF CRITICAL CRAB AND HALIBUT HABITAT IN THE OLD POT SANCTUARY; THIS BEING CLOSED TO ALL ON-BOTTOM TRAWLING, WITH A BUFFER ZONE OF LESS CRITICAL AREAS THAT WOULD BE OPEN UNTIL A RATIO OF INCIDENTAL CATCH OR A CEILING TOTAL OF INCIDENTAL CATCH WOULD TRIGGER A CLOSURE. IT IS EVIDENT THAT A SIMPLE RATE OF INCIDENTAL CATCH FORMULA ALONE WILL NOT WORK. TOO MANY DIRTY TOWS ARE BEING DUMPED PRIOR TO COD END TRANSFER THAT PREVENTS ACCURATE OBSERVER DOCUMENTATION.

WE ARE UPSET TO LEARN THAT A NEW ASSESSMENT OF THE GULF POLLOCK STOCKS INDICATES A RESOURCE SO DEPRESSED THAT NO FISHERY MAY BE SUGGESTED FOR 1986. THIS COMES WHILE FOREIGN SHIPS ARE FISHING POLLOCK IN THE GULF. THE COUNCIL MUST CLEARLY SEE ITS RESPONSIBILITY FOR 1986. WE FIRMLY BELIEVE THAT 1986 SHOULD SEE NO FOREIGN FISHING IN THE GULF OF ALASKA. ALSO, WE FEEL THAT WITH THE WEAKNESS OF THE POLLOCK RESOURCE, AND THE NEGLIGIBLE ECONOMIC RETURN TO OUR COASTAL COMMUNITIES COMPARED TO INCIDENTAL CATCH LOSSES OF HALIBUT, TANNER CRAB, KING CRAB, BLACK COD AND KING SALMON, IN THE ON-THE-BOTTOM TRAWL FISHERIES, THAT JOINT VENTURE OPERATIONS SHOULD NOT BE ALLOWED IN THE CENTRAL GULF OF ALASKA IN 1986.

RESPECTFULLY,

Oliver M. Holm

Kathryn Kinnear

OLIVER HOLM, PRESIDENT
KATHRYN KINNEAR

SEPTEMBER 20, 1985

AGENDA ITEM B-.7

North Pacific
Fishing Vessel
Owners' Association

September 24, 1985

TO: North Pacific Fisheries Management Council

FROM: Industry Incidental Catch Working Group

Thorn Smith Thorn

SUBJECT: Progress Report on King Crab Incidental Catch

As of August 31, 1985, 915,707 king crab were estimated to have been caught incidentally by trawlers in the southeastern Bering Sea (Area I; see attachment). The Industry Incidental Catch Working Group established by the Council is providing a forum for the development of a solution to this problem. The work group recognizes that the problem includes crabs which may be injured or killed under bottom trawl gear, as well as those which are actually caught.

A series of meetings has been held to identify means to reduce the incidental catch and associated mortality during the remainder of the 1985 trawl season, and to initiate the development of measures to prevent a recurrence in 1986. Some 300 copies of a report on these meetings have been distributed to the Council family, and to fishermen in Dutch Harbor, Akutan, Kodiak, and Seattle. Further meetings will be held to develop preventive measures to be implemented for 1986 and subsequent years. These meetings have been intentionally delayed until after the crab and trawl seasons, so that all interested parties may participate. Please contact the work group at the NPFVOA address or telephone below if you wish to participate in subcommittee or work group efforts.

The aim of the work group is to gather all available data on incidental crab catches and associated mortality, to examine all relevant measures to reduce that mortality, and to reach an industry-developed consensus regarding an incidental catch and mortality reduction program to be implemented voluntarily or by regulation before the beginning of the 1986 yellowfin sole trawl fishery in the Bering Sea. As a practical matter, such a program will have to be developed before the January meeting of the Council; an earlier resolution will be sought. The work group will document its activities carefully, to provide a record for possible Council action should achievement of an industry consensus prove impossible.

Building C-3, Room 218 Fishermen's Terminal Seattle, Washington 98119 Telephone 206-285-3383

The following issues are being addressed by the work group:

1. CRAB INCIDENTAL CATCH REDUCTION IN 1985. Joint venture managers and operators redoubled efforts to reduce king crab incidental catches during the balance of the 1985 trawl season, reducing effort in critical areas, employing improved gear and operational techniques, and imposing incidental catch limits on their trawl vessels. Incidental catch rates in Area I were reduced by half from July to August (see attachment).

2. TIME/AREA CLOSURES. Members of the staff at the Northwest and Alaska Fisheries Center (NWAFC) are reviewing and updating a study on the establishment of optimum closed fishing areas to reduce the trawl catch of red king crab in the yellowfin sole fishery in the southeastern Bering Sea. With the assistance of the NWAFC and of fishermen, the work group will attempt to identify times and areas which are biologically and economically significant, to be considered for closure. Crabbers have suggested permanent closure of the Bristol Bay "Pot Sanctuary" (see attachment).

3. GEAR AND OPERATIONAL IMPROVEMENTS. A subcommittee will follow up on previous efforts to develop gear and operational techniques to reduce crab incidental harvests. Improved trawl doors are now being tested, and discards are being made at a distance from the trawl tracks in order to reduce incidental catches. Voluntary incidental catch limits have been imposed. Studies on incidental catch reduction and on crab handling techniques to reduce mortality have been distributed. The NWAFC has initiated a program to assess the viability of crabs caught in trawls (see attached letter).

4. INCIDENTAL CATCH CEILINGS. A subcommittee has been established to investigate the establishment of ceilings on crab incidental catches by trawlers in the Bering Sea generally and in the Bristol Bay area specifically (see attached letter). These limits would be implemented in 1986.

5. IDENTIFICATION OF CAUSES OF HIGH INCIDENTAL CATCHES. The substantial differences in crab incidental catch rates experienced by different trawl operations suggests that improvements can be made. Each joint venture management company involved in the yellowfin sole fishery has been asked to request that the National Marine Fisheries Observer Program provide it with confidential information as to its incidental catch experience during 1985 (see attachment). Representatives of these companies will meet to determine when, where, and why high incidental catches occurred, and how to avoid them in future. It is to be emphasized that this will not be a public witch-hunt to embarass groups which experienced difficulty, but rather a co-operative effort to avoid future problems.

6. SUBMARINE RESEARCH. Considerable concern has been expressed regarding injury or mortality inflicted upon crabs which are not caught in trawls, but which may be hit by trawl doors, footropes, and trawls. Many feel that this damage far exceeds that inflicted upon crabs which are actually caught. The NWAFC has requested that the NOAA Office of Undersea Research support the charter of a remotely operated vehicle to study the observable effects of trawls on crabs in the eastern Bering Sea (see attached letter).

The work group feels that the problem is an acute one, which must be resolved promptly. The subcommittees will assemble all relevant data as soon as possible, and will identify alternatives for action to be presented to the full work group.

AGAIN, ALL INTERESTED PARTIES ARE INVITED TO PARTICIPATE IN THESE ACTIVITIES INDIVIDUALLY, OR THROUGH REPRESENTATIVES. IF YOU WISH TO PARTICIPATE, PLEASE CALL (206) 285-3383, OR WRITE TO THE ADDRESS BELOW.

PLEASE NOTE: These figures are through August 31, 1985.

1985 JOINT VENTURE CATCHES IN BSA - 1

	Yellowfin Sole & Flounder	Halibut		King Crab		Tanner Crab	
	Mt.	No.	Mt.	No.	Mt.	No.	Mt.
March	1,080	56,005	77.6	2,120	2.3	41,639	10.1
April	10,674	13,809	29.9	96,197	86.9	33,014	13.7
May	36,148	39,219	96.1	187,143	168.8	69,559	25.8
June	28,970	68,844	158.9	200,646	175.1	122,792	46.0
July	33,035	92,744	258.6	289,878	251.4	158,564	32.5
August	31,395	95,115	241.5	139,723	100.8	145,216	25.9
Cumulative to-date	141,302	384,914	888.8	915,707	785.3	587,655	157.6

N3.27.1

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest and Alaska Fisheries Center
7600 Sand Point Way NE
Bldg. 4, BIN C15700
Seattle, WA 98115

AUG 23 1985

F/NWC2:RN

Mr. Philip E. Chitwood
Director, Operations Department
Marine Resources Company International
192 Nickerson, Suite 307
Seattle, WA 98109

Dear Phil:

Thank you for your August 15, 1985 letter on the subject of information required by the U.S. industry group working on the control of incidental catch in the yellowfin joint venture fishery. We will be happy to provide the information requested. It will take the staff responsible for these data several weeks to compile the information which you listed. Russ Nelson will coordinate provision of the information and will be the primary individual on my staff to contact regarding the data provided.

With respect to the subject of data on the mortality of trawl caught crab and halibut, the observer program has been collecting data on halibut viability since 1980. These data have been periodically evaluated by the Pacific Halibut Commission and have also been summarized by Natural Resources Consultants in their report on the impacts of large-scale trawling efforts in the Bering Sea and Gulf of Alaska. Summaries of the data collected are also available from the observer program. Until recently, there have been no organized efforts by the observer program to collect data on the viability of trawl caught crab. In response to the concerns which have been raised this year, the observer program implemented the collection of data on the viability of king crab this August. This collection program will be continued in the future and expanded to Tanner crab. As these data become available, they will be provided to those working on the incidental catch problem.

We will continue to support the industry efforts to develop and implement guidelines for the control of incidental catches in whatever way we can.

Sincerely,

Bill

William Aron
Center Director

KING CRAB VIABILITY PROJECT

Observers assigned this project should use the criteria in the table below to record the King crab condition. Just as with halibut condition, the observer should avoid having the sampling procedure affect the condition of the King crab. The viability estimate should be the estimate of the King crab's condition upon release to the sea under ordinary shipboard handling conditions.

Record the King crab viability information on a separate set of Form 4's used specifically for this purpose. On the top of the first sheet, label the set as "King crab viability study". Fill out the form as shown in the example below, dividing the King crab first into species and sex before determining the condition. Record the condition in the "halibut condition" columns. For this study you do not have to bother with the probability of sea lion predation, so leave that column blank.

Definition of King Crab Condition:

1) Excellent: No sign of stress or dismemberment

2) Poor: Alive but showing signs of stress--a few limbs may be missing; minor mouthpart movement may be the only sign of life

3) Dead: No sign of life or, if alive likely to die from major carapace fracture or dismemberments

---

King Crab Viability Project John Borden - The Rising Star

Form 4 – SPECIES COMPOSITION OF SALMON, KING CRAB, TANNER CRAB; VIABILITY OF HALIBUT

Page 1 of ___

Cruise No.			Vessel code				Date					
							Year		Mo.		Day	
1	2	3	4	5	6	7	8	9	10	11	12	13
5	3	0	N	S	7	8	8	5	0	9	2	0

1. Record all individuals from form 3(1) or a random subsample.
2. Leading zeros in columns 1,2,10 and 12 only as needed.
3. Sex: male = M; female = F; unknown = U.
4. Probability of predation; none (0 sea lions) = 1; moderate (1-3) = 2; high (≥4) = 3.
5. Skip a line after each haul/set sample.

Keypunchers: right-adjust all columns.

Set	Haul or sample number		Species Name	Species code		Sex	No. of indiv.			Total weight with decimal point	Halibut condition						Probability of sea lion predation
											Number excellent			Number poor		Number dead	
14	15	16		19	20	21	22	23	24	25	26–34	35	36	37	38	39	40	41	42	43	44
1	1	5	Red King crab	1	3		M					1	5		3	0		2	2		
	↓		Red King crab	1	3		F					1	0		3						
1	1	5	Blue King crab		6		F						2		1			1			
1	1	7	Red King crab	1	3		M						2		2	3		3	2		
	↓		Red King crab	1	3		F					1	6		3			1			
	↓		Blue King crab		6		M											2			
1	1	7	Blue King crab		6		F								2						

Bristol Bay "Pot Sanctuary" which is the area enclosed by straight lines from Capt Sarichef light at:
54°36' N. latitude, 164°55'42" W. longitude; to
55°16' N. latitude, 166°10' W. longitude; to
56°20' N. latitude, 163°00' W. longitude; to
57°10' N. latitude, 163°00' W. longitude; to
58°10° N. latitude, 160°00' W. longitude; then due south along 160°00' W. longitude to the Alaska Peninsula.

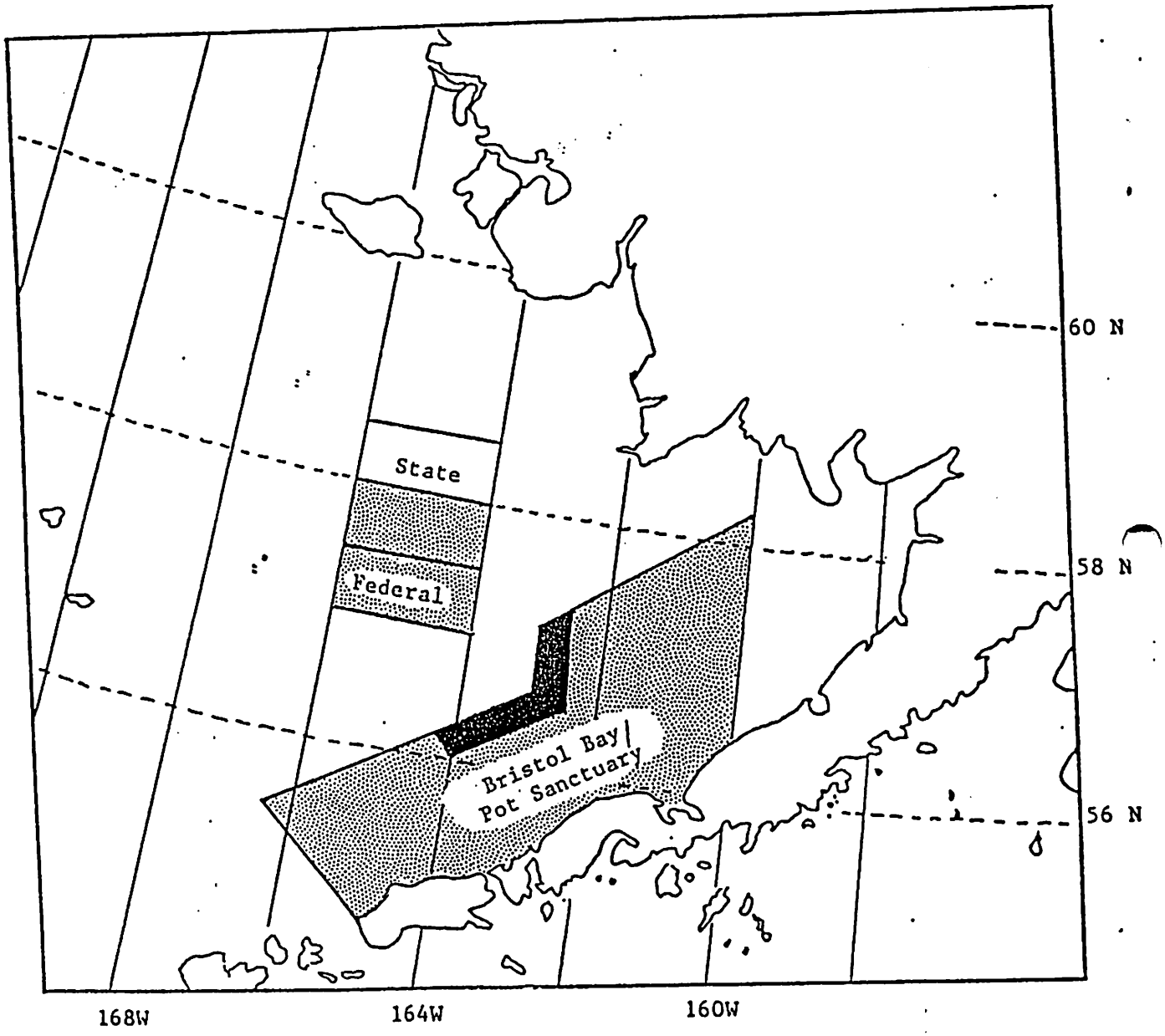


Figure 1. Bristol Bay High Seas King and Tanner Crab Pot Storage Area (State and Federal) and the Proposed Area within the Bristol Bay Pot Sanctuary.

TO: Dr. R. Marasco, Director
Resource Ecology and Fishery Management Division
National Marine Fisheries Service
7600 Sand Point Way N.E.
Building 4, BIN C-15700
Seattle, Washington 98115

Dear Mr. Marasco:

My company's joint fishing operations between U.S. fishermen and foreign flag processing vessels _____ (is, will or may) operate(s) on sole and cod in the Bering Sea this year. We are aware of the problems surrounding the by-catch of crabs and halibut in this fishery and wish to closely monitor the rates on a week-by-week basis, in our operation.

The names and country of the processing vessels we will be working with in this fishery are:

_____ _____

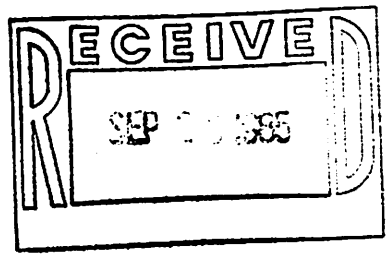
_____ _____

We would like to receive your estimates of king crab, tanner crab and halibut by-catch rates per ton of total catch and also your calculations showing total catch for the week. Receiving this information on a processor-by-processor basis would be most useful.

Thank you for your cooperation.

Kind regards,

AGENDA B-7
SUPPLEMENTAL



KODIAK LONGLINE ASSOCIATION
BOX 3406
KODIAK, AK 99615 486-3638
486-6957

TO THE NORTH PACIFIC FISHERIES MANAGEMENT COUNCIL :

WE ARE SATISIFED WITH THE COURSE OF THE HALIBUT SEASON THIS YEAR. IT WAS GENERALLY QUITE PROFITABLE AND THE OVERALL QUALITY OF PRODUCT LANDED WAS EXCELLENT.

HOWEVER, IT IS TIME THAT THE NPFMC TAKE CONCRETE ACTION REGARDING THE INCIDENTAL CATCH PROBLEM. WHILE THE KING CRAB INCIDENTAL CATCH IS REACHING CRISIS PROPORTIONS, THE COUNCIL MUST NOT LOSE SIGHT OF THE AFFECT THE SAME TRAWL FISHERY HAS ON HALIBUT. WE SUPPORT THE CONCEPT OF A CORE AREA OF CRITICAL CRAB AND HALIBUT HABITAT IN THE OLD POT SANCTUARY; THIS BEING CLOSED TO ALL ON-BOTTOM TRAWLING, WITH A BUFFER ZONE OF LESS CRITICAL AREAS THAT WOULD BE OPEN UNTIL A RATIO OF INCIDENTAL CATCH OR A CEILING TOTAL OF INCIDENTAL CATCH WOULD TRIGGER A CLOSURE. IT IS EVIDENT THAT A SIMPLE RATE OF INCIDENTAL CATCH FORMULA ALONE WILL NOT WORK. TOO MANY DIRTY TOWS ARE BEING DUMPED PRIOR TO COD END TRANSFER THAT PREVENTS ACCURATE OBSERVER DOCUMENTATION.

WE ARE UPSET TO LEARN THAT A NEW ASSESSMENT OF THE GULF POLLOCK STOCKS INDICATES A RESOURCE SO DEPRESSED THAT NO FISHERY MAY BE SUGGESTED FOR 1986. THIS COMES WHILE FOREIGN SHIPS ARE FISHING POLLOCK IN THE GULF. THE COUNCIL MUST CLEARLY SEE ITS RESPONSIBILITY FOR 1986. WE FIRMLY BELIEVE THAT 1986 SHOULD SEE NO FOREIGN FISHING IN THE GULF OF ALASKA. ALSO, WE FEEL THAT WITH THE WEAKNESS OF THE POLLOCK RESOURCE, AND THE NEGLIGIBLE ECONOMIC RETURN TO OUR COASTAL COMMUNITIES COMPARED TO INCIDENTAL CATCH LOSSES OF HALIBUT, TANNER CRAB, KING CRAB, BLACK COD AND KING SALMON, IN THE ON-THE-BOTTOM TRAWL FISHERIES, THAT JOINT VENTURE OPERATIONS SHOULD NOT BE ALLOWED IN THE CENTRAL GULF OF ALASKA IN 1986.

RESPECTFULLY,

OLIVER HOLM, PRESIDENT
KATHRYN KINNEAR

SEPTEMBER 20, 1985

PACIFIC SEAFOOD PROCESSORS ASSOCIATION
4019 - 21st Ave. West, Suite 201
Seattle, WA 98199
(206) 281-1667

September 18, 1985

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

Attention: James O. Campbell, Chairman

The level of incidental catch of king crab, Tanner crab and halibut by bottom trawlers in the 1985 Southeastern Bering Sea (Bristol Bay) yellowfin sole joint venture fishery has risen to an intolerable level. Predictions are that by the end of the calendar year over one million king crab will have been taken in this joint venture fishery, in addition to the Tanner crab and halibut. This quantity is totally unacceptable.

PSPA recommends that the North Pacific Fishery Management Council consider options for reducing this harvest level, such as adopting time/area closures for the 1986 yellowfin sole fishery. Please feel free to call upon PSPA if we can be of assistance while formulating the appropriate FMP amendment to address this growing problem.

Sincerely yours,

Robt F. Morgan

Robt F. Morgan
President

RFM:gg

CC: Council Members
PSPA Members

AGENDA B-7
SUPPLEMENTAL

Midwater Trawlers Cooperative

4055 21st Avenue West Seattle, Washington 98199

ACTION	ROUTE TO	INITIAL
	Exec. Dir.	
	Deputy Dir.	
	Admin. Off.	

September 13, 1985

James Campbell, Chairman
North Pacific Fisheries Management Council
PO Box 103136 Anchorage, Alaska 99510

Dear Mr. Campbell:

MEMBER VESSELS
BLUE FOX
CAPE KIWANDA
COHO
COLINTINO ROSE II
EXCALIBER II
GOLDEN VENTURE
HAZEL LORRAINE
LESLIE LEE
NEW JANET ANN
PAT SAN MARIE
PEGASUS
QUEEN VICTORIA
RAVEN
RONNIE C

The Midwater Trawlers Cooperative (an organization of some 16 trawlers involved in the Bering Sea yellow fin sole fishery) opposes the unilateral emergency closures petitioned by some crab and halibut fisherman in telegrams to the Council.

It is our understanding that the petition calls for a total ban on all trawling. All trawling would include domestic trawlers fishing for shore plants in Alaska, American factory trawlers, American trawlers fishing for joint ventures, etc. Further all trawling would include both bottom and midwater trawling.

The petition currently being circulated by these same crab and halibut fisherman spells this out very clearly. "Petition to restore and reestablish the jurisdiction (sic) of the Pot Sanctuary in the Eastern Bering Sea from Cape Saricheff east of Bristol Bay. It is requested that no trawling be permitted in this area by either foreign or domestic fisherman".

We question the advisability of such a drastic move for a variety of reasons. The Council agreed in late 1982 to appoint an industry work group to evolve and initiate in the concerned fisheries, policies and practices to minimize incidental catches of crab, salmon and halibut. This group has worked hard and has submitted reports and recommendations in the intervening years which has lowered incidental catches and as promised in 1985 to lower incidental catch rates even lower.

The trawl component of the group we feel has borne most of the brunt of this task of lowering incidental catch rates.

Incidental catch rates have come down as follows:

	King Crab No./mt.	Halibut No./mt.	Tanner Crab No./mt.
1983	12.286	4.568	10.611
1984	5.453	1.753	3.853
1985*	3.7	1.5	1.8

The group's work is not finished. The industry work group further promised the council that we would recommend upon the conclusion of the 1985 season both a conservationally meaningful catch rate of incidentally caught species per metric ton catch of target species, and secondly, season "cap" numbers to be put on the yellow fin sole trawl fishery in 1986.

Apparently the Council agreed with the wisdom of this approach by involving a similar industry work group to handle incidental catch problems of salmon in the summer pollock fishery.
The petitions for closure of the Pot Sanctuary to trawling now state that "we did not agree to the so called approval levels or incidental catch rates established by the industry work group. Neither do we recognize this group as representing the best long range interest of the Alaskan fishing industry.....".

This surprises us. We in the industry work group apparently failed to recognize that these individuals did not recognize the industry work group in whose meetings several of them actively participate. Further most of us in the trawling fleet felt that agreement had been reached viz a viz the incidental catch levels of king crab recommended by the group to the Council. (7.5 king crab per metric ton of target species, again the cumulative catch average of the M.R.C. fleet from Feb. 1, 1985 to Aug. 31, 1985 is 3.7 crabs per metric ton of sole, less than half of the level set by the Council).

If one carries the reasoning in the petitions presented to the Council to their logical end, the Council is now being presented with an ultimatum. The ultimatum briefly put is "all trawling", bottom or midwater, regardless of market intent; Alaska shore plants, American factory trawlers,

*M.R.C. fleet average, February 1, 1985-August 31, 1985. So far in 1985 we do not have access to data from other yellow fin sole fleets beyond M.R.C.

American trawlers fishing for J.V., etc. are to cease and we "concerned crabbers or longliners no longer recognize an industry work group sanctioned by the Council. It has come down to an emotional appeal with some highly questionable and some incorrect statements in the language of the petition.

To set the record straight, the yellow fin sole fishery started in 1980 not 1981. The industry work group has always been open to all concerned fisherman: crabbers, longliners and trawlers. The group by deliberate design was left unstructured so all interested parties could attend and participate. We have urged all to come from Alaska, from Washington, from Oregon. Meeting announcements have been issued by mail and telephoned to all possible interested parties including the fixed gear groups. To suggest otherwise is chicanery. It is stated that the catch data and monitoring methods used in incidental catches is scientifically invalid, that damage done by hard on bottom gear in this sensitive area, etc. etc.

In the yellow fin sole fleet we have been and have always welcomed 100% observer coverage by N.M.F.S. Council members will recall this. The data collected is consistent from year to year and as such allows consistent comparisons over entire seasons. This data is every bit as scientific (if not more so) than king crab and halibut trawl survey data which is heavily used as management tools in the Alaskan F.C.Z.

Council members will also recall the constant pleading by our fleet to N.M.F.S. and the Regional Director of N.M.F.S. to institute a warning system so that sole trawlers are notified immediately on a tow by tow basis of their incidental catch. Constant allusion is made by some crab and halibut fisherman to bottom damage. A literature search of fishery papers world wide will yield no supporting evidence for bottom damage occasioned by trawl nets. There is some evidence that concentrated dragging of heavy scallop dredges or Dutch type beam trawls will, in certain circumstances, change bottom topography. But even here scientists hesitate in describing damage to these operations, and in fact some argue that any damage is offset by increased productivity of small crustacea, worms, feed, etc. in areas heavily dragged by these gears.

Rather the inference is made that wide use of tickler chains and heavy hard rollers are destroying crabs. We believe that the framers of the petition are confusing tickler chains, which is discussed in my paper published by Alaska Sea Grant, as a means of reducing crab catch with the heavy chain aprons [redacted]

employed by the Dutch beam trawlers which total thousands of pounds of chain apron weight in the mouth of the beam trawl.

In regard to heavy hard bobbins, it must be remembered that the weight of a footrope in air and in water differ radically. For example, Northeastern Trawl Co. was queried by our Association as to the weights of footropes commonly used by the fleet.

A standard "big boat" footrope constructed of 12 and 14 inch diameter bobbins, 52 chain toggles (which fasten the fishing lines of the trawl to the footrope), 5 1/2 inch diameter rubber disks as spacers all hung on a 1/2 inch diameter footrope chain weighs some 2870 pounds in the air but only 840 pounds in the water. A light footrope used by the smaller boats of 1/2 inch chain with 12 to 14 inch lighter bobbins, 52 toggle chains and 4 inch disks weighs some 2200 pounds in air and only 560 pounds in the water. Further one must remember that such footropes have bottom contact only on the bearing surfaces of the bobbins and not the whole footrope. In essence, a 133 foot long footrope has a bottom contact surface of approximately 9-10 feet.

It has been stated by some crabbers that the trawlers are "destroying 10-20 times the number of crabs recorded by observers as incidental catch with doors, trawls, bobbins and chains." I feel the Council should demand documentation and justification of this claim.

Most gear technicians feel otter trawls capture 40-60% of the bottom organisms in the path of the trawl. I feel this letter or any letter is not the place to argue this point, but rather conservation of all species is extremely important, and we feel conservation is not well served by careless and extravagant claims with little justification and/or proof. Accountability for statements should be put on all of us appearing before the Council.

What is very important is lowering the incidental catch rate of crab. I feel we will have some impressive things to tell the Council at the September and December meetings relative to gear and methods to reduce catches further, self policing tactics which have lowered rates in catches, and we feel we will be in a position to discharge our responsibilities to the Council and to the concerned fisheries by providing meaningful cap numbers for 1986 as well as in season strategies and formulae for 1986 that will keep all of us under these cap numbers.

Unlike the petitioners, we expect that these issues and problems can and will be worked out by all of us in the industry work group from the concerned fisheries.

We feel that the yellow fin sole fishery is a valuable fishery that can exist in harmony with other ocean users. For example if the yellow fin sole joint ventures reach their targets you will see export sales of some $30 million worth of fish in 1985. Further, it should be remembered that the yellow fin sole fishery is an ideal fishery for the smaller trawlers. M.R.C. has adequate documentation that larger trawlers that can do well in the pollock fishery do not do as well economically in this fishery, however it is a very, very profitable fishery for boats from 60-90 feet. It should be remembered that the majority of the Alaskan trawl fleet is of this size configuration, and the expansion of fisheries like yellow fin sole will provide markets for additional trawlers.

Finally, we would respectfully point out to the Council that to grant a closure to this type of petition as opposed to using management tactics and techniques based upon good data to lower the incidental catch rates would constitute a very negative signal to the people who want to invest in the development of the bottom fisheries in Alaska. Unilateral closing of such a huge area would affect not only the yellow fin sole boats but as pointed out above, all other American trawlers. A precedent of such sweeping nature would in our opinion tend to discourage investment in the Alaskan bottom fishery.

We believe the Council should continue to address the problem, to stand by its stated direction to the industry work group, and to allow all of us, crabbers, longliners and trawlers to work out viable solutions and compromises.

Thank you for your interest and understanding.

Sincerely yours,

R Barry Fisher

R. Barry Fisher
President
Midwater Trawl Cooperative

RBF:ssa

**North Pacific
Fishing Vessel
Owners' Association**

September 24, 1985

STATEMENT BY JEFF HENDRICKS, PRESIDENT, NPFVOA

As most of you know, the North Pacific Fishing Vessel Owners' Association was founded many years ago on the Alaska Crab Industry. Throughout those years, the Association membership has shared an earnest belief in the open oceans philosophy, a view that integrates the desire for conservation achieved through sound management and the understanding that the best way to utilize the seafood resources of the North Pacific is to let fishermen decide where to work and what kind of gear to use. The open oceans philosophy does not favor the establishment of special interest fishing zones, exclusion zones, or gear restrictions. When the inevitable conflicts between various segments of the domestic fishing industry arise, the Association view holds that settlements negotiated directly by the parties to the dispute are far preferable to restrictions imposed by governments or agencies that won't have to live and work with the consequences.

Never the less, the Association is slowly recognizing that its open ocean philosophy is now threatening its very existance and the economic future of its members.

This has come to light with the destruction of a significant portion of the king crab resource by the yellowfin sole fishery.

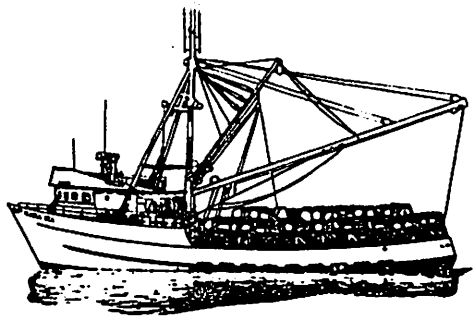
Therefore, the Association has recently established its position that unless a voluntary solution is found to avoid the destruction of king crab in the Yellowfin Sole fishery, the North Pacific Fishing Vessel Owners' Association will support a Bering Sea area closure in 1986 to trawl fisheries targeting on Yellowfin Sole.

Signed: _____
Jeff Hendricks, President
North Pacific Fishing Vessel Owners' Association

Building C-3, Room 218 Fishermen's Terminal Seattle, Washington 98119 Telephone 206-285-3383

Alaska Sea, Inc.

A. O. Nordheim
Secretary-Treasurer



20437 – 16th North West
Seattle, Washington 98177

September 24, 1985

Statement made at North Pacific Fishery Management Council

Economic Impact on Fishing Fleet:

Year	Amt of Crab In Millions*
1972	3.90
1973	5.00
1974	7.60
1975	8.70
1976	10.60
1977	11.70
1978	14.70
1979	16.80
1980	20.80
1981	5.30
1982	0.50
1983	0.00
Total	105.60

*Eastern Bering Sea (Bristol Bay & Pribilof Is.) as per data from NMFS

Annual average: 8.80 x 6 lbs = 52.8 million lbs.

Annual average to fishermen:

If price is $2.00 — $105,600,000
If price is $3.00 — $158,400,000

Economic impact on US Economy if multiplier of 5 is used:

$158,400,000 x 5 = $792,000,000

The above figures do not include tanner crab and halibut.

Please consider the importance of a healthy crab fishery by properly managing this resource.

Respectfully,

A.O. Nordheim

Table 2.--Annual abundance estimates (millions of crabs) for *P. camtschatica* in the Pribilof and Bristol Bay Districts from NMFS surveys.

Size[1]	Males					Females			Grand Total
	<110	110-134	>134	120-134	Total	<90	>89	Total	
1969	41.0	20.3	9.8	9.6	71.1	18.3	28.5	46.8	117.9
1970	9.5	8.4	5.3	5.2	23.2	4.9	13.0	17.9	41.1
1972[2]	14.1	8.0	5.4	4.7	27.5	7.0	12.1	19.1	46.6
1973	50.0	25.9	10.8	14.2	86.7	24.8	76.8	101.6	188.3
1974	59.0	31.2	20.9	20.0	111.1	37.7	72.0	109.7	220.8
1975	84.9	31.7	21.0	18.6	137.6	70.8	58.9	129.7	267.3
1976	70.2	49.3	32.7	30.7	152.2	35.9	71.8	107.7	259.9
1977	80.2	63.9	37.6	35.3	181.7	33.5	150.1	183.6	365.3
1978	62.9	47.9	46.6	30.9	157.4	38.2	128.4	166.6	324.0
1979	48.1	37.2	43.9	27.4	129.2	45.1	110.9	156.0	285.2
1980	56.8	23.9	36.1	15.3	116.8	44.8	67.6	112.5	229.3
1981	56.6	18.4	11.3	8.9	86.3	36.3	67.3	103.6	189.9
1982	107.2	17.4	4.7	8.5	129.3	77.2	54.8	132.0	261.3
1983[3]	43.3	10.4	1.5	4.9	55.2	24.3	9.7	34.0	89.2
1984	81.8	12.6	3.1	5.6	97.6	57.6	17.6	75.1	172.7
1985	14	10	2.5			7	6.8		40.0
Limits[4]									
Lower	36.7	10.7	2.0	4.4	52.3	17.3	12.1	34.5	111.9
Upper	127.1	14.5	4.2	6.7	142.8	97.8	23.1	115.8	233.5
±%	55	15	36	21	46	70	31	54	35

[1] Carapace length (mm).
[2] Limited survey in 1971, not used for population estimate.
[3] 1983 and 1984 data include small numbers of crab from the Northern District.
[4] Mean ±2 standard errors for 1984.

Trough

King Crab Cycle: 12 years

Trough

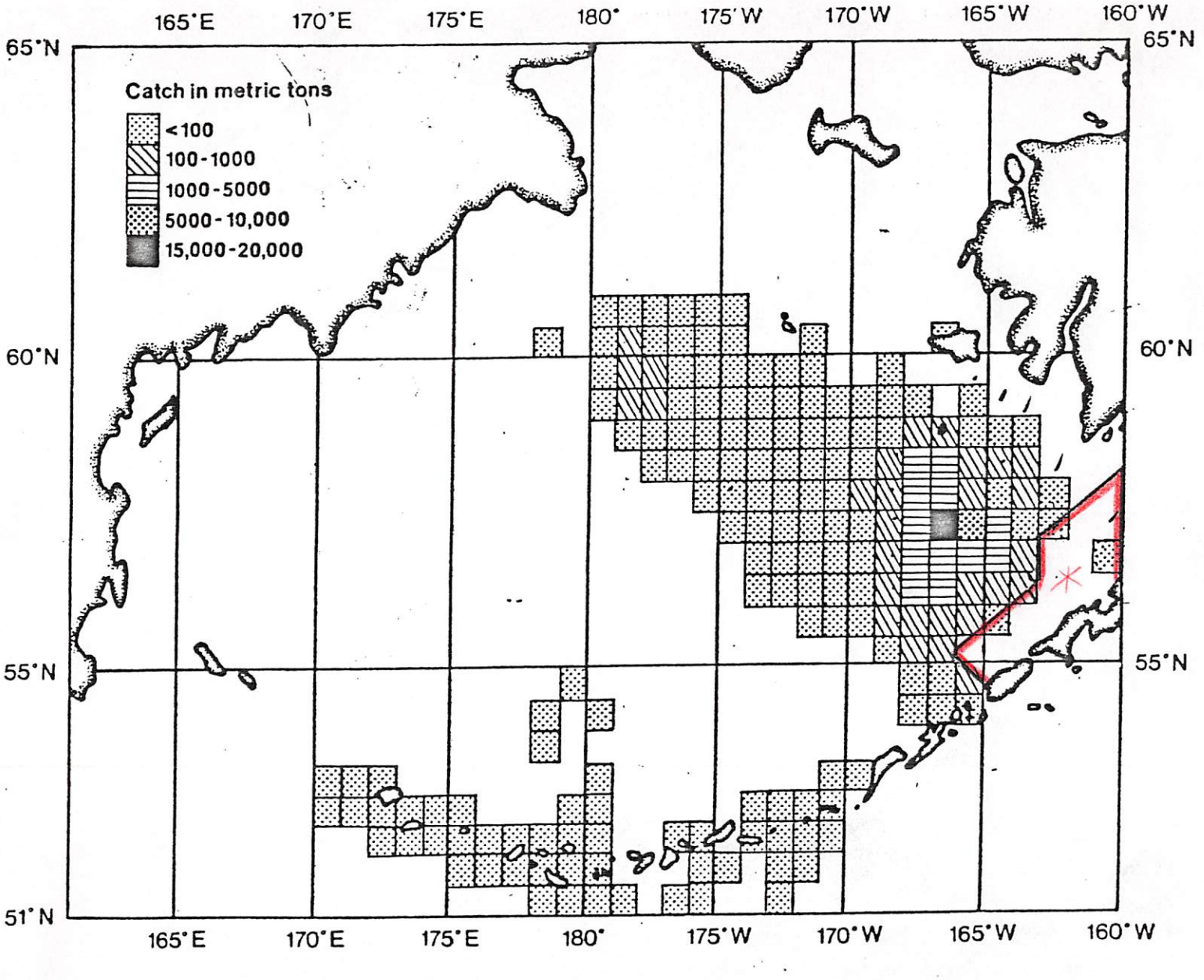
* Largest bottom trawling effort ever, in Pot Sanctuary Area, is destroying next up cycle in the King Crab fishery. Notice the bounce back in small males and females catagories after the trough in 1983

Table 1. -- Population estimates for eastern Bering Sea king crabs from NMFS surveys (millions of crabs).

Bristol Bay and Pribilof Red King Crabs

MALE

Year	Pre-recruits 1/ ± 2S	Legals 1/	Harvest No.	Harvest Exploit
1969	19.5	9.8		90
1970 2/	8.4	5.3		
1972	8.3	5.4	3.9	72
1973	25.9	10.9	5.0	46
1974	31.2	20.8	7.6	37
1975	29.6	21.2	8.7	41
1976	49.3	32.7	10.6	32
1977	63.9	37.6	11.7	31
1978	52.5	46.6	14.7	32
1979	38.8	45.5	16.8	37
1980	23.9	36.1	20.8	58
1981	18.9	10.8	5.3	50
1982 3/	17.1	4.4	.5	11
1983	10.4	1.5	No Season	0
1984	12.6	3.1	0.533	17.2
1985	10	2.5		

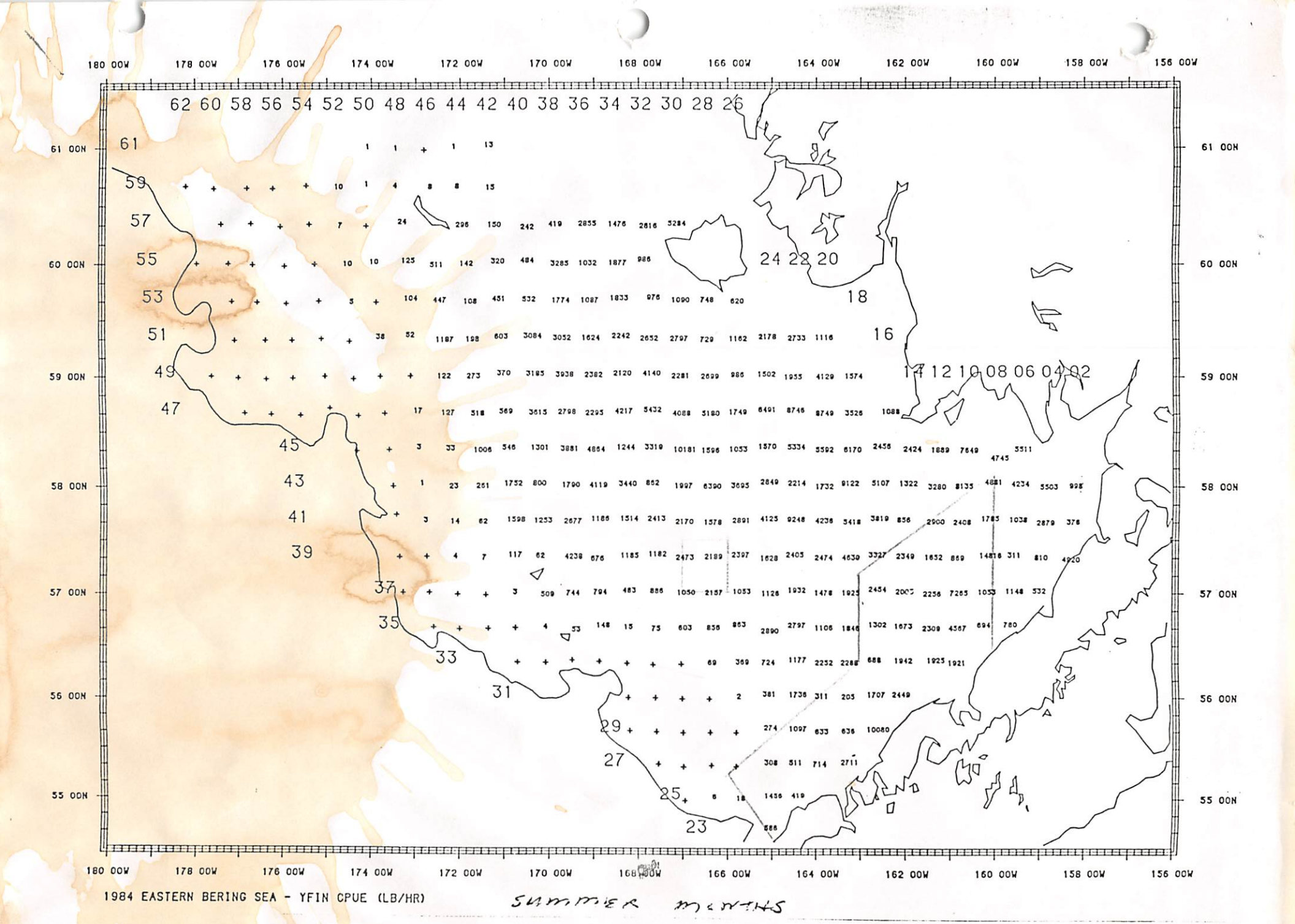


Area A -- Bristol Bay Pot Sanctuary

The portion of the Fishery Conservation Zone encompassed by straight lines connecting the following points, in the order listed:

Cape Sarichef Light (54°36'N - 164°55'42"W)
55°16'N - 166°10'W
56°20'N - 163°00'W
57°10'N - 163°00'W
58°10'N - 160°00'W
Intersection of 160°00'W with the Alaska Peninsula

Figure 1. Average annual catches of yellowfin sole by Japan according to blocks of ½° latitude by 1° longitude within the Bering Sea/Aleutian region, 1977-1982.



1984 EASTERN BERING SEA - YFIN CPUE (LB/HR)

SUMMER MONTHS