UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

Date : July 3, 1984

Reply to Attn. of:

To : F/M11 - Pete Jensen

From : F/AKR - Robert W. McVey

Subject: Submission package for the King Crab Fishery of the Bering Sea and Aleutian Islands Area FMP

On July 2, 1984, the North Pacific Fishery Management Council submitted to the Central Office the FMP for the King Crab Fishery of the Bering Sea and Aleutian Islands Area, thereby initiating Secretarial review. The submitted package includes copies of the following documents as required by the Operational Guidelines:

- Final FMP (50)
- FEIS (50)
- RIR/IRFA (20)
- Proposed regulations and preamble (10)

In behalf of the Council we are submitting copies of the following documents, making the King Crab FMP package structurally complete:

- Request for Information Collection (6)
- Letter to the State of Alaska's Office of Management and Budget requesting a Coastal Zone Consistency determination (4)
- FEDERAL REGISTER Notice of Availability (1)

Item (g) on page 28 of the Operational Guidelines requires submission of an ESA section 7 biological evaluation or a determination that ESA consultation is not required. The Council has determined that implementation of the FMP is not an action that may affect endangered species or their habitat and a statement to this effect is contained in the FEIS (page 24). The Council's determination is based on information contained in pages 17 and 18 of the FEIS. We believe that the Council's July 2, 1984 package and this submission satisfy the "structurally complete" requirements of the Operational Guidelines.

North Pacific Fishery Management Council

James O. Campbell, Chairman
Jim H. Branson, Executive Director

605 West 4th Avenue
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July 3, 1984

Mr. William G. Gordon
Asst. Administrator for Fisheries
National Marine Fisheries Service
3300 Whitehaven, Page 2 Building
Washington, DC 20235

Dear Bill:

On July 2, 1984 I sent you the Bering Sea/Aleutian Islands King Crab Fishery Management Plan and its supporting documents for Secretarial review. These documents have been revised since our October 25, 1983 submission to incorporate recommended changes by your office and to include a federal permit requirement in the implementing regulations. To help hasten your review I am enclosing a list of documents and page numbers where changes have been made so your reviewers will be able to locate the new material without having to reread the entire package.

Please let me know if there is any other assistance I can provide.

Sincerely,

Jim H. Branson
Executive Director

Enclosure

320/F

North Pacific Fishery Management Council
Bering Sea/Aleutian Islands King Crab Fishery Management Plan

June 1984 revisions to the BS/AI King Crab FMP document package:

Document	Subject	Page
Preamble	-Classification under RFA - conclusion of significance	7
	-Federal permit requirement	10
Implementing Regulations	-Federal permit requirement	17-20
FEIS	-Revised responses to comments on permits:	
	Comment #115	61
	" #131	66
	" #213	85
	" #214	85
RIR/RFA	-Supplement attached to present document	--

32D/F

F I N A L

ENVIRONMENTAL IMPACT STATEMENT
FOR THE BERING SEA/ALEUTIAN ISLANDS KING CRAB
FISHERY MANAGEMENT PLAN

June 1984

Prepared By:

North Pacific Fishery Management Council
P.O. Box 103136
605 West Fourth Avenue
Anchorage, Alaska 99510

U.S. Department of Commerce, NOAA
National Marine Fisheries Service
Alaska Region
P.O. Box 1668
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KCEIS/C1

COVER SHEET

RESPONSIBLE AGENCIES:

Assistant Administrator for Fisheries
National Oceanic and Atmospheric Administration
United States Department of Commerce
Washington, D.C. 20235

North Pacific Fishery Management Council
P.O. Box 3136 DT
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Anchorage, Alaska 99510

PROPOSED ACTION: Approval and implementation of the Bering Sea/Aleutian Islands King Crab Fishery Management Plan.

FOR FURTHER INFORMATION CONTACT:

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TYPE OF STATEMENT:

( ) Draft (X) Final

ABSTRACT:

This Statement evaluates the direct and indirect impacts upon the quality of the human environment of the implementation of a fishery management plan prepared pursuant to the Magnuson Fishery Conservation and Management Act. This Statement also evaluates the impacts on the human environment of alternatives to and variations of such action. It concludes that commercial king crab fishery operations of the kind likely to be authorized under the proposed variations of and alternatives to the Plan would probably have minor adverse impacts upon the natural environment. It also concludes, however, that these operations will be or can be so limited as to mitigate these adverse impacts without imposing undue burdens upon participants in the fishery and consumers of king crab products.

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CHAPTER I

SUMMARY

This statement examines the impacts upon the human environment of the approval and implementation of a Bering Sea/Aleutian Islands King Crab Fishery Management Plan (FMP). The FMP was submitted in June 1982 to the Assistant Administrator for Fisheries, National Oceanic and Atmospheric Administration, for approval and implementation under the Magnuson Fishery Conservation and Management Act.

This statement has been prepared pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) and its implementing regulations. It concludes that commercial king crab operations in the Bering Sea/Aleutian Islands area have the following types of impacts on the quality of the human environment:

1. incidental harvest of other marine resources;
2. direct stress to marine mammals and birds;
3. environmental pollution resulting from the dumping at sea by catcher/processor fishing vessels and by shore-based processing facilities of crab processing and other wastes;
4. navigational hazards posed by crab pots;
5. stress to biota caused by lost gear;
6. damage to benthic organisms caused by gear placement; and
7. handling mortality.

Precise data on most of these impacts are not currently available, but the information that does exist indicates that they do not severely affect the environment of the Bering Sea and Aleutian Islands area. In reviewing the management alternatives considered in the development of the FMP, this Statement concludes that, to the extent that a particular alternative would restrict the geographical extent, permissible harvest, intensity, and duration of the commercial king crab fishery, it would tend to mitigate the impacts of that fishery on the environment. Management alternatives that would permit expanding these four qualities of the fishery would also tend to increase the level of environmental impact.

This statement was preceded by a draft environmental impact statement that was issued in November 1981, and this statement includes revisions that reflect public comments made on the draft statement. The Agency's preferred alternatives as reflected in the FMP are identified in this statement.

This Statement incorporates by reference the FMP as submitted to the Assistant Administrator in June 1982. This document is available upon request from the North Pacific Fishery Management Council, P.O. Box 3136 DT, Suite 32, 333 West Fourth Avenue, Anchorage, Alaska 99510, telephone 907-274-4563.

CHAPTER II

PURPOSE OF AND NEED FOR THE PROPOSED ACTION

In the Magnuson Fishery Conservation and Management Act (MFCMA), Congress found that the marine resources off the coasts of the United States are valuable natural resources in need of immediate conservation and management by the United States to preserve their value to the Nation. It reasserted the exclusive fishery management authority of the United States over the resources of the continental shelf, and extended that authority to all living marine resources except for highly migratory species found within a Fishery Conservation Zone (FCZ) extending 200 miles from the shoreline of the United States, and excluding the areas within the territorial sea over which State management authority was reaffirmed.

The management of these marine resources is vested in the United States Secretary of Commerce and in eight Regional Fishery Management Councils. Each of these Councils has the duty to develop fishery management plans (FMP) for the marine resources in its region of responsibility that require conservation and management. Among other things, an FMP must specify the optimum yield from each fishery which would provide the greatest benefit to the Nation, and must state how much of that optimum yield can be expected to be harvested by United States vessels. Each Council consists of Federal and State officials having authority for fishery management, and of private persons nominated by the governors of states in the region served by the Council and appointed by the Secretary of Commerce.

When a Council has adopted an FMP for a fishery under its jurisdiction, it must be submitted to the Secretary of Commerce for approval and implementation by him. The Secretary has delegated this authority to the Assistant Administrator for Fisheries (Assistant Administrator) of the National Oceanic and Atmospheric Administration (NOAA). The Assistant Administrator is the head of the National Marine Fisheries Service (NMFS). Upon receipt of an FMP from a Council, the Assistant Administrator must determine whether it is consistent with the MFCMA and other applicable law. If he so finds, he tentatively approves the FMP, and publishes it for public comment together with proposed implementing regulations. If, in light of this public comment, the Assistant Administrator reaffirms his finding of the consistency of the FMP with the MFCMA and other applicable law, he publishes final regulations implementing the FMP. An FMP may be amended in accordance with these procedures.

Foreign fishing in the FCZ may be authorized under permits to the extent that the marine resources in question will not be harvested by United States fishermen. If an FMP has not been implemented for a fishery in which foreigners wish to participate, the Assistant Administrator must prepare and implement a Preliminary Fishery Management Plan (PMP) for that fishery. A PMP and its implementing regulations govern only foreign fishing operations, and do not limit the activities of United States fishermen. A PMP and its implementing regulations are automatically suspended when an FMP is implemented for the fishery to which the PMP applies.

There are three commercially important species of king crab in Alaskan waters. The species commonly referred to as the king crab or red king crab is Paralithodes camtschatica. The other two commercial species are the blue king

crab, P. platypus, and the brown or golden king crab, Lithodes aequispina. The domestic commercial harvest of king crab is unique to waters off the State of Alaska. Of these three species of king crab found in Alaska waters, the red king crab is the most significant in economic value to fishermen and processors. In fact, the red king crab fishery has a cash value which is more than that of any other seafood species (i.e., sockeye salmon, halibut, Tanner crab, etc.) caught in Alaska.

King crab have been exploited commercially in Alaska since the 1920's. Except for fishing by the Japanese during the 1930's, there were no major fisheries for king crab prior to World War II. Commercial fishing for king crab was restarted after the war by domestic fishermen in 1948. Both the Japanese and the Russians entered the postwar fishery for king crab off Alaska, primarily in the Bering Sea. The efforts of both the Russians and the Japanese increased into the mid 1960's until bilateral agreements with the United States began to set limits on their catch. The United States was successful in eliminating both nations from this fishery by 1975 through diplomatic negotiations. The king crab fishery thus became solely a domestic fishery before passage of the MFCMA. The domestic and foreign harvest of king crab from the waters off Alaska between 1953 and 1980 is shown in Table 11 of the Appendices to the FMP.

In January 1977, NMFS adopted the Preliminary Fishery Management Plan for King and Tanner Crabs of the Eastern Bering Sea. This PMP established total allowable level of foreign fishing (TALFF) for king crab equal to zero, further eliminating the possibility of any foreign fishing for king crab.

A Fishery Management Plan for the King Crab Fishery of the Bering Sea/Aleutian Islands (FMP) has been prepared for consideration by the North Pacific Fishery Management Council (Council) and submitted for approval and implementation by the Assistant Administrator. Management measures authorized by the FMP were chosen by the Council as its preferred alternatives. Both the management alternatives chosen and those that were considered but not chosen, are reviewed in this statement. The FMP is designed as a "framework" FMP prescribing general management standards and criteria, but leaving the formulation of detailed management regulations to NMFS and State officials. The implementation of the FMP would require close cooperation among NMFS, the Council, the Alaska Department of Fish and Game (ADF&G), and the Alaska Board of Fisheries (Board). The FMP would supersede the king crab provisions of the current crab PMP, discussed above.

CHAPTER III

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

As required by MFCMA section 303 and by 50 CFR Part 602, the FMP consists of: (a) informational sections summarizing current scientific, historical, and statistical information about the king crab fishery of the Alaska region and the various goals for, and considerations involved in, its management; and (b) operative sections, prescribing or authorizing management measures, standards, and criteria for the fishery. It is the operative sections of the FMP that would affect regulations governing the fishery should the FMP be approved and implemented. Each prescribed or authorized management measure and its alternatives must be examined, and the environmental impacts of the various alternatives compared on the basis of the analysis of environmental consequences set forth below.

The organization of the following discussion comparing the alternatives and their environmental impacts is based upon ten major groupings of alternatives considered in the development of the FMP. The preferred management alternatives are indicated by an asterisk (*). These include alternatives concerning:

A. need for a FMP;
B. boundaries of the fishery management unit;
C. selection of the OY concept to be prescribed by the FMP;
D. fishing seasons;
E. gear restrictions;
F. gear placement;
G. gear storage;
H. vessel tank inspection;
I. sex restrictions; and
J. registration areas.

A. Alternatives Concerning The Need For An FMP

The alternatives concerning the need for a FMP are as follows:

1. No FMP

There is some question whether the western Alaska king crab fishery "requires conservation and management" within the meaning of MFCMA section 304(c)(1)(A), and the Council has considered the alternative of not adopting an FMP at all.

If there were no action, and a fishery management plan were not implemented for the western Alaska king crab resource in the FCZ, the fishery would continue to be managed by the State of Alaska, to the extent it was carried out by vessels registered under the laws of that State. During the 1980-81 fishing season, over half of the total number of vessels fishing king crab in the Bering Sea and Aleutian Islands were owned by non-residents of Alaska, and they harvested almost three-fourths of the landings of king crab from these areas. Some of these fishermen have stated that the implementation of a fishery management plan would give them more

opportunity to participate in the management and decision making process. Most of their vessels have, however, been registered under Alaska State law.

Under the present State of Alaska king crab management program, the king crab fishery may produce minor environmental impacts described below, due to incidental harvest of other marine resources, displacement of migratory birds, possible drowning of sea otters, environmental pollution, navigational hazards, lost gear, damage to benthic organisms, and handling mortality of crab. However, no major environmental impacts are expected to occur nor have any been identified in over 20 years of State management of this resource.

*2. FMP implemented with Secretarial delegation of regulatory authority to the State of Alaska

Under this alternative the Council would adopt and the Assistant Administrator would approve an FMP. The FMP would be implemented by a Federal regulation delegating management authority to the State of Alaska with oversight by the Council and the Assistant Administrator. This alternative is preferred since it would maximize efficiency, reduce implementation costs, and take maximum advantage of the existing expertise and management system of the State of Alaska.

The environmental impacts of this alternative would depend upon the management standards and criteria which were incorporated into the FMP. Because implementation of these standards and criteria could be expected to have the same environmental impacts, whether it took place under State or Federal auspices, the following discussion of the environmental impacts of the alternative management measures being considered for incorporation into the FMP applies to the consideration of this alternative.

3. FMP implemented with regulatory authority retained by the Secretary.

The approval and implementation of an FMP through detailed Federal regulations would result in the cooperative management of the king crab resource in the FCZ area by NMFS, the Board, and the Council. Regulations would be developed and reviewed by both the Council and the Board, and promulgated by the Assistant Administrator. Enforcement of regulations would be a cooperative effort of the Alaska Department of Public Safety, NMFS, and the U.S. Coast Guard. Effective implementation of this alternative would require some Federal duplication of management capabilities already possessed by the State of Alaska.

Any environmental impacts of implementing an FMP, whether adverse or beneficial, would depend on which management measures it prescribed or authorized. The following discussion compares the environmental impacts of the management alternatives selected by the Council for incorporation in the FMP.

B. Alternatives Concerning The Boundaries Of The Fishery Management Unit

The alternatives that were considered for the boundaries of the fishery management unit were as follows:

1. Western Gulf of Alaska, Bering Sea and Aleutian Islands

This alternative would include the FCZ south of the latitude of Cape Douglas and west of 148°40' W. longitude including the current State of Alaska Kodiak, Alaska Peninsula, Dutch Harbor, Adak, Bristol Bay, and Bering Sea management areas.

This management unit would include all the known harvestable king crab resource of the FCZ off Alaska. The FMP would thus affect all of the environmental impacts of the commercial king crab fishery in the FCZ, discussed below in Chapter V.

*2. Bering Sea and Aleutian Islands

Under this alternative the FMP would apply only to the FCZ waters of the Bering Sea and Western Aleutians, including Bristol Bay, Dutch Harbor, Adak and Norton Sound. This option would exclude the Kodiak and Peninsula king crab management areas. The FMP would therefore not affect the environmental impacts of king crab fisheries in the Gulf of Alaska. This alternative is preferred because Bering Sea/Aleutian king crab stocks are distinct from those of the Gulf of Alaska; and because most participants in the Bering Sea/Aleutian Island fishery desire an FMP while most in the Gulf fisheries do not; and because it is not clear to the Council that the Gulf fisheries require Federal conservation and management.

C. Alternatives Concerning The Determination Of Optimum Yield

The alternatives considered for the determining of optimum yield (OY) were as follows:

1. Season and size limit management

A closed season would be established to protect the mating and molting stages of the stocks and a minimum size limit set each year. No quota would be set, and the harvest would be unlimited during the open season. The OY would be defined as all crab over a specified size which can be harvested during the open season. In the past, the prescribed season has been from August 1 to January 14 for 6½" crabs (carapace width).

This alternative maximizes the yield from the resource and spreads effort out over several months, thus providing the longest possible commercial fishing season while still protecting the stocks during the vulnerable period of their life cycle. This alternative does not consider scheduling the king crab season in relation to other fisheries, to allow optimal seasonal use of vessels, processing plants or work forces. Nor does it take into consideration recovery rates, weather conditions or split seasons. This alternative would require some adjustment in the industrial cycle which has been set

up to process large volumes of crab in a short time. For example, the harvest of 130 million pounds of red king crab in the southeastern Bering Sea during 1980 took only 41 days.

Allowing unrestricted fishing for crab above a minimum size limit would produce the maximum physical yield. Management and enforcement costs would be reduced. The commercial harvest would, however, be largely dependent on a single recruit class which could cause great annual fluctuations in the harvest. If recruitment failure resulted in a very small harvest, it would have a severe economic impact on vessels, processors, communities, markets and consumers. Other possible disadvantages of selecting this alternative are an increase in fuel costs to fishermen and that at low stock levels there could be a loss in reproductive potential if all the the older crab, which are believed to be important in reproduction, are removed.

This alternative has other disadvantages including the probability of enticing more vessels into an already depressed fishery. Processors have generally been against prolonged seasons and low volume, preferring a shorter period when volume is high enabling the most efficient utilization of their facilities and work force.

Since this approach would extend the fishing season to several months, the time period for possible displacement of migratory birds would be increased, although the fishing effort would be less concentrated. The contact time with marine benthos would be increased. The time period of danger to navigation, marine mammals, and other marine resources would be extended.

Also, since this alternative would result in an increase in physical yield over an extended period of time, an increase in environmental pollution may result, although the long period over which this increase would be spread would tend to mitigate its effects.

2. Multiple age class management

The current State management strategy employs fishing seasons, size limits, and exploitation rates to derive OY or harvest quotas. This management strategy reserves a portion of each recruit class to carry over into the next year's fishery so that multiple age classes support the fishery. This strategy is designed to moderate the extreme fluctuations in harvest levels that are possible under a recruit only fishery, and to enhance the reproductive potential of the stock. Optimum yield would be based on an exploitation rate of 40 percent of the recruit class and 50 percent of the next two older age classes.

Using this alternative, the environmental impacts of the commercial king crab fishery described in Chapter V, below, would probably remain unchanged.

*3. Spawning stock management

The management approach of this option, preferred by the Council, would be to ensure a spawning stock of fertilized females. The minimum female spawning stock for production of MSY would be established by analysis of the stock-recruitment relationship. The estimation of yield from the stock would be calculated using exploitation rates and size limits which vary according to the condition of the stock. The resulting estimate would form the basis for calculation of OY. For those stocks at a low level, or where data are insufficient for determination of a spawner-recruitment relationship, the OY would be based on the catch level which maintains full (near 100%) female fertilization. This level currently corresponds to an exploitation rate of about .4 and a minimum size limit of 6.5 - 7 inches for most management areas.

The determination of OY would be made annually by the NMFS Alaska Regional Director (Regional Director) or by the Board subject to concurrence by the Regional Director, in consultation with the Council. In accordance with limitations and criteria specified in the FMP, OY would be adjusted to respond to socioeconomic concerns. This alternative is preferred because while achieving many of the stabilizing advantages of multiple age class management (i.e. extreme fluctuations in harvest levels can be moderated by use of various combinations of size limits with exploitation rates), it also maintains a minimum required female spawning stock.

The environmental impacts described in Chapter V would be affected under this option by the size of the fishery permitted in each area. Where spawning stocks are healthy, a more extensive fishery would be authorized, and the environmental impacts would be more pronounced. Where spawning stocks were depressed the authorized fishery and its attendant environmental impact would be reduced.

D. Alternatives Concerning Fishing Seasons

The alternatives that were considered for fishing seasons were as follows:

*1. Provide Fishing Seasons

The use of this management alternative, as authorized by the FMP would allow prescription of fishing seasons, based on a variety of criteria specified in the FMP. These criteria are summarized by the following: (a) the need to protect king crabs during the molting, mating, and growing stages of their life cycle; (b) the desirability of discouraging king crab fishing effort, particularly by small vessels, in adverse weather conditions; (c) coordination of king crab harvesting and processing with other fisheries utilizing the same vessels and facilities; and (d) the desirability of timing king crab fisheries relative to one another so as to spread fishing effort, prevent gear saturation of particular areas, and increase participation by locally-based fleets. The primary objectives of this alternative are to conserve the king crab resource, avoid undue safety risks to fishermen, promote full exploitation of king crab

stocks, and promote maximum utilization of available vessels and processing facilities. For these reasons, this alternative is preferred by the Council.

Under this alternative, the environmental impacts of the commercial king crab fishery described in Chapter V would probably remain generally at their current levels. Shortening of seasons would decrease these impacts, while lengthening of seasons would increase them.

2. Eliminate fishing seasons

Eliminating closed seasons would allow fishing to occur legally throughout the year, although this is unlikely to actually happen due to seasonal weather conditions and participation of many king crab fishermen in other fisheries. This alternative would allow fishing to occur at critical periods in the crabs life cycle, which could cause higher mortality due to handling and stress.

Since this alternative would extend the fishing period, the time period for possible displacement of migratory birds, the contact time with marine benthos, and the danger to navigation and marine mammals would all be increased.

E. Alternatives Concerning Gear Restrictions

The alternatives that were considered for gear restrictions were as follows:

*1. Legal gear for the commercial king crab fishery is limited to pots (traps) and ring nets.

This alternative maintains the status quo. King crab pots are selective in the sense that non-legal crab (i.e., female and undersized male crab) can to some extent be kept out of the gear and, if caught, can be returned to the water unharmed. King crab pots contain a mechanism to terminate their holding ability within six months if not removed from the water. This ensures they will not continue to catch and hold crabs and other organisms if they are lost.

Adoption of this alternative would probably not change the environmental impacts discussed in Chapter V.

2. No gear restrictions

This alternative would allow the use of any type of fishing gear to harvest king crab. During the early development of the king crab fishery tangle nets and otter trawls were used. These gear types were eventually prohibited (1955 and 1960 respectively) because they were non-selective. They take females, softshelled crab and undersized male crab, with capture resulting in injury or deadloss even though they are returned to the sea.

Adoption of this alternative would result in significant damage to both the king crab resource and many other benthic populations. The non-selectivity of the gear would have an adverse impact on the entire fishery. The environmental impacts discussed in Chapter V would be much more severe than they currently are in the Bering Sea and Aleutian Islands area.

F. Alternatives Concerning Gear Placement and Removal

The alternatives that were considered for gear placement and removal were as follows:

*1. The placement of gear on the fishing grounds up to seven days before the opening of a king crab fishing season, and the leaving of such gear on the fishing grounds for up to seven days after the close of any such reason, may be authorized if such early placement and late removal is justified in light of (a) its biological impacts on king crab and other species; (b) the additional enforcement cost to the public that it will cause; (c) the possibility that it will lead to additional gear conflict; and (d) the availability of unloading facilities for disposal of king crab catches and of gear storage areas outside the fishing grounds.

Because of the limited availability of crab unloading facilities and nearby gear storage areas, as well as the limited gear hauling capacity of many crab fishing vessels, it may be desirable to permit the placement of gear a short time before, and the removal of gear a short time after, the king crab fishing season. While this would eliminate inequities to king crab fishermen, it could increase enforcement difficulties and costs due to covert fishing out of season. Generally, the longer gear remains on the fishing grounds, the greater will be the magnitude of the impacts described in Chapter V. This alternative is preferred since it would prevent vessel congestion at pot loading/unloading facilities and also provide fishermen the opportunity to fish through the last day of the season.

2. No king crab pots could be on the fishing grounds before the opening or after the close of the season.

Under this alternative, deployment of king crab pots could begin only after the king crab season had opened. Smaller vessels that take several trips to remove their gear from the grounds, and vessels that expected delays at offloading facilities, would have to start reducing the number of deployed pots well before the end of the season. This alternative would mitigate the environmental impacts of the commercial king crab fishery as described in Chapter V.

G. Alternatives Concerning Gear Storage

The alternatives for gear storage are as follows:

*1. King crab gear shall be stored on land. Storage of gear in a non-fishing condition in ice free water areas of low abundance may be authorized if such storage is justified in light of (a) its biological impacts; (b) the additional enforcement costs to the public that it will cause; (c) the costs to vessel owners of storage on land; (d) the availability of other land and sea storage areas; and (e) the possibility that it will lead to additional gear conflict.

This alternative would alleviate the scarcity of gear storage areas on land, and the high costs to fishermen of using on land storage areas. It is recognized that the requirement for fishermen to store gear on land or in designated storage areas results in increased costs and energy consumption for the fishermen. However, this alternative is preferred because it avoids the even greater costs and energy consumption of both the other alternatives. This alternative would increase the risk of covert fishing out of season, and would tend to generally increase the level of the impacts described below in Chapter V.

2. Require king crab gear to be removed from the water during closed fishing periods

Dry land storage has the highest direct cost to the fisherman of any type of gear storage although it does eliminate the risk of gear loss with water storage. Any possible impact on the benthic community or on sea otters would be eliminated under this alternative. Lost gear and navigational hazards would also be eliminated.

3. Provide for pot storage on the fishing grounds

This alternative would reduce the costs of moving gear to storage areas, but would increase enforcement costs to the public and encourage covert fishing before the start of the fishing season, risking biological harm to the king crab resource. The impact of prolonged storage of thousands of king crab pots on the benthos in active fishing areas has not been established. This option would create additional navigational risks and possibly preempt fishing grounds needed by other fisheries using different forms of gear.

H. Alternatives Concerning Vessel Tank Inspection

Two alternatives concerning vessel tank inspection were considered:

*1. The inspection of the tank or live hold of each vessel engaged in the king crab fishery may be required not more than five days before the opening of a king crab fishing season if such inspection is justified in light of (a) enforcement requirements; (b) the need to document the location of commercial harvests; (c) the ability of the vessels concerned to move easily between the fishing grounds and the location of inspection centers; (d) the time necessary for the vessels concerned to transport their gear from storage areas to the

fishing grounds; (e) the fuel consumption that the inspection requirement will cause; and (f) the equity of allowing all participants to start the fishery at substantially the same time.

Vessel tank inspections help assure an equal start for all participants at the beginning of the season and reduce covert king crab fishing. Tank inspections also provide fishery managers with useful information for managing the fishery. Requiring the inspection prior to fishing standardizes the fleet which improves greatly the quality of the catch data needed by managers for harvest projections. Inspections are also useful as a second source of participating vessel information. Registration of fishing vessels for an area often change just prior to a season opening and the inspections prevent catches in one registration area from being delivered to another registration area. This alternative creates an additional economic impact on vessels by increasing their travel and fuel costs. Because it increases the difficulties of covert fishing, it would mitigate the impacts described below in Chapter V.

2. No vessel tank inspection required prior to fishing for king crab

Eliminating the vessel tank inspection requirement should reduce the travel cost for vessels, but useful catch information regarding the fleet would not be readily available to the fishery managers. This alternative would facilitate covert fishing prior to the season opening, thereby risking biological harm to the king crab resource and possibly increasing the environmental impacts described in Chapter V.

I. Alternatives Concerning Sex Restrictions

The alternatives concerning sex restrictions are as follows:

1. No commercial harvest of female crabs

Harvesting only mature male crabs as currently required by the Board is an effective means of protecting the reproductivity of the king crab resource. The data base to support or reject an intensive harvest of female crabs is poor.

The males-only policy of the Board may result in a under-harvesting during periods of healthy stock conditions. Female crabs were harvested by foreign fleets in the 1950's with unknown impacts. Female crabs are smaller and produce less meat in proportion to total weight than male crabs, and thus are of limited interest to U.S. processors. Where stock assessments are incomplete or poor, protection of female crabs is plainly appropriate.

Adoption of this alternative would probably not affect the severity of the environmental impacts discussed in Chapter V.

*2. Allow a percentage of female crabs to be taken if a surplus is determined to be available. The surplus would be dependent on the number of crabs above the threshold amount used in the spawning stock calculation of OY.

This would increase the quantity of legally exploitable crabs. Since females are smaller than males, higher processing costs and a lower demand may cause an ex-vessel price reduction. Increased catches could result in increased environmental pollution caused by dumping a larger volume of crab processing wastes. However, the total amount is small in comparison to the entire ecosystem and the net effect is probably negligible. The risk of depletion of the king crab resource would be increased because of the possibility of error in the determination of the surplus. This alternative is preferred because it allows the possibility of expanding the portion of the resource that can be utilized if such use will not reduce the reproductive potential of the affected stock.

J. Alternatives Concerning Registration Areas

The options that were considered for registration areas were as follows:

*1. Exclusive registration areas may be designated if such designation is justified in light of (a) the extent to which such designation will facilitate proper management of the fishery; (b) the extent to which such a designation will help provide vessels with a reasonable opportunity to participate in the fishery; (c) the extent to which the designation will help to avoid sudden economic dislocation; (d) the desirability of promoting the most efficient use of vessels and gear; (e) the extent to which the economic benefits conferred by the designation will be offset by economic costs and inefficiences; and (f) the extent to which other management measures could yield the results desired from the designation.

Registration by statistical areas which correspond approximately to stock boundaries provides the fisheries manager with information needed to determine levels of fishing effort and to project fishing rates prior to the season opening. The use of exclusive and non-exclusive area registration provides for a measure of protection for local fleets and some stability in all sectors of the industry, and encourages exploration in new areas. As a result of this shift in fishing effort, the environmental impacts discussed in Chapter V are likely to be mitigated in the exclusive registration areas and exacerbated in non-exclusive areas. For these reasons, this is the preferred alternative.

2. No registration system

This alternative could result in concentrated effort on local crab populations by very large fleets shifting from area to area as season or availability dictate with an adverse impact on locally-based industry elements. Pre-season effort information would not be available to fisheries managers so harvest management decisions would be much more difficult to make. Overharvest or, conversely, underharvests would be more likely to occur under those conditions. The environmental impacts discussed in Chapter V would be increased over current levels in the existing exclusive registration areas, Bristol Bay and Dutch Harbor.

3. Statistical registration system

This alternative, while providing the fisheries manager with information needed to determine levels of fishing effort, would not allow for accurate fishing rate projections since some vessels would be able to move rapidly between areas. In addition to the likelihood of increased fishing effort on certain stocks, this alternative would severely affect industrial and community investment as well as increase the environmental impacts in existing exclusive registration areas as described in Chapter V.

CHAPTER IV

DESCRIPTION OF THE AFFECTED ENVIRONMENT

The area that is expected to be affected by a king crab fishery in the Bering Sea and off the Aleutian Islands, consists of: (1) the Bering Sea, especially the eastern Bering Sea which includes Bristol Bay and Norton Sound; and (2) the Aleutian Islands and the waters of the Pacific Ocean and Bering Sea immediately adjacent thereto. The environment of this area, and the environmental impacts upon it resulting from the conduct of a king crab fishery, are determined by the distinctive physical and biological characteristics of the Bering Sea and the western Gulf of Alaska.

International North Pacific Fisheries Commission annual reports and associated documentation provide a summary of oceanographic research conducted by the United States, Canada, and Japan in the waters that are inhabited by king crabs. The series entitled Soviet Investigations in the Northeast Pacific (Moiseev 1964) provides a fairly complete analysis of the Bering Sea as a habitat. A more recent comprehensive review of the Bering Sea environment is given in Oceanography of the Bering Sea (Hood and Kelly 1974). McLain and Favorite (1976) describe recent anomalous climatic conditions in the Bering Sea and discuss the possible effects on fisheries.

Pereyra et al. (1976) and Wolotira et al. (1977) describe the baseline biological surveys conducted as part of the Bureau of Land Management/NOAA Outer Continental Shelf Environmental Assessment Program.

The Bering Sea is located between approximately 160° east longitude and 160° west longitude; and between approximately 52° north latitude and 65° north latitude. It is bounded on the east by the Alaska mainland; on the west by the Siberia mainland and the Kamchatka Peninsula; on the south by the Alaska Peninsula, the Aleutian Islands, and the Commander Islands; and on the north by the Bering Strait.

The area of the Bering Sea is about 2.3 million square kilometers. Of this area, 44 percent consists of continental shelf; 13 percent of continental slope; and 43 percent of deepwater basin. The continental shelf of the northeastern Bering Sea is one of the largest in the world. It is extremely smooth and has a gentle uniform gradient. The continental slope bordering this shelf is abrupt and very steep, and is scored with valleys and large submarine canyons. On the south, the Aleutian/Commander Islands Arc forms a partial barrier between the Bering Sea and the Pacific Ocean. This chain consists of more than 150 islands, and it is about 2,260 kilometers long. The continental shelf of the Aleutians is narrow and discontinuous, with a breadth ranging between 4 kilometers and 46 kilometers. The broader parts of this shelf are in the eastern Aleutians. The Aleutian Trench, a large canyon stretching from the central Gulf of Alaska to the Kamchatka Peninsula, adjoins the Aleutian/Commander chain on the south.

Bowers Bank is a submerged ridge extending to the northwest from the westcentral Aleutians into the Bering Sea. It is about 550 kilometers long and 75 to 110 kilometers wide, increasing in width as it approaches the continental shelf of the Aleutians. The summit of the ridge is 150 to 200 meters deep in the south, 600 to 700 meters deep in the center, and 800 to 1,000 meters deep in the north.

Aside from the Aleutians and Commanders, the Bering Sea has relatively few islands. The very small Pribilof and St. Matthews Island groups lie adjacent to the continental slope of the northeastern Bering Sea. Nunivak Island lies just off the Alaska mainland between the Yukon and Kuskokwim deltas. St. Lawrence Island lies in the northern part of the Bering Sea, between Norton Sound and the Chukchi Peninsula.

Water flows into the Bering Sea from the Pacific Ocean and from the rivers and surface of the adjoining land areas. Water moves from the Bering Sea into the Arctic Ocean through the Bering Strait. Thus, there is a net movement of water northward throughout the Bering Sea. On the eastern Bering Sea continental shelf, the dominant movement of water involves water entering the Bering Sea from the Pacific in the area of Unimak Pass. This water moves northward to St. Matthews Island and eastward toward Bristol Bay. Dividing near St. Matthews Island, the northward stream reunites and passes through the Bering Strait.

Except for the southernmost part, which is in the temperate zone, the Bering Sea has a subarctic climate. It experiences moderate to strong atmospheric pressure gradients, and is subject to numerous storms. Pack ice covers most of the continental shelf of the northeastern Bering Sea during winter and spring, intruding into the northern Bering Sea in November and reaching its maximum extent in late March, when the ice edge may be south of the Pribilof Islands and as far west as Unimak Island. The more southerly area of the continental shelf between the Pribilofs and Unimak Island, and the deepwater basin area, are usually ice free throughout the year because of the intrusion of warmer water from the Pacific. In April and May, the ice begins to retreat, and the Bering Sea is usually free of ice by early summer.

Although the responsible natural processes are not completely understood, the physical features of the Bering Sea that have just been described combine to create conditions that are very favorable for biological production. During the cold winter months, there is a buildup of nutrients. The mixing of Pacific and Bering Sea water produces an upwelling of these nutrients along the Aleutian Chain, and the broad continental shelf of the northeastern Bering Sea provides a favorable habitat for plants and animals that consume those nutrients either directly or indirectly through a complex food web. As a result, the Bering Sea supports some of the largest fish, marine mammal, and bird populations in the world. The red king crab is the most widespread and abundant of the three commercial king crab species. It is found from Vancouver Island, British Columbia to Norton Sound in the Bering Sea. Moderate numbers are found in Southeast Alaska and Prince William Sound. King crab are abundant in the Gulf of Alaska and the Bering Sea where major fisheries exist at Cook Inlet, Kodiak Island, South Alaska Peninsula, the Aleutian Islands, and the southeastern Bering Sea at depths of 100 fathoms or less.

The blue king crab is the second most abundant species. It has a more limited distribution. Populations are found in the eastern Bering Sea, in Herendeen Bay on the Alaska Peninsula, Olga Bay on Kodiak Island, and in Icy Strait, Auke Bay and Gambier Bay in Southeast Alaska (Wallace et al., 1949).

The brown or golden king crab is the least abundant of the commercially important king crab in Alaskan waters. It characteristically inhabits deep water (greater than 100 fathoms) along the continental slopes of the North

Pacific Ocean and the Bering Sea. This crab enters the commercial catch in limited quantity in the State of Alaska southeastern management area which encompasses all waters surrounding the Alexander Archipelago and the outer coast. Little is known of its life history.

The distribution of the red king crab in the southeastern Bering Sea is related to the bottom temperature. Data compiled over a five-year period and analyzed by Stinson (1975) indicate that males inhabit a temperature range from 0 to 5.5° C with a maximum abundance at 1.5° C during summer months. Adult females inhabit the same temperature range with maximum abundance between 3° and 5° C. King crab have been found in depths of 200 fm or more although the majority of the commercial fishery is taken from depths less than 150 fm. Juveniles are abundant in inshore waters and in relatively shallow (less than 75 fm) waters offshore. Most king crab are harvested from soft substrates of mud or sand. King crab are unable to tolerate wide variations in salinity (stenohaline) and are adapted to cold waters, generally 0°-10° C.

Although king crab are found in most Alaskan waters, tagging evidence demonstrates that they belong to several stocks rather than one population. During the course of tagging studies in the southeastern Bering Sea, thousands of king crab have been tagged but none have been recovered in the Gulf of Alaska (Simpson and Shippen 1968). Moreover, Hayes and Montgomery (1963) reported that crab marked in the Shumagin Islands area had never been reported in either the Bering Sea or Kodiak Island fisheries. In addition, crab tagged in the Kodiak Island fishery have not been recovered in other fisheries (Powell and Reynolds 1965).

Very little is known about the interactions of king crab with their physical and biotic environments. Most of the information about king crab pertains to natural history or descriptive bionomics. Knowledge of its intra-and interspecific relationships is still rudimentary.

A high mortality occurs during the larval stages due to plankton feeding animals. Juveniles, because of their small size, are susceptible to predation by fish and large invertebrates. Adult crab are also particularly susceptible to predation when they are in the soft-shelled stage. The only animal known to prey upon larger king crab for much of their diet is the halibut.

The food and feeding habits of king crab vary with age, geographical distribution, and the availability of a particular food source. Adult king crab are benthic predators (Fenuik 1945). The food web of the Kodiak king crab has been constructed by scientists at the University of Alaska (Feder and Jewett, 1977). Larval crab are planktonic feeders subsisting on phytoplankton and smaller zooplankton. Upon metamorphosis to the benthic state, they utilize bottom species and organic detritus. Bright (1967), in analyzing the stomach contents of king crab larvae, found that diatoms were almost exclusively utilized.

Large populations of marine mammals are present in the Bering Sea. These marine mammals feed on various combinations of fish and other marine species. In general, there is minimal interaction between king crab and marine mammals. The major exceptions are the bearded seal, Erignathus barbatus and the sea otter, Enhydra lutris.

Unlike most seals, which are pelagic feeders, the bearded seal is a benthic feeder. Tanner crab and, to a lesser extent, king crab constitute part of its diet. The king crab taken by the bearded seal are generally smaller than the commercially legal crab so direct competition with the commercial fishery is avoided, though the commercial fishery is deprived of potential harvests. The degree of predation upon crab by bearded seals has not been quantified.

The sea otter feeds upon a wide variety of fish, sea urchins, clams, mussels, crabs, and octopus. Sea otters may take any size of king crab including legal-sized crab. The frequency and significance of such predation is unknown. There has not been any documentation of intense feeding of sea otters upon king crab. Sea otters regularly dive to 25 fathoms in search of food and have been recorded at depths as great as 50 fathoms. There is the potential for conflicts between fishermen and sea otters when crab pots are set in relatively shallow water near shore. Sea otter mortality due to drowning in crab pots is rare, but it is a possible occurrence where sea otters and crab fishing areas overlap.

Indirect interaction between the pelagic-feeding seals and king crab also occurs, in the sense that king crab larvae constitute part of the zooplankton utilized by the forage fish, such as herring and capelin, which are preyed upon by these seals. The contribution of king crab larvae to the diets of these forage fish, the subsequent impact of this predation on the population of adult king crab, and any role played by seals in regulating the numbers of these fishes is unknown at this time. Subsequent research will have to investigate the significance of the interactions among these species.

The other marine mammals present in the waters off Alaska (whales, porpoises, sea lion, walrus, and polar bear) do not interact with king crab or the king crab fishery except inasmuch as they all co-exist in the same waters.

The 1980 human population of Alaska was estimated to be 481,000 according to the Alaska Department of Labor. Of this total, 39,974 individuals (civilian and military) were residents of the Bering Sea, Alaska Peninsula, and Kodiak. Along the northern coast of Norton Sound, these people are predominantly Inupiat Eskimos. From Norton Sound to Bristol Bay and on Saint Lawrence Island, most of the natives are Yup'ik Eskimos. The Pribilof Islands, and Aleutian Islands are inhabited predominantly by Aleuts. While various features of the cash economy prevailing in the rest of the United States have made inroads, all of these native people continue to depend heavily, as they have for centuries, upon the direct subsistence harvest of the other forms of life that are found in the Bering Sea and the Aleutians. While these are not, in general, seafaring peoples, they have been able to take advantage of the fact that many of the animals upon which they depend are accessible at various times of the year in coastal areas. Throughout the recorded history of the region, they have been particulary dependent upon salmon, herring, halibut, seals, ducks, geese, and in the case of the Inupiat and Saint Lawrence Island Yup'ik, whales. The entire culture of each of these peoples is based upon the pursuit, capture, and consumption of these animals, without which human life in the region would, until recent years, have been totally impossible. The hunting of these animals thus fulfills deep seated spiritual and social, as well as physical, needs of the people of the region, needs which purported substitutes offered by the gradually encroaching Western culture have consistently proved unable to satisfy completely.

In addition to native subsistence users, the king crab resource is utilized by other Alaskan and non-Alaskan fishermen. The non-Alaskan fishermen are predominantly from the Pacific Northwest area of the United States and represent the majority of the commercial king crab fishing fleet in the Bering Sea/Aleutian Islands area.

There is no licensed recreational fishery for king crab. The taking of king crab for personal use is permitted under subsistence fishery regulations. Though the subsistence harvest of king crab may be significant to those individuals who participate in the fishery, the size of the subsistence harvest is negligible compared to the commercial harvest. Except for the Bering Sea area (Norton Sound), catch and effort records are not kept for the subsistence fishery. The subsistence catch in the Bering Sea may range between 20 and 25 thousand crab per season.

In the northern portion of the Bering Sea area, subsistence herring and crab fishermen have expressed some concern with the developing commercial king crab fishery. They feel that the bait herring fishery, the primary source of crab bait, will compete with subsistence and the developing (through the ice) commercial king crab fishery.

The commercial fishery is a dramatic perturbation (130 million pounds of red and blue king crab in 1980 from the Southeastern Bering Sea alone) on the crab resource and the community of which it is a part.

CHAPTER V

ENVIRONMENTAL IMPACTS OF THE PROPOSED MANAGEMENT MEASURES AND ALTERNATIVES

A. Description Of Impacts

Like other human activities, the harvest of king crab in the Bering Sea and Aleutian Islands has impacts upon the natural environment. These impacts can vary depending upon the particular management alternatives selected. The impacts of the king crab fishery in these regions upon the natural environment include:

1. the incidental harvest of other marine resources;
2. direct stress to marine mammals and birds;
3. environmental pollution resulting from the dumping at sea by catcher-processor fishing vessels and by shore based processing facilities of crab processing and other wastes;
4. crab pots as a navigational hazard;
5. stress to biota caused by lost gear;
6. damage to benthic organisms caused by gear placement; and
7. handling mortality.

Each of these impacts will now be discussed in detail. This discussion forms the basis for the analysis and comparison of the environmental impacts of the proposed management alternatives which were presented in Chapter III. This description of the impacts of king crab commercial fishing operations in the Bering Sea and Aleutian Islands accounts for adverse environmental impacts that cannot be avoided if this fishery is allowed. It discusses any irretrievable commitments of resources which would be involved if such a crab fishery were allowed; the relationship between the short-term uses of marine resources that are involved in king crab operations; and the maintenance of the long-term productivity of the natural environment of the Bering Sea and Aleutian Islands.

B. Direct Impacts Of King Crab Fishing In The Bering Sea And Aleutian Islands Upon The Natural Environment.

1. Incidental harvest of other marine resources

No statistics are available on the by-catches of domestic commercial crab fishing in the Bering Sea. However, information from research cruises can provide some insight into the problem. During the July 1978 Kodiak area crab survey, 895 pots were fished. The catch composition was 59,720 king crab, 7,522 Tanner crab, 2,909 cod, 66 sculpin, 212 halibut, 25 octopus as well as numerous starfish and snails.

If caught during the commercial fishery, the tanner crabs, sculpins, octopi, starfish, and snails most likely could be returned to the sea unharmed. Cod mortality would depend on the depth of capture and pot retrieval speed. Halibut mortality probably would approach 100% if the halibut remained in the crab pots for more than 2 days. Studies by ADF&G around Kodiak and Cook Inlet have shown that 62% to 85% of incidentally caught halibut will survive if the crab pots are

fished, or soaked, for less than 24 hours. The International Pacific Halibut Commission (IPHC) has found that about 80% of the halibut taken in king crab pots which have been soaked about 18 hours were in good or excellent condition. However, when finfish are captured in pots, fishermen will often illegally use them for bait, thus increasing the mortality of incidentally caught finfish.

The IPHC took ADF&G incidental halibut catches from summer pot index surveys and extrapolated the data to the commercial fishery. Although this methodology may be rather crude, it does tend to support the thesis that incidental catch is significant. Based on their data, it is estimated that the incidental catch of halibut in commercial king crab pots for 1974-79 in the Bering Sea and Gulf of Alaska west of Cape Spencer was equal to about 25% of the total catch taken by the commercial halibut fishery in these areas. It is emphasized that in order to have accurate estimates of the incidental catch of halibut in king crab pots, catch data is needed from the commercial fishery.

2. Direct stress to marine mammals and birds

Sea otters may take any size king crab including legal-sized crab. The frequency and significance of such predation is unknown. There is the potential for conflicts between fishermen and sea otters when crab pots are set in relatively shallow water near shore where sea otters feed. Sea otter mortality due to drowning in crab pots is rare, but it is a possible occurrence where sea otters and crab fishing areas overlap.

King crab harvesting operations may cause marine birds, including those protected by the Migratory Bird Treaty Act, to avoid areas that they might otherwise frequent. Fishing activity may disrupt normal feeding and migratory behavior in these areas. Such displacement of these birds does not appear to be a prohibited taking for purposes of the Migratory Bird Treaty Act, but its long-term effect on them should be the subject of further study.

3. Environmental pollution resulting from the dumping into the sea by catcher-processor fishing vessels and by shore-based processing facilities of crab processing and other wastes

Commercial king crab operations in the Bering Sea and Aleutian Islands have resulted in the discharge into the environment of a variety of solid and liquid wastes. Because some of the vessels engaged in this fishery have processing capability, crab processing wastes are routinely discharged. Since these wastes are composed primarily of the discarded remains of harvested crab, they are not believed to be harmful to the ecosystem and, in fact, provide nutrients for the food web, although their amount is so small in comparison to the ecosystem of the region as a whole that the net effect of their discharge is probably negligible. Sewage and other organic wastes are also discharged in the course of commercial king crab operations, also in amounts that are believed to be too small to significantly affect the ecosystem. However, dead loss and dumping of crab are local problems in ports such as Dutch Harbor

where a high volume of crab is delivered during short periods when processing capacity is over taxed. Crabs are highly sensitive to water quality and the passage of a live tank boat through an area of poor water quality or of low salinity will cause heavy mortality of the crabs held in the live tanks of the fishing boat. It is not known how pollution affects king crab.

Properly conducted, king crab operations should not result in the discharge of toxic wastes into the environment. One constant hazard of commercial fishing, as of any other modern seaborne operation, is the discharge of petroleum products used as fuel as a result of accidents. While such discharges would not approach the magnitude of the massive oil spills that result from the wreck of an oil tanker, they can and have had significant short-term environmental effects when they occur near the coastline. Responsibility for avoiding and remedying such discharges and the accidents that lead to them is vested by law in the United States Coast Guard and the Environmental Protection Agency.

4. Crab pots as a navigational hazard

Crab pots which are stored or fishing present a navigational hazard. Pot storage areas are designated Statewide in waters generally less than 25 fathoms. In addition, a large Bering Sea pot storage area in water deeper than 25 fathoms is currently in effect.

Periodic reports of navigation problems caused by crab gear appear in the news media. Preemption of shrimp fishing grounds by crab gear has also been reported. An accurate estimate of the magnitude of these problems or their frequency cannot be made on the basis of current data.

5. Stress to biota caused by lost gear

Lost gear which continues to fish could have an adverse impact on the king crab resource and other marine resources. Crab will continue to enter a pot as long as bait exists. In addition to the normal fish bait used commercially, crabs that become trapped and subsequently die become a form of bait which will draw more animals into the pot. However, this adverse impact should be reduced since biodegradable escape panels are presently required by the State on all king crab pots.

6. Damage to benthic organisms due to gear placement

The impact of thousands of king crab pots on benthic communities is unknown. The impact on king crab populations may be significant when many pots are placed in areas of dense crab schools. The collection of juvenile and female king crab may increase during these situations placing additional stress, injury and mortality upon the population. Other benthic communities (algae, bacteria, crustaceans, annelids, etc.) may also suffer. The above impacts need to be studied.

7. Handling mortality

The actual extent of mortality caused by catching and the subsequent sorting and return to the sea of small male and female crab is unknown. The impact on king crab populations may be significant during periods of increased fishing intensity. The effects of stress and injury on the crabs ability to avoid predation, resist disease, and reproduce, require study.

C. Irreversible Or Irretrievable Commitments Of Resources Which Would Be Involved If Commercial King Crab Operations Are Permitted In The Bering Sea And Aleutian Islands

The proposed action requires considerable cooperation among the agencies responsible for management and enforcement in the territorial sea and fishery conservation zone waters to insure that the management measures are reviewed and implemented. There will be no irretrievable or irreversible commitment of resources if this action is implemented. No irreversible commitment of financial resources is required by the proposed action, although recommendations have been made for further research. Short-term irretrievable commitments of funds for monitoring the fisheries will be necessary by the State of Alaska and the Federal Government.

D. Relationships Between Short-Term Uses Of Marine Resources Which Are Involved In Commercial King Crab Operations And The Maintenance Of The Long-Term Productivity Of The Natural Environment Of The Bering Sea And Aleutian Islands.

The objectives of the fishery management plan require the determination of a harvest level that will ensure the continuing viability of the stocks to support a high annual harvest. Annual variations in recruitment and availability of crabs require a flexible system to review the status of stocks, and catch per unit of effort in order to achieve the optimum yield from the stock over the long-term. Commercial king crab operations that are under active consideration for authorization under an FMP are not expected to significantly affect the long-term productivity of the environment of the Bering Sea. Even if an FMP is not immediately implemented, the Council would be obliged to review the fishery periodically to determine that its long-term productivity is being maintained.

E. Relationships Between The Proposed Action And The Objectives of Federal, Regional, State and Local Governments' Plans And Policies For The Affected Area.

1. Coastal Zone Management Act

According to the requirements of the Coastal Zone Management Act of 1972 (CZMA), the State of Alaska submitted a Coastal Management Program and an Environmental Impact Statement which were approved by the NOAA Assistant Administrator for Coastal Zone Management in July 1979. CZMA Section 307 states that all major federal actions shall be made consistent to the maximum extent practicable with the State's approved coastal management program. A determination of the

consistency of the FMP with the Alaska Coastal Management Program has been submitted to and concurred on by the Alaska Office of Coastal Management pursuant to this requirement.

2. State of Alaska Board of Fisheries

The Alaska Board of Fisheries is responsible for the management and regulation of the fisheries of Alaska. The role of the Board of Fisheries in the management of the king crab fishery is discussed in Section 7.2 in the Appendices of the fishery management plan. The FMP has incorporated a review of the historic and current management strategy of the Board and provides a coordinated management process based on a cooperative policy whereby the biological assessments and public input would be reviewed simultaneously by both the Council and Board. In addition, the FMP proposes the use of a single federal "turnover" regulation which will delegate management authority to the State in order to avoid unnecessary duplication.

3. Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972 established a moratorium on the taking, harassing or killing of marine mammals except under permits issued by NMFS or the Fish and Wildlife Service.

4. Endangered Species Act

According to the requirements of the Endangered Species Act, the Council has determined that implementation of the FMP is not an action that may affect endangered species or their habitat.

F. Consultation And Coordination With Others

The king crab fishery management plan drafting team consulted extensively with representatives of the Alaska Department of Fish and Game, National Marine Fisheries Service, members of the Scientific and Statistical Committee of the North Pacific Fishery Management Council, and members of the academic and industrial community.

CHAPTER VI

PUBLIC COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND FISHERY MANAGEMENT PLAN

During the public comment period (January 22, 1982 to March 8, 1982) on the Draft Environmental Impact Statement, 223 written comments were sent in to the Council, with 217 of these comments submitted by one fishermen's organization. This chapter summarizes the comments made by members of the public and government agencies. The comments and the responses are organized by the seven commentors.

A. U.S. Department of the Interior

Comment

If our knowledge of post settling larvae/early juvenile biology is deficient, then the EIS should address the kind of investigative program needed to provide the data base necessary to assess the importance of the coastal/ inshore environment to the survival of juvenile king crab.

Response

Most of the Eastern Bering Sea shelf waters support developing juveniles with the region north of the Alaska Peninsula being important for young red king crab. King crab typically spawn during the spring with female king crabs carrying their eggs until they are hatched. The pelagic stage of the king crab is relatively short, lasting about 10 weeks, before developing into the juvenile stage at the sea bottom. During the first year of life juvenile king crab are found in shallow waters along the continental shelf with crab typically inhabiting the littoral zone of exposed coastal areas. Later with advancing age, juveniles form pods in in-shore waters from low tide to as deep as 30 meters. The shortness of the pelagic larval stage coupled with a possible counter-clockwise current system of the Southeastern Bering Sea may explain the apparent confinement of most juvenile king crab in this portion of the Bering Sea (Pereyra, Reeves and Bakkala, 1976). The general circulation in the Southeastern Bering Sea is cyclonic with water movement eastward along the north side of the Alaska Peninsula and then north and northwesterly (Takenouti and Ohtani, 1974). Haynes (1974) found a shift of king crab larvae with each increasing stage of development from spawning sites off the Peninsula eastward toward Bristol Bay. Hebard (1959) indicated a probable counter-clockwise circulation for the Southeastern Bering Sea. Therefore, coastal waters appear important to the survival of juvenile king crab. The relationship between current systems, spawning and nursery areas, and the duration of pelagic life of the young king crab in the waters should be the objectives of any future research program.

B. State of Alaska, Division of Policy Development and Planning

Comment

The Office of Coastal Management has reviewed the DEIS and FMP and has concluded that there is no apparent conflict between the proposed management plan and the Alaska Coastal Management Program.

Response

Comment noted.

C. Hilary S.L. Scott (political science student)

Comment

I wish to congratulate the Council for producing a well prepared EIS and FMP. These documents set forth objectives and then offer a choice of alternative management measures which is an approach that is both practical and yet allows for maximum flexibility in the regulatory process. Your plan exemplifies an ideal balance between man and nature into the foreseeable future.

Response

Comment noted and appreciated.

D. Jeff Hiatt (fisherman)

Comment

I am concerned with the expansion of the federal bureaucracy into an area which is healthy and thriving beyond even the wildest expectations. In these troubled times with the President reducing the size and scope of the Federal government, such expansion into the king crab fishery does not make sense.

Response

The impetus for development of this FMP under circumstances where the State has been managing the fishery in a highly professional manner was principally a response to some fishermen, who primarily fish in the BS/AI area, who expressed concern that Alaska's regulatory measure might tend to discriminate in favor of local residents at the expense of the non-resident fishing fleet. This plan and Secretarial oversight will guarantee against any discriminatory action against these fishermen. In light of the President's desire to improve the government and reduce federal spending, the proposed plan is designed to maximize efficiency in management, reduce paperwork and be less costly to the taxpayer.

E. U.S. Environmental Protection Agency

Comment

We have reviewed the DEIS and FMP and have rated this statement LO-1 (Lack of objections; Adequate information).

Response

Comment noted.

F. Rural Alaska Community Action Program, Inc.

Comment

While the DEIS refers to the importance of king crab subsistence to the diet of people living around the northern portion of the Bering Sea, the EIS fails to discuss what impact an FMP will have on the socioeconomic environment of this area.

Response

The FMP will have little or no impact on the socioeconomic environment of the northern Bering Sea. A commercial king crab fishery will exist in this area regardless of whether a federal plan is implemented. A possible impact of the plan could be the result of Federal commercial fishery restrictions which may enhance the subsistence utilization of this resource.

G. North Pacific Fishing Vessel Owner's Association

(The following responds to comments included in the commentor's submission on the DEIS, as well as those appearing in several previous submissions by this commentor that were incorporated by reference therein.)

Comment #1

The current version of the FMP (November 1981) makes storage of king crab gear on land mandatory, while previous versions merely required that it be removed from the fishing grounds and stored in a non-fishing condition.

Response

While the FMP now includes a presumption in favor of land storage, it authorizes storage in ice-free water of low crab abundance if this is justified in light of specified factors, and if the gear is stored in non-fishing condition.

Comment #2

The current version of the FMP (November 1981) authorizes the use of pots and ring nets, while earlier versions allowed consideration of other types of gear.

Response

King crab pots and ring nets are the most efficient and popular type of gear for commercial crab fishing and thus are authorized for use in the FMP. An advantage is that these gear types are selective since non-legal crab (i.e. female and undersized male crab) may be returned to the sea unharmed. Also this management measure specifically prohibits the use of trawls and tangle nets because they inflict high mortality rates on non-legal crabs and other organisms. It is unlikely that a new type of gear will be considered by the commercial king crab fishery in the near future. However, if a new design is developed which maintains or surpasses the advantages of pots and ring nets while still keeping mortality rates low on non-legal crab, the Council may, following review, wish to amend the plan.

Comment #3

The current version of the FMP does not, like earlier versions, include costs to the industry as a criterion for determining gear placement regulations.

Response

We have made appropriate changes to the FMP.

Comment #4

The desirability of discouraging king crab fishing in bad weather has become a consideration in setting seasons. Earlier versions of the FMP merely made weather conditions a factor and stated that bad weather "will particularly disadvantage operators of small vessels."

Response

Both the reviewed November draft FMP and the Final FMP list weather conditions as a factor to be considered in setting fishing seasons. In reference to the weather's effects on small vessel operations, revisions to the text now read, "...schedule the season to minimize the period of severe weather conditions during the fishery to avoid loss of fishing time and losses of men and ships..." since adverse weather affects vessels of all sizes.

Comment #5

The current version of the FMP (November 1981) states that there are at least four factors to be weighed in setting fishing seasons, while previous versions enumerated five factors.

Response

Portion of the FMP in question has been modified by subsequent revisions. Seven factors are now set forth.

Comment #6

The current version of the FMP (November 1981) does not list all the criteria included in previous versions for allowing a harvest of females.

Response

We have made appropriate changes to the FMP.

Comment #7

The current version of the FMP (November 1981) does not specify who must report catch data, while previous versions required the buyer or catcher-processor to make such reports.

Response

Revisions to the text provide that current State reporting requirements are essential to the effectiveness of the FMP. A list of the minimum information

required is also provided. Because it will be included in implementing regulations, there is no need to provide additional detail in the FMP.

Comment #8

The DEIS violates 40 C.F.R. 1500.1(b) because it does not provide high quality information to public officials and citizens before decisions are made and actions taken.

Response

In light of the general lack of scientific information about the Bering Sea and Aleutians, and about king crab, the quality of the information set forth in the EIS is high. No final decision or action on the FMP will be taken by NOAA until review of the FMP, the EIS, and implementing rules is complete.

Comment #9

The DEIS violates 40 C.F.R. 1502.2(g) because it merely justifies a decision already made by the Council.

Response

Regardless of what action is taken by the Council (in this case a recommendation in favor of the proposed FMP), the Secretary of Commerce and the National Marine Fisheries Service ultimately make the final decision on approval and implementation of the FMP. The decision of neither the Secretary nor NMFS has been predetermined, and will be made independently of the recommendation of the Council.

Comment #10

The DEIS violates 40 C.F.R. 1502.14 because it does not present environmental impacts in comparative form; devote substantial treatment to each alternative considered in detail; or rigorously explore and objectively evaluate all reasonable alternatives. While preferred alternatives are specified, there is no discussion why these alternatives were selected.

Response

We disagree with all the conclusory assertions of this comment. However, discussions of the reasons for selecting preferred alternatives have been expanded in the FEIS.

Comment #11

The DEIS violates 40 C.F.R. 1502.16(e) because it repeatedly fails to discuss energy requirements and conservation potential of various alternatives and mitigation measures.

Response

We disagree. Energy considerations are discussed where appropriate, changes having been made to the text in response to more specific, less conclusory, comments.

Comment #12

The DEIS violates 40 C.F.R. 1502.22 regarding incomplete or unavailable information.

Response

We disagree. The existence of gaps in relevant scientific knowledge is repeatedly noted throughout the EIS.

Comment #13

The DEIS violates 40 C.F.R. 1502.24 because it fails to identify any methodologies used and to make explicit reference by footnote to the scientific and other sources relied on for its conclusions.

Response

The EIS relies on no unfamiliar "methodology" in its assessment of environmental impacts. It sets forth in a straightforward manner the impacts that can be expected under each of the described alternatives. Where conclusions are based on written sources, those sources are cited. Many conclusions of the EIS are based upon personal knowledge and experience of those who participated in its preparation and that of the FMP. In such cases, it is not possible to cite an individual source.

Comment #14

The DEIS violates 40 C.F.R. 1502.9 because the Council did not make every effort to disclose and discuss at appropriate points all major points of view on the environmental impacts of the alternatives, including the proposed action.

Response

We disagree with this comment. To the extent that, despite our best efforts, we omitted expressions of opposing points of view in the DEIS, we have remedied this in accordance with 40 CFR 1502.9(b) by including this summary of comments and responses in the FEIS.

Comment #15

Due to the controversial nature of the proposed action, public hearings on the DEIS should have been held.

Response

The FMP and its impacts have been the subject of a plethora of public hearings and meetings and public comment opportunities, in all of which the commenter has expressed its views at length. Additional hearings on the DEIS would have been a waste of the public's time and money.

Comment #16

The DEIS falsely indicates that non-resident fishing vessels fishing in the FCZ are subject to the State of Alaska's management authority because they have State of Alaska commercial fishery licenses and interim use permits and are therefore considered by the State of Alaska to be "registered" under its laws. Under Magnuson Act Section 306(a), a State may regulate only vessels belonging to its citizens outside of its own waters. Thus, in the absence of an FMP, most vessels in the western Alaska king crab fishery would be unregulated.

Response

There is nothing in the Magnuson Act that supports the commenter's view that a State may "register" under its laws only vessels that are owned by its residents. NOAA considers this view to be incorrect, and believes that the right of a state to require registration of a vessel under its laws depends on the relationship between that vessel's activities and the legitimate interests of the state, rather than on the citizenship of the vessel's owners.

Comment #17

Alternative 2 on the need for an FMP should discuss the Federal/State cooperation and review that would take place under it.

Response

This is described in Section 6.0 of the FMP, which is incorporated in the EIS.

Comment #18

The DEIS fails to indicate why Alternative 2 on the need for an FMP was selected over the others. If the reasons are in the FMP, the DEIS should reference the relevant portions of the FMP.

Response

The reasons for selecting this as the preferred alternative are contained in Sections 1.0 and 6.0 of the FMP.

Comment #19

The DEIS fails to discuss why the western Gulf of Alaska was excluded from the FMP. A strong socioeconomic nexus requires that the major king crab fisheries be covered by the FMP. If the Tanner crab FMP covered all the waters off Alaska, why cannot this FMP?

Response

When defining the fishery management unit for this FMP, the Council based its decision on a variety of factors. The two most important factors are as follows:

(1) The available scientific evidence shows that the king crab stocks of the BS/AI area are biologically discrete from those of the Gulf of Alaska.

(2) The character of the BS/AI king crab fishery is quite different from that of the Gulf of Alaska king crab fishery. Unlike the Tanner crab fishery which has just recently developed, commercial fishing for king crab which occurs both in inshore and offshore waters, began off Alaska in the Gulf during the late-1920's. Fishing for king crab in the BS/AI area did not begin until the late-1940's. Both fisheries developed independently of one another with respect to vessel size and requirements, processing needs, reliance on a single as opposed to a multiple species fishery, and the nature and extent of community infrastructures that are supported by fishing and related activities. The assessment of the socioeconomic costs of Federal management will thus differ considerably between the BS/AI king crab fishery and the fisheries of the Gulf of Alaska. While an FMP may eventually be adopted for implementation of an FMP for the BS/AI area should not be delayed for the significant period that would be required to assess the costs and benefits of Federal management in the Gulf, an assessment that may well draw upon experience under the BS/AI FMP.

(3) The impetus for development of this FMP under the current circumstances, in which state agencies are considered by the Council to have managed the BS/AI fishery in a highly professional manner for the last two decades, was provided by some fishermen, represented by the commenter, who fish in the BS/AI area but do not reside in Alaska. They urged that federal management be extended to cover their operations in order that they might obtain certain advantages that they believed would ensue from such management. Because they do not reside in Alaska, they believe that Federal management protects them from discriminatory treatment by the Board and ADF&G. In the absence of their strong expressions of concern about this, it is likely that the Council would have found the fishery in the BS/AI area not to require Federal conservation and management, and that it would not have prepared any FMP at all. On the other hand, the great majority of fishermen participating in the king crab fisheries of the Gulf have expressed satisfaction with existing state management. These fishermen, who are mainly Alaska residents, are adamant in their desire to avoid federal intervention, which they perceive as an unknown, and therefore an uncertain and possibly destabilizing factor. These conditions do not exist in the Tanner crab fishery where the majority of the catch is harvested from federal waters and, until recently, included foreign participation. The Council carefully considered the option of extending the FMP to king crab fisheries of the Gulf of Alaska. The Council decided to limit the scope of the plan since to do so would have no adverse effect on the conservation and management of the stocks, while it would substantially satisfy the basic requirements of the respective users of the BS/AI and Gulf fisheries.

Comment #20

The DEIS should discuss how a minimum size limit would be set under season and size limit management. Would it be based on biological considerations, economics, or both.

Response

Because this alternative is not the preferred one discussed in the FMP, the factors that would be considered in setting minimum size limits under it are

largely speculative. They would probably include both biological and economic factors similar to those used in setting the minimum size limit under the preferred management alternative (described at FMP Section 4.1).

Comment #21

The DEIS should discuss the energy (fuel) costs imposed on the fleet by season and size limit management.

Response

By maximizing the physical yield of the fishery, this management alternative could increase fuel costs. This has been noted in the FEIS.

Comment #22

The DEIS should discuss how management and enforcement costs would be reduced if the fishery were to continue year-round.

Response

A year-round fishery would eliminate the management costs associated with the promulgation and modification of season opening and closing dates. It would eliminate the enforcement costs arising from efforts to ensure that fishing does not begin before relevant opening dates and after relevant closing dates. However, considering the biology of the king crab, it would not be wise to have a year-round fishery. Season closures have been found necessary to protect the resource.

Comment #23

The DEIS should mention studies that may indicate that a loss in reproductive potential occurs when older crab are removed.

Response

There currently exists an unfortunate lack of knowledge of king crab biology, environmental requirements and behavior. In-depth research in these areas has only recently been initiated and until more information is gathered, many biological assumptions must be made. Many of the assumptions are based on scientific observations of other species. Where sufficient biological information is lacking, as with king crab reproduction, the Council must rely on the collective judgement of its scientific advisors. In this instance, it is believed by these advisors that larger and older crab do have an important role in king crab reproduction. There is however some evidence that indicates that young male crab may suffice as brood stock if large males are harvested by fishermen (Powell and Nickerson, 1965).

Comment #24

The DEIS should identify the displacements of migratory birds, dangers to navigation, and types of environmental pollution to which it refers.

Response

Alaska contains over 110,000 square miles of waterfowl breeding habitat, plus several thousand square miles of habitat used mainly as feeding, resting and staging areas. In addition, half a million square miles of open seas are used by seabirds during most of the year (Alaska Department of Fish and Game, 1973). Both of these estimates are considered conservative and include most of the area within the fishery management unit. Most of these birds are associated with nearby land, with large populations found along the Aleutian and Pribilof Islands, the Alaska Peninsula and the western mainland. With many species known to be migratory, there exists some possibility that commercial fishing activity may disrupt normal pathways, nesting sites, and feeding grounds. There currently exist no data on bird/ crab fishery operations and the EIS recommends further study in this area.

Navigational problems exist in areas where crab fishing occurs due to the difficulty in detection of crab fishing gear by other vessels. Crab pots are marked by colored buoys but during periods of poor weather and visibility, and in areas where crab pots are concentrated, navigating a safe passage through these areas is difficult.

Environmental pollution is defined in the EIS as all discharge into the environment of solid and liquid wastes. Processing wastes, organic sewage discharge, and petroleum discharges are all described with their potential impacts in the EIS.

Comment #25

The DEIS should discuss whether the State's system of multiple age class management has worked, referring to studies that prove or disprove this management strategy. The 1981 collapse of the Bristol Bay fishery seems inconsistent with the goal of avoiding boom and bust fisheries.

Response

The multiple age goal can be shown to have prevented recruit dependent fisheries which automatically insures some minimizing of the magnitude of fluctuations that would be expected otherwise. The fact that large numbers of post recruits have been carried over is apparent from Table 2 of the Bristol Bay section of the 1982 Westward Shellfish Board of Fisheries Report; other management areas show similar situations.

The State's multiple age system has not been practiced so conservatively in Bristol Bay. Many pressures have lead to liberalization of exploitation rates. Also, the only measure of what exploitation rate has been achieved is commercial fisheries catch and effort compared with the trawl survey. In most other management areas there is another check on exploitation rates through intensive tag and recapture programs. The few tagging programs in Bristol Bay, conducted jointly by ADF&G and NMFS, have been inadequate to determine fishing mortality. One can say that exploitation rates in Bristol Bay increased during the 79-80 and 80-81 seasons while recruitment was beginning to decline. No one anticipated just how precipitious the decline actually would be or the size limit could have been flexed upwards to take more advantage of the abundant post recruits which would have dampened the decline by reducing the catch more slowly. Since there have been no reproductive

problems as yet in the Bristol Bay red king crab fishery, one can surmise that there is no management strategy which would have prevented the decline in view of the successive lower recruitment.

Comment #26

The DEIS should discuss how exploitation rates and size limits would be set under spawning stock management. Are biological criteria, economic factors, or both, used?

Response

In areas where data is limited and spawner-recruitment relationships cannot be determined, the size limit used in the management regulations will always be the minimum required biological size, thereby protecting the crab stock.

For areas where spawner-recruitment relationships can be established, possible size limits (above the minimum required biological size) may be combined with various exploitation rates to produce a variety of possible harvesting strategies which still protect the reproductive potential of the stocks. The eventual harvest strategy that is chosen will be based on social, economic, or ecological factors.

Comment #27

The DEIS should discuss how the .4 exploitation rate and 6.5-7 inch size limit were selected for stocks at low levels or for which data are lacking; what other exploitation rates and size limits were examined; and why these other exploitation rates and size limits were discarded.

Response

Since exploitation rates and size limits will be based on population size and recruitment levels, and that the exploitation rate and size limit may vary between stocks and areas, reference to a .4 exploitation rate and 6.5-7 inch size limit have not been included in the FMP. However, the rate and size limit mentioned is the current combination used on these stocks. The basis for this approach is that in the Bristol Bay area where the data base is strongest there are still many unanswered questions regarding natural mortality, fishing mortality and population estimation precision. In the Aleutians the data base is extremely limited and more complex in a management sense due to the number of individual stocks, discontinuous habitat, at times extremely patchy distribution, and some history of sublegal crabs (one to two years away from legal size) not recruiting in expected numbers. In Bristol Bay the modelling efforts indicate we can be more liberal with size limits and exploitation rates but few have supported (scientific or fishing community) running the maximum test of what stress the stocks can take biologically or what the fishing community can adjust to economically. The liberalization will come from further information on the spawner-recruit relationship, more experience with the survey precision on low stocks and more data on factors influencing mortality in addition to clear direction from the fishing industry on quality or type of fishing desired. Unfortunately the economic questions are just as difficult for industry as the biological questions are for biologists. Neither the North Pacific Fishery Management Council or the Board of Fisheries want to dictate the strategy to the industry as long as it is within acceptable limits.

Comment #28

The DEIS should explain in a less confusing way how OY is set under spawning stock management.

Response

Section 4.1 of the FMP, which deals with this subject, has been redrafted to clarify the standards for setting OY.

Comment #29

The DEIS fails totally to discuss a study prepared by National Resources Consultants (NRC) and submitted by the commentor to the Council on November 4, 1980. This study states that a minimum size limit of 6.25 inches and an exploitation rate of at least .6 in the Bering Sea would substantially increase the yield per exploitable biomass; provide an adequate number of males to maintain a high reproductive potential; increase average catch per unit of effort; reduce sorting mortality; decrease energy demands (fuel costs); and minimize population fluctuation by including a broader spectrum of year classes in the fishery, thus increasing the stability of harvests.

Response

The FEIS has been modified to include reference to the NRC study. This study indicated that a 6.25 inch size limit and exploitation rate of .6 was within assumed safe biological limits. In 1980 the fishing mortality in Bristol Bay was 0.6. In 1981, 0.6 wasn't even achievable economically as the fishery nearly closed itself. Lowering the size limit in either season may not have substantially altered fishing success or catch and certainly would have decreased the cushion we now have should recruitment continue to remain low. Anticipating that the 1982 population estimate will be low, then perhaps the strategy that might have dampened the severity and abruptness of the decline might have been to inflict a .6 or higher fishing mortality in 1980 at 7 inches, the same in 1981 at 6.5 inches and .6 or less in 1982 at 6.25 inches. These strategies are always considered when determining OY. See also the response to comment #135.

Comment #30

The DEIS should have referred in its discussion of multiple age class management to the NRC study's discussion of ways in which the State of Alaska regulatory system inhibits the potential productivity of the king crab fleet in the Bering Sea and Kodiak areas.

Response

We agree that this approach to management will likely inhibit productivity. With this approach, increases in fuel costs and the possible decrease in potential annual harvest is the price paid for stability in the fishery.

Comment #31

The DEIS should state why OY Alternative 3 was selected.

Response

A statement of reasons for selecting this alternative has been added to the FEIS.

Comment #32

At low population levels, the exploitation rate, rather than the size limit, should be altered to protect the stocks' reproductive potential. The size limit should be 6.25 inches, and the instantaneous exploitation rate should be no less than .6. This is based on the NRC study.

Response

This is one method of protecting the reproductive potential of the stock. Another method would be to maintain the size limit (example: 6.5 inches) and reduce the exploitation rate (example: less than .6). This is currently the method used by the State.

Comment #33

The DEIS and FMP should mention that OY Alternative 1 (size and season management), with its longer season and no quotas, would probably entice new vessels into the fishery.

Response

We agree. This point and others have been added to the FEIS. Another disadvantage of this alternative is the liklihood of the old fisherman's/ processor's mentality "I've gotta fish if he's gonna fish." Such an attitude could increase both biological and environmental impacts.

Comment #34

The State of Alaska's 6.5 inch limit is based on the erroneous view that total yield from each year class is maximized by not allowing any fishing on that year class until it approaches its maximum biomass. In fact, maximizing yield from a cohort generally requires that fishing be initiated on a year class substantially before the year class maximizes its biomass. As a result, substantial potential yields are currently foregone in the Bering Sea and Kodiak areas. At the 6.5 inch size limit, great increases in harvest rates would be necessary to maximize yield per recruit. The current situation, which would be perpetuated under OY Alternative 2, is inconsistent with the FMP objective of full use of the resource by domestic fishermen.

Response

Much of the agreement about size limits, maximum biomass and yield per recruit is still theoretical or at least very much dependent on the precision of the growth, skipmolting and natural mortality data. There is some statistical inaccuracy in all these estimates as well as annual variation. The point that maximum yield is obtained at a precise size must be qualified in terms of precision of the data. Ideally you would want to harvest at a given age, not size, but the data on size/age/growth has enough inherent variability (both natural and man-made observational bias) that optimum size is debatable within a ½-inch range. Ideally size limits and exploitation rates would be set

annually according to growth and recruitment patterns; however, we are dealing with an imprecise science and probably should be reasonably cautious about applying all maximum theoretical or inprecise data to its fullest at one time.

Comment #35

As stated in the NRC study, the value of a size limit greater than 6 inches and of a relatively low exploitation rate is questionable, because male king crabs are polygamous; there seems to be an excess of mature males over females in the exploited population; spawner-recruit data indicates that large recruitment comes from medium or low population sizes; and different mortality rates between the sexes produce a natural surplus of males.

Response

Whether small, sexually mature crab are actually interested and participating in mating, let alone are they polygamous, is still in question. Sexual maturity does not necessarily correspond with sexual activity. The question of males outnumbering females at sexual maturity is a complex one which may be biased by our estimation/sampling techniques. In many areas schools of mature males and females show considerable segregation by size. Moreover, the spawner-recruit data is extremely limited in terms of number of observations considering the life span of king crabs. Right now too few data points are available to firmly establish spawner-recruit relationships, and managers are having difficulty estimating abundance of just legal males. Another point that applies to several other comments is that Bristol Bay seems to be manageable as one unit (population), with crabs intermingling freely. This is not the case in the Aleutians where several different stocks occur often differing in abundance and age composition. As a result, these stocks may receive different rates of exploitation.

Comment #36

A suggestion under OY Alternative 2 of a second fishing period to increase mortality on larger, older crabs raises biological concerns. Larger size limits cause increases in handling mortality and, from a yield per recruit standpoint, crabs can be used more efficiently by applying a single harvest rate each season with smaller size limits.

Response

Currently there is no study which indicates that handling mortality is a significant factor in the overall mortality of king crabs. Some of the same comments in #25 apply here. Both a larger or smaller size limit might have prevented the severity of the Bering Sea decline between 1980 and 1981 had it been known which population estimate was correct. All of these OY alternatives have been discussed with the Council and the Board of Fisheries. Very little public testimony favoring a change to a single harvest rate and smaller size limit was received, especially from processors.

Other concerns exist regarding price/size relationships and whether or not sublegal male crabs are capable of handling the reproductive burden. While studies by ADF&G are excellent, there are still large gaps in the data base. The only certain conclusion is that biological risks increase with decreasing size limits. Size preferences and/or requirements in mating pairs has been

demonstrated and it remains to be determined if small males will successfully mate with a larger female partner in the absence of large males.

Comment #37

Because high size limits require greater effort in order to maximize potential yield, they require greater consumption of fuel by the fleet. Fuel requirements per unit of effort increase while average catch per unit of effort decreases.

Response

This has been noted in the FEIS.

Comment #38

A "framework" FMP should not incorporate the State of Alaska's current seasons, size limits, and exploitation rates in detail, because changes to them would require an amendment to the FMP, rather than relatively simple changes in regulations.

Response

We agree. The FMP has been changed to eliminate detailed references to current State regulations, except where it is intended that a specific standard apply for the long-term.

Comment #39

The DEIS should discuss how the primary objectives of fishing seasons Alternative 1 (provide fishing seasons) would be met. It should also discuss why this alternative is preferred.

Response

The discussion of these matters contained in paragrpah III.D.1. of the EIS is sufficient.

Comment #40

In its discussion of fishing seasons Alternative 2 (eliminate fishing seasons), the DEIS should identify the critical period in the crab's life cycle; should discuss the effect of the alternative on the reproductive potential of the stock; and should state the kinds and number of migratory birds that would be displaced, the danger to which they would be subjected, and the extent to which those dangers would be increased by Alternative 2.

Response

The critical periods in the crab's life cycle are the molting and mating periods. Harvest during either of these periods could reduce the reproductive potential of crab stocks by directly interfering with the mating process. See the response to comment #24 concerning migratory birds.

Comment #41

The DEIS should discuss what other benthic populations would be affected by gear reductions Alternative 2 (no gear restrictions).

Response

All benthic populations could be subject to additional stress in the absence of gear restrictions if, for example, trawling were reintroduced as a method of taking king crab.

Comment #42

The DEIS should discuss the economic and fuel costs of gear placement and removal Alternatives 1 (gear on grounds 7 days before and after season) and 2 (no pots on grounds), especially in light of the short period between the close of Tanner crab season and the opening of king crab season. It should also include data on the extent of covert fishing, and explain why this is not elminated by vessel tank inspections.

Response

A discussion of the economic and fuel costs attributed to Alternatives 1 and 2 was not included in the DEIS since they are essentially the same for both alternatives. For example, the cost of transporting crab gear to a storage area will be the same regardless if conducted at the close of a season or seven days following the closure. What is discussed are the advantages and disadvantages of both alternatives. Alternative 1 is preferred since this alternative would prevent vessel congestion at pot loading/unloading facilities and also provide fishermen the opportunity to fish through the last day of the season. In reference to illegal fishing and tank inspections, see the response to comment #45.

Comment #43

The DEIS should identify the enforcement difficulties that would be increased by gear placement and removal Alternative 1, and state whether the costs of enforcement would outweigh the benefits.

Response

The approximate costs of enforcement prior to the season opening would be: air patrols, two six-hour flights at $2,000 per hour; and at-sea patrols by two State enforcement vessels at approximately $4,200 per day and trip lengths of 7 vessel days; the total cost would be about $83,000. The approximate costs for enforcement after the season opening would be to monitor vessels for late deliveries. This would usually require three aircraft patrols for about six hours each, totaling $36,000. It would be up to the Council and Board to determine if the costs outweigh the benefits.

Comment #44

The DEIS should state why gear placement and removal Alternative 1 is preferred.

Response

Alternative 1 is preferred because it maximizes the opportunity of all participants to fish actively through the whole season as long as this will not have adverse biological impacts on king crab stocks. This has been noted in the FEIS.

Comment #45

The DEIS, in its discussion of gear storage Alternative 1 (at-sea storage), should explain how the risk of covert fishing would increase under the Alternative with vessel tank inspections; how environmental impacts would be increased; and what the economic and energy costs would be. It should also discuss why this alternative is preferred.

Response

Tank inspections cannot prevent the "storage" of gear in a fishing condition outside the season, as long as illegally taken crab are not taken aboard until the inspection. This alternative would increase the risk of covert fishing by vessels that either were not subject to tank inspection at the time the fishing took place or had illegally circumvented the inspection requirement. Such covert overfishing tends to increase all the impacts discussed in Chapter V of the EIS. The EIS has been changed to note that requiring the transportation of pots to land or designated at-sea storage areas results in increased costs and energy consumption for the fishermen. This Alternative is preferred because it avoids the even greater costs and energy consumption of an exclusive on-land storage requirement while reducing the enforcement, conservation and navigational problems associated with storage on the fishing grounds, and this is noted in the FEIS.

Comment #46

The DEIS should discuss the economic and energy costs of gear storage Alternative 2 (no gear stored in water), and should also identify data showing impacts on sea otters and benthic communities.

Response

The FEIS notes the high cost of this alternative to fishermen. As mentioned in paragraphs V.B.2 and V.B.6 of the EIS, there is almost no data on the impacts of crab gear deployment on sea otters and benthic communities. That such impacts occur is known through the personal experience and observation of those who have engaged in the management of king crab fisheries.

Comment #47

In its discussion of gear storage Alternative 3 (pot storage on grounds), the DEIS should identify what enforcement costs would be increased and by how much; and the statistics substantiating the statement that hundreds of thousands of pots are being stored.

Response

It would be difficult to estimate the enforcement costs under this alternative since pot storage on the grounds would likely increase gear conflicts with gear types used in other fisheries. Enforcement costs would increase further due to the possibility of pots being stored improperly (i.e. baited and doors closed). A U.S. Coast Guard cutter would cost about $18,000 per day. State enforcement records indicate that there were over 82,000 crab pots in the Southeastern Bering Sea-Dutch Harbor area in 1979. With the reduction in the number of vessels from 236 during the 1979-80 seasons to 177 during the 1981 season, the actual number of pots now being used is likely lower than in 1979. There is no data available on the number of pots being stored, but ADF&G estimates approximately 50,000 pots are stored in the Southeastern Bering Sea. Referral to the number of pots being stored has been corrected in the FEIS.

Comment #48

The DEIS should explain how gear storage Alternative 3 would encourage covert fishing in light of the requirement of tank inspections; and should identify the data substantiating the statement that this alternative risks biological harm and the kind of harm anticipated.

Response

Persons engaging in covert fishing will naturally do so only when they either are not subject to tank inspection, can elude it, or can postpone bringing their illegal catch onboard until after inspection. It is the professional opinion of those who helped prepare the EIS that the environmental impacts described in Chapter V would be exacerbated by such covert fishing.

Comment #49

In its discussion of alternatives concerning vessel tank inspections, the DEIS should explain what useful information is provided to fishery managers by such inspections; the extent of additional costs to vessels caused by inspection; and why Alternative 1 (require tank inspections) is preferred.

Response

This management measure is preferred because managers rely on in-season catch statistics in order to project harvest rates. Vessel tank inspections standardize the fleet registered for a given area by requiring an inspection prior to fishing. This simple procedure improves greatly the quality of the catch data that becomes available during the season. Vessel tank inspections also are useful as a second source of participating vessel information. Registration of fishing vessels for an area often change just prior to a season opening. Tank inspections provide the opportunity to update this information. These reasons for preferring this alternative are noted in the FEIS. The exact extent of the additional cost to fishermen associated with this alternative is not known but is dealt with in more detail in the regulatory impact review of the FMP.

Comment #50

In its discussion of alternatives concerning sex restrictions, the DEIS should identify studies supporting the statements that harvesting only mature males protects reproductivity, that female crabs are smaller, and that increased catches could result in increased environmental pollution. It should also explain why Alternative 2 (allow limited female harvest) is preferred.

Response

Information on the relative sizes of male and female king crab is set forth in Appendix 7.3 of the FMP. Because male king crab are polygamous, it is the professional judgment of those advising the Council and NOAA that a higher proportion of males than of females can be harvested without affecting the reproductive potential of a stock. It should be apparent that increased king crab harvests will tend to increase resulting environmental pollution of the kind discussed in EIS paragraph V.B.3. Alternative 2 is preferred because it leaves open the possibility of expanding the portion of the resource that can be utilized if such use will not reduce the reproductive potential of the affected stocks. This is noted in the FEIS.

Comment #51

In its discussion of registration areas Alternative 1 (authorize exclusive areas), the DEIS should explain how exclusive registration areas protect local fleets, provide stability, and encourage exploration; and how environmental impacts are likely to be mitigated in exclusive areas and exacerbated in nonexclusive areas.

Response

Exclusive registration areas protect local fleets composed of small vessels and provide stability to the areas served by them by preventing fleets made up of large, more mobile vessels from moving into an area and conducting a very short, pulse-type fishery before moving to other areas for the rest of the season. The latter type of operation is considered undesirable by the Council because a more gradual harvest of crab over an extended time probably does less biological harm and is more easily monitored than a pulse-type operation; because pulse fisheries are erratic, coming to an area only when the resource there happens to be particularly abundant, causing short-term strain on nearby facilities, while leaving them underutilized at other times; and because the Council considers the social and economic health of certain fishery dependent communities to outweigh any arguable efficiencies that pulse fishing may introduce, efficiencies that the Council regards as speculative. The Council rejects the view that because most large crab vessels happen to come from outside Alaska while the communities that are most vulnerable to pulse fishing and most small vessels happen to be Alaskan, it is prevented from limiting the activities of large vessels in the interests of the fishery dependent communities. Alaskan and non-Alaskan large vessels are equally affected by such limits.

Because they are less likely to fish in only exclusive areas, it is expected that large vessels will have an incentive to explore unknown fishing grounds in non-exclusive areas. Fishing is likely to be more gradual and smaller in

magnitude in exclusive areas than it would be if those areas were non-exclusive. Therefore, the environmental impacts described in EIS Chapter V are expected to be mitigated in exclusive areas.

Comment #52

The DEIS is misleading in its discussion of registration areas Alternative 2 (no registration system), because it fails to distinguish between the designation of areas for statistical purposes and their designation as exclusive for protection of local fleets. If areas are designated solely for information collection and quota purposes, the failure to make them exclusive will not increase the risk of under- or overharvest. The DEIS should explain why eliminating exclusive areas increases environmental impacts over present levels in Dutch Harbor and Bristol Bay.

Response

We agree that the alternative of having registration areas solely for statistical purposes should be treated separately, and this has been done in the FEIS. As was noted in the preceding response, removal of the exclusive designation of Dutch Harbor and Bristol Bay would probably increase fishing effort in those areas, and thus increase the impacts described in EIS Chapter V.

Comment #53

The DEIS should explain why registration areas Alternative 1 is preferred.

Response

The response to comment #51 describes why this alternative is preferred, and these reasons have also been noted in the FEIS.

Comment #54

The DEIS fails to state whether king crab resources are found mostly in State waters or in the FCZ.

Response

When considering all sizes and both sexes, it is probable, in terms of numbers, that most king crab reside in State waters. In terms of biomass, it would probably be the FCZ. During the mating season the resource tends to move nearer shore, so there are considerable seasonal variations and also differences in where various preferred habitats/environmental zones occur. For these reasons, such a statement was not included in the FEIS.

Comment #55

Is there a predator-prey relationship between Pacific cod and king crab? If so, how will the crab harvest affect cod populations?

Response

It is known that Pacific cod (Gadus macrocephalus) prey on king crab. However, the importance of king crab to the overall diet of cod is unknown. Recent National Marine Fisheries Service trawl surveys have indicated dramatic declines in the BS/AI king crab population during periods when increases in cod have occurred. Many of the cod stomachs sampled in these surveys contained king crab. Whether the harvest of king crab will affect the cod population is not known at this time. Pacific cod would most likely target more heavily on the common prey organisms such as worms, shrimp, herring, and flatfishes, were crab to become less abundant.

Comment #56

How will removal of king crab affect halibut populations?

Response

Pacific halibut (Hippoglossus stenolepis) are found in all areas inhabited by king crab. Halibut are known to feed on crabs, fishes, clams, squids, and other invertebrates. It is not known what percentage of the total diet is composed of king crab. King crab are occasionally found in adult halibut samples. The importance of king crab may be far greater during the juvenile stages when halibut inhabit relatively shallow water with juvenile crab.

Comment #57

The DEIS suggests the potential for conflicts between sea otters and fishermen when pots are set in shallow water. Most crab fishing occurs in deep water.

Response

Generally this is true. Most commercial king crab fishing occurs offshore in deep water. In these areas, sea otter/fishermen interactions are unlikely. However, these interactions are possible along the northcoast of the Aleutian Islands where some crab fishing and storage of gear occurs in nearshore areas and bays. Specifically sea otters are abundant along the entire Aleutian Chain to Kiska Island (Alaska Department of Fish and Game, 1973).

Comment #58

The DEIS should describe the non-Alaskan human populations, such as those of Seattle, that are affected by the FMP.

Response

We agree. Recognition of affected non-Alaskan populations has been added to Chapter IV of the FEIS.

Comment #59

The DEIS should quantify the Native populations of Alaska. In describing the subsistence needs of Natives, it should specify the groups relying on crab for subsistence, the duration of this reliance, the quantity of crab harvested annually for subsistence, and the percent of the Native diet composed of subsistence-caught crab.

Response

Information on these matters beyond that set forth in the DEIS is unnecessary and, to a great extent, non-existent. Some information is available for the Norton Sound-Bering Strait area and may be found in Thomas (1981) and Magdanz (1982).

Comment #60

The DEIS should explain how the bait herring fishery will compete with the subsistence and through-the-ice commercial king crab fisheries.

Response

In the north portion of the Bering Sea, commercial and subsistence herring fisheries occur within waters managed by the State of Alaska. Currently no offshore (FCZ) fishing is allowed. The inshore commercial fishery is primarily for roe with a smaller proportion used for bait. This commercial fishery is managed conservatively with the needs of subsistence users taken into account. No competition is expected between herring and crab fisheries in the area.

Comment #61

The DEIS should expand on its statement that the commercial fishery is a dramatic perturbation on the crab resource and the community of which it is a part.

Response

It should be apparent in light of the other information in the EIS and FMP that the removal of 130 million pounds of king crab from the Southeastern Bering Sea is in itself a notable modification of that environment, even disregarding the effects of that removal.

Comment #62

The DEIS should explain why statistics from a Kodiak crab survey were included when Kodiak is not to be included in the FMP. This inclusion seems to imply that abundances and distributions of fishery resources in Kodiak at the time of the survey are the same as those in the Bering Sea and Aleutians during the crab fisheries. The DEIS should state whether this is true, and provide supporting materials.

Response

The use of biological data collected in the Kodiak area does not imply the need to include Kodiak within the fishery management unit. Due to a general lack of information on king crab as a whole, data from all areas is valuable to a more complete understanding of king crab biology and possible management. Kodiak, and the rest of the Gulf of Alaska are separated from the BS/AI area because of differences in crab populations and the make-up of the fishery itself.

Comment #63

The DEIS should contain additional data to support its claims of halibut mortality in king crab pots, citing ADF&G and IPHC studies. The DEIS states that IPHC extrapolated data from ADF&G summer pot index surveys. It should explain whether these surveys were conducted in Kodiak or the Bering Sea and, if in Kodiak, present the data showing that relevant conditions in Kodiak and the Bering Sea are the same. The IPHC study should be cited in the DEIS. The IPHC estimates for 1974-79 cover both the Bering Sea and the Gulf of Alaska: the DEIS should state the percentages and quantities attributable to the Bering Sea, and explain why it is assumed that incidental catches are the same during the fisheries as during the surveys.

Response

The IPHC extrapolation of ADF&G summer pot index survey data is unpublished and therefore was not cited specifically in the references of the DEIS. It is however, referred to in the text of the FEIS. These surveys were conducted in both the Bering Sea and the Gulf of Alaska and are extremely preliminary. They are a first attempt to generate some possible estimates on halibut incidence and mortality. These are used since no other information presently exists. The weakness in using this data is it may be season and area specific. However, area specific aspects do not decidedly indicate either lower or higher incidence during the fishery.

Comment #64

The DEIS should state how rare sea otter mortality in crab pots is, citing appropriate studies. It should state how probable drowning is, and identify the areas where sea otters and crab fishing overlap.

Response

The EIS describes the potential for conflicts between fishermen and sea otters when crab pots are set in relatively shallow water near shore. The document continues to state how sea otter mortality is rare, but is a possible occurrence where sea otters and crab fishing areas overlap, that is, in relatively shallow water. This is based on observations of both biologists and fishermen, since other data are lacking. See also the response to comment #57.

Comment #65

The DEIS should identify the migratory birds that come into contact with crab fisheries and the areas they frequent; explain how extensive the bird populations in these areas are; and state whether the birds are found in these areas during the crab fisheries.

Response

The term "migratory birds" as used in the EIS, refers to all waterfowl that move from one land mass to another (including ice). It is primarily these birds that directly interact in commercial king crab fisheries. The preparers deemed it unnecessary to specifically list all the species, population estimates, and areas of concentration since data is limited and observations have shown these animals may be found throughout the fishery management unit at most times of the year. See also the response to comment #24.

Comment #66

The DEIS should identify the solid and liquid wastes and sewage and other organic wastes discharged into the environment during crab operations, and the quantities of these wastes.

Response

This has been adequately addressed in EIS paragraph V.B.3. No data exist on quantities of wastes.

Comment #67

The DEIS seems to contradict itself in first stating that crabs are highly sensitive to water quality, but then stating that the effect of pollution on king crab is unknown. It should also identify studies that demonstrate crab sensitivity to water quality or salinity.

Response

It has long been known among biologists that temperatures approaching 50°F (10°C) are associated with increased deadloss as tank holding time increases. Hartsock (1970) indicates king crab begin having respiratory difficulties between 8.5° - 11.5°C. Crowding and the particular live tank characteristics (circulation/dissolved oxygen) are big factors in deadloss especially near the tolerance threshold levels above. It has also been observed that temperatures near 50°F coupled with lower water quality of inner harbors like Kodiak and Dutch Harbor contribute substantially to increased deadloss.

In 1977 the Norton Sound fishery experienced severe deadloss attributed to low salinities and high temperatures. Lechner (1977 INPFC Bering Sea Crab Report) reported 40.9% deadloss during mid-July in a period when salinity of 30% appeared satisfactory.

Comment #68

The DEIS should specify the number and quantity of petroleum discharges from crab vessels and the frequency of those discharges. It should also explain what "significant short-term environmental effects" oil spills can have and have had when they occur near the coastline, citing any relevant data and studies.

Response

Further information on these matters is unnecessary for purposes of the EIS and, to a great extent, is non-existent.

Comment #69

The DEIS should explain how pots are a navigational hazard, giving citation to the periodic news media reports of navigation problems, and stating where these problems have occurred.

Response

Crab pots and buoys that are deployed or stored at sea can damage the propulsion systems of passing vessels that fail to avoid them, and increase the danger of collision among vessels attempting such avoidance. Further detail is not necessary for purposes of the EIS.

Comment #70

The DEIS should identify the studies showing the adverse impacts on crab and other marine resources due to lost pots.

Response

The statement "lost gear which continues to fish could have an adverse impact on the king crab resource and other marine resources," is based on the professional opinion of scientific advisors to the North Pacific Fishery Management Council. There is currently no data on pot impact to the biota. It is assumed that crab pots lost in a fishing condition (i.e. baited and pot doors closed) will continue as efficient crab traps. This gear could continue to fish even with the eventual decomposition of the bait, since the pots probably become "self-baiting" with captured crabs and other fishes. Whether crab pots provide protection from predators is unknown.

Comment #71

The DEIS should explain whether lost pots also offer crabs protection from predators.

Response

See response to comment #70.

Comment #72

The DEIS should refer to the NRC study's conclusion that lower size limits and a higher exploitation rate than are currently used in the Bering Sea would reduce handling mortality, though the extent of such mortality is admittedly unknown.

Response

The EIS states that the actual extent of mortality caused by catching and the subsequent release of crab is unknown. Specific reference to the NRC study was not made since it provides no information on crab mortality in the Bering Sea/Aleutian Islands area. The NRC study does however, suggest that handling mortality would be reduced if lower size limits and higher exploitation rates were used. An obvious biological concern associated with an increased exploitation rate applied to smaller male king crab would be its impact on female fertilization. Further research is needed on this and other possible effects from handling and the EIS makes this clear.

Comment #73

The DEIS discussion of commitments of resources should consider the fuel costs resulting from different gear storage and placement options and minimum size limits and exploitation rates, as noted in the NRC study.

Response

Fuel costs that may be incurred in fishing operations conducted under the FMP would not be rendered "irreversible" or "irretrievable" upon approval and implementation of the FMP itself. Those participating in the fishery will determine at later times whether those costs will, in fact, be incurred.

Comment #74

The DEIS should consider the indication of the NRC study that greater long-term productivity can be obtained with lower minimum size limits and higher exploitation rates than are currently allowed.

Response

As was noted in response to previous comments, the conclusions of the NRC study were carefully considered during preparation of the EIS, but they were not considered so compelling as to warrant special mention in the text. In any event, the "framework" format of the FMP provides flexibility for the raising and lowering of size limits and exploitation rates. See also the response to comment #135.

Comment #75

The DEIS should discuss whether the spawning stock management scheme envisioned for the Bristol Bay area will ensure the long-term productivity of king crab stocks.

Response

This is discussed in Section 4.1 of the FMP.

Comment #76

The DEIS is incorrect in stating that there is a thorough review of the current management strategy of the Board of Fisheries in the FMP.

Response

We disagree. See Appendices 7.2 and 7.5 of the FMP.

Comment #77

Under 40 C.F.R. 1502.16(c), the DEIS must discuss possible conflicts between the proposed action and Federal and State policies and laws. It should, therefore, explain how delegation of Federal king crab regulatory authority to the State of Alaska would conform to the Magnuson Act's mandate of a regional management system giving all fishermen, regardless of residence, an equal voice in the formulation and promulgation of regulations. It should explain

how the Board can be expected to adhere to the provisions of the Magnuson Act when its members must all be Alaska residents appointed by the Governor of Alaska; its constituency consists of Alaskans; and the constitution and laws of Alaska requires the Board to manage in the interest of the State and its citizens.

Response

These matters are explained in FMP, Section 6.0.

Comment #78

In summarizing consultation with others, the DEIS should list the Council's Advisory Panel.

Response

The Advisory Panel to the North Pacific Fishery Management Council consists of representatives of the fishing industry, both catching and processing, subsistence fishermen, consumers, sport fishermen, etc. The Panel was not directly cited since the preparers did not consult with the Panel as a whole. Consultation with Panel members familiar with the BS/AI king crab fishery did occur individually and thereby are included in the reference to members of the industrial community.

Comment #79

The latest publication listed in the "Literature Cited" section of the DEIS was published in 1977, and other items go back more than 37 years. Because FMPs are supposed to be based on the best scientific information available, more recent information should have been used in writing the DEIS.

Response

The works listed in the DEIS bibliography were limited to items dealing with the general characteristics of the king crab resource and fishery, the existing knowledge of which was gained mostly before 1977. The annual catch, effort, and other statistics, on the fisheries covered by the FMP are current through 1981, and are derived from numerous NMFS and ADF&G reports. Citations to some of these have been added to the FEIS bibliography.

Comment #80

None of the literature cited in the DEIS appears to deal with possible environmental impacts of the proposed action.

Response

The EIS and FMP are probably the first published documents that deal with the impacts of king crab fishing on the environment as a whole. In describing these impacts, it relies most heavily on the experience and observations of the scientists who advise the Council, rather than on written sources which are generally lacking. Literature published up to the time of the DEIS and FMP focused almost exclusively on the characteristics and dynamics of the king crab resource and fishery themselves, rather than the impacts of their exploitation on the rest of the environment.

Comment #81

Contrary to the FMP's claim that "it focuses upon a detailed statement of objectives," the objectives appear to be very general.

Response

While the objectives themselves are broadly stated, in accordance with the "framework" nature of the FMP, each is explained in greater detail by the additional text of FMP Section 3.0.

Comment #82

The FMP does not include a detailed study and finding that the State of Alaska regulatory regime is consistent with the FMP, the Magnuson Act, and other Federal law.

Response

Through its adoption of the FMP, with its preference from reliance on State of Alaska management structures, the Council has implicitly expressed satisfaction with existing State regulations. The Council also provided, however, for specific review of this matter by the Regional Director. Upon approval of the FMP, the Regional Director will have to make a formal finding that the State king crab regulations then in effect in the part of the FCZ that is subject to the FMP are consistent with the plan. State regulations that he finds to be inconsistent will not apply to any fishing for king crab in the FCZ. The Regional Director's determination of consistency or inconsistency will be based on an administrative record that will include public comments specifically requested on the consistency question. As in the case of other administrative actions, his determination will have to be supported by this administrative record.

Comment #83

The FMP does not include a determination that the Secretary's authority under the Magnuson Act may be legally delegated.

Response

Once again, such a determination by the Council is implied by its adoption of the FMP. The Assistant Administrator will have to make similar determination before approving the FMP if he decides to do so. The NOAA Office of General Counsel is providing advice to both the Council and the Assistant Administrator concerning the conditions under which the Assistant Administrator may delegate to the State of Alaska his regulatory function under the Magnuson Act.

Comment #84

The FMP does not include an analysis proving that the framework and delegation "are designed to achieve economics in management and to reduce the delay which is normally attendant upon the regulatory process."

Response

The Council's premise in reaching this conclusion is that a fishery like king crab, in which the resource or knowledge about it changes significantly from year to year and even in the course of a season, requires a management system in which measures can be imposed, modified, and removed quite speedily. Because speed of regulatory action is a primary measure of efficiency under such a system, the minimization of Federal regulatory procedure in addition to that provided by the State of Alaska can under this standard reasonably be expected to increase the efficiency of the system by reducing opportunities for administrative delay. This conclusion relies on the additional finding by the Council that the State of Alaska management system is of such high quality and is sufficiently consistent with the requirements of Federal law that minimizing the extent of active Federal regulation will not violate the policies and purposes of the Magnuson Act.

Comment #85

The FMP states that the Board process requires less than six months to effectuate nonemergency regulations. The Federal system should be able to accomplish this if regulations are drafted properly.

Response

It may be true that, under a properly drafted "framework" FMP, regulatory adjustments could be made through Federal rulemaking in periods of time comparable to those taken by the Board process. The preference of the FMP for reliance on the State of Alaska management system is not, however, based solely on an appreciation of the speed with which it acts, but also on the conclusion that its results are of such high quality that a Federal attempt to supplant the State system would be wasteful.

Comment #86

FMP Table 23 shows that the Federal government, including the Council, now pays over two-thirds of the costs of Western Alaska king crab management, research, and enforcement. This seems to weaken the State's investments in king crab management as a basis for delegating regulatory authority to the State.

Response

More than 90 percent of the Federal contribution reflected in Table 23 is for stock assessment in the Bering Sea, which is carried out by the NMFS Northwest and Alaska Fishery Center. A viable king crab management system requires much more than stock assessment, including regulation development, biometrics and data processing, and enforcement. In these latter areas, the current Federal contribution is dwarfed by that of the State of Alaska, which also has sole responsibility for stock assessment in the Aleutians.

Comment #87

The FMP includes much evidence of links between the king crab fisheries of the Bering Sea and Aleutians on the one hand, and of Kodiak on the other. The Westward Region (including Kodiak) produced 98 percent of the State's catch;

there are common markets for their products; and much of the information in the FMP on crab stocks came from research conducted around Kodiak. Many vessels that fished in the Bering Sea during the 1980 season, fished in Kodiak during 1981. These relationships seem to indicate that Kodiak should be under the FMP, as it was in earlier versions. While fishermen resident in Kodiak may not want an FMP, the desires of nonresident fishermen who fish there to have an FMP are equally worthy of consideration. All waters off Alaska were covered by the Tanner crab FMP, and it seems that the king crab FMP could cover the same area.

Response

The Council plainly could reasonably have included the Kodiak area in the management unit covered by the FMP, based upon the inter-relationships mentioned in the comment. The relevant question, however, is whether the exclusion of Kodiak from the management area would also be reasonable. The Council concluded that it would be reasonable, in light of the considerations described in the response to comment #19, above. It should be emphasized that, in accordance with its obligations under the Magnuson Act, the Council must continue to consider the possible addition of Kodiak and other areas off Alaska to the FMP management unit, or the preparation of separate FMPs for these areas. The FMP is so written that it could readily be amended to include additional management areas if those areas were determined to require Federal conservation and management.

The Tanner crab FMP was prepared at a time when the U.S. Tanner crab fishery was at a much earlier stage of development than the U.S. king crab fishery, and there was a resulting possibility of foreign participation in the fishery. In order to ensure its participation in any decisions on such foreign participation, the Council included in the Tanner crab FMP all areas off Alaska where Tanner crab are taken. It should be noted here that the Council's dissatisfaction with the management system under the Tanner crab FMP was a major reason for its desire to incorporate a more flexible approach in the King Crab FMP.

Comment #88

The FMP should explain how conflicts among its secondary objectives are to be resolved if they are all of equal importance.

Response

The resolution of such conflicts will depend on the specific situation to which the objectives are being applied. For example, if a proposed season would have only slight positive effects in "minimizing adverse interactions among fisheries" and "optimizing the cost effectiveness of management and enforcement", but would have serious adverse socioeconomic impacts, the proposed measure would be inconsistent with the FMP as a whole.

Comment #89

The FMP should classify what harvesting and processing systems and community infrastructures it is trying to protect (e.g., those of Dutch Harbor, Kodiak, Seattle).

Response

All such systems and infrastructures that are affected by king crab fisheries in the management area are intended to be protected by the FMP. Outside of Alaska, the affected systems tend to be those related to the harvest of king crab in the management area. Within Alaska, the affected systems tend to be related to processing and ancillary services.

Comment #90

The FMP never identifies with any specificity who the subsistence fishermen are, their populations, and their subsistence needs. Since subsistence harvests take place in State waters, it seems strange that subsistence should be given priority in an FMP covering the FCZ.

Response

Information about subsistence users is provided in Chapter IV of the EIS. While subsistence harvests take place within State waters, king crab harvests in the FCZ can affect the resources available for subsistence use. Also see response to comment #59.

Comment #91

The FMP should identify studies showing that large amounts of halibut are caught in crab pots in the Bering Sea and Aleutians.

Response

The only information available are some incidental halibut catch rates for crab pots in Dutch Harbor and Kodiak areas. These data were obtained from the ADF&G summer pot index surveys. The only conclusion which can be made from these data is that for some areas, there exists a significant incidental catch rate. These surveys are part of a on-going research program which may produce new information in the future.

Comment #92

The FMP should contain analysis showing that the management measures are intended to establish a management regime consistent with the National Standards and other applicable law.

Response

Such an analysis by the Council is, of course, implicit in its adoption of the FMP, but it need not be set out in written form. If he approves the FMP, the Assistant Administrator must make the same findings. Once again, he need not set forth the mental processes underlying his findings in written form--he need only make sure that those findings are reasonably supported by the whole administrative record.

Comment #93

The FMP should explain how the minimum size limits it prescribes were established.

Response

Explanation on how size limits are determined is provided in the FMP, Section 4.1.

Comment #94

The FMP should explain whether Bristol Bay is an area where data are sufficient to determine spawner-recruit relationships; and also how the minimum size is established.

Response

Explanation on the development of a spawner-recruitment relationship for Bristol Bay and the process for establishing size limits for that area is provided in the FMP, Section 4.1.

Comment #95

The FMP should explain what data are needed to determine if spawner-recruit relationships exist for the Adak, Dutch Harbor, and Bering Sea areas; and also whether other size limits were considered before selection of the size at which 50 percent of the male population is sexually mature.

Response

Spawner-recruit relationships do undoubtedly exist for Adak, Dutch Harbor, and the Bering Sea; they have not yet been determined. Determination of these relationships requires additional data on both spawning and recruitment for the king crab stocks in these areas. While other size limits were considered, that which corresponds to the age 3 years after 50 percent of a male age class is sexually mature was considered most likely to promote maximum opportunity for fertilization (allowing each male to spawn at least once) while not imposing excessive limits on the fishery.

Comment #96

In its OY discussion, the FMP should identify the communities and social groups associated with the industry and the resource.

Response

These are sufficiently described in the EIS and the appendices to the FMP.

Comment #97

The OY discussion of the FMP is confusing. For areas where there is a spawner-recruit relationship, environmental and ecological factors are considered in the calculation of ABC. Thus, only social and economic factors should cause OY to deviate from ABC. If ecological factors are not considered in establishing ABC for areas where the spawner-recruit relationship is unknown, then the FMP should clearly indicate that OY for these areas can differ from ABC due to ecological, social, or economic considerations.

Response

The FMP Section 4.1, Determination of Optimum Yield, has been re-written and should be less confusing. ABC is defined as the value based on the biological status of the stocks. Optimum yield represents a modification of ABC based on social, economic or ecological factors. Ecological factors, where they primarily relate to biological purposes, are included in the determination of ABC. Where ecological factors relate to resolving conflicts and accomodating competing uses and values, they are included as appropriate with economic and or social factors. These ABC/OY definitions apply to all areas regardless whether or not spawner-recruitment relationships exist.

Comment #98

The first paragraph of the FMP's fishery seasons discussion states that "at least" four factors are to be considered, but the discussion then specifically sets out five factors, including "recovery rate" along with the other four.

Response

Appropriate changes have been made to the FMP.

Comment #99

If unspecified factors other than the four or five listed can be used in setting seasons, there seem to be no real standards to guide the Board in setting fishery seasons and prevent it from acting in an arbitrary and capricious manner.

Response

The listed factors are all that are recognized at this time and as such, provide direction to the State. The flexible wording in this section was developed to assure that other future factors which become important to the Council are also considered.

Comment #100

The FMP should assign relative weights to the four or five factors for establishment of fishing seasons.

Response

Depending on the specific situation to which they are applied, factors may fluctuate in relative importance. For example, costs associated with industry operations or the timing of the king crab fishing season in relation to other fisheries, may be of less importance during periods when crab deadloss can be extremely high. It would thus be inappropriate to assign rigid priorities to the factors.

Comment #101

The FMP should identify the studies showing that "the recovery rate increases dramatically during the period of rapid growth following molting."

Response

Meat content and recovery rate of king crabs have been studied by Sakuda (1957), Bright, Durham and Knudsen (1960), and Powell and Nickerson (1965). Following molting there is at least a two-month period during which the shell is soft and pliable but also a longer period during which the meat is watery and may occupy one-half or less of the allotted space. The State has set a minimum time required on the average to obtain a reasonable recovery/meat yield condition, but in most cases industry has delayed seasons even further to insure even better yields. However, even seasons starting one month later or more than the minimum State closure has not always insured completely full/high recovery crab. There have been seasons in the Aleutians (example: Adak) where crabs never did completely regain full meat yield between molts. This simply indicates that environmental factors such as food availability, will determine crab condition/meat yield. In addition to the mentioned academic studies, special permits have been issued to processors to explore recovery rates. Their requests have been rare and no renewals were requested.

Comment #102

The FMP should explain how the timing of the season is important in determining price, distribution of floating processors, and ability to meet processors' marketing commitments.

Response

While the language in question has been deleted from the FMP, an expanded section on fishing seasons elaborates more fully some of the effects these measures can have on the economics of king crab and other fisheries.

Comment #103

The FMP should clarify whether the gear placement regulations it prescribes also result from the varying pot carrying capabilities of vessels in the fleet.

Response

The variable pot carrying capacity of fishing vessels was not a significant reason for developing gear placement restrictions as described in the FMP. For this reason, it was not included in the FMP. Of course, vessels having smaller pot carrying capacities would be benefited by the extension of gear placement and removal periods before and after a season.

Comment #104

The FMP should include the statement by ADF&G biologists that there is no evidence indicating that at-sea pot storage has an adverse biological effect on crab.

Response

This statement was not included in the FMP since it could be misinterpreted to mean that at-sea pot storage is biologically safe to crab. The effects of pot storage on crab populations is currently unknown. The FMP authorizes at-sea

pot storage in light of a multitude of factors, one being any known biological impacts. Future research may provide data on the effects of pot storage and the plan's flexibility will allow consideration of this information.

Comment #105

The FMP's gear storage discussion should state that, if at-sea storage is allowed and vessel tank inspections are required, illegal fishing will be eliminated or held to a minimum.

Response

This statement was not included in the FMP because it is not necessarily true. While vessel tank inspections will prevent the illegal loading of crab by requiring all vessels to have their holding tanks inspected prior to the season opening, it does not eliminate the entire problem. Fishermen have been known to "store" their crab gear illegally (i.e. pots equiped with baits and doors closed; or placed in a non-storage area) prior to the season opening. These fishermen, while still obtaining their tank inspection, would have preempted other fishermen by having crab pots already working or by having gear already on the prime fishing grounds. This was the situation as recently as the 1981 season, when 30 citations were issued. The problem would only be compounded by allowing random at-sea pot storage.

Comment #106

Each fisherman on his own should be allowed to choose whether the risks of gear loss and deterioration are outweighed by the benefits of at-sea storage. It is presumptuous of the FMP to state that land storage is "preferred."

Response

Within the BS/AI area, land storage is preferred by the majority of the fishermen because of the elimination of gear loss to weather and other fishery operations. During the winter months up to 80 percent of the crab pots used in both the king and Tanner crab fisheries are stored on land (Ken Griffin, ADF&G; Personal communication).

Comment #107

The September 1980 version of the FMP contained in Table 25 comparing the economic and fuel costs of various types of pot storage (randomly, at-sea, at-sea in specified areas, onshore). This table should be in the current version of the FMP and DEIS.

Response

We feel that there is no longer a need for this table since costs of storage are discussed in Section 4.5 of the FMP. It is recognized that various gear storage regulations do vary in management enforcement and industry costs, and these are all considered in addition to potential biological impacts and gear conflicts when developing regulations.

Comment #108

The FMP gives the false impression that fishermen store their gear in water during the winter. In fact, gear is stored at sea only between the end of the Tanner crab fishery and the beginning of the king crab fishery, often a period of only a few days or weeks. This information seems to be relevant to the balance of the costs and benefits associated with at-sea storage.

Response

See response to comment #106.

Comment #109

The FMP discussion of female harvest should explain what is meant by the "threshold amount used in the spawning stock calculation of OY." It should also identify studies comparing the size and recovery rates of males and females.

Response

Since a detailed discussion of the ABC/OY procedure was already presented in the EIS and FMP, we decided it was unnecessary to repeat the discussion in the Restrictions on Taking Females section. It seems clear that the number of crabs (in pounds) above the threshold amount used in the spawning stock calculation refers to the estimated yields (in pounds) available while maintaining the spawning stock and thereby maximizing recruitment. In reference to recovery rate studies, see response to Comment #101.

Comment #110

The FMP discussion of registration areas should identify the industrial and community investments to be protected, particularly whether they are Alaskan or non-Alaskan.

Response

Exclusive registration areas tend to protect short-range fleets and shore-based processors dependent upon them, which in the case of this fishery are all located in Alaska. See also the response to comment #51.

Comment #111

The FMP should explain why exclusive registration areas are needed to manage the fishery now that area quotas have been instituted. It should state whether exclusive registration has been retained solely to protect small boat, mostly local Alaskan, fleets against competition from large vessels owned primarily by nonresidents. A January 1982 Alaska Fisherman article indicates that the purpose of exclusive area registration is economic protection.

Response

While area catch quotas place a ceiling on the amount to be harvested from each area, they cannot control the rate at which that amount will be harvested. By slowing down the rate of harvest, exclusive registration makes

the harvest easier to monitor and control, and also limits the biological harm which can sometimes result from very quick harvests. The primary purposes of exclusive registration are, however, economic. See the response to Comment #51.

Comment #112

If regulatory authority is delegated to the State, how can the NMFS Regional Director make in-season adjustments, as suggested in the FMP?

Response

Under the FMP, the Regional Director will have authority to issue whatever regulations, including in-season adjustments, he may consider necessary for management of the fishery in addition to the regulations of the State that he has approved. This authority will be particularly important if the Regional Director disapproves a State regulation and is faced with the necessity of filling a resulting regulatory gap.

Comment #113

The FMP should explain whether ADF&G and the NMFS Regional Director will justify in-season adjustments to the public, and whether they will be treated as emergency actions.

Response

Both ADF&G and NMFS in-season adjustments under the FMP will in most cases be implemented on an emergency basis, without prior opportunity for public comment. When this is the case with a NMFS in-season adjustment, a finding will be made that there is good cause for implementing the adjustment immediately, and public comment will be allowed on whether the adjustment should continue in force. Whenever possible, opportunity for prior public comment on proposed NMFS in-season adjustments will be afforded.

Comment #114

The September 1981 version of the FMP listed four circumstances in which in-season adjustments might be necessary, while the November 1981 version lists only three.

Response

This is true. The fourth factor in the older draft was derived from previous FMP's, and addressed the situation in which it might be necessary in a mixed stock fishery to hold down the harvest of a healthy stock in order to prevent excessive harvest of depressed stocks. This mixed stock situation does not appear to arise in the king crab fisheries covered by the FMP.

Comment #115

The FMP should explain who has the authority to suspend or revoke a permit or license, and whether the Secretary can impose sanctions against an Alaska license or ADF&G against a Federal permit. It should also explain the procedures to be followed in imposing permit and license sanctions and identify the laws and regulations in which these are spelled out.

Response

The FMP has been changed to require all vessels fishing in the portion of the FCZ covered by the plan to obtain a Federal permit. Such permits will be subject to modification, suspension, and revocation under the civil procedures prescribed in 50 CFR Part 621.

Comment #116

The FMP should explain to whom catch reports must be made. Under Magnuson Act section 303(a)(5), the FMP must specify that information on estimated domestic processing capacity and actual domestic processing shall be submitted to the Secretary.

Response

Most catch and processing reports under the FMP will probably be made to ADF&G. Data derived from those reports will be submitted by ADF&G to NMFS. This procedure has been followed even under FMP's implemented by detailed Federal regulations, such as those for Tanner crab and Alaska salmon.

Comment #117

The FMP fails to assess and specify domestic harvesting and processing capacities, in violation of Magnuson Act section 303(a)(4).

Response

The FMP has been changed to specify these amounts more clearly.

Comment #118

The State of Alaska advisory committee system, like the Board itself, is an example of the disproportionate participation of Alaskans in the proposed management system. Because there is no comparable forum for nonresident fishermen, the proposed system discriminates against them and is therefore inconsistent with the Magnuson Act.

Response

The safeguards provided for in the FMP, particularly Federal review of any State regulation before it takes effect in the FCZ, is intended to offset any possible bias against non-Alaskans that might otherwise result from such features as the limitation of Board advisory committees to Alaskans. The Council believes that such safeguards provide a method of remedying such undesirable features of the State of Alaska management system without foregoing at the same time that system's many advantages.

Comment #119

The FMP should identify any study showing that Alaska has "exercised effective control over king crab fisheries." It should also state the purposes for which this control has been effective. The NRC study shows that Alaska's management has not been as beneficial to the industry as it could have been.

Response

There is much room for argument whether the State of Alaska could have managed the king crab fisheries even better than it has, and about the nature and extent of its past mistakes in such management. What the Council has concluded is that the State management system, with all its imperfections, is the best that can feasibly be devised for the king crab fishery for the foreseeable future, given the resources at the disposal of the Federal government. What the Council has attempted in the FMP has been to devise a method for taking maximum advantage of the benefits offered by the State system while providing for Federal intervention in case it operates in a manner contrary to the Magnuson Act.

Comment #120

The Board's system for "extensive public input" favors Alaskans over non-Alaskans.

Response

See the response to comment #118.

Comment #121

The FMP should explain how the "Various (Ad Hoc) Public Input To Staff" referred to in Figure 2 differs from public testimony at joint meetings of the Council and Board, and how nonresidents participate in this aspect of the regulatory process.

Response

This "input" consists of oral and written communications by members of the public with the Board's and Council's staff outside the context of formal Board or Council testimony. It has been produced by both Alaskans and non-Alaskans, including the commentor, who maintains regular telephone and written contact with the Board's and Council's staff.

Comment #122

Alaska's investment in management, research, and enforcement for the king crab fishery are dwarfed by those of the Federal Government, as shown on page 88 of the FMP.

Response

See the response to comment #86.

Comment #123

The FMP should explain how nonresidents of Alaska will be informed of Board activities, since Alaska law does not require notification of these events in publications outside Alaska.

Response

Section 6.0 of the FMP requires that proposed State regulations and the reports and data on which they are based be made "readily available" in written form for at least 30 days before the Board takes final action. This would require that copies of the data be made available at appropriate places outside Alaska, and that copies of the regulations and notices of availability be sent to industry representatives like the commentor and to industry publications.

Comment #124

The Board should be required in its written justifications, to show affirmatively that its regulations are consistent with the Magnuson Act and other Federal law.

Response

It would be sufficient if this could be demonstrated through the findings read in light of the record of the Board's action. The burden will naturally be on adverse parties to introduce into the record evidence that a proposal is inconsistent with Federal law.

Comment #125

The Board should be required to set forth in its written justifications data which support its decisions.

Response

This is unnecessary, provided that the finding is so written that the relevant data can be located in the administrative record of the Board's action.

Comment #126

The FMP should explain what constitutes an "emergency" justifying emergency regulations.

Response

The determination of whether such an "emergency" exists is not one that lends itself readily to abstract definitions, and must instead be carried out on a case-by-case basis as a factual determination. Under the Federal Administrative Procedure Act, the determination is actually whether "good cause" exists for waiving normal rulemaking procedures.

Comment #127

The FMP should explain how a decision of the Regional Director is to be appealed to the Secretary; and the extent to which the Secretary's determination would be subject to judicial review.

Response

Assuming that Federal authority under the FMP is delegated to the Regional Director, it is not now anticipated that there would be formal appeal of individual decisions of the Regional Director to higher levels of NOAA or the Department of Commerce. The FMP's proposed implementing regulations provide, however, for reconsideration by the Regional Director of his decisions under the FMP. Recourse of parties dissatisfied by the Regional Director's decision after reconsideration would be directly to judicial review.

Comment #128

The Council should be required to be present when the Board votes on a proposed regulation, and to participate in the discussion leading to the vote.

Response

This requirement is unnecessary. In light of its own incentive to ensure compliance of Board actions with the FMP and Federal law, the Council should be trusted to judge correctly whether its presence at particular Board functions is necessary to achieve this. In case of a non-complying action, even one for which the Council was not present, the Council may request the Regional Director to disapprove the action and replace it with an appropriate Federal measure.

Comment #129

The Board hearing in Seattle is not comparable to the Board's shellfish meeting in Alaska because it fails to afford non-Alaskans the same type of participation in the regulatory process that is afforded to Alaskans at advisory committee and Board meetings.

Response

The Seattle meeting is not intended to substitute for the Board's annual shellfish regulatory meeting as much as it is intended to parallel the local advisory committee meetings that the Board must hold throughout the State of Alaska. At these meetings formal action is rarely taken. The Seattle meeting does afford participants all the opportunities that are afforded Alaskans at these local meetings. Out-of-state participants do have the same opportunity as Alaskans to participate in the annual shellfish meeting itself. It should be noted that, because of the difficulties and costs of travel within Alaska, it is not necessarily less convenient for persons living in Washington State to travel to a Board shellfish meeting in Anchorage than it is for Alaskan participants in the fishery.

Comment #130

The FMP should explain the circumstances under which either the Secretary or the State may withdraw from the "protocol," and the procedures for such withdrawal.

Response

Withdrawal may be "for any reason", and would in all likelihood be by simple notification to the other party. This would be followed by Federal rulemaking procedures for the adoption of Federal implementing regulations.

Comment #131

The legal rights and duties of fishermen under the bastardized management system provided for in the FMP are unclear. The FMP should explain (a) whether fishermen with Federal permits will need State vessel licenses or interim use permits to bring crab into State waters; (b) which judicial forums will be available to fishermen accused of violating regulations under the FMP, and whether this will depend on the kind of permit the fisherman has; (c) who will impose permit sanctions and under what procedures; and (d) whether regulations under the FMP must be challenged judicially within 30 days. The FMP's management system may be legally invalid for failing to define the rights and responsibilities of regulators and regulated.

Response

(a) The issuance of Federal permits under the FMP will not of itself relieve vessels from State permit requirements that do not conflict with Federal regulations and other Federal law. Whether such a conflict exists must be determined on a case-by-case basis.

(b) In most cases, both State and Federal forums will be available for the resolution of conflicts under the FMP, since most regulations will have force under both State and Federal law.

(c) Permit sanctions will be imposed by the Regional Director or Assistant Administrator (subject to appeal to the Administrator) under the procedures prescribed in 50 CFR Part 621.

(d) The Regional Director's approval of State regulations under the FMP would probably have to be challenged within 30 days under Magnuson Act 305(d).

Comment #132

While Alaska law gives subsistence uses a preference, there is no such preference under Federal law. The FMP should explain how this conflict is to be resolved.

Response

There is no conflict, because such a preference is not precluded under Federal law. In each case in which the Board implements such a preference, it will be necessary for the Regional Director to determine in light of all the facts whether the Board's action complies with the National Standards and other Federal law.

Comment #133

The FMP should explain how the State of Alaska's landing laws will affect fishing by nonresidents in the FCZ.

Response

Alaska landing laws may be used to implement State regulations that have been approved by the Regional Director under the FMP with respect to all vessels. They may also be used to enforce State regulations that have not yet been reviewed by the Regional Director against vessels registered under the laws of the State of Alaska.

Comment #134

While the Board is required to hold hearings once a year around the State to assure all Alaskans ready access to the Board, nonresidents are not afforded this kind of access.

Response

This is incorrect. Under the Procedures for Plan Implementation, Section 6.0, the FMP specifically requires a public hearing in the State of Washington to provide all persons and agencies interested in the fishery the same opportunity to comment on the management of the fishery that they would have had at the annual joint Board/Council meeting and at Board hearings in various areas around the State of Alaska.

Comment #135

The Magnuson Act requires that management measures be based on the best scientific information available, but the NRC study, which seems to fit in this category, is not even mentioned.

Response

The NRC study was considered in the preparation of the EIS and FMP. Its various conclusions were not considered sufficiently convincing to warrant specific mention in the text of those documents. Like any other scientific study that has been prepared primarily for purposes of advocacy, the NRC study must be used with great caution. It is not in the same category as the more academic studies cited as authorities in the EIS and FMP; it is more in the nature of a detailed public comment, albeit one prepared by a distinguished expert.

Comment #136

The FMP violates the holding of Washington Trollers Association v. Kreps that an FMP must "provide information sufficient to enable an interested or affected party to comment" on the specification of the fishery's condition, of MSY, and of OY.

Response

We disagree. The FMP sets forth in considerable detail the reasoning that underlies its provisions on these subjects.

Comment #137

The difference between Alaska's ad valorem tax on land-based processors and that on floating processors is another instance of discrimination against nonresidents and a denial of equal protection of the law.

Response

This is a matter lying beyond the scope of the FMP.

Comment #138

The appendices of the FMP should include the Board's policy on king crab resource management, the Joint Statement of Principles, and the Framework. The FMP should mention that regulations for the 1981 fishery were supposedly promulgated in accordance with these documents.

Response

The Joint Statement and Framework will be superseded by the FMP if it is implemented. The addition of a Board policy statement concerning king crab management to the FMP was deemed unnecessary since the plan in essence will become the Board's new policy statement.

Comment #139

Contrary to the Introduction's claim, the FMP fails to provide clear guidance to the on-going regulatory process and eliminate duplication of bureaucratic functions, because it (a) fails to indicate the fishery conditions that must exist before management measures are even considered; and (b) fails to state clearly that its criteria for development of regulations are exclusive, or to assign priorities to those criteria. The FMP gives the Board license to do whatever it wants. It also multiplies the administrative steps a regulation must go through, rather than reducing them, thus failing to reduce cost and delay.

Response

We disagree. The Board and the Regional Director will always be ready to consider new management measures, though such measures may not actually be imposed unless their results would comply with the National Standards and other Federal law. In promulgating regulations, the Board is not necessarily limited to considering the standards and objectives of the FMP, as long as it does not adopt any regulation that conflicts with them. As was discussed in previous comments, priorities among the FMP's standards and objectives will vary according to the specific situations in which they are applied. It is plain from the most casual perusal of the FMP's standards that they do not give the Board license to do whatever it wants. While implementation of the FMP will increase the number of administrative steps through which State regulations must pass, this is inherent in affording the Federal oversight demanded by the commentor. The procedures provided for in the FMP will accomplish such oversight more efficiently than would be the case under conventional Federal regulations.

Comment #140

The FMP states that bureaucratic functions are unnecessary to effective resource management when the fishery is limited to the waters off a single state. This would seem to apply as much to the Board and ADF&G, which perform bureaucratic functions, as to Federal agencies.

Response

The intended meaning of the statement in question is that the duplication of bureaucratic functions is unnecessary under the stated circumstances.

Comment #141

The FMP errs in claiming that the State of Alaska has a "longstanding and successful history of regulation" of the king crab fishery. While the Board's policy is to establish stability and minimize harvest fluctuations, it failed to accomplish this in 1981 when there was a sharp drop from the previous year's record harvest.

Response

The FMP does not claim that the State's success in king crab management has been complete. In any situation in which there is a fluctuating resource, concerning which scientific knowledge is limited, there are bound to be occasional sharp declines in the harvest. It is noteworthy that the 1981 decline was predicted far in advance by State and Federal scientists, giving the industry the opportunity to mitigate its losses. The conclusion on which the Council based the FMP was not that Alaska's management record has been perfect, but that no Federal entity could establish a comparable record in the foreseeable future.

Comment #142

The FMP should acknowledge that most of the king crab harvest is taken by nonresident fishermen.

Response

A statement to this effect appears in Appendix 7.4.1 to the FMP.

Comment #143

The FMP's statement that, ideally, appropriate management measures would be selected on an almost mathematical basis is misleading. It gives the impression that such measures are developed solely on the basis of resource fluctuations. In fact, they are based almost exclusively on social and economic goals favoring Alaska and its residents.

Response

There is no doubt that the ideal of mathmatical precision in fishery management will be difficult to realize as long as social and economic considerations are not quantified. The allegation that Alaska's management is based solely on social and economic considerations is simply belied by the text of the FMP.

Comment #144

The Kodiak area should have been covered by the FMP in light of a letter of May 19, 1981, from the ADF&G Commissioner denying a request for a season change in the Bering Sea area on the ground that it would disrupt processing in other areas, including Kodiak. This demonstrates the strong economic interrelationship between fisheries covered by the FMP and the Kodiak fisheries, making it unreasonable to exclude Kodiak from the FMP's management unit.

Response

As was discussed above, the social and economic linkages between the fishery in the Kodiak area and that in the Bering Sea and Aleutians would have made inclusion of Kodiak in the management area covered by the FMP reasonable. The questions that must be addressed by the Assistant Administrator is whether the exclusion of Kodiak from the management area was also reasonable, and whether the fishery in the Kodiak area requires Federal conservation and management.

Comment #145

The FMP does not explain how the listed management measures will be used to achieve its objectives.

Response

Sufficient information on this subject is provided in FMP Section 4.0, elaborating the standards governing each management measure.

Comment #146

While the FMP implies that stabilization of the annual harvest is a goal, this seems unrealistic in light of environmental conditions and limited knowledge about the resource.

Response

Attainment of this goal may be difficult, but it nevertheless remains a worthy objective of king crab management.

Comment #147

The FMP should identify the "production and marketing standards and requirements" that management measures should be designed to compliment.

Response

These standards and requirements will vary with changes in king crab markets.

Comment #148

Why are management measures necessary to protect "well-established" harvesting and processing systems and community infrastructures?

Response

Overly restrictive or wildly fluctuating management measures tend to lessen the profitability of existing investments in the king crab industry. To the extent this is consistent with conservation of the resource, such measures should be avoided under the FMP. See also the response to Comment #51.

Comment #149

The FMP should define "subsistence."

Response

A satisfactory definition of "subsistence" has proven elusive in other management contexts, so it would be undesirable for the FMP to prescribe such a definition rigidly. Any concept of subsistence that was implemented under the FMP would, however, have to conform generally to those used under post State of Alaska law, the Alaska National Interest Lands Conservation Act, and the Marine Mammal Protection Act Amendments of 1981.

Comment #150

The FMP should identify the other commercial fisheries affecting worker availability and processing capacity, and how they do this.

Response

Such a specification would be inappropriate in a framework FMP, as this is a matter in which circumstances will frequently change.

Comment #151

The FMP should identify the trawl fisheries that may interfere with the conduct of the king crab fishery.

Response

Any trawl fishery in the management area, either foreign or domestic, potentially conflicts with the king crab fishery.

Comment #152

The FMP should identify the species that may be caught incidentally in crab pots and the history of these incidental catches.

Response

Practically any species of appropriate size can be caught incidentally in crab pots. The incidental catches that have received the most attention have been those of marine mammals and halibut. Little specific information is available on either of these incidental catches.

Comment #153

The FMP is unclear as to whether the Bristol Bay ABC must be the highest of the catches estimated in the size limit/exploitation rate table. For 1981, Reeves' data showed that fishery above the .8 exploitation rate on 6.5 inch crab would not impair future reproductive potential, but the Board would not allow fishery above a .6 exploitation rate.

Response

Clarification on the specification of ABC has been added to the FMP. In reference to Table 1, an estimated harvest on 6.5 inch crab could have exceeded a .8 exploitation rate without reducing future reproductive potential. However, based on a variety of social, economic and ecological factors a lower exploitation rate was selected in 1981.

Comment #154

Why doesn't FMP Table 1 go beyond .8? How were the size limits established?

Response

In earlier drafts, the exploitation rate ranged from .3 to .8 as this range is considered realistically possible. Table 1 in the FMP has been expanded to include a .9 exploitation rate. A rate of 1.0 was not included since a total harvest of the available king crab resource is economically impossible by the commercial fishery. The procedure for establishing size limits and the criteria to be used, has been added to the FMP, Section 4.1.

Comment #155

The FMP should specify the maximum levels of catch that will not result in decline of female fertilization for the Adak, Dutch Harbor, and Bering Sea areas.

Response

These may vary from year to year, depending on stock condition.

Comment #156

The FMP should address whether exploitation rates higher than .4 might protect female fertilization while allowing higher yields in Adak, Dutch Harbor, and the Bering Sea.

Response

Since exploitation rates will be based on population size and recruitment levels in these areas, and the exploitation rate may vary between areas, reference to a .4 rate has been eliminated from the FMP. This rate had been included as an example of current exploitation on these crab stocks. Experience has shown that a harvesting at a .4 rate does protect female fertilization in these areas. Whether or not a higher exploitation rate would also protect female fertilization in not known.

Comment #157

Since ABC takes into account environmental and ecological factors, it is inappropriate to consider ecological factors in moving from ABC to OY.

Response

See response to comment #97.

Comment #158

The social and economic reasons for harvesting more or less than the ABC should be identified.

Response

Lists of such factors have been added to the FMP's discussion of OY.

Comment #159

The FMP should identify the approximate dates of the "period from late summer through early winter when crab are in a valuable condition to the fishery."

Response

Most stocks are in such a valuable condition from September until February. Many stocks are valuable even beyond this period.

Comment #160

The statement that simultaneous openings "[result] . . . in less utilization of the capacity of large vessels that could otherwise fish a number of areas in succession" implies that simultaneous openings are used discriminatorily to protect small boat fisheries from influxes of large vessels.

Response

Under the provisions of the FMP, it would be permissible for season opening dates to be used for many of the same purposes as exclusive registration, as stated in response to comment #51. In such cases, the inefficiency imposed on larger vessels that might fish several areas quickly in succession must be justified by the conservation benefits and the social and economic benefits to small vessels and communities dependent upon them that result from simultaneous openings.

Comment #161

The FMP should explain how season openings are "important in determining prices, the distribution of floating processors, and the ability to meet marketing commitments," and why it is concerned with such matters.

Response

The language in question has been deleted from the FMP.

Comment #162

The factors considered in establishment of gear placement regulations should include the costs of onshore loading and unloading facilities compared to the costs of at-sea storage.

Response

The current version of the FMP requires that the costs of onland storage be considered.

Comment #163

Why are regulations on gear placement limited to seven days before and after a season.

Response

Seven days was considered a maximum period that could be justified by the difficulties of deploying and removing king crab gear.

Comment #164

The FMP should identify by whom land storage of gear is preferred.

Response

See the response to comment #106.

Comment #165

In light of the vessel tank inspection requirements, the cost of enforcing the requirement that pots be stored in nonfishing condition seems to outweigh the benefits.

Response

Enforcing pot storage regulations is a costly management measure. However, by making such an investment, the result is a "fishing environment" that is equitable and fair to all fishermen. Enforcement of these regulations will eliminate preemption of crab and other fishing grounds by crab fishermen, support season openings and closures, and protect the crab resource. It is the consensus of fishery managers that such benefits outweigh the costs. As was noted in previous responses, vessel tank inspection is not a complete remedy to the problem of illegal fishing.

Comment #166

The FMP should make it clear that socioeconomic impacts on local Alaskan communities have been the primary basis for designation of exclusive registration areas, and that this designation is at the expense of larger, mostly nonresident, fleets.

Response

See the response to comment #51.

Comment #167

The FMP should clarify the agency to which catcher/processor and processor reports must be submitted.

Response

See the response to comment #116.

Comment #168

The FMP should clarify whether data submitted to the State will be subject to the Magnuson Act's confidentiality requirements.

Response

Because it would be submitted in compliance with a requirement imposed by the FMP under Magnuson Act Section 303(a)(5), such data would be subject to the confidentiality requirements of Section 303(d).

Comment #169

May the Regional Director prevent a State regulation from taking effect in the FCZ if he does not have time for consultation with the Council?

Response

Yes. The Regional Director would probably conduct an informal consultation with individual Council members if he considered it necessary to disapprove a new State law or regulation before the time of the next Council meeting.

Comment #170

Is the annual shellfish public hearing of the Board in Seattle, mentioned in the Introduction to the FMP, the same as the joint Council/Board public hearing provided for in the State of Washington?

Response

Yes, these are both references to the same hearing.

Comment #171

Will the mandatory annual joint meeting of the Board and Council take place before, after, or at the same time as the Board's annual shellfish public hearing?

Response

This joint Council/Board meeting will take place during the Board's annual shellfish meeting which will be held following the public hearing in Seattle, assuming that the Board remains on the schedule that it has in the past.

Comment #172

Limitation of the FMP to the Bering Sea, Bristol Bay, Adak, and Dutch Harbor areas may violate National Standard 3 of the Magnuson Act, requiring management of an individual stock as a unit throughout its range.

Response

This statement is incorrect. It is well established that the king crab stocks exploited in these areas are distinct from those taken in Kodiak and the Gulf of Alaska.

Comment #173

What is meant by "optimization of the reproductive potential of individual king crab stocks" in the FMP objectives?

Response

The FMP's discussion of ABC and OY in Section 4.1 should be considered an elaboration of this objective.

Comment #174

The FMP objective on reproduction of individual stocks cannot be applied unless it is clear whether stocks are currently at low, high, or average abundance.

Response

This is true, and such determinations will be an integral part of the FMP's implementation.

Comment #175

In applying the first FMP objective, what is "a sufficient number of adult males" to "maximize reproductive potential" in each area?

Response

This is discussed in revised Section 4.1 of the FMP.

Comment #176

According to subsistence uses a priority in king crab allocation may conflict with Magnuson Act National Standards 4 and 5.

Response

In individual instances, there may be such a conflict. One of the responsibilities of the Regional Director will be to determine on a case-by-case basis whether a State measure giving preference to subsistence conflicts with these or other National Standards. There is, however, no necessary conflict between these standards and a preference for subsistence use.

Comment #177

What is meant by the term "maximum physical yield" as used in the FMP objectives, and what relationship does it bear to "maximum yield per recruit?"

Response

"Maximum physical yield" (MPY) and "maximum yield per recruit" (MYPR) are quite similar but the difference lies in the amount of information needed to determine each value. MPY is an absolute number, a yield that managers feel the stock can produce. A part of this determination is the reproductive potential of the stocks. MYPR is the maximum yield that can be harvested from a particular recruitment into the fishery. Such a value does not consider reproductive requirements.

Comment #178

Maximization of yield per recruit, as suggested by the NRC study, is more likely to optimize the net value of the fishery and achieve National Standards 1 and 5 than is Alaska's practice of maximizing year-class biomass.

Response

Current State management procedures are just as likely to optimize the net value of the fishery while preventing overfishing and achieving optimum yield. The proposed management regime under the FMP will promote economic efficiency in the utilization of the resource, and any advantages and disadvantages of "efficiency" will be carefully examined in the context of the other objectives of the plan.

Comment #179

The FMP should identify the social, economic, and ecological factors that may affect calculation of OY.

Response

These have been listed in the latest version of the FMP.

Comment #180

The FMP should identify the "adverse socioeconomic consequences" of "boom" and "bust" fisheries.

Response

These are the adverse effects common to extreme economic fluctuations in any area.

Comment #181

The FMP should identify the social and conservation objectives that must be achieved if additional burdens are to be imposed on the industry.

Response

These objectives are incorporated into the FMP's objectives and management standards, set forth in Sections 3.0 and 4.0.

Comment #182

Because the objective of minimizing adverse socioeconomic impacts by protecting community and industrial investments is only a guise to continue discrimination against non-Alaskans and may perpetutate inefficiency, it violates National Standards 4 and 5.

Response

This statement is incorrect. One of the basic reasons for preparation of the FMP is to provide a method of Federal review of State management measures to ensure that they are not applied discriminatorily against non-Alaskans in violation of the Magnuson Act.

Comment #183

In the FMP objective of optimizing the cost effectiveness of management and enforcement, what are the "reasonable limits" for management and enforcement costs? This objective should consider costs to fishermen in complying with management measures.

Response

The meaning of this objective is elaborated in the discussion of management standards in Section 4.0 of the FMP. These standards require consideration of costs to fishermen that are imposed by management measures.

Comment #184

The FMP should identify, for the Bristol Bay area, (a) who conducts the resource assessment surveys; (b) what the high stock levels in Bristol Bay are; (c) what the excess reproductive potential is; and (d) what criteria are used in setting minimum sizes and exploitation rates.

Response

(a) In the Bristol Bay area (i.e. Southeastern Bering Sea), the resource assessment surveys are conducted by both the National Marine Fisheries Service (NMFS) and Alaska Department of Fish and Game (ADF&G). The name of the organizations conducting the surveys were not included in the FMP because the point is not who is doing the survey but that assessment surveys are being conducted whenever possible.

(b) The term "high stock levels" and "excess reproductive potential" are being used to describe recent stock conditions in the Bristol Bay area.

(c) Citing specific numbers for these values was deemed unnecessary in the FMP given the relatively wide fluctuation in stock estimates over the

last few years. A more detailed description of stock levels and excess reproductive potential in Bristol Bay are in the cited reports.

(d) Lists of such criteria have been added to the FMP's discussion of OY.

Comment #185

For the Adak, Dutch Harbor, and Bering Sea areas, the FMP should identify (a) what data are needed and what attempts will be made to gather those data to determine the minimum required spawning stock for each area; (b) what exploitation rates other than .4 were considered, and why they were rejected; (c) what the minimum sizes for each area are, and the criteria used in their establishment.

Response

(a) What is needed is a series of abundance estimates taken over a period of years, of male and female crabs by age. This information is lacking from these other areas.

(b) Reference to a .4 exploitation rate have been dropped from the FMP since exploitation rates will vary from area to area based on population size and recruitment levels.

(c) A discussion of how minimum size limits are determined is provided in the FMP in Section 4.1. The specific size limit for each area is not included in the FMP. The plan provides guidelines to be used in setting size limits and the actual numerical size will be established by the Board, subject to Council and NOAA review.

Comment #186

The fact that poor weather conditions make fishing more difficult and pose serious threats to the safety of crews and vessels should be included in the FMP's considerations for establishment of fishing seasons.

Response

The FMP has been changed to require that this be considered.

Comment #187

The real motive behind simultaneous season openings is discrimination against nonresident vessels, which violates National Standard 4.

Response

See the response to comment #160.

Comment #188

Because most major fisheries take place in exclusive registration areas, it is doubtful that simultaneous openings help distribute fishing effort and prevent gear saturation problems.

Response

Exclusive registration is the primary method for eliminating such problems. Simultaneous season openings can be used where exclusive registration does not do this.

Comment #189

The FMP should explain how the Board will achieve "a balance of attitudes within the industry with respect to the several factors" involved in setting seasons, and whether some of the factors will be more important than others.

Response

The language in question has been removed from the FMP.

Comment #190

Such criteria for the designation of exclusive registration areas as "the socioeconomic impact upon local communities," and the desire "to protect industrial and community investments," are favorable to Alaskan interests and are likely to be interpreted in the interests of Alaskans, to the detriment of non-Alaskans. This is particularly true in light of the easy access to the administrative process that is afforded to Alaskans. Such favoritism violates National Standards 4 and 5.

Response

See the response to Comment #51.

Comment #191

The criterion for designation of exclusive registration areas focusing on "providing fleets a reasonable opportunity to participate in the fishery" violates National Standards 4 and 5 because it is intended to free small vessels, most of which are owned by Alaskans, from competition by large vessels, most of which are owned by non-Alaskans.

Response

See the response to Comment #51.

Comment #192

It is unclear how designation of an exclusive registration area would affect proper management of the fishery.

Response

See the response to Comment #111.

Comment #193

It is doubtful that exclusive registration areas will promote efficient use of vessels and gear, something which seems incompatible with protection of industrial and community investments.

Response

Some stocks may be used more efficiently through slower, small-vessel fisheries than through quick, large-vessel, pulse-type fisheries of the kind described in the response to Comment #51. Protection of the small vessel fisheries and the communities dependent upon them in such circumstances is necessary because, in the absence of such protection, the large-vessel fisheries could impose extenalities the costs of which they could avoid absorbing. Among these would be damage to the smaller stocks overexploited by the pulse fishing effort, or the underutilization of such stocks caused by extremely conservative management designed to prevent such overexploitation.

Comment #194

The FMP should identify the measures other than exclusive registration areas that can be available to limit overall fishing effort.

Response

Adjustments to OY specifications, fishing seasons, area closures, gear restrictions, and size and sex restrictions are other methods of limiting fishing effort. Exclusive registration has the advantage of giving fishermen a choice in where to direct their effort.

Comment #195

The FMP should identify the priority, if any, among the factors for designation of exclusive registration areas.

Response

There is no predetermined priority among these factors. Their relative importance will vary among the specific situations to which they are applied.

Comment #196

The safety of crews and vessels should be a consideration in promulgating gear placement and storage regulations.

Response

The Council did not consider safety to be a significant factor relevant to these management measures. This does not mean that safety may not be considered when a peculiar factual situation so requires.

Comment #197

The FMP should identify the priority, if any, among the factors for promulgation of regulations on gear storage and placement and on vessel tank inspection.

Response

See the resonse to Comment #195.

Comment #198

The criteria for in-season adjustments of time and area regulations are too broad. The FMP should explain what "any other factors relevant to the conservation and management of king crab" are.

Response

These criteria are intended to be broad, and the final criterion is intended as a flexible catch-all for any development that raises the possibility that a previously prescribed management measure may have a harmful effect on the king crab resource and fishery.

Comment #199

The decision on regulations to implement management measures should be based on an assessment not only of the cost of enforcement, but also of whether they would be enforceable.

Response

Practically any management measure is enforceable if sufficient cost is expended. Therefore, the question of enforceability has been subsumed under the question of cost of enforcement.

Comment #200

Because Alaska's jurisdiction over vessels fishing outside State waters extends only to resident vessels, its reporting requirements cannot be imposed on nonresident vessels fishing for king crab in the FCZ.

Response

We disagree. Alaska's management authority in the FCZ extends to any vessel registered under the laws of that State, whether or not owned or operated by Alaska residents. Under the FMP, Alaska's reporting requirements, once approved by the Regional Director, will also have the force of Federal law against all vessels fishing in the FCZ, whether or not registered in Alaska.

Comment #201

The FMP should include criteria for the selection of minimum size limits and exploitation rates.

Response

Such criteria are included in FMP Section 4.1.

Comment #202

The proposed delegation of the Secretary's regulatory authority to the State of Alaska is illegal.

Response

We disagree. There is nothing in the Magnuson Act or other Federal law that prevents reliance upon State management measures subject to the kind of Federal oversight provided for in the FMP. Every State management measure implemented under the FMP will be subject to Federal review in light of the FMP's management standards and criteria.

Comment #203

The proposed delegation undermines the policies and provisions of the Magnuson Act for regional fishery management, not only in the North Pacific, but throughout the United States.

Response

We disagree. State of Alaska management measures will govern the king crab fishery in the FCZ under the FMP only as long as this is agreeable to the Council, which includes representatives from Alaska, Washington, and Oregon, and to NOAA.

Comment #204

The proposed delegation puts the Council in a subordinate position relative to the Board.

Response

We disagree. While the Board will play the more active role in the development of individual management measures, its continued authority in the FCZ is plainly subject to the continued consent of the Council and NOAA.

Comment #205

The Board's regulatory system is inherently discriminatory because non-Alaskans are by State law prevented from participating in the management process to the same extent as Alaskans, and because Alaska law requires that the Board manage in the interest of the State of Alaska and its citizens.

Response

It is precisely to prevent the type of descrimination feared by the commenter that the FMP provides for Federal review of State management measures for king crab fishing in the FCZ, and for the replacement of State management measures, or even the entire State management system, in the FCZ if they should discriminate against non-Alaskan fishermen in violation of the Magnuson Act.

Comment #206

The FMP proposes that all existing Alaska king crab regulations be adopted. Since the Council has never done a study of these regulations, it cannot find that they meet the National Standards.

Response

The FMP does not propose automatic Federal approval of all existing State of Alaska managment measures. If the FMP is approved and implemented, existing measures will be screened by NOAA to determine which are consistent with the FMP and other Federal law.

Comment #207

The Board has already violated its agreement with the Council to establish regulations for the 1981 fishery in accordance with the Joint Statement of Principles and the Framework. The Council should, therefore, reconsider its proposal for delegation of management authority to the Board, and should vigorously protect the violation of this agreement.

Response

The Council, the other party to the Joint Statement, has not regarded any noncompliance with it that might have taken place to be so grave as to call into question the State's commitment to the type of management proposed in the FMP.

Comment #208

The objectives and criteria for adopting management measures are so broad that they invite the Board to act in an arbitrary and capricious manner. The Board should be given less discretion.

Response

We disagree. The objectives and standards of the FMP are designed to minimize the danger of arbitrary action, and further protection against this is provided by NOAA review of State management measures affecting king crab fishing in the FCZ.

Comment #209

Under the proposed delegation, would fishermen challenge regulations in Federal or State courts? Would fishing violations give rise to civil or criminal actions?

Response

See the response to Comment #131(b). Under both State and Federal law, fishing violations may give rise to both civil and criminal actions.

Comment #210

In view of the economic and social links between the king crab fisheries of Kodiak and those of the Bering Sea and Aleutians, the non-inclusion of Kodiak in the FMP is discriminatory and violates the Magnuson Act. Since the Tanner crab FMP covers all of Alaska, so should the king crab FMP.

Response

See the responses to Comment #87 and Comment #144.

Comment #211

Many of the FMP's management objectives and criteria are so drafted as to favor Alaskan over non-Alaskan interests.

Response

We disagree. There is no doubt that certain interests receiving protection under the FMP, such as small vessel owners and shore-based crab processors, tend to be located in Alaska while certain interests that are disadvantaged by such protection, such as large vessel owners, tend to be non-Alaskan. Residence is not, however, a criterion for such measures, and they apply equally to all similarly situated persons. For example, Alaskan owners of large vessels are not accorded treatment better than that of non-Alaskan large vessel owners.

Comment #212

Exclusive area registration violates National Standards 4 and 5.

Response

See the responses to comment #51 and comment #193.

Comment #213

If the cost of obtaining an Alaska vessel license exceeds the administrative cost of its issuance this would violate Magnuson Act Section 304(d).

Response

Under the current version of the FMP, a Federal permit for which no fee will be charged would be required for king crab fishing in the part of the FCZ covered by the plan. Because it would be inconsistent with the FMP, the State vessel license requirements would have no effect in that part of the FCZ.

Comment #214

If nonresident vessels fishing in the FCZ with Federal permits were required to obtain Alaska interim use permits or vessel licenses before transporting crab to processors in State waters or onshore, this would sanction a permit/ license system whose fee structure violates the Magnuson Act and the United States Constitution.

Response

See the response to comment #131(a).

Comment #215

The Council's hearings on the FMP violated Magnuson Act Section 302(h)(3), because they were held during the 1981 Bristol Bay and Bering Sea king crab fisheries. They were thus not held at "appropriate times."

Response

We disagree. The difficulty of scheduling individual hearings on fishery management measures so as to facilitate attendance in person by all interested fishermen is well known. It is necessary for agencies like the Council and the Board to rely heavily upon fishermen's representatives, like the commentor, who can be available for such hearings on a full-time basis. The 1981 hearings on the FMP were accessible to such representatives. It should be emphasized that these were not the only hearings to be held on the FMP. Whenever the FMP has been on the agenda of a Council meeting, a public comment opportunity identical to that provided at the 1981 hearing has been provided to all interested persons, with advance notice.

Comment #216

Recent events call into question the State of Alaska's willingness to manage the king crab fishery in a nondiscriminatory manner and to coordinate its fishery management with that of the Federal government. These include the following:

(1) The Board's failure to set 1981 harvest levels in accordance with the joint statement and the framework, and its lack of response to public inquiries about that failure.

(2) The Board's failure to follow the Joint Statement for its 1982 shellfish meeting (by sending only 53 copies, rather than the 100 requested by the commentor, of its shellfish regulatory proposals and by sending them so they were received only 21 days rather than 30 days before the meeting).

(3) The Board's holding of its 1982 shellfish hearing in Seattle when most affected fishermen were not available to attend.

(4) The Board's and Alaska Legislature's opposition to the proposed Herring FMP's authorization of an offshore fishery engaged in predominantly by nonresidents.

(5) Certain statements in an Alaska House of Representatives resolution criticizing the Federal management in the FCZ fisheries.

(6) Certain comments by the Alaska Lieutenant Governor, a leading gubernatorial candidate, about "federal interference" in fishery management.

Response

While these events cannot be ignored, they are certainly not so serious as to call for the Council's withdrawal of the FMP. This would, in fact, only postpone the establishment of effective Federal oversight of king crab management in the Bering Sea and Aleutians, which is the main purpose of the FMP. The FMP, if implemented, would provide a means for rapid Federal response to any development that did threaten the quality of king crab management in the FCZ.

Comment #217

While the President's "New Federalism" is a justification for the proposed delegation to the State of Alaska, it was not intended to form a basis for denying non-Alaskan fishermen equal protection of the law.

Response

We agree, and believe that the FMP will ensure that it does not have that effect.

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Comments Requested

Comments on this statement are requested of all interested persons and agencies, including:

Alaska Department of Fish and Game
Alaska Board of Fisheries
Alaska Board of Game
Bureau of Land Management
Alaska Office of Coastal Management
Commercial Fisheries Entry Commission
U.S. Department of Commerce
U.S. Department of the Interior
U.S. Department of State
Environmental Organizations
U.S. Environmental Protection Agency
Fishermen's Associations
Marine Mammal Commission
Native Alaskan Associations and Corporations
North Pacific Fishery Management Council
Pacific Marine Fisheries Commission
Processors and Seafood Industry
State Clearinghouses
U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Fish and Wildlife Service

Hearings

Over the last five years, the public has had numerous opportunities to comment on earlier drafts of the FMP, the final FMP and the DEIS, most often at Council meetings. Written comments have always been accepted. Public hearings on the king crab FMP have been held in Seattle, Washington, Anchorage, Juneau, Kodiak, Dutch Harbor and Nome, Alaska.

North Pacific Fishery Management Council

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Jim H. Branson, Executive Director

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July 2, 1984

Mr. William G. Gordon
Assistant Administrator for Fisheries
National Marine Fisheries Service
3300 Whitehaven Street, Page Bldg. 2
Washington D.C. 20235

Dear Bill:

On September 29, 1983 the Council approved the King Crab FMP and supporting documents for submission to the Secretary for fast-track review. Subsequently your office determined that the FMP package was not "structurally complete" and requested additional material from the Regional Office of NMFS. We also learned from your office that a federal permit regulation would be required to implement the permit section of the FMP. The Council and the Region have worked closely together over the past month to address those concerns and we are resubmitting the entire FMP package which we believe is structurally complete. Under this cover you will find the FMP, FEIS, RIR/RFA, and proposed implementing regulations with Preamble. The Region is providing the additional elements under a separate cover.

At their May 1984 meeting the Council approved a federal permit regulation identical with the permit requirement of the FMP. That action should remove the last major stumbling block to fast-track review. In addition, the Region has prepared the revised implementing Regulations and Preamble which the Council had before them at their meeting. The Regulations were modified to include a federal permit regulation and the Preamble was modified to address that regulation and the Region's determination of significance under the Regulatory Flexibility Act. Twenty copies of the Preamble and Regulations are enclosed here for your review.

Also enclosed is the RIR with an attached addendum which addresses the concerns raised by your office. We have not modified the main body of the RIR, but have attached the addendum for your convenience. The addendum addresses the points raised in the November 10 memo (Bribitzer to Jensen), and includes (1) a memo from Jim Wilson, Regional Economist, to Thorn Smith regarding significance under P.L. 94-265 and "major" under E.O. 12291; (2) two memos from Steve Davis, NPFMC, to Smith (May 14, and May 18, 1984) re-examining the RIR and its conclusions in light of more recent data; and (3) a memo from Ron Berg to Smith regarding enforcement costs related to the King Crab FMP.

32D/C

We have modified responses to four comments in the FEIS that pertain to the federal permit regulation. These comments addressed the permit requirements and the revised responses clarify the Council's intent and the impact of the regulation. The enclosed copies of the FEIS contain these minor changes.

Although most of the enclosed material is identical to that which was received by your office in the fall of 1983, we feel that starting Secretarial review with fresh copies may head off possible confusion about what is the most current version of each document. As I stated earlier, we feel that this Bering Sea/Aleutian Islands King Crab FMP package is structurally complete and Secretarial review should begin as soon as possible. If you see any holdups please let me know immediately.

Sincerely,

Jim H. Branson
Executive Director

cc: Robert McVey
Patrick Travers

Enclosures:

(1) Bering Sea/Aleutians King Crab FMP (50 copies)
(2) Final EIS (50 copies)
(3) RIR/RFA with attached Addendum (20 copies)
(4) Proposed Bering Sea/Aleutian Islands King Crab Implementing Regulations with Preamble (10 copies)

32D/C

BERING SEA/ALEUTIAN ISLANDS

KING CRAB

FISHERY MANAGEMENT PLAN

June 1984
(updated August 1983)

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

KC1/A

The following changes were made to the May 1982, BS/AI King Crab FMP. These changes have been incorporated into the revised FMP, dated August 1983.

Page

Title Page - Revised date.

i Table of Contents - 5.0 added "AND JOINT VENTURE PROCESSING"

8 Secondary objectives; Optimize the Net Value of the Fishery added "(a.k.a. maximum physical yield)"

15 Section 4.0. Management Measures; ABC for areas where spawner-recruitment relationships can be determined. After Table 1, we added the paragraph, "If the female spawning stock drops... ."

16 We improved Table 2 by describing further the exploitation rate that is based on a depressed population size and whose pre-recruitment abundance is declining.

19 A fifth step has been added to the OY procedure for Bristol Bay.

35 Section 5.0. Added to title, "AND JOINT VENTURE PROCESSING." Also added "and/or joint vessel processing" to the last sentence in this section.

40 Section 6.0 Procedures for Plan Implementation; Item 4; deleted "off Alaska" from the first sentence and substituted "of the management unit."

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1.0 INTRODUCTION

This Fishery Management Plan (FMP) has been developed by the North Pacific Fishery Management Council (NPFMC) to manage the king crab fishery in the Fishery Conservation Zone (FCZ) of the Bering Sea and Aleutian Islands. It replaces that portion of the Preliminary Fisheries Management Plan for the King and Tanner Crab Fishery of the Eastern Bering Sea which applies to this fishery. Two new approaches to the development of a fishery management regime are presented in this FMP.

The first is the essential structure and function of the present document: this is a "framework" FMP. It serves as the basis for continuing long-term management of the fishery, and provides clear guidance to the ongoing regulatory process, without itself having to undergo frequent amendment. Therefore, this plan is necessarily more general than other FMPs; instead of selecting specific management measures it focuses upon a detailed statement of objectives and sets forth a choice of alternative management measures which can be used either singly or in combination in order to meet the objectives established in this plan.

The second innovative aspect of this FMP is the manner in which it is intended to be implemented: Instead of relying upon a fully developed and detailed set of federal regulations to carry out its objectives, it is proposed that the Secretary of Commerce accept and make use of the ongoing regulatory regime of the State of Alaska as long as it remains consistent with the FMP, the Magnuson Fishery Conservation and Management Act (MFCMA) and other federal law.

Both of these innovations -- the framework concept and the proposal for provisional acceptance of Alaska regulations to carry out the FMP -- are designed to achieve economies in management and to reduce the delay which is normally attendant upon the regulatory process. Each proposal serves to eliminate duplication of bureaucratic functions which are unnecessary to effective resource management where the fishery is entirely limited to the waters off the coast of a single state, where there is a long-standing and successful history of regulation by that state, and where there is no directed foreign participation in the fishery.

This framework FMP is intended to guide future management decisions along specific channels defined and limited by the terms of the MFCMA and other applicable law. The framework first presents its objectives in detail. After the objectives the framework offers a series of possible management measures. The issue then becomes selecting the appropriate management measure or measures for a given year, and for a given geographical area within the fishery, in order to further the accomplishment of one or more objectives.

Ideally, selection of appropriate management measures for the achievement of any objective would be done almost mathematically through the use of standard techniques of population dynamics. While it is one of the Council's goals to raise management of the king crab resource to this level of precision, our knowledge of the resource and the socioeconomic structure of the fishery is less than complete. At this point we must rely on less exact means to describe how, and under what circumstances, a given set of measures will be employed to achieve a given set of objectives.

The process by which management measures will be adopted provides assurance that the objectives of the FMP will receive appropriate consideration, and that the result will be consistent with the MFCMA and other applicable law. It is intended that individual management measures for carrying out this framework FMP be supplied by the Alaska Board of Fisheries (Board) under the terms of a single implementing regulation promulgated by the Secretary in the usual manner under Section 305 of the MFCMA. The Secretary's enabling or implementing regulation will do the following:

1. reserve to the Secretary final authority to supersede or supplement any State regulation which he determines to be inconsistent with the FMP, the MFCMA, or other applicable law;
2. provide that the National Marine Fisheries Service (NMFS) Alaska Regional Director, after consulting the Council, be empowered to prevent any State regulation from taking effect in the FCZ if he concludes the measure is inconsistent with the FMP, the MFCMA or other applicable law; and
3. provide that the North Pacific Fishery Management Council and Alaska Board of Fisheries shall meet jointly at least once every calendar

year to consider management of the fishery and discuss the need for amendment of the FMP or any regulations governing the fishery.

Alaska has developed and is implementing a system for the conservation and management of domestic fisheries in the waters of and adjacent to the State. This system centers around the Board of Fisheries for policy and regulations. The Board's regulatory system provides for extensive public review and input through written and oral comment periods and through a network of sixty-seven local Advisory Committees; is sufficiently structured to insure annual revisions (the process requires less than six months to effectuate non-emergency regulations); is flexible enough to accommodate resource and fishery emergencies; and is understood and familiar to the users of the fisheries resources. Further, through the Alaska Department of Fish and Game, there exists a substantial investment by the State in facilities, communications, and information systems, vessels and other equipment, coupled with a cadre of experienced personnel capable of carrying out extensive management, research, and enforcement programs to monitor the conduct of the fisheries and the status of the resource. It is not necessary to replace or duplicate the State's system and efforts.

During the formative stages of the present proposal for a state-implemented framework FMP, concern was expressed from some quarters that the State of Alaska's regulatory measures would tend to discriminate in favor of local residents at the expense of the nonresident fishing fleet. To assure that implementation of this framework FMP is carried out with fairness and equity to all participants in the fishery no matter where they reside, the procedural safeguards discussed in 1 to 3 above will be incorporated into the State regulatory process. Further, the Alaska Board of Fisheries will modify its own regulatory procedure by providing written explanations of the reasons for its decisions and, with representatives of the NPFMC, will hold at least one annual public hearing in Seattle, Washington.[1/]

1/ Although previously the Board of Fisheries has not published written explanation, it does conduct extensive regulatory hearings at which it receives oral and written testimony from interested parties, including representatives of out-of-state fleets. It has been the custom of the Board to respond orally to comments and testimony.

2.0 DESCRIPTION OF FISHERY MANAGEMENT UNIT

This management plan applies only to the king crab (family Lithodidae) fisheries in the Bering Sea and Aleutian Islands (BS/AI). The BS/AI area with respect to U.S. extended jurisdiction is defined as those waters lying south of the Bering Strait, east of the U.S.-U.S.S.R. convention line of 1867, and extending south of the Aleutian Islands for 200 miles between the convention line and 164°47'30"W. longitude (Figure 1a).

The BS/AI area supports several discrete stocks of king crab whose ranges are substantially congruent with the area's boundaries. It is not necessary to enlarge this management unit in order to manage these stocks effectively.

There are other stocks of king crab, for example those in the areas of Kodiak, Cook Inlet and Prince William Sound, which are not part of this management unit. They will continue to be managed by the Alaska Board of Fisheries and the Alaska Department of Fish and Game (ADF&G). However, because the State regulatory agencies and processes will carry out the objectives of this FMP within the BS/AI area, and will also manage the other stocks occurring beyond the management unit, close management coordination for all stocks of king crab subject to U.S. jurisdiction, will be the result.[1/]

The FMP establishes a formal mechanism to ensure coordination of management inside and outside the management unit. Under the protocol for plan implementation described in Section 6.0 of this FMP, the Council and Board have agreed to meet regularly in joint sessions to discuss management options, plan for the future, and to share scientific and statistical data. These procedures are specifically designed to facilitate complementary king crab management as set forth in the draft NMFS national standard guidelines in 50 CFR Section 602.13(d)(2)(i).

1/ This conforms with MFCMA National Standard 3 which requires that "to the extent practicable ... interrelated stocks shall be managed as a unit or in close coordination."

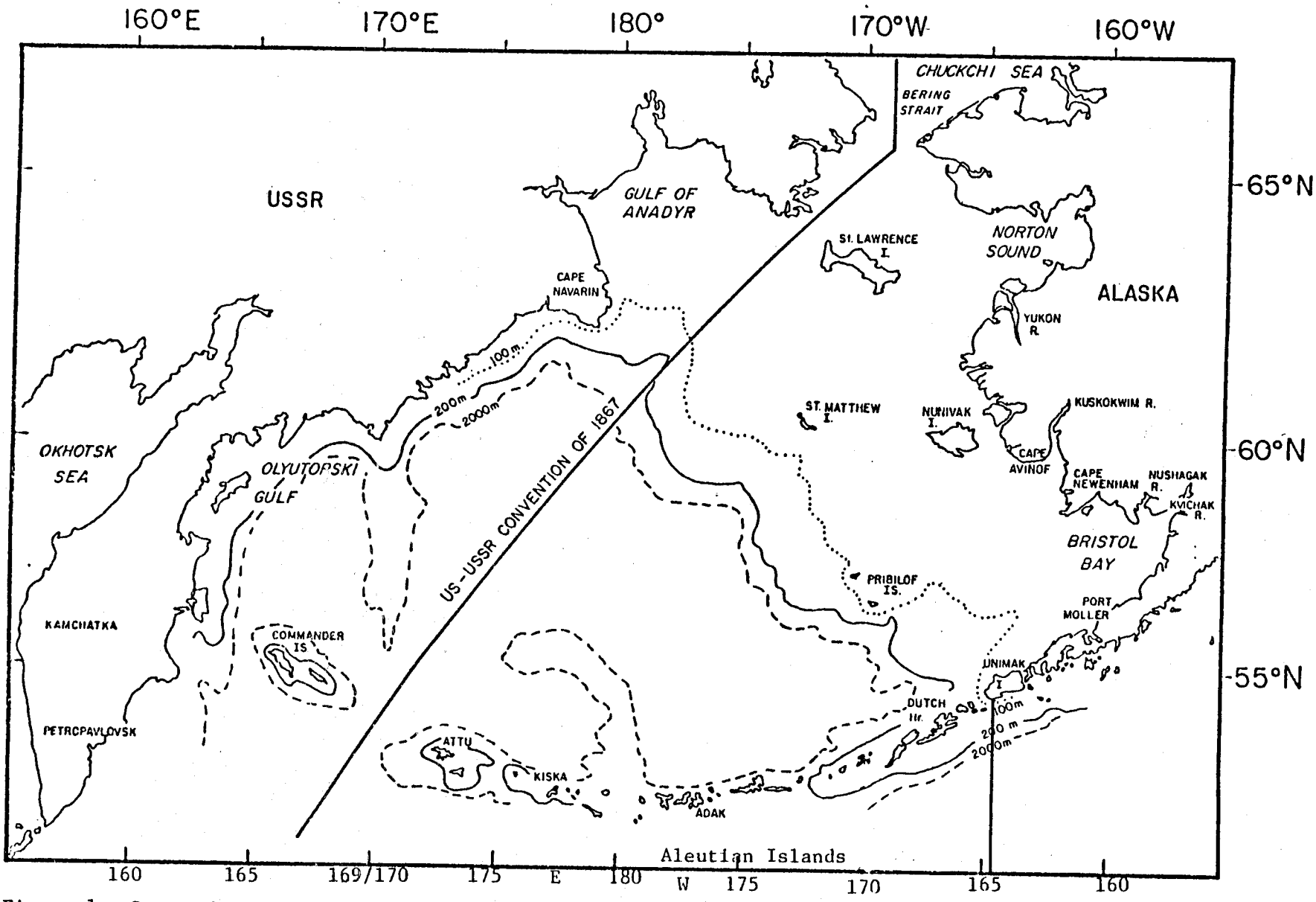


Figure 1a.-Geographical locations in the eastern Bering Sea and Aleutian Islands.

Since this FMP describes a management unit whose boundaries are substantially identical to the ranges of discrete king crab stocks, and because all "related" stocks will be subject to a well coordinated and complementary management system, there is no practical need to enlarge the management unit at the present time. In addition to the foregoing, however, it may be useful to note several factors which the Council considered in deciding ultimately to define the management unit as it did.

1. The fisheries outside and inside the BS/AI management unit are clearly different in a number of important respects, including the reliance on a single species as opposed to a multiple species fishery (i.e. red king crab vs. red, blue, and golden king crab), participation by resident and non-resident fishermen, composition and mix of vessel classes, and the nature and extent of community infrastructures that are supported by fishing and related activities.

2. Given the complex network of biological, geographical, industrial, socioeconomic, and political components within the king crab fishery off Alaska, the management unit is as large as possible under one FMP at this time. The FCZ within the BS/AI area is the largest fishery management unit off Alaska (727,276 sq. miles). In comparison it is larger than the entire FCZ along the east coast of the United States, which is approximately 445,000 sq. miles.

3. The impetus for development of this FMP under circumstances where a State agency has been managing the fishery in a highly professional manner for the last two decades was principally a response to some fishermen, who primarily fish in the BS/AI area, who demanded that a federal management system be extended to cover their operations in order to afford them certain perceived advantages they believed would ensue from secretarial oversight. Conversely, other groups of fishermen in other fisheries on separate stocks of crab are satisfied with existing state management. These groups are adamant in their desire to avoid federal intervention, which they perceive as an unknown, and therefore an uncertain and possibly destabilizing factor. The Council carefully considered the options of covering the BS/AI area alone versus extending the coverage of

the FMP to other fisheries of the Gulf of Alaska. The Council decided to limit the scope of the plan since to do so would have no adverse effect on the conservation and management of the stocks, while it would substantially satisfy the basic requirements of both opposing elements of the fishery. A cautious approach was ultimately deemed to be the best alternative in light of the basically experimental nature of this FMP. The Council will continue to study the king crab fisheries not governed by this FMP to determine whether they require Federal conservation and management. Particular attention will be given to the adverse economic impacts that an extension of Federal management to these fisheries might cause, including impacts that might be caused by elimination of State measures designed to encourage small local fleets in certain areas.

3.0 MANAGEMENT OBJECTIVES

The management system set forth in this plan has been developed in accordance with the MFCMA and other applicable law. It is designed to achieve the following objectives. These objectives are not mutually exclusive and management measures are designed to balance the various components within these objectives. Secondary objectives are all of equal importance.

Primary Objective

Maintain Resource Base By Optimizing the Reproductive Potential of Individual King Crab Stocks. When population levels are low or when not enough is known about a stock to identify spawner-recruit relationships and thence define spawning requirements, it is necessary to ensure that a sufficient number of adult males be left in the population to maximize reproductive potential. When stock levels are high, full egg clutch development in all female crab is not necessary. Under those conditions male crab can be exploited at a much higher rate and at very high stock levels a harvest of female crab may be consistent with the goal of achieving optimum reproduction potential of that stock.

Management measures which can be expected to be used in attaining this objective are:

* Optimum Yield Specification
* Fishing Seasons
* Catch Restrictions based on sex and size

Secondary Objectives

Optimize the Net Value of the Fishery. The optimum yield for the BS/AI king crab fishery is not necessarily the same as the allowable biological catch (a.k.a. maximum physical yield). Social, economic, or ecological factors may favor a reduction of the physical yield in order to stabilize annual harvest. In this case, the lower yield would be considered optimum. Maximum physical yield is attained through heavy harvesting and

an almost complete dependence on a single age class entering the fishery between fishing seasons. Because individual age classes vary wildly, that dependence leads to heavy annual fluctuations in the catch and the attendant adverse social and economic conditions associated with "boom and bust" fisheries. Management strategies could be designed to moderate the peaks and troughs (which are a function of year class strength). While there will still be fluctuations in the catch from year to year they will be less severe, allowing better opportunities for orderly planning and marketing.

Management measures should minimize restrictive or additional burdens on industry or on efficient harvesting and processing techniques. They should be designed to complement production and marketing standards and requirements. Management measures and regulations will be imposed only to attain specific conservation or social and economic objectives.

Management measures which can be expected to work toward this objective are:

* Optimum Yield Specification
* Fishing Seasons
* Gear Placement Limitations
* Gear Storage Limitations
* Catch Restrictions based on Sex and Size

Minimize the Socioeconomic Impacts of Conservation and Management Measures. The king crab fishery in the Bering Sea and Aleutian Islands is an established fishery which has gone through rapid development in the last 20 years. After a short-lived small scale American fishery in the late 1940's and 1950's, Japan and the Soviet Union began heavy exploitation of the resource in the late 1950's and early 1960's. Those activities have been supplanted by a purely American fishery which has had more than enough capacity to harvest and process the total resource since the late 1960's. Harvesting and processing systems and community infrastructures are well established and management measures may be necessary to avoid sudden economic dislocation. Unless dictated by resource emergencies, management measures should not make abrupt changes

causing losses or creating requirements for heavy new investments by the U.S. fishing industry or by the communities involved in the harvest and processing of this resource. Considerations of impacts of management measures should not be based solely on economics, but should include the social impact on all segments of this complex.

There are some areas of this fishery management unit where king crab have been utilized as a traditional subsistence food source for many years. The fishery will be managed to assure a continued source of crab to those areas at a level compatible with customary and traditional use of the resource.

Management measures which may be used to achieve this objective include:

* Optimum Yield Specification
* Fishing Seasons
* Exclusive Registration Areas
* Gear Placement Limitations
* Gear Storage Limitations
* Vessel Tank Inspections
* Closed Areas

Minimize Adverse Interactions Among Fisheries. Management measures developed for the king crab fishery must take into account the interaction of that fishery and the people engaged in it with other fisheries. Three areas of concern can be identified:

1. Scheduling king crab fisheries so that they will mesh compatibly with other commercial fisheries, taking into account ship and worker availability as well as processing capacity;

2. The compatibility of different types of fishing gear and activity on the same grounds. The king crab fishery is conducted with stationary gear, pots. Many of the other fisheries in the fishery management unit, both American and foreign, are conducted with mobile trawl gear. Seasons and fishing areas must be arranged for

both types of gear to eliminate, insofar as possible, conflicts between gear types and preemption of grounds by one form of gear over another; and

3. Management measures must take into account the incidental catch of species other than king crab taken in this fishery. Gear, seasons, and fishing areas may have to be adjusted to minimize catches of species such as halibut during the course of the regular king crab fishery.

Management measures which may be used to achieve this objective include:

* Fishing Seasons
* Gear Storage Areas and Methods
* Restrictions on the type of gear that can be used
* Closed areas (for either fixed or mobile gear)

Optimize the Cost Effectiveness of Management and Enforcement. Fishery management should seek to bring costs of management and enforcement to within reasonable limits relative to the value of the fishery. Also, the administrative system which implements this plan should strive to be efficient, non-duplicative, and timely.

Management measures which may be used to achieve this objective include:

* Fishing Seasons
* Gear Storage Limitations
* Gear Placement Limitations
* Vessel Tank Inspection

4.0 MANAGEMENT MEASURES

This section authorizes a variety of management measures which can be used to achieve the management objectives just set forth. While some of them can be used to realize either one or several objectives, it is essential that only those mechanisms deemed necessary be adopted. Most of these management measures are currently employed by the State of Alaska to manage the king crab fishery. For a description of the management history of this fishery refer to Section 7.5.

The management measures are intended to establish a management system, consistent with the National Standards of the MFCMA and other applicable law and at the same time provide for administrative flexibility to implement those measures. Public comments on the plan and the implementing regulations will be requested on an annual (or more frequent) basis.

Based on the regulatory experience of the State, it is apparent that management measures must be frequently revised in order to meet changes in the fishery. This plan allows for periodic revisions in management measures by providing guidelines to be considered prior to establishing or amending each measure.

4.1 Determination of Optimum Yield

Two numerical values are addressed in this section. One is the Acceptable Biological Catch (ABC) of king crab, which is based on the biological status of the stocks. The other is king crab Optimum Yield (OY), which represents a modification of the ABC for social, economic, or ecological factors. The OY is attained through the use of two specific regulations: (1) establishment of a minimum size limit for crabs which can be taken for commercial harvest; and (2) establishment of guideline harvest levels which are a function of an exploitation rate applied to the biomass above the minimum size.

ABC

The ABC is to be determined using primarily estimates of stock abundance, distribution of crabs by sex and size, and recruitment into the fishery.

These estimates are revised annually from population surveys, commercial catch statistics, and research. In addition, secondary considerations, though less frequently updated due to lack of information, are used in the determination of ABC. These are:

1. natural mortality rates by sex and size class;
2. fishing mortality rates from previous years by size class;
3. growth rates by sex and size class;
4. critical size necessary for reproductive needs;
5. reproductive success given a specific population size, sex ratio, and distribution of spawning stocks; and
6. environmental and ecological effects.

The ABC shall be so calculated as to maintain recruitment to the fishable stock at the highest possible level. Maintenance of this level of recruitment for king crab shall be achieved by determining and perpetuating an optimum required spawning stock of fertilized females. When the stock is below the determined optimum, the fishery shall be restricted to maintain full female fertilization. When the stock is above this optimum, higher exploitation or lower size limits on males may be permitted.

The amount of information available to determine the ABC varies from area to area of the BS/AI. As a result, the procedure for determining ABC shall be different based on the amount of information available on that particular stock.

Maximum sustainable yield (MSY) is the average of annual ABC's over a reasonable number of years and is the maximum average annual catch which can be taken from a stock under environmental conditions prevailing during these years. Determination of MSY for the BS/AI area is described in detail in Section 7.3.6.

ABC for areas for which spawner-recruitment relationships can be determined

The procedure for determining ABC for king crab in fishing areas on which resource data is sufficient for determination of spawner-recruitment relationships is as follows:

1. Establish the minimum female spawning stock required to maximize recruitment. This is done by an analysis of the spawner-recruitment relationship for a given area (example: Bristol Bay), based on abundance estimates from resource assessment surveys (Reeves, 1981). The spawner-recruitment relationship is the relationship between the number of spawning individuals in a stock and the number of recruits (i.e. the supply of fish that becomes available to the fishery) the stock will produce each year. The spawner-recruitment relationship can take many forms, but from a management standpoint, two basic types can be distinguished: (1) relationships in which recruitment drops off at high levels of spawner abundance; and (2) those in which recruitment becomes independent of spawner stock density above a certain level. The spawner-recruitment relationship data from Bristol Bay suggests that we are dealing with the first form, although at this early stage of knowledge other forms cannot be discounted. The description of spawner-recruitment relationships is a product of an ongoing analysis which builds on the use of additional data as each resource assessment survey is completed.

The waters currently encompassed in the State of Alaska's Bristol Bay management area (see Section 4.8 below) have thus far yielded the best king crab data base and have experienced high stock levels. A study by Reeves and Marasco (1980) which analyzed the spawner-recruitment relationship for that area, indicates that at high stock levels there are more males than are needed to achieve full reproductive potential. Reeves (1981) has indicated that 20-40 million fertilized females is a reasonable estimate of the number necessary to maximize recruitment. Therefore, at the high population levels prevailing in 1980 when 60 million mature females were present in this stock, a large portion of male stock was unnecessary for reproduction and was available to ABC. The ABC is estimated using spawner-recruitment information combined with current survey estimates of abundance. A detailed example is produced by Reeves (1981).

2. ABC is set equal to the maximum catch (i.e., a given minimum size limit/exploitation rate combination applied to survey estimates of abundance) which maintains the minimum required number of spawners.

Potential ABC's are calculated from a series of survey abundance estimates using various size limits and exploitation rates. Those catches which will not reduce the number of spawners below the minimum required for maximum recruitment are then identified. These catches are defined as the values above the line drawn through Table 1, which provides an example based on 1980 survey and fishery information. The position of the line is established from reproductive considerations and corresponds to the spawning stock level which maximizes recruitment, as calculated from a spawner-recruit relationship (see Reeves, 1981 for details of the procedures). The highest of the catches above the line is selected as the ABC.

Table 1 -- Estimated yields (millions of pounds) for red king crab in Bristol Bay for 1981, by minimum size limit and exploitation rate (from Reeves, 1981).

	Exploitation Rate						
Size Limit	.3	.4	.5	.6	.7	.8	.9
7.00"	24	32	41	49	57	65	73
6.75"	31	41	52	62	72	83	93
6.50"	37	50	62	75	87	100	112
6.25"	43	57	71	85	100	114	128
6.00"	48	63	79	95	111	127	143
5.75"	52	70	87	104	122	139	157
5.50"	55	73	91	109	128	146	164
5.25"	57	76	95	114	133	152	171

If the female spawning stock drops below the level which maximizes recruitment, either because of reduced clutch size, barreness, or lowered abundance of mature females, the ABC will be based on the exploitation rates in Table 2 (page 16) for depressed populations, applied to that part of the male stock above the minimum biological size.

Table 2. Comparison of exploitation rates of legal crab given relative population size and recruitment and post-recruitment abundance levels.

Population Size[1/]	Pre-Recruitment Abundance	Recruitment Level Approximate exploitation rates of legal crab at given levels of post-recruits Low[2/]	Moderate[3/]	High[4/]
Depressed	Declining	Less than .20[5/]	Less than .25[5/]	Less than .25[5/]
	Stable	.30	.30	.35
	Increasing	.30	.30	.35
Average	Declining	.40	.40	.40
	Stable	.40	.45	.45
	Increasing	.40	.50	.50
Peak	Declining	.40	.45	.50
	Stable	.50	.55	.60
	Increasing	.60	.60	.60

1/ Corresponds to the upper, middle and lower third of the range of recorded legal stock indices.
2/ Low = less than 1/3 of total population (lbs.)
3/ Moderate = 1/3 - 2/3 of total population
4/ High = over 2/3 of total population
5/ Exploitation rate will be based on review of in-season considerations described in Section 4.9.

Definitions for the above variables are provided as examples in the Appendices, Section 7.5.1.

ABC for areas for which spawner-recruitment relationships cannot be determined.

In some parts of the BS/AI data are insufficient to determine a spawner-recruitment relationship. Until such data become available for a fishing area, the ABC will be set at the maximum catch of male crab which does not result in a decline of female fertilization. The ABC for an area is determined by applying an exploitation rate based on population size and recruitment levels (Table 2), to male crab above a minimum biological size. The size limit is determined for each area by using the size when 50% of the male population is sexually mature and adding three years, thus ensuring each male the opportunity to reproduce at least once before becoming vulnerable to the fishery. (For further explanation of the reproductive characteristics of king crab, refer to the life history description in Section 7.3.1.)

Fisheries where size limits and exploitation rates set on this basis are in effect have not shown any decline in female fertilization. Therefore, until additional information indicates otherwise, for stocks that are at a low level or whose spawner-recruitment relationship is unknown, the ABC will be calculated on this basis.

OY

Optimum yield (expressed in pounds) for the BS/AI king crab fishery is pre-season estimate of the harvest based on biological and economic conditions. The specification of OY for an area will be based on the procedure used in determining ABC. In areas where ABC is determined using spawner-recruit relationships (eg. Bristol Bay), the OY will be specified within a range and, if necessary, for separate districts within the area. The OY in those areas can be modified annually without a plan amendment as long as the OY remains within the range specified in this plan and described in the next paragraph. In areas where biological information is limited and spawner-recruit relationships cannot be determined, the OY will equal the ABC. It is recognized that the actual harvest may differ from earlier estimates of OY because of information gained during the season, or from assessment surveys just prior to the season. (See Section 4.9, In-Season Adjustment of Time and Area).

In Bristol Bay, the OY will equal the ABC unless modified by social, economic, or ecological factors which require it to be less than ABC in order to achieve the management objectives of this plan (refer to Section 3.0 on page 8). The OY may not be larger than ABC and the reduction from ABC is limited to that amount of crab that would be equal to the amount which could be taken at a carapace width equal to 7.0 inches and an exploitation rate equal to 30 percent. The actual specification of OY shall be derived annually through the use of minimum size limits and exploitation rates.

The OY for the Bristol Bay area shall be determined annually using the following procedure:

1. The ABC recommendation will be reviewed and adopted.

2. A minimum size limit will be adopted. Criteria which will be considered in establishing the size limit include:

    - industrial (processing) requirements such as the desirability of a uniform crab size to facilitate processing.
    - minimum size requirements for domestic and foreign markets;
    - marketing requirements such as large claws for speciality markets or advertising commitments;
    - fishing gear requirements, such as design changes in gear if size limits are changed; and
    - fishing efficiency requirements; for example changes in size limits may substantially increase sorting problems.

3. An exploitation rate will be adopted. Criteria which will be considered in establishing the exploitation rate include:

    - an evaluation of the economic viability of the fishery;
    - an evaluation of processing availability and marketing requirements;
    - an evaluation of king crab population composition and levels;
    - an evaluation of opportunities for diversification by the harvesting and processing sectors; and
    - an evaluation of labor forces and industry dependence on the king crab fishery.

4. The purpose of this process will be to permit the harvest of individual king crab stocks by adhering to the primary objective specified in Section 3.0 while striving to achieve the secondary objectives.

5. If in the case an OY cannot be determined due to the female spawning stock dropping below the level which maximizes recruitment, either because of reduced clutch size, barreness, or lowered abundance of mature females, the OY will equal the ABC as based on the exploitation rates in Table 2 for depressed populations.

4.2 Fishing Seasons

Open and closed fishing seasons are used to protect king crab during the molting, mating, and growing periods of their life cycle. The season will normally be closed during those periods to protect crab from mortality caused by handling and stress when shells are soft and to maximize meat recovery by delaying harvest until the shells are filled out.

Closed seasons will be set to maximize the reproductive potential of the king crab population based on one or more of the following conditions:

1. They will protect the breeding population of male king crab during their migrations into shallow water breeding grounds.

2. They will allow enough time preceeding peak breeding periods so that male breeders are not overharvested as they segregate into discrete schools immediately prior to breeding.

3. They will continue long enough after molting periods so that the shells have hardened enough to permit handling with minimal mortality and damage.

4. The closed season should include all of the sensitive periods of the life cycle of the crab, including egg hatching by females and pre-breeding schooling of male crabs in shallow water.

It may be desirable in some areas to provide for an open season that conflicts with some of the preceeding conditions. Openings during that time must be justified on one or more of the following guidelines:

1. They will provide for an exploratory fishery to encourage effort on a stock of low productivity which would otherwise not be fished during a regular season because fishermen would concentrate on more productive stocks.

2. It may not be possible to fish during more favorable periods of a stock's life history because of adverse environmental conditions, such as sea ice covering the fishing grounds.

3. A fishery during a sensitive biological period will be designed to ensure that no irreparable damage will be done to any king crab stock.

The biologically sensitive period in the life cycle of king crab in the FCZ area is generally from late winter to early summer although the timing for individual stocks may vary somewhat, allowing some adjustments in seasons. From late summer through early winter most stocks are valuable to the fishery. Harvest levels or optimum yields are generally taken in two months or less so there is an opportunity to look beyond strictly biological conditions in setting season openings.

Within the confines of the biological season the open fishing season should be set to optimize the economic efficiency of the industry in utilizing the king crab resource. Among the factors that will be considered in accomplishing this goal are the following:

1. Scheduling the season to minimize deadloss; all king crab must be alive when processing begins. Those dying prior to processing are classed as "deadloss" and discarded. They are counted as part of the harvest and the OY. Deadloss increases if crabs are softshell, if not completely filled out, if they are held for long periods in

boat tanks or processor holding tanks, if holding tanks are contaminated by fresh water, and if handled too many times. Seasons should be set, when possible, late enough so crab are hard and well filled out, and scheduled in relation to other fishing seasons and activities so deliveries and processing are orderly, thereby reducing to a minimum the time a catch is kept in vessel or processor holding tanks. Warm water temperatures and periods when fresh water may be a problem on the surface of bays and harbors should be avoided if possible since both factors increase mortality in holding tanks.

2. Produce the best possible recovery rate, that is the ratio of meat recovered in proportion to live weight. Since different portions of a stock within a fishing area may fill out at different times during the acceptable biological season, it is not always possible to harvest all crabs in an area during the best meat recovery period.

3. Insofar as possible schedule the season to minimize the period of severe weather conditions during the fishery to avoid loss of fishing time and losses of men and ships because of adverse conditions.

4. Schedule to minimize the cost of industry operations.

5. Other fisheries that will be making demands on the same harvesting, processing, and transportation systems needed in the crab fishery.[1/]

6. The need to time king crab seasons relative to one another to spread fishing effort, prevent gear saturation in a particular area, and allow maximum participation in the fishery by all elements of the king crab fleet.

1/ King crab seasons set during other ongoing fisheries, particularly for salmon, may over-stress all components of the industry. If set too long after other seasons, overhead costs from idle crews and facilities are greatly increased.

7. The cost of enforcement and management before, during, and after an open season as affected by the timing and area of different king crab seasons and as affected by seasons for other resources.

Seasons will usually be closed based on in-season assessments. Close monitoring of the fishery as it progresses will provide for closures when the OY is attained or when the harvest range is reached. The OY and harvest ranges will probably be adjusted by surveys immediately prior to the fishery, by changes in catch per unit of effort (CPUE), by tag recoveries during the fishery, and by any other methods available, including observers on fishing vessels and interviews with fishermen.

Closing dates may be set prior to season openings as safeguards in areas that are difficult to monitor, where population estimates are not considered particularly reliable, or for other reasons as required.

4.3 Gear Restrictions

Legal gear for the commercial king crab fishery is limited to pots (traps) and ring nets in all areas, and each king crab pot must contain a mechanism which will terminate its catching and holding ability within six months if the pot is not removed from the water. These gear are selective in the sense that non-legal crab (i.e., female and undersized male crab) may be returned to the water unharmed. Trawls and tangle nets are prohibited because of the high mortality rates which they inflict on nonlegal crab.

4.4 Gear Placement Limitations

The placement of gear on the fishing grounds up to seven days before the opening of a king crab season, and the leaving of such gear on the fishing grounds for up to seven days after the close of any such season, may be authorized if such early placement and late removal is justified in light of (1) its biological impacts on king crab and other species; (2) the enforcement problems and costs borne by the public versus by the industry; (3) the possibility that it will lead to additional gear conflict; and (4) the availability of unloading facilities for disposal of king crab catches and of gear storage areas outside the fishing grounds.

Regulations which effect gear placement on the grounds prior to and immediately following some highly competitive king crab fisheries, grew out of the need to provide additional time to haul gear to and from the fishing grounds. This time was needed because of limited storage and loading and unloading facilities available to the entire fleet.

4.5 Gear Storage Limitations

Although king crab gear is generally stored on land, storage of gear in a non-fishing condition in ice-free water areas of low crab abundance may be authorized if such storage is justified in light of (1) its biological impacts; (2) the additional enforcement costs to the public that it will cause; (3) the costs to vessel owners of storage on land; (4) the availability of other land and sea storage areas; and (5) the possibility that it would lead to additional gear conflicts.

King crab pots should be removed from the fishing grounds between seasons to reduce problems with other types of fishing gear that may be in use in the same area and eliminate, insofar as possible, illegal fishing prior to or after the close of the regular king crab fishing season. Pots have been stored both on land and in the water. When in the water, it has been required by state regulations that they be in shallow waters, generally less than 25 fathoms unless otherwise specified, or in specially designated areas adjacent to, but not on, the normal crab fishing grounds.

Land storage is to be preferred because of the elimination of gear loss and the greatly reduced deterioration of fishing gear in open air storage. There is not, nor is there likely to be in the immediate future, enough land storage area available in the BS/AI region to store all of the pots that are currently used in this fishery. In addition, land storage is expensive because gear must be moved on land and generally some lease fee is necessary for the use of the land. Most of the storage areas are a fair distance from the fishing grounds and additional costs are incurred in vessel running time for moving the gear.

Storage in the water, while generally closer to the fishing grounds and therefore less costly for moving gear to a storage area, has disadvantages. There are virtually no areas available in shallow water or in bays or in designated high seas areas where some interference with other vessel or fishing traffic will not occur. Any area chosen must be ice-free through the winter to avoid loss of gear from pack ice. It should be well away from concentrations of Stellar sea lions or else each pot must be equipped with a hard plastic "sea lion" buoy so the buoys will not be punctured by sea lions and the pot lost.

4.6 Vessel Tank Inspection

The inspection of the tank or live-hold of each vessel engaged in the king crab fishery may be required not more than five days before the opening of a king crab fishing season if such inspection is justified in light of (1) enforcement requirements; (2) the need to document the location of commercial harvests; (3) the ability of the vessels concerned to move easily between the fishing grounds and the location of inspection centers; (4) the time necessary for the vessels concerned to transport their gear from storage areas to the fishing grounds; (5) the fuel consumption that the inspection requirement will cause; and (6) the equity of allowing all participants to start the fishery at substantially the same time.

Vessel tank (live-hold and freezer) inspections are used to enforce the opening of a king crab season and to prevent vessels from covertly fishing in adjacent statistical areas and misreporting a landing. In order to pass inspection, the vessel must have no crab aboard. Generally, the tank inspection is performed by ADF&G personnel during a 1-5 day period preceding the season opening depending on the statistical area. Due to the great number of vessels and amount of gear involved, and considering the limited high seas enforcement capabilities, the tank inspection requirement generally represents the opening of the commercial season.

4.7 Restrictions on Taking Females

Unless a surplus is determined to be available, female crabs cannot be taken. The surplus would be dependent on the number of crabs above the threshold amount used in the spawning stock calculation of OY.

Most west coast crab fisheries take only male crab, a restriction that is assumed to contribute to maximum reproductive potential. The data base to support or reject an extensive harvest of female king crab is poor. There have been some recent studies indicating that there are probably surplus female crab which can be taken when stock levels are high (Reeves and Marasco, 1980; Reeves, 1981). However, the accumulative effects of a female harvest and the subsequent environmental impacts are not demonstrable at this time and may never be without actually harvesting females.

Harvesting female king crab has not been an issue in past management of the king crab fishery. While management philosophy endorses a limited fishery for females in years of high abundance industry has shown little interest. Not only are females considerably smaller than males of the same age, but the proportion of recoverable meat is much less than that of males of the same size.

When a surplus of female crabs is determined, this plan authorizes experimental harvest and processing of females by permit if (1) fishermen provide accurate documentation of harvest rates and location; and (2) processing and marketing results are made available to the management agency.

4.8 Registration Areas

The Fishery Management Unit is divided into four (4) registration areas - Bering Sea, Bristol Bay, Adak, and Dutch Harbor (Fig. 1b). These areas also serve as statistical areas and may be further divided into fishing districts for purposes of management and reporting. Registration areas are characterized by relatively homogeneous established fisheries on stocks of crab that have, at most, insignificant transfer between areas. They tend to be utilized by the same general class of boat from year to year and seasons vary somewhat

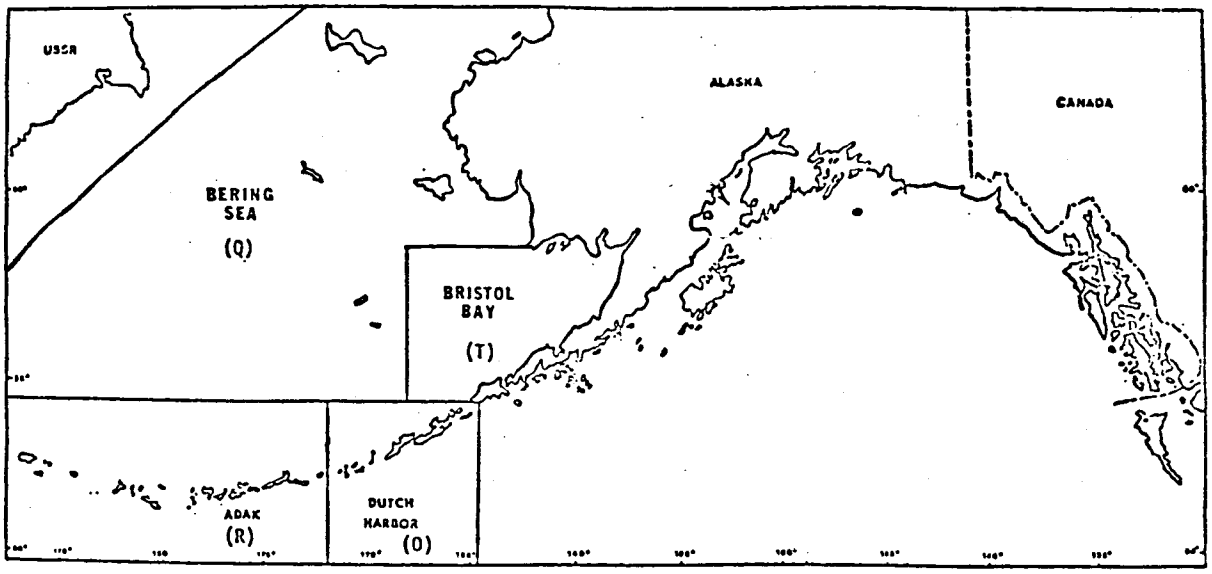


Figure 1b. Alaska King Crab Statistical Areas in the BS/AI area.

from area to area because of natural causes such as differences in timing of molting and breeding in each. Geographic remoteness from processing plants and support facilities may further characterize some areas. The areas designated in this plan are not expected to change as stock conditions fluctuate or new stocks are discovered. While a change in the geographic delineation of the registration area boundaries will require a plan amendment, a change in the delineation of districts may be accomplished by regulation. In designating a district within a registration area, or when modifying current district boundaries, the following factors will be considered:

1. does the area contain a reasonably distinct stock of crab that may require separate optimum yield designations within the composite OY determination for the registration area in order to avoid overharvest of that particular stock?

2. do species or stock differences require different size limits from other stocks in the registration area?

3. does different timing for molting and breeding require a different fishing season than other stocks in the registration area?

4. are estimates of fishing effort needed before the season so overharvest can be prevented? A district may require pre-fishing registration beyond that required for the registration area.

5. is part of an area relatively unutilized and unexplored; and will establishing a district encourage exploration and exploitation?

The same variety and kinds of management measures used in registration areas might also be warranted and employed in districts.

Registration of vessels will be required for each registration area and may be required for fishing districts within a registration area, particularly for fishing districts in which the stock conforms to the biological boundaries of the district. The registration requirement allows the management authority to estimate fishing effort and the rate at which the resource will be harvested.

Registration areas and districts may also be designated as either exclusive or non-exclusive. Historically, exclusive registration areas have been relatively small, contain known concentrations of king crab, are close to shore, and are fished by well developed fisheries. Non-exclusive registration areas are usually quite large, have developing fisheries, and may contain some sections that are both underutilized and unexplored. The use of "exclusive" designations as a conservation and economic measure aids in dispersing the fishing effort while still allowing the majority of the fleet the opportunity to harvest the majority of the crab.

A vessel may register for only one exclusive area within any registration year, but may also fish in non-exclusive areas by registering in each prior to fishing. Fishermen can register for any exclusive area and are not restricted in their choice. Fishermen will often consider potential harvest, proposed prices, and distances between the fishing grounds and processing facilities when making their selection.

The exclusive registration area assists in preventing economic dislocation of a certain segment of the industry dependent on an individual registration area's crab stocks, particularly if the character of the fishing fleet and the related industry participants depending upon the registration area's potential production would not allow movement to another registration area. Generally the combination of exclusive and non-exclusive areas tends to spread the fishing effort within a fishing season to fully utilize the crab stocks. The most significant conservation purpose served by exclusive areas is the reduction of the opportunity for "pulse" type fishing effort, which tends to either over exploit discrete stocks or require overly conservative management that prevents full utilization of all available segments of the total crab stocks within the registration area.

Any designation of an area or district as an exclusive registration area must be supported by a written finding that covers these factors:

1. The extent to which the designation will facilitate proper management of the fishery.

2. The extent to which such designation will help provide vessels with a reasonable opportunity to participate in the fishery.

3. The extent to which the designation will help to avoid sudden economic dislocation. Established processing facilities and fishing fleets within a registration area may provide economic stability for the labor force and affected communities and may be destroyed or adversely affected by an in-season influx of mobile processing plants and additional fishing power.

4. The extent to which the designation will encourage efficient use of vessels and gear.

5. The extent to which the economic benefits conferred by the designation will be offset by economic costs and inefficiencies.

6. The extent to which other management measures could yield the results desired from the designation.

The following are examples of situations in which the designation or maintenance of an exclusive registration area might be appropriate:

1. The existence of differences in seasons between registration areas that could promote peak harvest rates only at the beginning of each season. Vessels capable of moving rapidly between areas could fish the season opening of more than one area, thereby creating an adverse impact on the vessels that planned on or were capable of fishing just one area for the entire season.

2. The occurrence of ex-vessel price settlements at different times in different registration areas, causing concentration of fishing and processing effort in registration areas that have completed price settlements.

3. Historic profitable utilization of the crab resource of an area by a fleet that could not be used to fish in more distant areas, and by processors heavily dependent for their supplies of crab upon the activities of that fleet.

4. Crab populations that vary in availability or on a seasonal basis may trigger effort shifts between registration areas to maximize the economic returns for a single segment of the overall fishing and processing effort. This provides a significant advantage for mobile processing units and larger vessels capable of operating in a wide range of sea conditions, but which may not in any particular area be as efficient as the less mobile harvesting and processing units that they displace.

5. The crab fishing fleet has experienced rapid growth and advanced in fishing efficiency. There is therefore, an increasing potential for overharvest of a particular stock especially during normal fluctuations in crab populations. Situations may exist where in the absence of limitations, the number of vessels registering for an area or district may possess a one-trip cargo capacity that exceeds the amount of crab that can be safely taken from that area.

6. Registration areas historically fished by small vessels require a longer period of fishing time to harvest crab resources because they cannot fish in bad weather and have limited carrying capacity. Relatively low production levels of inshore fishing grounds combined with inshore migration of king crab stocks over a very long season provide the smaller vessels opportunity to maximize their production capabilities. Larger vessels designed primarily for areas of greater fishing power can adversely affect the economics of established fleets, processing facilities, labor forces, and community dependence on production from the local resource, while failing to maximize utilization of smaller crab stocks.

7. Since fleet capabilities have developed in response to demands within registration areas, they may vary significantly with regard to the volume of fishing gear (pot units) used, the ability to transport quantities of pot gear and the severity of the weather in which they can fish. These factors and others can place a fleet comprised of mostly small vessels at a distinct disadvantage.

8. Some registration areas contain several discrete harvestable stocks of crab, which become available to the fishery at different periods during the season. These registration areas tend to develop fleets with less fishing power and also less overhead costs. The best yield from this type of fishery is usually attained by avoiding "pulse" fisheries, which harvest high volume from the immediately available stocks which tend to overharvest some stocks and under-harvest others.

An important factor to consider in respect to vessel classes involved in a specific registration area is the relationship to the overall production capabilities of that vessel to participate in diversified fisheries. Registration areas that tend to be exclusive are primarily composed of vessels that annually rely on salmon, Dungeness crab, herring and other fisheries where the utilization of a small vessel is a regulatory or production limitation factor. Vessels used in these fisheries tend to be very manuverable, possess a shallow draft that allows fishing close to shore, and they do not require a large hold capacity since transportation time between the fishing grounds and the processors must be kept to a minimum. Vessels which are designed for open sea conditions and longer voyages are more directly linked with other deep-water fisheries requiring greater fishing power or vessel carrying capacity, such as for the bottomfish fishery and tendering. When registration areas are made exclusive it tends to protect the overall diversified fishery activities of the participating vessel classes which maintains their economic stability.

4.9 In-season Adjustment of Time and Area

The provisions of this plan and the regulations implementing it are based upon the best scientific information that is available at the time of their development. Because this information is inexact, this plan and the regulations necessarily cannot incorporate detailed predictions concerning the condition of king crab resources and the performance of king crab fisheries. Therefore, a procedure by which adjustments to otherwise applicable time and area restrictions can be changed immediately in light of actual stock and fishing conditions by an official such as the NMFS Alaska Regional Director or the ADF&G Commissioner without resorting to normal rulemaking procedures is authorized. This procedure may be invoked when application of the prescribed time and area limitations raises the likelihood of harm to king crab resources or of waste of those resources, or the risk that the true OY of a king crab stock will not be achieved or that it will be exceeded.,

Three circumstances relevant to the attainment of the OY are illustrative of the general need for these adjustments in time and area limitations:

1. When the OY has been achieved for any area, the fishery in that area shall normally be closed even if the season closure date previously prescribed has not yet arrived.

2. OY specifications are based upon projections several months in advance of the actual conduct of the fishery. Because these specifications may prove incorrect due to evaluation of new information or re-evaluation of previous information, adjustments of time and area restrictions may be necessary during the fishing season. These evaluations may increase or decrease the projections of true OY and may necessitate a corresponding adjustment of the season.

3. In-season adjustments to time and area limitations may be necessary to minimize the wastage of the resource from causes such as deadloss.

The following factors shall be taken into account when immediate changes are made in previously prescribed time and area limitations:

1. distribution of fishing effort by time and area;
2. catch per unit of effort and rate of harvest;
3. relative abundance of age classes of king crab within the area in comparison with preseason prediction;
4. the proportion of immature or soft shell king crab being handled; and
5. any other factors relevant to the conservation and management of king crab.

4.10 Permit Requirements

All U.S. fishing vessels operating in the FCZ must have on board a current Federal permit issued annually by the Secretary of Commerce. The authority to fish in the FCZ of any vessel used in committing a serious violation of management measures adopted under this plan, as well as such authority of any other vessel owned or operated by the same person, may be suspended or revoked permanently.

4.11 Reporting Requirements

As the commercial Alaskan king crab fishery has grown over recent years, so has our knowledge of king crab. Information gained through scientific surveys, research, and fishermen observations, have all led to a better understanding of king crab biology, their environmental requirements, and behavior. These data are always accumulating and are of great benefit to both shellfish biologists and managers. Some of the most useful information is obtained in-season from fishermen and processors reports. Biologists gain data on crab distribution, female fecundity, disease and molting periods. Fishery managers are able to monitor harvest rates and determine areas of greatest fishing effort, thereby preventing overharvest of individual crab stocks. With the undisputed value of obtaining in-season fishery information, the current State catch and processing report requirements are an essential component of this FMP. This information must be provided regardless if the catch is landed in or outside of Alaska.

Catch Reporting: Catch reporting by the fishermen, processors, and buyers is necessary for proper management and shall be required by regulations adopted to implement this plan. At a minimum, the information required to be reported shall include the following:

1. the total amount of catch landed;
2. the total time fished;
3. the total number of pot lifts;
4. the quantity and type of gear used; and
5. the reporting of deadloss.

Processing Reporting: Fish buyers, processors, and others who purchase, transport, or process king crab shall provide the following data under regulations adopted to implement this plan:

1. the amount of crab purchased, transported, and/or processed, by species;
2. locations at which crab are received or processed, by species;
3. limitations as to time of receipt, quantity, or quality of crab imposed by the buyer or transporter, by species;
4. disposition of the crab received or processed, by species;
5. prices paid for crab received, by species;
6. the amount of king crab which the processor expects to purchase, transport, or process, by species, by year; and
7. the amount of deadloss.

4.12 Recreational and Subsistence Fisheries

Recreational and subsistence fishing for king crab in the FCZ may be exempted from any management measure otherwise applicable to the king crab fishery in the FCZ under this plan, to the extent that this exemption does not have a significant adverse effect on king crab resources.

5.0 TOTAL ALLOWABLE LEVEL OF FOREIGN FISHING AND JOINT VENTURE PROCESSING

The domestic fishing and processing capacity for king crab greatly exceeds any reasonably foreseeable OY for the Alaska king crab fisheries covered by this plan (see section on Description of Domestic Fishery in Section 7.4). There is no reasonable doubt that the domestic industry will completely utilize the optimum yield. Thus, under the MFCMA, Section 201(d), the total allowable level of foreign fishing and/or joint venture processing for the fisheries covered by this FMP equals zero (see also Section 7.4).

6.0 PROCEDURES FOR PLAN IMPLEMENTATION

Implementation of this plan requires an annual review of king crab management measures and regulations by the NMFS Alaska Regional Director, ADF&G, the NPFMC, and the Board, to the extent the Board participates in implementation of this FMP, as outlined below. In order to conduct this review, they will rely on proposals and advice received during the year from fishery biologists, economists, industry representatives, advisory committees, and the public. The review process currently follows a relatively predictable schedule. The procedure for managing the fishery and how it encompasses research and fishing input are illustrated in Figures 2 and 3. The precise scheduling of the various stages of this procedure may vary slightly from year to year, and it could be quite different to the extent that NMFS could assume sole responsibility for implementation of this plan.

State and Federal governmental agencies have limited fiscal resources. The optimal use of the money available for North Pacific fisheries management, research, and enforcement can be best achieved through a clear definition of agency roles and division of responsibilities, thus avoiding unnecessary duplication.

The NPFMC has the responsibility for preparing fishery management plans (and amendments to such plans) for the conservation and management of the fisheries seaward of Alaska, with particular emphasis on the consistency of these measures with the National Standards of the MFCMA.

It is intended that individual management measures for carrying out this FMP will be supplied by the State of Alaska under terms of a single implementing regulation promulgated by the Secretary of Commerce in the usual manner under Section 305 of the MFCMA. The State of Alaska for more than two decades has exercised effective control over king crab fisheries both within and without its territorial waters. The State system currently centers around the Board's policy and regulations (Section 8.5.1). The Board's regulatory system provides for extensive public input; is sufficiently structured to ensure annual revisions; is flexible enough to accommodate resource and resource utilization "emergencies;" and is understood and familiar to the users of

Figure 2 -- Yearly cycle of King crab management.

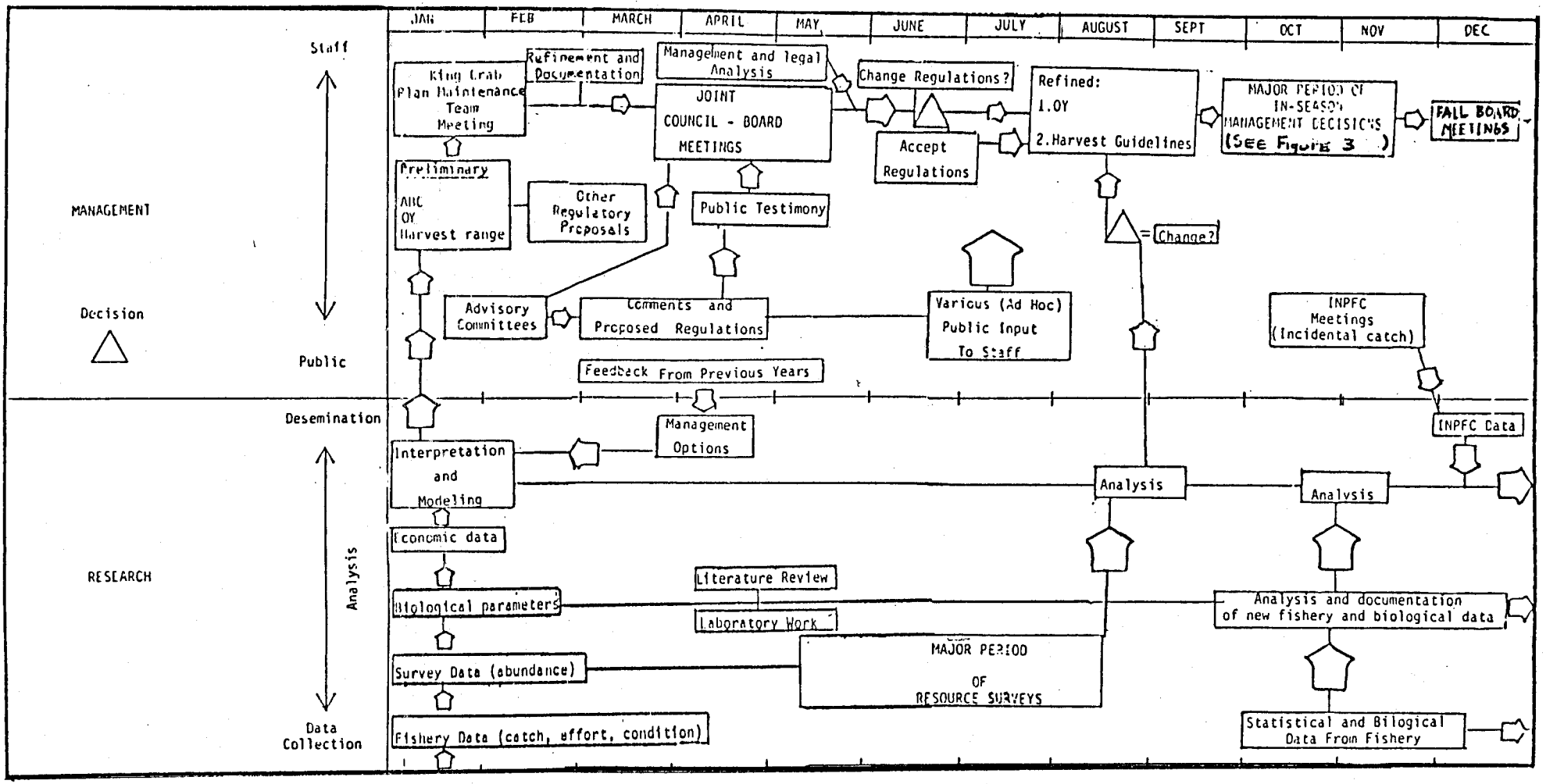
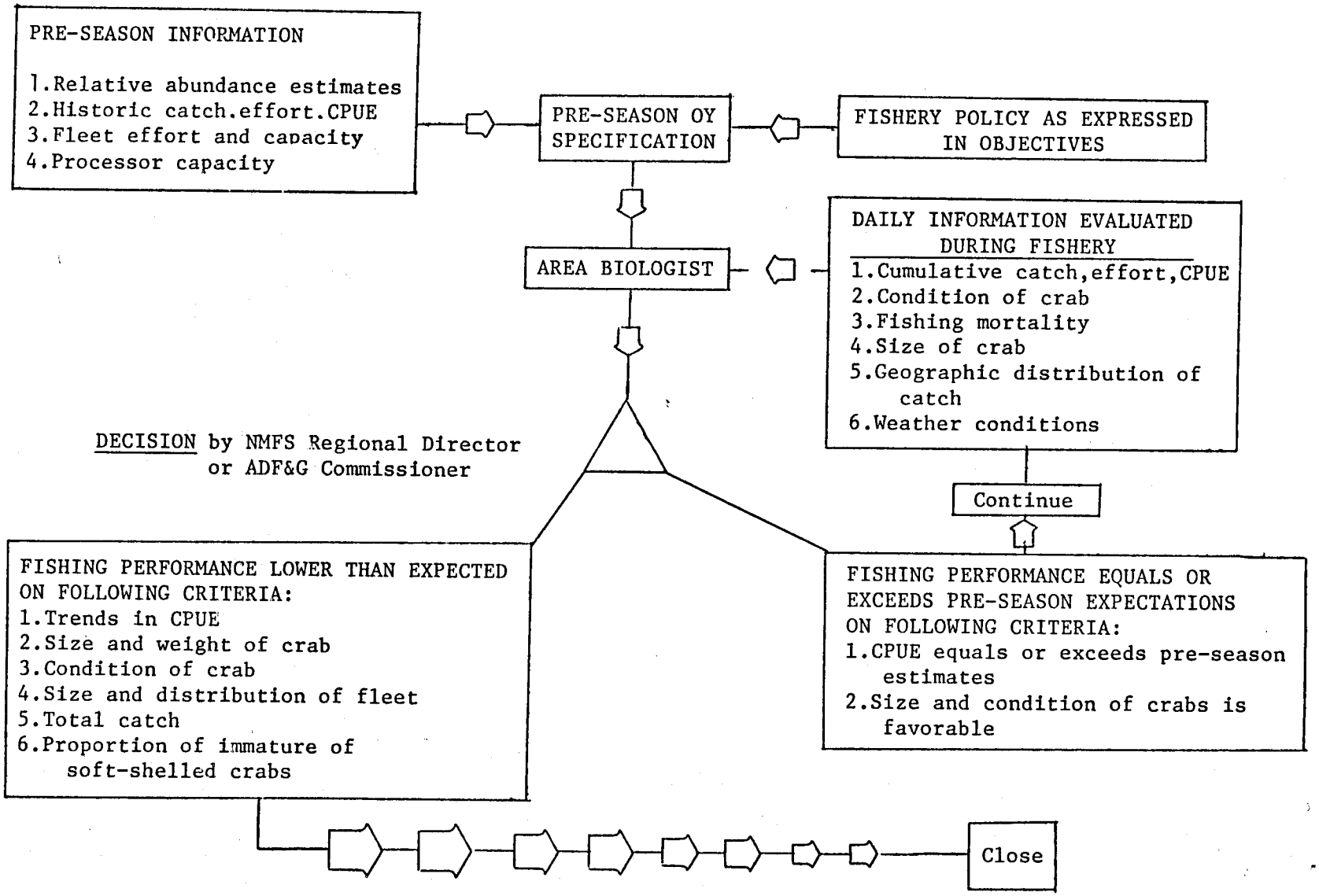


Figure 3. Information used to manage fisheries



North Pacific fisheries resources. Further, there exists a substantial investment by the State of Alaska in facilities, communications and information systems, vessels and other equipment, coupled with a cadre of experienced personnel capable of carrying out extensive management, research, and enforcement programs to monitor the conduct of the fisheries and status of resources.

The Federal government (through the NPFMC and the NMFS Alaska Regional Office) and the State of Alaska establish the following protocol which describes roles each will play in order to achieve the most effective and efficient management of domestic king crab fisheries in the BS/AI area:

1. The NPFMC shall develop an FMP (references to the FMP in this section also apply to amendments to the FMP) to govern management of the fishery, prescribing objectives, standards, and measures found to be necessary for the fishery's effective management. These objectives, standards, and measures shall be consistent with the MFCMA and other applicable law;

2. The NPFMC shall submit the FMP and the proposed regulations delegating management authority to the State, to the Secretary for approval. Following approval of the plan by the Secretary, the plan shall be implemented through Federal utilization of State processes, agencies, and regulations. The specific regulations for the management of the BS/AI king crab fishery shall be promulgated in accordance with the laws of the State. These regulations shall be consistent with the MFCMA, other applicable law, and the objectives, standards, and measures prescribed in the FMP.

3. Before taking final action on any regulation governing the fishery, the Board shall make readily available in written form to all persons interested in the fishery for a period of at least thirty (30) days, the reports and data received by the Board upon which the proposed regulation is based; shall afford all such persons the opportunity to submit written and oral comments to the Board on the proposed regulation during that period; and shall, upon the request of the NPFMC, meet with the NPFMC or its representatives to discuss

the proposed regulation. Before any Board regulation governing the fishery goes into effect, the Board shall issue a written statement explaining the basis for the regulation. The preceding provisions of this paragraph shall not apply to emergency regulations or to in-season field orders.

4. The Regional Director, after consulting the Council, shall be empowered to prevent any State regulation from taking effect in the FCZ of the management unit if he concludes that the measure is inconsistent with the FMP, the MFCMA or other applicable law.

5. The commissioner of ADF&G or his designee, in consultation with the Regional Director or his designee, may, when circumstances require, summarily open or close seasons or areas by means of emergency orders. Emergency orders shall be publicized and made known to interested persons including fishermen, buyers, packers and canneries by as many of the following means as time and circumstances permit:

   (a) radio transmission;
   (b) notice posted at commercial and public places;
   (c) press releases and announcements in local newspapers and commercial radio stations; and
   (d) telegrams and commercial radio facilities.

   Subject to the necessities of sound conservation and management, emergency orders shall be announced as far in advance of an opening or closing of a season or area as possible.

6. The Secretary shall have the final authority to supersede or supplement any State regulation which he determines to be inconsistent with the FMP, the MFCMA, or other applicable law.

7. The Board or the Commissioner of ADF&G, after consultation with the Regional Director, may adopt an "emergency" regulation after making a written finding, including a statement of the facts which

constitute the emergency, that the adoption of the regulation is necessary for the immediate conservation or management of the resource or the fishery. Emergency regulations are not subject to the notice of proposed action, comment period, etc. prescribed for normal rulemaking (see paragraph 3 above). However, upon adoption of an emergency regulation the standard procedure for giving notice of adoption of a regulation shall be followed.

8. The NPFMC and Board shall meet jointly at least once every calendar year to consider management of the fishery and discuss the need for amendment of the FMP or any regulations governing the fishery. The NPFMC and Board or their designated representatives shall also meet jointly to consider management of the fishery at the request of either the NPFMC or the Board. All persons and agencies interested in the fishery shall have the opportunity to submit written and oral comments and reports on management of the fishery to the NPFMC and the Board at these meetings. In preparation for the mandatory annual joint meeting provided for in the first sentence of this paragraph, representatives of the NPFMC and the Board shall hold a public hearing in the State of Washington at which all persons and agencies interested in the fishery shall be afforded the same opportunity to comment on management of the fishery that they would have at the meeting itself.

9. ADF&G shall have primary responsibility for developing the information upon which regulations governing the fishery are to be based, and for implementing these regulations through monitoring of the fishery and development of in-season management measures. In carrying out this responsibility, ADF&G will consult actively with the NMFS and the fishery management and research agencies of other states, in order to prevent duplication of research and management effort and to make optimum use of the resources available for management of the fishery.

If either the Federal Government or the State of Alaska should for any reason withdraw from this protocol, the other provisions of this FMP shall remain in effect and be implemented by the Secretary or his designee.

7.0 APPENDICES

7.1 National Standards of the Magnuson Fishery Conservation and Management Act

1. Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery.

2. Conservation and management measures shall be based upon the best scientific information available.

3. To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and inter-related stocks of fish shall be managed as a unit or in close coordination.

4. Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (a) fair and equitable to all such fishermen; (b) reasonably calculated to promote conservation; and (c) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

5. Conservation and management measures shall, where practicable, promote efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

6. Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

7. Conservation and management shall, where practicable, minimize costs and avoid unnecessary duplication.

7.2 State of Alaska Management Structure

Institutions: The State Organizational Act of 1959 provided for Alaska Statutes, Title 16, which deals with Alaska Fish and Game Resources. Article 1 provides for a Department of Fish and Game whose principal executive officer is the Commissioner of Fish and Game. The Commissioner is appointed by the Governor for 5 years.

The Commercial Fisheries Division was established to manage all commercially harvested fish species in Alaska. The Division is headed by a director who supervises four regional supervisors. The regions are further separated into management areas. Area management biologists are responsible for collecting catch data and monitoring fisheries in their areas.

A Subsistence Section within the Commissioner's Office was recently established to document subsistence needs and utilization and to make recommendations for developing regulations and management plans to ensure subsistence use preference.

The enforcement of fish and game laws and regulations is provided by ADF&G and the Alaska Department of Public Safety (ADPS). The Fish and Wildlife Protection officers of the ADPS operate independently of the Department of Fish and Game although communication between the two departments is maintained and activities are coordinated.

Jurisdiction: ADF&G has management authority over all migratory fish and shellfish species which enter and leave territorial waters of the State during any given year including the migratory fish and shellfish taken from State waters which are indistinguishable, in most instances, from those taken from adjacent high seas areas. Regulations governing migratory fish and shellfish apply in both areas and are enforced by the State's landing laws. These landing laws prohibit the sale or transportation within State waters of migratory fish and shellfish taken on the high seas unless they were taken in accordance with State regulations.

The Fisheries Regulatory Process: The Alaskan system has a seven member Board of Fisheries, composed of fishermen and other businessmen appointed by the Governor, which considers both public and staff regulatory proposals in deciding on regulatory changes.

The Board is required by law to meet or hold a hearing at least once a year in each of the following areas of the State in order to assure all people of the State ready access to the Board: (a) Upper Yukon-Kuskokwim-Arctic; (b) Western Alaska (including Kodiak); (c) Southcentral; (d) Prince William Sound (including Yakutat); and (e) Southeast.

Since the late 1960's, the Board and, before it, the Board of Fish and Game has held a minimum of two meetings annually to adopt changes in the fisheries regulations. The fall Board meeting, usually held in early December, considers proposals for changes in sport fishing regulations and in commercial and subsistence finfish regulations. A spring Board meeting, usually held in late March or early April, considers commercial and subsistence shellfish regulatory proposals.

Regulations which may be adopted by the Board cover seasons and areas, methods and means of harvesting, quotas, and times and dates for issuing or transferring licenses and registrations.

Advisory committees, composed of people informed on the fish and game resources of their locality, serve as local clearinghouses and sources of proposals for Board consideration.

Following submission of public proposals, ADF&G staff members review the proposals and redraft the wording, when necessary, to conform to the style required. ADF&G also submits proposals for the Board's consideration.

In adopting new regulations, the Board follows Alaska's Administrative Procedure Act. This act has several requirements: At least 30 days prior to the adoption of new regulations, a notice giving the time and place of the adoption proceedings, reference to the authority under which the regulations are proposed, and a summary of the proposed action must be published in a

newspaper of general circulation and sent to all interested people who have asked to be informed of the proposals. During the proceedings, the public must be given an opportunity to testify on the proposed changes. If a new regulation is adopted, it must be submitted to the Lieutenant Governor through the Attorney General's office. Thirty days after being filed with the Lieutenant Governor, the new regulation becomes effective. Because of these requirements, new regulations usually do not become effective until about two months after being adopted by the Board.

Regulatory flexibility is given to the Commissioner of Fish and Game and to his authorized designees to adjust seasons, areas, and weekly fishing periods by emergency order.

The requirements outlined in the preceding paragraph do not apply in the case of emergency regulations, which may be adopted if needed for the immediate preservation of public peace, health, safety, or general welfare. An emergency regulation remains in effect 120 days unless it is adopted as a permanent regulation through the procedure described above. Emergency regulations have the same force and effect as permanent regulations. The Board has delegated authority to the Commissioner to adopt emergency regulations where an emergency exists as described in AS 44.62.250.

7.3 Biological and Environmental Characteristics of the Resource

7.3.1 Life History Features

Description of Species

There are three commercially important species of king crab in Alaskan waters. The species commonly referred to as the king crab or red crab is *Paralithodes camtschatica*. The other two commercial species are the blue king crab, *P. platypus*, and the brown or golden king crab, *Lithodes aequispina*.

King crabs are not true crabs, such as the Dungeness crab of the Pacific Coast, but are more closely related to hermit crabs. Members of the genera *Paralithodes* and *Lithodes* are noted for their large size at maturity, spinate

bodies, and only three pairs of walking legs. Fleshy abdomens of king crabs are compressed under their bodies and are covered by a series of protective plates. The abdomen of the female is fanshaped and functions as a brood chamber for fertilized eggs. The legs of king crab are jointed to fold behind the body instead of being jointed forward as are the legs of true crabs. The legs and carapace are spiny, which provides protection from predators.

Sexual dimorphism in adult king crab of the same age is extreme (Figure 4). Only the large male crab are currently of economic importance. Male king crab may grow as large as 24 pounds in 15 years while a similarly aged female is but 10 pounds. Commercially caught males average about 7 pounds and are 7 or 8 years old. Crabs this size measure about three feet across with legs extended.

The majority of king crab research has been directed towards the red king crab because of its commercial importance. Consequently, this section emphasizes the life history of this species. Much of the life history research on king crab has been conducted on stocks of crab around Kodiak Island. The results to a degree can be applied to other stocks until further research on other important stocks is conducted.

General Distribution

The red king crab is the most widespread and abundant of the three commercial species harvested along the North Pacific rim. In Asian waters it is found from the sea of Japan northward into the Sea of Okhotsk and along the shores of the Kamchatka Peninsula. The northern limit of red king crab on the Asian coast has been reported as Cape Olyutorskiy (60° N. latitude). On the west coast of North America red king crab are found northward from Vancouver Island, British Columbia to Norton Sound in the Bering Sea. King crab are abundant in the Western Gulf of Alaska and the Bering Sea. Major fisheries exist at Cook Inlet, Prince William Sound, Kodiak Island, south Alaska Peninsula, Aleutian Islands, Norton Sound and the southeastern Bering Sea.

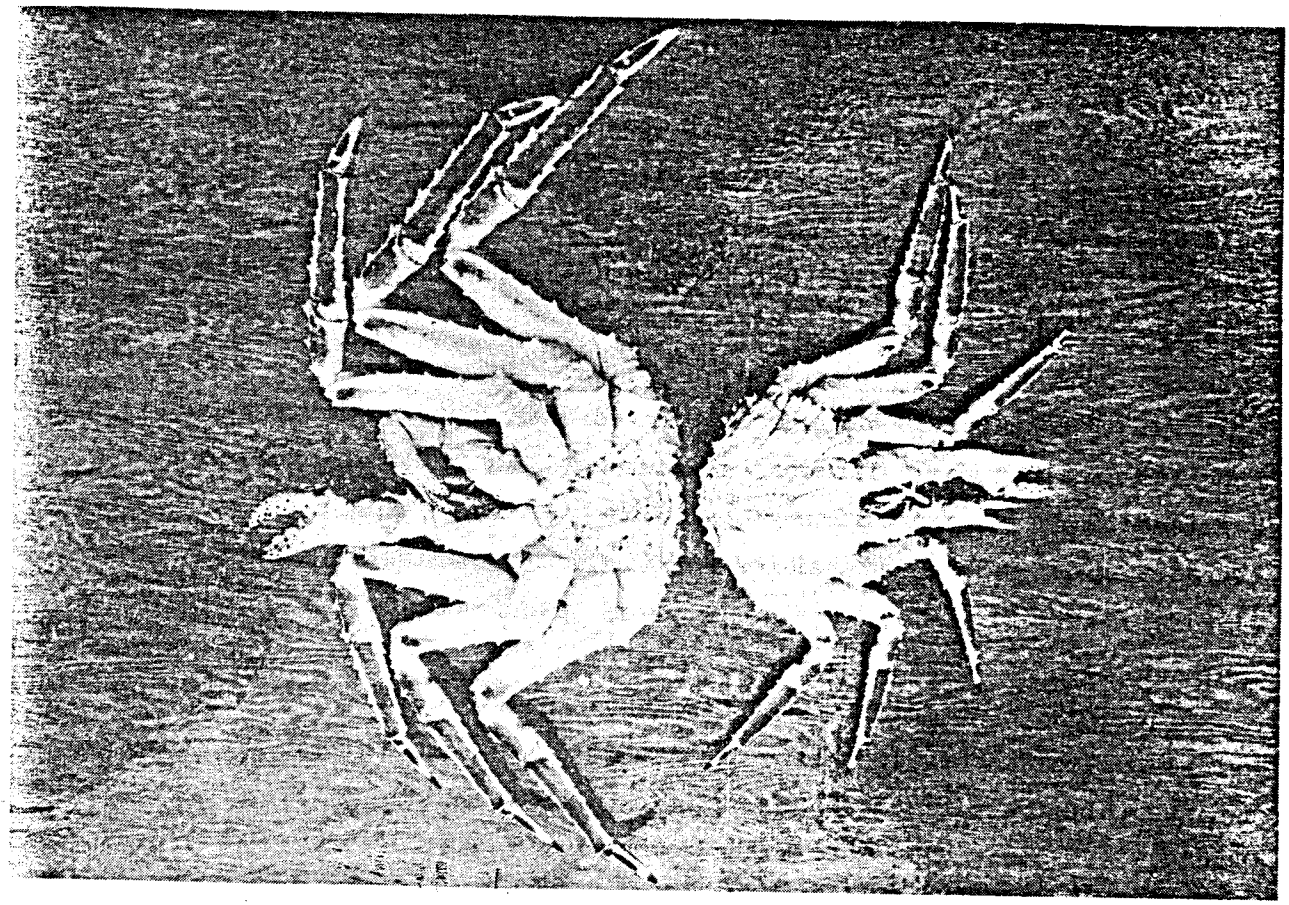


Figure 4. Sexual dimorphism of king crab (male left; female right).

Photo from G. Powell

The blue king crab has a more limited distribution with scattered populations along the Asian coast (Marukawa 1933). Other populations are found in the eastern Bering Sea, Olga Bay on Kodiak Island, and in Icy Strait, Auke Bay, and Gambier Bay in Southeast Alaska (Wallace et. al. 1949).

The brown king crab is the least abundant king crab in Alaskan waters. It characteristically inhabits deeper waters along the continental slopes of the North Pacific Ocean, the Bering Sea, and the Okhotsk Sea. This crab enters the commercial catch in limited quantities in Southeast Alaska, Kodiak, and Adak. Little is known of its life history.

The distribution of red king crab in the southeastern Bering Sea is related to the bottom temperature. Data compiled over a five-year period and analyzed by Stinson (1975) indicate that males inhabit a temperature range from 0 to 5.5° C with a maximum abundance at 1.5° C during summer months. Adult females inhabit the same temperature range with maximum abundance between 3° and 5° C. King crab have been found in depths of 200 fathoms (fm) or more although the majority of the commercial fishery is taken from depths less than 150 fm. Juveniles are abundant in inshore waters and in relatively shallow (less than 75 fm) waters offshore. Most king crab are harvested from soft substrates of mud or sand.

Although adult king crab are found in most Alaskan waters, tagging evidence demonstrates that they belong to discrete stocks rather than one population. During the course of tagging studies in the southeastern Bering Sea, thousands of king crab have been tagged but none have been recovered in the Gulf of Alaska (Simpson and Shippen 1968). Moreover, Hayes and Montgomery (1963) reported that crab marked in the Shumagin Islands area had never been reported in either the Bering Sea or Kodiak Island fisheries. Crab tagged in the Kodiak Island fishery have not been recovered in other fisheries (Powell and Reynolds 1965).

Age and Growth

King crab like all crustaceans have rigid exoskeletons and must molt (ecdysis) to increase in size. Growth in length occurs immediately after molting and

before the new exoskeleton hardens. Growth therefore is divided into two parts: the increase per molt and the frequency of molting. Unlike the smooth growth function in fishes where growth may take place relatively continuously through the year, growth in length in crabs is a step function.

Several studies of king crab growth are presented in the literature for the Bering Sea (Weber and Miyahara 1962; Weber 1965; Hoopes and Greenough 1970; Balsiger 1974;) and Gulf of Alaska (Powell 1967; Eldridge 1975; McCaughran and Powell 1977). All these studies (except Weber) examined tagged king crab in the commercial fishery.

A model for king crab growth in the Bering Sea is presented in Figures 5 and 6. Some age specific conversion factors for southeastern Bering Sea male red king crab are presented in Table 3. A similar model for the Kodiak area is presented in Figure 7. Molting frequency schedules for the Bering Sea and Kodiak are presented in Figures 8 and 9.

The time interval between molts progressively increases from a minimum of approximately three weeks for early post-larval juveniles to a maximum of three years for adult males. Molt frequency for juveniles of both sexes is similar. After attaining sexual maturity in the fifth year, young adults molt annually. An age-length key is presented in Table 4. Molting of adult females is correlated with mating and occurs annually just prior to copulation. Ecdysis of males apparently is a function of growth independent of reproduction. Most adult males molt annually through the seventh year. During the eighth and succeeding years increasing proportions of the age class begin to molt every two years. The probability of molting for male crabs that have skipped two molts is very high, hence, very few male crab molt less frequently than biennially.

A study by Powell et al. (1973) indicates that the majority of the female king crab in the Kodiak area were mature at a length of 111 mm (4.4 inches) or approximately 7 years of age. Males were found to attain sexual maturity a year or two before females at a smaller size. The majority (94%) of small newshell males, 90-109 mm (3.5 to 4.3 inches) mated successfully in undersea pens. In the southeastern Bering Sea both sexes mature at approximately 4 inches in carapace length and are 5 or 6 years of age (Weber 1967).

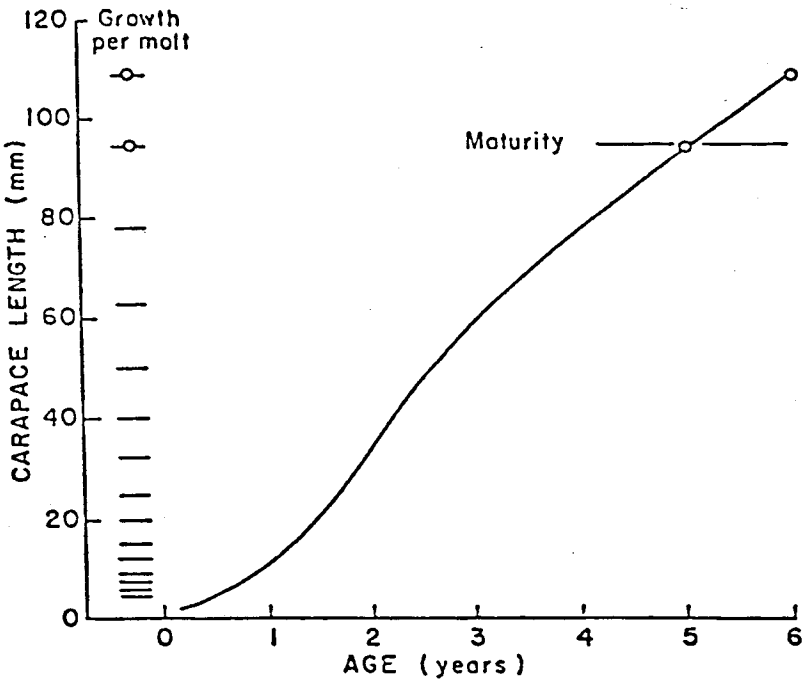


Figure 5 Growth curve for the southeastern Bering Sea immature king crab. Cumulative growth per molt is shown on the left.

Source: Weber (1965)

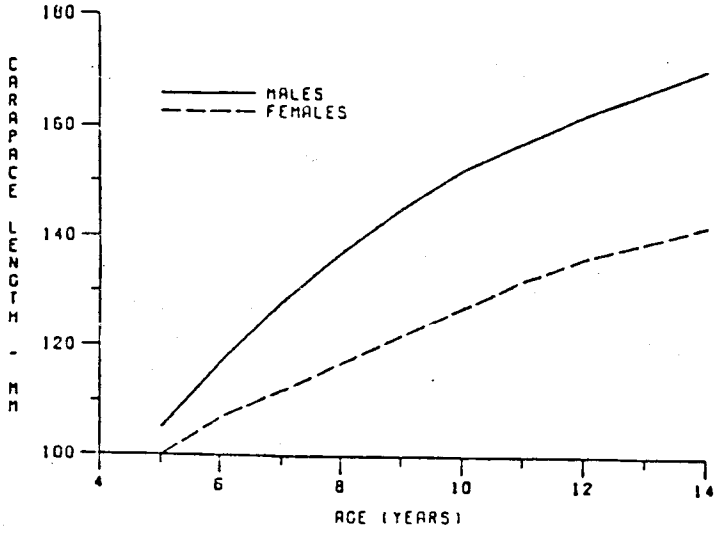


Figure 6 Growth curve used in simulation for adult male and female red king crab in the southeastern Bering Sea.

Source: Reeves and Marasco (1980)

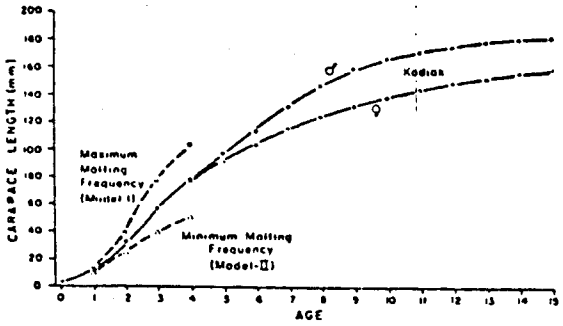


Figure 7 Simulated mean carapace length as a function of age for Kodiak male king crab and simulated mean carapace lengths under maximum and minimum probability of molting for juvenile male king crab.

Source: McCaughran and Powell (1977)

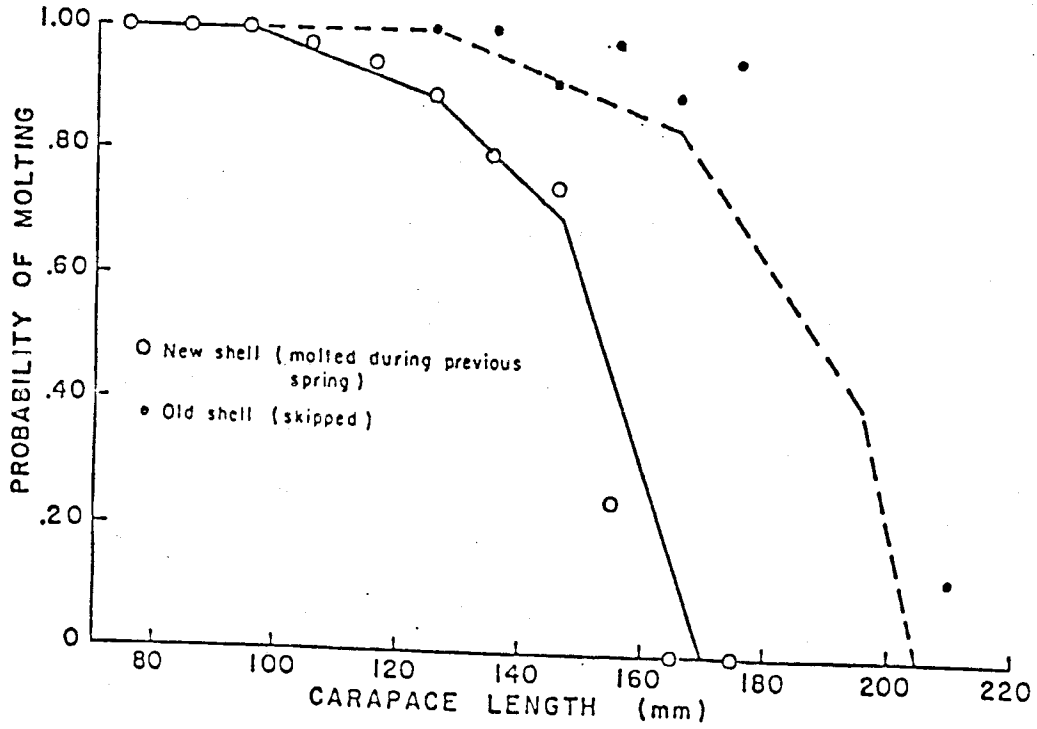


Figure 8 Probability of molting of male king crab from the Bering Sea.

Source: Balsiger (1974)

Table 3. Age-specific conversion factors for Southeast Bering Sea male king crab.

Age	Average Length (mm)	Average Width (inches)	Average Weight (lbs)
4	85	4.2	1.0
5	105	5.2	1.9
6	117	5.8	2.7
7	128	6.3	3.6
8	137	6.7	4.5
9	145	7.1	5.4
10	152	7.5	6.2
11	157	7.7	6.9
12	162	8.0	7.6
13	166	8.2	8.2
14	170	8.4	8.9

Source: Reeves 1980 (unpublished data)

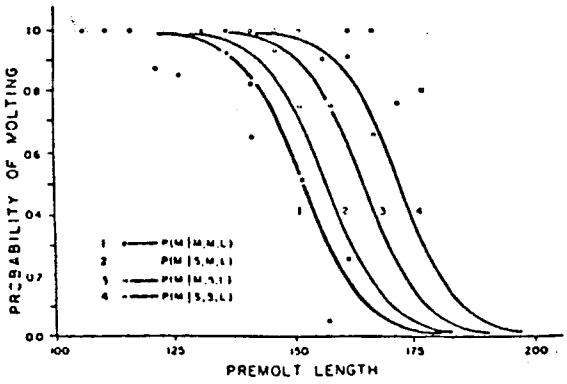


Figure 9 The conditional probability of molting given premolt length and the previous 2 years of molting history for male king crab near Kodiak Island. (Carapace length in millimeters)

Source: McCaughran and Powell (1977)

Table 4. Growth simulation of individual king crab carapace lengths taken from the Kodiak Island area, N = 2000. (Carapace length in millimeters)

	Male king crabs			Female king crabs		
Age	Mean length	SD	Mean length ± 2 SD	Mean length	SD	Mean length ± 2 SD
1	12.58	1.71	9.16–16.00	12.65	1.72	9.21–16.09
2	33.44	5.97	21.49–45.39	33.40	5.90	21.60–45.20
3	57.85	12.08	82.00–33.69	57.35	12.00	45.35–69.35
4	78.87	16.90	45.08–112.67	77.36	14.84	48.80–105.92
5	95.52	18.86	57.80–133.24	91.01	14.31	62.39–119.63
6	113.62	20.24	73.15–154.09	103.67	12.74	78.19–129.15
7	131.57	19.38	92.82–170.33	114.63	10.92	92.79–136.47
8	146.97	16.40	114.17–179.76	123.88	9.25	105.38–142.38
9	158.29	12.60	133.13–183.45	131.57	8.13	115.31–147.83
10	165.89	9.70	146.48–185.28	137.59	7.30	122.99–152.19
11	170.90	8.36	154.19–187.61	143.64	6.61	130.42–156.86
12	174.63	7.47	159.70–189.56	148.49	6.20	136.09–160.89
13	177.59	6.74	164.10–191.07	152.69	6.00	140.69–164.69
14	179.66	6.36	166.95–192.38	156.42	5.96	144.50–168.34
15	181.63	5.96	169.71–193.55	159.73	5.91	147.91–171.55

Source: McCaughran and Powell (1977)

Mortality

Eldridge (1975) summarized mortality rates in exploited king crab populations. He examined data from the Kodiak fishery and reviewed studies presented by other authors for different fishing locations, primarily the Bering Sea. Mortality rates of king crab are very difficult to estimate. The major problem in developing these estimates is the difficulty in accurately aging king crab. There may also be effects of the commercial fishery which may alter the size or age.

The data suggest that natural mortality of male king crab increase with size. Smaller males appear to have a relatively low natural mortality rate. Eldridge's best estimates indicate that for the Kodiak fishery males between the size of 125 and 163 mm in carapace length have an annual instantaneous mortality rate of approximately 0.15. Further he suggests the upper limit for the natural mortality rate for larger males may be equal to or less than 0.40.

Balsiger (1974) examined mortality rates of king crab in the southeastern Bering Sea. He used tagging data to distinquish between fishing and natural mortality rates. Later, Reeves and Marasco (1980) developed estimates of natural mortality rates for king crab based on survey estimates of abundance by age. An overall estimate of natural mortality was obtained by averaging over the years 1970-1979. This average of M .26 was determined to be 24 percent lower than the weighted average of .34 calculated from Balsiger's (1974) M schedule. Reeves (unpublished data) has therefore adjusted age-specific values of M for ages 9-14, leaving estimates for ages 5-8 unchanged. His estimates of natural mortality and average length for ages 5-14 are presented in Table 5.

Reproduction

Around Kodiak Island migration of spawning males to shallow water areas begins in January and continues through April as males search for adult females. The character of the migration varies by year and area depending upon environmental conditions.

Table 5. Age-specific population parameters used in king crab simulations.

Age	NATURAL MORTALITY (annual M)		AVERAGE LENGTH (mm)	
	Male	Female	Male	Female
5	.13	.58	105	100
6	.12	.58	117	107
7	.08	.58	128	112
8	.08	.58	137	117
9	.11	.58	145	122
10	.23	.58	152	127
11	.50	.58	157	132
12	.57	.58	162	136
13	.61	.58	166	139
14	.76	.58	170	142

*Ages 5-7 estimated by back-calculation using the natural mortality schedule.

Source: Reeves 1980 (unpublished data)

One feature of king crab life history is that the ratio of males to females varies between adjacent areas, indicating segregation between sexes. Segregation occurs upon attainment of sexual maturity and is maintained to a large extent during much of each year except during the mating season. Adult king crab also segregate by size and shell age within sexes (Miyahara and Shippen 1965; Powell et al. 1974).

The female migration begins at about the same time as the male migration. When the females arrive on the spawning grounds they form large congregations and emit a pheromone which attracts the males. For mating to be successful among the females of each congregation, an adequate number of capable males must be present in the vicinity of the aggregation during the relatively brief receptive period following female ecdysis. Mating will be unsuccessful for those females which must wait for a male partner for more than 5 days after molting (Powell et al. 1974).

Males select females according to their behavior and relative size. Males in nature almost always select females the same size or smaller. The mating procedure requires the male to "grasp" the female while he waits for her to molt; however, as pointed out by Marukawa (1933), it is not necessary that males be present for the female to be able to molt.

The male king crab grasps the female by the meropodite of both chelipeds while oriented anteriorly. The "grasping" seems to serve three functions: (1) keeping breeding adults together until mating has occurred; (2) the male protects the female during the molting process; and (3) aiding the female to exuviate (Powell and Nickerson 1965).

After assisting the female to molt, the male regrasps his soft partner in the same manner as before. He inverts her beneath his body and spreads spermatophore bands over her gonopores. Ovulation usually occurs after this procedure and the eggs are fertilized before they attach to the pleopod. The eggs remain there, protected by the abdominal flap, for about eleven months.

Males leave the female after fertilization and search for another female. Male king crab are polygamous and are capable of fertilizing an average of seven females (Powell et al. 1974).

From 1963 through 1971, 3,402 grasping pairs were observed by divers along 150 miles of Kodiak's eastern shoreline (Powell et al 1974). Analysis of the size of breeding males reveals that only 0.2 percent of the males were smaller than 4 inches, 3 percent were smaller than 5 inches, 14 percent were smaller than 7 inches, and 83 percent were 7 inches or larger. Recently molted males constituted 39 percent of the graspers while 61 percent were skip molts.

Examining the data on undersize males showed that the sublegal broodstock was comprised primarily of oldshell crab (70%). This is particularly interesting since the population of sublegal males was comprised of only 2 percent oldshells (Eldridge, Powell, and Chapman 1980). Several authors have reported finding oldshell crab congregated with females in the mating season (Gray and Powell 1966; and Miyahara and Shippen 1965). Males that molt during the mating season may not mate after molting because molting may interfere with mating, molting areas may be distant from mating grounds, or recently molted males may not be able to compete with hardshell nonmolting males. Size differences between partners reveal that 97 percent of brood males are larger than their female partners. Of 14 matings where females were larger than their male partners, 11 produced partial clutches (Powell, James, and Hurd 1974). Small males probably produce less spermatophore bands than large males, and as a result, may be less capable of fertilizing the greater egg masses of large females.

Observations indicate that small adult males do not participate in mating until 2 years after attaining sexual maturity. The extent to which small adults attempt to mate and their ability to compete with larger males remain unknown.

Female king crab carry the fertilized eggs for about 11 months before hatching occurs. The eggs hatch during the three-month period of March, April, and May. Upon hatching, zoea larvae are about 1 mm in width and are capable of

swimming, but are largely dependent on the flow of currents for movement and distribution.

The lack of oceanographic current data limits the knowledge of king crab larval drift. Studies of the drift of halibut larvae have been completed in some areas of Alaska (Thompson and VanCleve 1936) providing at least some information upon which assumptions of crab larval drift can be based. The currents distribute the larvae into nursery areas that are shallow and close to shore. As crab larvae molt through their successive stages, they gradually settle in the water column until they assume a benthic existence. After the sixth molt, the first recognizable adult form is attained, with a size of about 2 mm in carapace length.

Juvenile king crab less than 2 years old exist mainly as solitary individuals, living under rocks and debris. Juvenile king crab increase in size at the rate of 25 percent per molt. In their second and third year, crab begin to form tightly packed schools called "pods". These pods contain as many as 6,000 individuals with up to 50 crabs stacked on top of each other (Powell and Nickerson 1965; Powell 1974). After reaching puberty the crab segregate by sexes and begin an annual cycle of movements typical of the adult.

Predation

A high mortality occurs during the larval stages due to plankton feeding animals. Juveniles, because of their small size, are susceptible to predation by fish and large invertebrates. Powell (1974) has observed sculpins feeding on juveniles.

Adult crab are particularly susceptible to predation when they are in the softshelled stage. The only animals known to prey upon larger king crab for much of their diet are halibut and marine mammals. Gray (1964) removed 3 mature female king crab from the stomach of an 80 pound halibut. All were softshelled and the largest measured 4.9 inches. Wallace et al. (1949) stated that newly molted crab are frequently found in the stomachs of halibut, cod, and sculpins.

Recruitment

King crab are recruited into the commercial fishery when they molt to the minimum legal size. Accurate recruitment data are only available for those fisheries which have a stock assessment program. The only two areas which have had long-term research programs are the southeastern Bering Sea and Kodiak. Recruitment data from these fisheries are presented in Tables 6 and 7. Although research surveys have been conducted along the Alaska Peninsula, Dutch Harbor, Adak, the Pribilof Islands, and the northern Bering Sea, these programs are too new and/or too limited to yield sufficient data to accurately reflect recruitment trends.

Recruitment in king crab is known to fluctuate greatly, for example, the harvest of king crab from the Kodiak area during the mid 1960's to early 1970's. The management strategy under which the fishery operated allowed a year round fishery on crabs above a specific size limit. During this period the annual catches increased to 94 million pounds in 1965 and then rapidly declined to 10 million pounds by 1971. Although there are no recruitment values for the Kodiak fishery during this period, it is assumed that the 9-fold decrease in catches directly resulted from poor recruitment into the fishery.

King crab recruitment into the Bering Sea fishery, based on trawl survey catches of 5-year old crab, had an increase shown during the period of 1973-77. This trend however has reversed and the recruitment has declined in recent years.

7.3.2 Habitat

Due to the complexity of the habitat in which king crab exist, this section will be limited to a review of related studies.

INPFC annual reports and associated documentation provide a summary of oceanographic research conducted by the United States, Canada, and Japan in the waters that are inhabited by king crab. The series entitled Soviet Fisheries Investigations in the Northeast Pacific (Moiseev 1964) provides a

Table 6. Estimates of recruitment to the legal-sized male red king crab population in the Southeastern Bering Sea stock as measured by millions of 5 year old male crabs.

Year	No. of Recruits (millions)	Year	No. of Recruits (millions)
1968	9.5	1975	18.3
1969	15.9	1976	27.2
1970	3.4	1977	45.6
1971	--	1978	20.5
1972	7.4	1979	10.6
1973	19.2	1980	14.9
1974	14.7	1981	16.7
		1982	19.9

Source: Reeves 1983 (unpublished data)

Table 7. Research stock assessment estimates of recruitment to the legal-sized male red king crab population in the Kodiak crab fishery.

Year	Millions of Pounds
1974	37.8
1975	26.0
1976	17.7
1977	13.6
1978	23.5
1979	53.8
1980	39.1
1981	33.2
1982	3.5
1983	3.5
10 year average	25.2

Source: Alaska Department of Fish and Game, Kodiak office (unpublished data)
Westward Region (unpublished data)

fairly complete analysis of the Bering Sea as a habitat. A more recent comprehensive review of the Bering Sea environment is given in Oceanography of the Bering Sea (Hood and Kelly 1974). McLain and Favorite (1976) describe recent anomalous climatic conditions in the Bering Sea and discuss the possible effects on fisheries. Pereyra et al (1976) and Wolotira et al (1977) describe the baseline biological surveys conducted as part of the Bureau of Land Management Outer Continental Shelf Environmental Assessment Program.

7.3.3 Ecological Relationships

Very little is known about the interactions of king crab with their physical and biotic environments. Most of the information about king crab pertains to natural history or descriptive bionomics. Knowledge of the functional aspects (intra- and interspecific relationships) is still rudimentary.

Marine Mammal/King Crab Interactions

In general, there is minimal interaction between king crab and marine mammals. The major exceptions are the bearded seals (Erignathus barbatus) and the sea otter (Enhydra lutris).

Unlike most seals which are pelagic feeders, the bearded seal is a benthic feeder. Tanner crab and, to a lesser extent, king crab constitute part of the diet. The king crab taken by the bearded seal are generally smaller than commercial size so direct competition with the commercial fishery is avoided, though the commercial fishery is deprived of potential harvests. The degree of predation upon crab by bearded seals has not been quantified.

The sea otter feeds upon a wide variety of fish, sea urchins, clams, mussels, crabs and octopus. Sea otters may take any size of king crab including commercial sized crab. The frequency and significance of such predation are unknown. There has not been any documentation of intensive feeding of sea otters upon king crab. In near shore areas where sea otter occur, there exists the potential for incidental mortality when sea otters enter king crab pots and cannot escape. Sea otters regularly dive to 30 fathoms in search of food and have been recorded at depths as great as 50 fathoms. There is the

potential for conflicts between fishermen and sea otters when crab pots are set in relatively shallow water near shore. The occurrence of sea otter mortality due to drowning in crab pots is rare but it is a possible occurrence where sea otters and crab fishing areas overlap.

Indirect interaction between the pelagic-feeding seals and king crab does occur, in the sense that king crab larvae constitute part of the zooplankton utilized by the forage fish, such as herring and capelin, which are preyed upon by these seals. The contribution of king crab larvae to the diets of these forage fishes, the subsequent impact of this predation on the population of adult king crab and any role played by seals in regulating the numbers of these fishes are unknown. Subsequent research will have to investigate the significance of the interactions between these species.

7.3.4 Catch and Effort Data

The State has maintained a commercial catch fish ticket system since statehood (1959). Prior to statehood, the Bureau of Commercial Fisheries collected similar data. Currently the state requires the buyers of commercially-landed king crab to complete a record of sale at the time of landing. This record includes the buyer's name, vessel number, type and quantity of gear used; catch by species in numbers of fish or weight; statistical reporting area; and value of catch. Each ticket is collected by ADF&G, edited for accuracy, then key punched for data processing. A variety of reports are generated for management purposes. This data base does not include a minor subsistence fishery. In recent years deadloss (wastage) by the commercial fleet has been estimated and included in the final season totals.

Effort data are recorded on each fish ticket as the number of crab pots pulled for each landing. The use of these data has two serious limitations. Reporting the exact numbers of pots pulled is the greatest source of error, followed by the problem of standardizing effort. At best these estimates of effort can only show gross trends in the fishery. The historical catch and effort data by management area are presented in Tables 8-11.

Table 8. Catch and effort statistics for Southeast Bering Sea red king crab and Pribilof blue king crab fishery.

Fishing Season	Species	No. Vessels Making Landings	No. Landings	No. Pot Lifts	No.[1/] Crab	No.[1/] Pounds	No. Crab Per Pot	Ave. Lbs. Per Crab
1966-67	Red	9	15	2,720	140,554	997,321	51.7	7.1
1967-68	Red	20	61	10,621	397,307	3,102,443	37.4	7.8
1968-69	Red	59	261	47,496	1,278,592	8,686,546	26.9	6.8
1969-70	Red	65	377	98,426	1,749,022	10,403,283	17.8	5.9
1970-71	Red	51	309	96,658	1,682,591	8,559,178	17.4	5.1
1971-72	Red	52	394	118,522	2,404,681	12,945,776	20.3	5.4
1972-73	Red	64	611	205,045	3,994,356	21,744,924	19.5	5.4
1973-74	Red	67	441	194,095	4,825,963	26,913,636	24.9	5.6
	Blue	--	13	6,814	174,420	1,276,578	25.6	7.3
1974-75	Red	108	599	211,918	7,653,944	41,945,768	36.2	5.5
	Blue	--	101	45,519	908,072	7,107,294	19.9	7.8
1975-76	Red	102	592	205,096	8,745,294	51,326,259	42.6	5.7
	Blue	20	54	16,297	314,931	2,433,714	19.3	7.7
1976-77	Red	141	984	321,010	10,653,288	63,919,728	33.0	6.0
	Blue	47	113	71,738	855,505	6,611,084	12.1	7.7
1977-78	Red	130	1,020	451,273	11,857,895	69,967,868	26.0	5.9
	Blue	34	34	28,521	807,092	6,456,738	8.0	7.9
1978-79	Red	162	926	406,165	14,962,951	87,618,320	36.0	5.8
	Blue	58	154	101,117	789,569	6,395,512	8.0	8.1
1979-80	Red	236	889	315,226	16,806,605	107,828,057	53.0	6.4
	Blue	46	115	83,527	778,601	5,995,231	9.0	7.7
1980-81	Red	236	1,251	567,292	20,845,350	129,948,436	37.0	6.2
	Blue	110	258	167,684	1,497,101	10,970,246	9.0	7.3
1981-82	Red	177	1,026	542,250	5,307,947	33,591,368	10.0	6.3
	Blue	99	312	176,168	1,202,499	9,080,729	7.0	7.6
1982-83	Red	90	255	141,656	541,006	3,001,210	4.0	5.6
	Blue	122	281	127,728	587,908	4,405,353	5.0	7.5

1/ Beginning with 1974-75 deadloss included. Source: Westward Region King Crab Survey Results For 1983, 9/83.

KC2/C-2

Table 9. Catch and effort statistics for the Adak king crab fishery.

Fishing Season		No. Pounds[1/]	No. of Vessels Making Landings	Landings	No. Pot Lifts
1971-72		15,475,924	40[2/]	166[2/]	46,011[2/]
1972-73		18,702,464	53	308	80,457
1973-74		9,742,731	56	235	69,457
1974-75		2,774,963	40	97	32,540
1975-76		437,073	21	26	8,616
1976-77	Brown	2,285	2	2	110
1977-78	Red	905,527	12	18	7,269
	Brown	47,445	1	1	1,200
1978-79	Red	807,195	13	27	13,948
1979-80	Red	467,229	18	23	9,757
	Brown	23,485	1	1	325
1980-81	Red	1,365,153	17	52	20,914
	Brown	58,914	4	4	700
1981-82	Red	1,638,776	46	106	40,532
	Brown	1,194,046	15	77	24,647
1982-83	Red	1,701,818	72	192	66,893
	Brown	7,935,530	--	495	--

1/ Includes all species of king crab unless otherwise designated.

2/ Does not include western Aleutians vessel effort.

Source: Westward Region Shellfish Report to the Alaska Board of Fisheries, March 1981.

Adak, Western Aleutians Monthly Shellfish Report, 1981.

Westward Region King Crab Survey Results for 1983, September 1983.

Table 10. Catch and Effort Statistics for the Dutch Harbor King Crab Fishery.[1/]

Fishing Season	No. Pounds (thousands)	No. Vessels Making Landings	No. Landings	No. Pot Lifts
1961-62	533	4	69	--
1962-63	1,536	6	102	--
1963-64	3,893	4	242	--
1964-65	13,761	12	336	--
1965-66	19,196	21	555	--
1966-67	32,852	27	893	--
1967-68	22,709	34	747	--
1968-69	11,300	44	--	--
1969-70	8,950	41	375	72,683
1970-71	9,652	32	268	56,198
1971-72	9,392	32	210	31,531
1972-73	10,450	51	291	34,037
1973-74	12,723	56	290	41,840
1974-75	13,991	87	372	71,821
1975-76	15,907	79	369	86,874
1976-77	10,198	72	287	83,094
1977-78	3,684	33	234	47,429
1978-79	6,824	60	300	51,783
1979-80	14,980	104	540	120,354
1980-81	18,902	121	947	260,602
1981-82	5,115	92	683	220,087
1982-83	431	93	279	72,924

1/ Deadloss included beginning in 1974-75.

Source: Westward Region Shellfish Report to the Alaska Board of Fisheries, April 1979.

Westward Region Shellfish Report to the Alaska Board of Fisheries, March 1983.

Table 11. Western Alaska king crab catch by fishing season by domestic fishermen from 1966-67 through 1982-83[1/] in millions of pounds.

Fishing Season	Kodiak	Alaska Peninsula	Dutch Harbor	Adak	Western Aleutian[2/]	Bering Sea
1966-67	73.8	24.4	32.8	5.9	--	1.0
1967-68	43.4	12.6	22.7	14.1	0.8	3.1
1968-69	18.2	10.9	11.3	16.1	1.9	8.7
1969-70	12.2	4.1	9.0	18.0	1.6	10.4
1970-71	11.7	3.4	9.6	16.0	0.5	8.6
1971-72	10.9	4.1	9.4	15.4	0.0	13.0
1972-73	15.5	4.1	10.4	18.0	0.7	21.7
1973-74	14.4	4.3	12.7	9.0	0.7	28.2
1974-75	23.6	4.6	14.0	2.5	0.2	49.4
1975-76	24.1	2.6	15.9	0.3	0.1	53.3
1976-77	18.0	1.0	10.2	0.0	--	69.6
1977-78	13.5	0.7	3.7	1.0	--	78.0
1978-79	12.0	3.1	6.8	0.8	--	98.1
1979-80	14.6	4.4	15.0	0.5	--	117.3
1980-81	20.4	5.1	18.9	1.4	--	143.6
1981-82	24.2	3.2	5.1	1.6	--	50.1
1982-83	8.7	1.7	0.4	1.7	--	16.9

1/ Deadloss included beginning 1974-75.

2/ Combined with Adak management area after 1975-76.

Source: Westward Region Shellfish Report to the Alaska Board of Fisheries, April 1978.

Westward Region Shellfish Report to the Alaska Board of Fisheries, April 1979.

Westward Region Shellfish Report to the Alaska Board of Fisheries, March 1981.

Westward Region King Crab Survey Results For 1983, September 1983.

In 1962, a voluntary logbook program was instituted in Kodiak. This program was found to be inadequate and was replaced in 1973 by a vessel captain interview program. The dockside vessel captain interview and commercial catch sampling programs are now the primary means of collecting effort information from the fleet. The interview system collects information on effort levels, precise fishing locations, and tag recoveries to determine fishing mortalities. This information is used to edit fish tickets and is the primary source of data for monitoring the progress of the fishery.

7.3.5 Survey and Sampling Data

There are currently three programs used to monitor the conduct of the commercial fisheries. These are the dockside catch sampling program, the high seas stock assessment program, and aerial surveys to determine fleet effort and distribution.

The dockside sampling program began in 1959. The purpose of this effort is to provide information on catch composition by year class as the fishing season progresses. Currently this program is conducted in conjunction with the vessel captain interview and tag recovery efforts. These data are summarized and compared to the age structure analyses from the stock assessment cruises. Further, tag recoveries by the commercial fishery are compiled by statistical fishing area and fishing mortalities are closely monitored.

The high seas stock assessment program is conducted by the ADF&G for the Gulf of Alaska and by NMFS for the Bering Sea. ADF&G using pot gear, has conducted surveys of the Kodiak area since 1972. Later these surveys were expanded to the Alaska Peninsula, Dutch Harbor, and Adak. NMFS has conducted annual trawl surveys in the Bering Sea since 1968. Both of these surveys are designed to 1) determine the abundance of each size group; 2) assess female ovigerity; and 3) determine the level of acceptable biological catch. The Bering Sea population estimates are obtained using a combination of the area swept technique (Alverson & Pereyra 1969; Hoopes and Greenough 1970) and stratified random sampling techniques (Cochran 1963). Stratification is based on the density of crabs for each species. Variance of population estimates, used in computing confidence intervals, are also derived according to stratified sampling

theory. Using these techniques, survey information directly provides estimates of stock size. Results of these surveys are published as processed reports from NMFS Kodiak facility (see Otto et al 1981). ADF&G's surveys in the Gulf of Alaska provide indirect estimates of population size. An estimate of fishing mortality is made by using the Peterson single census method (Ricker 1975). Preseason population estimates are obtained from the commercial fisheries performance during the previous season in combination with the age-class structure and relative abundance determined from the survey results. In-season estimates of fishing mortality provide the basis for adjustments of harvest levels during the conduct of the commercial fishery. Results of these surveys are published in annual shellfish reports to the Board (see Powell 1980).

Aerial surveys of the fleet to determine distribution and effort have been used in the Kodiak area since 1975 to assist in management decisions. This technique is also used in the Alaska Peninsula and Dutch Harbor area but to a lesser degree due to restricted budgets. Aerial surveys have become necessary in rapidly expanding fisheries on a dwindling resource. In many smaller geographical areas, the harvesting capacity of the fleet exceeds the available resource thereby intensifying the management problems associated with the fishery.

7.3.6 Current Status of Stocks

Maximum Sustainable Yield

The maximum sustainable yield (MSY) for the various fisheries within the fishery management unit described in this plan is 85 million pounds per year.

The plan development team examined several methods of calculating MSY: (1) averaging the historical catches; (2) various stock production models, e.g. Schaefer's method (Ricker 1975), Gulland's method (Ricker 1975), and a modification of Pella-Tomlinson's GENPROD model (Rivard and Bledsoe 1978); and (3) the Alverson-Pereyra (1969) method using biomass estimates and an estimate of natural mortality. The use of stock production models was rejected by the team due to inconsistent results generated with the above methods. Therefore,

the team deemed the long-term catch to be the best estimate of MSY for the BS/AI area except where limited exploitation has occurred as in the Bering Sea northern district red and blue crab fishery. For this area the Alverson-Pereyra method was used.

The MSY for the current State of Alaska Bristol Bay management area is 48 million pounds of red king crab per year. This MSY was determined by averaging the long-term foreign and domestic annual harvests from 1960 through 1982. MSY for the current Pribilof district of the current State of Alaska Bering Sea management area is 6 million pounds of blue king crab per year. The annual harvests from 1973 through 1982 were averaged to determine MSY for the Pribilof district. MSY for the current northern district of the Bering Sea management area is 7 million pounds of blue king crab and 4 million pounds of red king crab. The Alverson-Pereyra method was used to estimate the MSY for king crab in the northern district. For the current State of Alaska Dutch Harbor management area the MSY for red king crab is 11 million pounds. The MSY value for Dutch Harbor represents the mean of long-term (1961-1982) annual harvests. The Adak management area MSY for red king crab is 9 million pounds. This MSY represents the mean annual harvest over the long term (1960-1982). The expression here of MSY in terms based on the current State of Alaska management areas is not intended to preclude the abolition or modification of those areas by regulation in accordance with Section 4.8 of this FMP.

Future Outlook

The 1983 population abundance king crab surveys conducted by NMFS and ADF&G have been completed. The preliminary results of those surveys by area are as follows:

Bristol Bay: The 1983 NMFS Trawl Survey indicated that the total king crab population is at its lowest level since 1972. The abundance of legal males is the lowest ever recorded by a survey (1.5 million crab), and the female population has declined to less than 10.0 million individuals, mainly smaller crabs with lower fecundity. Recruitment has continued to decline. The survey also found an increase in halibut and cod which are known to be predators on king crab.

Dutch Harbor: Comprehensive king crab population assessment surveys have not been conducted in Dutch Harbor for the past two years due to budget limitations. The 1981 survey indicated generally declining recruitment expected for both 1982-83 and for 1983-84 fishing years. The stocks are severely depressed. Dutch Harbor brown king crab stocks were fished for the first time during the 1981-82 season. The potential of the brown king crab stocks is unknown.

Bering Sea:

1. The Pribilof district blue king crab males are at or near the lowest abundance on record. The abundance of prerecruits has declined steadily and the prospects for future recruitment are poor. Some red king crab were taken throughout the Pribilof district during the 1982-83 fishery, but not large concentrations were found.

2. The Northern district blue king crab prerecruits and legals are declining according to preliminary 1983 NMFS survey results.

3. In Norton Sound the largest legal male red king crab population estimate (11 million pounds) occurred in 1978. Since then the male population has declined at a low of about 2.8 million pounds in 1982. The 1983 season ended August 5 after 3.8 days of fishing and a total harvest of 368,000 pounds.

Adak: The Adak-Western Aleutians area has not been surveyed for red king crab since 1977 due to budget limitations. Red king crab harvests in this area declined after the 1972-73 season and have remained at a low level. Adak is no longer managed under a published guideline harvest for red king crab but the 1983-84 season is expected to produce 500,000-3,000,000 pounds.

Brown king crab catches in Adak have increased dramatically from 58,914 pounds caught in the 1980-81 season to 7,935,530 pounds during the 1982-83 season. Expectations for the 1983-84 season are for a catch at least as high as last season.

7.3.7 Research Needs

Research studies by the U.S. on king crab since the 1950's have contributed greatly to the general knowledge of distribution, abundance, recruitment and basic life history in many areas of the State. In order to achieve the objectives listed in this plan, an expansion of studies is required to determine the following: (1) accuracy of reported domestic catches and deadloss; (2) sex and size distribution of discarded catch; (3) level of incidental king crab catches in the foreign fishery; (4) estimates of current and future biomass; (5) effects of gear (stored and fishing) on king crab and other important fishes such as halibut; (6) accuracy of current growth, mortality and recruitment rates; (7) accuracy of the bioeconomic model for the southeast Bering Sea king crab fishery; and (8) the utility of ecosystem modeling.

7.4 Description of the Fishery

King crab have been exploited commercially in Alaska since the 1920's. Except for fishing by the Japanese during the 1930's, there were no major fisheries for king crab before World War II. Commercial fishing for king crab was restarted after the war by domestic fishermen in 1948. Both the Japanese and the Russians entered the postwar fishery for king crab off Alaska, primarily in the Bering Sea. The efforts of both the Russians and the Japanese increased into the mid 1960's until bilateral agreements began to set limits on their catch. By 1975, through diplomatic negotiations, Russia and Japan were eliminated from the fishery. The king crab fishery thus became solely a domestic fishery before passage of the MFCMA. The domestic and foreign harvest of king crab from the waters off Alaska between 1953 and 1980 is presented in Table 12.

The domestic commercial harvest of king crab is unique to the State of Alaska. Of three species of king crab found in Alaska waters the red king crab is the most significant in economic value to fishermen and processors. In fact, the red king crab fishery has a cash value which is more than double that of any other seafood species (i.e., sockeye salmon, halibut, Tanner crab, etc.) caught in Alaska.

Table 12. Estimated annual king crab catches in the Eastern Bering Sea, including Bristol Bay, by the United States, Japan, and USSR, 1953-1982.[1/]

Year	United States[2/]	Japan[3/]	USSR[3/]	Total
1953	2,000	11,356	0	13,356
1954	2,329	8,086	0	10,415
1955	1,878	8,693	0	10,571
1956	1,896	8,308	0	10,204
1957	588	8,548	0	9,136
1958	7	8,136	0	8,143
1959	0	9,432	2,170	11,602
1960	598	13,838	10,773	25,209
1961	459	21,581	18,581	40,863
1962	74	35,152	18,114	53,340
1963	747	36,142	20,529	55,003
1964	910	40,676	22,400	63,986
1965	1,762	27,826	13,579	43,167
1966-67	997	29,918	14,080	44,995
1967-68	3,102	24,090	8,438	35,630
1968-69	8,687	24,661	3,020	36,368
1969-70	10,403	12,231	1,882	24,516
1970-71	8,559	11,234	1,696	21,489
1971-72	12,995	4,784	1,404	19,183
1972-73	21,744	4,721	0	26,465
1973-74[4/]	28,190	1,279	0	29,469
1974-75[4/]	49,373	2,618	0	51,991
1975-76[4/]	53,300,067[6/]	0	0	53,300,067[6/]
1976-77[4/]	69,655,485	0	0	69,655,485
1977-78[5/]	78,010,444	0	0	78,010,444
1978-79[5/]	98,104,376	0	0	98,104,376
1979-80[5/]	117,342,890	0	0	117,342,890
1980-81[5/]	143,817,600	0	0	143,817,600
1981-82	50,017,000	0	0	50,017,000
1982-83	16,816,100	0	0	16,816,100

1/ Weights in thousands of pounds, (1,000 pounds = 0.489 metric tons); all estimates were made by multiplying reported catch in numbers times an estimate of average weight.

2/ Weight estimates prior to 1966 are derived from INPFC statistics, average weights since 1966 are live crab as reported by ADF&G.

3/ Average weights computed from average carapace lengths and pack data given in INPFC annual reports (mostly Hoopes, Karinen and Pelto, 1970) and the length weight relationship given by Wallace, Pertuit and Hvatum, 1949.

4/ Includes Pribilof and Southeastern District king crab catches.

5/ Includes Pribilof, Southeastern and Northern District king crab catches.

6/ 1975-83 deadloss included.

Source: Westward Region Shellfish Report to the Alaska Board of Fisheries, March 1981

Westward Region Shellfish Report to the Alaska Board of Fisheries, March 1983.

7.4.1 Domestic Commercial Fishery

General Description of the Fishery

The first commercial venture by American king crab processors was in 1920 from a shorebased cannery at Seldovia. Until the late 1940's, the fishing effort was sporadic, with limited packs at Hoonah, Seldovia, and Kodiak. Factors responsible for late entry into the king crab fishery by the American fishing industry were ignorance of Japanese canning techniques, a weak market at home, and a healthy salmon fishery which left little incentive for winter fishing (Gray et. al. 1965).

In March 1948, the factoryship PACIFIC EXPLORER left Seattle with a fleet of ten fishing vessels to fish for both groundfish and king crab, but primarily for king crab. This fleet utilized otter trawls and tangle nets and caught a total of 387,250 crab. The success of these and other exploratory fishing trips led to a small trawl fishery for king crab in the Bering Sea in the 1950's. Trawling for king crab, however, was later prohibited in 1960.

At the same time, crab fisheries were developing in the Cook Inlet, Kodiak Island, and south Alaska Peninsula areas. In 1953, production from these areas exceeded that from the Bering Sea for the first time. The development of the successful pot fishery for king crab south of the Alaska Peninsula attracted the domestic crab fishermen from the eastern Bering Sea after the 1957 season. A token effort was resumed in 1960, but it was not until 1967, when the U.S. fishermen harvested 3.1 million pounds, that the U.S. began exploiting the Bering Sea king crab in earnest.

Early development of the Kodiak king crab industry lagged behind that of the Bering Sea. By 1954, however, Kodiak landings had increased to over 3,000,000 pounds which surpassed American catches in the Bering Sea (Gray et. al. 1965).

Initially, the fishery for king crab in the Shumagin Islands-False Pass area was conducted by salmon fishermen primarily during the winter. Their efforts depended greatly on economic conditions and especially on income received from

salmon the preceding summer (Hayes and Montgomery 1963). A similar situation existed in the Kodiak fishery.

Until the late 1950's, Kodiak fishermen harvested salmon in the summer and fished king crab in the winter. Crab fishing usually commenced in September or October and ended in June, at which time the boats rigged for salmon. While exploring offshore grounds surrounding Kodiak Island, catches of 3,000 crab per vessel day were generally taken during July, August, and September of 1961. Some canneries and factoryships were unable to process the large number of crab being captured and in some instances were forced to limit the number of crab a boat could unload each trip.

During the greatest expansion of the Kodiak fishery, 1960 to 1966, the number of vessels registered to fish in Kodiak, (not necessarily the number that actually fished during this period) increased from 143 to 213. Moreover, the average size of vessels increased considerably. The increase in vessel size as well as numerous technological innovations such as the use of live tanks and the development of more efficient pots tremendously increased the fishing power of the fleet.

As the harvests declined in the Kodiak, Alaska Peninsula, and Dutch Harbor areas after 1966, interest in the Bering Sea area increased rapidly. In 1966, only nine vessels fished the Bering Sea but eleven years later in 1976, over 140 vessels were fishing there. Not only had the number of vessels fishing the Bering Sea increased greatly but the quality and efficiency of the vessels had increased. In recent years larger vessels have been built specifically for crab fishing. These vessels are capable of longer, faster trips in rougher seas, have larger tank and gear capacities, and utilize sophisticated electronics.

There is a wide range of commercial participants in the fishery, small vessel operators who harvest king crab for supplemental income after the end of salmon or halibut seasons to large vessel operators who fish exclusively for king crab.

There is not a licensed recreational fishery for king crab. The taking of king crab for personal use is permitted under subsistence fishery regulations. Though the subsistence harvest of king crab may be significant to those who participate in this fishery, the subsistence harvest is negligible relative to the commercial fishery.

Vessels and Gear Employed

The initial efforts to establish the domestic king crab fishery were conducted by trawler processors fishing off Kodiak and the Shumagin Islands and in the Bering Sea during the late 1940's. Local king crab fleets gradually developed in areas such as Kodiak and Cook Inlet during the 1950's. These local fleets consisted of salmon purse seiners with a maximum legal length of 58 feet. These vessels were capable of handling tangle nets and most of them had gypsy winches which allowed the pulling of the modified dungeness traps. Crab were carried on deck or stacked in the hold and not immersed in water because these vessels lacked live tanks. Under average conditions king crab will not live out of water for more than 12 hours; hence the boats were forced to unload their catches daily or place the crab in underwater pens on the fishing grounds.

The gear employed in these initial years included tangle nets, otter trawls, and pots. However, tangle nets were prohibited in 1955 and trawling for king crab was prohibited in major areas in 1960. The reasons for the prohibitions were essentially the same, i.e, nonselectivity of the gear. With both methods many females, as well as softshelled and undersized male crab were captured resulting in injury or deadloss. At present, the only legal gear allowed for commercial king crabbing are pots, ring nets, or diving gear.

By 1960, many of the purse seiners continued to fish during the summer months. During the summer months, king crab migrate to the offshore waters forcing the fishermen to move out of the shallow bays into deeper water to make good catches. Purse seiners proved unsuitable for offshore fishing due to their small size and lack of live tanks. In the succeeding years several converted halibut boats and herring seiners entered the summer king crab fishery. These

vessels were larger than the salmon purse seiners and had tanks with circulating systems for maintaining a constant flow of sea water that allowed crab to be held alive for several days. The range of the fleet was increased by utilizing live tanks, allowing vessels to follow the migrating crab from the shallow inshore banks to the deep offshore trenches.

Power scows also made their appearance as king crab vessels during the early 1960's. They became popular due to a large working space on deck.

Prior to the late 1960's all vessels in the king crab fleet were conversions. The fishery was so new that no vessel design peculiar to it had yet been developed. The first ship built for the king crab fishery entered the fleet in 1966. By 1972 there were about 40 of these specially designed vessels. These vessels were 80-100 feet in overall length with a live tank capacity of about 100,000 pounds of king crab.

At the present time, vessels used in the king crab fishery vary from skiffs fishing a few pots in sheltered bays to large vessels (up to 180 feet) equipped with multiple saltwater circulating live tanks, fishing 500 pots hundreds of miles from port. Beginning in 1973, new vessels have been designed and constructed specifically for fishing king crab in the Bering Sea. These vessels are well adapted to fishing in the adverse weather conditions common in the Bering Sea.

In the late 1970's, a new class of king crab vessels began to appear in the Bering Sea fishery. These vessels were large (130-160 ft.) multiple purpose vessels with the capacity to process their catch. In 1978 three catcher/processors were in operation. During the 1979 season, ten such vessels were operational and five new vessels were under construction. This is the first time that domestic crab fishermen have experimented with combined fishing and processing capabilities. The eventual success of catcher/processors in the domestic fleet is yet undetermined.

At present, the composition and size of the fleets operating in each of the major king crab fishing areas are closely related to the productivity of the area, the general weather conditions, and any limitations on the quantity of

gear that can be fished. The Bering Sea is fished by vessels which are predominantly over 75 feet in length. The adverse weather which is common in the Bering Sea and the high productivity of the area encourage the use of large vessels fishing numerous units of gear. The Kodiak area fleet is evenly distributed between large and small vessels. There are large areas of bays and sheltered waters suitable for smaller vessels and highly productive but exposed offshore areas where larger vessels are needed.

Non-residents form a significant portion of the Alaskan king crab fishery. The following percentage of vessels from each area were registered to non-residents: Southeastern Bering Sea 67%, Dutch Harbor 41%, Adak 94%, and northern Bering Sea excluding ice fishing 84%. Approximately 72% of the total catch from all these areas was taken by non-residents (Table 13).

Value of Catch

From 1969 to present, the value of the king crab catch (ex-vessel) has increased steadily. This increase is primarily due to the gradual increase in landings over this period and the increasing ex-vessel price of landed crab. In 1980, the king crab catch reached record levels. The Westward Region which includes Kodiak Island, Alaska Peninsula, Aleutian Islands and the Bering Sea, produced 98 percent of the State's catch. The Westward Region harvest of 187 million pounds was valued at about 95 cents per pound to the fishermen or about $177.6 million.

The landings and ex-vessel value of king crab, all shellfish, and all fish during the period of 1969-79, and the proportion of king crab to all shellfish and all fish landed in Alaska is given in Table 14. The 1979 king crab catch of 154 million pounds comprised 45 percent of the statewide shellfish catch and 17 percent of the statewide fish catch for that year. The number of vessels operating in each area off the State and the values of both the king crab catch and total catch for each group of vessels is presented in Table 15. Vessels which operated in more than one area are placed into their respective dominant area of catch in the second set of columns in Table 15. The average

Table 13. 1980-81 King crab catch by resident status by area.

Area	Number of Vessels		Catch (millions of pounds)	
	Resident	Non-Resident	Resident	Non-Resident
Bristol Bay	78	158	35.3	94.6
Dutch Harbor	68	48	8.2	10.8
Adak	1	16	0.1	1.4
Bering Sea	18	98	1.9	11.4
TOTAL			45.5	118.2

Source: ADF&G Westward Region

Table 14. Landings and ex-vessel value of king crab, total shellfish, and total fish (including shellfish) caught in Alaska, 1969-79 and the percentage king crab of the total shellfish and fish (in parentheses).

Year	King Crab		All Shellfish				All Fish			
	1,000 lbs	$ 1,000	1,000 lbs	%	$ 1,000	%	1,000 lbs	%	$ 1,000	%
1969	58,232	13,779	128,556	(45)	18,513	(74)	384,994	(15)	68,028	(20)
1970	52,060	12,726	150,647	(35)	18,404	(69)	542,247	(10)	96,989	(13)
1971	70,794	17,185	182,631	(39)	23,137	(74)	451,779	(16)	77,403	(22)
1972	74,124	21,592	199,236	(37)	28,412	(76)	401,463	(18)	86,121	(25)
1973	76,824	44,728	265,001	(29)	68,350	(65)	465,563	(17)	146,271	(31)
1974	96,576	39,268	273,309	(35)	66,913	(59)	465,507	(21)	149,490	(26)
1975	100,396	38,418	249,303	(40)	55,813	(69)	444,309	(23)	128,799	(30)
1976	105,981	67,520	316,697	(33)	95,930	(70)	614,345	(17)	245,218	(28)
1977	98,399	98,446	314,084	(31)	151,815	(65)	670,828	(15)	351,996	(28)
1978[1/]	122,921	155,861	333,896	(37)	230,245	(68)	783,719	(16)	507,487	(31)
1979[1/]	154,312	146,544	344,576	(45)	235,564	(62)	884,811	(17)	623,587	(23)

1/ Preliminary data.

Source: Commercial Fisheries Entry Commission.

Table 15. Ex-vessel value[1/] from king crab and all other fishery resources for 1979.

Management Area	Estimated Ex-Vessel Value (in thousands of dollars) For King Crab For-- All Vessels Fishing These Areas[2/] Number of Vessels	Total Value	Average Value	Vessels Whose Only Or Dominant King Crab Catch Was In The Specified Area Number of Vessels	Total Value	Average Value	Estimated Ex-Vessel Value Of All Fishery Resources By Area Of Largest King Crab Catch[3/] Total Value	Average Value	Percentage King Crab of Total Value
Kodiak	258	18,669	72	244	17,753	73	47,363	194	37
Alaska Peninsula	66	5,076	77	50	3,950	79	16,625	332	24
Dutch Harbor	96	12,281	128	39	7,233	185	12,782	328	22
Adak-Western Aleutians	13	992	76	0	--	--	--	--	--
Bering Sea	239	107,457	450	228	104,780	460	159,152	698	66

1/ Estimated ex-vessel value is derived from applying a particular average price per pound for each species and area. These prices do not necessarily include payments in kind or bonuses.

2/ Since many vessels fish in more than one management area, these individual counts cannot be added to obtain total fleet size.

3/ This includes any fishery resource from any area that was harvested by the vessel.

Source: Commercial Fisheries Entry Commission.

KC2/C-3

value of the king crab catch per vessel for each area for 1979 is also given in Table 15. The catch for the 239 vessels which fished in the Bering Sea averaged $450,000. The next highest average value ($128,000) was for the vessels that fished in the Dutch Harbor area. The vessels that fished in the Kodiak, Alaska Peninsula, and Adak-Western Aleutians area averaged $72,000, $77,000, and $76,000 per vessel respectively for their king crab catches.

Information on the number of vessels, ex-vessel values, and the harvest by fishing area for 1971-79 is presented in Table 16. Between 1971 and 1979 the total harvest has generally increased while the ex-vessel value has fluctuated.

Description and Value of Product

King crab is the major crab species commercially harvested in Alaska and is also the largest component of shellfish production in the State. Since 1969, the value of king crab production has varied between 51-64 percent of the total value of all shellfish production in Alaska and between 12-29 percent of the total value of all seafood products (Table 17). King crab production in terms of wholesale value has increased each year since 1969 in both current and constant dollars with the exception of 1974. In 1976, the wholesale value exceeded $100 million for the first time (Table 17).

King crab is processed into the following five forms: whole frozen, frozen sections, frozen meats, canned meats, and separate claws (Orth et. al. 1979). Frozen sections and frozen meats are now the predominant forms of processing (Figure 10). This is a significant change. In 1969, the value of crab sections was only half that of canned crab. The shift to frozen sections can be partially explained by reduced labor needed for this form of production.

Sales of whole frozen crab is limited to local markets within Alaska. Frozen claws are produced locally only in small quantities because it is cheaper to produce them from frozen sections elsewhere in the continental U.S.

In 1976, a total of 45 king crab processors operating in Alaska realized a gross income (at first wholesale level) of $100 million from king crab. Thirty-three of these processors operated in the Kodiak, Alaska Peninsula, and

Table 16. Domestic Bering Sea/Aleutian Island king crab catch, value and participation by area and year (not by season).

Year	Management Area	No. Vessels	Pounds (thousands)	Metric Tons	Ex-Vessel Value (thousand dollars)
1971	Dutch Harbor	38	11,110	5,039	2,777
	Adak	62	25,850	11,725	5,683
	Bering Sea	56	12,847	5,827	2,569
	Total	156	49,807	22,591	11,029
1972	Dutch Harbor	68	11,297	5,124	2,937
	Adak	50	16,235	7,365	4,219
	Bering Sea	4	20,963	9,509	5,241
	Total	122	48,495	21,998	12,397
1973	Dutch Harbor	59	12,723	5,771	7,634
	Adak	62	11,246	5,101	6,161
	Bering Sea	68	28,240	12,809	14,685
	Total	189	52,209	23,681	28,480
1974	Dutch Harbor	87	13,069	5,928	5,097
	Adak	39	1,335	606	521
	Bering Sea	105	49,374	22,396	19,256
	Total	231	63,778	28,930	24,874
1975	Dutch Harbor	81	15,049	6,826	5,719
	Adak	42	2,826	1,282	989
	Bering Sea	104	52,112	23,638	18,239
	Total	227	69,987	31,746	24,947
1976	Dutch Harbor	74	11,471	5,203	7,112
	Adak	20	386	175	236
	Bering Sea	142	70,411	31,938	43,631
	Total	236	82,268	37,316	50,979
1977	Dutch Harbor	58	4,131	1,874	4,001
	Adak	2	2	1	2
	Bering Sea	139	76,406	34,667	72,585
	Total	199	80,539	36,542	76,588
1978	Dutch Harbor	61	6,847	3,106	8,672
	Adak	12	954	433	1,182
	Bering Sea	167	98,170	44,530	119,802
	Total	240	105,971	48,069	129,656

Table 16. (continued)

Year	Management Area	No. Vessels	Pounds (thousands)	Metric Tons	Ex-Vessel Value (thousand dollars)
1979	Dutch Harbor	96	13,130	5,956	12,281
	Adak	10	808	366	992
	Bering Sea	239	118,666	53,826	107,457
	Total	345	132,604	60,148	120,730

Source: Compiled by the Commercial Fisheries Entry Commission.

Table 17. Value and poundage of king crab production (at processors' level) relative to all shellfish and all fish 1969-77.

Year	King Crab	All Shellfish	All Fish
	thousand dollars		
1969	26,582	42,765 (62)	144,200 (18)
70	24,836	47,487 (52)	213,932 (12)
71	32,252	53,819 (60)	198,658 (16)
72	44,045	77,380 (57)	202,951 (22)
73	72,868	142,480 (51)	307,587 (24)
74	48,410	94,754 (51)	254,366 (19)
75	83,838	131,506 (64)	293,192 (29)
76	104,267	178,905 (58)	452,267 (23)
77	165,781	279,226 (59)	644,126 (26)
	thousand pounds (product weight)		
1969	12,824	29,666 (43)	189,008 (7)
70	14,842	36,347 (41)	284,802 (5)
71	17,147	37,827 (45)	239,061 (7)
72	19,794	49,082 (40)	201,829 (10)
73	28,581	82,806 (35)	227,380 (13)
74	25,512	69,290 (37)	247,752 (10)
75	40,350	78,814 (51)	216,767 (19)
76	39,887	95,577 (42)	283,111 (14)
77	49,543	109,279 (45)	339,205 (15)

Numbers in parentheses represent the proportion of king crab.

Source: ADF&G, Catch and Production Statistics leaflet.

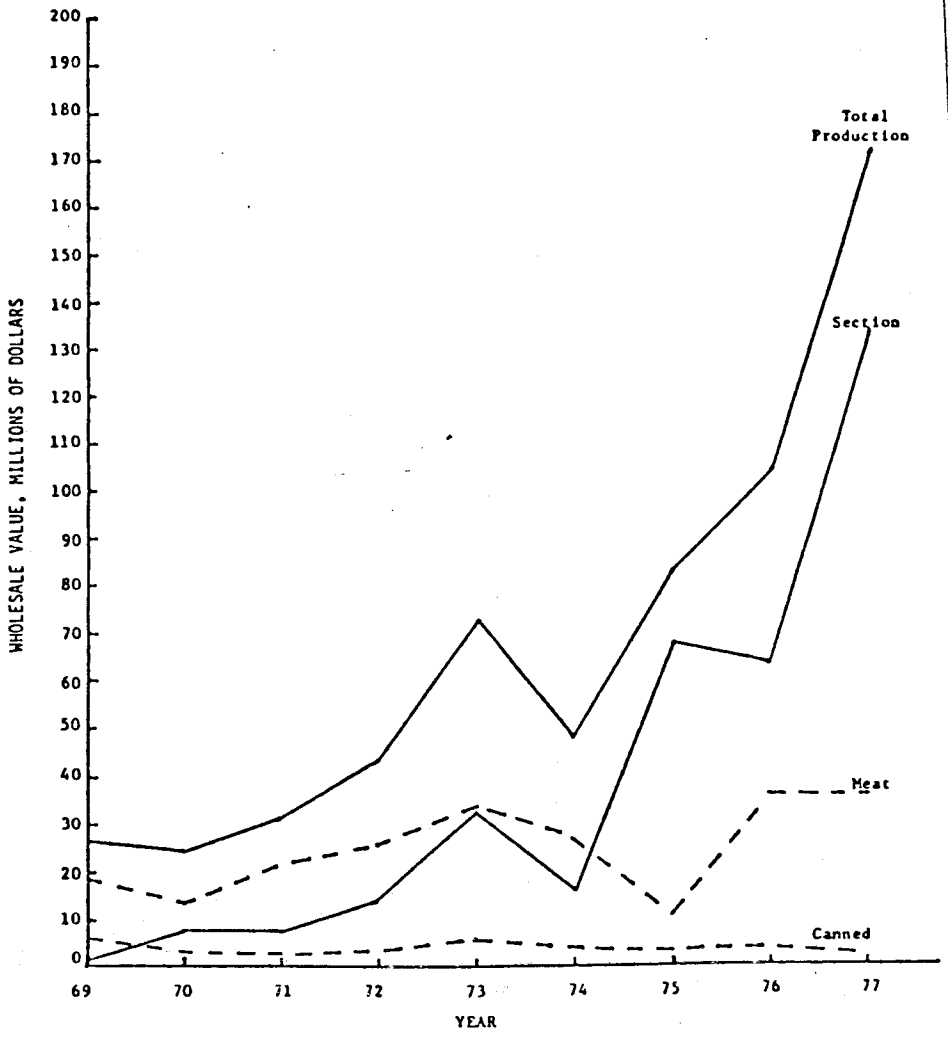


FIG. 10. WHOLESALE VALUE OF KING CRAB BY PRODUCT FORM, 1969-77.

SOURCE: ADF&G STATISTICAL LEAFLETS

Dutch Harbor areas, including a floating processor which operated in the Bering Sea and Adak areas. The total gross income earned by all processors in 1977 was $248 million. Forty percent of this value was acquired from the processing of king crab (Table 18).

The dependence of processors upon king crab increases from Kodiak to Alaska Peninsula to Dutch Harbor. The processing of king crab accounted for 87 percent of the processing value for the Dutch Harbor management area. The processors in the Alaska Peninsula and the Kodiak areas derive 45 and 42 percent respectively, of their gross income from processing king crab.

In terms of gross annual income from king crab processing during 1977, processors in Dutch Harbor were highest at $4.4 million. In terms of average gross annual income from all fish processing, processors in the Alaska Peninsula area showed the highest income of $7.7 million. Gross annual income per processor for the 47 king crab processors averaged $3.4 million and $5.3 million from king crab and from all fish, respectively (Table 18).

Markets

Almost all king crab harvested in Alaskan waters is shipped to Seattle after initial processing (Orth et. al. 1979). The product is then either exported to foreign markets or shipped to major domestic centers of distribution around the United States. In recent years the United States has become a net exporter of king crab (Figure 11). Exports increased from 1 million pounds in 1969 to 18 million pounds in 1977. Imports peaked in 1971 at 9 million pounds and were insignificant by 1974. The major destination of domestic king crab exports has been Japan. Tables 19 and 20 show U.S. exports of king crab, canned (1976 and 1977) and frozen (1981 and 1982), by country of destination. King crab exports are now mostly in the frozen form.

Crab intended for domestic markets is shipped from Seattle in bulk packages weighing 75 to 100 pounds gross weight. Destinations include Los Angeles, Denver, Minneapolis, Chicago, Philadelphia, New York, and Boston. When they reach secondary processing centers, the bulk packages are processed into small blocks of meat.

Table 18. Productivity data for king crab processors, by management area, 1977.

Management Area	Number of Processors	Total Gross Income		Average Gross Income Per Processor		King Crab[1/] Percent of Area's Processing Value
		King Crab	All Fish	King Crab	All Fish	
		thousand dollars				
Kodiak	18	38,174	91,265	2,121	5,070	42
Alaska Peninsula	4	13,932	31,052	3,483	7,763	45
Dutch Harbor[2/]	25	109,684	126,156	4,387	5,046	87
TOTAL	47	161,790	248,473	3,442	5,287	65

1/ King crab percentage of the total and average value from all species and products produced by area's processors.

2/ Includes communities of Dutch Harbor, Unalaska, Akutan, and Captains Bay. Confidentiality forced the addition of one processor that worked the Bering Sea and Adak areas.

Source: Commercial Fisheries Entry Commission

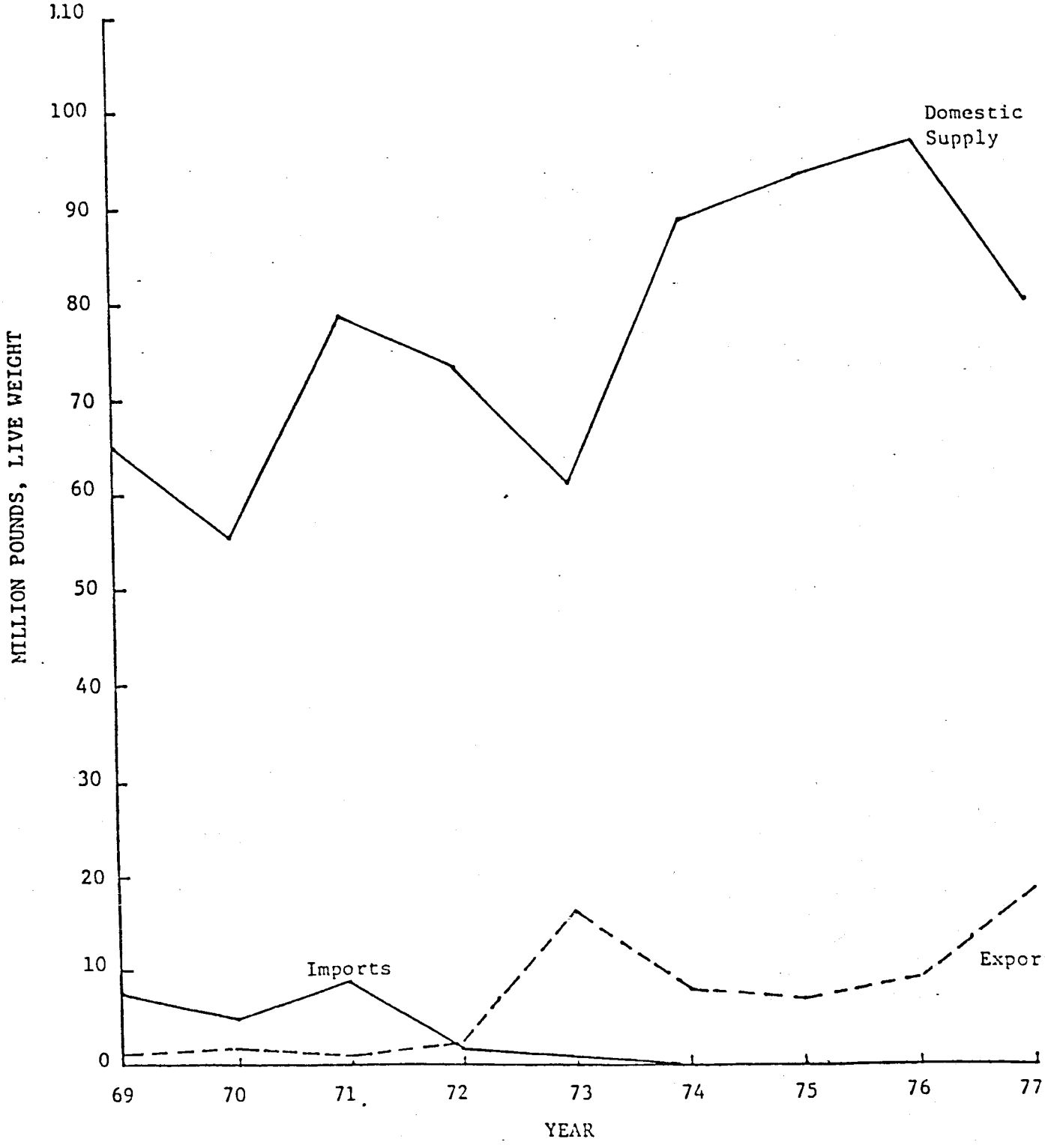


FIG. 11 U.S. KING CRAB SUPPLY, 1969-77

SOURCE: Landings - ADF&G Statistical Leaflets
Imports - FAO Yearbook of Fishery Statistics and Japan Tariff Commission publications
Exports - U.S. Bureau of Census, U.S. Exports/Schedule B, Commodity by Country, FT 410, various issues.

Table 19. U.S. exports of king crab, canned, by country of destination, 1976 and 1977

(Product weight)

Country	1976	1977	1977 as a percentage of 1976	Percentage of total exports	
				1976	1977
	Thousand pounds			Percent	
France	29	99	341.4	7.8	36.9
Japan	196	58	29.6	53.0	21.6
Canada	30	31	103.3	8.1	11.6
Netherlands	40	26	65.0	10.8	9.7
Belgium	17	24	141.2	4.5	9.0
Bermuda	17	9	52.9	4.5	3.4
Sweden	15	7	46.7	4.1	2.6
Norway	-	5	-	-	1.9
Other	26	9	34.6	7.0	3.4
Total	370	268	72.4	100.0	100.0

Source: Shellfish Market Review, NMFS, Washington DC Nov 1978

Table 20. DOMESTIC FROZEN KING CRAB EXPORTS, BY COUNTRY OF DESTINATION, 1981 AND 1982

Country	1981		1982	
	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars
Japan	11,352	36,985	3,381	16,190
Canada	2,935	10,039	1,199	6,961
Australia	149	788	94	638
Netherlands	305	2,095	50	430
Belgium and Luxembourg	234	1,447	41	382
France	90	660	31	382
Federal Republic of Germany	70	309	41	252
Switzerland	36	173	35	247
United Kingdom	105	440	56	206
Hong Kong	36	159	25	161
Singapore	21	94	25	157
Other	498	1,583	141	796
Total	15,831	54,772	5,119	26,802

Source:--U.S. Department of Commerce, Bureau of the Census.

The major buyers of king crab from wholesale centers are distributors supplying restaurants. This is a significant change from 10-15 years ago when a considerable amount of canned crab was sold through retail supermarkets. These sales have since declined substantially. Overall, the per capita consumption of king crab has increased, though somewhat erratically. From 1969 to 1976 domestic annual per capita consumption was up 40 percent from 0.32 pounds to 0.45 pounds (Table 21). In 1977, the consumption per capita dropped to 0.39 pounds. The market for king crab has been strong in recent years.

Some factors which might affect the king crab market in the future include the exchange rate between the Japanese yen and the American dollar and the potential for high seas green-frozen processing on a large scale. A green-frozen processor is one which immediately freezes the crab without cooking it first. If the yen continues to appreciate in relation to the dollar, Japanese imports will probably expand further as the effect is to reduce the price of U.S. crab to the Japanese. This could act to reduce the supply available to the domestic U.S. market which might drive prices higher, particularly if harvest levels drop concurrently for whatever reason. The advent of frozen processing vessels operating on the high seas would have a similar effect. Vessels would be able to export directly to Japan, reducing transportation costs and in effect increasing Japanese buying power.

Foreign Fishery

All foreign fishing within the FCZ was eliminated by bilateral agreements with Japan and Russia by 1975. Thus, even before passage of the FCMA, the king crab fishery had become an exclusively American fishery east of the U.S. Russia Convention Line of 1867. In addition, as previous sections of this plan reveal, the domestic fishing capacity greatly exceeds the optimum yield for king crab. Thus, the domestic fleet will totally utilize the available harvestable resource and there will be no portion of the resource available for harvest by foreign fishermen.

Table 21. U.S. king crab supply and domestic per capita consumption.

Year	Population	Landings	Imports[1/]	Exports[1/]	Total[2/] Supply	Consumption Per Capita
	million persons	thousand pounds (live weight)				pounds
1969	202.677	58,232	7,715	1,157	64,790	.32
1970	204.878	52,060	5,070	1,873	55,257	.27
1971	207.053	70,794	8,990	1,151	78,633	.38
1972	208.846	74,124	1,795	2,514	73,405	.35
1973	210.410	76,824	500	16,220	61,104	.29
1974	211.901	96,576	45	8,139	88,482	.42
1975	213.540	100,396	15	7,161	93,250	.44
1976	215.120	105,981	--	9,303	96,678	.45
1977	216.8	99,449	--	19,499	79,950	.39

1/ Converted to live weight based on the following factors:

meat to live 5.0
fresh/frozen sections to live 1.818

2/ Total supply is not adjusted for beginning and ending stocks.

Source: Population: U.S. Bureau of Economic Analysis, Survey of Current Business, 1977.

Landings: Commercial Fisheries Entry Commission

Imports: FAO Yearbook of Fishery Statistics and Japan Tariff Commission publications

Exports: U.S. Bureau of Census, U.S. Exports/Schedule B Commodity by country, FT 410, various issues.

Subsistence Fishery

There are communities in Alaska where king crab have been utilized as a traditional subsistence food source for many years. The majority of the subsistence users are Alaskan natives who inhabit the shores of Norton Sound and the Bering Strait. Fishing is normally conducted during the winter months when sea ice provides access to king crab areas offshore. Most catches of king crab are harvested within the territorial waters of the state, and although the subsistence harvest of king crab may be significant to those who participate in this fishery, the subsistence harvest is negligible relative to the commercial fishery.

7.5 History of Management

Foreign Fishery

Prior to 1964, there were no regulations for the foreign crab fisheries off Alaska except for a self-imposed size limit of 5.1 inches on male king crab which the Japanese instituted in 1955. In 1964, the United States ratified the Convention of the Continental Shelf and subsequently arranged bilateral agreements with Japan and the USSR. These agreements established quotas on the catch of king crab by each nation, limited the catch to hard shell male crab, and imposed a minimum carapace width of 6.25 inches. The agreements were renegotiated at two-year intervals with progressively lower quotas being set. As a result the USSR ceased fishing for king crab in the Eastern Bering Sea after 1971; the Japanese ceased fishing after 1974. In 1976, the United States enacted the MFCMA and subsequently adopted the Preliminary Management Plan for King and Tanner Crabs. This plan established a TALFF for king crab equal to zero, eliminating the possibility of any foreign fishing for king crab.

Domestic Fishery

Prior to Statehood, regulatory authority for the domestic fisheries off Alaska was vested in the U.S. Bureau of Commercial Fisheries. The Bureau first promulgated regulations for the king crab fishery in 1941, establishing a

minimum size limit of 5.5 inches and prohibiting the retention of softshell or female crab. In 1950, the Bureau increased the size limit to 6.5 inches and closed an area to fishing at Canoe Bay on the Alaska Peninsula. The next significant addition to regulations occurred in 1954 when the Bureau prohibited tangle nets and established a minimum mesh size for trawl nets. These measures were designed to protect female and immature male crab from the high mortality rates inflicted by these gear types. In 1955, the Bureau set a limit of fifteen on the number of pots that could be fished in Cook Inlet and also established a fishing season from June 1 to December 31 for this area.

In 1959, Alaska achieved statehood and, after a one-year transition period, assumed management authority over the fish and wildlife resources of the state. Regulatory authority was vested in the Alaska Board of Fish and Game; management responsibility was assigned to ADF&G.

The Board adopted the Bureau's regulatory regime and added an area registration system. Under this system, State waters were divided into registration areas. Vessels were required to register for an area before fishing. Once a vessel had registered for one area, it could not fish in other registration areas for the balance of the season. This system was intended to protect local fleets and enhance management ability.

By 1960, the king crab fleet had expanded fishing effort into offshore areas beyond the State's three-mile jurisdictional boundary. The State then enacted landing laws which prohibited the sale or transportation within State waters of migratory fish and shellfish taken on the high seas unless they were taken in accordance with State regulations. These statutes withstood subsequent court tests and have remained an important component of the State's regulatory authority.

The Board continued to modify king crab regulations throughout the 1960's but did not introduce any further innovations until 1970. At that time the Board responded to the rapid decline of the Kodiak king crab fishery by establishing a quota system. Under this system, individual fisheries were closed once the catch had reached a preset quota. Quotas were set at a level such that a significant portion of the recruit class would be held over for the next year.

The intent was twofold: (1) to moderate the extreme fluctuations in harvest levels that were associated with the previous recruits-only fishery; and (2) to enhance the reproductive potential of stocks by maintaining a broader distribution of age classes among legal size male crab.

In 1975, the Board modified the catch quota system in recognition of ADF&G's greater inseason stock assessment capabilities. Instead of setting rigid quotas, the Board opted for guideline harvest levels which were expressed as a range instead of as a point estimate. This gave ADF&G greater flexibility in selecting the most opportune point at which to close individual fisheries; more weight could be given to data collected during the course of the fishing season.

7.5.1 Current Management Regime

The State of Alaska's management regime for the king crab fishery is a complex system of regulatory measures involving size, sex, season, area, and gear restrictions and a flexible catch quota system with an area registration system. These regulations vary between areas within the State to reflect local biological conditions and fleet characteristics. The regulations are published annually in the Alaska Shellfish Commercial Fishing Regulations. The 1981-82 major regulations are summarized in Table 22. This summary is provided for informational purposes only, and is not intended to imply that the current State regime is inconsistent with the standards set forth in Chapter 4 of this FMP, or that it is entitled to any presumption in the application of those standards.

The State of Alaska is currently utilizing the ABC/OY procedures described in Section 4.1 in management of these fisheries. Since these procedures were developed as a framework, with eventual ABC and OY values dependent on stock and socioeconomic conditions, the actual values are likely to change from year to year. The values provided in Table 1 (page 15) illustrate how the spawner-recruitment relationship is used for determining ABC/OYs in Bristol Bay. For management areas other than Bristol Bay, rates of exploitation are determined from information on the abundance of legal crabs, since spawner recruitment

Table 22. 1983-84 Major State of Alaska Regulations for King Crab Fishing.

Management Area	Fishing Seasons	Guideline Harvest Levels (ABC/OY)	Minimum Size Limits	Legal Gear	Gear Storage
Dutch Harbor	Nov 10 - until closed by emergency order (EO); 6½" or greater. During periods opened and closed by EO. 7½" or greater.	See Table 2	6½"	Pot Only	25 fathoms or less, only during the period beginning 30 days prior to the opening of the Dutch Harbor king crab season until 7 days after the closing of the E. Aleutians Tanner crab fishery.
Adak	Nov 10 - Feb 15	See Table 2	6½"	Pot Only	30 fathoms or less.
Bristol Bay	Oct 1 - until closed by EO; red, blue, and brown king crab 6½" or greater. During periods opened and closed by EO 7" or greater.	See Table 1	6½"	Pot Only	25 fathoms or less, or in Southeastern waters north of 57°30'N. lat., south of 58°30'N. lat., west of 164°W. long., and east of 166°W. long.
Bering Sea	Pribilof district: Oct 1 - Apr 15 for red and blue crab 6½" or greater. During periods opened and closed by emergency order 7½" or greater.	See Table 2	6½"	Pot Only	In the Northern district, only in waters north of 59°N. lat., south of 59°30'N., west of 169°30'W. long., and east of 171°W. long., or by removal from water.
	Seasons for the Pribilof district brown crab fishery are opened and closed by EO.	See Table 2	6½"		

Source: ADF&G Alaska Commercial Fishing Shellfish Regulations, 1983.

(cont'd on next page)

Table 22 (cont'd)

Management Area	Fishing Seasons	Guideline Harvest Levels (ABC/OY)	Minimum Size Limits	Legal Gear	Gear Storage
Bering Sea (cont'd)	Northern district red and blue crab fishery Aug 20 - Sept 22. Brown crab May 1 - Aug 1.	See Table 2	red crab 4-3/4" blue crab 5½" brown crab 5½"		
	Norton Sound section of the northern district red and blue crab fishery Jan 1 - Apr 30 and Aug 1 - Sept 3.	See Table 2	red crab 4-3/4" blue crab 5½"		

Source: ADF&G Alaska Commercial Fishing Shellfish Regulations, 1983.

data are insufficient for these areas. Table 2 (page 16) shows how exploitation rates will be determined utilizing estimates of population size and pre-recruitment and post-recruitment levels. These estimates are obtained from either survey information or from catch histories for areas where survey data is inadequate. Estimates of population size (a variable used in Table 2), based on 1982 survey information, are provided in Table 23.

State Revenues Derived From Fishery

Alaska collects revenues from the king crab fishery by the sale of permits and licenses as well as from raw fish taxes based on commercial sale. Table 24 provides information on revenues derived for 1970-1978. Only portions of the processor taxes and Commercial Fisheries Entry Commission permits can be directly attributed to the king crab fishery. In 1978, these two sources accounted for $2,366,158.

Beginning January 1, 1978, a combined license took effect. Prior to this time fishermen were required to purchase gear, vessel, and commercial licenses in addition to the interim-use permits. With the combined license that now exists a fisherman is required to possess only an interim permit and crewmen license.

The Alaska raw fish tax is an ad valorem tax based on the value of the raw product sold to processors. For land-based crab processing plants this tax is 3 percent of the ex-vessel value. Floating crab processors pay 5 percent. If a fishery is designated by the Commissioner of Fish and Game as a developing fishery then the processor taxes on land-based and floating processors is equal to 1 percent and 3 percent, respectively. The only king crab fisheries to have been designated as developing are brown king crab statewide and all king crab fisheries north of 58°39'N latitude (Northern Bering Sea).

Costs of Management

Current and projected annual costs of western Alaska king crab management, research, and enforcement are summarized in Table. 25.

Table 23. Definitions of variables used in population size estimates when developing king crab harvest strategy in areas where information is limited.[1/]

For management areas other than Area T (Bristol Bay), rates of exploitation are set based on information on the abundance of legal crabs, since spawner-recruit data are insufficient for these areas. This information comes either from survey data or from catch histories for areas where survey data is inadequate. For the Dutch Harbor, Adak, and Bering Sea management areas, "depressed," "average," and "peak" population levels are defined as follows:

Abundance Level	Red king crab		Blue king crab
	Dutch Harbor (catch in millions of lbs.)	Adak (catch in millions of lbs.)	Bering Sea (stock in millions of lbs.)
Depressed	< 10	< 6	< 4
Average	10-20	6-12	4-7
Peak	> 20	>12	>7

1/ It should be noted that these definitions are in terms of millions of legal crabs estimated from the NMFS survey for blue king crabs, and in terms of catch in millions of pounds for red king crabs. Survey data are not adequate for use in defining population levels in the Aleutians, and CPUE values there apprear to fluctuate from year to year with effort levels as well with population abundance. The use of catch ranges in these cases assumes that catch in any year is abundance-related rather than market-limited.

Information is not extensive enough at this time to define population levels for brown king crab.

Table 24. State revenues related to king crab.

	1970	1975	1976	1977	1978
Processor Taxes	$239,099	$633,869	$1,080,102	$1,654,675	$2,360,958
Interim-use Permits[1/]	--	62,625	80,110	97,850	361,255
Processor Licenses	6,425	5,325	5,450	5,375	5,200
Comm. Fish Licenses	375,240	334,510	391,550	444,920	--
Crewmen Licenses[1/]	--	--	--	--	337,180
Vessel Licenses	161,863	158,704	163,180	179,142	290,080
Gear Pot Licenses	18,225	28,875	31,410	39,690	--

1/ The fishermen's fund is supported by 60% of the money collected from each crewmember fishing license issued, and from an equal amount of the money derived by the State from each commercial fisherman who is issued a permit.

Source: Alaska Department of Revenue: except interim-use permits and crewmen licenses which are from Commercial Fisheries Entry Commission.

Table 25. Current (FY84) and projected annual costs of Western Alaska king crab management, research, and enforcement programs.

Program	Current FY81 Expenditures[1/] (funding source)
1. Program Management	
a. Regulation/mgt.	377.0 (ADF&G) 30.0 (NMFS) 60.0 (NPFMC)
b. Biometrics/data processing	66.6 (ADF&G)
c. Research program mgt.	0.0 (ADF&G)
Total	533.6
2. Stock Assessment Program	
a. Aleutians[2/]	0.0 (ADF&G)
b. Bering Sea[3/]	1,000.0 (NMFS) 0.0 (ADF&G)
Total	1,000.0
3. Enforcement	147.0 (ADPS)

1/ Thousands of dollars.

2/ Includes Adak and Dutch Harbor.

3/ Includes Northern Bering Sea and Bristol Bay.

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Washington, D.C. 20235

JUL 16 1984

F/M11:RBG

TO: Distribution*

FROM: F/M11 - William P. Jensen

SUBJECT: Review of Final Package for the King Crab Fishery Management Plan

On July 5, 1984, we received the final package for the Bering/Sea Aleutian Islands King Crab Fishery Management Plan (FMP) with associated documents, as resubmitted by the North Pacific Fishery Management Council (Council). On July 13, 1984, we determined the final FMP package to be "structurally complete." Accordingly, the fast-track 110-day Magnuson Act review begins with July 16, 1984, as Day 1.

Please review the attached final FMP package including the Regulatory Impact Review/Regulatory Flexibility Analysis, Final Environmental Impact Statement, and associated documents. I would appreciate receiving your response (including "no comment") by August 13, 1984. Please contact Robert Gorrell (634-7449) if you have any questions.

Attachment

*Distribution

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REGULATORY IMPACT REVIEW/REGULATORY FLEXIBILITY ANALYSIS
FOR THE
BERING SEA/ALEUTIAN ISLANDS
KING CRAB FISHERY MANAGEMENT PLAN

North Pacific Fishery Management Council

October 1983

Prepared by:

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KC3/A

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1.0 INTRODUCTION

The incumbant Administration's policy on the development and issuance of regulations is established by Executive Order 12291. The main objectives of that policy are to reduce the burdens imposed by existing and future regulations, to increase agency accountability for regulatory actions, and to provide for Presidential oversight of the regulatory process, minimize duplication and conflict of regulations, and insure well-reasoned regulations. Under these guidelines each agency, to the extent permitted by law, is expected to comply with the following requirements:

1. Administrative decisions shall be based on adequate information concerning the need for and consequences of proposed government action;

2. Regulatory action shall not be undertaken unless the potential benefits to society from the regulation outweigh the potential costs to society;

3. Regulatory objectives shall be chosen to maximize the net benefits to society;

4. Among alternative approaches to any given regulatory objective, the alternative involving the least net cost to society shall be chosen; and

5. Agencies shall set regulatory priorities with the aim of maximizing the aggregate net benefit to society, taking into account the condition of the particular industries affected by regulations, the condition of the national economy, and other regulatory actions contemplated for the future.

In compliance with the Executive Order 12291, the National Marine Fisheries Service (NMFS) requires the preparation of a Regulatory Impact Review (RIR) for all regulatory actions which either implement a new fishery management plan (FMP) or significantly amend an existing FMP, or may be significant in that they affect important DOC/NOAA policy concerns and are the object of

public interest. The RIR (1) provides a comprehensive review of the level and incidence of impact associated with the proposed or final regulatory actions; (2) provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problems; and (3) ensures that the regulatory agency or council systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost effective way.

The RIR also serves as the basis for determining whether the proposed regulations implementing the FMP or amendment are major under criteria provided in Executive Order 12291 (described above), whether or not the proposed regulations will have a significant economic impact on a substantial number of small entities under the Regulatory Flexibility Act (P.L. 96-354), and whether or not the Paperwork Reduction Act of 1980 (P.L. 96-511) applies. The primary purpose of the Regulatory Flexibility Act is to relieve small businesses, small organizations, and small governmental jurisdictions (collectively, "small entities") from burdensome regulatory and recordkeeping requirements. This Act requires that if regulatory and recordkeeping requirements are not burdensome, then the head of an agency must certify that the requirement, if promulgated, will not have a significant economic effect on a substantial number of small entities.

The purpose of the Paperwork Reduction Act, in part, is to minimize the federal paperwork burden for individuals, small businesses, state and local governments, and other persons. This Act requires each agency to ensure its information systems do not overlap each other or duplicate the systems of other agencies.

A. Problems Necessitating an FMP

The Council considered the option of not preparing the proposed Fishery Management Plan for the Bering Sea/Aleutian Islands King Crab Fishery (FMP) and ultimately rejected that option, deciding that an FMP's benefits were substantial, and outweighed the costs. The following benefits can be expected. (Costs will be reviewed in later sections).

1. Extension of regulatory authority to all elements of the fishery

At present there are a number of large vessels in the king crab fishery which harvest and process their catch while at sea. Some of these catcher-processors are capable of conducting all of their operations without having to enter the territorial waters of Alaska (the three-mile limit). Consequently, they may lawfully refuse to "register" as required by Alaska State Law, placing themselves beyond the reach of Alaska's regulatory and enforcement powers, even when these powers are construed liberally in favor of the State. The no-FMP alternative, coupled with the present attitude of a vocal segment of the Bering Sea/Aleutian Islands (BS/AI) fleet, which is averse to State management believing it to be illegitimate, might lead to the concerted utilization of catcher-processors to avoid State authority. This could produce a fishery which contained both a regulated (State registered) and a "free" (unregistered) component. The problems inherent in such a situation readily can be imagined. Possible problems would include the failure to count the harvest of catcher-processors who could not be compelled to complete fish tickets, and thereby risk exceeding the king crab OY; and the possibility that systematic harvest by these vessels of under-sized crab might occur due to the inability of the state to enforce minimum size limits while at sea. The significance of this problem cannot be exaggerated. The number of catcher-processors entering the fishery has dramatically increased over the last five years, from three to ten vessels. While being a small component of the large fleet (280+), over ten percent of the 1982 king crab harvest was attributed to these vessels.

On the other hand, under an FMP, binding regulations would apply to all vessels in the FCZ covered by the plan regardless of lack of State registration or contacts.

2. Interaction with other fisheries

The potential for development of the domestic groundfish fishery off Alaska was one of the major reasons for implementation of the

Magnuson Fishery Conservation and Management Act (MFCMA). In the past several years, participation by domestic fishermen in the groundfish fishery has greatly expanded and shows signs of continuing that trend. There are groundfish FMPs in place for the Gulf of Alaska, and for the Bering Sea/Aleutian Islands Area.

There is and will continue to be conflict between the domestic fixed gear (crab pot, longline) fishermen and domestic trawl fishermen. A king crab FMP will allow the Council to act as a forum for resolution of these conflicts. Without this forum within which to resolve conflicts, grounds preemption and gear conflict problems can develop into serious economic and biological management concerns for the king crab fishery.

3. Increased flexibility to respond to emergencies

Under the MFCMA the Secretary of Commerce is without power to issue any regulations governing domestic fishing in the 200-mile fishery conservation zone (FCZ) unless there is an approved fishery management plan in place. The FMP is a predicate to the Secretary's domestic regulatory authority. If a bona fide emergency affecting the king crab resource in the FCZ off Alaska were to occur, and if the State failed to act, or acted wrongly in the judgment of the Secretary, he would not have legal authority to correct the problem absent an FMP.

If the system proposed under the FMP functions as intended, the Secretary rarely, if ever, will need to supersede or supplement a State measure in order to carry out the objectives of the FMP. Nevertheless, there is a value to the Nation in the assurance of Secretarial power to act when circumstances demand action. This would not be possible under the no-FMP option.

4. Achievement of stability among the participants in the fishery

The majority of the BS/AI crab fleet is based in the State of Washington. One organized segment of these Washington-based

fishermen has been highly vocal in its objection to existing State of Alaska management, complaining of discriminatory or potentially discriminatory treatment based on non-resident status. These fishermen have demanded that regional-federal Magnuson Act management be extended to the king crab fishery in the belief that this will mean they will have more influence over the decision process.

The present framework proposal is a balanced and structured accommodation of those who object to State management and actively demand federal regulations. Under this proposal there will be a federal FMP for the fishery, thus extending Magnuson Act regional management to the Washington State fleet that fishes in the FCZ off Alaska. Review of all State laws and regulations by the Regional Director of the National Marine Fisheries Service, as the Secretary's designee, will ensure that the State of Alaska's laws and regulations treat all fishermen equally. The Council will confer with the State Board of Fisheries and participate in its notice and comment rule making procedures. Access to federal courts will be governed by section 311(d)[1/] of the Magnuson Act. The FMP will therefore reduce the potential that actions taken by the State of Alaska could be perceived as discriminatory.

5. Monitoring incidental catch of other species

There is an incidental catch of halibut and other species in the king crab fishery, however no information regarding this by-catch is being collected in a systematic way. Since some of the species caught incidentally are target species for other fisheries, the FMP is necessary to enable the collection of data to allow observation of this potential problem and initiate regulatory action to resolve that problem if it becomes necessary. Data may be obtained through a variety of traditional methods including fish tickets, logbooks, and/or observer programs.

1/ 16 U.S.C., Section 1861(d)

B. Objectives of the FMP

The management system set forth in the FMP has been developed in accordance with the MFCMA and other applicable law. It is designed to achieve the following objectives. These objectives are not mutually exclusive and management measures are designed to balance the various components within these objectives.

1. Maintain resource base by optimizing the reproductive potential of individual king crab stocks

When population levels are low or when not enough is known about a stock to identify spawner-recruit relationships and hence define spawning requirements, it is necessary to ensure that a sufficient number of adult males be left in the population to maximize reproductive potential. When stock levels are high, full egg clutch development in all female crab is not necessary. Under those conditions male crab can be exploited at a much higher rate and at very high stock levels a harvest of female crab may be consistent with the goal of achieving optimum reproduction potential of that stock.

2. Optimize the net value of the fishery

The optimum yield for the BS/AI king crab fishery is not necessarily the same as the allowable biological catch. Social, economic, or ecological factors may favor a reduction of the maximum annual yield in order to stabilize annual harvest. Maximum physical yield is attained through heavy harvesting and an almost complete dependence on a single age class entering the fishery between fishing seasons. Because the abundance of individual age classes vary wildly, that dependence leads to heavy annual fluctuations in the catch and the attendant adverse social and economic conditions associated with "boom and bust" fisheries. Management strategies could be designed to moderate the peaks and troughs (which are a function of year class strength). While there will still be fluctuations in the catch from year to year they will be less severe, allowing better opportunities for orderly planning and marketing.

Management measures should minimize restrictive or additional burdens on industry or on efficient harvesting and processing techniques. They should be designed to complement production and marketing standards and requirements. Management measures and regulations will be imposed only to attain specific conservation or social and economic objectives.

3. Minimize the socioeconomic impacts of conservation and management measures

The BS/AI king crab fishery is an established fishery which has gone through rapid development in the last 20 years. After a short-lived small scale U.S. fishery in the late 1940s and 1950s, Japan and the Soviet Union began heavy exploitation of the resource in the late 1950s and early 1960s. Those activities have been supplanted by a purely domestic fishery which has had more than enough capacity to harvest and process the total resource since the late 1960s. Harvesting and processing systems and community infrastructures are well established and management measures may be necessary to avoid sudden economic dislocation. Unless dictated by resource emergencies, management measures should not make abrupt changes causing losses or creating requirements for heavy new investments by the U.S. fishing industry or by the communities involved in the harvest and processing of this resource. Considerations of impacts of management measures should not be based solely on economics, but should include the social impact on all segments of this complex.

There are some areas of this fishery management unit where king crab have been utilized as a traditional subsistence food source. The fishery will be managed to assure a continued source of crab to those areas at a level compatible with customary and traditional use of the resource.

4. Minimize adverse interactions among fisheries

Management measures developed for the king crab fishery must take into account the interaction of that fishery and the people engaged in it with other fisheries. Three areas of concern can be identified:

(a) Scheduling king crab fisheries so that they will mesh compatibly with other commercial fisheries, taking into account ship and worker availability as well as processing capacity;

(b) The compatibility of different types of fishing gear and activity on the same grounds. The king crab fishery is conducted with stationary gear, i.e. pots. Many of the other fisheries in the fishery management unit, both U.S. and foreign, are conducted with mobile trawl gear. Seasons and fishing areas must be arranged for both types of gear to eliminate, insofar as possible, conflicts between gear types and preemption of grounds by one form of gear over another; and

(c) Management measures must take into account the incidental catch of species other than king crab taken in this fishery. Gear, seasons, and fishing areas may have to be adjusted to minimize catches of species such as halibut during the course of the regular king crab fishery.

5. Optimize the cost effectiveness of management and enforcement

Fishery management should seek to bring costs of management and enforcement to within reasonable limits relative to the value of the fishery. Also, the administrative system which implements this plan should strive to be efficient, non-duplicative, and timely.

C. Methodological Approach to the Regulatory Impact Review/Regulatory Flexibility Analysis

The FMP is a very broad plan that establishes objectives and a process for management of the king crab resource for the overall benefit of the nation. It represents a unique State of Alaska/Federal Government cooperative approach to the management of the fishery. As a "framework FMP," the Plan serves as the basis for continuing long-term management of the fishery, without itself having to undergo frequent amendment. This RIR/RFA reflects the broadness of the FMP but will provide insight into the economic consequences of various specific management decisions on the groups that could be affected by the FMP. The scope of the analysis will be sufficiently broad to encompass the reasonable range of management measures which could be implemented in the foreseeable future.

The analysis initially describes the problems which are to be addressed in the FMP. Additional sections will discuss the objectives, the history of king crab management, development and implementation of the plan, alternative approaches to the plan, and an overview of the king crab fishery. The specific management measures to accomplish the objectives are described in general terms. The extent of the impact of a particular management tool (i.e. size limits, quotas, seasons) on a specific sector (i.e. small boat owners, consumers, processors) is depicted qualitatively in an impact matrix. Each potential impact is discussed in some detail with potential impacts based on historical ranges in the fishery and/or likely theoretical limits. The above discussion will provide estimates of benefits and costs for most of the regulations that are within reasonable discussion for the fishery manager to control.

Because natural variations in the abundance of king crab are beyond control of the fisheries manager, stock abundance will be considered as given in the RIR/RFA. Fisheries managers will react to changes in king crab abundance by adjusting regulations to assure the perpetuation of the resource and continued economic viability of the fishery.

A special analysis of the impacts of attempts to increase the stability of the fishery by "smoothing" natural variations in resource abundance has also been included.

D. History of King Crab Management

Foreign fishery. Until 1964 there were no regulations for the foreign crab fisheries off Alaska. During 1964 the United States arranged bilateral agreements with Japan and the USSR. These agreements established quotas, limited the king crab catch to hard shell male crab, and imposed a minimum carapace width of 6.25 inches. The agreements were subsequently renegotiated at two-year intervals with progressively lower quotas set. Consequently the USSR and Japan ceased fishing for eastern Bering Sea king crab during 1971 and 1974 respectively. During 1976 the United States enacted the MFCMA and subsequently adopted the Preliminary Management Plan for king crab and Tanner crab. This plan established a total allowable level of foreign fishing (TALFF) for king crab equal to zero, officially ending the foreign directed king crab fishery off Alaska.

Domestic fishery. Prior to Alaska statehood, the U.S. Bureau of Commercial Fisheries managed the king crab fishery. In 1941 the Bureau established a minimum size limit of 5.5 inches and prohibited the retention of soft shell or female crab. The next significant addition to regulations occurred in 1954 when the Bureau prohibited tangle nets and established a minimum mesh size for trawl nets. These measures were designed to protect female and immature male crab from the high mortality rates inflicted by these gear types. In 1960, one year after achieving statehood, regulatory authority was vested in the Alaska Board of Fisheries with management responsibility assigned to the Alaska Department of Fish and Game. The Board adopted the Bureau's regulatory regime and added a registration system designed to protect local fleets and enhance management ability. By 1960, due to the expansion of the fishery, the State enacted landing laws which prohibited the sale or transportation within State waters of migratory fish and shellfish taken on the high seas unless they were taken in accordance with State regulations. In 1970, the Board reacted to a rapid decline in the Kodiak king crab fishery by establishing a quota system, which was designed to allow a

significant portion of the recruit class to be held over for the next year. This quota system was intended to moderate extreme fluctuations in harvest levels associated with the previous recruits-only fishery, and to enhance the reproductive potential of the stocks. In 1975, the Board modified the catch quota system to guideline harvest levels, which were expressed as a range instead of a point estimate. This gave the Department greater flexibility in selecting the most opportune point at which to close individual fisheries since more weight could be given to data collected during the course of the fishing season.

E. Development of a Fishery Management Plan

With the adoption of the MFCMA in 1976, it became the responsibility of the Council to prepare an FMP with respect to each fishery within its geographical area of authority that required conservation and management. Fisheries that included foreign participation were given first priority. Since the king crab fishery is entirely domestic, development of the FMP did not begin until 1977. The process was made difficult because the FMP had to take into consideration the long-standing successful management of the fishery by the state; the complexity in managing the many individual king crab populations; and the established fishing communities that rely on king crab for a large part of their livelihood. As noted above, another consideration was to develop an FMP that would maximize effectiveness as a management tool. Traditional FMPs require annual amendments in order to respond to changes in the respective fisheries. Due to the increasing amount of time required for amendment review, FMPs have become increasingly out-of-date with the fishery. In an attempt to resolve this problem the Council developed a framework FMP which serves as a basis for continuing long-term management of the king crab fishery, and which provides clear guidance to the ongoing regulatory process, without itself having to undergo frequent amendments.

F. Implementation of the King Crab FMP

The proposed framework FMP includes the Bering Sea, Bristol Bay, Dutch Harbor, and Adak/Western Aleutians (ADF&G regulatory areas Q, T, O and R).

The other waters in the State are not included in this FMP and will remain under the exclusive regulatory jurisdiction of the Board of Fisheries.

The intent of the Council is that these other areas may eventually be included in an FMP. However, recognizing the biological, geographical, industrial, socioeconomic, and political differences between the Gulf of Alaska and the Bering Sea/Aleutian Islands area, the Council chose to focus first on areas Q, T, O and R, the area of greatest need, as the best approach to implementing a king crab FMP. Also, since the area included in the FMP accounts for most of the total state catch of king crab (see Section II), the amount of the total king crab catch not included in the FMP is relatively minor.

King crab stocks in the areas included in the FMP are discrete from those which are presently excluded, so the separation of the Bering Sea/ Aleutian Islands area from the Gulf of Alaska is reasonable based upon the distribution of the resource. This separation is compatable with National Standard 3 which states that an individual stock of fish shall be managed as a unit throughout its range.

The difficulties in including all areas of the state in the FMP at present are due to a number of factors. One of the main difficulties is that user groups, fishermen and processors, in the non-FMP areas such as Kodiak and the Alaska Peninsula do not wish to be included. They have stated in public comment to the Council that they fish mostly in inshore waters on relatively small discrete stocks of king crab and do not feel the need for federal participation in the management of the fishery. They feel that the Board of Fisheries has done a good job managing the fishery and conserving the king crab resource.

Some of the regulatory measures promulgated by the Board of Fisheries, such as exclusive registration areas, pot limits and season opening dates, assist in preventing economic dislocation of a certain segment of the industry dependent on an individual area's crab stocks. This is particularly true if the character of the fishing fleet and the related industry depending upon the area's potential production, would not allow

movement to another area. Generally the combination of exclusive and non-exclusive areas tends to spread the fishing effort within a fishing season to fully utilize the crab stocks. The most significant conservation purpose served by exclusive areas is the reduction of the opportunity for "pulse" type fishing effort, which tends to either over exploit discrete stocks or require overly conservative management that prevents full utilization of all available segments of the total crab stocks within the registration area.

The data presented in Section II of this document show that for Kodiak and the Alaska Peninsula area, the percentage of resident fishermen during the 1980-81 fishing season was 98.9 percent and 87.0 percent respectively. By comparison, the resident catch percentage for Dutch Harbor, Bristol Bay and Adak/Western Aleutians during the same season was 43.2, 27.2 and 7.2 percent, respectively. The tables in Appendix A show that there is a significantly different distribution in vessel length size between the FMP and non-FMP areas. The vessels fishing Kodiak and the Alaska Peninsula are smaller than those which fish the westward areas included in the FMP. These smaller vessels are restricted in their ability to move between registration areas because of the severe weather and ocean conditions often encountered. It is known throughout the industry that large vessels are better suited for offshore fishing while smaller vessels fish more effectively close to shore. These data also indicate that the fishing fleets in the non-FMP areas are smaller in size. This is due, in part, to the natural limitations of the crab resource in those areas. As a result of this FMP development process, it is apparent that further data collection and analysis on the impacts of various regulatory measures implemented by the Board of Fisheries is needed before these areas can be included in the FMP.

G. King Crab FMP - Major Approaches

The Council investigated and evaluated three different approaches to the king crab FMP before choosing one. The approaches were to:

(1) not have a king crab FMP;

(2) have a king crab FMP implemented, with the Secretary of Commerce delegating regulatory authority for the fishery to the Alaska Board of Fisheries, within the framework guidelines of the FMP; and

(3) have a king crab FMP implemented and regulations issued by the Secretary of Commerce.

The Council has chosen approach two as the best approach for management of the king crab resource. The important determination for the purpose of this review is whether or not this approach is consistent with the regulatory requirements of Executive Order 12291. Since the management measures to be implemented in the fishery are not specifically identified in the framework FMP, analysis of the costs and benefits for different parts of the plan is difficult. The following section will be restricted to discussion of the three major options listed above, however, some discussion of the alternative management measures adopted by the Board of Fisheries in recent years is included in Section III.

Option one, to not have a king crab FMP, would leave the responsibility for regulatory authority for the fishery with the Alaska Board of Fisheries as it has been since 1960. This option is consistent with most of the regulatory requirements of E.O. 12291, which were stated earlier. Since no additional expenditure for federal regulation of the fishery would be necessary, this would be the least cost approach to regulation of the fishery. The Council members are in agreement that the regulations promulgated by the Board of Fisheries have been successful in ensuring both conservation of the resource and optimum harvest levels. Therefore the adoption of this option, (i.e. maintenance of the status quo) would not have a significant economic impact on the king crab fishery.

However, there are a number of present and potential costs associated with this approach which make it less desirable than the other options, even if it does have the apparent advantage in lowest cost of regulation. These costs were discussed in subsection A and include: dissatisfaction of an important segment of the king crab fleet with the present management regime, possible regulation enforcement problems with the catcher-

processor vessels, grounds and gear preemtpion problems among different segments of the domestic fishing fleet and potential conflicts among the domestic user groups due to incidental catches in one fishery of species which are a target species in other fisheries. Due to the lack of data and the potential nature of some of these costs, they are not quantified. For the purposes of this RIR however, identification of these costs should be sufficient.

Under option one, most of the burden of enforcement of the king crab fishery regulations resides with the State of Alaska, Department of Public Safety, Fish and Wildlife Protection Division. Table 24 of the King Crab FMP estimates the 1981 enforcement costs to be 147 thousand dollars.

The second option, that of having a framework FMP for king crab with a single enabling regulation to delegate management authority to the Alaska Board of Fisheries, is a second best solution in terms of Federal regulatory costs. It will require expenditures for developing and implementing the framework FMP, and will continue to require the expense of meetings, at least once a year, between the Board of Fisheries and the Council to hear public testimony, and to discuss and agree upon management measures for the fishery. This approach would not require annual (or more frequent) amendments to the FMP, allowing both more effective and timely fishery management and a more cost effective approach to regulation, compared with option three.

The Council supports option two because it allows the development of an FMP, thus ensuring that the management objectives and measures adopted by the Board of Fisheries will be compatible with those mandated by the MFCMA. This approach is intended to alleviate the concerns of some user groups, particularly non-resident fishermen, with the Alaska Board of Fisheries having sole regulatory authority without the participation of the Council. These fishermen have voiced the opinion that the Council will be more responsive to their concerns than the Alaska Board of Fisheries. Since the non-resident fishermen comprise a major component of the BS/AI king crab fleet and that fleet is responsible for most of the king crab catch in Alaska (see Table 2), the Council support of

option two is justified even though it may not be the least cost approach to regulation. Since this option does require implementation of an FMP the potential costs for management of the king crab fishery discussed in subsection A should be minimized.

Because of these advantages, option two was chosen as the best approach to management of the king crab resource.

Under option two, the State of Alaska would still play the major role in enforcement of fishery regulations through the Department of Public Safety, Fish and Wildlife Protection Division with some assistance from NMFS and the Coast Guard. According to NMFS, no significant enforcement costs would result from adoption of this option over and above those already estimated for option one (i.e. maintenance of the status quo).

Option three, implementing an FMP with regulations issued by the Secretary of Commerce, is the least cost effective of the three regulatory approaches. In addition to the costs of developing and implementing an FMP, the periodic amendments necessary to manage the fishery would be extensive and costly. Even if an FMP were implemented and regulations were issued by the Secretary for king crab management in the FCZ, the State of Alaska would still have to maintain its management infrastructure to regulate the king crab fishery within the three-mile territorial waters. The federal infrastructure to manage the resource in the FCZ does not presently exist and would have to be created. The duplication of management functions required by this option is not consistent with the E.O. 12291 regulatory requirement that the least net cost alternative for management be chosen. Also, with the assumption that the joint Board/Council management operates as planned, there would be no significant benefits from option three over option two. Management measures, and changes to regulation would still be subject to review by the Council and the public before being acted upon by the Board of Fisheries, so the interests of particular components of resource user groups should be satisfied.

Under option three, the structure of enforcement would differ from that of option one or option two. Enforcement would be purely a federal function in FCZ waters. NMFS and the Coast Guard would be responsible for monitoring compliance with the fishery regulations.

The costs of enforcement under this option are currently estimated at the following amounts:

Coast Guard Costs	$148,000
NMFS Agents (est. 13 agent days)	3,000
Total Enforcement Costs	$151,000[1/]

Since the State of Alaska would still be enforcing king crab regulations in the territorial waters at an estimated annual cost of 147 thousand dollars, there would be significant duplication of enforcement costs.

II. AN OVERVIEW OF THE KING CRAB FISHERY

The king crab fishery is one of the most important in the waters off Alaska in terms of participation in the fishery, processing plant employment and value of catch.

The catch levels and ex-vessel values for all fisheries off Alaska are shown in Table 1 and Figure 1, for 1979, the most recent year for which complete data are available. The king crab fishery landed a total of 149 million pounds in 1979 with an ex-vessel value of over 148 million dollars. These amounts are 17.2 percent and 22.8 percent respectively, of the total catch and ex-vessel value for all fisheries off Alaska in that year.

The catch of king crab is from all areas of the state, however the largest share of the catch is from the BS/AI area, as included in the king crab FMP. Table 2 shows that in recent years over 85 percent of the total state catch of king crab has been from this area (having an ex-vessel value of approximately 127 million dollars in 1979). The BS/AI has increased its contribution

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1/ NMFS, Juneau. Personal communication, November 1981.

TABLE 1

Catch and Ex-Vessel Value for all Fisheries Off Alaska for 1979[1/]

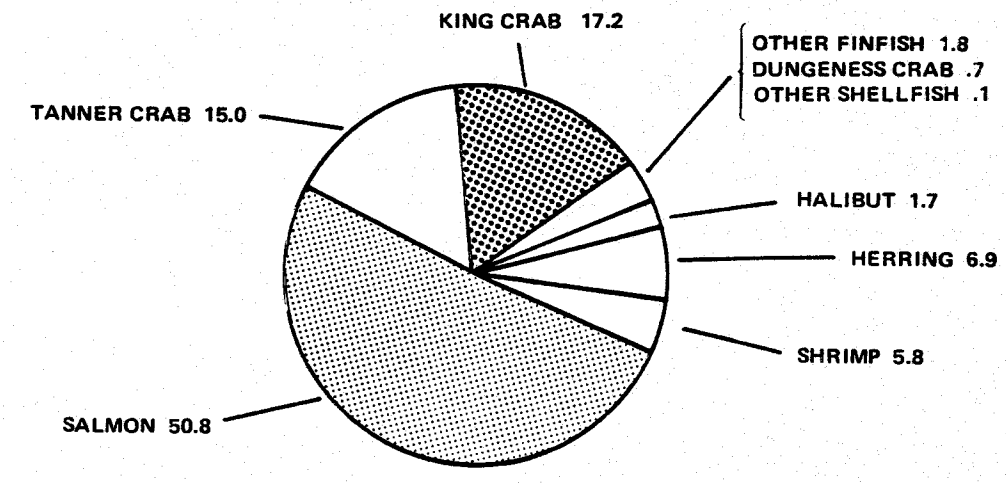
(catch in thousands of pounds, value in thousands of dollars)

	Catch	Percent	Value	Percent
Salmon	442,954	50.8	344,571	52.7
Halibut[2/]	14,837	1.7	31,603	4.8
Dungeness Crab	6,334	.7	4,166	.6
King Crab	149,660	17.2	148,745	22.8
Tanner Crab	130,589	15.0	71,992	11.0
Shrimp	50,613	5.8	12,867	2.0
Herring	60,566	6.9	32,709	5.0
Other Finfish	15,944	1.8	6,272	1.0
Other Shellfish	567	.1	945	.1
Total	872,064	100.0	653,870	100.0

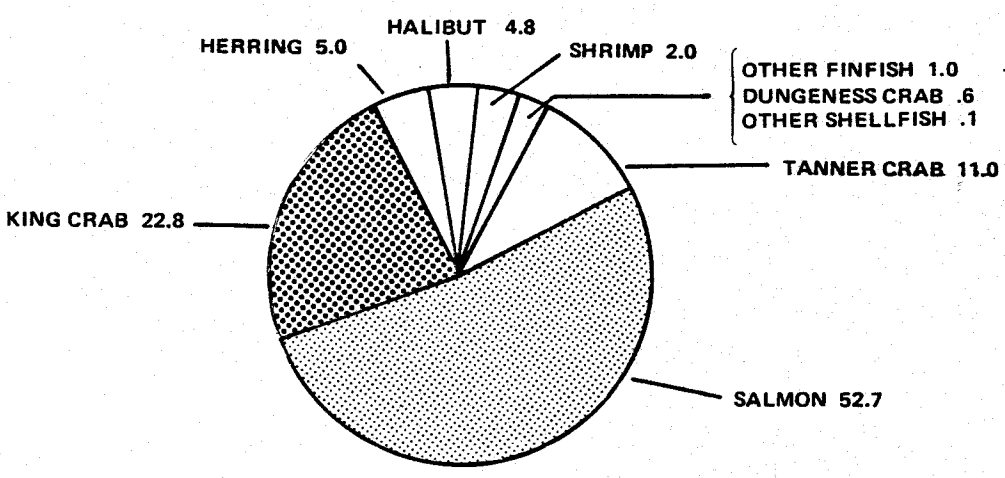
Source: Alaska Department of Fish & Game, "Alaska 1979 Catch and Production," statistical leaflet no. 32, July 1981.

1/ This is the most current year available for these data.

2/ The ex-vessel value for the halibut catch was calculated by applying the average 1979 price reported by the International Pacific Halibut Commission to the catch since it was not included in the cited publication.



LANDED WEIGHT: TOTAL 872,064,000 lbs.



LANDED VALUE: EX-VESSEL, NOT INCLUDING BONUSES
TOTAL $653,870,000

FIGURE 1

Landed Weight and Ex-vessel Value of Alaska's Fisheries, 1979
(shown in percent of total)

to the state catch over time. In 1970 for example, the BS/AI area accounted for 60.7 percent of the total Alaska catch. This percentage increased steadily over the years to the present situation.

To process the king crab catch over a relatively short season, there are a large number of processing plants in the BS/AI area (ADF&G statistical areas Q, T, R and O). For the 1980 fishing season, 46 plants operated as follows:[1/]

Dutch Harbor/Bering Sea	
floating processors	21
shore-based processors	15
catcher-processors	9
Total	45
Adak	
floating processor	1

For the 1981 king crab season, there were new catcher-processors operating in addition to those listed above.

The employment in the shore-based and floating processor plants can be determined to some extent from the Alaska Department of Labor statistics. The latest data available showing employment in the fish-processing sector of the BS/AI area during the time king crab is processed is: September, 2,217 employed; October, 2,306 employed; and November, 1,986 employed.[2/]

The king crab fishing fleet in the BS/AI area is made up mostly of large modern vessels. The numbers of vessels which fished in the 1980 season for the different ADF&G regulatory areas was as follows:[3/]

Area T	-	Bristol Bay	236 vessels
Area O	-	Dutch Harbor	116 vessels
Area R	-	Adak/Western Aleutians	17 vessels
Area Q	-	Bering Sea	116 vessels
Area M	-	Alaska Peninsula	44 vessels
Area K	-	Kodiak	164 vessels

1/ Alaska Department of Fish and Game, Report to the Board of Fisheries, 1980.

2/ Alaska Department of Labor, "Statistical Quarterly" (1980 data).

3/ Source: Alaska Department of Fish and Game.

TABLE 2

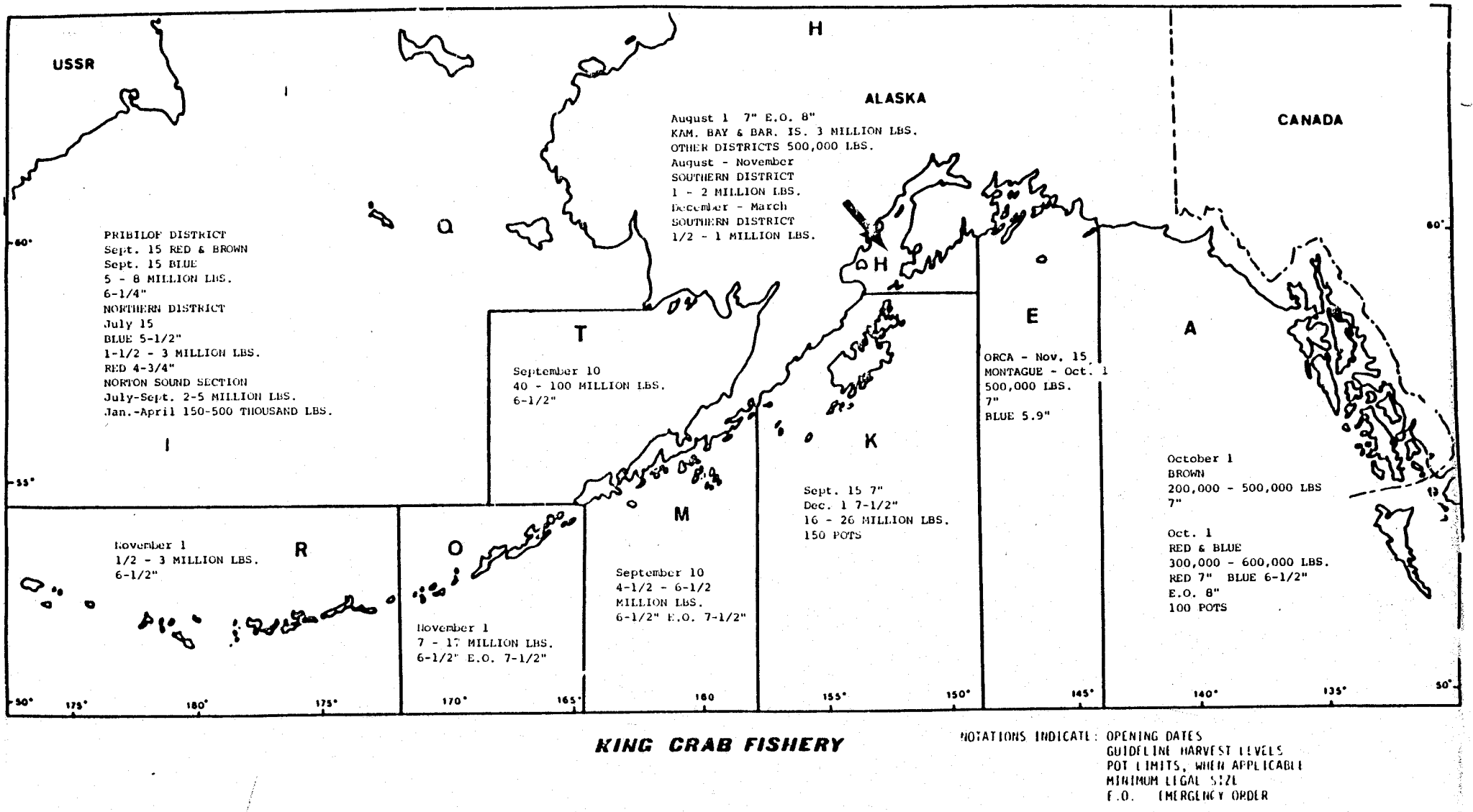
Bering Sea/Aleutian Island King Crab Catch as a Percentage of Total Alaska Catch, 1969-1980[1/]

	Western Alaska (1,000 lbs)	Percent of Total Catch	Total (1,000 lbs)
1980	160,723	85.4	188,100
1979	128,188	85.6	149,660
1978	104,396	86.1	121,274
1977	82,002	83.3	98,398
1976	82,263	77.7	105,901
1975	70,292	70.0	100,398
1974	63,857	66.1	96,573
1973	52,055	67.7	76,839
1972	48,496	65.4	74,160
1971	49,934	70.5	70,799
1970	31,590	60.7	52,058
1969	35,796	61.5	58,205

Source: Alaska Department of Fish & Game, "Alaska 1979 Catch and Production," statistical leaflet no. 32, July 1981.

Alaska Department of Fish & Game, "Monthly/Cumulative Shellfish Catch," (preliminary data for 1980).

1/ Bering Sea/Aleutian Islands is the area included in Draft #11 of the King Crab Fishery Management Plan.



KING CRAB FISHERY

NOTATIONS INDICATE: OPENING DATES
GUIDELINE HARVEST LEVELS
POT LIMITS, WHEN APPLICABLE
MINIMUM LEGAL SIZE
E.O. EMERGENCY ORDER

Figure 2. Alaska Department of Fish and Game.
King Crab Regulatory Areas.

The areas included in the FMP are T, O, R and Q. A map is shown in Figure 2 which gives the geographical boundaries of the different regulatory areas. Two regulatory areas which are not in the FMP, M and K, are included to allow comparison of participation in the fishery.

There are five tables which are included as Appendix A to this document which give the fleet vessel size distribution in 10-foot increments, and the percentage contribution to the total catch by that vessel size category. These tables include ADF&G regulatory areas T, O, R, Q, M and K. These data show how the size composition of the fleet changes from area to area, and also show how the contribution to total catch in each size category changes from area to area. For example, in Bristol Bay, 59.2 percent of the area king crab catch was taken by vessels over 100 feet in length. The same percentage contribution to the 1980 king crab catch in the other regulatory areas by vessels over 100 feet was: Adak/Western Aleutians 48.2 percent; Dutch Harbor 15.7 percent; Bering Sea 61.6 percent; Alaska Peninsula 0.0 percent; and Kodiak 6.2 percent. These data indicate that larger vessels are responsible for the major part of the catch from Bristol Bay. Dutch Harbor and Adak/ Western Aleutians also have major portions of their total catch contributed by the larger sized vessels. In comparison, the other regulatory areas have the major part of their catch taken by smaller vessels, which would likely have less mobility to fish areas such as the Bering Sea, due to constraints imposed by distance, weather and ocean conditions.

Another pertinent distribution among the king crab fleet is between resident and non-resident fishermen. As pointed out earlier, both of these user groups have concerns that the regulatory authority takes their particular interest into account when new regulatory measures are being considered.

As shown in Table 3, most of the non-resident components of the fleet fishes in Area T - Bristol Bay (67 percent non-resident), Area O - Dutch Harbor (41 percent non-resident) and Area R - Adak/Western Aleutians (94 percent non-resident) and Area Q - Bering Sea (84 percent non-resident). These are the regulatory areas which are included in the king crab FMP.

TABLE 3

King Crab Catch by Resident Status, 1980-81 Fishing Season

Resident Status	No. of Vessels	Percent of Vessels	Catch in Pounds	Percent of Catch
Bristol Bay - Area T				
Resident	78	33.1	35,331,502	27.2
Non-Resident	158	66.9	94,616,934	72.8
Total	236	100.0	129,948,436	100.0
Dutch Harbor - Area O				
Resident	68	58.6	8,233,918	43.2
Non-Resident	48	41.4	10,821,369	56.8
Total	116	100.0	19,055,287	100.0
Adak/Western Aleutians - Area R				
Resident	1	5.9	106,066	7.2
Non-Resident	16	94.1	1,372,361	92.8
Total	17	100.0	1,478,427	100.0
Bering Sea - Area Q				
Resident	18	15.5	1,924,744	14.5
Non-Resident	98	84.5	11,385,371	85.5
Total	116	100.0	13,310,115	100.0
Alaska Peninsula - Area M				
Resident	42	95.5	4,244,930	87.0
Non-Resident	2	4.5	635,602	13.0
Total	44	100.0	4,880,532	100.0
Kodiak - Area K				
Resident	160	97.6	20,225,438	98.9
Non-Resident	4	2.4	223,216	1.1
Total	164	100.0	20,448,654	100.0

Source: Alaska Department of Fish and Game, Kodiak, fish tickets and vessel registrations, 1980-81.

In summary, the areas included in the king crab FMP have provided over 80 percent of the total Alaska catch in recent years. These areas also have size distribution skewed toward larger vessels compared with other areas in the state and also the largest proportion of non-resident fishermen.

III. MANAGEMENT MEASURES PROPOSED IN THE KING CRAB FMP

The framework king crab FMP provides several management measures which can be implemented, either singularly or in combination with one another, to enable the fishery to achieve the objectives stated above in Section I. The management measures which have been employed by the Board of Fisheries and are the major regulatory issues in the FMP are discussed in this section. Since the FMP does not specify any particular set of measures which will be employed, the usual benefit-cost analysis of impacts from implementation of alternative measures is difficult.

Assuming that the fishery is deficient in achieving the stated objectives of the FMP, the management measures employed to regulate the fishery would be changed under option two, in accordance with the best scientific data available and public testimony from user groups and other interested parties.

A. OY Determinations

The BS/AI king crab FMP proposes an approach for determining Optimum Yield (OY), which is currently being used by the State of Alaska. The approach, called Spawning Stock Management, defines the Acceptable Biological Catch (ABC) as the largest catch possible without reducing the biological status of the stocks, and Optimum Yield (OY) as a modification of ABC in response to social, economic, or ecological factors. The OY is attained through the use of two specific regulations: (1) establishment of a minimum size limit for crabs which can be taken for commercial harvest; and (2) establishment of harvest levels which are a function of an exploitation rate applied to the biomass above the minimum size. The management strategy of this approach would insure a spawning stock of fertilized females. In areas where sufficient data exist, the minimum female spawning stock is determined by analysis of the stock-recruitment

relationship, based on abundance estimates from resource assessment surveys[1/]. The estimation of yield is then calculated using exploitation rates and size limits which vary according to the condition of the stock. For example, when examining the 1981 estimates for possible harvests in Bristol Bay (Table 4), a harvest ranging from 24 to 112 million pounds could be accomplished based on the minimum size limit and exploitation rate that is eventually used.

TABLE 4 -- Estimated Yields (millions of pounds) for Red King Crab in Bristol Bay for 1981, by Minimum Size Limit and Exploitation Rate (from Reeves, 1981).

	Exploitation Rate						
Size Limit	.3	.4	.5	.6	.7	.8	.9
7.00"	24	32	41	49	57	65	73
6.75"	31	41	52	62	72	83	93
6.50"	37	50	62	75	87	100	112
6.25"	43	57	71	85	100	114	128
6.00"	48	63	79	95	111	127	143
5.75"	52	70	87	104	122	139	157
5.50"	55	73	91	109	128	146	164
5.25"	57	76	95	114	133	152	171

These estimates are all above the reproductive threshold, a line where female fertilization is maximized. The ABC would equal the largest possible harvest above this threshold, in this example 112 million pounds. Deviating from ABC by creating any combination of a size limit with an exploitation rate would qualify as an OY consideration.

If, however, the female spawning stock drops below the level which maximizes recruitment, either because of reduced clutch size, barrenness, or lowered abundance of mature females; or if crab stocks are at a low level; or if there are insufficient stock assessment data for an area, a different approach to ABC will be used.

1/ J.E. Reeves, "Projected 1981 Guideline Harvest Level for Red King Crabs in Bristol Bay," unpublished research paper for the NPFMC King Crab Development Team, March 1981.

In instances where the female spawning stock drops below the reproductive threshold which results in the inability to utilize fully the spawner-recruitment model, ABC will be based on the exploitation rates in Table 5 for depressed populations, applied to that part of the male stock above the minimum biological size. The biological size limit is determined for each area by using the size when 50% of the male population is sexually mature and adding three years, thus ensuring each male the opportunity to reproduce at least once before becoming vulnerable to the fishery. This table, with its population size, pre-recruitment and recruitment variables, and the range of exploitation rates, are based on historical management actions which appear to have successfully maintained full female fertilization. In 1983 this approach was used in Bristol Bay when the number of fertilized females dropped below the 20 million threshold. Population estimates and recruitment levels were the lowest on record which resulted in an exploitation range of 0-20 percent, using Table 5. This exploitation range, when applied to the number of mature male king crab above the minimum biological size, produced an ABC of 0 to 1.5 million pounds.

For stocks at a low level, or when insufficient data are available, the ABC is set at a catch which maintains full female fertilization. This is the situation in the Adak, Dutch Harbor and Bering Sea areas. For these areas, ABC will be determined by using Table 5. A management team will annually evaluate the status of the stocks in the Bering Sea/Aleutian Islands area and report their findings to the Council and Board at their joint meeting. The Council and Board will then use the described procedures for determining ABC. This overall approach is designed to allow the harvest of surplus crab which are not needed to maintain the stock's full reproductive potential. The size limit would be lowered or raised depending on whether recruitment was above or below average. However, while a lowered size limit could increase the physical yield as Reeves

Table 5. Comparison of exploitation rates of legal crab given relative population size and recruitment and post-recruitment abundance levels.

Population Size[1/]	Pre-Recruitment Abundance	Recruitment Level Approximate exploitation rates of legal crab at given levels of post-recruits		
		Low[2/]	Moderate[3/]	High[4/]
Depressed	Declining	Less than .20[5/]	Less than .25[5/]	Less than .25[5/]
	Stable	.30	.30	.35
	Increasing	.30	.30	.35
Average	Declining	.40	.40	.40
	Stable	.40	.45	.45
	Increasing	.40	.50	.50
Peak	Declining	.40	.45	.50
	Stable	.50	.55	.60
	Increasing	.60	.60	.60

1/ Corresponds to the upper, middle and lower third of the range of recorded legal stock indices.
2/ Low = less than 1/3 of total population (lbs.)
3/ Moderate = 1/3 - 2/3 of total population
4/ High = over 2/3 of total population
5/ Exploitation rate will be based on review of in-season considerations described in FMP Section 4.9.

Definitions for the above variables are provided as examples in the FMP Appendices, Section 7.5.1.

and Marasco[1/] showed, it may have an adverse economic impact if there is a significant price advantage for the larger size crab. No data are available which indicate whether or not such a price advantage exists.

Based on the approach used to calculate ABC for any area during a given year, the resulting OY is projected as a range. In areas where biological information is limited and spawner-recruitment relationships cannot be determined, the OY will equal the ABC. In areas where sufficient information exists (ex. Bristol Bay), the OY will equal the ABC unless modified by social, economic, or ecological factors which require it to be less than ABC in order to achieve the management objectives of the FMP. One of the objectives of the fishery manager is to reach that OY range, and once the lower limit of the range is attained, to allow adjustment of the quota for that area within the range, based on in-season catch statistics and other data.

The approach to OY in the FMP allows for incorporation of the best economic data available into the OY determination, and should allow achievement of maximum economic yield, subject to limits to ensure conservation of the resource.

When adopting a size limit, be it the minimum biological size or a size required by the fishing industry, the Council and Board will consider processing, marketing, fishing gear, and fishing efficiency requirements.

An exploitation rate for a given area will be adopted by the Council and Board only after evaluating the economic viability of the fishery, processing availability and marketing requirements, king crab population composition and levels, opportunities for diversification by harvesting and processing sectors, and the industrial and labor force dependence on the king crab fishery. Based on these and other considerations, the resulting size limit/exploitation rate combination produce the OY range.

1/ J.E. Reeves and R. Marasco, "An Evaluation of Alternative Management Options for the Southeastern Bering Sea King Crab Fishery," Northwest and Alaska Fisheries Center, Processed Report 80-6, March 1980.

B. Fishing Seasons

Fishing seasons have historically been used in the king crab fishery to protect crab during the mating, molting, and growing periods of their life cycle. Because harvest levels are usually taken in two months or less, there is the opportunity to look beyond biological considerations in setting the date of the season opening.

In addition to the above concerns, several additional factors will be weighed in determining an appropriate season. One factor to be considered is the recovery rate (the ratio of recoverable meat to total body weight). Because the recovery rate increases dramatically during the period of rapid growth following molting, a delayed opening will generally act to increase both the volume and value of the catch and final product.

A second factor to be considered is weather conditions. These generally worsen as the year progresses; consequently a late season opening is likely to translate into more difficult fishing conditions. This would particularly disadvantage operators of smaller vessels.

A third factor is the timing of the king crab fishery relative to other fisheries, particularly the salmon fisheries. If the season opening for king crab occurs before the salmon fisheries are over, this will create difficulties for vessels and processors that normally participate in both fisheries. Conversely, a lengthy period of time between the two fisheries will force vessels and processors to lie idle and may create additional start up costs.

A fourth factor is the timing of the season openings for individual areas relative to one another. Most of the major king crab fisheries now open simultaneously. This distributes fishing effort at the start of the season, helps prevent gear saturation problems, and allows greater participation by local fleets.

The season will reflect a balance of attitudes within the industry with respect to the several factors described above.

C. Gear Restrictions

Current State regulations limit the legal gear for the king crab fishery to pots (traps) and ring nets only. These gear are selective in the sense that non-legal crab (i.e., female and undersized male crab) may be returned to the water unharmed. Trawls and tangle nets are prohibited because of the high mortality rates which they inflict on non-legal crab. Since crab pots are lost during normal fishing operations, each king crab pot must contain a mechanism which will terminate its catching and holding ability within six months should the pot become lost at sea.

Depending on the status of the crab stocks, future gear restrictions may be necessary, e.g. limits on number of pots. In determining the need for any further restrictions, consideration will be given to the biological impacts on target and non-target species, harvesting efficiency, and previous investments in gear and vessels.

D. Gear Placement

The placement of gear on the fishing grounds up to seven days before the opening of a king crab season, and the leaving of such gear on the fishing grounds for up to seven days after the close of any such season, may be authorized if such early placement and late removal is justified in light of (1) its biological impacts on king crab and other species; (2) the enforcement problems and costs borne by the public versus by the industry; (3) the possibility that it will lead to additional gear conflict; and (4) the availability of unloading facilities for disposal of king crab catches and of gear storage areas outside the fishing grounds.

Regulations which effect gear placement on the grounds prior to and immediately following some highly competitive king crab fisheries, grew out of the need to provide additional time to haul gear to and from the fishing grounds. This time was needed because of limited storage and loading and unloading facilities available to the entire fleet.

E. Gear Storage

In order to protect the crab stocks during sensitive biological periods, provide designated storage areas which are protected from other fishing gear, and as an enforcement measure, crab gear storage regulations were developed. Under current State regulations, in between fishing seasons, king crab gear must be stored on land or at sea. The expense of storage on land is of course greater than at sea, however, loss of gear is significantly reduced with on land storage. Within seven days following area or season closure, gear must be removed from the fishing grounds and stored on land, in shallow waters (less than 25 fathoms unless otherwise specified) or in specific high seas storage areas when there is insufficient shallow water storage. The seven-day period given vessels to clear gear from the grounds is primarily for smaller vessels which may require several trips. Those designated storage areas have historically been areas of low crab abundance. Gear stored in the water must be in a non-fishing condition, bait and bait containers removed and pot doors locked open.

F. Vessel Tank Inspection

Vessel tank inspections are required under current State regulations to meet the legal requirement for the State's landing laws. Tank inspections are required within a 1-5 day period prior to season opening and at any time during the season when leaving one statistical area for another. In order to pass inspection, the vessel must have no crab aboard. The rationale supporting this management measure are twofold: first, vessel tank inspections are used to enforce the opening of the king crab season and to assure an equal start for all participants; and second, they prevent vessels from covertly fishing in adjacent statistical areas and misreporting a landing which would effect the catch statistics and the manager's in-season harvest rate projections.

The inspection is completed by ADF&G port samplers who are already on location for other duties. For example, 1981 vessel tank inspections were completed at Dutch Harbor, Akutan, Port Moller and the Pribilofs. Vessels were not required to travel out of their way for the inspections.

G. Restrictions on Taking Females

Most westcoast crab fisheries take only male crab, a restriction assumed to contribute to maximum reproductive potential. The data base to support or reject an extensive harvest of female crab is poor. There have been some recent studies indicating that there are probably surplus female crab which can be taken from areas of high abundance (Reeves and Marasco, 1980; Reeves, 1981). However, the accumulative effects of a female harvest and the subsequent environmental impacts are not demonstrable at this time and may never be without actually harvesting females.

Harvesting female king crab has not been an issue. Management philosophies endorse a limited fishery for females in years of high abundance; however, industry has shown little interest. Females are considerably smaller than males of the same age, and the proportion of recoverable meat is much less than that of males of the same size.

H. Registration Areas

Under State regulations, the BS/AI king crab fishery is divided into four statistical areas roughly conforming to biological boundaries of individual stocks. Fishermen intending to fish king crab must register in advance of king crab seasons for those areas in which they intend to operate. A vessel is also required to land crab within the registration area in which the crab were taken unless other arrangements are made. These measures greatly enhance the management of the fishery by providing managers with information needed to determine levels of fishing effort and to project fishing rates prior to season opening for each individual area.

The use of exclusive and non-exclusive area registration provides a measure to avoid sudden economic dislocation, and encourages exploration in new areas. Historically, exclusive registration areas have been relatively small, contain known concentrations of king crab, are close to shore, and are fished by well developed fisheries. Non-exclusive registration areas are quite large, have developing fisheries, and contain some sections that are both underutilized and unexplored.

Currently, the State designates Dutch Harbor and Bristol Bay as exclusive registration areas while Adak and the Bering Sea are non-exclusive. Vessels may register for only one exclusive registration area during any one fishing season. All vessels may freely register for any non-exclusive registration area. Fishermen can register for any exclusive area and are not restricted in their choice. Fishermen will often consider potential harvest, proposed prices, and distances between fishing grounds and processing facilities when making their selection. This management measure prevents vessels from concentrating their effort on small pockets with high concentrations of king crab in exclusive registration areas, which could have significant socioeconomic impact upon fishermen in those areas. This management measure is designed to direct the expansion of the king crab fishery, through the non-exclusive provision, to areas that can generally sustain further production.

IV. ANALYSIS OF THE IMPACTS OF VARIOUS MEASURES IN THE FMP

As proposed, the FMP would make use of the ongoing regulatory regime of the State of Alaska as long as it remains consistent with the FMP, the MFCMA, and other federal law. According to informed sources, all available evidence indicates that, to date, virtually all of the king crab fishing off Alaska has come under and conformed with the regulatory measures imposed by the State.[1/] If the Council/NMFS/Secretary accept the State of Alaska's ongoing management measures with little or no change, it is anticipated that the immediate incremental impacts of "federalizing" the State regulations will be insignificant. Participants currently in the fishery would absorb identical impacts under the existing state regulations and the "federalized" state regulations under the FMP. The immediate incremental impacts of the FMP, therefore, are expected to be zero.

Because the immediate incremental impacts of the proposed FMP are expected to be insignificant, the primary purpose of this RIR/RFA is to analyze the

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1/ Personal communication with NPFMC and NMFS regional personnel.

impacts of potential regulations based on the "framework" nature of the plan. The impacts will be analyzed in terms of the reasonable range of regulatory measures which may be implemented and the impacts that can be expected on the various groups associated with the fishery.

The FMP relies on annual and inseason specification of a variety of methods of controlling the king crab fishery to achieve the benefits from the resource. The measures that can be changed without requiring an FMP amendment include season (both opening and closing date), size limits, sex, exclusive registration areas, OY levels, gear storage and placement, tank inspection rules, and reporting requirements. A change in any one of these measures may have an effect on the various groups that have an interest in the fishery, i.e. small boat owners and crew, large boat owners and crew, processors, consumers, taxpayers, and the king crab resource itself.

The following (Table 6) is a summary of the potential relative magnitude of impacts resulting from changes in an individual management measure. The impact could be either adverse or beneficial, and would be the result of a significant change in the measure from the status quo, which falls within the scope of the framework FMP.

A. Seasons

The FMP provides for flexibility in setting the opening and closing dates for the king crab season in each registration area or for districts within a registration area. The FMP (p. 19) identifies biological conditions under which the seasons will be closed and states factors that will be considered in setting the season within the biologically safe period. In general, seasons will not open until late summer and will close before March of the following year.

The primary impact of adjustments in the opening of the season will arise from the variation in meat yields from the crab. It is exceedingly unlikely that any harvest would be allowed when the average meat yield of the crabs is below 15%. There are two reasons for this. First, when the meat yield is low, the crabs are recovering from molting and are in a weak, vulnerable condition. Under these conditions, the handling

TABLE 6

IMPACTS MATRIX

Management Measures

Affected Group	Season (opening-closing)	Size	Exploitation Rate (optimum yield)	Exclusive Registration	Gear Storage	Sex
Small Vessels	**	*	*	**	*	*
Large Vessels	*	*	*	**	*	*
Processors	*	**	*	*	0	*
Consumers	*	*	*	0	0	*
Taxpayers	0	0	0	*	0	0
Resource	*	**	**	0	0	*

** Large Impact
* Moderate Impact
0 No Impact

mortality is probably unacceptably high on undersized and female crabs (if retention of female crabs is illegal) that are sorted on deck and thrown overboard. Even those crab that are retained will experience higher mortality during the trip to the processing plant. Second, and perhaps of greater importance, is that generally processors will not purchase crab when the meat yield is 15% or less because of the high costs of production compared to yield. Thus the earliest that fishing would commence would likely correspond to about a 15% meat yield.

As the season opening date is delayed, the meat yield increases. A meat yield of 17-19% is normal and 20% is quite good, with 22% being exceptional.[1/] A reasonable range of meat yields to evaluate is from 15% to 20%. Increasing the meat yield by 1/3 from 15 to 20% can have significant beneficial impacts on all sectors of the industry as well as for consumers. The additional costs of catching a crab with a 20% yield versus a crab with 15% yield is zero, assuming other factors remain constant. The additional costs of processing the greater yielding crab are probably minimal.

In a typical (MSY level) year of landing of 86 million pounds (live weight), the 15% pickout would yield 12.9 million pounds of meat versus 17.2 million at a 20% yield. At a typical meat yield of about 17-18%, the ex-vessel value of the landing equal to MSY would be about $101 million.

The ex-vessel value of landings could reasonably be expected to fluctuate as a function of the meat yield. For example, if the season is delayed to allow the yield to increase from an average 17½ percent to 20 percent, the amount of meat derived from an 86 million pound catch would be equivalent to a 98 million pound catch. On the other hand, if the season is begun early and only a 15% yield is achieved, the meat derived from the 86 million pound catch would be the equivalent of only a 73.7 pound

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1/ NMFS, Alaska Region, personal communication, 1982.

catch. Based on the estimated price flexibility for this fishery, landings of 98.3 and 73.7 million pounds would result in ex-vessel revenues of about $136.7 million and $120.2 million, respectively.[1/] Thus, in this very simplistic, hypothetical analysis, the benefit of delaying the season to increase yield from 15 to 20% would increase ex-vessel revenues by $16.5 million.

Impact on small vessels. The impact of a change in yield as a result of changes in season openings, would not be expected to differentially impact small vessels relative to large operations. However, as discussed earlier in the RIR/RFA, there are other factors to consider in setting season openings. Although meat yield improves as the season progresses, weather conditions deteriorate. The smaller the vessels, the more difficult and dangerous it becomes to fish as weather conditions worsen. Thus the later the season, the greater the relative disadvantage accruing to smaller vessels. The extent of the disadvantage is not subject to easy quantification.

Impact on large vessels. As discussed in the previous section, larger vessels may gain a relative advantage by a later season opening. However, if the season is extremely late, the costs of production will increase even for the largest vessels because worsening weather:

(1) increases lost fishing time as the vessel weathers storms without fishing;

(2) results in greater "dead loss" as the crabs are subject to more battering in the vessel live tanks; and

(3) increases risk of damaging vessel and/or gear, and injuring crew members as the 800-pound pots are hoisted aboard in heavy seas.

These increased costs are not easily quantified.

1/ Utilizing 1981 statewide catch and price data as base.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

ADDENDUM TO KING CRAB RIR/IRFA

June 4, 1984

Reply to Attn. of:

File: 900-06
THRU: Thorn Smith

Ron Berg RJB

Enforcement Costs related to the FMP for King Crab

Communications between our Enforcement Division and the U.S. Coast Guard indicate that annual costs to enforce federalized State of Alaska regulations would be about $123,400. This estimate is derived from 80 hours of Coast Guard C-130 flight hours at $1,500/hour, or $120,000, and 200 NMFS man-hours at $17/hour, or $3,400.

The State of Alaska is expected to continue enforcing federalized State regulations at sea at no additional federal cost.

RJBERG:gcs 6-4-84 File: 900-06

Impact on processors. The changes in meat yield as a function of the opening of the season will have an impact on king crab processors. As meat yield increases, the cost per unit of producing the meat (that is removing the meat from the legs) decreases. The cost of cooking the crabs and removing the meat from the legs of the crab is much more dependent on the number of crab handled than on the amount of meat in each crab leg. Approximately 30% of king crab is picked. Thus for the roughly 25 million pounds of whole crab that would be picked in a typical year, the cost per unit of output of picking the meat could vary by as much as 1/3, depending on the rate of meat yield. However, as the season progresses, bad weather could prevent delivery thereby idling shoreside crews and increasing processor overhead.

There are, however, other impacts that affect the processor costs and revenue and arise from the choice of season opening dates such as scheduling of king crab seasons in relation to other fisheries (including other crab fisheries). This aspect is discussed qualitatively in the FMP and in other portions of the RIR/RFA.

Impact on consumers. There will be a noticeable impact of changes in season openings because of potential changes in the meat yield. The increase in meat yield of 33% that is represented by going from one extreme to the other would tend to lower prices to the consumer.

Impact on taxpayers. Enforcement and other agency costs will not change measurably as a result of the season.

Impact on the resource. Both early and late seasons are considered biologically safe although there could be a slight increase in incidental mortality with an earlier rather than a later seasons.

B. Optimum Yield (OY)

The OY in the king crab fishery varies by area by year in response to biological and economic conditions. The principal determinants of the OY are carapace width size limits and exploitation rates. The impacts of

size limits and exploitation rates are discussed below in separate sections. In combination these discussions cover the range of impacts associated with variations in the OY authorized under the FMP.

1. Size limit

One of the components employed by resource managers in developing the OY for the crab fishery is carapace size. Size limits in the king crab fishery, based upon carapace width, have varied by species, area, and season. Since 1975 the minimum size limit has been set at 6.5 inches, except for limited special fisheries districts in the extreme north of the Bering Sea and late season "large crab" fisheries openings. Markets have developed over time in such a way as to make small crab, i.e. those less than 6.5 inches in carapace width, less desirable and less valuable. While motivations for initially raising the size limit to 6.5 inches included biological and enforcement concerns, the most persuasive force for change, and that which has sustained the 6.5 inch size limit, was the mandate of the market place. But if market pressures were responsible, in large measure, for increasing the carapace size limit, it seems reasonable to assume that the reverse is also possible, so long as the resource itself is not endangered.

For purposes of demonstrating the probable impacts associated with a change in carapace size limit, the example presented earlier in Table 4 for the 1981 Bristol Bay stock assessment will be employed. Using a linear regression model based upon historic price and landings data for the Alaska king crab fishery, spanning the period 1961 through 1980, a price flexibility coefficient of -.577 was derived for purposes of this examination. The regression was statistically significant at the α=.01 level, with an adjusted R^2 of .947, and a Durbin-Watson statistic of 2.11.

Utilizing these data from the model, the estimated yields presented for Bristol Bay, and preliminary 1981 price and landings statistics as a base,[1/] a range of feasible size limits was evaluated with regard to ex-vessel value of the catch and predicted price. The further assumption is made that the exploitation rate is held constant at .6 and the total statewide landings of king crab minus the Bristol Bay catch remains approximately constant at the predetermined base level. The results of this evaluation are summarized in Table 6.

Within these constraints and the reproductive threshold, beyond which exploitation is biologically detrimental to sustained productivity of the resource, it was determined that the carapace size limit could not be reduced below 6.25 inches. At this level, i.e. 6.25 inch width, the harvest would expand to 85 million pounds, or 51.4 million pounds above the base year catch. Representing an increase in total statewide landings of 58.34 percent, the predicted resultant reduction in ex-vessel price would be of the order of 33.7 percent, or a decline from $1.49 to approximately $.99 per pound, statewide average price. Bristol Bay prices have averaged 95.5 percent of statewide levels, thus for area catches of 85 million pounds, an ex-vessel price of $.945 per pound and a total ex-vessel landings value of $80.3 million dollars are derived.

At the present 6.5 inch size limit, the projected yield in this example would be 75 million pounds, or an increase of 46.99 percent in total statewide landings compared to the base year harvest. The statewide average ex-vessel price would be expected to decline by 27.1 percent to approximately $1.09 per pound. Bristol Bay price is estimated to be $1.04 per pound for a total ex-vessel value of $77.8 million for this area.

1/ 1981 statewide landings were 88.1 million pounds, Bristol Bay landings 33.6 million pounds, statewide average ex-vessel price was $1.49 per pound.

TABLE 7

Estimated Response to Variations in Carapace Size Limit for Bristol Bay King Crab Fishery

Carapace Width Size Limit	Bristol Bay Yield (millions lbs)	Statewide Average Price Per Pound	Bristol Bay Price Per Pound	Ex-vessel Value Bristol Bay Catc (million $)
6.25	85	.99	.945	80.4
6.50	75	1.09	1.04	77.8
6.75	62	1.21	1.16	71.8
7.00	49	1.34	1.28	62.7

If the carapace size limit were raised to 6.75 inches, total yield in the Bristol Bay fishery would reach 62 million pounds. This would represent a 32.2 percent increase in statewide catch, reducing average statewide ex-vessel price by 18.6 percent to $1.21 per pound. The associated Bristol Bay price of $1.16 per pound would produce a total ex-vessel value of the catch of $71.8 million.

At a carapace size limit of 7.0 inches the estimated catch would be 49 million pounds in Bristol Bay. This represents a 17.5 percent increase in the base year statewide landings. Average statewide ex-vessel price would decline by just over 10 percent to $1.34 per pound. The ex-vessel price in Bristol Bay would be approximately $1.28 per pound for a total area landings value of $62.7 million.

The estimates of the response of harvest value to changes in size limits reflect an implicit assumption that king crab command a uniform price per pound over the range of carapace widths examined in the analysis. No data are available with which to rigorously evaluate this assumption. Empirically there does not appear to be a price differential paid for large carapace crab in a mixed size class fishery. However, intuitively one might assume that as carapace size increases, with all things being the same, a price premium for uniformly large sized crab may accrue. If this were the case, the value of the catch would increase for the 6.75 and 7.0 inch cases and perhaps decline for the 6.25 inch fishery.

Impact on small vessels. It is clear from the analysis above that the potential impacts of changes in carapace size limits could significantly alter the available harvestable surplus. Because, on average, small vessels achieve a lower catch per unit effort (CPUE) and thus receive a smaller share of the available harvest per operation, any action which reduces the available OY will disproportionately impact, in an adverse way, this vessel class. Conversely, any action taken which expands the total available OY should improve the condition of the small operator.

Impact on large vessels. Assuming that imposition of a larger minimum size limit in the fishery was not associated with a "price premium" the reduction in OY would, as for the small operators, adversely impact the large vessel fleet. Because of the relatively higher CPUE enjoyed by these vessels and their ability to fish even in extreme weather and sea conditions, the impact should be somewhat less than for the small vessel fleet until OY levels become so low as to make fishing uneconomical. Should size limits be so constraining as to result in low and dispersed concentrations of "legal" crab, then the impact on larger vessels which depend upon relatively high CPUE to cover their higher operating costs could disadvantage the large vessels relative to the smaller boats.

Impact on processors. To the extent that processing costs per unit of output increase as the average size of the crab decreases, a reduction in the carapace size limit could adversely impact the processing sector of this industry. The magnitude of this impact and the extent to which it would be offset as a result of increased total landings is a question for empirical investigation.

Similarly, it is unknown whether an increase in carapace size would reduce the per unit processing cost and yield a higher value product as a function of overall body section size. Also, whether these advantages would offset the economic impact of significantly smaller total landings is questionable.

Impact on consumers. To the extent that total supplies of king crab are significantly changed by alterations of the size limit, consumers may be expected to incur impacts through variability in both product price and availability.

Impact on taxpayers. No impact on this group would be anticipated from changes in the carapace size limit within the range of acceptable alternatives outlined above.

Impact on the resource. Because changes in carapace width limits authorized within the scope of the framework FMP would occur only above the reproductive threshold, a line where female fertilization is maximized, the impact on the resource would be expected to be insignificant. It may be that at the lower size limits some males are extracted before they contribute optimally to the reproductive base in which case a decision as to appropriate exploitation rates may be in order.

At the upper extreme of the carapace size limit range, male crab currently harvested at 6.5 inches and 8 years would contribute to the breeding population for at least one additional cycle. However, handling mortality to the larger numbers of sublegal crab could become an issue of concern at which time a decision regarding exploitation rates and total long range yields in the fishery can be made utilizing the latest mortality information. None of the authorized size limits in itself should adversely impact the resource.

2. Exploitation rate

The estimated yields for the red king crab in Bristol Bay (or for any other area where a specific spawner/recruit relationship has been established) will change characteristically in any one year as a function of the exploitation rate. This analysis focuses on a 6.5 inch size limit and the yields as a function of the exploitation rate in Table 4 of the RIR/RFA.

At the extreme, the yield resulting from exploitation rates of .3 and .9 are 37 and 112 million pounds respectively. The ex-vessel revenues from these extremes would be about $51.5 and $76.5 million respectively[1/]. The most likely exploitation rates are in the low to middle portion of the range. If the exploitation rates are very high, fishermen probably will stop fishing before the exploitation

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1/ Based upon 1981 statewide landings and ex-vessel price and price flexibility of -.577.

rate is reached because costs of harvesting increase as exploitation rate increases. Very low exploitation rates, (below .3), will result in most of the crab dying from old age.

Impact on small and large vessels. The higher the exploitation rate, the greater the catch and the greater the revenues, ceteris parabus, but costs increase in a fishing season as a greater percentage of the crabs have been caught and the CPUE decreases. A small vessel, because of lower variable costs (smaller crew and less fuel needed) might have a slight advantage over a larger vessel and might fish profitably on a lower CPUE when a larger vessel would lose money. A higher exploitation rate implies a longer season and any advantage the small vessel gains because of lower costs may be lost by the greater difficulty a smaller vessel has in fishing in the worsening weather of an extended season.

Impact on processors. Processors in any one season will gain from a higher exploitation rate, although it is conceivable that at high exploitation rates the late season rate of delivery to the plant would be so low that the crab would not be worth processing.

Impact on consumers. Consumers in any one season will benefit from the increased supplies resulting from higher exploitation rates.

Impact on taxpayers. A change in exploitation rate will not change enforcement costs although at high exploitation rates, when a fishery closes voluntarily, there might be a very small savings in enforcement and administration costs.

Impact on the resource. At high exploitation rates the proportion and absolute number of sublegal and female crab that are caught will increase. If there is an appreciable handling mortality rate then the resource could be adversely affected.

C. Exclusive Registration Areas

The Fishery Management Unit to which this FMP applies is currently divided into four registration areas - Bering Sea, Bristol Bay, Adak, and Dutch Harbor. Registration areas have been designated as either exclusive or nonexclusive. Bristol Bay and Dutch Harbor are exclusive registration areas while the Bering Sea and Adak are non-exclusive. A vessel may register for only one exclusive area per year, but may also fish in any non-exclusive area. Fishermen are not restricted in their choice of exclusive areas.

The primary objective of the exclusive registration areas is to assist in preventing economic dislocation of certain segments of the fleet who are limited in their ability to move to other areas and, therefore, are dependent on an individual registration area's stock. It is assumed that there will be no impact on the overall stock condition because of protection afforded by area OY estimates. Furthermore, it is assumed that total revenue of the fleet will not be measurably altered by this regulatory measure since the entire available stock will be taken by some segment of the fleet.

The major impact of variation in this regulatory measure will be the distributional effect on revenues between large and small vessels. Large vessels (90 feet and over) have a high degree of mobility and can more easily move between areas, while small vessels are generally restricted to a single area. Because nearly one-half of the fleet is composed of large vessels, there is a very real possibility that in the absence of exclusive registration large vessels could move into an area traditionally used by small vessels. Significant dislocation of small vessels could occur as a result. One area which would be susceptible to such a development is in Dutch Harbor where nearly 80 percent of the fleet are small vessels. On the other hand, between 75 and 95 percent of the vessels fishing Bristol Bay, Adak/Western Aleutians, and the Bering Sea are large vessels (Table 8).

TABLE 8

Number and Catch of King Crab Vessels by
Registration Area and Vessel Size Class, 1980

	Vessels		Catch	
	Number	Percent of Total	1,000 lbs	Percent of Total
Bristol Bay				
Total	236	100.0	129,948	100.0
Large	175	75.0	104,537	80.5
Small	61	25.0	25,411	19.5
Dutch Harbor				
Total	116	100.0	19,055	100.0
Large	24	20.7	5,354	28.1
Small	92	79.3	13,701	71.9
Adak/Western Aleutians				
Total	17	100.0	1,478	100.0
Large	16	94.2	1,472	95.9
Small	1	5.8	6	4.1
Bering Sea				
Total	116	100.0	13,310	100.0
Large	92	79.3	10,800	81.1
Small	24	20.7	2,510	28.9
Total All Areas				
Total	358	100.0	163,791	100.0
Large	175	48.9	122,163	74.6
Small	183	51.1	41,629	25.4

Note: Small vessels - under 90 feet

TABLE 9

Catch Per Unit of Effort in the King Crab Fishery
in the Bering Sea and Aleutians Management Area

Season	CPUE PER AREA					
	Area T[1/] Bristol Bay Red Crab	Area Q[1/] Pribilofs Blue	Red	Area Q[1/] Northern Red	Area O[2/] Dutch Harbor Red	Area R[2/] Adak Red
76-77	33	12				
77-78	26	8		16		
78-79	36	8		62		
79-80	53	9		26		
80-81	37	9	5	24		12
81-82	10	7	2	10	2	10

1/ Source: Bering Sea Management Area by Ken Griffin and Tim Perry, Dutch Harbor, ADF&G.

2/ Source: Eastern and Western Aleutians Areas Shellfish Management Report to Alaska Board of Fisheries by Dan Dunaway, Dutch Harbor, ADF&G.

Another factor which could add to the disruption of fishing patterns and viability of small vessels is the timing of the fishing seasons in the various registration areas. The current configuration of seasons are timed such that the large, mobile vessels could fish all areas if regulations were to permit such activity. The season in the northern district of the Bering Sea, for example, generally begins in July and ends prior to the opening of the Bristol Bay and the Pribilof Islands season in mid-September. These seasons, in turn, generally close before the seasons in Adak and Dutch Harbor open in November. Additionally, the seasons in the latter two areas appear to be sufficiently long to allow vessels to fish both areas during the season.

Impact on small and large vessels. Two alternatives for the use of registration areas as a management technique in addition to the status quo, are (1) elimination of all exclusive registration and (2) the requirement that all areas be designated as exclusive. In the absence of exclusive registration areas, the primary impact would likely fall on the small vessels fishing the Dutch Harbor area. The vessels in this area are small and generally restricted to fishing this area and are, therefore, susceptible to being dislocated by larger vessels. All other areas are dominated by large vessels and it is assumed that current size class distributions would continue. Under the status quo system, mobile vessels are required to choose between fishing in either Bristol Bay or Dutch Harbor. Because of the larger resource base and higher CPUE in Bristol Bay, the large majority of vessels presumably choose to fish Bristol Bay rather than Dutch Harbor. Without this restriction, however, many vessels may choose to fish both areas, particularly since the timing of the seasons would be conducive to such a decision.

A definitive analysis of the impact of the elimination of exclusive registration is not possible because the number of vessels fishing an area at any one time reflects the individual decisions of numerous operators based on potential harvests, proposed prices and distances between fishing grounds and processing facilities. However, two hypothetical cases will be put forth as a demonstration of potential impacts of a change in regulatory strategy. The first scenario would involve the influx of all large vessels from the Bristol Bay king crab fishery into

the Dutch Harbor area, placing them in direct competition with the small vessels currently registered there. While this scenario may be unlikely because of a relatively low CPUE in the area, it is conceivable because the seasons would have closed in the Bering Sea and Bristol Bay areas and vessels would be in the vicinity of Dutch Harbor due to the location of the pot storage area. Under these conditions, large vessels would constitute 68 percent of the fleet in the area and would likely account for a greater proportion of the catch. Based on the 1980 catch level in Dutch Harbor, large vessels would have landed about 15.2 million pounds, a gain of 9.9 million pounds from the status quo situation. Small vessels, on the other hand, would suffer a loss of 9.9 million pounds. At the average 1981 ex-vessel price of $1.49, small vessels would suffer a reduction in revenue of $14.8 million while large vessels would incur a gain in the same amount. It should be noted that the reduction in revenues for small vessels could partially be offset by earnings from harvests of dungeness crab, salmon, herring, etc.

The second management alternative in the analysis of exclusive registration is the designation of all registration areas as exclusive. In this case, each vessel would be required to select an area to fish for the entire season. Individual decisions would be based on potential harvests, proposed prices, and distances between fishing grounds and processing facilities. Because of the already mentioned higher levels of CPUE in Bristol Bay (Table 8) most large vessels in the fleet register to fish this area and not Dutch Harbor. Therefore, assuming the number of large vessels remains constant and that small vessels would be constrained by their size to remain in their current locations, no change in CPUE or average gross revenue in either area would result from such a change in area designation.

Impact on processors. Processors would generally be unaffected by changes in the designation of exclusive registration areas. Product would generally be delivered in the same quantities as under the status quo situation. Processors could be adversely impacted, however, as a result of excessively concentrated effort resulting in a shortened season and/or deliveries of product in excess of processing capacity. Because data on processing capacity are unavailable, quantification of the impact on processors is not possible.

Impact on consumers. There would be no measurable impact on consumers as a result of a change in the designation of exclusive registration areas.

Impact on taxpayers. The expenditure of public funds could increase significantly under the alternative to designate all registration areas as exclusive. Enforcement costs would increase sharply in an effort to assure that vessels fish only in the areas in which they register. Estimates of increased costs are not available.

Impact on the resource. The resource would not be affected since catch levels would be constrained by OY determinations.

D. Gear Storage Discussion

As has been discussed earlier in Section III.E., gear storage regulations are developed to (1) protect crab stocks during sensitive biological periods; (2) to provide designated storage areas which are protected from other fishing gear; and (3) as an enforcement measure. The impact of these regulations could vary considerably based on the extent of regulation. The FMP authorizes flexible use of this management measure when justified in light of (1) its biological impacts; (2) the additional enforcement costs to the public that it will cause; (3) the costs to vessel owners of storage on land; (4) the availability of other land and sea storage areas; and (5) the possibility that it would lead to additional gear conflicts. Following such justification, the regulation can take a variety of forms. For example, the State of Alaska currently authorizes at-sea gear storage in waters of 25 fathoms or less (i.e. inshore) or in designated, at-sea storage areas. This regulation was justified by providing crab fishermen with the opportunity to store gear in the water, prior to, or following a fishing season in order to avoid the frequent dockside congestion experienced during these periods. These at-sea storage areas are most often utilized by fishermen during the summer months between the closure of Tanner crab fishing (early August) and the beginning of the king crab fishery (mid-September). Storage of gear in the water at other times of the year is not popular due to the likelihood of gear being lost due to weather, conflicts with other gear types, and other factors.

It is recognized that impacts attributed to the implementation of the proposed FMP will be essentially zero since the plan adopts current State gear storage regulations and any impacts from such management upon the fishing industry already exists. However, any change in current management regulations, especially at the extreme range of the measure's flexibility could have some future impact and are presented for consideration.

Gear storage impacts on small and large vessels. In recent years the king crab fleet has expanded with the addition of new and larger vessels, which has increased the actual number of crab pots fished and later stored. Storage areas for crab gear can take two forms, either on-land or at-sea storage. With on-land storage, space (each crab pot is 7-10 ft. sq.) and dockside loading and unloading facilities are required. Even though storage space has grown to accommodate the additional pots, a similar growth in dockside facilities has not occurred. The result is, prior to a season opening or following a season closure, there is often congestion at the docks with many fishermen having to wait to load or unload their gear. For this reason, traditional at-sea storage areas and gear placement regulations have provided fishermen with additional time to move their gear into or out of on-land storage.

There are two extremes with the gear storage management measure as described in the FMP: (1) storage on-land only; and (2) random at-sea storage. Regulations for just on-land storage would most severely impact the smaller vessels since these vessels are unable to transport the same number of pots as large vessels and thereby are unable to fish as efficiently as larger vessels. Most vessels in the BS/AI area fish with approximately 428 pots, more than can be carried in one trip by a small vessel. The number of pots used in this area reflects the amount of "soak-time" fishermen prefer for each pot. A too-short soak-time would reduce the amount of crab per pot lift. A pot soaking too long may catch more crab but the increase in deadloss also occurs.

Disadvantages commonly associated with on-land pot storage are the direct costs involved. It has already been mentioned that the cost of storing crab pots on land or in the sea will be considered when developing

regulations. Storage of gear on land requires the leasing of space and equipment necessary for loading and unloading the gear. These annual costs vary, but average $18 per pot per year. With the normal compliment of gear per vessel being 428 pots, the cost of storage on land is $7,704 per year. Currently, about 80% of the king crab fleet fishing in the BS/AI area store their gear on land. Fishermen prefer land storage due to the seemingly high risk of loss or damage to pots stored at sea. If a storage regulation were developed which required land storage, the regulation would only impact the 20% of the fleet (approximately 72 vessels) which presently store their gear in the water. The new cost attributed to the regulation would therefore be at least $552,000.

The other extreme of the measure is random at-sea storage. While both small and large vessels would be able to store their gear anywhere in the management area, doing so would increase the risk of gear loss and conflicts with other fisheries. A random at-sea storage regulation would have no direct cost to the fishermen, but with the possibility of gear loss and higher deterioration, fishermen stand to lose a considerable investment. King crab pots commonly used in the BS/AI area cost about $600 a piece. Damage or loss to some or all of a vessel's pots would result in a potential loss ranging from $0-256,800. The significant advantage of this regulation is the considerable savings in fuel expenditures for all vessels by allowing the storage of gear in any area where fishermen wish to fish.

Other gear storage impacts. There would be few additional impacts of an on-land only gear storage requirement. There are though, other identifiable impacts of random at-sea storage. There has been some question as to the possible effect of in-water gear storage on the crab resource. Unfortunately, no information is presently available to allow any conclusions. With king crab stocks usually concentrated in a few areas, gear stored on these crab stocks may have an adverse impact on the resource. Other disadvantages of this extreme measure would be the inability to enforce storage regulations and the lack of management control over season openings. Such a regulation would require enforcement agents to actually lift pots to check for illegal fishing, thereby requiring additional ships and enforcement personnel. These enforcement

costs would be drastically reduced if at the other extreme, no at-sea storage was required. Enforcement agents would then be able to broadly examine an area and assume any detected gear as illegal.

It has already been mentioned that there exists potential impacts of gear storage with other fisheries. This is emphasized since fisheries such as salmon, shrimp and groundfish utilize many of the same areas as the king crab fishery. An objective of the FMP is to coordinate the king crab fishery with other fisheries and avoid gear conflicts when possible. While random at-sea storage would produce the greatest potential for conflict, the extreme alternative of no at-sea storage would completely eliminate any conflict between stored king crab pots and other gear types.

E. A Directed Fishery on Female King Crab

A study by Reeves (1981) indicated that 20-40 million fertilized females is a reasonable estimate of the number necessary to maximize recruitment in the BS/AI king crab fishery. At high population levels, such as those that prevailed in 1980, estimates placed the number of mature females at 60 million. Thus conservatively, it is possible that as many as 20 million mature female king crab would be surplus to the optimum breeding stock level and therefore theoretically available for harvest.

The harvest of female king crab has historically not been an issue in management of the king crab fishery, principally because industry has shown little interest. This is probably because the female of the species is considerably smaller than a male of the same age and the proportion of recoverable meat is much less than that of a male king crab of the same size.

None the less, with the experience and technology developed in the U.S. processing sector as a result of handling the smaller C. bairdi and C. opilio Tanner crab, the exploitation of a female surplus is possible. Because of the size and meat yield characteristics of the female, it is probable that the harvest would be sectioned and in large part enter the export market in competition with Tanner crab sections. Since no marketing information is available regarding consumer response to smaller section king crab the following analysis is necessarily speculative.

While the output of a female target fishery would have many of the characteristics of the familiar king crab product, its significantly smaller size would likely reduce its value at the retail, and thus wholesale, and ex-vessel levels. For purposes of evaluating the possible economic performance of this fishery a conservative assumption has been made that female king crab would command at least the equivalent ex-vessel price per pound of the male C. bairdi Tanner crab.

In 1980, the year for which Reeves made his optimum breeding stock projections, the ex-vessel price for C. bairdi averaged $ .58 per pound. Utilizing the 20 million crab surplus, an average body weight of mature female king crab of 3.5 pounds, and a maximum exploitation rate of .8, the resulting harvest in this target fishery could approach 56 million pounds with a conservative estimated gross ex-vessel value of $32.5 million. Assuming a sections recovery rate of 35% of body weight, the total produce could reach 19.6 million pounds. It is highly unlikely that landings from a female target fishery could be sustained at anything approaching these levels. Therefore, much of the projected $32.5 million ex-vessel value must be regarded as a one time, or at best cyclical windfall. Further examination of the biological impacts of a female target fishery on the resource and the associated economic implications for the male only king crab fishery would seem appropriate before commencing a large new fishery on the resource.

Impact on small vessels. Should a target female king crab fishery be authorized under the framework FMP, the implications for the small vessels operating in the present fishery could be significant. Since legal male crab tend to segregate themselves from sub-legal and female crab during the period when the fishery is in progress king crab operators are reportedly able to selectively set their gear so that the pots contain almost exclusively legal sized males. As a result, the vessel technology and operational strategy which has evolved in the fishery, particularly with regard to the new large vessel, is dependent upon this relatively homogeneous catch composition for operational efficiency and economic viability. Stock assessment survey results indicate that concentrations of mature female crab include large numbers of sub-legal males and females which would reduce CPUE and significantly increase handling and sorting costs.

It is conceivable that a target female fishery could provide an opportunity for some subset of the king crab smaller vessel fleet to fish on a significantly large and distinct resource concentration without the competition of the larger king crab vessels. Because of the lower operating costs of many of these vessels as compared to the large vessel fleet, they may find profit margins in the more labor intensive, reduced CPUE female fishery that could not support the high margin, high cost large boats.

Impact on large vessels. As noted above, authorization of a female target fishery probably would not provide an economically attractive alternative for the large boat operation under stock conditions cited above. The simultaneous opening of a 20 million crab target female fishery with the traditional king crab season could have the secondary effect of reducing effort from a segment of the small vessel fleet in the male fishery and thus potentially improving CPUE and harvest shares for those who remain. The extent to which this would occur, should the female fishery become a reality, cannot be judged.

If speculation about the market performance of female king crab is correct, the landing of surplus females would not be expected to significantly impact the ex-vessel price paid for the traditional male king crab because the female would be expected to either enter a new specialty market to exploit the "king crab" product name or compete with the C. bairdi sections product for shares of its market.

Impact on processors. A female king crab fishery could be expected to have a significant impact on the processing sector of the industry by providing an additional 19.6 million pounds of sectioned crab product. Because the industry has had more than a decade of experience receiving, processing, and marketing Tanner crab, it is believed that no significant additional developmental or handling costs would be associated with processing female king crabs.

The fact that the female king crab sections would be available some months before the opening of the Tanner crab fishery could enhance the

marketability of the product and effectively extend the supply of "fresh" small crab sections to domestic and export markets by up to six months per year.

Impact on consumers. Should the smaller female king crab sections be marketed domestically through new distribution networks, a substantially broader segment of the American public would have the opportunity to enjoy this high quality seafood product. This would be anticipated because the smaller section size would not command the premium price of the traditional king crab product.

If the female crab is marketed through existing channels as a supplement to the supply of Tanner crab, the addition of over 19 million pounds of product should reduce, somewhat, the price of small crab sections and increase retail product availability.

If, as has been speculated, this fishery results in a significant extention of the period when fresh small crab sections are available, then the consumer will also benefit from the expanded supply of a higher quality seafood product, as well.

Impact on taxpayers. The establishment of a target fishery for surplus female king crab would not be expected to impact the taxpayer.

Impact on the resource. Because a target female fishery has not occurred historically, no definitive information exists as to the probable impact of such a fishery on the resource itself. Careful analysis of this issue should preceed any authorization of a female harvest.

V. THE INFLUENCE OF EXPLOITATION RATES ON MAXIMUM PHYSICAL YIELD

Estimates of natural mortality and weight of king crab are cited in the FMP. These estimates can be used to gain an understanding of the relationship between the exploitation rate (the percentage of legal crabs harvested based on the number of legal crabs in an area), and harvest.

A. Variations in Exploitation Rates

A simple model is used to analyze the impact of changing exploitation rates. The model starts with a given number of crabs entering the fishery at age 8, the first year class that yields crabs larger than the assumed legal limit of 6.5 inches. In the first year of fishing, a certain percent of the crabs are caught (exploitation rate), some of the crabs not caught die (natural mortality) and the survivors grow and become 9 years old. The following year the survivors in this year class are subject to the same exploitation rate, but a different natural mortality rate and a different growth rate. The model used estimates the weight of crabs caught each year (for five years at which time virtually all the crabs have either been caught or died naturally), and sums the weights for each exploitation rate. Exploitation rates of .10 to 1.0, by increments of .1 were evaluated.

The model uses the natural mortality, weight, and size at various ages from Tables 3 and 5 in the FMP. Assuming the model starts with 1 million crabs at age eight, the harvest from the initial year class for five years as a function of exploitation rate is:

Exploitation Rate	Harvest (Million Pounds)
.1	1.85
.2	3.06
.3	3.82
.4	4.26
.5	4.49
.6	4.59
.7	4.61
.8	4.59
.9	4.58
1.0	4.50

The maximum harvest occurs at a rate of .69.

The basic equation in the model is:

$$\sum_{n=o}^{5} 1{,}000{,}000\ (x) \cdot (1-x)^{n} \cdot wt_{(n+8)}\ NSR$$

Where:

x = exploitation rate

wt = the weight of a crab of age n+8

NSR = the natural survival rate.

For any one year the survival rate = 1.0 - (natural mortality). These rates are compounded to account for the cumulative effects of natural mortality on the original base population.

The results of the model indicate that, within a wide range, the physical harvest is not particularly sensitive to the exploitation rate. For example, doubling the exploitation rate from .3 to .6 raises harvest by only 20%. Raising the exploitation rate from .4 to .6 increases the harvest by 7%. The insensitivity of the harvest level to the exploitation rate arises because at a size limit of 6.5 inches, growth is greater than natural mortality and a lower exploitation rate is somewhat compensated for by the larger crabs harvested in future years.

B. Smoothing the Peaks

The abundance of king crab fluctuates widely from year to year. For example, in 1980 the catch off Alaska was 186,000,000 pounds, compared to 88,000,000 pounds in 1981 and an expected 1982 catch that will be much lower than in 1981. For individual stocks, the percentage change can be even more chaotic.

The FMP contemplates the possiblity of trying to smooth the catches by "banking" crab. Catches in one year might be held below the level dictated by resource abundance, especially if the forecast for the following year's recruitment were low. The crab not caught would be available the following year, less any natural mortality, and would compensate for the anticipated poor recruitment.

To test this hypothesis, a simple model of the fishery was developed that, for a given age distribution in the fishery and an assumed recruitment, would estimate catch as a function of changing exploitation rates. The model, based upon population parameters for the Bristol Bay stocks, assumes that:

- the size limit is 6.5 inches
- there are initially 120 million pounds of legal crab on the grounds
- the initial distribution as a function of age is:

Age	% of Population (by number)
8	60%
9	25%
10	10%
11	5%

- Growth and mortality are as specified in tables 3 and 5 in the FMP
- Recruitment in the second year of the model is 50% of the first year's recruitment

Initially the distribution of crab by number and weight is:

Age	Percent (by numbers)	Number of crab (millions)	Weight by year class (millions of pounds)
8	60	14.4	64.8
9	25	6.0	32.4
10	10	2.4	14.8
11	5	1.2	8.3
			120.3

Using natural mortality estimates and growth estimates, the catch for two years was estimated for different exploitation rates. The following results were obtained:

Exploitation Rate Year 1	Exploitation Rate Year 2	Harvest (millions of pounds) Year 1	Harvest (millions of pounds) Year 2	Harvest (millions of pounds) Total
6	6	72	48.7	120.7
4	6	48	63.3	111.3
5	5	60	46.6	106.6

Within the constraints of this particular model there are apparently no substantial gains from trying to "smooth" the peak harvest level. However, this analysis does not consider the incurred costs of trying to harvest at a high exploitation rate (.6 year 1 and year 2) when abundance is low. Catch per unit of effort may be so low that it is not economically feasible to fish in year 2 if there is not a carry over from year 1.

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APPENDIX A

King Crab Catch by Vessel Length for Bristol Bay, Dutch Habor, Adak/Western Aleutians, Alaska Peninsula and Kodiak: 1980-81 Fishing Season.

VESSEL LENGTH	NUMBER OF VESSELS	CATCH IN POUNDS	PERCENT OF CATCH	CUMULATIVE PERCENTAGE
UNDER	0	0	0.0	0.0
20-29	0	0	0.0	0.0
30-39	0	0	0.0	0.0
40-49	0	0	0.0	0.0
50-59	0	0	0.0	0.0
60-69	2	538,701	0.4	0.4
70-79	19	6,750,181	5.2	5.6
80-89	40	18,122,534	13.9	19.5
90-99	59	27,736,104	21.3	40.8
100-109	37	22,299,012	17.2	58.0
110-119	33	23,097,642	17.8	75.8
120-129	19	12,799,004	9.8	85.6
130-139	6	3,359,454	2.6	88.2
140-149	5	4,002,882	3.1	91.3
OVER	16	11,242,922	8.7	100.0
IOD TOTAL	236	129,948,436	100.0	

otes: Deadloss is included.
Percentages may not total 100 due to rounding.

rces: Fish tickets, area vessel registrations.

BATCHES USED IN THIS REPORT

80Q031 80Q032 80Q033 80Q034
80Q035 80Q036 80Q037

ND OF REPORT>

VESSEL LENGTH	NUMBER OF VESSELS	CATCH IN POUNDS	PERCENT OF CATCH	CUMULATIVE PERCENTAGE
UNDER	0	0	0.0	0.0
20-29	0	0	0.0	0.0
30-39	6	85,977	0.5	0.5
40-49	20	1,027,595	5.4	5.9
50-59	7	385,408	2.0	7.9
60-69	9	1,746,470	9.2	17.1
70-79	26	5,714,126	30.0	47.1
80-89	24	4,741,557	24.9	72.0
90-99	12	2,353,485	12.4	84.4
100-109	3	670,820	3.5	87.9
110-119	2	464,686	2.4	90.3
120-129	3	1,101,666	5.8	96.1
130-139	2	150,569	0.8	96.9
140-149	2	612,928	3.2	100.1
OVER	0	0	0.0	100.1
PERIOD TOTAL	116	19,055,287	100.1	

Notes: Deadloss is included.
Percentages may not total 100 due to roundings.

Sources: Fish tickets, area vessel registrations.

BATCHES USED IN THIS REPORT

800017	800018	800024	800025
810003	810004	810005	810009

<END OF REPORT>

VESSEL LENGTH	NUMBER OF VESSELS	CATCH IN POUNDS	PERCENT OF CATCH	CUMULATIVE PERCENTAGE
UNDER	0	0	0.0	0.0
20-29	0	0	0.0	0.0
30-39	0	0	0.0	0.0
40-49	0	0	0.0	0.0
50-59	0	0	0.0	0.0
60-69	0	0	0.0	0.0
70-79	1	5,840	0.4	0.4
80-89	0	0	0.0	0.4
90-99	7	760,120	51.4	51.8
100-109	2	145,910	9.9	61.7
110-119	3	171,440	11.6	73.3
120-129	1	255,445	17.3	90.6
130-139	1	39,385	2.7	93.3
140-149	1	70,225	4.7	98.0
OVER	1	30,062	2.0	100.0
OD TOTAL	17	1,478,427	100.0	

otes: Deadloss is included.
Percentages may not total 100 due to roundings.

rces: Fish tickets, area vessel registrations.

BATCHES USED IN THIS REPORT

81R001 81R003 81R004 81R005
81R006

D OF REPORT>

KING CRAB CATCH BY VESSEL LENGTH
AREA Q-BERING SEA

VESSEL LENGTH	NUMBER OF VESSELS	CATCH IN POUNDS	PERCENT OF CATCH	CUMULATIVE PERCENTAGE
UNDER	0	0	0.0	0.0
20-29	1	353	0.0	0.0
30-39	1	565	0.0	0.0
40-49	0	0	0.0	0.0
50-59	0	0	0.0	0.0
60-69	2	135,546	1.0	1.0
70-79	5	989,707	7.4	8.4
80-89	15	1,383,711	10.4	18.8
90-99	27	2,590,745	19.5	38.3
100-109	18	1,829,758	13.7	52.0
110-119	18	2,228,005	16.7	68.7
120-129	15	1,954,527	14.7	83.4
130-139	4	911,152	6.8	90.2
140-149	3	328,423	2.5	92.7
OVER	7	957,623	7.2	99.9
PERIOD TOTAL	116	13,310,115	99.9	

Notes: Deadloss is included.
Percentages may not total 100 due to roundins.

Sources: Fish tickets, area vessel registrations.

BATCHES USED IN THIS REPORT

80Q022	80Q023	80Q024	80Q027
80Q028	80Q029	80Q030	80Q038
80Q039	80Q051		

<END OF REPORT>

VESSEL LENGTH	NUMBER OF VESSELS	CATCH IN POUNDS	PERCENT OF CATCH	CUMULATIVE PERCENTAGE
UNDER	0	0	0.0	0.0
20-29	0	0	0.0	0.0
30-39	4	64,194	1.3	1.3
40-49	29	2,632,468	53.9	55.2
50-59	7	608,440	12.5	67.7
60-69	1	29,500	0.6	68.3
70-79	2	1,199,108	24.6	92.9
80-89	1	346,822	7.1	100.0
90-99	0	0	0.0	100.0
100-109	0	0	0.0	100.0
110-119	0	0	0.0	100.0
120-129	0	0	0.0	100.0
130-139	0	0	0.0	100.0
140-149	0	0	0.0	100.0
OVER	0	0	0.0	100.0
RIOD TOTAL.	44	4,880,532	100.0	

Notes: Deadloss is included.
Percentages may not total 100 due to roundings.

ources: Fish tickets, area vessel registrations.

BATCHES USED IN THIS REPORT

81M001 80M064 80M065 80M066
80M067

END OF REPORT>

VESSEL LENGTH	NUMBER OF VESSELS	CATCH IN POUNDS	PERCENT OF CATCH	CUMULATIVE PERCENTAGE
UNDER	1	1,535	0.0	0.0
20-29	3	6,409	0.0	0.0
30-39	35	520,298	2.5	2.5
40-49	46	4,029,304	19.7	22.2
50-59	17	1,347,750	6.6	28.8
60-69	16	3,403,408	16.6	45.4
70-79	25	4,608,825	22.5	67.9
80-89	13	3,468,329	17.0	84.9
90-99	5	1,803,428	8.8	93.7
100-109	2	1,044,118	5.1	98.8
110-119	0	0	0.0	98.8
120-129	1	215,250	1.1	99.9
130-139	0	0	0.0	99.9
140-149	0	0	0.0	99.9
OVER	0	0	0.0	99.9
PERIOD TOTAL	164	20,448,654	99.9	

Notes: Deadloss is included.
Percentages may not total 100 due to roundings.

Sources: Fish tickets, area vessel registrations.

BATCHES USED IN THIS REPORT

80K173	80K180	80K187	80K188
80K189	80K190	80K191	80K192
80K193	80K194	80K199	80K200
80K202	80K203	80K204	80K205
80K210	80K211	80K212	80K215
81K001	81K002	81K003	81K004

<END OF REPORT>

SUPPLEMENT

REGULATORY IMPACT REVIEW/REGULATORY FLEXIBILITY ANALYSIS FOR THE BERING SEA/ALEUTIAN ISLANDS KING CRAB FISHERY MANAGEMENT PLAN

North Pacific Fishery Management Council

June 1984

Prepared by:

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and

National Marine Fisheries Service Alaska Region
P.O. Box 1668
Juneau, Alaska 99802

DATE: June 4, 1984

TO: Reviewers, BS/AI King Crab RIR

FROM: F/AKR11 - Thorn Smith Thorn Smith

SUBJECT: Supplement to BS/AI King Crab RIR

Upon request by the National Marine Fisheries Service, Washington, D.C. office, the attached supplementary memoranda were prepared on the subject Regulatory Impact Review. These memoranda address the follwing issues:

1. Is the action "major" under E.O. 12291;

2. Will the action have "a significant impact on a substantial number of small entities" under the Regulatory Flexibility Act;

3. How will elimination of State of Alaska permits for king crab fishing in the fishery conservation zone affect the ability of the State to collect revenues;

4. Would the 1981-1982 and 1982-1983 harvest data series significantly affect the conclusions presented in the RIR; and

5. What is the likely cost to the Federal Government of enforcement activities under the king crab FMP?

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

June 4, 1984

F/AKR11 - Thorn Smith

F/AKR11 - J. R. Wilson J. R. Wilson

Are regulations implementing the King Crab Plan "Significant" under P.L. 94-265 (the Regulatory Flexibility Act) and "Major" under E.O. 12291 (Executive Order)?

RFA and E.O. 12291 Conclusions

The expected magnitude of economic impacts of a regulatory action need to be addressed in the RIR for purposes of compliance with the Regulatory Flexibility Act (RFA) and Executive Order 12291 (E.O. 12291). I conclude that these issues have been addressed in the RIR, and that the proposed actions will be "significant" under RFA, but not major under E.O. 12291. The E.O. 12291 defines a major rule as:

1. one in which there is an annual effect of $100 million or more;

2. one resulting in a major increase in costs or prices for consumers, individual industries, federal, state, or local government agencies, or geographic regions; or

3. one in which significant adverse impacts on competition, employment investment, productivity, innovation, or on the ability of U.S.-based enterprises to compete with foreign-based enterprises in domestic or export markets (emphasis added).

The RFA addresses the question of how congruent proposed regulations are to the structure and function of businesses, especially small businesses. In this regard, it is important to assess whether a proposed rule has a "significant impact on a substantial number of small entities." Significance is not often addressed as an empirical issue, mainly because the criterion for significance is not well developed or generally agreed upon (see for example, NOAA Guidelines, Fishery Management Plan Process, Appendix 4C, pp. 8 and 9); i.e., it is more of a judgment call than a statistical test. The RFA is not clear on whether a determination of significance is required for both positive and adverse effects. However, the above-mentioned Guidelines suggest that determinations are required when both negative and positive impacts are found.

The regulations proposed to implement the FMP are divided into those procedural implementing regulations for the FMP, and those regulations which are used, subsequent to the implementation of the FMP, in order to

determine approvability of state regulations. The implementing regulations are not expected to affect the fishery within the context of criteria set out in E.O. 12291 or in the RFA. However, regulations which govern the adoption of state regulations may be subject to review and determinations of "significant" and "major" under RFA and E.O. 12291. For this reason, the focus of this memo will be on the expected effects of approval or disapproval of state regulations under the FMP.

In relation to the first E.O. 12291 criterion listed above, the regulations proposed to implement the FMP likely will not have an effect of $100 million or more. The reason is that much of the FMP acknowledges and/or replicates the present State of Alaska (State) fisheries management system in the fishery conservation zone (FCZ), except that crab fishermen who fish in the FCZ will not be required to purchase a State permit.

Again, for reasons stated in the above paragraph, it is not at all likely that the change from the status quo (state management) to Federal management in the FCZ will bring on any of the effects outlined in (2) above, except perhaps in the area of creating revenues to the State. This repercussion cannot be construed as increasing costs or prices for the State, although it can be construed fundamentally as a disapproval of discriminatory pricing practices for management services, which may impose a constraint on the State's ability to recoup management costs. If one is inclined to view a State agency as one which produces a good, then the State could also be viewed as a monopolist which discriminates in order to maximize net revenues. Such a condition deviates from pure economic competition and would result in some loss to society if all of the assumptions about monopoly pricing were to hold. Under the FMP, the State regulations would not be approvable for the FCZ because the State discriminates in licensing. For approval to occur, the State would have to charge only for the administrative costs of issuing the licenses (see Magnuson Act section 304(d), and Travers' memo of March 21, 1984). The proposed management action calls for a Federal permit to be issued to those vessels fishing the FCZ. Adoption of a Federal permit for the FCZ is separate from the State's licensing fees, which will not be approved under the Magnuson Act in any event. In other words, although the State's fee structure is not affected by this regulatory action, vessels fishing exclusively in the FCZ would not be required to buy a State permit. Vessels which choose to forego fishing in State waters would contribute to a loss in revenues to the State. For example, in 1982, $334,000 was collected (Gaffney, ADF&G). If, under the FMP, all vessels fishing chose not to fish in State waters, then the State would have lost a maximum of $334,000. The likelihood of this high loss estimate is remote for the following reasons:

1. a portion of fishing ground for crab in the management area lies well inside the 3-mile limit;

2. fishermen, historically, have tended to hold permits as options, in the event that a fishing area might become desirable during a season;

3. the permit price, as an investment in an option, is relatively small compared to the cost structure of a fishing vessel; and

4. a State permit might be looked on as a means of taking advantage of shelter or port services in the event of bad weather or equipment/vessel failures.

It is reasonable to expect that a substantial, but unknown, number of vessels would continue buying a State permit, even though the Federal permit for the FCZ does not cost anything.

In summary, implementation of the FMP does not involve an increase in costs of State management, although the State may lose revenues if some fishermen decide not to buy the State permit required for fishing the territorial sea. This loss to the State is expected to be closer to 0 than to $334,000.

The third issue we have been asked to address under E.O. 12291 is the question of "significant adverse impacts in competition" (see e.g. Bribitzer's memo of November 10, 1983, to W.P. Jensen). Two questions to be asked would be:

1. What are the likely effects on competition, etc., of an FCZ permit with a zero price?

2. What are the likely effects of the changes on competition brought on by implementation of other measures contained in the FMP?

The domestic licensing process by the State in the Bering Sea/Aleutians Islands Area costs approximately $250; nonresident costs are $750. Suppose the State retains its fee structure and, in addition, the Federal permit is instituted at no cost to each fisherman. Is it reasonable to expect an appreciable change in entry or exit of firms? Although license fee costs would be considered fixed over a season (after a license is already purchased), they can also be thought of as variable, if purchase is considered prior to a season. If they are looked on as fixed, then they have no bearing on the decisions to produce or not to produce in the season; i.e., the primary consideration of a producer already in possession of a permit is the meeting of variable costs, at least in the short run. However, prior to a season, the license fee could be thought of as variable. For example, the price of a permit, if high enough, will cause the potential purchaser to ask what the stream of net benefits is likely to be in exchange for the right to fish. He may decide not to buy a permit because an alternative investment is expected to give a higher return. In this sense, he/she has treated the cost of a permit as variable. If the permit price for an FCZ permit drops to zero, it is less likely that the potential entrant will be deterred from entering the fishery. The more committed the operator is, in terms of fixed (and sunk) costs already incurred by fishing crab, the less effect the price of a permit will have on his/her decision to reenter the fishery. For new entrants, the same arguments apply except that the costs of entering the fishery are larger, with the license fees playing a relatively minor role. One would expect new entry to occur only if a discernable difference can be seen in the profit, or rents, paid to productive factors (especially entrepreneurship), since this is what actually entices entry. A downward shift in average variable costs would have to be substantial to entice entrants into the fishery, because

capital and labor would enter the fishery in a "lumpy" manner. Since the State of Alaska will likely retain the same fee structure for fishing in territorial waters, and since most vessels will find it useful to continue buying State licenses, for reasons cited above, there should not be a substantial change in competition.

In addition, a more uniform State-Federal management system would address the issue of enforcement against factory ships which do not deliver in Alaska, by requiring at least a Federal permit (the State cannot require that such vessels acquire State permits). Since this constitutes no real barrier to entry, and since coordination of Federal and State management systems is not perceived to be aimed at affecting the entry, then "competition" in the sense of an economy with many sellers is not adversely affected.

The question of significance in terms of the number of small entities which may be affected must also be addressed within the context of the RFA. It appears that the "Federalization" of State regulations under the implemented FMP will have a significant impact on a substantial number of small entities, for the following reasons: In the 1983-84 season there were at least 157 active vessels in the management unit even though the only two management areas which had exclusive area registration were closed this past year. This appears to be a significant number of vessels. Just 4 years ago in the 1979-80 fishery, it has been estimated that there were at least 330 vessels.

The extra 180 vessels which exited the fishery during those 4 years still exist. Some of them may be be idle or trying other fisheries in the interim. However, they will be back if the crab resource makes an upturn. The costs of compliance with the FMP, in terms of licenses and fees, is practically zero. It only involves applying for a free permit. The RIR and the preamble to the regulations explain in detail the effects of every framework management measure in the FMP. Although the analysis is very long, with many different types and magnitudes of impacts, all will be major in the sense that the whole fleet and processing sector will be affected, either positively or negatively.

The only caution is that the impacts of a rule, which is a humanly controlled event (a tool), should not be confused with impacts of adhering to existing legal constraints, or with impacts resulting from information which is collected objectively. For example, an optimum yield is essentially a quota. However, the quota is determined by the health of the crab stock based on best available information (thereby conforming to a National Standard). What cause, then, produces the "impact"; the national standard, the health of the crab stock which yields the OY determination, or the tools used to achieve OY? To do a cogent impact analysis, the term "rule" must be interpreted carefully to discriminate between the sum of all other events leading to the effect and the rule.

In conclusion, implementation of the regulations will lead to effects which are not major under E.O. 12291, but which are significant under RFA.

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North Pacific Fishery Management Council

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MEMORANDUM

TO: Thorn Smith, NMFS Alaska Region

FROM: Steve Davis, NPFMC

DATE: May 14, 1984

SUBJECT: Re-examination of BS/AI King Crab RIR and its Conclusions

As per your request, I have conducted a quick re-examination of the BS/AI King Crab RIR (dated October 1983) in light of new fishery data collected over the last two years. Doug Larson, Council staff economist, and I reviewed the Central Office concerns last fall prior to our resubmission of the King Crab FMP for fast track review. Our conclusion then, and mine now, is that the description of the impacts as analyzed in the RIR are still accurate and will not change even with the addition of more recent data.

The RIR describes in detail the various impacts which might be expected when utilizing a framework approach for particular management measures. A framework measure by definition establishes extremes or limits within which management action will likely fall. As long as management action lies between those framework extremes (which it has since 1981 even without an implemented FMP), the anticipated impacts and the costs/benefits of that action are described in the RIR analysis. For example, the FMP presents a step-by-step framework procedure for determining OY in different areas utilizing described criteria. Fishery data presented in the plan and in the RIR while from the 1980-81 season are used to illustrate how the framework procedure will work. Since 1981, the BS/AI king crab resource has undergone a tremendous decline. However, even with a reduction in harvestable crab the same OY procedure applies. The OY may now be lower than before but the framework procedure remains unchanged and is still considered valid by the scientific community. Fortunately, the framework is broad enough in this case to encompass the recent declines in crab stocks without requiring a plan amendment to revise the framework limits. Inclusion of 1982 or 1983 fishery data would not affect the conclusions at all, but only revise the examples used in this analysis. When we discussed the possible need to update historical summaries of the king crab fishery in the FMP, I mentioned that it was the Council's intent to make such revisions annually and the reason why such historical data was presented in the FMP appendices as opposed to the FMP itself. This will allow routine updating of the fishery statistics as necessary without requiring a plan amendment as is necessary with the Tanner crab plan. I would expect that we would begin routine submission for the appendices as soon as the plan is implemented.

31C/EE

North Pacific Fishery Management Council

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M E M O R A N D U M

TO: Thorn Smith
NMFS, Alaska Region

FROM: Steve Davis
Plan Coordinator

DATE: May 18, 1984

SUBJECT: Supplemental Examination of BS/AI King Crab RIR

As per our conversation on May 16, 1984, you mentioned that the Central office wanted to see more of the analysis as referred to in my memo to you (dated May 14, 1984). I mentioned, both in the memo and on the telephone, that the addition of the 1981-82 and 1982-83 data series would not significantly affect the conclusions presented in the BS/AI King Crab RIR (dated October 1983). The numerical analysis presented in the RIR use primarily resource data from 1980-81 and in both the RIR and FMP it is made clear that the data is being provided as an example of how the plan would work. Since the RIR analyzes the framework procedures for managing this fishery, insertion of more recent data, while changing the example, would not change the framework procedure. Therefore, I concluded that the RIR is satisfactory in its present condition.

In my earlier memo I referred to the OY procedure as an example. I chose this example given that it is based on the condition of the resource and by nature must be flexible to accommodate extreme fluctuation in the resource. This frameworked measure was designed in this manner based on our knowledge of extreme fluctuations in the crab stocks observed in the 1960's and early 1970's.

Since the Central office is interested in reviewing my analysis further, let me continue to use my OY example. I will present data collected in 1982-83.

31C/FF

In my earlier memo I mentioned that management action taken by the State of Alaska has fallen within the framework even without an approved FMP. This is due in part to the North Pacific Council and Alaska Board of Fisheries agreeing to jointly manage this fishery using the proposed FMP. The plan, in essence, has been undergoing a trial run and we have been pleased with the responsiveness of the framework approach.

In March 1982 at its annual shellfish meeting with the Board, the Council received Attachment 1 by NMFS which provides estimated catches of red king crab in Bristol Bay for 1982. These catches, which are acceptable in terms of their effect on the reproduction of the stock, are based on 1981 abundance estimates from the annual NMFS trawl survey and 1981 fishery removals. Two sets of catches are presented in the table, based on two possible natural mortality schedules for sub-legal crabs.

The procedure for determining ABC in which a spawner-recruitment relationship is available, describes how ABC will equal the maximum catch which maintains the minimum number of spawners (i.e. 20-40 million fertilized females). The dotted line in the table represents this minimum threshold, where all values above the line represent biologically safe harvest given a variety of size limit and exploitation rate combinations. Following this procedure the ABC was selected as 27-43 million lbs. in 1982, presented as a range due to the uncertainty surrounding the rate of natural mortality on sub-legal crabs.

Once ABC had been identified, the OY is determined as described in the FMP. A minimum size limit was selected at 6.5" based primarily on industry requirements, and an exploitation rate of .6 was chosen because of the relative abundance of large male king crab, the significant reduction in estimated harvest as compared to prior years, and on processing limitations. Examining the table in light of this step-by-step procedure led the Council to approve an OY range of 19-34 million lbs. for 1982.

You will note that while the numbers have changed from the example presented in Table 1 of the FMP (same as Table 4 in RIR), the framework procedure has not.

In June 1982, NMFS conducted its annual trawl survey in the southeastern Bering Sea. Results from that survey became available in early September and are provided as Attachment 2. The survey showed that the abundance of legal red king crabs was the lowest on record, and significantly alters the pre-season estimates reviewed in March. The survey indicated the legal abundance of crab to be about 4.4 million animals which equates to approximately 25 million lbs. When the previously approved .6 exploitation rate is applied, a 15 million lb. OY, or a range of 10-20 million lbs. is the result. This revised OY was publicized throughout the fleet and it became the range used by management at the start of the season. Again, the numbers have changed due to new information, but the framework procedure does not.

On September 10, 1982 the Bristol Bay king crab fishery opened with 58 vessels on the grounds. This compares to 166 and 200 vessels for the 1981-82 and 1980-81 seasons, respectively, with most of these vessels choosing to fish king crab in other areas or participate in other fisheries.

With the extreme, low density of king crab in the area, vessel trips were very long and deliveries very small. Crabs averaged only 5.6 lbs., 0.7 of a pound less than the 1981-82 season. By the end of the second week, less than one million lbs. of king crab had been delivered out of the Bristol Bay area.

During this period, a state observer program, funded by the Council, provided data showing a high incidence of handling sub-legal and female crab while fishing. Poor catches and catch per unit of effort data (a measure used for calculating relative abundance) indicated only 4.7 million lbs. of legal crab available at the 0.6 exploitation rate. As more data was received and evaluated, it became quite apparent to biologists that the Bristol Bay area was experiencing a serious female fecundity problem and that the number of fertilized females was well below the 20-40 million threshold. Data later showed that the number of fertilized females on the grounds had fallen from 48 to 18 million crabs in one year. For this reason, the Bristol Bay fishery was closed on October 10 with a final catch of 3 million lbs.

Did the FMP fail in 1982? No it did not. The plan did what it was designed to do. It provided the necessary guidance, objectives, and management measures to swiftly respond to changes within the fishery. It provided management with a set of measures to allow this flexibility. The OY procedure in particular provided a tremendous serivce to the fishing industry by presenting survey data and harvest estimates in a easy-to-understand, logical manner and yet early enough in the year to allow fishermen and processors to respond to the anticipated shortfall in catch. The RIR describes the potential impacts of management decisions using the framework plan. I believe the framework as presented in the plan and analyzed in the RIR, still fulfills the Council's intent for a flexible management system. The two-year trial run under the plan has shown that this plan works.

Table 2.--Estimated catches of red king crab males for 1982 in Bristol Bay, based on two different natural mortality schedules. (millions of pounds)

Size Limit (inches)	Exploitation Rate							
	.3	.4	.5	.6	.7	.8	.9	1.0
"Normal" Sub-legal Mortality								
7.00	9	12	15	19	21	25	28	30
6.75	13	18	22	26	30	35	39	(43) = ABC
6.50	18	23	28	34	40	46	52	57
6.25	22	29	36	43	52	59	66	73
6.00	27	36	45	54	62	72	81	89
5.75	33	43	55	66	76	87	98	109
5.50	36	48	60	72	83	95	108	120
5.25	39	52	64	77	90	103	116	130
"High" Sub-legal Mortality								
7.00	7	9	12	14	15	18	19	22
6.75	8	11	14	16	19	22	25	(27) = ABC
6.50	9	13	16	19	23	26	29	33
6.25	13	16	21	26	29	34	38	42
6.00	16	21	27	32	38	42	48	53
5.75	19	27	34	40	47	54	61	67
5.50	22	29	38	45	53	60	67	75
5.25	25	33	41	49	57	66	74	82

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

Bristol Bay and Pribilof Red King Crabs

Year	Pre-recruits 1/	Legals 1/
1969	19.5	9.8
1970 2/	8.4	5.3
1972	8.3	5.4
1973	25.9	10.9
1974	31.2	20.8
1975	29.6	21.2
1976	49.3	32.7
1977	63.9	37.6
1978	52.5	46.6
1979	38.8	45.5
1980	23.9	36.1
1981	18.9	10.8
1982 3/	17.1	4.4

MAY 29

Billing Code 3510-22

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 676

[Docket No.]

King Crab Fishery of the Bering Sea and Aleutian Islands Area

AGENCY: National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Proposed rule and request for comment.

SUMMARY: NOAA proposes a rule to implement a fishery management plan for the king crab fishery of the Bering Sea and Aleutian Islands area (FMP). Under this proposal, NOAA will evaluate current and future State of Alaska laws and regulations for conformance with the FMP and applicable Federal law. If approved by NOAA under the procedures provided in the proposed rule, Alaska laws and regulations applicable to the king crab fishery shall also have force and effect as Federal regulations for the Bering Sea and Aleutian Islands area. NOAA requests public comment on this rule and the FMP. This action is necessary to promote full participation in the conservation and management of king crab stocks in the Bering

Sea and Aleutian Islands area by all persons interested in this fishery, whether or not they are residents of the State of Alaska. This action is intended to provide for the continued active participation of the State of Alaska in the management of king crab fisheries of the Bering Sea and Aleutian Islands area.

DATES: Comments on the FMP and the proposed rule must be received on or before [day 75].

ADDRESS: Comments should be addressed to Robert W. McVey, Director, Alaska Region, National Marine Fisheries Service, P.O. Box 1668, Juneau, Alaska 99802. Copies of the FMP may be obtained from the North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, Alaska 99510, telephone 907-274-4563.

FOR FURTHER INFORMATION CONTACT: Robert W. McVey, 907-586-7221.

SUPPLEMENTARY INFORMATION: On _____, 1983, the North Pacific Fishery Management Council (Council) adopted the FMP under §302 of the Magnuson Fishery Conservation and Management Act, 16 U.S.C. §§1801 et seq. (Magnuson Act). In accordance with Magnuson Act §§303-305, the FMP has been submitted to the Secretary of Commerce (Secretary) for approval and implementation.

Rather than prescribing specific management measures for the fishery it covers, the FMP sets forth general standards and criteria for the management of that fishery. It provides a flexible framework for the development of specific management measures consistent with these standards and criteria, without requiring amendment of the FMP itself to incorporate those measures. The FMP provides management standards and criteria dealing with the following subjects: fishing seasons, gear restrictions, gear placement, gear storage, vessel tank inspection, size and sex restrictions, and registration areas. The FMP also specifies the optimum yield (OY) of the fishery it covers by prescribing a method by which the annual allowable catch from that fishery must be determined, using the best available scientific information.

In adopting the FMP, the Council intended that, to the extent practicable, the State of Alaska should continue to play a leading role in the management of this king crab fishery. Since 1960, shortly after it attained statehood, Alaska has developed a sophisticated management system for the king crab fishery off its shores, both within and beyond the three-mile limit. This system, representing the acquired expertise of scores of State of Alaska employees and an investment by that State over the years of many millions of dollars, could not be duplicated in the immediate future by NOAA. At the same time, some residents of states other than Alaska who participate in the king crab fishery off that State have long been concerned

about their lack of representation on the Alaska Board of Fisheries (Board) and in the Alaska Department of Fish and Game (ADF&G), the agencies that manage fisheries on behalf of Alaska. In order to take maximum advantage of Alaska's ability and willingness to continue to manage the king crab fishery while at the same time providing sufficient Federal oversight to ensure representation and consideration of non-Alaskan concerns, the Council and NOAA have proposed that the FMP be implemented by the Board and ADF&G in consultation with the Council (which includes non-Alaskan representatives) and subject to the approval by NOAA of individual management measures adopted by the Board or ADF&G. The proposed rule delegates management authority for the fishery to the State of Alaska, and specifies the procedures by which existing and future State of Alaska management measures are to be evaluated for consistency with the standards and criteria of the FMP. These procedures are designed to ensure that all interested persons have the opportunity to make their views on State management measures known to NOAA while preventing unnecessary delay in their implementation or amendment. Consultation between the Council and the Board concerning proposals for new management measures will be conducted at joint meetings of those two bodies. Pending approval by the Secretary, new State of Alaska management measures may govern fishing for king crab beyond the three-mile limit in the Bering Sea and Aleutian Islands area only by vessels registered under the

laws of the State of Alaska. After approval by the Secretary, State of Alaska management measures will acquire the force and effect of Federal law, and will apply to all vessels fishing for king crab in the Bering Sea and Aleutian Islands area.

Under the FMP and the proposed rule, each vessel fishing for king crab beyond the three-mile limit in the Bering Sea and Aleutian Islands area would have to obtain a Federal permit from the Secretary.

The FMP covers only the king crab fishery of the Bering Sea and Aleutian Islands area, and excludes the fishery in the Gulf of Alaska. King crab stocks in the Gulf are biologically discrete from those in the Bering Sea and Aleutians, and thus can be managed separately from them. The king crab fishery of the Gulf is, to a much greater extent than the fishery covered in the FMP, relied upon heavily by small local fleets. This fact renders much more difficult an assessment of the socio-economic costs and benefits of proposed management standards and criteria for the Gulf fishery. While an FMP may eventually be adopted for the Gulf fishery, the Council decided that implementation of an FMP for the Bering Sea and Aleutians should not be delayed for the significant period that will be required to assess the costs and benefits of Federal management in the Gulf. NOAA concurs with this decision. In addition, there is substantial controversy

whether any king crab fishery off Alaska would require Federal conservation and management in the absence of the concerns expressed by non-Alaskan participants about the representation of their interests in the State of Alaska management system. The expression of these concerns has been more urgent in connection with the king crab fishery of the Bering Sea and Aleutians than with the Gulf king crab fishery.

CLASSIFICATION

Section 304(a)(1)(C)(ii) of the Magnuson Act, as amended by Pub. L. 97-453, requires the Secretary to publish regulations proposed by a Council within 30 days of receipt of the FMP and regulations. At this time the Secretary has not determined that the FMP these rules would implement is consistent with the national standards of Magnuson Act §301, other provisions of the Magnuson Act, and other applicable law. The Secretary, in making that determination, will take into account the data, views, and comments received during the comment period.

The NOAA Administrator has determined that this proposed rule is not a "major rule" requiring a regulatory impact analysis under Executive Order 12291. None of the economic effects that are summarized below are expected to rise to a level that would make this proposed rule a "major rule" for purposes of the Executive Order. The Council prepared

a regulatory impact review/initial regulatory flexibility analysis (RIR/IRFA) which concludes that this proposed rule, if adopted, would have the following significant economic effects on small entities. These effects would derive from the fishery management measures that would be implemented under the proposed rule.

Delayed season opening dates tend to increase meat yield, which will probably cause ex-vessel value of landings to fluctuate. Later opening dates will place the season in bad weather conditions, which will affect smaller vessels more than large vessels. Both small and large vessels could be expected to lose fishing time under such circumstances. Increases in dead-loss would be likely, and the probability of personal injury of the crew and damage to gear would be greater. Season changes would affect processors by changing product recovery rates. Late seasons would also affect transshipment of final product. Consumers might experience moderate price fluctuations, as a result of changes in meat yield.

The proposed carapace size limit is predicted to have wide-ranging effects on statewide price per pound because of a market preference for larger crab. At a carapace width of 6.25 inches, the predicted price per pound would be $.99. At 7.00 inches, this price is estimated to be $1.34. Changes in carapace size limits will likely alter available harvestable

surplus. Decreases in allowable harvests resulting from size limits are expected to affect small operators adversely, since the average catch-per-unit-of-effort for such operators tends to be low. Larger vessels would be less subject to this phenomenon. Size limits would affect meat recovery rates and the ease of meat removal, and would thus affect the costs of processors. The magnitude of these potential effects is not known. Size limits could also affect prices to consumers and, in extreme cases of low crab abundance, lead to interruptions in king crab availability on the market.

Yields of crab will change with the exploitation rate, given any particular size limit. At a 6.5 inch size limit, with exploitation rates of .3 and .9, the expected ex-vessel revenues based on 1981 price data would be $51.5 million and $76.5 million, respectively. Processors would gain, ceteris paribus, with higher exploitation rates.

The establishment of exclusive registration areas would tend to redistribute the benefits of the fishery between small and large vessels. Exclusive registration favors smaller vessels, while non-exclusive registration favors large, more mobile vessels with high capacity. Processors are expected to be unaffected by the designation of registration areas.

Variations in gear storage regulations would also affect large and small vessels in different ways. The extremes for

such regulations are on-land storage only and random at-sea storage. On-land storage, while adversely affecting all vessels, would tend to affect smaller vessels more than larger ones because of their lack of pot transport capacity. The direct costs of on-land storage would include the rental of space and cost of equipment necessary to handle the gear. The average cost per pot of on-land storage has been estimated at $18 per pot per year, or $7,704 per fisherman per year. The other extreme in gear storage regulations is the allowance of random at-sea storage. Because 80 per cent of the crab fleet currently stores its pots on land, a regulation allowing at-sea storage would simply result in another possible productive activity of the land. However, at-sea storage might affect fishery resources and impede navigation and other fisheries.

The FMP leaves open the possibility of a directed fishery on female king crab, which have heretofore been avoided by both fishermen and processors in favor of the larger males. The effects of such a change on small vessels would be significant, because an additional large and distinct biomass of females might tend to relieve some of the competition between small and large vessels. The smaller vessels might be better suited than the larger ones to exploit the females, which would yield a lower catch-per-unit-of-effort and could require considerable sorting. Processors are not likely to be affected adversely by delivery of the smaller female king crab, since they have

had more than a decade of experience in processing Tanner crab, which are similar in size to female king crab.

The Federal permit provided for by the FMP and the proposed rule would be issued to a vessel owner free of charge with no requirement other than the submission of certain information. It would thus have no significant economic effect. The main purposes of the Federal permit requirement are to generate information about the size and characteristics of the fleet for future management purposes; and to make administrative permit revocation or modification available to NOAA as a response to violations of the management measures applicable to the king crab fishery.

This proposed rule is exempt from the procedures of Executive Order 12291 under §8(a)(2) of that Order. Deadlines imposed under the Magnuson Act, as amended by Pub. L. 97-453, require the Secretary to publish this proposed rule 30 days after its receipt. The proposed rule is being reported to the Director, Office of Management and Budget, with an explanation of why it is not possible to follow procedures of the Order.

This proposed rule contains collection of information requirements subject to the Paperwork Reduction Act. A request to collect this information has been submitted to the Office of Management and Budget for approval.

The Council determined that this proposed rule will be implemented in a manner that is consistent to the maximum extent practicable with the approved coastal zone management program of Alaska. This determination has been submitted for review by the responsible state agencies under section 307 of the Coastal Zone Management Act.

List of Subjects in 50 CFR Part 676

Administrative practice and procedure, Fish, Fisheries, Fishing, Reporting and recordkeeping requirements.

Dated:

Carmen J. Blondin
Deputy Assistant Administrator for
Fisheries Resource Management
National Marine Fisheries Service

For the reasons set out in the preamble, 50 CFR Chapter VI is amended by adding a new Part 676, to read as follows:

PART 676--KING CRAB FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS AREA

Subpart A--General Measures

Sec.

676.1 Purpose and scope.

676.2 Definitions.

676.3 Relation to other laws.

676.4 Permits.

676.5 General prohibitions.

676.6 Facilitation of enforcement.

676.7 Penalties.

Subpart B--Management Measures

Sec.

676.20 Initial implementation of the FMP.

676.21 New State laws and regulations.

676.22 Reconsideration of a final rule-related notice by the Secretary.

676.23 Amendment of the FMP.

AUTHORITY: 16 U.S.C. §§1801 et seq.

Subpart A--General Measures

§676.1 Purpose and scope.

(a) Regulations in this part govern fishing for king crab by vessels of the United States within the Bering Sea and Aleutian Islands area.

(b) Subject to the other provisions of this part, the authority to implement the Fishery Management Plan for the King Crab Fishery of the Bering Sea and Aleutian Islands Area (FMP) is delegated to the State of Alaska.

(c) Subject to other requirements of law, this part shall take effect upon receipt by the Secretary of a statement signed by the Governor of the State of Alaska accepting the provisions of this Part on behalf of the State and identifying the agencies that will exercise the authority to implement the FMP delegated by paragraph (b) of this section (designated agency).

§676.2 Definitions.

In addition to the definitions in the Magnuson Act, and unless the context requires otherwise, the terms used in this part have the following meanings:

Authorized officer means--

(a) Any commissioned, warrant, or petty officer of the U.S. Coast Guard;

(b) Any special agent of the National Marine Fisheries Service;

(c) Any officer designated by the head of any Federal or State agency which has entered into an agreement with the Secretary and the Secretary of Transportation to enforce the provisions of the Magnuson Act; and

(d) Any Coast Guard personnel accompanying and acting under the direction of any person described in paragraph (a) of this definition.

Bering Sea and Aleutian Islands area means those waters outside the boundaries of the State of Alaska lying south of the Bering Strait and east of the U.S.-U.S.S.R. Convention line of 1867, and extending south of the Aleutian Islands for 200 miles between the Convention line and 167°47'30" W. longitude.

Council means the North Pacific Fishery Management Council.

Designated agency means the agency designated by the Governor of the State of Alaska under §676.1(c) of this part.

Fish includes king crab.

Fishing means--

(a) The catching, taking, or harvesting of fish;

(b) The attempted catching, taking, or harvesting of fish;

(c) Any other activity which reasonably can be expected to result in the catching, taking, or harvesting of fish; or

(d) Any operations at sea in support of, or in preparation for, any activity described in paragraphs (a) through (c) of this definition.

Fishing vessel means any vessel, boat, ship, or other craft which is used for, equipped to be used for, or of a type which is normally used for fishing or for assisting or supporting a vessel engaged in fishing.

Fishery management plan (FMP) means the Fishery Management Plan for the King Crab Fishery of the Bering Sea and Aleutian Islands Area.

King crab means the following species of the family Lithodidae:

(a) Paralithodes camtschatica, red king crab;

(b) Paralithodes platypus, blue king crab;

(c) Lithodes aequispina, brown or golden king crab;

(d) Lithodes couesi.

Magnuson Act means the Magnuson Fishery Conservation and Management Act (16 U.S.C. §§1801 et seq.)

Operator, with respect to any vessel, means the master or other individual on board and in charge of that vessel.

Regional Director means the Director, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration.

Secretary means the Secretary of Commerce.

Vessel of the United States means--

(a) Any vessel documented under the laws of the United States;

(b) Any vessel numbered in accordance with the Federal Boat Safety Act of 1971 (46 U.S.C. §§1400 et seq.) and measuring less than 5 net tons; or

(c) Any vessel numbered under the Federal Boat Safety Act of 1971 (46 U.S.C. §§1400 et seq.) and used exclusively for pleasure.

§676.3 Relation to other laws.

(a) Federal law.

For regulations governing fishing by vessels of the United States for halibut, see regulations of the International Pacific

Halibut Commission at 50 CFR Part 301; for those governing fishing for groundfish off Alaska, see 50 CFR Parts 672 and 675; for those governing salmon fishing off Alaska, see 50 CFR Part 674; for those governing fishing for Tanner crab, see 50 CFR Part 671; and for those governing permits and certificates of inclusion for the taking of marine mammals, see 50 CFR Part 216.

(b) State law.

Each law and regulation of the State of Alaska approved under this part will be incorporated by reference in the FEDERAL REGISTER in accordance with 1 CFR Part 51. Laws of the State of Alaska approved under this part are codified in Title 16 of the Alaska Statutes. Regulations of the State of Alaska approved under this part are codified in Title 5 of the Alaska Administrative Code. Copies of these laws and regulations may be obtained from the Alaska Department of Fish and Game, Commercial Fisheries Division, P.O. Box 3-2000, Juneau, Alaska 99802, telephone 907-465-4210.

§676.4 Permits.

(a) General.

No vessel of the United States may fish for king crab in the Bering Sea and Aleutian Islands area without first obtaining a permit issued under this section. Each such permit will be issued without charge.

(b) Application.

A vessel owner may obtain a permit required under the preceding subsection by submitting to the Regional Director a written application containing the following information:

(1) The applicant's name, mailing address, and telephone number;

(2) The name of the vessel;

(3) The vessel's U.S. Coast Guard documentation number or State registration number;

(4) The home port of the vessel;

(5) The length of the vessel;

(6) The type of fishing gear to be used; and

(7) The signature of the applicant.

The Regional Director may accept a completed State of Alaska commercial fishing license application in satisfaction of the requirements of this subsection.

(c) Issuance.

(1) Upon receipt of a properly completed application, the Regional Director will issue a permit required by paragraph (a) of this section.

(2) Upon receipt of an incomplete or improperly completed application, the Regional Director shall notify the applicant of the deficiency in the application. If the applicant fails to correct the deficiency within 30 days

following the date of notification, the application will be considered abandoned.

(d) Notification of change.

Any person who has applied for and received a permit under this section must give written notification of any change in the information provided under paragraph (b) of this section to the Regional Director within 30 days of the date of that change.

(e) Duration.

A permit issued under this section shall authorize the permitted vessel to fish for king crab in the Bering Sea and Aleutian Islands area during a single specified year, and shall continue in full force and effect through December 31 of the year for which it was issued, or until it is revoked, suspended, or modified under 50 CFR Part 621 (Civil Procedures).

(f) Alteration.

No person may alter, erase, or mutilate any permit issued under this section. Any such permit that has been intentionally altered, erased, or mutilated will be invalid.

(g) Transfer.

Permits issued under this section are not transferable or assignable. Each such permit shall be valid only for the vessel for which it is issued. The Regional Director must

be notified of a change in ownership under paragraph (d) of this section.

(h) Inspection.

Any permit issued under this section must be carried aboard the vessel whenever the vessel is fishing for king crab in the Bering Sea and Aleutian Islands area. The permit shall be presented for inspection upon request of any authorized officer.

(i) Sanctions.

Subpart D of 50 CFR Part 621 (Civil Procedures) governs the imposition of permit sanctions against a permit issued under this section. As specified in that Subpart D, a permit may be revoked, modified, or suspended if the permitted vessel is used in the commission of an offense prohibited by the Magnuson Act or this part; and such a permit must be revoked if a civil penalty or criminal fine imposed under the Magnuson Act and pertaining to a permitted vessel is not paid.

§676.5 General prohibitions.

It is unlawful for any person to--

(a) Fish for king crab in the Bering Sea and Aleutian Islands area, except as permitted by laws and regulations

of the State of Alaska approved under this part at the time such fishing occurs;

(b) Fish for king crab in the Bering Sea and Aleutian Islands area without, or in violation of, a valid permit issued under this part;

(c) Violate any other provision of the Magnuson Act or this part;

(d) Fail to comply immediately with enforcement and boarding procedures specified in §676.6 of this part;

(e) Possess, have custody or control of, ship, transport, import, export, offer for sale, sell, or purchase any king crab taken or retained in violation of the Magnuson Act, this part, any permit issued under this part, or any law or regulation of the State of Alaska approved under this part;

(f) Refuse to allow an authorized officer to board a fishing vessel subject to such person's control for purposes of conducting any search or inspection in connection with the enforcement of the Magnuson Act, this part, any permit issued under this part, or any law or regulation of the State of Alaska approved under this part;

(g) Forcibly assault, resist, oppose, impede, intimidate, or interfere with any authorized officer in the conduct of any search or inspection described in paragraph (f) of this section;

(h) Resist a lawful arrest for any act prohibited by the Magnuson Act, this part, any permit issued under this part, or any law or regulation of the State of Alaska approved under this part; or

(i) Interfere with, delay, or prevent, by any means, the apprehension or arrest of another person knowing that such person has committed any act prohibited by the Magnuson Act, this part, any permit issued under this part, or any law or regulation of the State of Alaska approved under this part.

§676.6 Facilitation of enforcement.

(a) General.

The operator of any fishing vessel subject to this part must immediately comply with instructions and signals issued by an authorized officer to stop the vessel and with instructions to facilitate safe boarding and inspection of the vessel and its gear, equipment, fishing record, and catch for purposes of enforcing the Magnuson Act and this part.

(b) Communications.

(1) Upon being approached by a U.S. Coast Guard vessel or aircraft, or other vessel or aircraft with an authorized officer aboard, the operator of a fishing vessel must be alert for communications conveying enforcement instructions.

(2) If the sizes of the vessel and the wind, sea, and visibility conditions allow, loudhailer is the preferred method for communicating between vessels. If use of a loudhailer is not practicable, and for communications with an aircraft, VHF-FM or high frequency radiotelephone will be employed. Hand signs or placards may be employed by an authorized officer and message blocks may be dropped from an aircraft.

(3) If verbal communications are not practicable, the visual signal "L" meaning "you should stop your vessel instantly," may be transmitted by flashing light directed at the vessel signaled. If the enforcement vessel is equipped with signal flags, the flashing light signal "L" may be accompanied by the code flag "L". The flashing light signal "L" consists of short and long flashes as follows: short-long-short-short (.-..); and the code flag "L" is a square yellow and black flag configured as follows:

[Insert figure.]

(4) Failure of a vessel's operator to stop the vessel when directed by loudhailer, radiotelephone, or flashing light signal or code flag "L" constitutes prima facie evidence of the offense of refusal to permit an authorized officer to board.

(5) The operator of a vessel who does not understand a signal from an enforcement unit and who is to obtain clarification by loudhailer or radiotelephone should consider the signal to be "L" and stop the vessel instantly.

(c) Boarding.

The operator of a vessel directed to stop must--

(1) Guard Channel 16, VHF-FM, if so equipped;

(2) Stop immediately and lay to or maneuver in such a way as to allow the authorized officer and boarding party to come aboard;

(3) Provide a safe ladder, if needed, for the authorized officer and boarding party to come aboard;

(4) When necessary to facilitate the boarding or when requested by an authorized officer, provide a manrope or safety line, and illumination for the ladder; and

(5) Take such other actions as necessary to facilitate boarding and to ensure the safety of the authorized officer and the boarding party.

(d) Additional signals.

The following additional signals, extracted from the International Code of Signals, may be sent by flashing light by an enforcement unit when conditions do not allow communications by loudhailer or radiotelephone. Knowledge of these additional signals by the vessel operator is not required. However, knowledge of these additional signals and appropriate action by a vessel operator may preclude the necessity of sending the signal "L" and the necessity for the vessel to stop instantly.

(1) "AA AA AA etc." (.-.- .-.- .-.-) is the call to an unknown station. The operator of the signaled vessel should respond by identifying the vessel by radiotelephone or by illuminating the vessel's identification.

(2) "RY-CY" (-.- -.-- -.-. -.--) means "you should proceed at slow speed, a boat is coming to you." This signal is normally employed when conditions allow an enforcement boarding without the necessity of the vessel being boarded coming to a complete stop, or, in some cases, without retrieval of fishing gear which may be in the water.

§676.7 Penalties.

Any person or fishing vessel found to be in violation of this part is subject to the civil and criminal penalty, permit sanction, and forfeiture provisions of the Magnuson Act, to 50 CFR Part 620 (Citations), to 15 CFR Part 904 (Civil Procedures), and to other applicable law.

Subpart B--Management Measures

§676.20 Initial implementation of the FMP.

(a) After promulgation of this part, the Secretary will publish in the FEDERAL REGISTER a rule-related notice of approval which (1) specifies the laws and regulations of the State of Alaska governing fishing for king crab in the Bering Sea and Aleutian Islands area then in effect that he finds to be inconsistent with the FMP; (2) declares that the laws and regulations so specified cease to govern fishing for king crab in the Bering Sea and Aleutian Islands area by any vessel, whether or not it is registered under the laws of the State of Alaska; (3) declares that all laws and regulations of the State of Alaska governing fishing for king crab in the Bering Sea and Aleutian Islands area then in

effect that are not so specified are approved under this part and govern all fishing for king crab in the Bering Sea and Aleutian Islands area by any vessel, whether or not it is registered under the laws of the State of Alaska; and (4) states the findings and conclusions upon which the Secretary's action is based. The Secretary will not publish the rule-related notice provided for in this section until interested persons have been afforded a period of at least forty-five days in which to comment on laws and regulations of the State of Alaska governing fishing for king crab in the Bering Sea and Aleutian Islands area then in effect and the consistency of those laws and regulations with the FMP. The statement of findings and conclusions contained in the rule-related notice published under this section must respond to the comments received during this period. The Secretary will not publish the rule-related notice provided for in this section until he has consulted with the Council concerning his action and the findings and conclusions upon which it is based.

(b) The Secretary, after consultation with the Council, may promulgate and amend such other regulations as may be necessary to implement the FMP fully, in accordance with other requirements of law.

§676.21 New State laws and regulations.

(a) New State laws.

(1) Within thirty days after final enactment of a law of the State of Alaska governing fishing for king crab in the Bering Sea and Aleutian Islands area that was not in effect when the notice provided for in §676.20 of this part was published, the Secretary will publish in the FEDERAL REGISTER a rule-related notice requesting comments by any interested person on that law and whether it is consistent with the FMP. Interested persons will have the opportunity to submit comments for a period of at least forty-five days after publication of the notice requesting comments.

(2) Within ninety days after final enactment of a law referred to in paragraph (a)(1) of this section, and after consultation with the Council, the Secretary will publish in the FEDERAL REGISTER a rule-related notice of approval which (1) specifies any provision of that law that he finds to be inconsistent with the FMP; (2) declares that any provision so specified does not govern fishing for king crab in the Bering Sea and Aleutian Islands area by any vessel, whether or not it is registered under the laws of the State of Alaska; (3) declares that all provisions of that law which are not so specified are approved under this part and will govern all fishing for king crab in the Bering Sea and Aleutian Islands

area by any vessel, whether or not it is registered under the laws of the State of Alaska; and (4) states the findings and conclusions upon which the Secretary's action is based, responding to comments received under the rule-related notice provided for in paragraph (a)(1) of this section.

(3) A law referred to in paragraph (a)(1) of this section may govern fishing for king crab in the Bering Sea and Aleutian Islands area by any vessel registered under the laws of the State of Alaska, until the Secretary publishes the rule-related notice provided for in paragraph (a)(2) of this section. If a law or regulation of the State of Alaska that was previously approved under this part conflicts with a law governing fishing for king crab in the Bering Sea and Aleutian Islands area under this paragraph, the previously approved law or regulation will cease to be approved under this part with respect to vessels registered under the laws of the State of Alaska. When the Secretary publishes a rule-related notice under paragraph (a)(2) of this section disapproving the conflicting provisions of the new law, the previously approved law or regulation will once again be considered approved under this part with respect to vessels registered under the laws of the State of Alaska.

(b) New State regulations.

(1) As soon as practicable after the designated agency

of the State of Alaska publishes for public comment a proposed regulation governing fishing for king crab in the Bering Sea and Aleutian Islands area that was not in effect when the rule-related notice provided for in §676.20 of this part was published, the Secretary will publish in the FEDERAL REGISTER a rule-related notice requesting comments by any interested person on that proposal and whether it is consistent with the FMP. The rule-related notice will require that such comments be submitted to the designated agency in accordance with that agency's administrative procedures. It will explain that the Secretary will determine whether any such proposed regulation that may be adopted by that agency is consistent with the FMP on the basis of the administrative record developed before that agency.

(2) Within thirty days after the adoption by the designated State agency of a proposed regulation referred to in paragraph (b)(1) of this section, and after consultation with the Council, the Secretary will publish in the FEDERAL REGISTER a rule-related notice of approval which (1) specifies any provision of that regulation that he finds to be inconsistent with the FMP; (2) declares that any provisions so specified do not govern fishing for king crab in the Bering Sea and Aleutian Islands area by any vessel, whether or not it is registered under the laws of the State of Alaska; (3) declares that all provisions of that regulation that are not so specified are approved under this part and

govern all fishing for king crab in the Bering Sea and Aleutian Islands area by any vessel, whether or not it is registered under the laws of the State of Alaska; and (4) states the findings and conclusions upon which the Secretary's action is based. The statement of findings and conclusions contained in the rule-related notice published under this paragraph (b)(2) will be based upon the administrative record developed before the designated agency of the State of Alaska and respond to relevant points raised in comments submitted to that agency on the proposed regulation.

(3) A regulation referred to in paragraph (b)(1) of this section may govern fishing for king crab in the Bering Sea and Aleutian Islands area by any vessel registered under the laws of the State of Alaska, until the Secretary publishes the rule-related notice provided for in paragraph (b)(2) of this section. If a regulation of the State of Alaska that was previously approved under this part conflicts with a regulation governing fishing for king crab in the Bering Sea and Aleutian Islands area under this paragraph, the previously approved regulation will cease to be approved under this part with respect to vessels registered under the laws of the State of Alaska. When the Secretary publishes a rule-related notice under paragraph (b)(2) of this section disapproving the conflicting provisions of the new regulation, the previously approved regulation will once again be considered approved

under this part with respect to vessels registered under the laws of the State of Alaska.

(4) As soon as practicable after the designated agency of the State of Alaska adopts without opportunity for public comment a regulation governing fishing for king crab in the Bering Sea and Aleutian Islands area that was not in effect when the rule-related notice provided for in §676.20 of this part was published, the Secretary will publish in the FEDERAL REGISTER a rule-related notice of approval having the content prescribed for a rule-related notice published under paragraph (b)(2) of this section. A regulation referred to in this paragraph may govern fishing for king crab in the Bering Sea and Aleutian Islands area by vessels registered under the laws of the State of Alaska until the Secretary publishes the rule-related notice provided for in this paragraph (b)(4). If a regulation of the State of Alaska that was previously approved under this part conflicts with a regulation governing fishing for king crab in the Bering Sea and Aleutian Islands area under the second sentence of this paragraph, the previously approved regulation will cease to be approved under this part with respect to vessels registered under the laws of the State of Alaska. When the Secretary publishes a rule-related notice provided for in this paragraph (b)(4) disapproving the conflicting provisions of the new regulation, the previously approved regulation will once again

be considered approved under this part with respect to vessels registered under the laws of the State of Alaska.

§676.22 Reconsideration of a final rule-related notice by the Secretary.

(a) Within ten days after publication in the FEDERAL REGISTER of a rule-related notice of final action by the Secretary under §676.20 or §676.21 of this part, any person may request the Secretary to reconsider and change that action. The request will specify the proposed change in the action, and the reasons that change is believed to be necessary. The request will not be considered to have been made until it has been received at the address specified in the notice of the action. Within thirty days after publication of the rule-related notice of final action in the FEDERAL REGISTER, the Secretary will grant or deny all requests for reconsideration of that action that have been made, and will promptly publish a rule-related notice of such grant or denial in the FEDERAL REGISTER.

§676.23 Amendment of the FMP.

The provisions of §676.20 and §676.22 of this part apply upon implementation of any amendment of the FMP.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

July 2, 1984

Wendy Wolf
Division of Government Coordination
Office of Management and Budget
Pouch AW
Juneau, Alaska 98111

Dear Ms. Wolf:

The North Pacific Fishery Management Council (Council) has given its approval to the fishery management plan for the King Crab Fishery of the Bering Sea and Aleutian Islands Area (FMP) and will soon submit it to the Secretary of the U.S. Department of Commerce for approval. The FMP is a framework plan under which Federal management of the commercial king crab fishery could be delegated to the State of Alaska within certain bounds defined by the FMP.

The National Oceanic and Atmospheric Administration's Assistant Administrator for Fisheries has determined that approval and implementation of the FMP will be carried out in a manner that is consistent, to the maximum extent practicable, with the Alaska Coastal Management Program, as required by section 307(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations, 15 CFR, Part 930, subpart C.

We would appreciate your review of this action and your determination of consistency. To aid you in your review, the Council is sending to you the following documents:

- FMP for the King Crab Fishery of the Bering Sea and Aleutian Islands Area
- Final Environmental Impact Statement
- Regulatory Impact Review/Initial Regulatory Flexibility Analysis
- Proposed regulations and preamble

If you have any questions on the enclosed material, please contact me at 586-7221 or Ron Berg of my staff at 586-7230.

Sincerely,

Robert W. McVey
Director, Alaska Region

Enclosure

Billing Code 3510-22

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration (NOAA)

50 CFR Part 676

[Docket No.]

King Crab Fishery of the Bering Sea and Aleutian Islands Area

AGENCY: National Marine Fisheries Service (NMFS), NOAA, Commerce

ACTION: Notice of availability of fishery management plan and request for comments.

SUMMARY: NOAA issues this notice that the North Pacific Fishery Management Council has submitted the fishery management plan for the King Crab Fishery of the Bering Sea and Aleutian Islands Area (FMP) for review by the Secretary of Commerce and is requesting comments from the public. Copies of the FMP may be obtained from the address below.

DATE: Comments on the FMP should be received on or before [insert date].

ADDRESS: All comments should be sent to Robert W. McVey, Director, Alaska Region NMFS, P.O. Box 1668, Juneau, Alaska 99802.

Copies of the FMP are available upon request from the North Pacific Fishery Management Council (Council), P.O. Box 103136, Anchorage, Alaska 99510. Also available from the Council are the final Environmental

Impact Statement and Regulatory Impact Review/Initial Regulatory Flexibility Analysis. Comments are invited on these documents.

FOR FURTHER INFORMATION CONTACT: Raymond E. Baglin, Fishery Biologist, Kodiak Field Office, National Marine Fisheries Service, telephone (907) 486-4791.

SUPPLEMENTARY INFORMATION: The Magnuson Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.) requires that each Regional Fishery Management Council submit any fishery management plan it prepares to the Secretary of Commerce (Secretary) for review and approval or disapproval. This act also requires that the Secretary, upon receiving the plan, must immediately publish a notice that the plan is available for public review and comment. The Secretary will consider the public comments in determining whether or not to approve the plan.

This plan proposes measures for managing the Commercial King Crab Fishery in the Bering Sea and Aleutian Islands Area. The receipt date for this plan is _____.

Regulations proposed by the Council and based on this plan are scheduled to be published within 30 days.

Dated:

_____

Carmen J. Blondin
Deputy Assistant Administrator for
Fisheries Resource Management,
National Marine Fisheries Service