UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

MAR 2 1989

MEMORANDUM FOR: Distribution*

FROM: F/CM - Joe P. Clem

SUBJECT: Secretarial Review of the Fishery Management Plan for Commercial King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands (FMP)

The North Pacific Fishery Management Council has submitted the subject FMP for Secretarial review, approval, and implementation under the Magnuson Fishery Conservation and Management Act (Magnuson Act).

This FMP will not be implemented by any final rulemaking due to the extent to which it provides the State of Alaska with the lead role for management of these fisheries. However, the FMP provides that the Secretary of Commerce may supercede State of Alaska preseason and inseason actions in the Exclusive Economic Zone if any such regulations are found not to conform with the FMP's objectives, the Magnuson Act, or other applicable Federal law through a review and appeal procedure available to the public.

Please provide your comments (including "no comment") on this FMP by March 20. If you have any questions, please call Mark Millikin at 427-2343.

Attachments

*Distribution

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# ENVIRONMENTAL ASSESSMENT

# FOR THE

# BERING SEA/ALEUTIAN ISLANDS KING AND TANNER CRAB

# FISHERY MANAGEMENT PLAN

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Revised by

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North Pacific Fishery Management Council

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## 1.0 INTRODUCTION

The king crab fisheries in the exclusive economic zone (EEZ) of the United States (3-200 miles offshore) and the territorial sea of the State of Alaska (0-3 miles offshore) in the Bering Sea and Aleutian Islands area (BSAI) are currently managed by the State of Alaska (State) under a joint Statement of Principles with the North Pacific Fishery Management Council (Council). The Tanner Crab Fishery Management Plan (FMP) which had been in effect was repealed in 1986 and the King Crab FMP which had been developed was never implemented.

The development of a new FMP for the BSAI king and Tanner crab fisheries was a response to requests for greater Federal involvement in the management of those fisheries. The new FMP addresses the management of both king and Tanner crabs because the fisheries are prosecuted similarly by many of the same vessels and because the same management approaches are appropriate for both fisheries. The State is and has been intimately involved in the management of both crab fisheries and has long-term monitoring, enforcement, and research programs in place. The perceived net benefits of utilizing the existing State programs versus developing entirely Federal programs led the Council to direct the Council's Crab Management Committee to develop a cooperative State/Federal management plan in which significant authority is deferred to the State.

### 1.1 Purpose of the Document

This document provides background information and assessments necessary for the Council and Secretary of Commerce to evaluate the FMP alternatives with respect to the Magnuson Act and other applicable law. Other principal statutory requirements that this document is intended to satisfy are the National Environmental Policy Act (NEPA), the Regulatory Flexibility Act (RFA), and Executive Order 12291 (E.O. 12291). It was initially prepared by the Council's Crab Plan Team and later revised by the Council staff following the direction of the Council's Crab Management Committee.

#### 1.1.1 Environmental Assessment (EA)

Part of the analysis in this document provides an EA that is required by NOAA to comply with NEPA. The purpose of the EA is to analyze the potential impacts on the quality of the human environment of major Federal actions and serve as a means of determining if significant environmental impacts could result from a proposed action. If the action is determined not to be significant, the EA will result in a finding of no significant impact (FONSI). This EA then would be the final environmental document required by NEPA. If a FONSI cannot be made, then a more detailed environmental impact statement (EIS) must be prepared. An EIS must be prepared if the proposed action may be reasonably expected to: (1) jeopardize the productive capability of the target resource species or any related stocks that may be affected by the action, (2) allow substantial damage to the ocean and coastal habitats, (3) have a substantial adverse impact on public health or safety, (4) affect adversely an endangered or threatened species or a marine mammal population, or (5) result in cumulative impacts that could have a substantial adverse effect on the target resource species or any related stocks that may be affected by the action. Following the end of the public review of this document, the Council could determine that the FMP will have significant impacts on the human environment, and proceed directly with preparation of an EIS.

Certain management alternatives assessed in this document may have some impact on the environment. Measures, such as those affecting harvests of stocks, may result in environmental changes either directly through the actual removal of crab from the ecosystem or indirectly as an incidental result of harvest operations. Environmental impacts of management measures may be beneficial when they accomplish their primary intended effects. Conversely, adverse environmental impacts may be associated with unintended outcomes, or may be necessary if other more important objectives are to be met.

Other environmental impacts that may occur as a result of fishery management practices include changes in predator-prey relations among invertebrates and vertebrates (including marine mammals and birds), and

nutrient changes due to processing and dumping of crab wastes. Given the natural variability in the environment and current capability to measure it, however, changes in the ecosystem due to changes in management measures that affect king and Tanner crab removals are expected to be difficult to detect.

### 1.1.2 Regulatory Impact Review (RIR)

Another part of this document is the RIR that is required by NOAA for all regulatory actions or for significant policy changes that are of public interest. The RIR: (1) provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action, (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 systematically and comprehensively considers all reasonable alternatives so that the public welfare can be enhanced in the most efficient and cost effective way. The RIR is intended to serve as input in the decision-making process, not as a vehicle for justification of a proposed course of action.

The RIR also serves as the basis for determining whether any proposed regulations are major under criteria provided by E.O. 12291 and whether proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with RFA.

The primary purpose of the RFA is to relieve small businesses, small organizations, and small governmental jurisdictions (collectively, "small entities") of 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 effect on a substantial number of small entities.

The analysis in this document estimates the impacts that regulations implementing the described fishery management plan (FMP) alternatives would have on the king and Tanner crab fisheries in the BSAI. It also provides a description and an estimate of the number of vessels (small entities) to which these regulations would apply.

**[Editor's Note: The Alaska Regional Office of NOAA Fisheries has advised the Council that the proposed FMP will not require federal rulemaking to implement; therefore, an RIR or initial RFA analyses are not formally required. However, these analyses are included in this EA for purposes of the administrative record.]**

## 1.2 FMP Objectives

The goal of king and Tanner crab management is to maximize the overall long-term benefit to the nation of BSAI stocks of king and Tanner crabs by coordinated Federal and State management, consistent with responsible stewardship for conservation of the crab resources and their habitat. More specific objectives are defined in terms of biological conservation, economic and social benefits, gear conflicts, habitat protection, vessel safety, due process, and research in Chapter 7 of the FMP.

## 1.3 Problem Statement

In the absence of king and Tanner crab FMPs, the State is managing king and Tanner crab fisheries in the BSAI in cooperation with the Federal Government.

A king crab FMP, which delegated significant management authority to the State, was approved by the Secretary of Commerce in 1984. However, full implementation of its management measures was deferred pending acceptance of the delegation of authority by the Governor. In 1986 the Governor declined to accept the delegation of authority. His principal objections were: excessive Federal oversight, uncertainties in the regulatory approval process, unnecessary governmental duplication, and concern with the degree to which discretionary authority of the Alaska Board of Fisheries would be constrained.

From late 1978 until late 1986, Tanner crab fisheries in the BSAI and the Gulf of Alaska were managed under a Tanner crab FMP. It was amended nine times before being repealed. The Tanner crab FMP was repealed because it failed to conform to several of the MFCMA national standards. In particular, it was found to be insufficiently flexible to provide either: (1) management based on the best scientific information available, or (2) timely coordination of management with the State.

There are two problems of particular concern that result from not having king and Tanner crab FMPs. One problem is defined by the following two concerns of what may happen without an FMP: (1) non-resident fishermen and processors may not have adequate access to the management process, and (2) their preferences may not be adequately considered. Because non-residents account for the majority of the BSAI crab fisheries in terms of numbers of vessels, catch, and processing, it is important that they be adequately represented in the management process.

Another problem is that, without an FMP, it may not be possible to extend fishery regulations to all vessels. Currently, the State is only able to enforce its fishery management regulations for vessels which are registered with the State. However, vessels which do not enter State waters are not required, by State law, to register. This provides catcher/processor vessels and fishing vessels which deliver to at-sea processors the option of not being subject to any fishery regulations in the absence of an FMP. This problem is diminished to the extent that companies insuring or financing vessels often require that they be registered in Alaska. The FMP would assume that all vessels would be covered by existing regulations, although it would not require vessels to register with the State.

The mere presence of an FMP, however, is not a solution for all management problems. This is clearly demonstrated by the frequent amendments to and the eventual repeal of the Tanner crab FMP, and by the refusal of the State to accept the delegation of authority under the king crab FMP. Sources of potential problems include the following: (1) the Federal regulatory system may not be able to provide the effective, efficient, and timely management of fisheries in which there can be rapidly changing conditions; (2) some individuals may prefer State management to management under an FMP because they believe the former will be more responsive to their interests and opinions; (3) the State may reduce its crab research, enforcement, and other management activities if it believes an FMP places significant constraints on its management authority; and (4) there may be duplication of management regulations and effort.

It is the Council's intention to implement a king and Tanner crab FMP for the BSAI that will, to the greatest extent possible, prevent potential problems that might arise in the absence of an FMP while averting those associated with having an FMP. It is clear that compromises will be required to achieve this result. It is also the Council's intention to implement such an FMP without further undue delay.

## 1.4 Description of Alternatives

Three explicit FMP alternatives are defined in this document. They are: (1) the status quo in which the State manages the BSAI king and Tanner crab fisheries in the absence of an FMP, (2) the FMP developed by the Council's Crab Management Committee to defer significant authority to the State, and (3) an FMP in which most management measures can only be changed by a plan amendment and in which no authority is deferred to the State.

Each of the three alternatives consists of a unique combination of seven procedures for changing the specifics of 23 individual management measures. The first three measures are treated as definitions and not listed as management measures in the Draft FMP. The seven procedures are as follows:

1. Alaska Department of Fish and Game emergency order procedure.

2. Alaska Department of Fish and Game emergency order procedure constrained by an FMP framework.

3. Council/Regional Director inseason management authority procedure specified by an FMP framework.

4. Alaska Board of Fisheries annual decision making procedure.

5. Alaska Board of Fisheries annual decision making procedure constrained by FMP frameworks.

6. Council/Regional Director annual decision making procedure specified by FMP frameworks.

7. FMP amendment procedure.

Note that throughout this document the term "Regional Director" refers to both the Secretary of Commerce and the Regional Director to whom the Secretary has delegated specific authority.

With the exception of one of the 23 management measures, the three FMP alternatives differ only with respect to the procedures for changing management measures. This is because the initial specifications of the other 22 measures are the same for any of the three alternatives. The exception, which is for permit requirements, is discussed in Section 4.8.

The differences among the three alternatives in terms of which procedure would be used to change the specifics of each of the 23 management measures are summarized in Table 1.1. The first and third alternatives are almost polar cases with respect to the procedures that would be used, and the second alternative falls in between.

The evaluations of the individual procedures and measures in Chapters 3 and 4 are intended to provide information that will permit a comparison among the three explicit FMP alternatives as well as other alternatives that could be defined by different combinations of the seven procedures.

Table 1.1

Summary of Differences Among Three FMP Alternatives in Terms of the Procedure to be used to Change the Specifics of Each of 23 Management Measures.

| Management Measures a/ | Alt. 1 | Alt. 2 | Alt. 3 |
|---|---|---|---|
| 1. Fishery Management Unit | Board | Category 1 | FMP Amendment |
| 2. MSY | " | " | " |
| 3. OY | " | " | " |
| 4. Legal Gear | " | " | " |
| 5. Pot Limits | " | Category 2 | " |
| 6. Sex Restrictions | " | Category 2 | " |
| 7. Registration Areas | " | Category 2 | " |
| 8. Permit Requirements | " | Category 1 | " |
| 9. Observer Requirements | " | Category 1 and 3 b/ | " |
| 10. Bycatch Limits | " | Category 3 | " |
| 11. Limited Access | " | Category 1 | " |
| 12. Closed Waters | " | Category 2 | " |
| 13. Minimum Size Limits | " | Category 2 | " |
| 14. Guideline Harvest Levels | " | " | C/RD with FW1 |
| 15. Inseason Adjustments | ADF&G | " | " |
| 16. Area Boundaries | Board | " | FMP Amendment |
| 17. Fishing Seasons | " | " | C/RD with FW1 |
| 18. Reporting Requirements | " | Category 3 | FMP Amendment |
| 19. Gear Placement and Removal | " | " | " |
| 20. Gear Storage | " | " | " |
| 21. Vessel Tank Inspections | " | " | " |
| 22. Gear Modifications | " | " | " |
| 23. Other Measures | " | " | " |

Notation: Alt 1 = status quo (i.e., no FMP)
Alt 2 = an FMP that defers much authority to the State
Alt 3 = an FMP that defers little authority to the State
Board = Alaska Board of Fisheries annual decision procedure
ADF&G = ADF&G emergency order procedure
C/RD = Council/Regional Director
with FW1 = with a more specific FMP framework
with FW2 = with a less specific FMP framework
Category 1 = Fixed in FMP
Category 2 = Frameworked in FMP with FW1
Category 3 = Frameworked in FMP with FW2 (discretion of State)

a/ Measures 1-3 are boundary parameters of the plan. Management measures 4-12a, 12b-16, and 17-23 are FMP Alternative 2 Category 1, 2, and 3 management measures, respectively, as described in the FMP.

b/ Federal observer requirements would be implemented as a Category 1 measure; State observer requirements would be implemented as a Category 3 measure.

As noted in Table 1.1, there are two types of frameworks with FMP Alternative 2. The first type is more tightly defined in that it is more specific concerning the process and criteria for changing a management measure. It would be used for what are referred to as Category 2 measures in the Draft FMP which describes FMP Alternative 2. It would also be used for the two measures frameworked in FMP Alternative 3. The second type only requires that the justifications for a change be included in an annual report to the Council but not necessarily the meeting at which the Alaska Board of Fisheries takes final action. Such justifications would necessarily be in terms of the objectives of the FMP.

Note that the frameworked measures with FMP Alternative 3 are limited to guideline harvest levels (GHLs) and inseason authority. The frameworks for these two measures differ between the second and third FMP alternatives only in terms of who makes the final decisions; the types of information to be used do not differ. With respect to the GHL frameworks, the final decision makers are the Alaska Board of Fisheries (Board) and the Council/Regional Director (C/RD), respectively, for the second and third FMP alternatives. With respect to the inseason authority frameworks, the decision makers are the Commissioner of the Alaska Department of Fish and Game (Commissioner) and the C/RD, respectively.

Although a large number of alternative FMPs can be defined by different combinations of the features of the three alternatives, there are possible FMP alternatives that cannot be defined this way. Such alternatives cannot be readily analyzed with the information presented in this document. For example, management with size, sex, and season restrictions but without guideline harvest levels (GHLs) is not considered. Similarly, management with limited access is not considered.

There are two reasons for excluding such alternatives. First, the additional time required to evaluate, select, and implement management measures that are significantly different than those currently being used would prevent the timely implementation of an FMP. Second, once an FMP is in place and it has been demonstrated that a different approach is appropriate, it can be implemented by the FMP amendment process. The three FMP alternatives differ only in terms of who makes the management decisions and the constraints under which the decision makers must operate.

## 1.5 Methods of Analyses

The analysis of the expected effects of the three alternative FMPs includes evaluations of the procedures and evaluations of the individual measures. These evaluations are prerequisites to the development of the EA and the RIR.

The descriptive data on the harvest exvessel value (gross receipts of fishermen), price, and participation in the BSAI king and Tanner crab fisheries is presented in Chapter 2, and provide a basis for the evaluations of the procedures and measures in Chapters 3 and 4, respectively. The evaluations are qualitative rather than quantitative. Chapter 5, the EA, and Chapter 6, the RIR, are to a great extent summaries of the environmental and economic impacts discussed in Chapters 3 and 4.

## 2.0 AN OVERVIEW OF THE KING AND TANNER CRAB FISHERIES IN THE BERING SEA AND ALEUTIAN ISLANDS

King and Tanner crab fisheries in the Bering Sea/Aleutian Islands areas (BSAI) have undergone dramatic changes since 1979. Tables 2.1-2.4 provide a general overview of catch, exvessel value, exvessel price, and number of vessels in the BSAI king and Tanner crab fisheries, as well as composite statistics for comparable fisheries in the Gulf of Alaska management area. Separate listings are made for king crab, and for the C. bairdi and C. opilio Tanner crab species.

Table 2.1 reveals two significant developments in this region's crab harvest. Most notable is the rapid decline of king crab harvest in the Bristol Bay area. From a high of 130 million lbs in 1980, this fishery produced an average of only 2.8 million lbs during 1982-85. Bristol Bay harvest for 1986 rebounded slightly to approximately 11.0 million lbs and then to 12.1 million lbs in 1987. Also noteworthy is the decline in C. bairdi crab harvest in the Bering Sea. The Bering Sea harvest of C. bairdi crab fell from 42.5 million lbs in 1979 to 1.2 million lbs in 1984, rebounded to 3.2 million lbs in 1985 and was closed in 1986 and 1987.

In all, 1987 BSAI crab production was diminished 45% relative to 1980; king crab harvests were reduced by over 81% and C. bairdi harvests were reduced by over 99%. Harvest of king crab in other areas of Alaska also plummeted during this period with the 1985 harvest being only 1% of that in 1980. Within the BSAI, a 155% increase in C. opilio harvest in the Bering Sea and a 2,788% increase in king crab harvest in Adak resulted in those two areas increasing their overall harvest during the period. In terms of actual pounds, however, the Bristol Bay reduction was over one and a half times the rest of the state harvest in 1980. While C. bairdi production in the rest of Alaska was not as severely impacted, 1986 harvest was only about 30% of that in 1980.

Throughout this period of decline in the harvest of king crab and C. bairdi, C. opilio has assumed a more important role in the BSAI region. As shown in Tables 2.1 and 2.2, the harvest of C. opilio has risen from relative unimportance to contributing roughly 80% of the poundage and 40% of the value of all king and Tanner crab harvested in the region. Within the BSAI, C. opilio has only been harvested in quantity in the Bering Sea regulatory area. No C. opilio harvest has taken place throughout the remainder of the State.

The trend in the exvessel value of harvest, for all species combined within the BSAI region, was one of steady decline from 1980 through 1984 followed by a steady rise from 1985 through 1987. The rebound was due to greatly increased exvessel prices per pound for all species, related primarily to the yen-dollar relationship. Over the period 1980 to 1987 exvessel revenues generated by harvest of these species fell by only 4%.

Throughout the rest of the State the decline in value due to a 60% drop in C. bairdi harvest (1980-85) was nearly offset by the concurrent 130% increase in price. King crab, however, fell from contributing 50% to the value of crab harvest in 1980 to just 6% in 1985. Thus, overall crab harvests in the remainder of the State are valued at just half of what they had been five years earlier.

As shown in Table 2.3, exvessel prices for king crab and C. bairdi crab rose between 1980 and 1983 in conjunction with reduced harvest throughout the region. Somewhat surprisingly, although king crab harvest continued to fall throughout 1984-85, prices also fell about 30%-35% over the two-year period. Even with this drop, prices remained higher than they had been prior to 1982. This price drop may have signaled some substitution away from king crab in the seafood marketplace. Prices rose steeply in 1986 and dropped only slightly in 1987, related to the yen-dollar exchange rate. With the exception of 1982, C. opilio prices oscillated between 25 and 35 cents a pound. This changed in 1986 and 1987 with price increases again tied to the exchange rate. Overall, the 1987 exvessel price for king and C. bairdi crab were over 3 times the 1980 exvessel price while the C. opilio price was over 2.5 times as great. King crab and C. bairdi prices for 1979-1985, throughout the remainder of the State, have exhibited movements similar to those within the BSAI region.

The vessel data provided in Table 2.4 reveals the involvement of the region's crabbers in the king crab harvest. From 1979 through 1985, consistently less than 10%-15% of the region's king and Tanner crab boats did not derive some of their earnings from king crab. In contrast, this percentage climbed from 25% to 85% in 1985 for the remainder of the State.

Also evident in the Table 2.4 data is the volatile nature of the BSAI crab fisheries. Since 1980 the number of vessels participating in the crab fisheries declined dramatically before returning to high levels in 1987. The most likely explanation for the fluctuation in effort is the extreme decline in king crab abundance during this period and the increased market for C. opilio Tanner crab.

Data in Tables 2.5 and 2.6 indicate the catch and percentage of catch, respectively, by residence of the vessel operator, for king crab and both Tanner crab species. Tables 2.7 and 2.8 similarly present the number and percentage of vessels, respectively. It is important to note that these tables, as well as those numbered 2.9-2.12, do not include all of the data presented in the first four tables. In addition to vessel records, which may be missing the appropriate residence or length coding, requirements protecting the confidentiality of vessels providing harvest information imply that some data are not reportable.

Over 70% of the BSAI region's king crab harvest was taken by residents of states other than Alaska (non-residents) from 1979 through 1984. Increased resident harvest in the Adak area and sporadic harvest in the largely non-resident Bristol Bay fishery combined to increase the overall resident share in 1985 through 1987. C. bairdi fisheries in the region have been characterized by greater fluctuation in residence composition, and although non-residents harvest the majority of C. bairdi throughout most of the region, the reverse is true in the Dutch Harbor area. So few vessels fished for C. bairdi in 1986 and 1987 that the data are confidential. The C. opilio fishery in the Bering Sea remains a predominantly non-resident fishery.

The total number of vessels fishing in the BSAI region declined from a high of 375 in 1980 to 159 in 1985 (Table 2.7). Although cumulative totals are not available for 1986 and 1987, it would seem that the total number of vessels has increased approaching 1980. The number of king crab vessels fishing in Bristol Bay was virtually the same in 1980 and 1987. However, the resident proportion of vessels (Table 2.8) had increased from 35% to 51%. This trend towards an increase in the proportion of resident vessels was evident in all king crab fisheries with the exception of Dutch Harbor. The Dutch Harbor fishery was also the only one showing a decline in any magnitude of the number of vessels participating, a decrease of 80%. The Adak fishery had an increase of 570% in the number of vessels fishing from 1980 to 1987.

The C. bairdi fishery has seen a dramatic decrease in the number of vessels participating, primarily related to the closure of the Bering Sea in 1986 and 1987. Resident participation increased in the Dutch Harbor area during the period and decreased in the Adak area. The C. opilio fishery has had a 20% increase in the number of vessels during the period, almost all by non-residents.

A significant difference exists between the residence composition of the BSAI and the rest of the State. The former has consistently experienced over 60% non-resident vessels and 70% non-resident harvest. Only in the Dutch Harbor C. bairdi fishery has resident harvest been greater than that of non-residents for any year since 1979. On the other hand, in the remainder of the State resident boats have consistently accounted for over 90% of the crab fleet. With the exception of 1983--the year of the Bristol Bay closure--residents have also contributed more than 80% of the yearly harvest in the remainder of the State.

A comparison of the vessel and catch percentages for resident and non-resident vessels reveals that, in most cases, residents have a higher percentage of vessels than catch. This implies a generally lower catch-per-vessel for resident boats (without relating vessel size to catch).

Data in Tables 2.9 and 2.10 illustrate the cumulative distributions of resident and non-resident vessels within 5 length classes for king crab and the Tanner species, respectively. In nearly all cases, the distributions indicate that larger percentages of resident boats are of shorter length than are those of non-residents. Unfortunately, the data for 1986 and 1987 are not available.

Table 2.11 includes mean vessel lengths for resident and non-resident vessels in each of the king and Tanner crab fisheries discussed previously. Table 2.12 similarly shows values for the harvest of C. opilio and for all species combined within each area.

With the exception of only four instances in the four years from 1982-85, the average length of non-resident vessels was slightly greater than that of resident vessels in each of the cases presented in the two tables. For most crab fisheries within the BSAI region, the mean length of non-resident boats has tended to remain more stable than that of residents.

Throughout the rest of the State, size has tended to be considerably smaller, with the average vessel size only about 60% of that for a representative vessel from the BSAI fleet. And, while the size of resident vessels outside the BSAI has remained roughly the same since 1979, non-resident vessels have increased in size, and are now much closer to their BSAI counterparts. Their numbers are generally so small, however, that they do not significantly affect the rest-of-State average.

Subsistence harvests of king crab occur in Norton Sound and in the vicinity of St. Lawrence and Little Diomede Islands. All of these are isolated areas where local residents traditionally depend on the harvest of wild animals. Nome, population 3,876 in 1985, lately has accounted for approximately 5,000 subsistence king crab yearly. Most are harvested through holes in the ice and harvest levels are dependent on ice conditions. A commercial fishery in the Nome area also exists during the winter but harvest in 1987 was about 2,100 crab (Lean, pers. comm.). The three island communities, total population 1,139 in 1985, account for an additional 5,000 subsistence crab per year. Some of these crab are distributed to extended families in Nome.

Table 2.1

Crab Harvest by Area and Species (1,000's of pounds)

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| Dutch Harbor[1/] | | | | | | | | | |
| King | 13,112 | 16,974 | 7,048 | 3,256 | 1,425 | 2,962 | 1,912 | 1,860 | 1,359 |
| Bairdi | 1,092 | 880 | 325 | 740 | 548 | 240 | 185 | 126 | 69 |
| All species | 14,204 | 17,854 | 7,373 | 3,996 | 1,973 | 3,202 | 2,097 | 1,986 | 1,428 |
| Bering Sea | | | | | | | | | |
| King | 10,876 | 12,861 | 16,430 | 14,023 | 12,912 | 4,659 | 2,624[2/] | 2,077 | 2,539 |
| Bairdi | 42,518 | 36,614 | 29,732 | 11,009 | 5,274 | 1,208 | 3,151 | 0 | 0 |
| Opilio | 33,325 | 39,593 | 43,934 | 29,355 | 26,128 | 26,813 | 65,998 | 97,590 | 100,925 |
| All species | 86,719 | 89,068 | 90,096 | 54,387 | 44,314 | 32,680 | 71,773 | 99,667 | 103,464 |
| Adak | | | | | | | | | |
| King | 808 | 466 | 2,797 | 5,234 | 12,292 | 5,335 | 11,931 | 12,025 | 13,457 |
| Bairdi | 197 | 337 | 221 | 1,079 | 558 | 196 | 39 | 72 | 123 |
| All species | 1,005 | 803 | 3,018 | 6,313 | 12,850 | 5,531 | 11,970 | 12,097 | 13,580 |
| Bristol Bay | | | | | | | | | |
| King | 107,790 | 129,965 | 33,814 | 3,001 | 0 | 4,182 | 4,175[2/] | 10,990 | 12,135 |
| All BS/AI | | | | | | | | | |
| King | 132,586 | 160,266 | 60,089 | 25,514 | 26,629 | 17,138 | 20,642 | 26,952 | 29,490 |
| Bairdi | 43,807 | 37,831 | 30,278 | 12,828 | 6,380 | 1,644 | 3,562 | 198 | 192 |
| Opilio | 33,325 | 39,593 | 43,934 | 29,355 | 26,128 | 26,813 | 65,905 | 97,590 | 100,925 |
| All species | 209,718 | 237,690 | 134,301 | 67,697 | 59,137 | 45,595 | 90,109 | 124,740 | 130,607 |
| Rest of Alaska | | | | | | | | | |
| King | 21,725 | 27,484 | 29,820 | 14,727 | 1,338 | 1,765 | 1,096 | 214 | NA |
| Bairdi | 55,553 | 44,715 | 27,009 | 29,724 | 30,263 | 22,072 | 18,433 | 13,663 | NA |
| All species | 77,278 | 72,199 | 56,829 | 44,451 | 31,601 | 23,837 | 19,529 | 13,877 | NA |

Source: Condensed gross earnings data base, Alaska Commercial Fisheries Entry Commission (1979-1987).

1/ 1982 Dutch Harbor harvest of opilio (3,000 lbs. by 5 boats) is not included in any of the tables.

2/ 1985 Bristol Bay and Bering Sea king harvests were obtained from the Westward Region Shellfish Report, Alaska Board of Fisheries, 1987.

Table 2.2

Exvessel Value of Crab Harvest by Area and Species ($1,000's)

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| Dutch Harbor | | | | | | | | | |
| King | 10,960 | 15,058 | 7,200 | 6,697 | 4,374 | 6,593 | 3,257 | 5,300 | 3,883 |
| Bairdi | 634 | 547 | 170 | 940 | 648 | 233 | 246 | 188 | 143 |
| All species | 11,594 | 15,605 | 7,370 | 7,637 | 5,022 | 6,826 | 3,503 | 5,488 | 4,026 |
| Bering Sea | | | | | | | | | |
| King | 9,779 | 11,494 | 15,599 | 32,085 | 29,532 | 7,860 | 4,544 | 5,197 | 7,927 |
| Bairdi | 24,192 | 21,201 | 18,015 | 15,958 | 6,265 | 1,428 | 4,632 | 0 | 0 |
| Opilio | 10,747 | 11,022 | 11,051 | 17,045 | 9,199 | 7,804 | 22,046 | 53,382 | 74,836 |
| All species | 44,718 | 43,717 | 44,665 | 65,088 | 44,996 | 17,092 | 31,222 | 58,579 | 82,763 |
| Adak | | | | | | | | | |
| King | 1,033 | 373 | 2,863 | 10,745 | 36,326 | 13,966 | 35,793 | 34,133 | 38,712 |
| Bairdi | 103 | 175 | 147 | 1,213 | 616 | 185 | 53 | 124 | 218 |
| All species | 1,136 | 548 | 2,983 | 11,958 | 36,942 | 14,151 | 35,846 | 34,257 | 38,930 |
| Bristol Bay | | | | | | | | | |
| King | 101,107 | 117,860 | 42,688 | 7,882 | 0 | 10,524 | 12,107 | 44,432 | 45,300 |
| All BS/AI | | | | | | | | | |
| King | 122,879 | 144,785 | 68,323 | 57,409 | 70,232 | 38,944 | 55,701 | 89,062 | 95,822 |
| Bairdi | 24,929 | 21,923 | 18,332 | 18,111 | 7,529 | 1,846 | 4,931 | 312 | 361 |
| Opilio | 10,747 | 11,022 | 11,051 | 17,045 | 9,199 | 7,804 | 22,046 | 53,382 | 74,836 |
| All species | 158,555 | 177,730 | 97,706 | 92,565 | 86,960 | 48,594 | 82,678 | 142,756 | 171,019 |
| Rest of Alaska | | | | | | | | | |
| King | 25,953 | 29,558 | 54,848 | 49,204 | 4,683 | 4,729 | 1,781 | NA | NA |
| Bairdi | 36,618 | 29,665 | 20,000 | 47,628 | 37,702 | 26,345 | 27,993 | NA | NA |
| All species | 62,571 | 59,223 | 74,848 | 96,832 | 42,385 | 31,074 | 29,774 | NA | NA |

Source: Condensed gross earnings data base, Alaska Commercial Fisheries Entry Commission (1979-1987).

Table 2.3

Exvessel Value of Crab Price-Per-Pound (of total landings)
by Area and Species ($)

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| Dutch Harbor | | | | | | | | | |
| King | 0.84 | 0.89 | 1.02 | 2.057 | 3.07 | 2.23 | 1.70 | 2.85 | 2.86 |
| Bairdi | 0.58 | 0.62 | 0.52 | 1.270 | 1.18 | 0.97 | 1.33 | 1.49 | 2.07 |
| All species | 0.82 | 0.87 | 1.00 | 1.911 | 2.55 | 2.13 | 1.67 | 2.76 | 2.82 |
| Bering Sea | | | | | | | | | |
| King | 0.90 | 0.89 | 0.95 | 2.29 | 2.29 | 1.69 | 1.73 | 2.50 | 3.12 |
| Bairdi | 0.57 | 0.58 | 0.61 | 1.45 | 1.19 | 1.18 | 1.39 | 0 | 0 |
| Opilio | 0.32 | 0.28 | 0.25 | 0.58 | 0.35 | 0.29 | 0.34 | 0.55 | 0.74 |
| All species | 0.52 | 0.49 | 0.50 | 1.20 | 1.02 | 0.52 | 0.44 | 0.59 | 0.80 |
| Adak | | | | | | | | | |
| King | 1.28 | 0.80 | 1.01 | 2.05 | 2.96 | 2.62 | 1.85 | 2.84 | 2.88 |
| Bairdi | 0.52 | 0.52 | 0.67 | 1.12 | 1.10 | 0.94 | 1.36 | 1.72 | 1.77 |
| All species | 1.13 | 0.68 | 0.99 | 1.89 | 2.88 | 2.56 | 1.84 | 2.83 | 2.87 |
| Bristol Bay | | | | | | | | | |
| King | 0.94 | 0.91 | 1.26 | 2.63 | --- | 2.52 | 2.94 | 4.04 | 3.73 |
| All BS/AI | | | | | | | | | |
| King | 0.93 | 0.90 | 1.14 | 2.25 | 2.64 | 2.27 | 2.10 | 3.30 | 3.25 |
| Bairdi | 0.57 | 0.58 | 0.61 | 1.41 | 1.18 | 1.12 | 1.38 | 1.58 | 1.88 |
| Opilio | 0.32 | 0.28 | 0.25 | 0.58 | 0.35 | 0.29 | 0.34 | 0.55 | 0.74 |
| All species | 0.76 | 0.75 | 0.73 | 1.37 | 1.47 | 1.07 | 0.70 | 1.14 | 1.31 |
| Rest of Alaska | | | | | | | | | |
| King | 1.20 | 1.08 | 1.84 | 3.34 | 3.50 | 2.68 | 1.63 | NA | NA |
| Bairdi | 0.66 | 0.66 | 0.74 | 1.60 | 1.25 | 1.19 | 1.52 | NA | NA |
| All species | 0.81 | 0.82 | 1.32 | 2.18 | 1.34 | 1.30 | 1.53 | NA | NA |

Source: Condensed gross earnings data base, Alaska Commercial Fisheries Entry Commission (1979-1987).

Table 2.4

Number of Vessels Landings by Area and Species

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| Dutch Harbor | | | | | | | | | |
| King | 96 | 129 | 141 | 121 | 73 | 50 | 12 | 19 | 26 |
| Bairdi | 18 | 18 | 25 | 33 | 24 | 16 | 7 | 19 | 8 |
| All species | 99 | 132 | 143 | 126 | 84 | 61 | 19 | NA | NA |
| Bering Sea | | | | | | | | | |
| King | 104 | 117 | 126 | 155 | 184 | 96 | 79 | 56 | 111 |
| Bairdi | 143 | 156 | 169 | 130 | 117 | 41 | 56 | closed | |
| Opilio | 102 | 140 | 150 | 122 | 110 | 53 | 81 | 219 | 174 |
| All species | 183 | 211 | 215 | 188 | 202 | 106 | 153 | NA | NA |
| Adak | | | | | | | | | |
| King | 13 | 18 | 52 | 95 | 173 | 142 | 59 | 80 | 121 |
| Bairdi | 6 | 10 | 9 | 64 | 47 | 37 | 6 | 8 | 13 |
| All species | 13 | 18 | 52 | 95 | 173 | 143 | 60 | NA | NA |
| Bristol Bay | | | | | | | | | |
| King | 234 | 237 | 178 | 91 | 0 | 89 | 128 | 160 | 234 |
| All BS/AI | | | | | | | | | |
| King | 265 | 359 | 326 | 258 | 219 | 183 | 147 | NA | NA |
| Bairdi | 156 | 172 | 190 | 164 | 156 | 83 | 67 | NA | NA |
| Opilio | 102 | 140 | 150 | 127 | 111 | 53 | 81 | NA | NA |
| All species | 270 | 377 | 344 | 266 | 238 | 193 | 169 | NA | NA |
| Rest of Alaska | | | | | | | | | |
| King | 492 | 358 | 448 | 539 | 179 | 138 | 69 | NA | NA |
| Bairdi | 502 | 486 | 413 | 526 | 571 | 559 | 458 | NA | NA |
| All species | 650 | 556 | 558 | 686 | 676 | 603 | 474 | NA | NA |
| Percentage of vessels not landing king crab | | | | | | | | | |
| All BS/AI | 1.85 | 4.77 | 5.23 | 3.01 | 7.98 | 5.18 | 13.02 | NA | NA |
| Rest of Alaska | 24.31 | 35.61 | 19.71 | 21.43 | 73.52 | 77.11 | 85.44 | NA | NA |

Source: Condensed gross earnings data base, Alaska Commercial Fisheries Entry Commission (1979-1987).

Table 2.5

Crab Harvest by Residence of Licensed Operator (1000's of lbs.) 1/

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| King Crab | | | | | | | | | |
| Dutch Harbor | | | | | | | | | |
| Resident 2/ | 3,277 | 7,314 | 2,109 | 861 | 444 | 945 | 443 | 282 | 186 |
| Non-resident | 9,029 | 8,679 | 3,098 | 1,695 | 761 | 1,930 | 1,263 | 1,578 | 1,173 |
| Total | 12,306 | 15,993 | 5,207 | 2,556 | 1,205 | 2,875 | 1,706 | 1,860 | 1,359 |
| Bering Sea | | | | | | | | | |
| Resident | 2,288 | 2,079 | 2,227 | 2,276 | 3,098 | 920 | 1,819 | 484 | 595 |
| Non-resident | 8,289 | 10,321 | 13,251 | 11,409 | 9,572 | 3,664 | 4,952 | 1,593 | 1,944 |
| Total | 10,577 | 12,400 | 15,478 | 13,685 | 12,670 | 4,584 | 6,771 | 2,077 | 2,539 |
| Adak | | | | | | | | | |
| Resident | 173 | 103 | 268 | 958 | 3,928 | 1,629 | 3,031 | 4,082 | 4,631 |
| Non-resident | 512 | 363 | 2,516 | 3,911 | 7,965 | 3,401 | 3,249 | 7,943 | 8,826 |
| Total | 685 | 466 | 2,784 | 4,869 | 11,893 | 5,030 | 6,280 | 12,025 | 13,457 |
| Bristol Bay | | | | | | | | | |
| Resident | 27,383 | 35,027 | 5,012 | 334 | 0 | 900 | | 3,982 | 4,521 |
| Non-resident | 74,193 | 91,634 | 28,230 | 2,566 | 0 | 3,215 | 3/ | 7,008 | 7,614 |
| Total | 101,576 | 126,661 | 33,242 | 2,900 | 0 | 4,115 | | 10,990 | 12,135 |
| All BS/AI | | | | | | | | | |
| Resident | 33,121 | 44,523 | 9,616 | 4,429 | 7,470 | 4,394 | 5,293 | 8,830 | 9,933 |
| Non-resident | 92,023 | 110,997 | 47,095 | 19,581 | 18,298 | 12,210 | 9,464 | 18,122 | 19,557 |
| Total | 125,144 | 155,520 | 56,711 | 24,010 | 25,768 | 16,604 | 14,757 | 26,952 | 29,490 |
| Rest of Alaska | | | | | | | | | |
| Resident | 19,784 | 26,670 | 28,184 | 13,506 | 1,296 | 1,675 | 788 | NA | NA |
| Non-resident | 1,614 | 801 | 1,396 | 767 | 40 | 57 | 308 | NA | NA |
| Total | 21,398 | 27,471 | 29,580 | 14,273 | 1,336 | 1,732 | 1,096 | NA | NA |
| Bairdi Crab | | | | | | | | | |
| Dutch Harbor | | | | | | | | | |
| Resident | | 399 | 209 | 348 | 315 | 164 | | 4/ | 4/ |
| Non-resident | | 481 | 94 | 392 | 233 | 76 | | 4/ | 4/ |
| Total | | 880 | 303 | 740 | 548 | 240 | | 126 | 69 |
| Bering Sea | | | | | | | | | |
| Resident | 8,639 | 6,439 | 3,328 | 2,011 | 518 | 207 | 451 | | |
| Non-resident | 32,430 | 28,972 | 25,547 | 8,666 | 4,661 | 936 | 2,518 | | |
| Total | 41,069 | 35,411 | 28,875 | 10,677 | 5,179 | 1,143 | 2,969 | 0 | 0 |
| Adak | | | | | | | | | |
| Resident | | 49 | | 91 | 51 | 85 | | 4/ | 4/ |
| Non-resident | | 288 | | 987 | 505 | 69 | | 4/ | 4/ |
| Total | | 337 | | 1,078 | 556 | 154 | | 72 | 123 |

Table 2.5 cont.

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| All BS/AI | | | | | | | | | |
| Resident | 9,411 | 6,887 | 3,537 | 2,450 | 884 | 456 | 617 | 4/ | 4/ |
| Non-resident | 32,569 | 29,741 | 25,862 | 10,045 | 5,399 | 1,081 | 2,518 | 4/ | 4/ |
| Total | 41,980 | 36,628 | 29,399 | 12,495 | 6,283 | 1,537 | 3,135 | 198 | 192 |
| Rest of Alaska | | | | | | | | | |
| Resident | 51,278 | 40,856 | 25,543 | 26,866 | 22,509 | 18,177 | 16,087 | NA | NA |
| Non-resident | 4,099 | 3,301 | 855 | 2,853 | 7,590 | 3,827 | 2,150 | NA | NA |
| Total | 55,377 | 44,157 | 26,398 | 29,719 | 30,099 | 22,004 | 18,237 | NA | NA |
| Opilio Crab | | | | | | | | | |
| Bering Sea | | | | | | | | | |
| Resident | 10,590 | 8,679 | 7,868 | 4,527 | 4,525 | 4,454 | 12,470 | 19,899 | 22,654 |
| Non-resident | 21,278 | 30,202 | 34,975 | 24,190 | 20,959 | 22,140 | 51,053 | 77,691 | 78,271 |
| Total | 31,868 | 38,881 | 42,843 | 28,717 | 25,484 | 26,594 | 63,523 | 97,590 | 100,925 |

Source: Condensed gross earnings data base, Alaska Commercial Fisheries Entry Commission.

1/ Some data may not be reported due to confidentiality requirements; totals reflect only that catch which is identifiable by residency.
2/ Resident refers to Alaskan residents; non-residents refers to all other U.S. residents.
3/ 1985 Bristol Bay catch is included with Bering Sea harvest.
4/ Confidential data.

Table 2.6

Percentage of Crab Harvest by Residence of Licensed Operator 1/

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| King Crab | | | | | | | | | |
| Dutch Harbor | | | | | | | | | |
| Resident 2/ | 26.6 | 45.7 | 40.5 | 33.7 | 36.8 | 32.9 | 26.0 | 15.2 | 13.7 |
| Non-resident | 73.4 | 54.3 | 59.5 | 66.3 | 63.2 | 67.1 | 74.0 | 84.8 | 86.3 |
| Bering Sea | | | | | | | | | |
| Resident | 21.6 | 16.8 | 14.4 | 16.6 | 24.5 | 20.1 | 26.9 | 23.3 | 23.4 |
| Non-resident | 78.4 | 83.2 | 85.6 | 83.4 | 75.5 | 79.9 | 73.1 | 76.7 | 76.6 |
| Adak | | | | | | | | | |
| Resident | 25.3 | 22.1 | 9.6 | 19.7 | 33.0 | 32.4 | 48.3 | 33.9 | 34.4 |
| Non-resident | 74.7 | 77.9 | 90.4 | 80.3 | 67.0 | 67.6 | 51.7 | 66.1 | 65.6 |
| Bristol Bay | | | | | | | | | |
| Resident | 27.0 | 27.7 | 15.1 | 11.5 | 0.0 | 21.9 | 3/ | 32.8 | 37.3 |
| Non-resident | 73.0 | 72.3 | 84.9 | 88.5 | 0.0 | 78.1 | | 67.2 | 62.7 |
| All BS/AI | | | | | | | | | |
| Resident | 26.5 | 28.6 | 17.0 | 18.4 | 29.0 | 26.5 | 35.9 | 32.8 | 33.7 |
| Non-resident | 73.5 | 71.4 | 83.0 | 81.6 | 71.0 | 73.5 | 64.1 | 67.2 | 66.3 |
| Rest of Alaska | | | | | | | | | |
| Resident | 92.5 | 97.1 | 95.3 | 94.6 | 97.0 | 96.7 | 71.9 | NA | NA |
| Non-resident | 7.5 | 2.9 | 4.7 | 5.4 | 3.0 | 3.3 | 28.1 | NA | NA |
| Bairdi Crab | | | | | | | | | |
| Dutch Harbor | | | | | | | | | |
| Resident | | 45.3 | 69.0 | 47.0 | 57.5 | 68.3 | | 4/ | 4/ |
| Non-resident | | 54.7 | 31.0 | 53.0 | 42.5 | 31.7 | | 4/ | 4/ |
| Bering Sea | | | | | | | | | |
| Resident | 21.0 | 18.2 | 11.5 | 18.8 | 10.0 | 18.1 | 15.2 | CLOSED | |
| Non-resident | 79.0 | 81.8 | 88.5 | 81.2 | 90.0 | 81.9 | 84.8 | CLOSED | |
| Adak | | | | | | | | | |
| Resident | | 14.5 | | 8.4 | 9.2 | 55.2 | | 4/ | 4/ |
| Non-resident | | 85.5 | | 91.6 | 90.8 | 44.8 | | 4/ | 4/ |
| All BS/AI | | | | | | | | | |
| Resident | 22.4 | 18.8 | 12.0 | 19.6 | 14.1 | 29.7 | 19.7 | 4/ | 4/ |
| Non-resident | 77.6 | 81.2 | 88.0 | 80.4 | 85.9 | 70.3 | 80.3 | 4/ | 4/ |
| Rest of Alaska | | | | | | | | | |
| Resident | 92.6 | 92.5 | 96.8 | 90.4 | 74.8 | 82.6 | 88.2 | NA | NA |
| Non-resident | 7.4 | 7.5 | 3.2 | 9.6 | 25.2 | 17.4 | 11.8 | NA | NA |

Table 2.6 cont.

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| Opilio Crab | | | | | | | | | |
| Bering Sea | | | | | | | | | |
| Resident | 33.2 | 22.3 | 18.4 | 15.8 | 17.8 | 16.7 | 19.6 | 20.4 | 28.9 |
| Non-resident | 66.8 | 77.7 | 81.6 | 84.2 | 82.8 | 83.3 | 80.4 | 79.6 | 71.1 |

Source: Condensed gross earnings data base, Alaska Commercial Fisheries Entry Commission.

1/ Some data may not be reported due to confidentiality requirements.
2/ Resident refers to Alaskan residents; non-residents refers to all other U.S. residents.
3/ 1985 Bristol Bay catch is included with Bering Sea harvest.
4/ Confidential data.

Table 2.7

Crab Vessels by Residence of Licensed Operator 1/

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| King Crab | | | | | | | | | |
| Dutch Harbor | | | | | | | | | |
| Resident 2/ | 36 | 73 | 46 | 36 | 18 | 17 | 4 | 5 | 7 |
| Non-resident | 61 | 56 | 61 | 70 | 27 | 30 | 11 | 14 | 19 |
| Total | 97 | 129 | 107 | 106 | 45 | 47 | 15 | 19 | 26 |
| Bering Sea | | | | | | | | | |
| Resident | 25 | 25 | 24 | 32 | 57 | 28 | 50 | 21 | 35 |
| Non-resident | 79 | 92 | 95 | 125 | 131 | 66 | 88 | 35 | 76 |
| Total | 104 | 117 | 119 | 157 | 188 | 94 | 138 | 56 | 111 |
| Adak | | | | | | | | | |
| Resident | 4 | 4 | 6 | 21 | 56 | 47 | 25 | 25 | 37 |
| Non-resident | 9 | 14 | 45 | 68 | 120 | 84 | 32 | 55 | 84 |
| Total | 13 | 18 | 51 | 89 | 176 | 131 | 57 | 80 | 121 |
| Bristol Bay | | | | | | | | | |
| Resident | 81 | 83 | 37 | 15 | 0 | 31 | | 76 | 115 |
| Non-resident | 157 | 154 | 149 | 74 | 0 | 56 | 3/ | 84 | 119 |
| Total | 238 | 237 | 186 | 89 | 0 | 87 | | 160 | 234 |
| All BS/AI | | | | | | | | | |
| Resident | 113 | 162 | 92 | 75 | 86 | 72 | 59 | NA | NA |
| Non-resident | 172 | 213 | 215 | 186 | 149 | 114 | 100 | NA | NA |
| Total | 285 | 375 | 307 | 261 | 235 | 186 | 159 | NA | NA |
| Rest of Alaska | | | | | | | | | |
| Resident | 463 | 350 | 426 | 502 | 174 | 128 | 63 | NA | NA |
| Non-resident | 30 | 6 | 21 | 39 | 5 | 8 | 7 | NA | NA |
| Total | 493 | 356 | 447 | 541 | 179 | 136 | 70 | NA | NA |
| Bairdi Crab | | | | | | | | | |
| Dutch Harbor | | | | | | | | | |
| Resident | 15 | 13 | 18 | 17 | 15 | 12 | 5 | 4 | 7 |
| Non-resident | | 5 | 6 | 17 | 9 | 5 | | 5 | 1 |
| Total | 15 | 18 | 24 | 34 | 24 | 17 | 5 | 9 | 8 |
| Bering Sea | | | | | | | | | |
| Resident | 49 | 44 | 42 | 32 | 27 | 8 | 17 | | CLOSED |
| Non-resident | 105 | 117 | 132 | 102 | 99 | 34 | 43 | | CLOSED |
| Total | 154 | 161 | 174 | 134 | 126 | 42 | 60 | | |
| Adak | | | | | | | | | |
| Resident | | 5 | | 10 | 11 | 17 | | 6 | 4 |
| Non-resident | 4 | 5 | 9 | 51 | 33 | 15 | | 2 | 9 |
| Total | 4 | 10 | 9 | 61 | 44 | 32 | | 8 | 13 |
| All BS/AI | | | | | | | | | |
| Resident | 59 | 56 | 57 | 48 | 48 | 34 | 25 | NA | NA |
| Non-resident | 108 | 121 | 138 | 124 | 117 | 47 | 46 | NA | NA |
| Total | 167 | 177 | 195 | 172 | 165 | 81 | 71 | NA | NA |

Table 2.7 cont.

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| Rest of Alaska | | | | | | | | | |
| Resident | 475 | 460 | 384 | 481 | 471 | 492 | 432 | NA | NA |
| Non-resident | 27 | 30 | 17 | 6 | 103 | 62 | 26 | NA | NA |
| Total | 502 | 490 | 401 | 487 | 574 | 554 | 458 | NA | NA |
| Opilio Crab | | | | | | | | | |
| Bering Sea | | | | | | | | | |
| Resident | 36 | 46 | 40 | 30 | 28 | 7 | 25 | 34 | 48 |
| Non-resident | 69 | 98 | 120 | 101 | 90 | 48 | 66 | 185 | 126 |
| Total | 105 | 144 | 160 | 131 | 118 | 55 | 91 | 219 | 174 |

Source: Condensed gross earnings data base, Alaska Commercial Fisheries Entry Commission.

1/ Some data may not be reported due to confidentiality requirements; totals reflect only the vessels which are identifiable by residency.
2/ Resident refers to Alaskan residents; non-residents refers to all other U.S. residents.
3/ 1985 Bristol Bay catch is included with Bering Sea harvest.

Table 2.8

Percentage of Crab Vessels by Residence of Licensed Operator 1/

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| King Crab | | | | | | | | | |
| Dutch Harbor | | | | | | | | | |
| Resident 2/ | 37.1 | 56.6 | 43.0 | 34.0 | 40.0 | 36.2 | 26.7 | 26.3 | 26.9 |
| Non-resident | 62.9 | 43.4 | 57.0 | 66.0 | 60.0 | 63.8 | 73.3 | 73.7 | 73.1 |
| Bering Sea | | | | | | | | | |
| Resident | 24.0 | 21.4 | 20.2 | 20.4 | 30.3 | 29.8 | 36.2 | 37.5 | 31.5 |
| Non-resident | 76.0 | 78.6 | 79.8 | 79.6 | 69.7 | 70.2 | 63.8 | 62.5 | 68.5 |
| Adak | | | | | | | | | |
| Resident | 30.8 | 22.2 | 11.8 | 23.6 | 31.8 | 35.9 | 43.9 | 31.3 | 30.6 |
| Non-resident | 69.2 | 77.8 | 88.2 | 76.4 | 68.2 | 64.1 | 56.1 | 68.7 | 69.4 |
| Bristol Bay | | | | | | | | | |
| Resident | 34.0 | 35.0 | 19.9 | 16.9 | 0.0 | 35.6 | 3/ | 47.5 | 49.1 |
| Non-resident | 66.0 | 65.0 | 80.1 | 83.1 | 0.0 | 64.4 | | 52.5 | 50.9 |
| All BS/AI | | | | | | | | | |
| Resident | 39.6 | 43.2 | 30.0 | 28.7 | 36.6 | 38.7 | 37.1 | NA | NA |
| Non-resident | 60.4 | 56.8 | 70.0 | 71.3 | 63.4 | 61.3 | 62.9 | NA | NA |
| Rest of Alaska | | | | | | | | | |
| Resident | 93.9 | 98.3 | 95.3 | 92.8 | 97.2 | 94.1 | 90.0 | NA | NA |
| Non-resident | 6.1 | 1.7 | 4.7 | 7.2 | 2.8 | 5.9 | 10.0 | NA | NA |
| Bairdi Crab | | | | | | | | | |
| Dutch Harbor | | | | | | | | | |
| Resident | | 72.2 | 75.0 | 50.0 | 62.5 | 70.6 | | 44.4 | 87.5 |
| Non-resident | | 27.8 | 25.0 | 50.0 | 37.5 | 29.4 | | 55.6 | 12.5 |
| Bering Sea | | | | | | | | | |
| Resident | 31.8 | 27.3 | 24.1 | 23.9 | 21.4 | 19.0 | 28.3 | CLOSED | |
| Non-resident | 68.2 | 72.7 | 75.9 | 76.1 | 78.6 | 81.0 | 71.7 | CLOSED | |
| Adak | | | | | | | | | |
| Resident | | 50.0 | | 16.4 | 25.0 | 53.1 | | 75.0 | 30.8 |
| Non-resident | | 50.0 | | 83.6 | 75.0 | 46.9 | | 25.0 | 69.2 |
| All BS/AI | | | | | | | | | |
| Resident | 35.3 | 31.6 | 29.2 | 27.9 | 29.1 | 42.0 | 35.2 | NA | NA |
| Non-resident | 64.7 | 68.4 | 70.8 | 72.1 | 70.9 | 58.0 | 64.8 | NA | NA |
| Rest of Alaska | | | | | | | | | |
| Resident | 94.6 | 93.9 | 95.8 | 98.8 | 82.1 | 88.8 | 94.3 | NA | NA |
| Non-resident | 5.4 | 6.1 | 4.2 | 1.2 | 17.9 | 11.2 | 5.7 | NA | NA |

Table 2.8 cont.

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| Opilio Crab | | | | | | | | | |
| Bering Sea | | | | | | | | | |
| Resident | 34.3 | 31.9 | 25.0 | 22.9 | 23.7 | 12.7 | 27.5 | 15.5 | 27.6 |
| Non-resident | 65.7 | 68.1 | 75.0 | 77.1 | 76.3 | 87.3 | 72.5 | 84.5 | 72.4 |

Source: Condensed gross earnings data base, Alaska Commercial Fisheries Entry Commission.

1/ Some data may not be reported due to confidentiality requirements.
2/ Resident refers to Alaskan residents; non-residents refers to all other U.S. residents.
3/ 1985 Bristol Bay catch is included with Bering Sea harvest.

Table 2.9

Cumulative Percentage of King Crab Vessels by Size Class
for Alaskan Residents and Non-residents 1/

| | 1979 | | 1980 | | 1981 | | 1982 | | 1983 | | 1984 | | 1985 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Res | Non-res | Res | Non-res | Res | Non-res | Res | Non-res | Res | Non-res | Res | Non-res | Res | Non-res |
| Dutch Harbor | | | | | | | | | | | | | | |
| 1-50' | 46.9 | 0.0 | 30.0 | 16.7 | 35.6 | 0.0 | 18.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 51-75' | 68.8 | 15.4 | 58.6 | 35.2 | 68.9 | 27.3 | 59.4 | 14.1 | 23.5 | 0.0 | 0.0 | 13.8 | 13.0 | 0.0 |
| 76-100' | 100.0 | 73.1 | 92.9 | 85.2 | 100.0 | 83.6 | 100.0 | 65.6 | 76.5 | 50.0 | 42.9 | 44.8 | 71.7 | 0.0 |
| 101-125' | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.3 | 100.0 | 79.3 | 100.0 | 100.0 |
| 126'+ | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Bering Sea | | | | | | | | | | | | | | |
| 1-50' | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 51-75' | 0.0 | 0.0 | 0.0 | 0.0 | 28.6 | 6.7 | 22.2 | 5.9 | 10.5 | 6.2 | 0.0 | 6.3 | 9.4 | 5.9 |
| 76-100' | 35.0 | 38.0 | 42.9 | 39.8 | 66.7 | 50.0 | 66.7 | 45.8 | 61.4 | 43.4 | 76.9 | 35.9 | 70.3 | 42.4 |
| 101-125' | 80.0 | 78.9 | 81.0 | 80.7 | 100.0 | 83.3 | 100.0 | 86.4 | 93.0 | 82.2 | 100.0 | 81.3 | 100.0 | 83.5 |
| 126'+ | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Adak | | | | | | | | | | | | | | |
| 1-50' | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 |
| 51-75' | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.5 | 5.2 | 0.0 | 0.0 | | 0.0 |
| 76-100' | | 0.0 | | 0.0 | 0.0 | 30.8 | 31.3 | 28.1 | 63.5 | 40.9 | 68.2 | 43.6 | | 43.3 |
| 101-125' | | 0.0 | | 100.0 | 100.0 | 74.4 | 100.0 | 70.3 | 100.0 | 81.7 | 90.9 | 83.3 | | 83.3 |
| 126'+ | | 100.0 | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | | 100.0 |
| Bristol Bay | | | | | | | | | | | | | | |
| 1-50' | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2/ | 2/ |
| 51-75' | 5.1 | 6.9 | 0.0 | 4.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 76-100' | 60.8 | 48.6 | 53.8 | 45.0 | 26.5 | 37.4 | 45.5 | 35.6 | 0.0 | 0.0 | 85.2 | 30.2 | | |
| 101-125' | 84.8 | 85.4 | 87.2 | 83.4 | 82.4 | 82.7 | 100.0 | 79.5 | 0.0 | 0.0 | 100.0 | 79.2 | | |
| 126'+ | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 | 0.0 | 100.0 | 100.0 | | |

1/ Some data may not be reported due to confidentiality requirements.
2/ 1985 Bristol Bay vessels are included with Bering Sea vessels.

Table 2.10

Cumulative Percentage of Bairdi Crab Vessels by Size Class
for Alaskan Residents and Non-residents 1/

| | 1979 | | 1980 | | 1981 | | 1982 | | 1983 | | 1984 | | 1985 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Res | Non-res | Res | Non-res | Res | Non-res | Res | Non-res | Res | Non-res | Res | Non-res | Res | Non-res |
| Dutch Harbor | | | | | | | | | | | | | | |
| 1-50' | 66.7 | | 100.0 | | 69.2 | | 53.8 | 0.0 | 42.9 | 0.0 | 100.0 | | 100.0 | |
| 51-75' | 100.0 | | 100.0 | | 69.2 | | 100.0 | 46.2 | 71.4 | 100.0 | 100.0 | | 100.0 | |
| 76-100' | 100.0 | | 100.0 | | 100.0 | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | | 100.0 | |
| 101-125' | 100.0 | | 100.0 | | 100.0 | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | | 100.0 | |
| 126'+ | 100.0 | | 100.0 | | 100.0 | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | | 100.0 | |
| Bering Sea | | | | | | | | | | | | | | |
| 1-50' | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 44.4 | 0.0 |
| 51-75' | 0.0 | 6.9 | 0.0 | 7.8 | 0.0 | 9.4 | 20.7 | 5.1 | 0.0 | 6.2 | 0.0 | 0.0 | 44.4 | 10.5 |
| 76-100' | 57.1 | 56.4 | 45.2 | 47.8 | 58.3 | 51.2 | 65.5 | 54.1 | 69.6 | 56.7 | 100.0 | 32.3 | 100.0 | 55.3 |
| 101-125' | 85.7 | 89.1 | 83.3 | 84.3 | 100.0 | 89.8 | 100.0 | 89.8 | 100.0 | 90.7 | 100.0 | 83.9 | 100.0 | 100.0 |
| 126'+ | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Adak | | | | | | | | | | | | | | |
| 1-50' | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 51-75' | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 76-100' | | | | | | 100.0 | 40.0 | 41.7 | 100.0 | 31.3 | 100.0 | 28.6 | | |
| 101-125' | | | | | | 100.0 | 100.0 | 83.3 | 100.0 | 78.1 | 100.0 | 71.4 | | |
| 126'+ | | | | | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | | |

1/ Some data may not be reported because of confidentiality requirements.

Table 2.11

Mean Crab Vessel Length (in feet)
by Species, Area, and Residency 1/

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|
| King Crab | | | | | | | |
| Dutch Harbor | | | | | | | |
| Resident 2/ | 67 | 71 | 63 | 73 | 93 | 101 | 98 |
| Non-resident | 89 | 82 | 85 | 96 | 105 | 110 | 104 |
| Bering Sea | | | | | | | |
| Resident | 118 | 106 | 101 | 93 | 98 | 95 | 97 |
| Non-resident | 109 | 108 | 106 | 105 | 109 | 109 | 105 |
| Adak | | | | | | | |
| Resident | 135 | 133 | 133 | 113 | 99 | 97 | 102 |
| Non-resident | 140 | 123 | 115 | 114 | 109 | 106 | 107 |
| Bristol Bay | | | | | | | |
| Resident | 101 | 104 | 117 | 107 | NA | 91 | 3/ |
| Non-resident | 105 | 108 | 110 | 109 | NA | 110 | |
| All BS/AI | | | | | | | |
| Resident | 90 | 88 | 87 | 90 | 96 | 97 | 98 |
| Non-resident | 103 | 102 | 102 | 104 | 108 | 108 | 105 |
| All Vessels | 99 | 96 | 97 | 101 | 103 | 104 | 101 |
| Rest of Alaska | | | | | | | |
| Resident | 55 | 53 | 58 | 56 | 54 | 50 | 55 |
| Non-resident | 73 | 66 | 67 | 68 | 67 | 77 | 98 |
| All Vessels | 57 | 53 | 58 | 57 | 54 | 52 | 59 |
| Bairdi Crab | | | | | | | |
| Dutch Harbor | | | | | | | |
| Resident | 55 | 56 | 57 | 60 | 60 | 50 | 51 |
| Non-resident | 67 | 81 | 83 | 76 | 81 | 85 | 90 |
| Bering Sea | | | | | | | |
| Resident | 100 | 107 | 99 | 96 | 98 | 113 | 85 |
| Non-resident | 102 | 106 | 102 | 101 | 102 | 110 | 98 |
| Adak | | | | | | | |
| Resident | 122 | 133 | NA | 110 | 93 | 87 | NA |
| Non-resident | 125 | 122 | 113 | 107 | 113 | 110 | NA |

Table 2.11 cont.

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|
| All BS/AI | | | | | | | |
| Resident | 90 | 96 | 87 | 86 | 87 | 77 | 82 |
| Non-resident | 100 | 105 | 102 | 100 | 102 | 110 | 100 |
| All Vessels | 97 | 101 | 98 | 97 | 98 | 96 | 93 |
| Rest of Alaska | | | | | | | |
| Resident | 54 | 56 | 58 | 57 | 57 | 54 | 54 |
| Non-resident | 68 | 84 | 82 | 81 | 90 | 94 | 90 |
| All Vessels | 56 | 59 | 59 | 59 | 64 | 59 | 56 |

Source: Condensed gross earning data base, Alaska Commercial Fisheries Entry Commission (1979-1985).

1/ Table does not include vessels of less than thirty feet, or those missing residence or length data.
2/ Resident refers to Alaskan residents; non-residents refers to all other U.S. residents.
3/ 1985 Bristol Bay vessels are included in Bering Sea.

Table 2.12

Mean Crab Vessel Length (in feet)
by Species, Area, and Residency 1/

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|
| Opilio Crab | | | | | | | |
| Bering Sea | | | | | | | |
| Resident 2/ | 100 | 101 | 98 | 97 | 99 | 118 | 103 |
| Non-resident | 101 | 104 | 104 | 101 | 102 | 108 | 104 |
| All BS/AI | | | | | | | |
| Resident | 100 | 101 | 98 | 89 | 97 | 118 | 103 |
| Non-resident | 101 | 104 | 104 | 101 | 102 | 108 | 104 |
| All Vessels | 101 | 102 | 102 | 99 | 102 | 108 | 104 |
| All Species | | | | | | | |
| Dutch Harbor | | | | | | | |
| Resident | 67 | 71 | 63 | 71 | 79 | 79 | 75 |
| Non-resident | 89 | 83 | 85 | 94 | 100 | 106 | 96 |
| Bering Sea | | | | | | | |
| Resident | 103 | 100 | 98 | 96 | 98 | 97 | 94 |
| Non-resident | 105 | 106 | 104 | 104 | 107 | 111 | 105 |
| Adak | | | | | | | |
| Resident | 135 | 133 | 133 | 113 | 99 | 97 | 102 |
| Non-resident | 140 | 123 | 115 | 113 | 109 | 106 | 107 |
| Bristol Bay | | | | | | | |
| Resident | 101 | 104 | 117 | 107 | NA | 91 | NA |
| Non-resident | 105 | 108 | 110 | 109 | NA | 110 | 107 |
| All BS/AI | | | | | | | |
| Resident | 90 | 88 | 87 | 91 | 92 | 92 | 92 |
| Non-resident | 103 | 101 | 101 | 103 | 106 | 108 | 104 |
| All Vessels | 98 | 95 | 96 | 99 | 101 | 101 | 98 |
| Rest of Alaska | | | | | | | |
| Resident | 55 | 55 | 58 | 56 | 56 | 54 | 54 |
| Non-resident | 73 | 81 | 74 | 77 | 90 | 94 | 94 |
| All Vessels | 57 | 57 | 59 | 58 | 61 | 59 | 57 |

Source: Condensed gross earning data base, Alaska Commercial Fisheries Entry Commission (1979-1985).

1/ Table does not include vessels of less than thirty feet, or those missing residence or length data.
2/ 1985 Bristol Bay vessels are included in Bering Sea.

## 3.0 EVALUATION OF PROCEDURES FOR CHANGING INDIVIDUAL MANAGEMENT MEASURES

As noted in Section 1.4, the principal differences among the three FMP alternatives are the combinations of procedures that would be used to change individual management measures. Each of the three FMPs is defined by a unique combination of the 7 procedures for changing the 23 management measures. The 7 procedures are again as follows:

1. Alaska Department of Fish and Game emergency order procedure.

2. Alaska Department of Fish and Game emergency order procedure constrained by an FMP framework.

3. Council/Regional Director inseason management authority procedure specified by an FMP framework.

4. Alaska Board of Fisheries annual decision making procedure.

5. Alaska Board of Fisheries annual decision making procedure constrained by FMP frameworks.

6. Council/Regional Director annual decision making procedure specified by FMP frameworks.

7. FMP amendment procedure.

The first three procedures are for inseason management changes and the last four are for preseason and long-term changes. The procedures themselves differ in terms of who makes the decisions concerning changes to the individual management measures and what constraints are placed on the decision makers. The constraints affect the amount of discretionary power a decision maker has, the types of information that are used in decision making, the timeliness of the procedure, and the cost to the management agencies of a procedure.

The two decision makers considered are the State, where the State refers to the Alaska Board of Fisheries (Board) and the Commissioner of the Alaska Department of Fish and Game (Commissioner), and the Council/Regional Director (C/RD). The three sets of constraints considered are those specified by what will be referred to as the State, FMP framework, and FMP amendment processes. There are also additional Federal constraints, some of which would be the same regardless of which FMP alternative is implemented. For example, all fishery management measures used in the U.S. EEZ must be in compliance with the MFCMA National Standards regardless of which FMP alternative is chosen. Other federal law such as the National Marine Mammal Protection Act and the National Environmental Policy Act all have guidelines which must be conformed to.

The evaluation of the 7 procedures is in terms of the following four criteria: (1) assurance that the interests and opinions of all U.S. residents will be given adequate consideration; (2) ability to produce timely responses to changes in fishery conditions or our understanding of them; (3) assurance that decision makers are well informed; and (4) the cost to management agencies of using a procedure. These interdependent criteria reflect the concerns submitted in past public comment to the Council. While not all of these concerns may be an issue, for completeness they are addressed in this analysis.

The evaluations of the procedures in terms of these criteria follow general statements concerning each criterion. A definitive evaluation of these procedures is difficult because the merits of a procedure in terms of the four criteria will depend heavily on three factors about which there is much speculation. These factors are: (1) the degree to which different decision makers would have or use discretionary authority; (2) the effect on the level of State support for crab management of alternative FMPs; and (3) the response of the Federal Government to any change in the level of State support.

## 3.1 Adequate Consideration of Interests and Opinions of All U.S. Residents

Many in the crab industry are opposed to delegation of any crab management authority to the State of Alaska. Much of this opposition is from residents of states other than Alaska and is based on a perception that non-residents have not received fair and equitable treatment by the Alaska Board of Fisheries. Both individuals and industry associations notified the Council of such concerns during the development of the Tanner crab FMP, its subsequent amendments, and an earlier proposed king crab FMP. Similar concerns have been raised during the drafting and review of this FMP.

The concerns some have about fair and equitable treatment are based both on the history of the State of Alaska in its treatment of residents versus non-residents in other arenas and the State's adoption of crab management measures which were opposed by non-resident industry members. Such concerns, either real or imagined, have lead the industry to request a federal FMP with legislated protection from discrimination based on residency.

An industry signed letter sent to the Regional Director concerning the repeal of the Tanner crab FMP (Aadland et al, 1986) listed a series of court cases, all concerning attempts by the State to discriminate against non-residents. Cited in the letter were several nonfishing related cases ranging from a limit on the hiring of non-Alaskans on public construction projects (Robinson v. Francis, 713 P.2d 259 (Alas. 1986)) to distribution of dividends from Alaska's permanent fund based on length of residency in the State (Zobel v. Williams, 457 U.S. 55 (1982)). In addition, a short history of similar cases involving the fishing industry from 1924 (Haavik v. Alaska Packers Assoc., 263 U.S. 510) to 1987 (North Pacific Fishing Vessel Owners' Assoc. v. Sheffield, No. A 84-054 1985 Civil (D. Alas.)) was presented to substantiate the perception of a parochial view on the part of the State. It should be noted that all of the cases were decided against discrimination and that the latter case was concerned with the extension of Alaska State Tanner crab regulations into the U.S. EEZ.

Several items should be considered concerning cases of State discrimination. First, Alaska is only one of many states which have passed regulations and subsequently had them overturned due to discrimination. It is apparent that many of the discrimination cases referenced by the industry were decided in State courts (Haavik occurred before statehood), demonstrating that the Alaska court system is responsive to such pleas. Much of the concerns of discrimination concerning crab regulations are based on Board actions taken several or more years ago and often concerning regulations in the Gulf of Alaska. The Gulf crab fisheries were characterized, at that time at least, by small, local crab vessels and larger, non-local vessels especially from out of state. This is in contrast to the fisheries considered in this FMP where most of the vessels, both large and small, are non-local. Since most vessels are non-local to the fishing area, the Board would be expected to have less impetuous to implement regulations which would favor local residents over others (historically, non-residents).

In particular, industry concerns seem to center on potential discrimination due to the use of registration areas and pot limits. The use of these management measures is described in greater detail in Sections 4.7 and 4.5, respectively. The following examples give some description of non-resident concerns with each management measure. However, over the years, disagreements with the Board on a variety of management measures has been couched in terms of discrimination by state of residency.

During the earlier days of crab fishing in the Bering Sea, the majority of the large vessels were owned by non-Alaskans, a ratio which has since changed (Chapter 2). Therefore, any regulation that disadvantaged larger vessels was disproportionately borne by non-residents. The Board passed several regulations which gave certain advantages to local vessels (exclusive registration area surrounding Dutch Harbor) or small vessels (proposed Tanner crab pot limits near Kodiak Island). Since these regulations disadvantaged larger vessels, there was a perception by some crabbers that the Board was discriminating against non-residents.

The establishment of exclusive registration areas has in the past been criticized by some industry members as a veiled attempt at restricting participation by non-residents. Some industry members cited the designation of the Dutch Harbor area as an exclusive registration area as one example of the state discriminating against non-residents (NPFVOA, 1980). They stated that exclusive registration was proposed by a few local fishermen but protested by non-resident fishermen, a majority. By restricting the movement of vessels, especially large ones, between areas, it was argued that non-resident's vessels would be disproportionately disadvantaged and barred from access to the resource. As Table 2.8 shows, the percentage of non-residents fishing in the Dutch Harbor area did increase in the year following the decision (1980). However, the occurrence was short lived and the percentages of residents and non-residents quickly returned to a level consistent with that before the change in registration area and has since decreased from the 1979 level by 27%.

The Board's use of pot limits to reduce the number of pots larger vessels are permitted to fish is interpreted by many of the concerned industry members as an attempt to discriminate against participants based on state of residency. On average in the past, non-Alaskan participants operated larger vessels than Alaskan residents (Tables 2.9-2.12). Although the data are not presented, it is probable that a high proportion of the smaller vessels are local to the fishing area rather than from other ports in Alaska or other states.

The pot limit concerns held by fishermen have some basis in fact, at least concerning limits to discriminate against large vessels. The Board instituted a pot limit on a Kodiak Tanner crab fishery in 1983 and extended it into the EEZ. This limit was challenged in court by a group of non-resident fishermen and was eventually repealed by the Board. The Council felt that the limits were not for conservation purposes but to favor smaller vessels and therefore did not institute similar regulations in the EEZ. Similar Board proposals have not been made for the area covered by this FMP.

Industry concerns have also been raised about such legislation as Alaska Subsistence Law SLA-151 which states that in the event of a resource shortage, the Board of Fisheries must grant subsistence users a priority allocation based on several criteria. Subsistence priority use provisions for Federal lands in Alaska are included in the Alaska Native Claims Settlement Act (16 USC 3114) and the State has based its statutes on them. Federal public lands can be closed to subsistence hunting only for public safety, administration, or to assume the continued viability of a particular fish or wildlife population [16 USC 3126(b)]. In response to these State and federal subsistence statutes, the FMP incorporates the established State commercial fishery closed areas around several communities (Section 4.12).

Although not necessarily concerned with discrimination by residency, an incident concerning fishing seasons illustrates some of the concerns of non-residents in terms of petitions to the Board. The timing of fishing seasons, as described in Section 4.17, can influence how many vessels can participate in various fisheries and areas, the vessel size composition of the fleet, and can affect product yield and quality. In 1981 the Alaska Crab Institute (ACI), an association based in Seattle but, at the time, representing a majority of the western Alaska crab packers in addition to some fishing vessels, requested the Board to change the king crab season date to a later time (ACI, 1981). The purpose of the proposal was to increase yield per crab which they reported had been low the prior year due to late molting. By means of written explanation concerning the defeat of the request, the State listed seven reasons the Board did not act including economic repercussions in the processing sector, fishermen's operating costs, support at the meeting for retention of the status quo, and several reasons relating to the need for uniform opening dates by the State. The use of uniform opening dates as one means of controlling harvesting effort seems to have been a prime factor in the Board's decision. In addition, the Board has stated that it is beneficial to keep the season opening date consistent to allow for planning on the part of both processors and harvesters.

Letters to the Council indicate that many crab industry members who are non-residents view the Alaska Board of Fisheries as being mandated to make decisions which promote and protect the interests of Alaskan residents. They also feel that participation in the Board process has been difficult due to meeting schedules, locations, and the memberships of advisory committees. They have stated that generally they must bring suit in the Alaska court system in order to challenge a Board action (NPFVOA, 1980). Other industry

members, including many who are non-residents, have pointed out that the crab fisheries have been effectively managed by the State of Alaska for the benefit of all fishermen. These fishermen stressed the conservative nature of State fisheries policies and cited both Federal and State Constitution rights which preclude discrimination by State of residency (ACC, 1987).

The Board of Fisheries, operating under the statutes of the State of Alaska, includes as one of its founding principles "the conservation and development of the fishery resources of the state" [AS 16.05.221(a)]. This has been interpreted to authorize the Board, for instance, to require a 48-hour notice to move between salmon fishing areas even though it burdens one competing subgroup of commercial users over another [Meier v. State, Bd. of Fisheries, 739 p. 2d 172 (1987)]. Likewise, the different treatment of various user groups such as commercial, sport fish, and subsistence is not prohibited to the Board [Kenai Peninsula Fisherman's Coop. Assn. v. State, 628 p. 2d 897 (1981)]. This later case illustrates that the Board can allocate between competing interests but must articulate their reasons clearly and arrive at a decision which balances the competing user groups (Stewart, 1988). The Statutes have not, however, been interpreted to allow the Board to discriminate against non-residents in a developed fishery.

The Board is also required to establish criteria for allocation of fishery resources including such factors as the number of residents and non-residents who have participated or can reasonably be expected to participate in a fishery [AS 16.05.251(e)]. The Board is not required to use all of the factors in every allocation decision (5 AAC 39.205) and the Board has not done so concerning residency (Spengler, 1988).

Allocating commercial fishing opportunities based on state of residency would potentially violate at least two provisions of the U.S. Constitution (Spengler, 1988). These two provisions, Article I, Section 8, clause 3 (the commerce clause) and Article IV, Section 2 (the privileges and immunities clause) state that the federal government shall have the right to regulate commerce between the states and citizens shall have the same privileges and immunities in all states.

Any allocation decision which purposefully allocated commercial fishing opportunities based on residency would probably violate the commerce clause, based on Hughes vs. Oklahoma, 441 U.S. 322, 336 (1979). One exception noted in the decision was if the implementing statute serves a legitimate local purpose and no alternative was available. In Robison vs. Francis, 713 p. 2d 259, 263 (AK 1988), the Alaska Supreme Court stated that the U.S. Commerce clause is designed to protect against residency discrimination for the purpose of economic protectionism. Any allocative Board decision considering state of residency would probably be in violation (Spengler, 1988).

Alternative 1 and Alternative 2, Categories 2 and 3 are designed in such a manner that the Council believes all crab industry participants will have improved access to the Board process. All alternatives would provide for redress of any violations of federal law. Past concerns by non-residents concerning lack of access to and review of the Board are also addressed. The Board currently provides for public input, appeals, and means of seeking relief from Board action, all within the State management and judicial system. The FMP allows for structured participation by non-residents in the Board process, NMFS review of Board actions for consistency with federal law, an annual joint State/Council public hearing in the Pacific Northwest, review of controversial inseason management by the Council, and a means of appealing to the Secretary of Commerce concerning Board actions in violation of federal law. All of these FMP safeguards are described in greater detail in Chapters 2, 9, and 10 of the FMP.

The creation of the Pacific Northwest Crab Industry Advisory Committee will allow non-resident crab industry members a direct conduit to both the Board and Council. This committee will advise the Board at the same level as other advisory boards and will also report to the Council, thereby allowing for one representative body to report to both decision making groups. When the Board and Council hold their yearly public hearing in the Pacific Northwest, this committee shall assist.

A Crab Interim Action Committee will be established by the Council and consist of a professional fishery manager representative of NMFS and the states of Alaska and Washington. This committee will provide

oversight of the FMP by reviewing all appeals to the Secretary and other industry concerns outside of the normal Council FMP review process.

Violation of federal law, including discrimination by residency, will be prevented by NMFS advising the Board on their actions and the Secretary judging appeals concerning Board action. These safeguards are expected to be sufficient to preclude any discrimination by the State, as has been alleged in the past.

### 3.2 Timely Management Responses to Changing Conditions

The biological and economic conditions of the BSAI king and Tanner crab fisheries will at times be subject to large or unexpected changes. The ability to meet management objectives is in part determined by the ability of the management system to respond to such changes. Therefore, a mechanism for timely changes is an essential component of a management system.

However, it is difficult to determine what the appropriate response time should be. One reason for this is that the determination of timeliness depends in part on how conservatively a fishery is being managed. If a fishery is managed conservatively, with a large margin for error, there will be more time to respond to a change without putting the fishery into jeopardy. Conversely, if a fishery is managed with little margin for error, a very short response time is required. The desired response time also depends on the nature of the change. Typically, a more rapid response time is required for inseason management than for interseason management, and inseason management authority diminishes the need for short response times between seasons. However, due to the amount of effort relative to the size of the quotas and regardless of the philosophy of management, crab fisheries often require very short response times in order to avoid overharvest.

### 3.3 Assurance of Well Informed Decision Makers

Ideally, the management system would assure that a change in a management measure would occur if and only if it is appropriate. Such a system would require perfect information and is, therefore, not attainable. Two elements of the appropriateness of a change have already been discussed; they are adequate representation of the affected groups and timeliness. The other element is the information available to the decision makers.

Two reasons why it is difficult to evaluate the different procedures in terms of the information that would be available to decision makers are as follows: (1) although the information explicitly required may differ among the procedures, the information that would in fact be used may be similar; and (2) the information that would be available will depend on how the State and Federal research and management information programs are coordinated and affected by the procedures used.

What the State's response will be to the implementation of a specific FMP alternative is highly speculative. The State's decision to continue to fund crab management at the current levels may depend on the FMP that is implemented, but the continued importance of the BSAI crab fisheries to the Alaska economy suggests that the State will probably continue to fund some crab programs even if the FMP that is selected defers less authority than FMP Alternative 2. There are two main reasons for this. First, the State could retain significant influence on crab management even with FMP Alternative 3 through: (1) being a major source of management related information; (2) representation on the Council; (3) participation on the crab plan team; and (4) access to the Regional Director and Secretary of Commerce. However, the State's influence would likely be diminished if it greatly reduced its crab management programs. Second, if the State significantly reduces its support, a relatively less intensive approach to crab management may be required and such a potentially fundamental change to the management approach developed by the State may not be in the State's best interest. However, changes in State revenues, which is based primarily on oil, could result in funding changes regardless of which management measure is chosen.

What the response of the Federal Government would be to any cut in State programs is equally speculative. Given the proposed Federal budget for 1989, it is not clear that NMFS would be able to replace State funding for crab management to the extent it was able to replace State funding for groundfish management in 1986. Therefore, the total funding available for BSAI crab management could be less than it currently is and the information available for the management of the resources could be reduced by an undetermined extent. If the total level of funding is reduced, there would probably be a decrease in the assurance that only well informed decisions are made even if the management approach were changed to one that is more appropriate with a lower level of funding.

## 3.4 Agency Costs

There are limited resources available to support fishery management programs both at the State and Federal levels, therefore, it is important that these resources be used effectively. This requires a cooperative and coordinated effort among State and Federal management agencies. This requirement will not be affected by the FMP alternative which is selected. A particular concern is the duplication of effort. It appears that this could be a problem with any of the alternatives being considered and that similar steps should be taken to minimize duplication of effort regardless of which alternative is implemented. The potential difference in agency costs among the alternatives is more thoroughly discussed elsewhere in Chapter 3 and in Chapter 6.

## 3.5 Procedures for Inseason Changes

### 3.5.1 ADF&G Emergency Order Procedure (FMP Alternative 1)

Each of the three FMP alternatives uses a different procedure for inseason management changes. With FMP Alternative 1, the Commissioner is the decision maker. Typically inseason changes are recommended by the State biologist responsible for a fishery, in consultation with other crab biologists, and the Commissioner decides whether to approve or deny the proposed changes. If they are approved, the changes are implemented under the emergency order authority provided to the Commissioner by the Board. This allows for timely responses to changes in conditions in a fishery at relatively low incremental costs to management agencies. Although consultation with NMFS biologists prior to taking an inseason action and a written justification of the action would not be required, they would probably often occur as they have in the past.

The constraints on this inseason authority are primarily determined by the Board (see Appendix C of the draft FMP). There are also what were defined earlier as the MFCMA and other Federal constraints. Because the principal difference among these three alternatives is the final decision maker (i.e., with Alternatives 1 and 2 it is the Commissioner, with Alternative 3 it is the RD), one alternative will be favored over the others if one decision maker is thought to be more likely to use inseason authority in a timely and adequately reviewed manner. That determination is influenced by how the choice of an FMP alternative is expected to affect the information available for inseason management. If the alternative selected results in a significant decrease in State management effort and if it is not adequately replaced with Federal effort, one would expect such an alternative to result in poorer inseason decisions. As noted in Section 3.3, it is difficult to predict what the State will do in terms of funding crab management or what the response of the Federal Government would be to a change in State funding. Currently, the State provides more timely inseason management decisions while Federal management provides for lengthier bureaucratic review.

### 3.5.2 ADF&G Emergency Order Procedure Constrained by the FMP Inseason Framework (FMP Alternative 2)

The procedure for inseason changes with the FMP Alternative 2 is the same as that of the first alternative except that the Commissioner's inseason authority is also constrained by the inseason change framework specified in the FMP. The framework lists what the State must consider in determining what changes to make and requires that a written justification of the changes be attached to the emergency order. This procedure is designed to increase the explicit accountability of the Commissioner without significantly increasing the cost or decreasing the timeliness of inseason changes because this procedure does not

require additional reviewers and decision makers to implement an inseason change. This accountability is self-imposed under State management since the Alaska Administrative Procedure Act requires such written justification.

The appeal and RD review processes specified in the FMP would probably result in more time being spent analyzing the data available to decision makers rather than collecting data. As with the other two procedures for inseason changes, timeliness and agency cost are important considerations. This alternative may increase costs slightly but would not reduce the timeliness of State response as exhibited in the past.

### 3.5.3 C/RD Inseason Management Procedure as Specified by the FMP Inseason Framework (FMP Alternative 3)

The procedure for inseason changes with the FMP Alternative 3 is similar to that of the second alternative with the exception that the Regional Director replaces the Commissioner as the decision maker. The inseason changes would be implemented under the RD's inseason management authority specified by the FMP inseason framework. The list of factors to be considered and the requirement of a written justification are the same as with FMP Alternative 2, and the flow of information from State biologists could remain the same if the State continues to provide such support. The additional step of obtaining the RD's approval and the implementation of a change through NMFS notices of adjustment would add three to seven days to the time required to make each inseason change and add as much as $12,000 to the administrative cost assuming the State continues its support. Such delays could result in potential conservation and economic problems such as fishing over quotas or GHLs, or harvesting high proportions of soft-shell crab. The importance of timeliness was discussed in Section 3.2.

## 3.6 Procedures for Preseason Changes

With the exception of the first FMP alternative, a combination of procedures for preseason management changes is specified in each alternative. Therefore, each of the four procedures is evaluated separately before summary statements are made concerning the three FMP alternatives.

### 3.6.1 Alaska Board of Fisheries Preseason Decision Making Procedure

The first procedure for preseason changes is the Board's annual decision making procedure without the constraint of FMP frameworks. This is thought to be a cost effective and timely procedure for making management changes on an annual basis if necessary. It should be noted that the Board has recently placed its shellfish management meeting on a two-year cycle in an effort to stabilize the regulatory regime since the Board does not believe that annual changes are prudent. While the Board is willing to hold annual meetings when necessary, this change in policy could diminish this procedure's timeliness advantage. In the past, there have often been only limited biological and economic analysis of proposed changes. The Board is attempting to address this problem with its two-year cycle which will provide additional time for analysis although a lack of sufficient funds and manpower could hinder such a solution.

### 3.6.2 Alaska Board of Fisheries Preseason Decision Making Procedure Constrained by FMP Frameworks

The second procedure for preseason changes is the Board's annual decision making procedure constrained by FMP frameworks. The extent of these constraints differs among the management measures because several different frameworks are specified. Typically, the frameworks require more analysis to justify a change and they explicitly include the requirement to address the economic implication of a change. These frameworks also allow for more input and review by the plan team, the Council, including its Scientific and Statistical Committee (SSC), the public, and the Pacific Northwest Crab Industry Advisory Committee. Therefore, the frameworks are expected to increase the probability that the decision makers and the public will be better informed. The frameworks and the additional federal oversight with respect to the constraints imposed by the FMP objectives are also expected to give greater review to the concerns and opinions of

all U.S. residents. The frameworks are not expected to significantly decrease the timeliness of the State's procedure for making preseason management changes.

The cost of these benefits are those required to meet the increased requirement for analysis and review. These costs are not expected to be excessive relative to the potential cost of making less fully informed decisions. The requirements for the increased analysis and review are consistent with federal laws and regulations and are not expected to result in any significant differences in timeliness of decision making.

### 3.6.3 Council/Regional Director Preseason Decision Making Procedure as Specified in FMP Frameworks

The third procedure for preseason changes is the C/RD annual decision making procedure within FMP frameworks. This procedure differs from the second in that the Board is replaced by the C/RD as the decision maker. The FMP frameworks would be similar for these two procedures with the possible exception that ADF&G would not necessarily be the lead agency in preparing the annual management report in which proposed changes are analyzed. The cost effectiveness and timeliness of this procedure are similar to those of the Board's decision making procedure constrained by FMP frameworks and will likewise provide similar assurance that decision makers will be well informed.

From a national perspective, an advantage of this procedure is that all U.S. residents are represented by the C/RD without perceived or actual discrimination. There are two potential disadvantages. First, the replacement of the Board by the Council as the decision making body would to some extent be disruptive and could result in large adjustment costs. The extent of the disruption and the associated costs would depend on how well the change in authority is planned for and understood by those affected by the change. Second, the use of this procedure could result in the State withdrawing some or all support for crab management and, therefore, result in a decrease in the assurance that decision makers are well informed if offsetting increases in Federal support are not made. As noted in Section 3.3, it is difficult to predict what the State will do in terms of funding crab management or what the response of the Federal Government would be to a change in State funding.

### 3.6.4 FMP Amendment Procedure

The FMP amendment procedure typically requires more analysis of the proposed change and more opportunities for public comment than does the C/RD annual decision procedure under FMP frameworks. As a result it is more costly to management agencies and less timely. It is, however, more likely to assure that decision makers are better informed and would probably have the same adjustment costs as replacing the State with the C/RD as the decision maker under a frameworked procedure. Because it may take a year or longer to make a change using the amendment procedure, this procedure may at times prevent the use of the best scientific information. However, the use of inseason authority can decrease the magnitude of this problem.

The expected frequency of change for a management measure and the potential cost of making an inappropriate change are important in determining whether the amendment procedure is best for a specific type of management measure. The benefits to the industry of a stable regulatory environment with respect to each type of measure are also important. The relative advantage of a cost effective and timely procedure for changing a management measure is probably greater for guideline harvest levels (GHLs) than for the other preseason management measures because the appropriate GHLs may change annually. With this one exception, it is difficult to determine whether the amendment procedure is preferable with respect to the objectives of the FMP.

### 3.6.5 Conclusions with Respect to Preseason Changes

FMP Alternative 1 makes use of only the Board's annual decision procedure for preseason changes. Therefore, it reflects the advantages and disadvantages of that procedure. These include: (1) a timely administrative procedure; (2) lower agency and adjustment costs; (3) a lack of formal representation of non-

Alaska residents on the decision making body; and (4) often limited biological and economic analyses of proposed changes.

FMP Alternative 2 makes use of the Board's preseason procedure constrained by FMP frameworks to change some management measures, and it makes use of the FMP amendment procedure to change the other measures. Compared to the procedure used in Alternative 1, both of these procedures would tend to result in more information being available to the decision makers. However, with limited funds, the increased effort focused on presenting data will reduce the amount of effort expended collecting and analyzing data. Therefore, it might be possible to arrive at a situation where greater review is given to significantly less data.

Several of the most controversial management measures could only be changed with the amendment procedure. This procedure provides the greatest assurance that adequate information is available to the decision makers and that adequate consideration is given to all expected impacts, but the replacement of the Board by the C/RD as the decision maker may result in some adjustment costs. Other controversial measures, such as minimum size limits, GHLs, area boundaries, and fishing seasons, are subject to a framework procedure that is more timely but inherently provides less opportunity for analysis prior to decision making. The appeal and RD review processes, which could often be lengthy and costly, and the Pacific Northwest Crab Industry Advisory Committee specified in FMP Alternative 2 may provide a good compromise for complete representation on the decision making body for frameworked measures.

Therefore, compared to FMP Alternative 1, FMP Alternative 2 would probably provide greater assurance that all expected impacts are given adequate consideration and that the decision makers will be better informed. However, the procedure for changing some management measures would be less timely, agency costs would be higher, and there could be the adjustment costs associated with not retaining the current procedure for changing some management measures.

FMP Alternative 3 uses the amendment procedure for all preseason changes other than changes to GHLs. A C/RD procedure specified by an FMP framework is used to change GHLs. The GHL framework provides a timely and cost effective mechanism for changing the type of preseason management measure that is expected to require frequent change. The amendment procedure is more costly and prolonged, but tends to provide more stability and greater assurance that inappropriate changes are not made. When regulations are deemed inappropriate, however, a long period of time is required to change them. There may be management measures in addition to GHLs for which a framework procedure for preseason changes is preferable to the amendment procedure.

This amendment procedure would allow lengthened review of the expected impacts, more presentation of analyses for decision makers, and due consideration of the interests and opinions of all user groups. The expected benefits of this, from a national perspective, should be compared to the expected cost of providing these benefits. A significant cost could occur: (1) if the State substantially reduces its support for king and Tanner crab management and adequate additional Federal support is not available; (2) if Federal management is less effective in managing the fisheries; (3) if the replacement of the Board by the C/RD as the decision making body is not well planned; or (4) if the changes are found to be needed in a time frame not accommodated by the amendment process.

## 4.0 EVALUATION OF INDIVIDUAL MANAGEMENT MEASURES

Many individual management measures have been used to manage crab fisheries off Alaska. Examples of these include gear, size, sex, and season restrictions, as well as guideline harvest levels, reporting and registration requirements, area closures, pot limits, and tank inspections. Each of the three alternative FMPs is a set of procedures for changing the current specifications of 23 management measures. The first three measures are treated as definitions and are not listed as management measures in the Draft FMP. The procedures were discussed in Chapter 3, the management measures are the topic of this chapter. For each individual management measure there is a discussion of the rationale for the measure, the specifics of the measure currently in effect, and the differences with respect to a measure among the three FMP alternatives. It is also noted if a specific management measure can be effectively used to change the distribution of benefits and costs among competing user groups. This is not done with the intention of suggesting that such measures would necessarily be used for that purpose, but rather to identify measures that are likely to have some allocative impacts.

As mentioned above, the EA in Chapter 5 and the RIR in Chapter 6 are principally environmental and economic summaries of the issues discussed in the previous chapter and in the remainder of this chapter. Therefore, some readers may prefer to read Chapters 5 and 6 before reading the sometimes lengthy discussions presented below.

### 4.1 Fishery Management Unit

The FMP fishery management unit would be the commercial fisheries for species of king and Tanner crab in the BSAI with alternatives two and three. Although this fishery management unit does not exist under the status quo, management is by sub units which would, at least initially, be similar under all three alternatives.

The exclusion of the Gulf of Alaska from this FMP is a controversial issue. There is probably less need for an FMP for the Gulf because the crab fisheries are much more heavily concentrated in State waters in the Gulf than in the BSAI. Even if the Gulf fisheries should be managed under an FMP, it may not be necessary or appropriate to include them at this time for the following reasons: (1) BSAI and Gulf stocks are thought to be distinct; (2) many vessels that fish in the Gulf do not fish in the BSAI and the Gulf vessels tend to be smaller; (3) the inclusion of the Gulf could delay the implementation of an FMP for the BSAI due to having to resolve the current differences between the fisheries in these two areas.

### 4.2 Maximum Sustainable Yield

The MFCMA requires that maximum sustainable yield (MSY) be specified in each FMP. MSY has had a minor role in the State's management of king and Tanner crab and would also be expected to have a minor role under an FMP.

With FMP Alternative 1, the State would neither be required to nor expected to specify MSYs. With FMP Alternatives 2 and 3, MSYs are specified in the FMP, but they would probably not be used for any other purpose. In the absence of better information, they are set equal to the average observed harvests by species and area. The MSYs in the draft FMP total 70 million pounds for king crab, 27.9 million pounds for C. bairdi, and 35 million pounds for C. opilio.

Due to the limited use of MSY, any differences in MSYs between FMP Alternative 1 and the other two FMP alternatives are not expected to affect the fisheries in any way.

### 4.3 Optimum Yield Specification

Optimum yield (OY) is another management concept that is mandated by the MFCMA. If it is specified in an FMP as a single value rather than as either a range or a procedure for establishing its value, the annual quota cannot be adjusted without a plan amendment. For this reason, numerical OYs are often stated in

terms of a range. This has resulted in the specification of OY becoming less important in terms of how the fisheries are actually managed as long as the range is large enough to accommodate the appropriate quotas based on conditions in the fisheries. The State has not used the concept of OY in managing king and Tanner crab.

With FMP Alternative 1, the State would neither be required to nor expected to specify OYs. With FMP Alternatives 2 and 3, OYs are specified in the FMP as ranges. The king crab OY range is from 0 to 200 million pounds, where the latter is the sum of the maximum observed annual harvests of individual king crab fisheries in the BSAI. The two Tanner crab OY ranges are from 0 to 108 million pounds and from 0 to 333 million pounds, respectively, for C. bairdi and C. opilio Tanner crab. The upper ends of these two OY ranges are based on estimated acceptable biological catches (ABCs) for peak levels of observed abundance. Due to the large variability in the factors affecting the appropriate annual harvest levels, the upper ends of the OY ranges greatly exceed the MSYs.

The estimated ranges of gross exvessel values associated with these OY ranges are approximately $400 million for king crab, $150 million for C. bairdi, and perhaps over $200 million for C. opilio. The range of exvessel value for king and Tanner crab together is expected to be perhaps $100 million less than the sum of the three ranges because an increase in the catch of each species is expected to also reduce the price of the other two species. The king crab estimate includes an adjustment for the lower exvessel price expected at the high end of the king crab OY range. Preliminary exvessel price models indicate that: (1) a 100 million pound increase in the king crab harvest would decrease the exvessel price by $1.25 a pound; (2) the prices of Tanner crab are dependent on the price and harvest of king crab; and (3) Tanner crab prices are not well explained by changes in Tanner crab catches (Terry and Hastie, 1988). An alternative king crab price model by Matulich, Hanson, and Mittelhammer (1987) includes a coefficient on catch that is not significantly different, but due to the nature of their model, that coefficient cannot be used alone to estimate the effect on the exvessel price of a change in king crab harvest.

As with the other FMPs in which OY ranges are used, management measures other than the OY ranges are used to limit annual harvests to the appropriate levels. For this reason and because these OY ranges are probably large enough to permit the appropriate annual harvest levels without an FMP amendment, the difference between Alternative 1 and the other two FMP alternatives with respect to OY is not expected to affect the fisheries in any way.

## 4.4 Legal Gear

Gear restrictions can be used to decrease: (1) the bycatch of fish and shellfish whose retention is prohibited, (2) the discard mortality resulting from such bycatch, and (3) the mortality resulting from lost gear. The retention of bycatch may be prohibited either by other management measures in the king and Tanner crab FMP or by FMPs and regulations for other fisheries. Such restrictions impose costs on the crab fleets if legal gear is more expensive to purchase and use or if it reduces catch per unit of effort. Gear restrictions also increase enforcement costs and may affect both habitat and conflicts with other fisheries.

Under State regulations, pots are currently the only legal gear for capturing king crab in the BSAI, while pots, ring nets, and diving gear are the only legal gear for capturing Tanner crab. This gear must have an escape mechanism to prevent it from fishing for a prolonged period after being lost at sea. Compared to either tangle nets or trawls, the use of this gear is thought to result in both lower bycatches of nonlegal crab and other species which cannot be retained and lower discard mortality rates for those crab which are taken as bycatch. The bycatch rates are thought to be lower because, to some degree, pots and ring nets can be designed to exclude animals larger than the target species or allow smaller animals an opportunity to escape. Tangle nets and trawls are not as selective by size. Lower discard mortality rates are thought to result from less stress being placed on crabs during both the capture and discard processes with the gear that is currently legal. The current gear restrictions are based on substantial gear research and the industry has had an active role in their development and they are thought to be cost effective.

The State has the prerogative to change the definition of legal gear with FMP Alternative 1, but that definition can only be changed via an FMP amendment with the other two FMP alternatives. However, pots and ring nets with escape mechanisms and diving gear are expected to remain the only legal gear regardless of which FMP alternative is selected.

### 4.5 Pot Limits

Pot limits restrict the overall number of pots that a vessel is permitted to fish but not the number it can carry or how long each pot can be soaked. Pot limits can be used in attempts to: (1) slow the rate of harvest to provide more time for managers to assess inseason fishery developments and reduce the chances of overharvest and (2) adjust the competitiveness of different sized vessels. Although not under Board authority, pot limits may also increase fishing safety.

Inseason management of crab requires managers to accurately estimate and project landings on a daily basis to prevent exceeding the GHL. By knowing the maximum number of pots being fished, managers are better able to estimate harvest ranges and announce season closures before overharvesting occurred. In a similar situation but without pot limits, managers would not be able to accurately estimate the amount of effort on the grounds. This could lead to underharvest based on overestimates of effort or overharvest based on underestimates of effort. Barring an ability to limit the number of vessels participating in a fishery, an area with a very low GHL might not open without a control, such as pot limits, allowing the managers to accurately anticipate effort levels and therefore set a closing date, perhaps even before the season opening in order to prevent overharvest.

Vessels of all sizes can pull pots at approximately the same speed. Therefore, pot limits effectively reduce the potential soak time per pot for vessels who have a reduced number of pots. For example, if a vessel had fished 400 pots and the limit restricted it to 250, it would pick some combination of shorter soak time per pot, idle time, and increased travel and prospecting time. Vessels would probably attempt to maintain the same number of pot lifts per day and week that they had before pot limits were installed. If their catch per pot remained unchanged, then they would not necessarily suffer a loss due to pot limits nor would the catch rate of the fleet as a whole change.

Depending on the soak time, pots may catch a different number of crabs. Crab pot soak time studies (Johnson, 1985; Somerton and Merritt, 1986) have shown that catches per pot for red king crab and C. bairdi increase over a 48-hour period. Therefore, assuming that fishermen are already maximizing catch per pot based on soak time, it is unlikely that soak time per pot would decrease but, instead, fishermen would take longer with each pot (increased safety) and possibly arrange pot strings at greater distance from each other. Increased running time between pot strings would increase operating costs. Pot limits could also reduce the number of pots being transported thereby decreasing the possibility of overloaded vessels. It is difficult to estimate the possible savings from such increased safety.

Pot limits could be uniform maximums for the entire fleet or could be vessel size specific. If all vessels were given the same limit, then, to the extent that vessels were required to reduce the number of pots they wish to fish, their competitive position would be reduced. This would affect mostly larger vessels which had the desire and ability to transport and fish a larger number of pots. If pot limits were made vessel size specific and if each limit was equally restrictive, then the competitive position of most vessels would remain the same. However, since not all vessels of the same size are designed to carry or fish the same number of pots, vessel size specific regulations would not be totally effective at maintaining competitive positions.

Pot limits could be restrictive enough to instigate vessels to change fishing areas. A model designed to investigate the possible effects of pot limits in the Tanner crab fishery near Kodiak (Larson, 1984) showed that restrictive pot limits (not vessel size specific) would result in the movement of large vessels to other, less restrictive fishing areas. The net result would be reductions in revenues to larger vessels and increases to smaller vessels. The harsher the pot limit, the greater the reduction in revenue to those vessels effected by the limit while those who would fish less pots anyway gained a greater share of the revenues.

The imposition of pot limits could increase enforcement and operating costs. Enforcement of pot limits would require identification of ownership on each pot and increased checks of the number of pots used by participants. In order to monitor these requirements, at-sea enforcement would need to be increased. The increase in enforcement costs would be related to the particular type and severity of pot limits imposed. Pot limits could also impose increased costs on fishermen, again depending on the type and severity of the limits. If fishermen were required to use fewer pots than they would have otherwise, their operating costs would be higher per pot used. If pot limits were instituted for a long period of time, excess investment in pots would be reduced, but this would not occur during the first few seasons when pots already owned would remain idle.

With FMP Alternative 1, the State can impose pot limits for biological or economic reasons. With Alternative 2, the rationale and method of changing pot limits would be specified in the FMP and changed only by plan amendment (Category 1) or the State could modify pot limits within a plan framework (Category 2). Alternative 3 would require an amendment to change pot limits. The State has made use of pot limits in the past whereas the Council has not; therefore, pot limits are more likely under Alternative 1 or Alternative 2, Category 2.

## 4.6 Sex Restrictions

Prohibiting retention of female crab can increase yield over time if female crab are more valuable for their future contribution to recruitment than for their direct contribution to harvest and if this prohibition does not result in high female discard mortality. The male-only restriction is used in many west coast crab fisheries in the belief that these conditions are met and that the associated enforcement costs are not significant.

The data base to support or reject an extensive harvest of female crab is poor. There have been some studies indicating that at times there are probably surplus female crab which can be, or even should be, taken from areas of high abundance (Reeves and Marasco, 1980; Reeves, 1987; Hanson, 1987). However, the cumulative effects of a female harvest are not demonstrable at this time and may not be without actually harvesting females.

Harvesting male king crab only has not been a controversial issue. Management philosophies have endorsed a limited fishery for females in years of high abundance in the past; however, the industry has shown little interest in harvesting females in such years.

With FMP Alternative 1, the State would have the authority to eliminate the prohibition on the retention of female crab. With the other alternatives, either a plan amendment or a decision by the Board within the specified framework would be necessary to eliminate the prohibition. However, for the reasons stated above and because the mature female populations of several stocks are at low levels, the prohibition is expected to remain in effect until bioeconomic research has adequately demonstrated that harvesting females is appropriate. Regardless of which alternative is selected, it is expected that a thorough analysis and review would be necessary before the harvest of females is permitted.

## 4.7 Registration Areas

When registration areas are used, a vessel must be registered in advance of fishing for each area in which it will fish. These registration requirements are used to: (1) make better preseason estimates of fishing effort and the rate at which resources will be harvested in each area; and (2) limit the ability of vessels to fish in multiple areas. The estimates are used to plan the inseason monitoring of the fishery and can also be of use to the industry for planning purposes.

The use of registration areas to limit participation in multiple areas is more controversial. This is done by designating the level of exclusivity of each area. A vessel which is registered to fish for a species or species group in an area with the highest designation cannot fish for that species in any other area; a vessel which

is registered to fish in an area with the next highest designation cannot fish in another area with the same designation, but it can fish in areas with a lower level of exclusivity; and a vessel can fish in any number of areas with the lowest designation. For king crab, the three designations are superexclusive, exclusive, and nonexclusive. For Tanner crab, only the first and third designations are currently used; they are referred to as superexclusive and nonexclusive areas.

Such designations increase the relative competitiveness of vessels which cannot or do not fish in multiple areas by limiting the ability of other vessels to fish in multiple areas. This is particularly advantageous to the less mobile vessels if the area in which they fish is not the most profitable area for the more mobile vessels. On average fewer mobile vessels will fish in the less profitable areas if their decision to do so restricts their ability to fish in other areas.

There are two types of vessel diversity that will be affected by these restrictions. One is the diversity of a vessel's activities with respect to the areas it fishes in, the other is the diversity of a vessel's activities in terms of target species. Such restrictions will tend to increase the latter type of diversity but decrease the former. In the absence of external costs, the net effect is expected to be a reduction in vessel efficiency.

Such restrictions generally do not have a strong conservation purpose. The argument that they will reduce the opportunity for pulse type fishing effort is not well supported. Guideline harvest levels, not restrictions on vessel mobility, serve that purpose. With one exception, the argument that such restrictions can be used to disperse effort and encourage full utilization of all available segments of the total crab stocks is particularly questionable when the major stocks are at relatively low levels, as they are now, and fishermen already have a very strong incentive to fully utilize the available stocks. The exception would be a stock that is highly concentrated but so small that a short intense fishery by a large fleet would exceed the GHL. In such a case, if the number of vessels could not be limited it might be necessary to have no fishery at all. However, it has not been demonstrated that the use of exclusive registration areas is a cost effective solution in this case.

By reducing the effort of mobile vessels in less profitable areas and increasing their effort in the more profitable areas, these restrictions tend to slow the rate of harvest in the former areas and increase it in the latter. This will provide an increased opportunity for inseason monitoring and management in the former areas but a decreased opportunity in the latter areas. The net effect is not necessarily expected to increase the ability of fishery managers to achieve conservation objectives for the BSAI as a whole.

Registration areas have been in place long enough that many investment decisions have been made based on the assumption that such restrictions would continue. Therefore, changes in the relative competitiveness among vessels and probably to a lesser extent changes in landing patterns could impose significant adjustment costs on those who currently benefit from the restrictions, should such restrictions be rescinded.

The current State designations are as follows: (1) the Bering Sea and Adak are nonexclusive registration areas for all king crab species; (2) Bristol Bay is an exclusive registration area for all king crab species; (3) Dutch Harbor is an exclusive registration area for red and blue king crab and a nonexclusive area for brown crab; and (4) the BSAI is part of a nonexclusive registration area for all Tanner crab species. There are currently no superexclusive registration areas in the BSAI; however, there are in the Gulf of Alaska. Therefore, within the BSAI, the current registration area designations only prevent a vessel from fishing for red and blue king crab in both the Bristol Bay and Dutch Harbor registration areas. The current designations also prevent vessels that fish in either of these exclusive areas from fishing in exclusive areas in the Gulf of Alaska.

Under FMP Alternative 1, area designations can be changed at the discretion of the Board of Fisheries for biological or economic reasons. Likewise, under Alternative 2, Category 2, the Board would be able to change area designations within the framework specified by the FMP. Under either Alternative 2, Category 1, or Alternative 3, registration areas would retain their current exclusivity status unless the FMP were amended.

## 4.8 Permit Requirements

Permit requirements are used to provide management agencies with information on participants in a fishery and with the authority to enforce fishery management regulations on vessels and fishermen which are registered and permitted. Both are useful purposes in terms of meeting crab management objectives.

Currently the State requires that all fishing vessels be registered, that all commercial fishermen be licenced, and that a gear permit operator be on a vessel when it is fishing. These registration and permit programs are managed by the State. Although there are lower fee schedules for residents than for non-residents, the differences (three times more for non-residents than residents) are probably not large enough to be considered discriminatory and the fees are sufficiently low that they are not considered to be burdensome (Table 4.1). Gear operator permits are issued by management area for the king and Tanner crab fisheries. Therefore, for example, three separate permits are required to fish for king crab in Bristol Bay, king crab in the Bering Sea, and Tanner crab in the Bering Sea.

If a sufficient number of fishermen do not obtain State permits, the ability of the State to manage the crab fisheries would be greatly diminished. However, it has been suggested that those who finance and insure fishing vessels typically require that the vessels be registered in Alaska and be able to enter State waters. Such requirements would eliminate the option for most fishermen and in so doing would remove most of the actual difference among the alternatives with respect to permit requirements. It may not be prudent to rely on the decisions of financial institutions with regards to there requirements for State registration. A potentially critical problem with FMP Alternatives 1 and 2 is that vessels could participate without registering with the State. Should this problem occur in the future, for whatever reason, it is likely that a plan amendment will be required.

This problem would not occur with FMP Alternative 3 because the fisheries would be managed with Federal regulations to which all vessels in the EEZ would be subject.

## 4.9 Observer Requirements

Observers are used aboard crab fishing and/or processing vessels to obtain, for example, catch and effort data; species, sex, and size composition data; and estimates of the proportion of soft shell crab being handled. That is, observers provide better scientific and enforcement information than is otherwise available. In so doing they increase the probability of attaining the biological and economic objectives of State and Federal fishery management if the costs of the observer programs are not excessive.

It should be noted that the placement of observers on commercial fishing vessels influences the distribution of benefits and costs among vessels because there are a variety of costs imposed on the vessels which have an observer. These costs can include those resulting from: (1) the inconvenience of having an additional person onboard; (2) additional food and insurance requirements; (3) reduced catch per unit of effort due to disruptions caused by the sampling activities of an observer; and (4) a (possible) direct charge to pay for the observer. These costs could be large enough to result in vessels with observers being at a disadvantage relative to vessels without observers, at least within comparative vessel classes.

With all three FMP alternatives the State is free to implement a State observer program. For example, at their 1988 shellfish meeting the Board approved a mandatory observer requirement on all catcher/processor and floating processor vessels participating in the king and C. bairdi crab fisheries, as a condition to obtaining a processing permit. This action was taken following an ADF&G analysis which suggests that these vessel categories are harvesting undersized king crab. The observer will collect catch and other biological information while acting as a deterrent to illegal fishing. Alternative 1 provides no authority for a Federal observer program. With the other two FMP alternatives a Federal observer program would be authorized and all vessels fishing for king or Tanner crab, and/or processing king or Tanner crab within the BSAI, would be required to take aboard an observer when so requested by the Regional Director. It should

be made clear that this authority is in addition to any State authorized program being applied to State registered vessels. If the Regional Director requires observers aboard crab vessels, such a program should be coordinated with the State observer program and they should not be overly burdensome.

As long as the State is able to enforce its observer requirements on any vessel registered in the State and all vessels are registered in the State, each of the three FMP alternatives is expected to have similar impacts on the crab fisheries. Alternative 1 will insure a single agency will operate observer programs. If Alternatives 2 or 3 are approved and a Federal observer program put in place, administration and coordination costs will increase.

### 4.10 Bycatch Limits

Limits on the bycatch of king and Tanner crab in other fisheries or on the bycatch of crab and other species in the king and Tanner crab fisheries can be used to control the bycatch mortality of crab and other species. In the absence of such restrictions, total king and Tanner crab fishing mortality can be managed by taking bycatch removals as given and establishing GHLs (quotas) in the king and Tanner crab fisheries accordingly. This has been done in the halibut fisheries in the EEZ off Alaska by reducing the halibut quota by an amount corresponding to the estimated halibut bycatch mortality. In the crab fisheries, bycatch has affected quotas through its effects on the status of crab stocks.

Bycatch limits are used to influence the allocation of a fishery resource between fisheries for which it is the target species and those for which it is a bycatch species. Bycatch limits may be used if the FMP authorizes such limits for the fishery it governs. For example, a king and Tanner crab FMP applies only to the king and Tanner crab fishery. Thus, any bycatch controls would only apply to participants in that fishery. Another example is the Bering Sea/Aleutian Islands Groundfish FMP. In this case, king and Tanner crab bycatch limits are applied to the groundfish fishery in an effort to minimize the impact of the groundfish fishery on the crab resources in the area. Only in rare instances are bycatch controls used strictly to protect a stock, and even in such instances the issue is typically the intertemporal allocation of the resource among these competing uses.

The State currently does not use bycatch limits to regulate the bycatch of king or Tanner crab in other fisheries. With FMP Alternatives 1 and 2, the State could place bycatch limits on other crab species in the crab fisheries, but not on other fisheries within the EEZ. Part of the rationale for the State's issuance of an Emergency Order closing the C. bairdi fishery in the Bering Sea in 1988 was a very high bycatch of red king crab in the soft-shell condition.

With Alternative 3, no bycatch limits can be used without a plan amendment. Management measures which control the bycatch of crab in the groundfish fisheries are expected to continue to be specified by the groundfish FMP regardless of which crab FMP alternative is selected.

### 4.11 Limited Access

Limited access is a management measure that possibly would increase our ability to attain the crab management objectives. However, because the use of limited access would be a major change to the current crab management approach, the consideration of limited access as part of the FMP would significantly prolong the evaluation, selection, and implementation of an FMP alternative. Therefore, limited access is not currently considered to be a relevant management measure.

Limited access is not currently used to manage crab fisheries in the BSAI. However, it is used in the Southeast Alaska king and Tanner crab fisheries. With Alternative 1 the State can impose a limited access system. With the other two FMP alternatives, limited access cannot be used as a management measure unless the FMP is amended.

Although the State can use limited access if Alternative 1 is selected, the State would not be expected to do so. Therefore, the three alternatives are not expected to differ with respect to the use of limited access as a management measure.

## 4.12 Closed Waters

Closed waters specify areas in which certain types of fishing are prohibited. They can be used to reduce the following: bycatch mortality, other adverse effects on crab and other species, and gear or user group conflicts. The bycatch mortality of female and sublegal male crab of the target species and the bycatch mortality of other species can be reduced by limiting fishing in areas of either high bycatch rates or high discard mortality rates. Similarly, other adverse effects on crab and other species and gear conflicts can be reduced by limiting fishing in areas where the probability of such effects or conflicts is high.

There may be net benefits or net costs associated with such closures. Net benefits may arise if the closures do not include productive areas for legal crabs and bycatch mortality on female or sublegal male crabs is significantly reduced. Net costs may arise if the converse is true. Unless good information (including estimates of enforcement costs) is available concerning the affect of the proposed closures on bycatch mortality or other adverse impacts of a fishery, it is difficult to demonstrate that a closure will meet the stated objective.

Closed waters have also been established to protect subsistence fisheries. Current State regulations close specific nearshore areas of Norton Sound during summer and waters within 10 miles of St. Lawrence, King, and Little Diomede Islands for this reason. These areas are closed in an attempt to ensure that subsistence needs regarding these crab resources are satisfied. The subsistence catch of crabs in the closed areas is quite small relative to the size of catches in the commercial fisheries.

With FMP Alternative 1, closed waters are deferred to the State, while with Alternative 2, Category 2, they are frameworked in the FMP and deferred to the State. With FMP Alternative 2, Category 1 and Alternative 3, the current closures are specified in the FMP and can only be changed by amendment.

It is not known how or whether the State would use the authority to establish new or larger closed areas to commercial crab fishing under FMP Alternative 1 or Alternative 2, Category 2. However, modification of closed areas is not anticipated to differ under any of the three alternatives.

## 4.13 Minimum Size Limits

A minimum size limit prohibits the retention of crab below a given carapace width. The potential contribution of a given year class to the fishery measured in terms of catch and reproductive capacity is significantly influenced by the age at which the year class is first subjected to a high level of fishing mortality.

For many species, rapid increases in average weight, exvessel price per pound, or reproductive capacity exceed the losses from natural mortality when cohorts are provided with an additional year of protection from legal retention in the commercial fishery. The use of the appropriate minimum size limit for such species can increase net benefits if animals below the size limit are not taken as bycatch or if discard mortality is sufficiently low.

The size limits established by current State regulations are summarized in Table 8.2 of the FMP. Prior to the use of legal minimum size limits, minimum sizes of crabs landed were dictated by industry economics, and to a large extent economics continues to play an important role. The biological minimum size limit for the Tanner crab species C. opilio has been 3.1", based on information on size of maturity and reproductive behavior. However, the average minimum size of crab landed since the inception of the domestic fishery has been in the range of 4.0" to 4.5". This reflects the desire for larger crabs by the processing sector. Past requests for lowering the minimum size limit for the Tanner crab species C. bairdi from 5.5" to 5.0" have met with resistance, also because of market preferences for larger crab.

The current size limits are intended to assure that male crab are not retained prior to having at least one opportunity to mate. The benefits and costs of using this philosophy for setting size limits are not known. The decision to establish these size limits was not based on a rigorous attempt to analyze the potential biological and economic implications. The issue of an appropriate minimum size based on biological and economic analyses has been examined in several recent studies (Reeves, 1987; Matulich, Hanson, and Mittelhammer, 1988; Terry and Hastie, 1988). If high red king crab bycatch mortality in other fisheries is considered, Terry and Hastie (1988) concluded that a lower minimum size would allow a greater economic yield in the crab fishery. However, considering current low red king crab stock conditions in Bristol Bay, Matulich et al. (1988) cautioned against a lower size limit and recommended further analysis.

With the first FMP alternative, the State has the authority to change size limits. With FMP Alternative 2, the State's authority is limited by a framework specified in the FMP. The framework lists the factors to be considered in changing a size limit and requires that an analysis be provided as the basis for any change. With the third FMP alternative, current minimum size limits are specified in the FMP and they can only be changed by plan amendment.

### 4.14 Guideline Harvest Levels (Exploitation Rates)

Annual harvest quotas are widely used in attempts to attain fishery management objectives. In addition to constraining catch, they provide the industry with a basis for planning fishing and processing operations. They have been referred to as guideline harvest levels (GHLs) in the management of crab off Alaska, and in the NPFMC groundfish FMPs they are called total allowable catches (TACs). GHLs differ from TACs in that a GHL is normally expressed as a range rather than as a single value. This difference is particularly important in determining the need for inseason authority, the topic of the next section.

It is generally accepted that the appropriate GHLs will vary from year to year and that it is, therefore, desirable to have a mechanism that will allow GHLs to be adjusted annually, if necessary, in an efficient and timely manner using the best available information. This argues against having GHLs specified in an FMP because, if they are, an FMP amendment is required to change them.

The goal of fishery management is to maximize benefits from the fisheries over time. To do this it may be necessary to forego some current catch in order to take more catch in the future or it may be necessary to reduce the total catch taken over time in order to reduce the costs associated with large fluctuations in both annual catch and the associated economic activity. GHLs, or more accurately the exploitation rates that are used to set the GHLs, have often been set lower than they would have otherwise been set in an attempt to decrease annual fluctuations in catch. The relative magnitudes of the benefits and costs of this policy have not been thoroughly evaluated.

In species such as king and Tanner crab, for which recruitment may be independent of stock size over a wide range of abundance levels, the costs and benefits of lower exploitation rates designed to reduce annual fluctuations in harvest are primarily a function of natural mortality, growth, and price. For example, if the instantaneous total mortality (i.e., natural, handling, bycatch) is 0.6, each additional 1,000 crab left on the grounds this year will result in only an additional 550 crab surviving to next year. On the other hand, if instantaneous total mortality (i.e., natural, handling, bycatch) is 0.1, the additional 1,000 left this year would result in an additional 905 survivors next year. The tradeoffs between such mortality schedules, increases in weight due to growth, corresponding changes in price per pound associated with both average size and magnitude of catches, and other economic factors determine the net benefits or costs of alternative harvest schedules. However, at low levels of stock abundance at least one additional factor becomes very important: the expected future value of progeny from mature crabs in the stock.

In analyzing the implications of alternative GHLs, it should be noted that it is possible to achieve a higher level of stability of catch and economic activity for the BSAI king and Tanner crab fishery as a whole than for individual fisheries. What might be referred to as stability through diversification can occur due to the

high degree of mobility of many vessels among the king and Tanner crab fisheries of this area and due to the concentration of processing facilities at locations that receive catch from most of the BSAI crab fisheries. Often, diversification can produce a larger and more stable return. The potentially larger and more stable returns may be forgone if excessive effort is exerted on obtaining increased stability for each fishery. The use of this broader concept of stability combined with a more rigorous use of both biological and economic analysis of exploitation rates and minimum size limits could result in significant benefits under any of the three FMP alternatives.

With FMP Alternative 1, GHLs are deferred to the State. Under the other two FMP alternatives, GHLs can be established annually using a GHL framework process specified in the FMP. The frameworks are similar with the exception of the decision maker. The final decision is made by the Board under alternative two and by the Council/Regional Director with alternative three. However, the criteria to be used in establishing GHLs, the individuals and groups involved in preparing and reviewing analyses, and the analytical procedures to be used are the same for FMP Alternatives 2 and 3.

The analytical procedure to be used varies with the types of information available for a stock. The procedures range from using a spawner-recruit model to merely making adjustments to a GHL based on year to year changes in catch per unit of effort in a crab fishery. The procedures are not very specific in terms of the formula which will be used to set a GHL because it is difficult to design a formula which will be appropriate as conditions in a fishery and our understandings of them change. However, the analysis currently utilized by the State involves an approach combining both State and Federal resources. Such analysis would be expected to continue regardless of the alternative chosen.

Protection for the long-term reproductive viability of the stocks is provided by first establishing for each stock an acceptable biological catch (ABC) that is conservatively expected to protect the stock. The GHL is then set at or below ABC based on biological and economic analyses of the implications of alternative GHLs with respect to FMP objectives.

### 4.15 Inseason Adjustments

Inseason adjustments assume roles of varying importance depending on season length. Red and blue king crab seasons in the Bering Sea and Bristol Bay management areas have typically been less than three to five weeks in length during recent years and the GHLs have typically been set just before the fisheries open. During such short seasons there is little time to consider data which might alter harvest guidelines. At the other end of the spectrum, seasons for C. opilio have usually been open from six to ten months of the year, providing a greater opportunity for inseason data to be analyzed and harvest guidelines revised.

Because the differences among the three FMP alternatives with respect to inseason changes are due to the differences in the procedures, the evaluation of these procedures in Section 3.5 should be referenced.

### 4.16 Districts, Subdistricts, and Section Boundaries

Area boundaries are designed to allow different GHLs, minimum sizes, and seasons for stocks or for portions of a stock. If information is available to support such differentiations, such refinements may be justified in terms of biological and/or economic objectives.

With FMP Alternative 1, the determination of boundaries is deferred to the State. With FMP Alternative 2 the determination is also deferred to the State but within a framework specified in the FMP. The framework lists the criteria for changing boundaries. Under FMP Alternative 3, the current boundaries are specified in the FMP and can only be changed with an amendment.

## 4.17 Fishing Seasons

There are two opposing concepts embodied in the management measure of crab fishing seasons. The first may be referred to as the "closed" season, a block of time set aside either to protect stocks during mating, molting, and soft shell periods or to provide preferential access to the resource for certain user groups. The rationale for making such closures is both biological and economic. Biological concerns relate generally to the consequences of adverse fishery effects during mating. Increased deadloss and discard mortality, due to the presence of soft shells, have biological and economic ramifications. The basis for protection of crab during the periods of growth rests with the opportunity cost, or foregone value, associated with earlier harvest. With respect to preferential access to the resource by non-commercial user groups, closures can be designed to provide such users access during the most desirable period. The dates which bound the "closed" season may vary from year to year, but probably not in a way which is easy to estimate.

If the rate of harvest and the quota are such that a fishery could be open for most of the year, the principal function of this management measure is to prevent fishing during such periods. In other words, all parts of the year which have not been set aside in this manner are actively open for fishing. Such has often been the case with the Bering Sea C. opilio fishery, for example.

In many of the recent king crab fisheries, GHL's and the rate of harvest have resulted in seasons of a few weeks duration or less. In such cases, that part of the year which is not closed represents an envelope within which the actual harvesting season may be scheduled. The rationale for determining when this more narrowly defined "open" season will occur within the available envelope is primarily economic. Economic factors which have commonly been influential in this determination include meat composition, industry costs including those associated with safety and gear conflicts, and the scheduling of other fisheries utilizing the same industry resources. Typically, the industry has had substantial input in the evaluation of these factors.

Allocation issues are affected by the establishment of opening and closing dates, particularly in those fisheries which typically have very short seasons. The scheduling of one- to four-week seasons concurrently in different registration areas effectively precludes fishermen from participating in both to the detriment of fishermen with large, mobile vessels. Also, scheduling of relatively small fisheries with large periods between them may effectively preclude these same vessels for economic reasons. Due to the size distribution of vessel ownership, nonlocal fishermen would be most adversely affected by such scheduling. On the other hand, fine-tuning of season dates to the optimal economic advantage of the distant-water crab fleet has adverse economic consequences to local, less mobile fleets which are dependent on particular fisheries.

With FMP Alternative 1, the determination of fishing seasons is deferred to the State. With FMP Alternative 2 the determination is also deferred to the State but within a framework specified in the FMP. The framework lists the criteria for changing fishing seasons and requires that a written justification of proposed changes be available for review by the public, the Council, and NMFS. Under FMP Alternative 3, the current fishing seasons are specified in the FMP and can only be changed with an amendment.

## 4.18 Reporting Requirements

The information provided on fish tickets and processors' reports is specified by the reporting requirements. These catch, effort, and processing data are used inseason to estimate when GHLs will be taken and to determine if the conditions of the stocks have changed sufficiently to require GHLs to be altered. These data are also used together with information gained through scientific surveys, research, and other data collection programs to establish GHLs for the next fishing year and to evaluate other management measures.

The current State catch and processing reporting requirements establish mandatory reporting programs for the industry in order to collect information for which the industry is the best or only source. Therefore, reporting requirements are an essential component in achieving the objectives of this FMP. If the reporting requirements are designed to collect information which fishermen and processors maintain for their own use

and if that information is not released to others so as to adversely affect the competitive position of those who provide it, the cost to the industry can be minimal and much smaller than the benefits they receive from more informed management decisions. Similarly if the data are collected and stored efficiently and used effectively, the total cost of the reporting requirements will be significantly less than the benefits they provide.

It is possible for differences in reporting requirements and costs among different types of operations to put one type of operation at a relative disadvantage. However, this is not expected to happen with any of the three FMP alternatives.

The differences among the three FMP alternatives with respect to reporting requirements and the remaining five management measures that follow are similar. Therefore, these differences and their implications are discussed once in this section for all seven types of measures. Other aspects of the five measures are discussed in Sections 4.19 through 4.23. The five measures are gear placement and removal, at-sea gear storage, vessel tank inspections, gear modifications, and other measures. The differences are as follows: (1) with FMP Alternative 1 changes to the seven measures are deferred to the State; (2) with FMP Alternative 2 changes are also deferred to the State, but the State is constrained by a framework that requires an analysis of the proposed changes and review by the Council and public prior to final action on the proposed changes; and (3) with FMP Alternative 3 the specifications of the measures could only be changed by plan amendment.

It is not known how reporting requirements would change if FMP Alternative 1 or 2 is selected. Therefore, it is not possible to evaluate the difference between alternative three and the first two FMP alternatives in terms of different reporting requirements. However, the recent action by the State to require observers on vessels that process crab at-sea suggests that, at least initially, greater observer coverage may occur with Alternatives 1 and 2. The information budget limitations for Federal agencies would probably prevent a Federal reporting system from being as comprehensive and as flexible as the State system.

### 4.19 Gear Placement and Removal

This measure limits the time before and after a season that fishermen are permitted to have gear on the fishing grounds. Such gear must be unbaited with doors secured open. Early placement may be permitted to enable vessels which fish more pots than they can safely carry an opportunity to make more than one trip to place their pots on the grounds. This provides what may be considered a fair start for all vessels regardless of their size and safe pot carrying capacity. Permitting late removal similarly allows such vessels to make additional trips to remove their pots once a fishery has been closed. The argument that these measures are in part justified in terms of limited loading, unloading, and storage facilities is significantly weakened by the availability of at-sea storage areas which is discussed below.

These provisions may also increase the relative competitiveness of smaller vessels and reduce the probability that any vessel will carry an unsafe number of pots. The former is accomplished by increasing the number of pots a small vessel can safely fish relative to the number fished by a larger vessel. This relative change occurs because, for example, a larger vessel that is able to safely carry twice as many pots is probably not able to fish twice as many pots per day. With the ability to store pots at-sea, a smaller vessel could fish as many pots as a larger vessel during the season, although the smaller vessel would spend more time moving pots.

The magnitude of these effects is dependent on the length of the season. In a very short intensive season, such as occurs in the Bristol Bay king crab fishery, there will be a high cost to a vessel in terms of reduced catch resulting from time required for additional trips to place gear on the grounds and to remove it if early placement and late removal are not permitted.

Limits are placed on early placement and late removals in consideration of potential effects on fishery resources, gear conflicts, and enforcement costs. The adverse effects for each tend to increase as more time is allowed for placement and removal.

The differences among the three FMP alternatives with respect to gear placement and removal are the same as those for reporting requirements (see Section 4.18).

4.20 Gear Storage

Gear storage regulations specify at-sea areas which may be used to store gear such as crab pots. They are developed to reduce the cost of participating in the crab fisheries by providing designated at-sea storage areas which are protected from other fishing gear. Important considerations in selecting such areas are the need to protect crab stocks during sensitive biological periods, preemption of fishing grounds, and enforcement problems.

The State 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 the Tanner crab fisheries (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 wide spread as the likelihood both of gear loss to weather and of conflicts with other gear types increases.

The differences among the three FMP alternatives with respect to gear storage are the same as those for reporting requirements (see Section 4.18). There is no reason to expect the areas to be significantly affected by which FMP alternative is selected.

4.21 Vessel Tank Inspection

Vessel tank (i.e., live-hold and freezer) inspections are required under current State regulations to meet the legal requirement for the State's landing laws. Tank inspections are normally required within a one- to five-day period prior to season opening and at any time during the season when leaving one management area for another. In order to pass inspection, the vessel must have no crab aboard. The rationale supporting this management measure is twofold: first, vessel tank inspections are used to enforce the opening of the crab seasons and to assure an equal start for all participants; and second, they prevent vessels from covertly fishing in adjacent management areas and misreporting a landing which would effect the catch statistics and the manager's inseason harvest rate projections.

The inspection is completed by ADF&G port samplers who are already on location for other duties. For example, 1987 vessel tank inspections were completed at Dutch Harbor, Akutan, Port Moller and the Pribilofs. This reduced, but did not eliminate, the possibility that vessels were required to travel out of their way for the inspections. If the costs imposed on the fleet are not excessive, tank inspections are an efficient means for increasing enforcement efficiency and effectiveness.

The differences among the three FMP alternatives with respect to vessel tank inspections are the same as those for reporting requirements (see Section 4.18). There is no reason to expect the regulations to be significantly affected by which FMP alternative is selected.

4.22 Gear Modifications

Both the general type of gear which may be used and the specific design of a type of gear may be regulated. The former type of regulation is discussed in Section 4.4. The latter is discussed in this section. This sometimes unclear distinction was made to allow different levels of flexibility for the specifics of each type of gear restriction.

Pot gear can be modified to decrease the possibility that crab and fish which cannot be legally retained will enter the pots or be able to escape prior to the pots being retrieved. Gear modifications can also decrease gear conflicts. However such designs may increase harvesting costs and enforcement costs.

Current State regulations prohibit the use of pots attached to a ground line in all but the brown king crab fishery. They also specify differences between king and Tanner crab pots. The differences among the three FMP alternatives with respect to gear modifications are the same as those for reporting requirements (see Section 4.18). There is no reason to expect the regulations to be significantly affected by which FMP alternative is selected.

### 4.23 Other Management Measures

This section recognizes the potential need for authorization to use new, and at this time unidentified, management measures determined necessary to address a future issue or problem with the crab fishery. Regardless of what FMP alternative is chosen, this section would allow managers to develop these measures. The process for implementing the measures does depend on the FMP alternatives selected. With FMP Alternative 1 this authority is deferred to the State and its processes. Under FMP Alternative 2, this section is also deferred but the State is constrained by a framework specified in the FMP. The framework states that these measures must be consistent with the FMP, MFCMA, and other Federal law, and implemented only after consultation with the Council. With FMP Alternative 3, the Council/RD would be required to prepare a regulatory amendment with its accompanying EA/RIR analysis and public review.

Since at this time the Secretary is not implementing any Federal rules under this section, no EA/RIR analysis of this section is possible or required. However, it should be made clear that under Alternative 2, should the State use the authority to implement a new measure under this section, the effected industry does have the right to appeal the action using the procedure described in the FMP. This procedure would require a determination if the new management measure is in compliance with the FMP and other Federal law.

It would also require a determination if a companion Federal regulation is necessary to fully implement and enforce the new measure. A conclusion that a Federal rule is necessary (assuming the State action is found in compliance with the FMP), would require preparation of a regulatory amendment and EA/RIR analysis prior to complete implementation of that rule.

Table 4.1

1988 Annual State of Alaska Permit, Vessel, and Crewmember Fees

| | AK Penin. and Aleut.Is. | Dutch Harbor | Bering Sea | Adak | Bristol Bay | Norton Sound |
|---|---|---|---|---|---|---|
| King crab (pots) | | | | | | |
| Vessel 50′ or less | | | | | | |
| Resident | $250 | $ 50 | $250 | $ 50 | $100 | $ 50 |
| Nonresident | $750 | $150 | $750 | $150 | $300 | $150 |
| Vessel over 50′ | | | | | | |
| Resident | $250 | $250 | $250 | $250 | $250 | $ 50 |
| Nonresident | $750 | $750 | $750 | $750 | $750 | $150 |
| Tanner crab (pots) | | | | | | |
| Vessel 50′ or less | | | | | | |
| Resident | $100 | $ 50 | $ 50 | $ 50 | NA | NA |
| Nonresident | $300 | $150 | $150 | $150 | NA | NA |
| Vessel over 50′ | | | | | | |
| Resident | $200 | $100 | $250 | $ 50 | NA | NA |
| Nonresident | $600 | $300 | $750 | $150 | NA | NA |
| Commercial Fishing License (crewmember) | | | | | [AS 16.05.480(a)] | |
| Resident | | $30/yr | | | | |
| Nonresident | | $90/yr | | | | |
| Annual Vessel License | | $20/yr | | (AS 16.05.530) | | |

## 5.0 ENVIRONMENTAL ASSESSMENT (EA)

This FMP and EA/RIR have been preceded by draft and final environmental impact statements accompanying an earlier FMP for king crab in the Bering Sea as well as a repealed FMP and environmental documents for Tanner crab fisheries off the coast of Alaska. This EA includes revisions that reflect public comments made on those documents.

None of the FMP alternatives are expected to change the nature and extent of crab fisheries from what has recently occurred under state management, therefore implementation of the FMP itself will not cause significant impacts. The alternatives concern procedures for decision making rather than any specific changes to management measures.

Addressing specific criteria in the NOAA Directives Manual, implementation of the FMP is not expected to: (1) jeopardize the long-term productive capacity of any stocks, (2) allow substantial damage to ocean and coastal habitats, (3) have substantial adverse impact on public health or safety, (4) affect adversely an endangered or threatened species or marine mammal population, or (5) result in cumulative adverse effects. Moreover, as described in Chapter 6.0, no substantial socioeconomic effects are anticipated. Finally, although there has been some controversy surrounding the intent to delegate substantial management authority to the State, the NOAA Directives Manual clearly states that controversy alone is not sufficient cause to consider a federal action as "significant." Therefore, an Environmental Assessment, leading to a Finding of No Significant Impact (FONSI, see page 76) is adequate analysis under NEPA.

### 5.1 Purpose of and Need for the Proposed Action

The purpose and need for the proposed action are discussed in Chapter 1.0 (Introduction) to the FMP and Chapter 1.0 of this document.

### 5.2 Description of the Proposed Action and Alternatives

Descriptions of alternatives are provided in Chapter 1.0 of this document.

### 5.3 Description of the Affected Environment

The areas expected to be affected by king and Tanner crab fisheries in the Bering Sea and off the Aleutian Islands, consist 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 king and Tanner crab fisheries, are determined by the distinctive physical and biological characteristics of the Bering Sea and waters near the Aleutian Islands.

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. More recent reviews of the Bering Sea environment are given in Oceanography of the Bering Sea (Hood and Kelly, 1974), The Eastern Bering Sea Shelf: Oceanography and Resources (Hood and Calder, 1981), and a specific volume of Continental Shelf Research (Hood, 1986).

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% consists of continental shelf; 13% of continental slope; and 43% 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 is about 2,260 kilometers long. The continental shelf of the Aleutians is narrow and discontinuous, with a breadth ranging between 4 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. Matthew 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. Matthew Island and eastward toward Bristol Bay. Dividing near St. Matthew 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. Red 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 has a more limited distribution. Populations are found in the eastern Bering Sea (St. Lawrence, St. Matthew, and Pribilof Islands), in Herendeen Bay on the Alaska Peninsula, Olga Bay on

Kodiak Island, Port Wells in Prince William Sound, and in scattered groups in Southeast Alaska (Armstrong, et al., 1987; Somerton, 1985; Wallace et al., 1949).

The brown or golden king crab is another 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 southeastern management area which encompasses all waters surrounding the Alexander Archipelago and the outer coast. It also supports a moderate fishery along the Aleutian Islands. 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° to 10° C.

Tanner crab (Chionoecetes sp.) are found throughout the Bering Sea/Aleutian Islands region. Two species are relatively large size crabs and therefore are of commercial importance. The Tanner crab C. bairdi is the target and is found most often in the southeastern Bering Sea. This crab is often encountered in the same habitat as red king crab. The crab C. opilio is smaller but is believed to be the most abundant of the species and is found in the northern and central Bering Sea on the Continental Shelf. Both of these species support large commercial markets for crab.

Other species of king and Tanner crabs are also encountered in the commercial crab fishery. The scarlet king crab (Lithodes covesi), the grooved Tanner crab (C. tanneri), and triangle Tanner crab (C. angulatus) are all deep water crabs which are occasionally captured. Due to their relatively low meat content, these species are only delivered to processors on an experimental basis. No information is available on the biomass of these species and their stock status.

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).

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 inter-specific relationships is still rudimentary.

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.

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 (particularly Pacific cod) and large invertebrates. Adult crab

are also particularly susceptible to predation when they are in the soft-shelled stage. Animals known to prey upon larger king crab include halibut, Pacific cod, and sea otters.

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 their diet. King crab taken by the bearded seal are generally smaller than 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.

Sea otters feed 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.

## 5.4 Environmental Impacts of King and Tanner Crab Fisheries

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

1. Predator-prey interactions.
2. The incidental harvest of other marine resources.
3. Direct stress to marine mammals and birds.
4. Environmental pollution resulting from the dumping at sea by catcher-processor fishing vessels and by shorebased processing facilities of crab processing and other wastes.
5. Crab pots as a navigational hazard.
6. Stress to biota caused by lost gear.
7. Damage to benthic organisms caused by gear placement.
8. Handling mortality.

This description of the impacts of king and Tanner crab commercial fishing operations in the Bering Sea and Aleutian Islands accounts for adverse environmental impacts that cannot be avoided. It discusses 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.

However, none of the three FMP alternatives will alter the nature of the crab fisheries themselves; the alternatives concern decision making procedures rather than any changes to specific management measures controlling the fisheries.

### 5.4.1 Direct Impacts of King Crab and Tanner Crab Fishing in the Bering Sea and Aleutian Islands upon the Natural Environment

#### 5.4.1.1 Predator-prey interactions.

Fish species which are known to consume Tanner crab (C. opilio and C. bairdi) in the Bering Sea are flathead sole, yellowfin sole, Pacific cod, Pacific halibut, and several species of sculpin (Cottidae) (Livingston et al., 1986; Brodeur and Livingston, 1988). Examination of the size ranges of Tanner crab consumed by these predators show that mostly juvenile Tanner crab from 1-4 years old are eaten (5-70 mm carapace width). Pacific cod is considered the most important predator of these species of crab because of the high abundance of Pacific cod and the large proportion of Tanner crab in the diet of cod. Depending on the year, Tanner crab may constitute from 5% to 45% of the diet of cod in terms of weight. Although there has been much speculation regarding the possibility of Pacific cod populations causing decline of crab populations through predator-prey interactions, there has been no evidence to support the speculation. Research is currently being performed which will show whether cod predation on crab is a density-dependent or density-independent factor. That is, whether cod consume increasing (or decreasing) proportions of the crab population as the crab population increases in size. Even if it can be shown that cod currently exert a large influence on natural mortality of crab a decline in cod populations does not imply an increase in the number of juvenile crab which would survive to fishery size. Given the number of other predators which consume Tanner crab, a decrease in predation pressure from one predator may merely make crab prey more available to other predators.

Pacific cod, and to some extent halibut, are probably the only fish which have been documented as predators of king crab. Evidence suggests that cod may consume soft-shell female red king crab during the spring molting season in the Bering Sea. Cod have also been shown to consume only crab legs with no other accompanying body parts (Shimada et al., 1988 unpubl. manuscr.). This suggests that Pacific cod are either consuming legs dropped by king crab (autotomy) due to injury or are pulling legs off of live crab. Although the percent by weight of whole red king crab in the diet of Pacific cod may range from 1% to 15% depending on the year, it is unknown whether this interaction is density-dependent or density-independent. Preliminary analysis indicates that the percent by weight of red king crab in the diet of cod has declined from 1981 to 1985 corresponding to the decline in population numbers of female red king crab (Livingston, P.A. unpubl. data). Thus, cod may merely be responding to changes in red king crab density and may not be the cause of the decline.

#### 5.4.1.2 Incidental harvest of other marine resources.

Few statistics are available on the bycatch of fish species in 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 untargeted 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 two 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 overall 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.

5.4.1.3 Direct stress to marine mammals and birds.

Sea otters may take any size 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.

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 pose a large threat nor to be a prohibited taking for purposes of the Migratory Bird Treaty Act.

5.4.1.4 Environmental pollution resulting from the dumping into the sea by catcher/processor fishing vessels and by shorebased processing facilities of crab processing and other wastes.

Commercial 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 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 boat with a live tank 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 crab.

Properly conducted, 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.

5.4.1.5 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.

5.4.1.6 Stress to biota caused by lost gear.

Lost gear which continues to fish could have an adverse impact on the 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 crab pots.

5.4.1.7 Damage to benthic organisms due to gear placement.

The impact of thousands of crab pots on benthic communities is unknown. The impact on crab populations may be significant when many pots are placed in areas of dense crab schools. The collection of juvenile and female 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.

5.4.1.8 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 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.

5.4.2 Irreversible or Irretrievable Commitments of Resources which would be Involved if Commercial King and Tanner 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 exclusive economic 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 and the Federal Government.

5.4.3 Relationships Between Short-term Uses of Marine Resources which are in Commercial King and Tanner 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 and Tanner 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.

## 5.5 Differences in Environmental Impacts of the Alternatives

Alternatives presented in this EA/RIR refer to differences in decision making procedures used to manage king and Tanner crab fisheries in the Bering Sea/Aleutian Islands. None of the alternatives contemplate changes to status quo management measures themselves and, therefore, present no differential environmental impact. Ultimately, however, Alternatives 2 and 3 may provide greater assurance that the broadest range of scientific expertise is used to analyze the environmental consequences of managing the fisheries. To that extent, FMP Alternatives 2 and 3 can be expected to assure better protection of the environment, although there is no indication that FMP Alternative 1 poses any particular environmental threat.

## 6.0 REGULATORY IMPACT REVIEW (RIR)

The discussions of the alternative procedures for changing individual management measures and of the measures themselves in Chapters 3 and 4 are the basis for many of the following statements concerning the impacts of the three FMP alternatives.

### 6.1 Reporting Costs

Although reporting requirements are deferred to the State in the first two FMP alternatives as opposed to being specified in FMP Alternative 3, reporting requirements and, therefore, the reporting costs borne by the industry, are not expected to differ significantly among the three alternatives. At the present time, the Federal government is unwilling to transfer the full financial costs of observers to industry. In the absence of an effective means of monitoring operational compliance with harvest regulation, particularly by at-sea processing operations, both biological and economic benefits may be foregone from an optimally managed crab resource. Recent statistical analysis of at-sea processor performance in the crab fishery strongly suggests a widespread disregard for minimum size regulations among some in this sector of the industry. Absent observer coverage, unfair economic advantage may accrue to violators, having adverse biological implications for rebuilding and/or maintenance of stocks, and reducing incentives of others to adhere to fisheries regulations.

### 6.2 Management Costs (Research, Administrative, Enforcement, and Judicial Costs)

The amount of review associated with the processes for changing a management measure would probably vary among the three FMP alternatives. The amount of review and, therefore, the research and administrative costs are expected to be lowest with Alternative 1 and highest with Alternative 3. The increased review is expected to result in a greater assurance that a change will be made if and only if the change is appropriate. With this one exception, the three FMP alternatives are not expected to require significantly different ongoing research, administrative, enforcement, and judicial effort or costs.

There would, however, be an additional one time cost with FMP Alternative 3 and, to a lesser extent, Alternative 2. This would be the cost of rule making to replace State management with Federal management. With Alternative 2, fewer Federal rules would be required and with Alternative 1, none. This difference means that, administratively, FMP Alternative 3 would be more expensive to implement and could require more time to implement. It is estimated that the additional administrative cost would be $100,000 and that an additional 12 months might be necessary to initially establish Alternative 3.

FMP Alternatives 1 and 2 defer significant management authority to the State, in the first case by default and in the second by explicit authorization. One of the principal justifications for either of these two alternatives is that they would result in lower management costs because the State already has research, administrative, and enforcement programs in place that could be used with FMP Alternatives 1 or 2. This assumes that the State would curtail or cut its programs if FMP Alternative 3 is implemented. Given the reduction in State funding for its groundfish program, which followed the development of an FMP for groundfish, this is a likely outcome. However, as with groundfish, the Federal Government could dedicate required levels of new funding to support current State programs through contract, although perhaps not as cost effectively as the status quo. The cost differential cannot be estimated, a priori. However, the difference is not expected to be great, in relative terms.

Complete substitute Federal programs may be more expensive than existing State programs. Current State programs for shellfish management, in part involve buildings, vessels, field crews, administration, and other components whose costs are shared with other State programs for salmon, herring, and others. Substitute Federal programs may not have these cost-savings advantages, although it is possible that these new programs could be designed in such a manner that their total costs are similar to existing State programs for shellfish. Regardless of total costs, substitute Federal programs will certainly cost the Federal Government more and the State less.

The following estimates of State and Federal costs are based on information provided in 1987 by ADF&G and NMFS Enforcement. The State's direct administrative and research program expenditures for king and Tanner crab in the BSAI are approximately $700,000-$900,000 per year. This does not include the cost of facility rentals, Board of Fisheries regulatory meetings, or the assistance of the Department of Law for regulatory review and legal counsel. State enforcement costs for these fisheries approach $800,000. It has been estimated that Federal enforcement costs would be the same. The Federal cost estimate includes $660,000 for USCG aerial patrols and at-sea boarding and just over $90,000 for NMFS enforcement costs. Note that the aerial patrols, which are currently being conducted in support of groundfish management and other USCG responsibilities, can to some extent simultaneously support crab management.

If the State withdraws support for BSAI crab management programs in the EEZ the probable level of Federal funding for substitute programs becomes an important issue. Although it is not known under what circumstances the State would withdraw support or what level of Federal funding would be available to replace State support, the implications of different levels of Federal funding can be considered.

At one extreme is a high level of funding with which the existing State programs could be continued by contract or comparable Federal programs. At the other extreme is a significantly lower level of funding that would not adequately allow the crab fisheries to be effectively managed with the relatively intensive management approaches embodied in each of the three FMP alternatives being considered. Less intensive management may be appropriate if adequate funding is not available to support the current approach to management. This does not necessarily suggest that the current approach is inappropriate if adequate funding is available. Less intensive management will require greater margins for management error, that is it must necessarily be substantially more conservative. This will, in turn, reduce the magnitude and scope of directed crab fisheries and reduce the biological and economic yield from the resource. No accurate estimate of this reduction can be made but it is likely that, at the least, moderate reductions in the commercial crab fishery would be required to assure prevention of overfishing of the resource under these circumstances.

Ongoing State management under Alternative 2 would result in increased marginal expenses due to increased reporting requirements to the Federal Government, increases in meetings, etc. The State quantified these costs as $171,400 on a yearly basis (ADF&G, 1988). Two new positions, an economist and a biologist, were envisioned as needed on a full-time basis to attend to these increased requirements. The salaries and benefits for these two positions accounted for $108,400 of the marginal costs.

## 6.3 Impacts on Consumers

Regardless of the FMP alternatives selected, large changes in catch will occur in response to changing conditions in the fisheries. These changes will affect consumers both in terms of the quantities of products available and the prices of those products. Although the choice among the three FMP alternatives may affect quantities and prices, the differences by alternative cannot be identified. For all practical purposes the impacts on U.S. consumers of any difference are expected to be small because: (1) much of the crab catch is exported, (2) there are relatively good substitutes for BSAI crab for most consumers, and (3) these crab account for an insignificant part of consumers' budgets.

## 6.4 Net Benefits and their Distribution Among Participants in the Industry

The three FMP alternatives differ in the delegation of authority for implementation, review, and change of many management measures outlined above. These differences could result in some management decisions being made. As noted in Chapters 3 and 4: (1) compared to FMP Alternative 1, FMP Alternative 2 would be expected to provide greater assurance that well informed decisions are made and that all vessels participating in the fishery are regulated; and (2) FMP Alternative 3 would be expected to provide even greater assurances that these benefits would be achieved. None of the alternatives are expected to interrupt or change the level of catch or supply to the consumer.

If an alternative (such as FMP Alternative 3) is selected that results in the State withdrawing its support for crab management and if sufficient substitute Federal funding would not be available, the ability to effectively manage the BSAI crab fisheries would diminish and the net benefits from these fisheries would probably decrease. If the State does withdraw its support for crab management, it would reduce the State's ability to: (1) retain a strong voice in the direction of management related programs, and (2) incorporate State priorities and philosophy in crab management policy.

Given the current Federal budget problems, it is quite likely that the level of funding for and the level of effort of Federal research and administrative programs, that would replace any eliminated State programs, would be below the current State level. Therefore, the cost, and perhaps the effectiveness, of the replacement programs, if they are needed, would probably be lower than with the current State programs.

The effectiveness and net benefits of a change in a fishery management system will depend on the rate at which the changes are made and the ability of those involved with or affected by the management system to adjust to the change. The short-term adjustment associated with both the uncertainty and confusion often associated with a new management system can be disruptive and, therefore, costly. This argues in favor of assuring that the changes are well conceived and understood by all those who will be affected.

More definitive statements can be made concerning the expected differences among the three FMP alternatives in terms of the distribution of net benefits. FMP Alternative 1 provides the State with the most control over management of the fisheries and, therefore, the distribution of benefits from the fisheries. However, as with the other FMP alternatives, this control is constrained by the fact that the State must still abide by the National Standards, Magnuson Act, and other applicable laws. FMP Alternative 3 provides the State the least control with the C/RD having the most direct control. Even with Alternative 3 the State can have significant influence on both management and benefits through: (1) representation on the Council, (2) participation on the crab plan team, and (3) access to the RD and Secretary of Commerce. State management authority described under FMP Alternative 2 falls in between FMP Alternative 1 and 3 with the C/RD sharing the management responsibility with the State.

It is difficult to determine to what extent the State would use its management control provided by the first two FMP alternatives. However, recognizing that the State has been managing the king crab fisheries and the Tanner crab fisheries under an FMP Alternative 1 scenario since 1977 and 1986, respectively (i.e., no FMP, but MFCMA), it is reasonable to expect that there would be no significant changes in current management of these fisheries, at least in the near term. However, it is possible that over the long term, diverging management approaches might result depending on what FMP alternative is selected. In fact, even with FMP Alternative 3, where the C/RD have the most direct control, it is doubtful that any immediate changes to management measures currently used by the State would occur. This statement is made based on the eight years experience of management under the former Tanner Crab FMP where it was the policy of the C/RD to generally adopt the management direction offered by the State as its own.

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# DRAFT
# FISHERY MANAGEMENT PLAN
# FOR THE
# COMMERCIAL KING AND TANNER CRAB FISHERIES
# IN THE
# BERING SEA/ALEUTIAN ISLANDS

November 28, 1988

North Pacific Fishery Management Council
P.O. Box 103136
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# INTRODUCTION

The king and Tanner crab populations of Alaska have had a history of extensive commercial exploitation for 20 or more years. That history is characterized by spectacular fluctuations in crab abundance and catch, and by the development of fisheries for previously unexploited stocks.

The Magnuson Fishery Conservation and Management Act (16 U.S.C. 1801, et seq.) (Magnuson Act), subsection 302(h)(1), requires that a fishery management plan (FMP) be prepared for any fishery that requires conservation and management. On December 7, 1984, the North Pacific Fishery Management Council (Council) adopted findings regarding fishery management policy which addresses the need for Federal management of fisheries off Alaska. The history of variation in the abundance of king and Tanner crabs off Alaska, and the interstate nature of the crab fleet and heavy capitalization in crab fisheries, particularly in the Bering Sea, create a situation which demands the Federal management oversight contemplated by subsection 302(h)(1) of the Magnuson Act and particularly Findings 2, 3, and 6, of the Council, as follows:

2. The fishery resources off Alaska are the property of the United States and should be managed for the benefit of everyone in the U.S. in accordance with the provisions of the Magnuson Act.

3. The common property nature of fishery resources tends to cause overcapitalization in the industry, increases the chances of resource depletion, and decreases the incentive for conservation of the resource by the users.

6. The lack of timely and adequate data has hampered Federal decision-making and management to the detriment of the resource and the economy (see page 1-4 for reasons for suspending Federal Tanner crab FMP).

Pursuant to subsection 302(h)(1), the Council has responsibility for preparing FMPs and amendments to FMPs for the conservation and management of fisheries in the Exclusive Economic Zone (EEZ) off Alaska.

In January 1977, the Secretary of Commerce (Secretary) adopted and implemented a Preliminary Fishery Management Plan (PMP) for the foreign king and Tanner crab fisheries in the eastern Bering Sea (U.S. Department of Commerce, 1977). Under the PMP, no foreign fishing for king crab was allowed and restrictions were continued on the foreign Tanner crab fishery.

After this initial action, the decision was made to coordinate Federal management of crab fisheries with the State of Alaska (State). This decision was based on a desire to optimize the use of limited State and Federal resources and prevent duplication of

effort by making use of the existing State management regime. The State has managed king crab fisheries inside and outside State waters since statehood in 1959. It also managed domestic Tanner crab fisheries since their inception in the Bering Sea in 1968, in the Aleutians in 1973, and jointly managed the Tanner crab fishery in the Bering Sea and Aleutian Islands (BS/AI) area and the Gulf of Alaska (GOA) from December 6, 1978, until November 1, 1986, in accordance with the FMP for the Commercial Tanner Crab Fishery off the Coast of Alaska. The Alaska Board of Fisheries (Board) is currently responsible for regulating and establishing policy for management of the crab fisheries for vessels regulated under the laws of the State. The State's regulatory system provides for extensive public input, ensures necessary annual revisions, is flexible enough to accommodate changes in resource abundance and resource utilization patterns, and is familiar to crab fishermen and processors. The State has made a substantial investment in facilities, communications, information systems, vessels, equipment, experienced personnel capable of carrying out extensive crab management, and research and enforcement programs.

The Tanner crab FMP was approved by the Secretary and published in the Federal Register on May 16, 1978, (43 FR 21170) under the authority of the Magnuson Act. Final implementing regulations applicable to vessels of the United States were published on December 6, 1978, (43 FR 57149). Final implementing regulations applicable to vessels of foreign nations were published on December 19, 1978, (43 FR 59075, 43 FR 59292). The FMP was

amended nine times, most recently on September 12, 1984, (49 FR 35779). To achieve its conservation and management objectives and to coordinate management effectively with the State, the FMP adopted many of the management measures employed by the State.

In October 1981, the Council and the State adopted a joint statement of principles for the management of domestic king crab fisheries in the BS/AI area (see Appendix A). This agreement formed the basis for interim management during development of the BS/AI king crab FMP. A notice of availability of the FMP was published on July 19, 1984, (49 FR 29250). A final rule was published on November 14, 1984, (49 FR 44998). Although the Federal regulations implementing framework provisions of the FMP were effective December 2, 1984, actual implementation of management measures under the FMP was deferred pending acceptance of the delegation of authority by the Governor of Alaska. In a letter dated June 20, 1986, the Governor declined the delegation of authority. His principal objections to the delegation were: excessive Federal oversight, uncertainties in the regulatory approval process, unnecessary governmental duplication, and concerns for the degree to which discretionary authority of the Board would be constrained.

At its March 1986 meeting, the Council voted to suspend the implementing regulations for the Tanner crab FMP because it did not provide for management based on the best available scientific information, provide for timely coordination of management with

the State, or conform to several of the Magnuson Act's national standards. Following the March meeting, the Council published management alternatives for public comment. The three major alternatives were: (1) State management with no Federal FMP, (2) an FMP that delegates management to the State; or (3) an FMP with direct Federal management. Three overriding concerns were evident in the public comments reviewed by the Council in September. Any management arrangement must provide efficient and effective management, conservation of the crab stocks, and fair access by all user groups to management's decision-making. The Council, at its September 24-26, 1986, meeting, appointed a workgroup of both industry representatives and Council members to develop a comprehensive management approach for crab fisheries off Alaska that would address these concerns.

On November 1, 1986, the National Oceanic and Atmospheric Administration (NOAA) promulgated an emergency interim rule, at the request of the Council, to repeal the regulations implementing the Tanner crab FMP for a period of 90 days (November 1, 1986, through January 29, 1987, (51 FR 40027).

On November 20, 1986, the Council workgroup met and recommended repeal of the Tanner crab FMP and its implementing regulations. The workgroup recommended that the Council's crab plan team draft a new FMP that includes both king and Tanner crabs, limits its scope to the BS/AI area, and defers management to the State to the maximum extent possible.

At its December 1986 meeting, the Council voted to request extension of the emergency interim rule repealing regulations implementing the Tanner crab FMP for a second 90-day period (January 30 through April 29, 1987). The Council also accepted the recommendation of the Council workgroup to begin preparation of a new king and Tanner crab FMP that would replace both previous FMPs for the BS/AI area, but not address king and Tanner crab fisheries in the Gulf of Alaska for the present time. The Council also determined that the 180-day duration of the emergency interim rule was insufficient to complete a study of management options, prepare a new FMP, and complete the Secretarial review process. The Council, therefore, requested the Secretary to prepare and implement a Secretarial amendment repealing the Tanner crab FMP and its implementing regulations, to allow time for preparation, approval, and implementation of a new FMP for king and Tanner crabs in the BS/AI area, and to prevent reinstitution of the Tanner crab FMP implementing regulations which did not conform to the Magnuson Act national standards. A final rule was published on May 11, 1987, (52 FR 17577) implementing the Secretarial Amendment repealing the Tanner crab FMP effective April 29, 1987.

This FMP is written as a cooperative FMP in an attempt to avoid problems that were encountered in the previous Tanner and king crab FMPs. It contains a general management goal with seven management objectives identified, and relevant management measures required to meet the objectives that are presented.

Several management measures may contribute to more than one objective, and several objectives may mesh in any given decision on a case-by-case basis.

The management measures are ones that have been used in managing the king and Tanner crab fisheries of the BS/AI area and have evolved over the history of the fishery. Additional analysis is encouraged in the FMP to determine if alternative management measures may be more appropriate.

This FMP attempts to avoid unnecessary duplication of effort. It defers much of the management to the State, while the most controversial measures are fixed in the FMP and require Plan amendment to change.

Federal management oversight to determine if an action is consistent with this FMP, the Magnuson Act, or other applicable Federal law is also provided in the form of a review and appeals procedure for both State preseason and in-season actions and through formation of a Council Crab Interim Action Committee.

## 2.0 PROCEDURES FOR FMP IMPLEMENTATION

Implementation of this FMP requires an annual review of king and Tanner crab management measures and regulations by the NMFS, the State and the Council. 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 described in detail in Otto (1985) and Otto (1986) with respect to king crabs and for this FMP are illustrated in Figures 2.1, 2.2 and 2.3. The precise scheduling of the various stages of this procedure may vary slightly from year to year.

The Secretary (through the Council and the National Marine Fisheries Service (NMFS) Alaska Regional Office) and the State have established the following protocol which describes the roles of the Federal and State governments:

1. The Council will develop an FMP (and future amendments) to govern management of king and Tanner crab fisheries in the EEZ of the BS/AI, prescribing objectives and any management measures found by the Secretary to be necessary for effective management. The State will promulgate additional regulations applicable to all vessels registered with the State governing the fisheries in

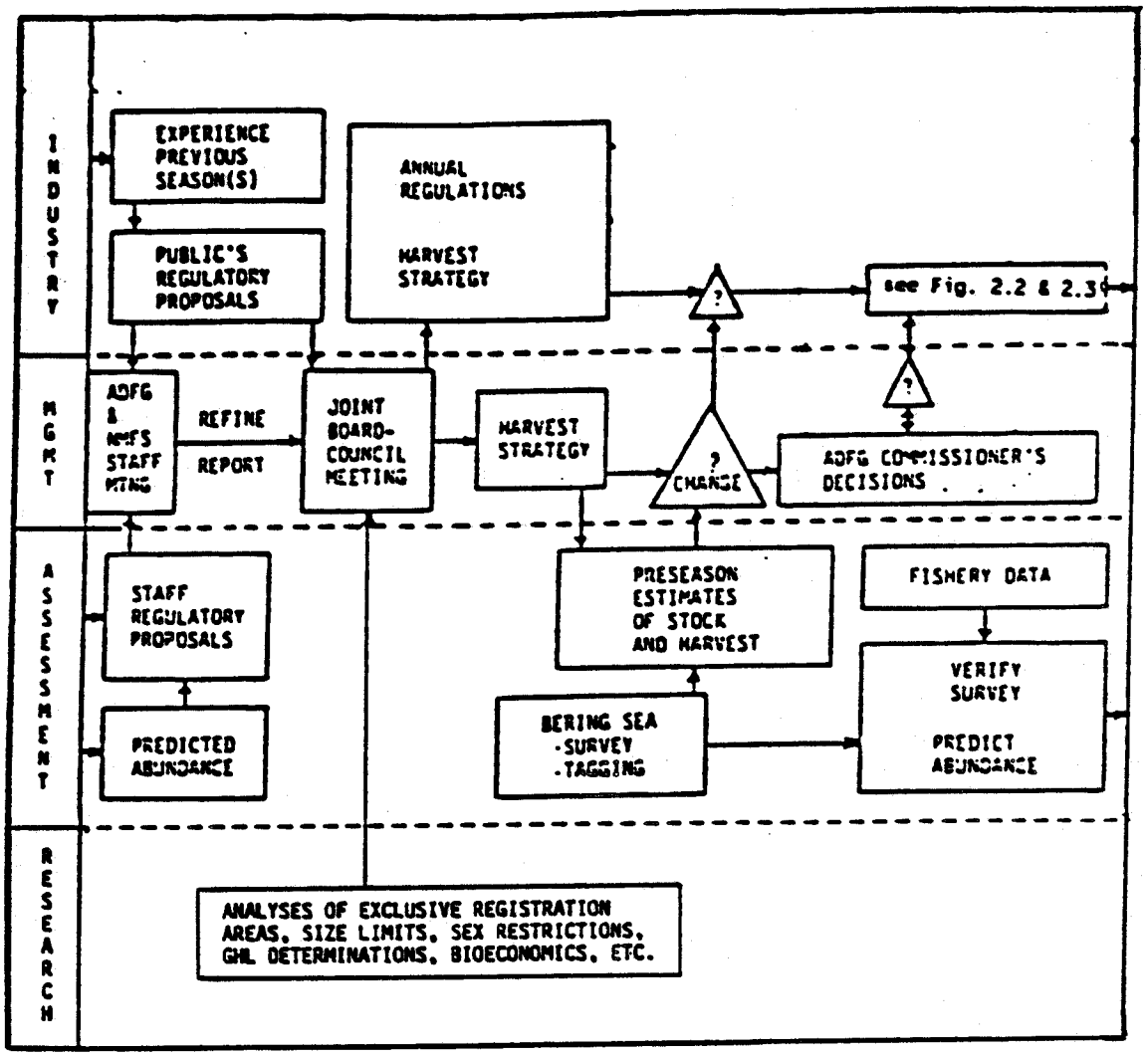


Figure 2.1. Annual cycle of management decision making for king and Tanner crab stocks and its interaction with fisheries and resource assessment (modified from North Pacific Fishery Management Council 1984, Otto 1985 and Otto 1986).

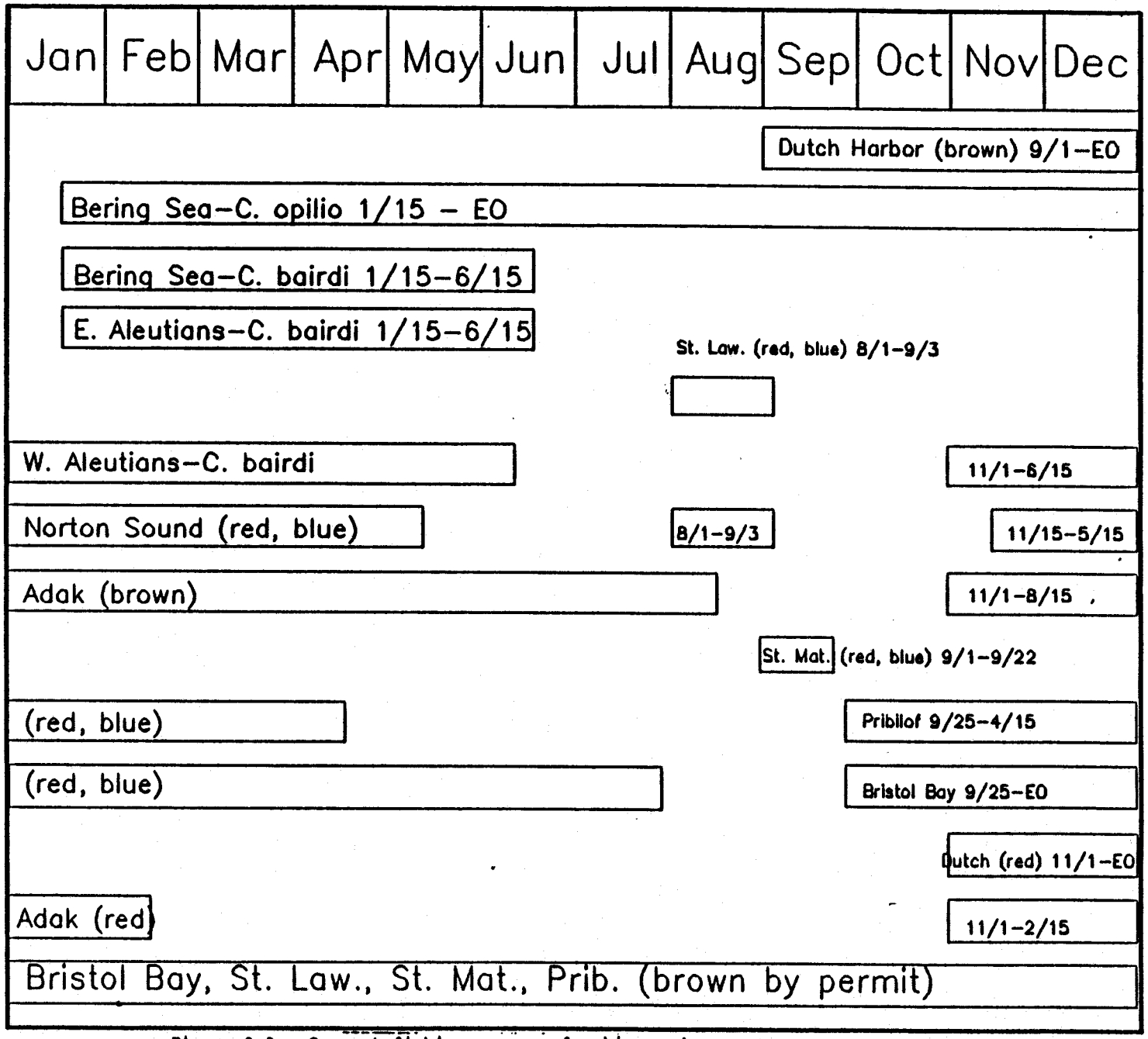


**Figure 2.2. Current fishing seasons for king and Tanner crab stocks in the BS/AI area (second seasons for larger crabs are also possible by State emergency order (EO).**

**Source:** Alaska Department of Fish and Game 1990 Commercial Shellfish Regulations

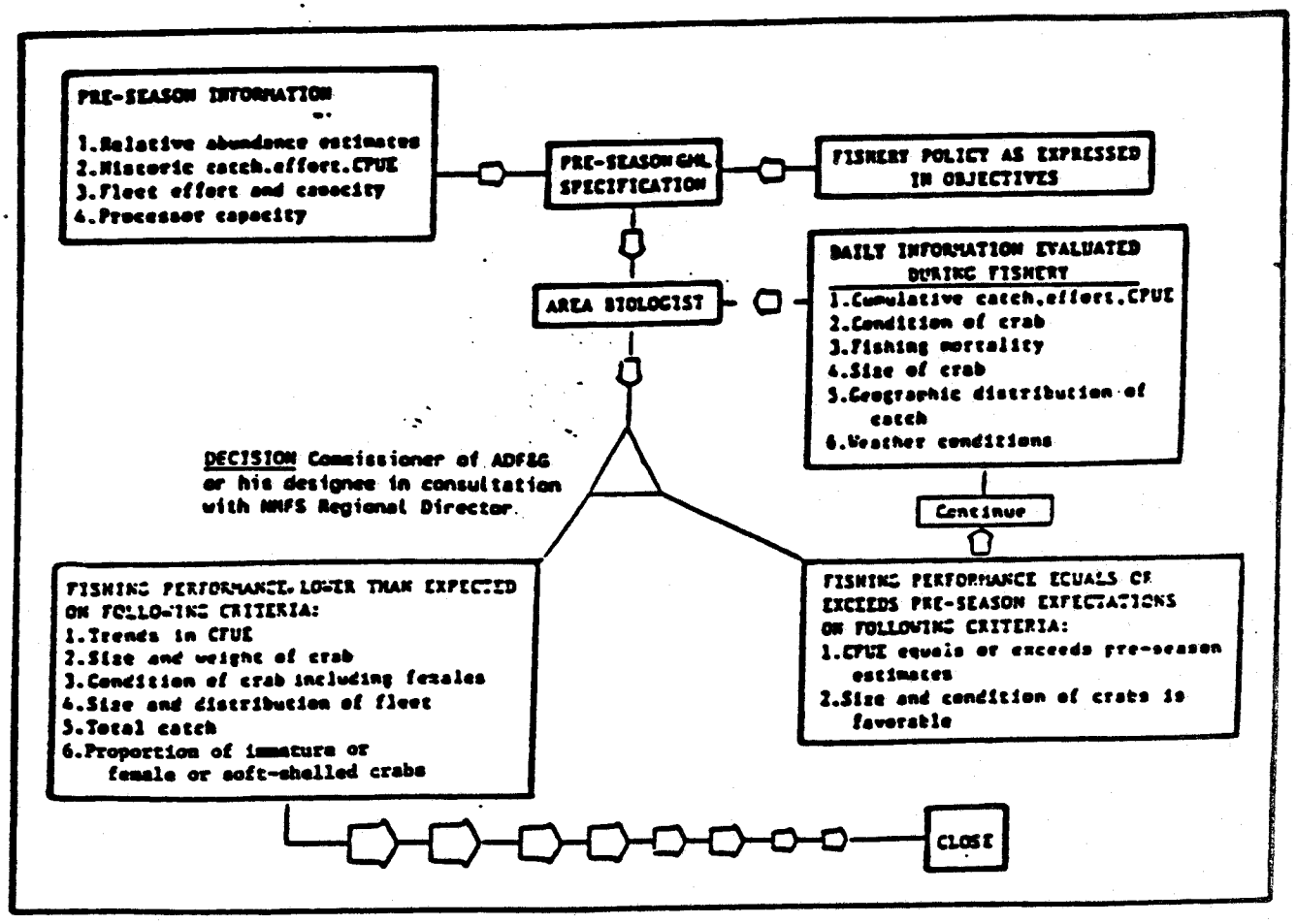


Figure 2.3. In-season management decision making by Alaska Department of Fish and Game (ADF&G) based on preseason specification of guideline harvest level (GHL). Cycle at right continues until GHL is reached. Area management biologists may issue emergency orders closing fisheries but final decisions are made by the Commissioner or his designee. Modified from North Pacific Fishery Management Council (1984), Otto (1985) and Otto (1986).

the EEZ that are consistent with the FMP, Magnuson Act, and other applicable Federal law. The FMP contains three types of management measures: (1) specific Federal management measures that are implemented by Federal regulations and require an FMP or regulatory amendment to change, (2) framework type management measures, with criteria set out in the FMP that the State must follow when implementing changes in State regulations, and (3) measures that are neither rigidly specified nor frameworked in the FMP, and which may be freely adopted or modified by the State, subject to an appeals process or other Federal law (see Chapter 8).

2. Representatives from the Council, NMFS, and NOAA General Counsel will participate in the State's development of regulations for management of king and Tanner crabs in the BS/AI area, including direct participation in the shellfish meeting of the State regulatory body[1] for the purpose of assisting the State in determining the extent to which proposed management measures fall within the scope of the FMP, Magnuson Act, and other applicable Federal law. However, these representatives will not vote on the various management measures.

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[1] Currently, the Alaska Board of Fisheries is the State regulatory body governing crab and is referred to as Board of Fisheries or Board in this FMP. The use of the phrase "State regulatory body" means the Board of Fisheries specifically, or any other State regultory body which subsequently may be delegated shellfish regulatory authority by the State.

The Secretary will review measures adopted by the State to determine if they are consistent with the FMP, the Magnuson Act and its national standards in accordance with Chapters 9 and 10.

3. The Secretary will issue Federal regulations to supersede any State laws in the EEZ that are inconsistent with the FMP, the Magnuson Act, or other applicable Federal law. The Secretary will consider appeals asserting that a State law is inconsistent with the Magnuson Act, the FMP, or other applicable Federal law (see Chapter 9).

4. The Alaska Department of Fish and Game (ADF&G) will have responsibility for developing the information upon which to base State fishing regulations, with continued assistance from NMFS. In carrying out this responsibility, ADF&G will consult actively with the NMFS (Alaska Regional Office and Northwest and Alaska Fisheries Center), NOAA General Counsel, the plan team, and other fishery management or research agencies in order to prevent duplication of effort and assure consistency with the Magnuson Act, the FMP, and other applicable Federal law.

5. The FMP provides that the Commissioner of ADF&G, or his designee, after consultation with the NMFS Regional Director, or his designee, may open or close seasons or areas by means of emergency orders (EO) authorized under State regulations. Interested persons may appeal these actions to the Secretary for a determination that the emergency orders are consistent with the

Magnuson Act, the FMP, and other applicable Federal law. If the Secretary determines that the State action is inconsistent with the above, the Secretary will issue a Federal regulation to supersede the State EO in the EEZ (see Chapter 10).

6. Access to the BS/AI king and Tanner crab regulatory process, particularly for nonresidents of Alaska, will be provided through an advisory committee. This Pacific Northwest Crab Industry Advisory Committee (PNCIAC) shall be sanctioned by and operate under the auspices of the Council. This is necessary because State law does not provide for the formation of a Board of Fisheries advisory committee located outside the State. This PNCIAC shall be recognized by the State as occupying the same consultative role on preseason and in-season management measures as all other existing State of Alaska Fish and Game Advisory Committees, no more and no less. The Council shall establish general guidelines and membership qualifications for the advisory group which shall be substantially similar to those guidelines established by the State pertaining to existing advisory committees. Within this framework the advisory committee shall establish its own by-laws and rules of procedure.

The PNCIAC shall be industry funded, but may request staff support from the Council, NMFS, and ADF&G as needed.

The PNCIAC shall meet at appropriate times and places throughout the year to review and advise the State and the

Council on crab management issues, stock status information, and biological and economic analyses relating to the BS/AI king and Tanner crab fisheries.

In addition, the PNCIAC shall report to the Council on any relevant crab management issue by filing reports as appropriate. The Council will also review reports as appropriate from other crab advisory committees that normally report to the State crab regulatory body. The PNCIAC shall assist in an annual Council/State public hearing to be held in the Pacific Northwest. The PNCIAC shall review and advise the State on proposed preseason management measures. During the fishing season, the PNCIAC, on the same basis as any other Board advisory committee, shall monitor ADF&G reports and data, may recommend to ADF&G the need for in-season adjustments, and may advise on decisions relating to in-season adjustments and "emergency-type" actions.

The PNCIAC may request review of any relevant matter to the Crab Interim Action Committee (discussed below) and may bring petitions and appeals in its own name pursuant to Chapters 9 and 10 of this FMP.

7. A Crab Interim Action Committee (CIAC) shall be established by the Council for the purpose of providing oversight of this FMP and to provide for Council review of management measures and other relevant matters. The CIAC shall be composed of the following members:

Regional Director, NMFS, or his designee
Commissioner, ADF&G, or his designee
Director, Washington State Department of Fisheries, or his designee

There are three types of review the CIAC may engage in:

A. Category 1--Appeals of a Preseason Management Decision

In accordance with Chapter 9 of the FMP, any appeal of a preseason management decision which is rejected by the Board and subsequently appealed to the Secretary will be reviewed by the CIAC prior to the appeal being reviewed by the Secretary. The CIAC will have no authority to grant or reject the appeal, but shall comment upon the appeal for the benefit of the Secretary.

B. Category 2--Appeals of an In-season Management Decision

In accordance with Chapter 10 of the FMP, the Secretary will, to the extent possible when reviewing any appeal of an in-season management decision, communicate with the CIAC in advance of making his decision whether to

grant or reject the appeal in order to solicit the CIAC's comments on the management decision at issue.

C. Category 3--Other

This category includes preseason management measures, in-season adjustments, and other matters relative to this FMP which fishery participants believe warrant Council action or attention, and which fall outside the Council's normal schedule for reviewing the FMP. The CIAC will not review any management decision or action which is concurrently being reviewed through the appeals process as outlined in Chapters 9 and 10. Such requests for review shall clearly identify the management measures to be reviewed and shall contain a concise statement of the reason(s) for the request.

The CIAC shall function similarly to the Council's "Interim Action Committee." The CIAC shall consider each request for review to determine whether the management measure(s) or other relevant matter(s) is consistent with this FMP (including compliance with framework criteria), the Magnuson Act, and other Federal law. Following its review, the CIAC will comment on the appeal in the case of Category 1 and 2 reviews; may determine no action is necessary on the Category 3 request; or, for any of the Categories, recommend the issue to the Council for full Council

consideration. In all cases, the CIAC shall issue its findings in writing.

8. The State will provide written explanations of the reasons for its decisions concerning management of crab fisheries. For emergency orders, the current EO written justification provided by the State meets this requirement.

9. Representatives of the State and Council will hold at least one annual public hearing in the Pacific Northwest.

10. An annual area management report to the Board discussing current biological and economic status of the fisheries, GHL ranges, and support for different management decisions or changes in harvest strategies will be prepared by the State (ADF&G lead agency), with NMFS and crab plan team input incorporated as appropriate. This will be available for public comment, with a Board report presented at least annually at a Council meeting normally held in conjunction with or close to the State Board meeting in March or April. GHLs will be revised when new information is available. Such information will be made available to the public.

11. Federal enforcement agents (NOAA) and the U.S. Coast Guard (DOT) will direct enforcement resources toward, and shall work in cooperation with, the State to enforce king and Tanner crab regulations in the BS/AI area.

## 3.0 FINDING OF CONSISTENCY OF EXISTING STATE REGULATIONS WITH THE FMP, THE MAGNUSON ACT, AND OTHER APPLICABLE FEDERAL LAW

Prior to implementation of the FMP, state laws and regulations are subject to mandatory review by the Secretary. Between the effective date of regulations implementing this FMP and the next regularly scheduled meeting of the State fisheries regulatory body concerning crab management, any member of the public may petition any existing regulation to the State and, if unsuccessful, to the Secretary, in accordance with the procedure set forth in Chapter 9 herein. If the Secretary finds, on the basis of an appeal, or as a result of mandatory review, that any existing State law or regulation is inconsistent with the Magnuson Act, the FMP, or applicable Federal law, he will publish Federal rules in the FEDERAL REGISTER superseding the State laws or regulations in the EEZ.

## 4.0 DEFINITIONS OF TERMS

The following terms are used extensively throughout this FMP:

Maximum sustainable yield (MSY) is an average over a reasonable length of time of the largest catch which can be taken continuously from a stock under current environmental conditions. MSY should normally be presented with a range of values around its point estimate. Where sufficient scientific data as to the biological characteristics of the stock do not exist, or the period of exploitation or investigation has not been long enough for adequate understanding of stock dynamics, the MSY will be estimated from the best information available. This definition adopted by the Council's Scientific and Statistical Committee (SSC) is similar to a definition presented in Ricker (1975). MSY for king and Tanner crabs in the BS/AI management unit is specified in Chapter 6.0

Threshold is the minimum size of a stock that allows sufficient recruitment so that the stock can eventually reach a level that produces MSY. Implicit in this definition are rebuilding schedules. They have not been explicitly specified since the selection of a schedule is a part of the OY determination process. Interest instead is on the identification of a stock level below which the ability to rebuild is uncertain. When a stock is at or below threshold, the fishery will be closed entirely, because further removals from the spawning stock will

further jeopardize the already uncertain ability of the stock to recover. The estimate given should reflect use of the best scientific information available (see 8.2.2 Guideline Harvest Levels). This threshold definition differs only slightly from those used in other FMPs. The primary distinction is the specification that the fishery will be closed when the stock is at or below threshold. However, this addition is made only for clarity, and is consistent with the range of harvests specified in the definition of ABC below.

Acceptable biological catch (ABC) is a seasonally determined catch or range of catches that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitment. Given suitable biological justification, the ABC may be set anywhere between zero and the current harvestable biomass less the biomass of mature males necessary to mate with a threshold level of females. Also, the ABC is defined as zero when the female stock is at or below threshold. The ABC may be modified to incorporate safety factors and risk assessment due to uncertainty. Lacking other biological justification, the ABC is defined as the MSY exploitation rate multiplied by the size of the biomass for the relevant time period. This definition of ABC differs slightly from other FMPs, in that others specify that the upper end of the range for ABCs is current biomass less threshold. Because king and Tanner crab fisheries are prosecuted on males only, females are excluded from the calculation of ABC in this FMP.

Optimum Yield (OY) is that which provides the greatest overall benefit to the nation with particular reference to food production and recreational fisheries. OY is based upon the maximum sustainable yield for a given fishery, modified by relevant economic, social or biological factors. It may be obtained by a plus or minus deviation from ABC for purposes of promoting economic, social or ecological objectives as established by law and the public participation process.

The definition of OY prescribes that the benefits of the fishery resources be allocated among all of the people affected by the fishery. These include commercial fishermen, processors, foreign fishermen, sport fishermen, distributors, consumers, governments, and a host of manufacturing and service industries. These groups usually have different and often conflicting ideas about the best use of the resources. Optimum yield then involves judgmental decisions that must be made by Councils based upon the best obtainable information. OY for king and Tanner crabs in the BS/AI management unit is specified in Chapter 6.0.

Fishing year is a calendar year used for accounting and tax purposes. It is defined as January 1 through December 31.

Registration year is defined as June 28 through June 27 for king crab, and August 1 through July 31 for Tanner crab.

Guideline harvest level (GHL) is the proposed level of harvest that is less than or equal to ABC, established preseason, and usually expressed as a range of allowable harvest for a species or species group of crab for each registration area, district, subdistrict or section. The sum of GHLs represent the allowable catch within the OY range.

Recruitment overfishing is the condition that occurs when the spawning stock is reduced by fishing to too low a level to ensure adequate production of young crabs--the recruits to the future fishery. This definition is modified from Gulland (1983).

Registration (statistical) area. According to the State regulations, a statistical area consists of a registration area comprising all the waters within the statistical area which are territorial waters of Alaska; and an adjacent seaward biological influence zone, comprised of all the waters within the statistical area which are not part of the registration area. Also, according to 5 AAC 34.010 and 5 AAC 35.010, king and Tanner crab regulations applicable to a registration area shall be applicable also in its adjacent seaward biological influence zone. For this FMP, the term registration area shall encompass the statistical area.

Commercial fishing means fishing, the resulting catch of which is intended to be sold or bartered.

Subsistence fishing means the taking of king or Tanner crab for customary and traditional uses by Alaska residents for direct personal or family consumption and not for sale in accordance with applicable State and Federal law.

## 5.0 DESCRIPTION OF FISHERY MANAGEMENT UNIT

This FMP applies to commercial fisheries for red king crab Paralithodes camtschatica, blue king crab P. platypus, brown (or golden) king crab Lithodes aequispina, scarlet (or deep sea) king crab Lithodes couesi, and Chionoecetes bairdi (or snow) Tanner crab, C. opilio (or snow or queen) Tanner crab, grooved Tanner crab, C. tanneri, and triangle Tanner crab C. angulatus in the BS/AI area.

To date, commercial landings have only been reported for red, blue, and brown king crab, and C. bairdi and C. opilio Tanner crab and hybrids of these two species of Tanner crab. The other species of king and Tanner crab are included in this FMP because the State now provides for a fishery for these species under the conditions of a permit issued by the Commissioner of ADF&G. Other crab species may be added at a later time.

The BS/AI area is defined as those waters of the EEZ lying south of the Point Hope (68°21'N.), 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 Scotch Cap Light (164°44'36"W. longitude) (Figure 5.1).

The BS/AI area contains several stocks of king and Tanner crabs (see Appendix E) that are discrete from stocks in the Gulf of Alaska. In addition, the physical environment of this area

possesses attributes distinguishable from crab grounds in the Gulf of Alaska. Stocks of king and Tanner crabs in the Gulf of Alaska are not included in this management unit and will be managed by the State until the Council prepares an FMP for those stocks.

The Council considered the following in determining the boundaries for the management unit:

1. Crab fisheries outside and inside the BS/AI management unit are clearly different in a number of important respects. First, historically the Gulf of Alaska fisheries rely largely on single species while the BS/AI fisheries are concerned with multiple species (i.e. mainly red king crab in the Gulf of Alaska vs. red, blue, and brown king crabs in the BS/AI area, and C. bairdi in the Gulf of Alaska vs. C. opilio and C. bairdi in the BS/AI area). Second, there is a difference in composition of resident and nonresident fishermen between the two areas (the Gulf of Alaska fisheries have been conducted mostly by Alaska residents and the BS/AI fisheries almost equally by residents of Washington and Oregon and residents of Alaska). Third, the composition and mix of vessel size classes is different in the two areas; the BS/AI area is traditionally fished by larger vessels. Fourth, a greater proportion of the king and Tanner crab fisheries in the Gulf of Alaska occur within State waters than do the king and Tanner crab fisheries in the Bering Sea.

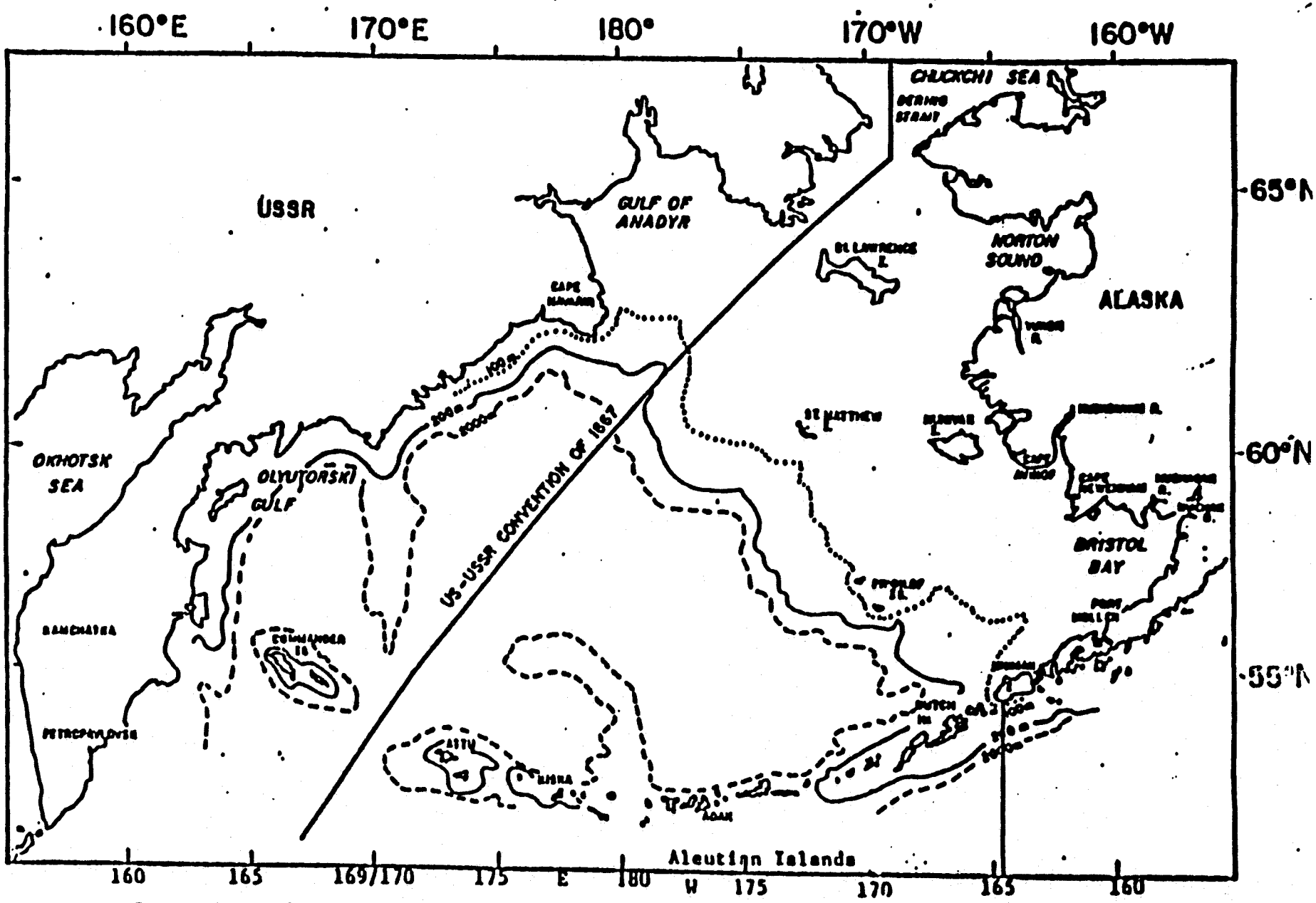



Figure 5.1 --Geographical locations in the eastern Bering Sea and Aleutian Islands.

2. The coordination of king and Tanner crab management in the BS/AI area with the BS/AI groundfish FMP was another consideration. This is especially important with respect to incidental catch issues.

# 6.0 SPECIFICATION OF MAXIMUM SUSTAINABLE YIELD, OPTIMUM YIELD, DOMESTIC ANNUAL HARVEST, TOTAL ALLOWABLE LEVEL OF FOREIGN FISHING, DOMESTIC ANNUAL PROCESSING, AND JOINT VENTURE PROCESSING

The total allowable level of foreign fishing and joint venture processing depends upon specification of MSY, OY, and the domestic fishing and processing capacity for king and Tanner crabs.

Although the estimate of MSY is of questionable utility in managing crab stocks due primarily to highly variable recruitment, MSY has been estimated on the basis of the best scientific data available for each species and stock of king and Tanner crab covered in this FMP. Lacking detailed information, MSY is equated to average catch levels in recent fisheries. These estimates are shown in Table 6.1.

Optimum yield (OY) is defined for this FMP as the amount of crab that may be legally landed under the requirements of this FMP and under the laws of the State of Alaska that have not been superseded by the Secretary pursuant to this FMP, not to exceed 200 million pounds of king crab, 108 million pounds of Chionoecetes bairdi Tanner crab, and 333 million pounds of Chionoecetes opilio Tanner crab in any one registration year.

Table 6.1. MSY estimates (average catches in millions of pounds) for king and Tanner crab stocks in the BS/AI management unit for the years indicated (approximate 95% confidence limit in parentheses).*

| Species | Bristol Bay | Pribilof Islands | St. Matthew | Norton Sound | Dutch Harbor | Adak | Bering Sea |
|---|---|---|---|---|---|---|---|
| Red king crab | 35 (25,45) 1953-87 | | | 1 (.4,1.4) 1977-87 | 11.2 (8,15) 1961-82 | 7 (5,10) 1960-86 | |
| Blue king crab | | 4 (3,6) 1973-87 | 3 (1,5) 1977-87 | | | | |
| Brown king crab | | | | | 1.4 (.9,1.9) 1981-87 | 7.4 (4,11) 1981-86 | |
| C. bairdi** | | | | | .7 (.4,1.0) 1973-86 | .2 (.1,.3) 1973-86 | 27 (18,36) 1965-86 |
| C. opilio** | | | | | | | 35 (19,51) 1970-86 |

* See Appendix E for stock definitions.

** Assumes foreign fishery caught only C. bairdi prior to 1970.

Source: Data from Westward Region Shellfish Report to the Alaska Board of Fisheries, Alaska Dept. of Fish and Game, 1987.

The upper limit for king crab is based on the sum of the highest historical harvest levels for each species in the management unit. Base periods of 1960 to 1986 were selected to cover the wide range of king crab harvests experienced during the development of the domestic fisheries. The upper limits for each species of Tanner crab represents estimates of ABCs for peak populations. The upper limit for C. bairdi is derived from 1976 NMFS survey abundance

estimates and the upper limit for C. opilio is derived from 1975 OCS survey abundance estimates (U.S. Department of Commerce, 1977). These surveys were used to estimate the upper end of the OY range because of limited harvest information. The lower end of the range for king crab and each species of Tanner crab is set at zero to reflect the possibility that a scheduled fishery may not open if stocks are at or below threshold. The OY so determined is 0.0 to 200 million pounds for king crab and 0.0 to 108 million pounds for C. bairdi Tanner crab and 0.0 to 333 million pounds for C. opilio Tanner crab in the BS/AI management area in any one registration year.

These estimates of OY indicate short-term harvest potential during periods of high crab abundance. However, they may overstate the harvest potential on a continuing basis, because peaks of harvest associated with a developing fisheries may have contributed to subsequent volatility in the abundance of crab stocks. In addition, the OY estimates do not indicate which stocks should be subject to rebuilding schedules, nor the manner in which national interest is attained over time through a balance of economic, social, and ecological factors relevant to OY. Because of temporal variability in these factors, GHLs are adjusted annually based upon current evaluations of the biological and socioeconomic components. The large upper limit on OYs is specified to accommodate the full range of possible GHL specifications depending upon annual assessments of short- and long-term tradeoffs in these factors.

Domestic fishing and processing capacity for king and Tanner crabs exceeds the OY for these species in the BS/AI area. During the 1980 peak of king crab fisheries, a harvest of 129.9 million pounds of Bristol Bay red king crab was caught and processed between September 10 and October 20. This amounted to about 3.2 million pounds per day (41 days) or about 1.0 billion pounds in a 330-day working year. This processing capacity is considerably more than the combined OYs (641 million pounds).

Pursuant to the Magnuson Act, Section 201(d), there is now no allowable level of foreign fishing or joint venture processing for the fisheries covered by this FMP. After GHLs are set each year, a determination will be made as to whether any of the annual harvest will be available for joint venture processing or foreign fishing.

Domestic, foreign and joint venture bycatch of king and Tanner crabs in trawl fisheries is currently regulated by limiting catches of these "prohibited species" by the BS/AI groundfish FMP and will be coordinated with implementation of this FMP and with stock conditions within the BS/AI area. The Council will provide estimates of levels of king and Tanner crab bycatch in groundfish fisheries prosecuted in the BS/AI management unit in a timely manner to ADF&G and the Board of Fisheries to allow the State to account for these removals in management of the directed crab fisheries.

Currently, there is insufficient information available for determining the MSY and OY for scarlet king crab, grooved Tanner crab, and triangle Tanner crab. The State provides for fisheries for these species under the terms of a special permit issued by the Commissioner of ADF&G which is designed to collect additional information needed for making such determinations.

## 7.0 GOAL AND OBJECTIVES FOR DOMESTIC FISHERY

The Council, in cooperation with the State, is committed to develop a long-range plan for managing BS/AI crab fisheries that will promote a stable regulatory environment for the seafood industry and maintain the health of the resources and environment.

The management system conforms to the Magnuson Act's national standards as listed in Appendix B and the comprehensive Statement of Goals adopted by the Council on December 7, 1984.

### 7.1 Management Goal

The management goal is to maximize the overall long-term benefit to the nation of BS/AI stocks of king and Tanner crabs by coordinated Federal and State management, consistent with responsible stewardship for conservation of the crab resources and their habitats.

### 7.2 Management Objectives

Within the scope of the management goal, seven specific objectives have been identified. These relate to stock condition, economic and social objectives of the fishery, gear conflicts, habitat, weather and ocean conditions affecting safe access to the fishery, access of all interested parties to the

process of revising this FMP and its implementing regulations, and necessary research and management. Each of these objectives requires relevant management measures (see Chapter 8). Several management measures may contribute to more than one objective, and several objectives may mesh in any given management decision on a case-by-case basis.

7.2.1 Biological Conservation Objective: Ensure the long-term reproductive viability of king and Tanner crab populations.

To ensure the continued reproductive viability of each king and Tanner crab population through protection of reproductive potential, management must prevent recruitment overfishing (see definition in Chapter 4). Management measures may also be adopted to address other biological concerns such as: restricting harvest of crabs during soft shell periods and maintaining low incidental catch of nonlegal crab. Other factors, including those currently under investigation, such as the effects of cold air temperatures on incidentally-caught egg bearing females and their resultant larvae (Carls 1987), could also be considered if they can be shown to result in recruitment overfishing. The maintenance of adequate reproductive potential in each crab stock will take precedence over economic and social considerations.

7.2.2 Economic and Social Objective: Maximize economic and social benefits to the nation over time.

Economic benefits are broadly defined to include, but are not limited to: profits, income, employment, benefits to consumers and less tangible or less quantifiable social benefits such as the economic stability of coastal communities.

To ensure that economic and social benefits derived for fisheries covered by this FMP are maximized over time, the following will be examined in the selection of management measures:

1. The value of crab harvested (adjusted for the amount of crab dying prior to processing and discarded, which is known as deadloss) during the season for which management measures are being considered (management season),

2. The future value of crab, which stems from the value of a crab as a member of both the parent and harvestable stock,

3. Subsistence harvests within the registration area, and

4. Economic impacts on coastal communities.

This examination will be accomplished by considering, to the extent that data allow, the impact of management alternatives on

the size of the catch during the current and future seasons and their associated prices, harvesting costs, processing costs, employment, the distribution of benefits among members of the harvesting, processing and consumer communities, management costs, and other factors affecting the ability to maximize the economic and social benefits as defined in this section.

Social benefits are tied to economic stability and impacts of commercial fishing associated with coastal communities. While social benefits can be difficult to quantify, economic indices may serve as proxy measures of the social benefits which accrue from commercial fishing. In 1984, 7 percent of total personal income or 27 percent of total personal income in the private sector in Alaska was derived from commercial fishing industries. However, in coastal communities most impacted by commercial fishing in the BS/AI area, the impacts were much greater. In 1984, 47 percent of the total personal income earned in the Southwest Region of Alaska (Aleutian Islands, Bethel, Bristol Bay Borough, Dillingham, and Wade Hampton Census Areas) or 98 percent of the total personal income in the private sector for this region was derived from commercial fishing activities (Berman and Hull 1987). Some coastal communities in this region are even more heavily dependent on commercial fish harvesting and/or processing than this. On a statewide basis, shellfish accounted for 21 percent of the total exvessel value of commercial fish harvested in Alaska in 1984. Therefore, social and economic impacts of BS/AI crab fisheries on coastal communities can be

quite significant and must be considered in attempts to attain the economic and social objective.

Subsistence harvests must also be considered to ensure that subsistence requirements are met as required by State and Federal law. It is very difficult to evaluate the economic impact of subsistence fishing. Yet, fish, shellfish, and game harvested by subsistence users to provide food for the family or social group can greatly exceed the economic value of the product itself (R. Wolfe, ADF&G, Division of Subsistence, personal communication). Data on subsistence red king crab fishing have been obtained in the Norton Sound-Bering Strait area of the BS/AI management unit (Thomas 1981; Magdanz 1982, 1983; and Magdanz and Olanna 1984, 1985), and declines in subsistence harvests have been associated with changes in crab distributions, poor ice conditions, and reductions in crab stocks due to commercial harvest and poor recruitment (ADF&G 1986).

7.2.3 Gear Conflict Objective: Minimize gear conflict among fisheries.

Management measures developed for the king and Tanner crab fisheries will take into account the interaction of those fisheries, and the people engaged in them, with other fisheries.

To minimize gear conflict among fisheries, the compatibility of different types of fishing gear and activities on the same

fishing grounds should be considered. King and Tanner crab fisheries are conducted with pots, which are stationary gear. Many other fisheries in the fishery management unit, both domestic and foreign, are conducted with mobile trawl or seine gear. Seasons, gear storage, and fishing areas may be arranged to eliminate, insofar as possible, conflicts between gear types and preemption of fishing grounds by one form of gear over another.

7.2.4 Habitat Objective: Preserve the quality and extent of suitable habitat.

The quality and availability of habitat supporting the BS/AI area king and Tanner crab populations are important. Fishery managers should strive to ensure that optimal habitat is available for juvenile and breeding, as well as the exploitable, segments of the population. It also will be important to consider the potential impact of crab fisheries on other fish and shellfish populations. The BS/AI habitat of king and Tanner crabs, and the potential effects of changes in that habitat on the fishery are described in Appendix F of this FMP.

Those involved in both management and exploitation of crab resources will actively review actions by other human users of the BS/AI area to ensure that their actions do not cause deterioration of habitat. Any action by a State or Federal

agency potentially affecting crab habitat in an adverse manner may be reviewed by the Council for possible action under subsection 302(i) of the Magnuson Act. The Council will also consider the effect on crab habitat of its own management decisions in other fisheries.

7.2.5 Vessel Safety Objective: Provide public access to the regulatory process for vessel safety considerations.

Upon request, and from time to time as appropriate, the Council and the State shall consider, and may provide for, temporary adjustments, after consultation with the Coast Guard and persons utilizing the fishery, regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safety of vessels.

7.2.6 Due Process Objective: Ensure that access to the regulatory process and opportunity for redress are available to all interested parties.

In order to attain the maximum benefit to the nation, the interrelated biological, economic and social, habitat, and vessel safety objectives outlined above must be balanced against one another. A continuing dialogue between fishery managers, fishery scientists, fishermen, processors, consumers, and other

interested parties is necessary to keep this balance. In so far as is practical, management meetings will be scheduled around fishing seasons and in places where they can be attended by fishermen, processors, or other interested parties.

Access to the FMP development and regulatory process is available through membership in a Council work group, testimony on the record before the Council's Advisory Panel or SSC, or before the Council itself, testimony before the Board or other State regulatory body for crab, conversations with members of the plan team or officials of regulatory agencies, and by commenting on the FMP, any subsequent amendments and the regulations proposed for their implementation.

This FMP defers much of day-to-day crab management to the State. Means of access to the regulatory process at the State level and of redress of perceived wrongs by the State are necessary. Appendix C describes the State management system and mechanisms for public input to it.

Chapters 9 and 10 of this FMP contain procedures for challenge of State laws or regulations regarding management of these fisheries alleged to be inconsistent with the Magnuson Act, the FMP or any other applicable Federal law.

7.2.7 Research and Management Objective: Provide fisheries research, data collection, and analysis to ensure a sound information base for management decisions.

Necessary data must be collected and analyzed in order to measure progress relative to other objectives and to ensure that management actions are adjusted to reflect new knowledge. Achieving the objective will require new and ongoing research and analysis, particularly relative to stock conditions, dynamic feedback to market conditions, and adaptive management strategies. For example, some possible research topics could include (1) the basis for exclusive registration areas, (2) the basis for sex restrictions in retained catch, (3) the basis for size limits, (4) the process for determining GHLs, (5) bioeconomic analyses of specific regulatory proposals, and (6) defining oceanographic conditions important to maximizing productivity of crab stocks.

An annual area management report to the Board discussing current biological and economic status of the fisheries, GHL ranges, and support for different management decisions or changes in harvest strategies will be prepared by the State (ADF&G lead agency), with NMFS and crab plan team input incorporated as appropriate. This will be available for public comment, with a Board report presented at least annually at a Council meeting, normally held in conjunction with or close to the State Board meeting in March or April. GHLs will be revised when new

information is available. Such information will be made available to the public.

# 8.0 MANAGEMENT MEASURES

This chapter describes management measures which may be used to achieve the FMP's management objectives. Most of these management measures are currently used by the State to manage BS/AI king and Tanner crab fisheries; some measures are appropriate for more than one management objective.

Three categories of management measures are described (Table 8.1): (1) those that are specifically fixed in the FMP, implemented by Federal regulations, and require an FMP or regulatory amendment to change, (2) those that are framework-type measures which the State can change following criteria set out in the FMP, and (3) those measures that are neither rigidly specified nor frameworked in the FMP. The measures in (2) and (3) above may be adopted as State laws subject to the appeals process outlined in the FMP (see Chapters 9 and 10).

The following description of management measures is not intended to limit the State government to only these measures. However, implementation of other management measures not described in the FMP must be consistent with the FMP, the Magnuson Act, and other applicable Federal law, and may occur only after consultation with the Council.

Table 8.1. Management measures used to manage king and Tanner crabs in the BS/AI management unit by category.

| Category 1 (Fixed in FMP) | Category 2 (Frameworked in FMP) | Category 3 (Discretion of State) |
|---|---|---|
| Legal Gear | Minimum Size Limits | Reporting Requirements |
| Permit Requirements | Guideline Harvest Levels | Gear Placement and Removal |
| Observers | In-season Adjustments | Gear Storage |
| Limited Access [Reserved] | Districts, Subdistricts and Sections | Vessel Tank Inspections |
| | Fishing Seasons | Gear Modifications |
| | Sex Restrictions | Bycatch Limits (in crab fisheries |
| | | Other |

Management Category Options

| | |
|---|---|
| Pot Limits | - Option 1 -- place into Category 1<br>- Option 2 -- place into Category 2 |
| Registration Areas | - Option 1 -- place into Category 1<br>- Option 2 -- place into Category 2 |
| Closed Waters | - Option 1 -- place into Category 1<br>- Option 2 -- Place into Category 2 |

Although specific strategies for attainment of objectives in the FMP are not described, management measures described in this chapter are all derived to attain one or more of those objectives. Any subsequent management measures must also be justified based upon consistency with the objectives in this FMP. All management measures must, further, be consistent with the Magnuson Act and other applicable Federal law.

## 8.1 Category 1--Federal Management Measures Fixed By The FMP

### 8.1.1 Legal Gear

Legal gear for commercial king crab fisheries is limited to pots (traps). Legal gear for commercial Tanner crab fisheries is limited to pots (traps), ring nets, and diving gear.

Trawls and tangle nets are specifically prohibited because of the high mortality rates which they inflict on nonlegal crab. An escape mechanism is required on all pots (traps) which will terminate a lost pot's catching and holding ability within 6 months.

Specification of legal gear is important to attainment of the biological conservation and economic and social objectives of this FMP.

### 8.1.2 Permit Requirements

No Federal fishing permits are required for harvesting vessels. This FMP assumes that all crab fishermen are licensed and vessels are licensed and registered under the laws of the State, and as such, while fishing in the EEZ are subject to all State regulations that are consistent with the FMP, Magnuson Act, and other applicable Federal law. Such licenses are subject to enforcement sanctions issued pursuant to State procedures.

### 8.1.3 Observer Requirements

Any vessel fishing for king or Tanner crab, and/or processing king crab or Tanner crab within the BS/AI area, shall be required to take aboard an observer, when so requested by the Director, Alaska Region, NMFS. Such an observer requirement may be imposed, notwithstanding the existence of a State mandated observer program for State registered vessels. To the maximum extent practicable, the Regional Director will coordinate any Federal observer program with that required by the State.

Observers are necessary aboard some crab fishing and/or processing vessels to obtain needed information such as catch per unit of effort (CPUE), species composition, sex composition, size composition of the catch, proportion of softshell crab being handled, and other information required to manage the crab stocks in the BS/AI area.

Observer requirements are important to attainment of the biological conservation and research and management objectives of this FMP.

### 8.1.4 Limited Access

This FMP establishes no measures to limit access to king crab or Tanner crab fisheries within the management unit. Only

the Council and the Secretary have authority to implement limited access measures in the fisheries managed under this FMP.

## 8.2 Category 2--Framework Management Measures

### 8.2.1 Minimum Size Limits

The FMP authorizes the State to adjust size limits under State regulations. In establishing minimum size limits, the State can consider, within constraints of available information, the following: (1) biological and functional size at maturity (2) protection of reproductive capability, (3) market and other economic considerations, (4) natural and discard mortality rates, (5) growth rates, and (6) yield per recruit.

Typically, biological considerations such as (1), (2), and (4)-(6) are used to establish minimum legal size limits to ensure that conservation needs are served. Generally, preference for larger crabs based upon market and other economic considerations are achieved through processor/harvester agreements.

If minimum size limits are proposed to be changed, an analysis with appropriate documentation will be presented.

Minimum size limits are commonly used in managing crab fisheries, and are important in meeting both the biological conservation and economic and social objectives of this FMP. The

use of the estimated average size of maturity is intended to allow crabs to mate at least once before being subjected to harvest. Evidence available for red king crab suggests that recently matured males may not enter into mating activity until one or two years after attaining maturity, while studies on Tanner crab suggest that this period of delay does not exist. Thus, minimum size limits may be set at various intervals above the average size of maturity depending on a species life history pattern. In addition, the rate of growth after maturity enters into the estimation of minimum size limits. This has resulted in variable minimum size limits depending on the species and area inhabited (Table 8.2) In developing fisheries with insufficient information, there may be no size limit set.

Prior to the use of legal minimum size limits, minimum size of crabs landed was probably dictated by industry economic conditions, and to a large extent economics continues to play an important role. The legal minimum size limit for the Tanner crab species C. opilio has been 3.1", based on information on size of maturity and reproductive behavior. However, the average minimum size of crab landed since the inception of the domestic fishery has been in the range of 4.0" to 4.5". This reflects the desire for larger crabs by the processing sector. Past requests for lowering the minimum size limit for the Tanner crab species C.

Table 8.2. Size of maturity for king crab (carapace length inches) and Tanner crab (carapace width inches), and minimum legal size (carapace width inches) for fisheries within the BS/AI management unit.

| Area | Species | Size of Carapace at Maturity Males | Females | Source | Minimum[16] Size |
|---|---|---|---|---|---|
| Dutch Harbor | red | - | 3.98-4.02[1] | ADF&G 1976 Dutch Harbor Survey | 6.50,7.50 |
| | blue | - | - | | 6.50 |
| | brown | - | - | | 6.00 |
| Bristol Bay | red | 3.35-3.54[2] 4.06 | 3.39-4.02[3] | Wallace et al 1949 Somerton 1980 | 6.50,7.00 |
| | blue | - | 3.54 | MacIntosh & Otto 1979 | 6.50,7.00 |
| | brown | - | - | | 5.50,7.00 |
| Adak | red | - | 3.50-3.54[4] | ADF&G 1976, 77 Adak Surveys | 6.50 |
| | blue | - | - | | - |
| | brown | 5.12[5] | 4.36[6] | Somerton & Otto 1986 | 6.00 |
| Pribilof | red | - | - | | 6.50,7.50 |
| | blue | 4.25[7] | 3.79[8] | Somerton & MacIntosh 1983 | 6.50,7.50 |
| | brown | 4.21[9] | 3.91[10] | Somerton & Otto 1986 | 5.50 |
| St. Matthew | red | - | - | | 4.75 |
| | blue | 3.03[11] | 3.17[12] | Somerton & MacIntosh 1983 | 5.50 |
| | brown | 3.62[13] | 3.85[14] | Somerton & Otto 1986 | 5.50 |
| Norton Sound | red | - | 2.68 2.87 | Powell et al 1983 NMFS 1986 | 4.75 |
| | blue | - | - | | 5.50 |
| St. Lawrence | red | | | | 4.75 |
| | blue | | | | 5.50 |
| | brown | | | | 5.50 |
| C. bairdi | | 4.45[15] | - | Donaldson et al 1981 | 5.50 |
| C. opilio | | 2.56[15] | - | Somerton 1981 | 3.10 |

1 54% adult, N=885
2 become mature
3 become ovigerous (50%=96mm, N=4)
4 equals 56% adults, N=73
5 SD=4.0, N=299
6 SD=0.8, N=527
7 SD=9.8, N=784
8 SD=0.3, N=333
9 SD=4.6, N=1,866
10 SD=0.6, N=4,783
11 SD=9.8, N= 622
12 SD=0.6, N= 174
13 SD=2.4, N= 205
14 SD=0.5, N= 324
15 Not including spines
16 Includes spines

bairdi from 5.5" to 5.0" have met with resistance, also because ofmarket preferences for a larger crab. Thus, the processing sector's preference for larger crab is accommodated by the industry, rather than through regulation.

Minimum size limit regulations interact closely with GHL regulations (see Section 8.2.2 below). The minimum commercial size limit has been determined for each area by using the size when 50 percent of the male population is sexually mature and adding the estimated dimensional growth of males up to a two-year period. This normally would give each male the opportunity to reproduce at least once before becoming vulnerable to the fishery. The minimum size limit serves to determine the portion of the total male stock that is subjected to exploitation. The GHL for a given season and area is established by applying an exploitation rate to the commercial fraction of the males defined as legal by the minimum size limit in effect.

### 8.2.2 Guideline Harvest Levels

The FMP authorizes the State to set preseason GHLs under State regulations. The term GHL corresponds closely to the term total allowable catch (TAC) used in the BS/AI groundfish FMP although GHL is normally expressed as a range and TAC is not. A range of harvest levels allows the State to make in-season management decisions based on current data obtained from the fishery. Seasons or areas may be closed when the GHL is reached,

or earlier or later based on current in-season information (see Section 8.2.3). GHL is used in this FMP in lieu of TAC because the State has used this term and it allows for State management within a framework of Federally-approved factors. The following factors are approved and will be considered to the extent information is available in establishing GHLs: (1) estimates of exploitable biomass, (2) estimates of recruitment, (3) estimates of threshold, (4) estimates of ABC, and (5) market and other economic considerations. The sum of all upper ranges of the GHLs for king crabs and either species of Tanner crab must fall within the OY ranges established in this FMP.

The GHL is the result of a process which includes the examination of the effects of different harvesting strategies on the seven objectives of management listed previously in this FMP. While harvest strategies will be evaluated relative to all seven of these objectives, GHL will most frequently be used as a management measure to achieve only the first two objectives. For this reason, the GHL is primarily composed of two interrelated components: a biological component and a socioeconomic component.

In overview, the biological component, ABC, is set to achieve the biological conservation objective of preventing recruitment overfishing. Because the maintenance of adequate reproductive potential takes precedence over economic and social considerations as described in objective 7.2.1, the ABC serves as an upper bound

constraint on harvest. A target harvest level is then chosen within ABC to maximize the anticipated discounted benefits to the fishery over the long term. As described in objective 7.2.2, these benefits include: profits, personal income, employment, benefits to consumers and less tangible or less quantifiable social benefits such as the economic stability of coastal communities. The GHL range represents a confidence interval around the proposed harvest level reflecting the uncertainty in stock status and the uncertainty in estimates of socioeconomic benefits. Ideally, bioeconomic analysis such as Matulich, et al. (1987a, b, c) should be used to determine the GHL. However, such modeling efforts are relatively new and complex; in the future they should be employed along with more conventional means of determining the GHL.

Regardless of the specific approach, the process of determining a GHL which prevents recruitment overfishing and maximizes socioeconomic benefits includes the routine collection and analysis of biological, economic, social, and other data. Crab resources of the BS/AI area vary in the level of scientific information available for management. Consequently, exact procedures for determining appropriate ABCs and GHLs vary due to differences in the quality and quantity of resource data bases. Information necessary to evaluate the five Federally-approved factors (above) for establishing GHLs include data from trawl surveys, pot surveys, fishery performance statistics (catch per

unit of effort), price, personal income, employment and other market and economic data.

Having specified an ABC, a GHL must be chosen to be less than or equal to the ABC. Ideally, bioeconomic analyses such as Matulich, et al. (1987c) can provide advice to management about the benefits to be received from alternative harvest levels. Such analyses can be used to evaluate the benefits (e.g., personal income, employment, etc.) resulting from two alternative harvest strategies. For example, high exploitation rates can be applied to obtain high current harvest levels of recruit-sized crabs at the expense of foregone future harvest. Alternatively, low exploitation rates can be applied to obtain higher future harvest of larger crabs at the expense of lower current harvest. Information on other socioeconomic factors, such as benefits to consumers and economic stability of coastal communities can also be used in the determination of harvest level.

As discussed within the Research and Management Objective, an annual area management report will be prepared which describes the determination of GHLs and ABCs for all types of stocks using the best available information. This report will be reviewed by the State, NMFS, and the Council, and available for public comment on an annual basis. The GHLs contained in this report will be updated when new information is available. This information will be made available to the public.

### 8.2.3 In-season Adjustments

The FMP authorizes the State to make in-season adjustments to GHLs and to fishing period lengths and to close areas under State regulations. In making such in-season adjustments, the State shall consider appropriate factors to the extent in-season data is available on: (1) overall fishing effort, (2) catch per unit of effort and rate of harvest, (3) relative abundance of king or Tanner crab, (4) achievement of GHLs, (5) proportion of soft-shelled crabs and rate of deadloss, (6) general information on stock condition, (7) timeliness and accuracy of catch reporting, (8) adequacy of subsistence harvests, and (9) other factors that affect ability to meet objectives of the FMP.

After registration areas are opened, seasons set, minimum sizes and GHLs established preseason, events can occur in-season which would disrupt the management scheme and resultant economic benefits to the nation. When a preseason prediction proves to be incorrect or when an unanticipated event occurs which affects preseason predictions, compensatory in-season adjustments must be made to keep the management system on track toward the biological and economic objectives of this FMP. In-season adjustments and analysis will be conducted within the constraints of this FMP.

All in-season adjustments must be recorded and justified in writing. These justifications are attached to the emergency order

and will be made available for review to the public, the State, the NMFS, and other regulatory agencies.

The State monitors the condition of king and Tanner crab stocks through such data and information as are practically available, both preseason and in-season. When the State, in close communication with the NMFS, finds that continued fishing effort would jeopardize the viability of king or Tanner crab stocks within a registration area, or continued fishing would be counter to the goal and objectives established by this FMP, the registration area or a portion of the registration area is closed by emergency order. In determining whether to close a registration area, the State shall consider all appropriate factors to the extent there is information available on such factors. Factors to be considered and which are currently embodied in State regulations for king and Tanner crabs include:

1. The effect of overall fishing effort within the registration area.

Large amounts of effort, vessels, and pots are often concentrated on crab aggregations. In extreme cases, high amounts of gear loss because of entanglement, and propeller contact result in wastage and unknown levels of harvest. In these limited areas, high levels of sorting of females and resultant mortality, and high levels of handling and sorting of nonmarketable crab because of softshell conditions result in wasted product and nonquantified

harvests to the crab stocks in these limited areas. In-season data concerning these practices can result in emergency closures of limited areas where these conditions occur, resulting in a more orderly fishery, reduced gear loss, less wastage, and the ability to meet the biological conservation objective, as well as other objectives identified in this FMP. This provision also addresses the ability of the ADF&G to close a registration area when the projected harvest equals or exceeds the GHL established for the registration area.

2. Catch per unit of effort and rate of harvest.

In addition to using CPUE to provide estimates when preseason GHLs are to be attained, these data are also analyzed in-season to check survey accuracy used to establish stock abundance levels and GHLs. Often the effort expended in surveys is limited, particularly when compared to the sampling power of the commercial fleet. However, standardization of effort of the commercial fleet is always a limiting factor in interpreting in-season data. If in-season data analysis suggests stocks are significantly higher or lower than indicated by survey, GHLs may be adjusted in-season using the new in-season estimates. Exploitation rates are generally not changed in-season, unless the estimates of stock levels using in-season data are so different from preseason estimates that different exploitation rates are necessary.

In cases where annual survey data are either unavailable, or unreliable, in-season data are relied on heavily. Such provisions are essential for prevention of overfishing and adherence to the biological conservation objective of this FMP. To the degree exploitation rates are established to meet economic and social objectives, this provision could be used to maximize economic benefits as well.

3. Relative abundance of king or Tanner crab within the area in comparison with preseason expectations.

Relative abundance is usually established by comparison of current in-season data with trends established over time within the current season or comparison with previous year's CPUE data. In certain cases, survey data may be obtained during an open fishery. These relative abundance data of king and Tanner crab stocks would be applied immediately to adjustment of GHLs as stated previously under item (2). This factor is usually considered as additional analysis of the data obtained or established under factors (1) and (2) discussed previously.

4. Such GHLs as may be promulgated by State regulations.

The primary use of in-season emergency order authority is when an established GHL is reached and the fishery is to be closed within current State regulations established within

the framework procedures listed in this FMP. The midpoint of the GHL is usually targeted except in cases where in-season data and analysis, or other provisions discussed in this section, require closure either before or after obtaining the established GHL, or below or above the range associated with the GHL.

5. The proportion of soft shell king or Tanner crab being handled and proportion of deadloss.

This factor is paramount to ensure product quality and prevention of unnecessary wastage. When deliveries of crab require significant levels of discard because of deadloss or unmarketable crab, a portion or all of a registration area may be closed to further harvest. Such closures are issued when sorting is of sufficient magnitude, at sea or at the unloading site, to have significant impacts on product quality or significant wastage. Rates of discard will vary; fixed rates are generally not established because factors modifying such decisions include the availability of nonmolting crab within the registration area and the degree of alternative areas available to fish that have low rates of soft shell crab or molting crab. Even though local areas of high molting may occur, often other areas are available for harvest and economic forces cause the fleet to move to those areas with acceptable handling mortality and deadloss associated with the harvest. The ability of managers to consider these factors without rigidly establishing formulas for issuing closures provides for continued fishing when the biological or economic

consequences will be minimal, even though short periods of high sorting in local areas may occur. Such flexibility allows the State to meet the biological conservation objective, as well as the economic and social objective established in this FMP.

6. General information on the condition of the king or Tanner crab stocks within the area.

This factor, in addition to including the softshell or molting conditions discussed previously, includes the salability of the product. Discard of large amounts of old shell crab, that have no market value but are capable of mating and assisting in reproduction, is one of the factors considered. In cases where diseases or parasites affect product quality, emergency order closures of portions of a stock could benefit the industry significantly, while allowing continued harvest of portions of the stock that have high quality crab. Low yields from newly molted crab are also a factor which may be considered when wastage levels are high in comparison to the economic value of the harvest. Use of this factor primarily addresses the economic and social objective established by this FMP.

7. Timeliness and accuracy of catch reporting by buyers, fishermen or vessel operators within the registration area to the extent that such timeliness or accuracy may reasonably be expected to affect proper management.

Management of a commercial fishery depends upon appropriate and timely data. In that in-season closure decisions almost always result in short-term loss of income for the participating commercial fleet and the processing industry, even though these closures will in the long run ensure long-term economic viability of these same participants, the temptation to underreport or misreport is obvious. Without accurate data, the management process breaks down. Therefore, the State may close a fishery if the timeliness and accuracy of catch reporting is inadequate. Only with this provision does the State have the ability to ensure compliance with reporting requirements and retain the ability to accurately regulate the fishery within the objectives established by this FMP. This factor is used in justifying emergency action only when misreporting is of such magnitude as to jeopardize the management process.

8. Adequacy of subsistence harvests within the registration area.

Subsistence harvests take precedence over all other harvests, as required by State regulations and provisions of Federal law. Emergency order authority would be used if subsistence fisheries requirements are not being met by established regulations by the State. Emergency order authority would close commercial fisheries to ensure that subsistence harvests would be achieved without jeopardizing conservation

concerns established in the biological conservation objective of this FMP.

### 8.2.4 District, Subdistrict, and Section Boundaries

The FMP authorizes the State to adjust district, subdistrict, and section boundaries on the basis of any of the following criteria: (1) If the area contains a reasonably distinct stock of crab that requires a separate GHL estimate to avoid possible overharvest, (2) if the stock requires a different size limit from other stocks in the registration area, (3) if different timing of molting and breeding requires a different fishing season, (4) if estimates of fishing effort are needed preseason so that overharvest can be prevented, or (5) if part of an area is relatively unutilized and unexplored and if creation of a new district, subdistrict or section will encourage exploration and utilization.

### 8.2.5 Fishing Seasons

Fishing seasons are used to protect king and Tanner crabs during the molting and mating portions of their life cycle. Normally the fisheries have been closed during these sensitive 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 have filled out. Fisheries conducted during sensitive biological periods have been, and

should be in the future, carefully designed to prevent any irreparable damage to the stocks.

Closed seasons have been set to maximize the reproductive potential of the king and Tanner crab populations based on one or more of the following conditions:

1. Protection of any breeding population of male crab that may form dense schools prior to and during annual migrations into shallow water breeding grounds. Such migrations have been described for red king crab and could possibly occur with other crabs.

2. Consideration of molting periods so that the shells have hardened enough to permit handling with minimal damage or mortality.

3. Protection of the population during sensitive softshell periods.

4. Consideration of increasing product quality.

At times, seasons have been set that conflict with some of the preceding conditions. Such openings historically have been based on one or more of the following considerations:

1. Provision for an exploratory fishery.

2. Compensation for particularly adverse environmental conditions, such as sea ice covering the fishing grounds.

The biologically sensitive period in the life cycle of both king and Tanner crabs within the management unit is generally from late winter to early summer. Part of the Tanner crab fishery has occurred during the mating period, although the timing of seasons for individual stocks may vary. Very little information is available on the sensitive period for brown king crab. The information that is available for brown king crab indicates that mating, molting, and hatching occur throughout the year and a sensitive period cannot be defined. Crab harvests frequently occur over a short period of time. Therefore, there is an opportunity to look beyond strictly biological conditions when setting season openings.

Within biological constraints, the open fishing season has been set:

1. To minimize the amount of deadloss. Deadloss has been found to increase if crabs are in softshell condition, if they are held for long time periods, if holding tanks are contaminated with fresh or warm water, or if crabs are handled too often.

2. To produce the best possible product quality.

3. To minimize fishing during severe weather conditions.

4. To minimize the cost of industry operations.

5. To coordinate the king and Tanner crab fisheries with other fisheries that are making demands on the same harvesting, processing, and transportation systems. Seasons can be timed relative to one another to spread fishing effort, prevent gear saturation, and allow maximum participation in the fisheries by all elements of the crab fleets.

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

King and Tanner crab seasons may be combined to minimize handling mortality, to maximize efficiency, and to reduce unnecessary administrative and enforcement burdens. Seasons may also be combined when a given species is taken primarily as an incidental catch; for example, C. bairdi are taken incidental to the red king crab fishery in Adak. Such considerations are secondary, however, to optimal utilization of each species.

Specification of fishing seasons is important to attainment of the biological conservation, economic and social, vessel safety, and gear conflict objectives of this FMP.

### 8.2.6 Sex Restrictions

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 or Tanner 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 will not be understood until additional research and analysis has been completed pursuant to the research and management objective of this FMP.

Harvesting female king crab has not been an issue in past management of the king and Tanner crab fisheries. 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 crabs is determined, this plan authorizes experimental harvest and processing of females by a State 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.

## 8.3 Category 3--Management Measures Deferred to State

### 8.3.1 Reporting Requirements

Assuming that all vessels participating in the fishery are registered with the State, only State reporting requirements are required by this FMP. Therefore, reporting requirements shall be deferred to the State.

Reporting of crab catches by individual vessel operators was required as early as 1941. Current State requirements (5 AAC 39.130) include: reporting the company or individual that purchased the catch; the full name and signature of the permit holder; the vessel that landed it with its license plate number; the type of gear used; the amount of gear (number of pots, pot lifts); the weight and number of crab landed (including deadloss); the dates of landing and capture; and the location of capture.

Processing companies are required to report this information for each landing purchased, and vessel operators are required to provide information to the processor at the time of sale. All reports ("fish tickets") are confidential. Reporting requirements ensure adequate information and efficient management and enforcement. The price paid for the crab is also important information for managing the fisheries and is included on fish tickets but is currently not required information by the State because it is not always available at the time the fish tickets are prepared.

As the commercial Alaskan king and Tanner crab fisheries have grown over recent years, so has our knowledge of these species. Information gained through scientific surveys, research, and fishermen's observations have all led to a better understanding of the biology, environmental requirements, and behavior of the crab stocks. Since fishery managers monitor harvest rates in-season to determine areas of greatest fishing effort, thereby preventing overharvest of individual crab stocks, the current State catch and processing report requirements are an important component in achieving the biological conservation, economic and social, and research and management objectives of this FMP.

### 8.3.2 Gear Placement and Removal

The FMP defers gear placement and removal requirements to the State.

Placement of unbaited gear, with doors secured open, on the fishing grounds before and after a season has been allowed within certain limits. Such early placement or late removal has been justified in light of (1) its lack of biological impacts, (2) enforcement problems and costs borne by the public and the industry, (3) lack of potential gear conflict, (4) the unavailability of loading or unloading facilities and gear storage areas, (5) vessel safety, (6) increasing the competitiveness of smaller vessels, and (7) decreasing fishing costs.

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

### 8.3.3 Gear Storage

The FMP defers gear storage requirements to the State.

Crab pots are generally stored on land or in designated storage areas at sea. Storage in a nonfishing condition in ice-free water areas of low crab abundance also has been justified in light of: (1) expected biological impacts; (2) the potential enforcement costs to the public; (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 gear conflict.

### 8.3.4 Vessel Tank Inspections

The FMP defers tank inspection requirements to the State.

Vessel tank, or live-hold and freezer, inspections usually are required before the opening of a king or Tanner crab fishing season to meet the legal requirements for the State's landing laws, provide effort information, and provide for a fair start to the fishery. The State normally considers the following factors when determining whether inspections should be required: (1) enforcement requirements, (2) the ability of the vessels to move easily between the fishing grounds and the location of inspection centers, (3) the time necessary for the vessels to transport their gear from storage areas to fishing grounds, (4) the fuel consumption that the inspection requirement will cause, and (5) the equity of allowing all participants to start the fishery at substantially the same time.

### 8.3.5 Gear Modifications

The FMP defers design specifications required for commercial crab pots and ring nets to the State.

Pots and ring nets are the specified legal commercial gear for capturing crab in the BS/AI area (see Section 8.1.1). Multiple pots attached to a ground line are currently allowed by the State in the brown king crab fishery. Various devices may be added to pots to prevent capture of other species. Escape areas may be incorporated or mesh size adjusted to allow female and sublegal male crab to escape. An escape mechanism is required on all pots which will terminate a pot's catching and holding ability in case the pot is lost (see Section 8.1.1).

### 8.3.6 Bycatch Limits

The FMP defers the right to implement bycatch limits of other species of crab in the crab fisheries managed under this FMP to the State. Often, regulation of bycatch in the directed fishery involves no, or limited, allocation because the same fishermen participate in both fisheries.

### 8.3.7 Other

As previously noted, the State government is not limited to only the management measures described in this FMP. However, implementation of other management measures not described in the FMP must be consistent with the FMP, the Magnuson Act, and other applicable Federal law, and may occur only after consultation with the Council. This management measure provides for an expanded scope of Federal review. Other management measures that the State

may wish to implement are subject to the review and appeals procedures described in Chapters 9 and 10 of this FMP.

## 8.4 Management Category Options

### 8.4.1 Pot Limits

Option 1. Pot limits to remain in Category 1.

Placing restrictions on the number of pots fished from a vessel in commercial fisheries is prohibited. Limiting the number of pots that any vessel can use would likely result in a restriction of effort and imposition of economic inefficiency, in that such limits inhibit or prohibit the ability of harvesting vessels to operate at full capacity. The use of pot limits may pit large vessel fishermen against small vessel fishermen by impeding the catching efficiency of the larger vessels to a greater extent.

Prohibition of pot limits is important to attainment of the economic and social objective of this FMP.

Option 2. Pot Limits to be frameworked and placed in Category 2.

This FMP authorizes the State to use pot limits to attain the biological conservation objective and the economic and social objective of this FMP. In establishing pot limits, the State can

consider, within constraints of available information, the following: (1) total vessel effort relative to GHL, (2) probable concentrations of pots by area, (3) potential for conflict with other fisheries, (4) potential for handling mortlaity of target or nontarget species, (5) adverse effects on vessel safety including hazards to navigation, (6) enforceability of pot limits, and (7) analysis of effects on industry.

Pot limits must be designed in a nondiscriminatory manner. For example, pot limits that are a function of vessel size can be developed which affect large and small vessels equally. Historic data on pot registration and keel length could be used for developing pot limit regulations.

Only special types of situations warrant the use of pot limits. There are at least two such cases. First, because the deployment of excessive amounts of gear may result in high amounts of wastage due to pots lost to advancing ice cover, pot limits may be a useful measure to attain the biological conservation objective. Second, it may not be possible to satisfy conservation concerns in a fishery using excessive amounts of gear to catch a relatively small guideline harvest from a depressed stock. Lacking ability to regulate the total number of pots placed on the grounds, it would otherwise be necessary to prohibit the fishery from ever opening. A limited but highly valuable fishery would be foregone. In this instance, prohibition of the fishery would satisfy biological conservation concerns, but the economic and social

objective would not be satisfied. Rather, a pot limit would provide a mechanism to attain the economic and social objective within biological conservation constraints.

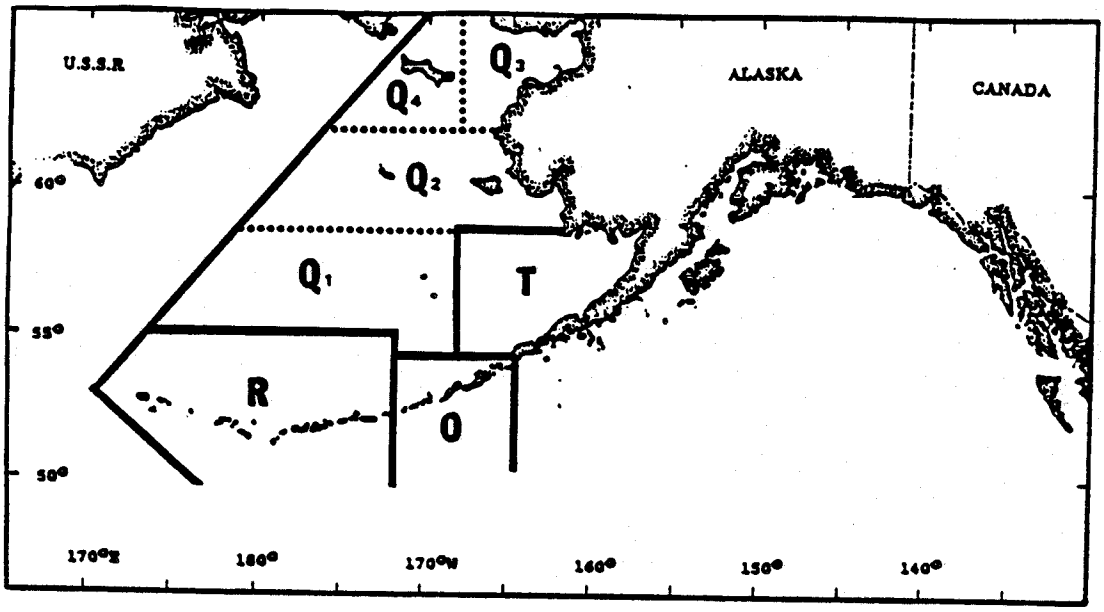
### 8.4.2 Registration Areas

Option 1. Registration areas to remain in Category 1.

This FMP adopts existing State registration areas within the BS/AI fishery management unit. The management unit historically has been divided by the State into four king crab registration areas--Bering Sea, Bristol Bay, Adak, and Dutch Harbor and one Tanner crab registration area--Westward (Figure 8.1). Kodiak, South Peninsula and Chignik are also part of the State's Westward registration area but not part of the management unit in this FMP.

Registration areas may be further divided into fishing districts, subdistricts, and sections for purposes of management and reporting, although Tanner crab districts and subdistricts correspond most closely to king crab registration areas in regards to size (see Appendix G and Figure 8.1). Registration areas are characterized by relatively homogeneous established fisheries on stocks of crab that have insignificant transfer of adults between areas. These stocks tend to be fished by the same general class of boats from year to year, with seasons varying somewhat from area to area because of natural causes such as differences in timing of molting and breeding. Geographic remoteness from

KING CRAB AREAS




TANNER CRAB AREAS

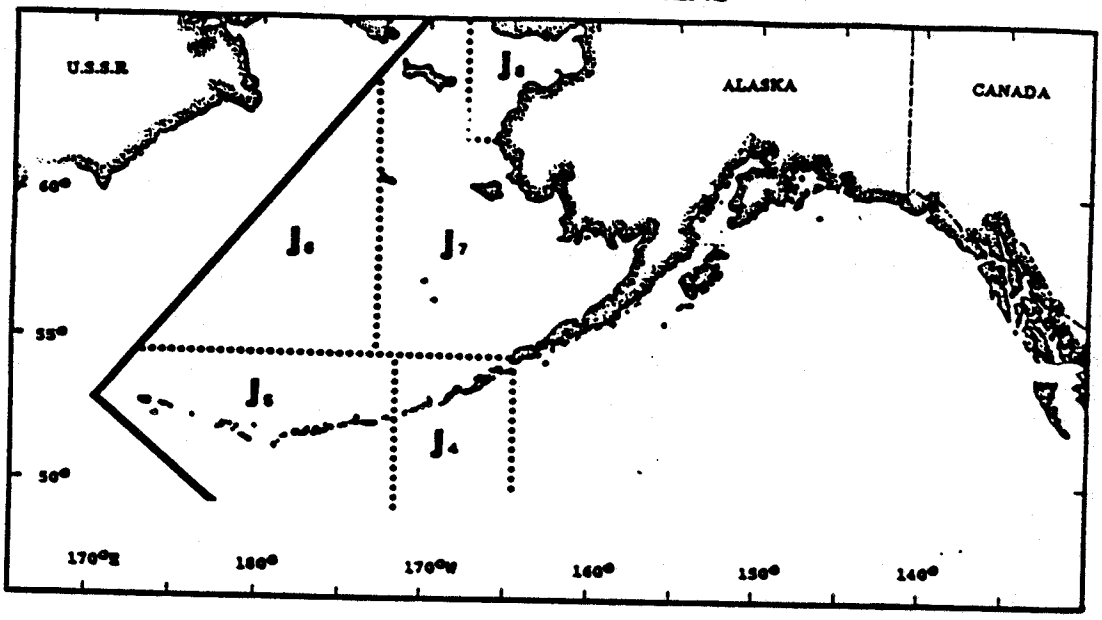



Figure 8.1 Bering Sea and Aleutian Islands Management Unit Showing State of Alaska Registration Areas for King Crab (O: Dutch Harbor; R: Adak; T: Bristol Bay; Q1: Pribilof District of Bering Sea; Q2: St Matthew Section of Bering Sea; Q3: Norton Sound Section of Bering Sea; Q4: St. Lawrence Section of Bering Sea). The entire management unit consists of a portion of one registration area for Tanner crab--the Westward Area (J) (J4: Eastern Aleutians; J5: Western Aleutians; J6: Western Subdistrict of Bering Sea; J7: General Section of Bering Sea; J8: Norton Sound Section of Bering Sea). The boundary of the management unit extends to the outer limit of the EEZ, and the seaward boundary of registration areas, districts, and subdistricts is fixed by State regulation.

processing plants and support facilities may further characterize some areas.

State regulations require vessels to register for fishing in these areas, and may require vessels to register for specific fishing districts within a registration area. Registration requirements allow estimation of fishing effort and the rate at which the resource will be harvested.

King crab registration areas within the management unit are designated as either exclusive or nonexclusive. Vessels can register for any one exclusive area and are not restricted in their choice, but cannot fish in any other exclusive area during the registration year. They can, however, fish any or all other nonexclusive areas. Fishermen often consider potential harvest, proposed prices, and distances between the fishing grounds and processing facilities when making their selection of an exclusive area. Historically, on a statewide basis exclusive registration areas are relatively small with the exception of Bristol Bay, contain known concentrations of crab, are adjacent to shore, and have well developed fisheries. Nonexclusive registration areas are usually quite large, have developing fisheries, and may contain some sections that are both underutilized and unexplored.

The use of exclusive area designations can aid in dispersing fishing effort while still allowing the majority of the fleet the opportunity to harvest the majority of the crab. Exclusive

registration areas can help provide economic stability to coastal communities (see objective 7.2.2) or to segments 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. This is particularly advantageous to the less mobile vessels if the area in which they fish is not the most profitable area for the more mobile vessels. This will not necessarily provide greater stability for the less mobile vessels because as fishery conditions change from year to year, the mobile vessels can change the area(s) in which they fish. However, on the average, fewer mobile vessels will fish in the less profitable areas if fishing in multiple areas is restricted. The removal of exclusive area regulations could place extreme economic pressure on smaller or older vessels unable to respond with fishing mobility (Katz and Bledsoe 1977).

The Bering Sea and Adak registration areas are designated as nonexclusive for all three species of king crab. The Bristol Bay registration area is designated an exclusive registration area for all three species of king crab. The Dutch Harbor registration area is designated an exclusive area for red and blue king crab and nonexclusive for brown king crabs.

Although exclusive registration areas can reallocate catch among different size vessels, it is not always clear which way

the allocation effects will go and, therefore, each situation must be studied carefully (Larson, ed. 1984).

For Tanner crab, the westward Tanner crab registration area is the only registration area within the Management Unit. It is designated nonexclusive.

The specification of registration area, both exclusive and nonexclusive, may be important to attainment of the economic and social objectives of this FMP.

Under this optiom, no changes regarding exclusive registration area designation shall be made without FMP amendment.

Option 2. Registration areas to be frameworked and placed in Category 2.

Under this option, the descriptive portion of Option 1 would be incorporated, along with the following framework for designating an area or district as exclusive.

Any designation of an area or district as exclusive must be supported by a written finding by the State that considers all of the following factors to the extent information is available:

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 such 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 the 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 exvessel 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. The absence of flexibility to modify registration areas in this instance could result in either no fishing or in an overharvest.

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 underharvest others.

### 8.4.3 Closed Waters

Option 1. Closed waters to be combined into Category 1.

Subsistence fisheries in the BS/AI area have been protected by closing to commercial fishing those waters fished in the subsistence fishery.

The FMP recognizes the current State regulations that prohibit commercial fishing for king crab in waters within 10 miles of mean lower low water around St. Lawrence, King and Little Diomede Islands.

The FMP also recognizes the following State closure to protect the Norton Sound subsistence king crab fishery:

All waters of the Norton Sound Section enclosed by a line from 65°23' N. lat., 167° W. long. to 64°15' B, lat., 167° W. long. to 64°15' N. lat., 162° W. long. to 63°27' N. lat., 162° W. long. are closed to the taking of king crab for commercial purposes during the summer season, currently August 1 to September 3. According to current State regulations, the State may reduce, by small increments, the closed waters to no less than 3 miles from mean lower low tide to allow the commercial king crab fishery to efficiently obtain the allowable harvest of red king crab.

In order to meet both State and Federal subsistence requirements, new closed waters areas may be needed and existing closed waters areas may need to be reduced or expanded. Such changes could occur only by plan amendment.

Option 2. Closed waters to be combined and frameworked into Category 2.

This option would include the same description presented in Option 1 of the existing State closed waters areas. Under this option, the State could designate new closed waters areas or expand or reduce existing State closed waters areas in order to meet State and Federal subsistence requirements. In making such

changes, the State shall consider appropriate factors to the extent data are available on: (1) need to protect subsistence fisheries, (2) need to protect critical habitat for target or non-target species, (3) prevention of conflict between species, and (4) creation of navigational hazard.

## 9.0 PROCEDURE FOR COUNCIL/SECRETARY PARTICIPATION IN STATE OF ALASKA PRESEASON FISHERIES ACTIONS AND NMFS REVIEW TO DETERMINE CONSISTENCY OF THE REGULATIONS WITH THE FMP, MAGNUSON ACT, AND OTHER APPLICABLE FEDERAL LAW

### 9.1 Prior to the Board of Fisheries or Other State Crab Regulatory Meeting.

Commencing on the effective date of the regulations implementing this FMP, and until the next regularly scheduled Board meeting concerning crab regulations, or other State crab regulatory meeting, any member of the public may appeal any existing regulation to the State[2] and, if unsuccessful, to the Secretary, and any Alaska Statute to the Secretary, in accordance with the procedure set forth below. Secretarial review is limited to whether the challenged statute or regulation is consistent with the FMP, the Magnuson Act, and other applicable Federal law.

### 9.2 At the Board of Fisheries or Other State Crab Regulatory Meeting.

Before the meeting of the Board or other State crab regulatory body (the Board meeting has usually taken place in March or April), the public has an opportunity to petition the State for new regulations or repeal of existing regulations. Copies of all

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[2] Current Board policy limits petitions to the subject of conservation emergencies.

proposals will be available to the public and to NMFS and the Council. Representatives of NMFS, NOAA's Office of General Counsel, and the Council will meet with the State and will participate in the State's discussions and deliberations for the purpose of assisting the State in determining the extent to which proposed management measures fall within the scope of the FMP, the Magnuson Act, and other applicable Federal Law. However, these representatives will not vote on the various management measures.

9.3 After the Board of Fisheries or Other State Crab Regulatory Meeting.

After the meeting, the procedure for review of the resulting crab regulations follows two paths:

First, under the State Administrative Procedure Act (described in Appendix C) an interested person may petition the Board for the adoption or repeal of a regulation. A member of the public who objects to a crab regulation must first appeal through this procedure and must receive an adverse ruling which will be reviewed by the CIAC prior to the appeal being reviewed by the Secretary. The CIAC will have no authority to grant or reject the appeal, but shall comment upon the appeal for the benefit of the Secretary. An appeal to the Board is not limited to a challenge that the proposed regulation is inconsistent with the FMP, the Magnuson Act, or other applicable Federal law. The Secretary will, however, consider only challenges to regulations alleging that the

new regulations ARE INCONSISTENT WITH THE FMP, THE MAGNUSON ACT, OR OTHER APPLICABLE FEDERAL LAW. The Secretary will not respond to comments that merely object to a regulation or state that an alternate regulation is better unless the interested person ties the objection to the appropriate standard of review. This will allow the Secretary to disregard frivolous comments and to encourage interested persons to participate fully in the State procedures before seeking Secretarial intervention. Nothing in this FMP is intended to limit any opportunity under the State Administrative Procedure Act for an interested person to seek judicial review of regulations.

The second path of review will be a Secretarial review of the measures adopted by the Board. During this review, the Secretary will review any measure adopted by the Board for consistency with the FMP, the Magnuson Act, and other applicable Federal law. The Secretary will also consider comments submitted by the Council on any measure adopted by the State during the 20 days after the end of the Board meeting or other State crab regulatory meeting. The Secretary may hold an informal hearing, if time permits, to gather further information concerning the regulations under review. The Secretary will consider only comments on WHETHER THE NEW REGULATIONS ARE CONSISTENT WITH THE FMP, THE MAGNUSON ACT AND OTHER APPLICABLE FEDERAL LAW.

If, as a result of its own review, or its review of comments received, or as a result of an appeal of an adverse decision in

the State appeal process, the Secretary makes a preliminary determination that a regulation is inconsistent with the FMP, the Magnuson Act, or other applicable Federal law, then the Secretary will:

1. publish in the Federal Register a proposed rule that is consistent with the FMP, the Magnuson Act, and other applicable Federal law, together with the reasons for the rule, and request comments for 30 days, and

2. provide actual notice of the proposed rule to the Council and the Commissioner of ADF&G. The State will have 20 days to request an informal hearing.

If, after reviewing public comments and any information obtained in an informal hearing, the Secretary decides that the State regulations in question are consistent with the FMP, the Magnuson Act, or other applicable Federal law, the Secretary will publish in the Federal Register a withdrawal of the proposed rule, and so notify the State and the Council.

If the State withdraws the regulation or states that it will not implement the regulation in question, the Secretary will publish in the Federal Register a withdrawal of the proposed rule. The State may choose to withdraw its rule as a result of its own appeals procedure or because of the review procedure set up under this FMP.

If, after reviewing public comments and any information obtained in an informal hearing, the Secretary decides that the regulations in question are inconsistent with the FMP, the Magnuson Act, or other applicable Federal law, the Secretary will publish in the Federal Register a final rule that supersedes the State regulation in the EEZ. Such rules are Federal regulations, which will comply with Federal rulemaking procedures and be enforced as Federal law.

If preseason changes are made at a Board or other State crab regulatory meeting which takes place later in the year than anticipated here, or if a season is to be set earlier in the year than usual so that there is not time to follow the procedure described in this chapter and have any final Federal rule that may be necessary in effect before the start of the season, the Secretary will notify the Council and the Commissioner of ADF&G that he will use an expedited review procedure, possibly including deletion of the requirement for initial appeal to the State, and explain what the procedure is. In the expedited review, the Secretary will provide for comment by the Council (or a committee of the Council) and the Commissioner of ADF&G if at all possible. However, if necessary, the Secretary can immediately publish in the Federal Register an interim final rule that supersedes in the EEZ any State regulation that the Secretary finds is inconsistent with the FMP, the Magnuson Act, or other applicable Federal law, and ask for comments on the interim final rule.

## 10.0 PROCEDURE FOR APPEAL TO THE SECRETARY OF COMMERCE TO SET ASIDE AN IN-SEASON ACTION OF THE STATE

For the purposes of this section, an in-season appeal is an appeal of any action by the State, other than an action taken by the State that NMFS had already reviewed in the process described above. It includes an appeal of an action of the Board or other State crab regulatory body, of the ADF&G, or of the State legislature. The in-season appeal process is limited similarly to the preseason review process, in that THE SECRETARY WILL ONLY CONSIDER APPEALS THAT THE STATE REGULATION IS INCONSISTENT WITH THE FMP, THE MAGNUSON ACT, OR OTHER APPLICABLE FEDERAL LAW. For example, where State in-season, discretionary action is alleged to violate a Magnuson Act National Standard, a management measure fixed in the FMP, or fails to follow the criteria set forth in the FMP for a decision under a frameworked management measure, an appeal to the Secretary would be appropriate. The Secretary will not consider appeals that merely state that the appellant does not like the regulation or prefers another. The latter argument is to be presented to the State.

If a person believes that an in-season action of the State is inconsistent with the FMP, the Magnuson Act, or other applicable Federal law, the person must, within 10 days of the issuance of the in-season action, submit to the Secretary in writing a description of the action in question and the reasons that it is inconsistent with the FMP, the Magnuson Act, or other applicable

Federal law. The Secretary will immediately provide a copy of the appeal to the CIAC and the Commissioner of ADF&G. The Secretary will, to the extent possible when reviewing any appeal of an in-season management decision, communicate with the CIAC in advance of making his decision whether to grant or reject the appeal in order to solicit the CIAC's and the Commissioner's comments on the management decision at issue. If time permits, he will allow them 5 days for comment on the appeal. If the Secretary determines that there is not sufficient time available for this review, he will seek comments by telephone from the Commissioner of ADF&G and from the Council.

State crab regulations grant certain rights to appeal in-season area closures. An interested person may wish to pursue State appeal procedures along with the procedure described here.

If, after review of the appeal and any comments from the Commissioner of ADF&G and the Council, the Secretary determines that the challenged action is consistent with the FMP, the Magnuson Act, and other applicable Federal law, he will so notify the appellant, the Commissioner of ADF&G, and the Council.

If, after review of the appeal and any comments of the Commissioner of ADF&G and the Council, the Secretary finds that the in-season action is inconsistent with the FMP, the Magnuson Act, or other applicable Federal law, and that for good cause he must immediately issue Federal regulations that supersede State

regulations in the EEZ, he will publish in the Federal Register the necessary final Federal rule and request comments on the rule.

If, after review of the appeal and the comments of the Commissioner of ADF&G and the Council, the Secretary makes a preliminary determination that the action is inconsistent with the FMP, the Magnuson Act, or other applicable Federal law, but that Federal regulations that supersede the State regulation in the EEZ need not be implemented immediately, he will follow the procedure for preseason actions (see Chapter 9). That is, he will publish a proposed rule in the Federal Register and request comment, provide the State with an opportunity for an informal adjudicatory hearing, and either withdraw the proposed rule or publish a final rule that supersedes the State rule in the EEZ. This would be a Federal action and would comply with Federal rulemaking procedures.

# APPENDICES

## Appendix A

The following document is the Joint Statement of Principles between the North Pacific Fishery Management Council and the State of Alaska, which has been used in cooperative management of the BS/AI king crab stocks since 1981.

Revised 9/8/81

JOINT STATEMENT OF PRINCIPLES

BETWEEN

NORTH PACIFIC FISHERY MANAGEMENT COUNCIL (NPFMC)
ANCHORAGE, ALASKA

and

ALASKA BOARD OF FISHERIES (BOF)
JUNEAU, ALASKA

ON

MANAGEMENT OF DOMESTIC KING CRAB FISHERIES
IN THE BERING SEA AND ALEUTIANS

Recognizing that NPFMC has a legal responsibility for reviewing and recommending to the Secretary of Commerce measures for the conservation and management of the fisheries of the Arctic Ocean, Bering Sea, and Pacific Ocean seaward of Alaska, with particular emphasis on the consistency of those measures with the National Standards of the Magnuson Fishery Conservation and Management Act (Magnuson Act); and

Recognizing that State and Federal governmental agencies are limited in fiscal resources, and that the optimal use of these monies for North Pacific fisheries management, research, and enforcement occurs through a clear definition of agency roles and division of responsibilities, thus avoiding unnecessary duplication; and

Recognizing that the State of Alaska has for more than two decades exercised effective control over domestic king crab fisheries both within and without its territorial waters. The State system centers around BOF for policy and regulations. BOF's regulatory system provides for extensive public input; is sufficiently structured to insure annual revisions; is flexible enough to accommodate resource and resource utilization "emergencies;" and is understood and familiar to the users of North Pacific fisheries resources. Further, 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 resources.

Therefore, NPFMC and BOF enter into this Joint Statement of Principles, defining the roles of both organizations, in order to achieve the most effective and efficient management of domestic king crab fisheries in the Bering Sea and Aleutians.

I. Applicable Fisheries

This Joint Statement of Principles applies only to the domestic fishery for king crab (all members of genera Paralithodes and Lithodes) in the Bering Sea, Bristol Bay, Adak, and Dutch Harbor areas, also known as State of Alaska king crab statistical areas Q, T, R, and O. This fishery is hereinafter referred to as "the fishery."

II. Duration of Agreement

Recognizing that NPFMC is currently preparing a Fishery Management Plan (FMP) for the fishery, this agreement shall remain in effect until that FMP is implemented by the Secretary of Commerce. At that time the agreement shall be reviewed by both NPFMC and the BOF and revised as necessary and as they may agree so that it will conform with the then existing situation.

III. NPFMC and BOF shall undertake the following activities:

1. NPFMC and BOF shall adopt the framework developed and approved by both organizations in April and May, 1981 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 are consistent with the national standards of the Magnuson Act and with the laws of the State of Alaska; and do not discriminate between residents and non-residents of the State of Alaska.

2. The framework shall be implemented through regulations adopted by BOF in accordance with the laws of the State of Alaska, which shall be consistent with the objectives, standards, and measures prescribed in the framework. Before taking final action on any regulation governing the fishery, BOF 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 BOF upon which the proposed regulation is based; shall afford all such persons the opportunity to submit written and oral comments to BOF on the proposed regulation during that period; and shall, upon the request of NPFMC, meet with NPFMC or its representatives to discuss the proposed regulation. Before any BOF regulation governing the fishery goes into effect, BOF shall issue a written statement explaining the basis for the regulation. The preceding provisions of this paragraph shall not apply to emergency regulations.

3. NPFMC and BOF shall meet jointly at least once every calendar year to consider mangement of the fishery and discuss the need for amendment of the framework or any regulations governing the fishery. NPFMC and BOF or their designated representatives shall also meet jointly to consider management of the fishery at the request of either NPFMC or BOF. 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 NPFMC and BOF at these meetings. In preparation for the mandatory annual joint meeting provided for in the first sentence of this paragraph, representatives of NPFMC and BOF 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.

4. The Alaska Department of Fish and Game (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. NPFMC and BOF shall encourage ADF&G, in carrying out this responsibility, to consult actively with the National Marine Fisheries Service and the fishery management 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.

5. NPFMC and BOF shall resolve conflicts on the framework and implementing regulations through all appropriate means.

Approved:

For the North Pacific Fishery Management Council

Clement V. Tillion, Chairman

10-20-81
Date

For the Alaska Board of Fisheries

Nick Szabo, Chairman

10/20/81
Date

Appendix B

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 for the United States fishing industry.

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 interrelated 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.

Appendix C

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 ADF&G, although communication between the two departments is maintained and activities are coordinated.

Jurisdiction: ADF&G asserts management authority over all migratory fish and shellfish species which enter and leave territorial waters of the State,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 cover 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, 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 1960s, the Board, and before it,the Board of Fish and Game, has usually 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 concerned about the fish and game resources of their locality, serve as local clearinghouses and sources of proposals for Board consideration.

Following submission of advisory committees and 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 2 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.

## Appeals to the Board of Fisheries

Reconsideration of issues during a meeting - During a Board meeting, any Board member may move to reconsider an issue regardless of how the member voted on the original issue. Board Policy #80-78-FB requires that the motion be made prior to the adjournment of the meeting, that the motion be supported with new evidence, unavailable at the time of the original vote and that public notice be given as to when reconsideration will occur.

Petitions to the Board - Under Section AS 44.62.220, an interested person may petition the Board for the adoption or repeal of a regulation. Upon receipt of a petition requesting the adoption, amendment or repeal of a regulation, the Board shall, within 30 days, deny the petition in writing or schedule the matter for public hearing. The Board and the Board of Game adopted a Joint Board Petition Policy which limits the scope of petitions they are willing to act upon outside of the normal regulatory cycle. The Joint Board recognized that in rare instances extraordinary circumstances may require regulatory changes outside this process. Therefore, it is the policy of the Board and the Board of Game that petitions will only be accepted if the problem outlined in the petition results in a finding of emergency. In accordance with State policy (AS 44.62.270), emergencies will be held to a minimum and rarely found to exist. Alaska Statute 44.62.250 specifies that in order to adopt emergency regulations, the agency must find that it is necessary for the

immediate preservation of the public peace, health, safety, or general welfare. If such a finding is made, the agency adopting the emergency regulation shall submit a copy to the Lieutenant Governor for filing and for publication in the "Alaska Administrative Register" notice of adoption shall be given within five days of the adoption. Failure to give notice within ten days automatically repeals the regulation. For fish and game regulations, the Boards determined that an emergency is an unforeseen, unexpected event that either threatens a fish or game resource, or an unforeseen, unexpected resource situation where a biologically allowable resource harvest would be precluded by delayed regulatory action and such delay would be significantly burdensome to the petitioners since the would be unavailable in the future.

## Appeals to the Commissioner of Fish and Game

Petitions - Board Policy #79-53-FB delegates authority to the Commissioner to adopt emergency regulations, during times of the year when the Board is not in session. The Commissioner may adopt, in accordance with the Administrative Procedure Act (AS 44.62), an emergency regulation where an emergency exists as described in AS 44.62.250. All emergency actions shall, to the full extent practicable, be consistent with Board intent. The Commissioner is further required to consult, if possible, with members of the Board to obtain their views.

In-season Management Actions - Within 5 days after the closure of any registration area, an individual holding a king or Tanner crab permit issued by the Commercial Fisheries Entry Commission or the owner of any vessel registered to that area may formally request the commissioner to reopen the area. The commissioner shall personally review pertinent information on the condition of crab within the area, and shall formally announce his decision within 14 days of the request. 5AAC 34.035(d), 35.035(d).

Judicial Review - The APA in Section 44.62.300 provides for court review of regulatory actions of the Board or commissioner. An interested person may get a judicial declaration on the validity of a regulation by bringing an action for declaratory relief. All actions are to be brought in the Superior Court. The court may declare the regulation invalid for a substantial failure to comply with required administrative procedures (AS 44.62.010-44.62.320) or, in the case of an emergency regulation or order of repeal, upon the grounds that the facts recited in the statement do not constitute an emergency under AS 44.62.250.

Appendix D

## Biological and Environmental Characteristics of the Resource

### Life History Features.

This section summarizes the habitats and life history of king and Tanner crabs in the BS/AI area. More detailed information can be found in the following: U.S. Department of Commerce 1978, Adams 1979, Somerton 1981, Somerton 1981, Melteff, ed. 1982, North Pacific Fishery Management Council 1984, Kessler 1985, Fukuhara 1985, and Melteff, ed. 1985, Tester and Carey 1986, and International North Pacific Fisheries Commission (INPFC) annual reports and associated documents.

A bibliography of Tanner crab references is presented by Donaldson and Hicks, 1978, and a bibliography of king crab and Tanner crab references is presented by Bowerman, et al. 1983.

### Description of Habitat Types.

The Bering Sea covers a flat, relatively featureless shelf whose southern boundary extends from near Unimak Pass to Cape Navarin, and from a deep-water basin bounded by the shelf and the Aleutian Island Arc. The Bering Sea has certain characteristic features which make it different from other corresponding regions in higher latitudes (see Table D.1 from Favorite and Laevastu,

TABLE D.1

Characteristic features of the eastern Bering Sea shelf ecosystem

| Characteristic features | Consequences |
|---|---|
| *Physical features* | |
| Large continental shelf | High standing stocks of biota |
| | High fish production |
| | Large food resources for mammals |
| High latitude area | Nutrient replenishment with seasonal turnover |
| | Environmental distribution limits for many species |
| | Large seasonal changes |
| | Seasonal presence of ice |
| | Accumulation of generations |
| Large occasional changes | Seasonally changing growth |
| | Seasonal migrations |
| | Possibility of large anomalies |
| Ice | Presence of ice-related mammals |
| | Migration of biota (in and out) caused by ice |
| | Limited production in winter |
| Cold bottom water | Outmigration of biota |
| | Higher mortalities and lower growth of benthic and demersal bi |
| | Accumulation of generations |
| High runoff | Low salinities (near coasts) |
| | High turbidities |
| | Presence of eurohaline fauna |
| Sluggish circulation | Local biological production |
| | Local pelagic spawning |
| *Biological features* | |
| High production and slow turnover | High standing stocks |
| Fewer species (than in lower latitudes) | Few species quantitatively very dominant |
| Large numbers of marine mammals and birds | High predation by apex predators |
| Pronounced seasonal migrations | Great local space and time changes of abundance |
| *Fisheries resource features* | |
| Pollock dominant semidemersal species | Flexible feeding and breeding habits, special environmental adap |
| Yellowfin sole dominant demersal species | Abundant benthos food supply |
| Herring and capelin dominant pelagic species | Important forage species in the ecosystem |
| Abundant crab resources | Large, relatively shallow shelf |
| | Few predators on adults, special environmental adaption |
| Abundant marine mammals | Abundant food supply, no enemies, insignificant hunting. |
| | Compete with man for fishery resources |
| *Man-related features* | |
| Fisheries development rather recent | Ecosystem in near-natural state, not yet fully adjusted to effects of extensive fishery |
| Little-inhabited coasts | Ample space for breeding colonies of mammals and birds |
| | Very limited local fisheries, no pollution |

Favorite, Felix and Taivo Laevastu, 1981. Finfish and the environment. In Hood, D.W. and J.A. Calder (eds.): The eastern Bering Sea shelf: oceanography and resources, Vol. 1. Univ. of Washington Press, Seattle, Washington: 597-610.

1981). The Aleutian Island Arc contains a narrow shelf that drops off rapidly to the Bering Sea on the north and the North Pacific Ocean to the south. Seasonal changes are more moderate than over the Bering Sea shelf. Ocean currents flow through the passes between the Islands, and south of the chain the narrow shelf is washed by a westward current which is stronger in the eastern part; on the Bering Sea side this current is missing.

The waters of the Bering Sea can be partitioned (Kinder and Schumacher, 1981 a, b) during the summer by transition zones which separate four hydrographic domains (Figure D.1). The hydrographic domains are distinguished by bottom depth and seasonal changes in their vertical density structure. During the winter this structure is absent or much less apparent under the ice. Beginning in the nearshore area, the coastal domain includes waters less than 50 m in depth that due to tidal and wind mixing do not stratify seasonally. A frontal zone of transition separates the coastal domain from the middle shelf domain. In the middle shelf domain, over bottom depths of 50 to 100 m, seasonal stratification sets up during the ice-free season, and warmer, less saline waters overlie colder and more saline bottom waters. This stratification persists until broken down by winter cooling and storms. A broad transition or frontal zone separates the middle shelf zone from the outer shelf domain. This latter domain, in water depths from 100 to 170 - 200 m, is characterized by well-mixed upper and lower layers separated by a complex intermediate layer containing fine density structure. In general,

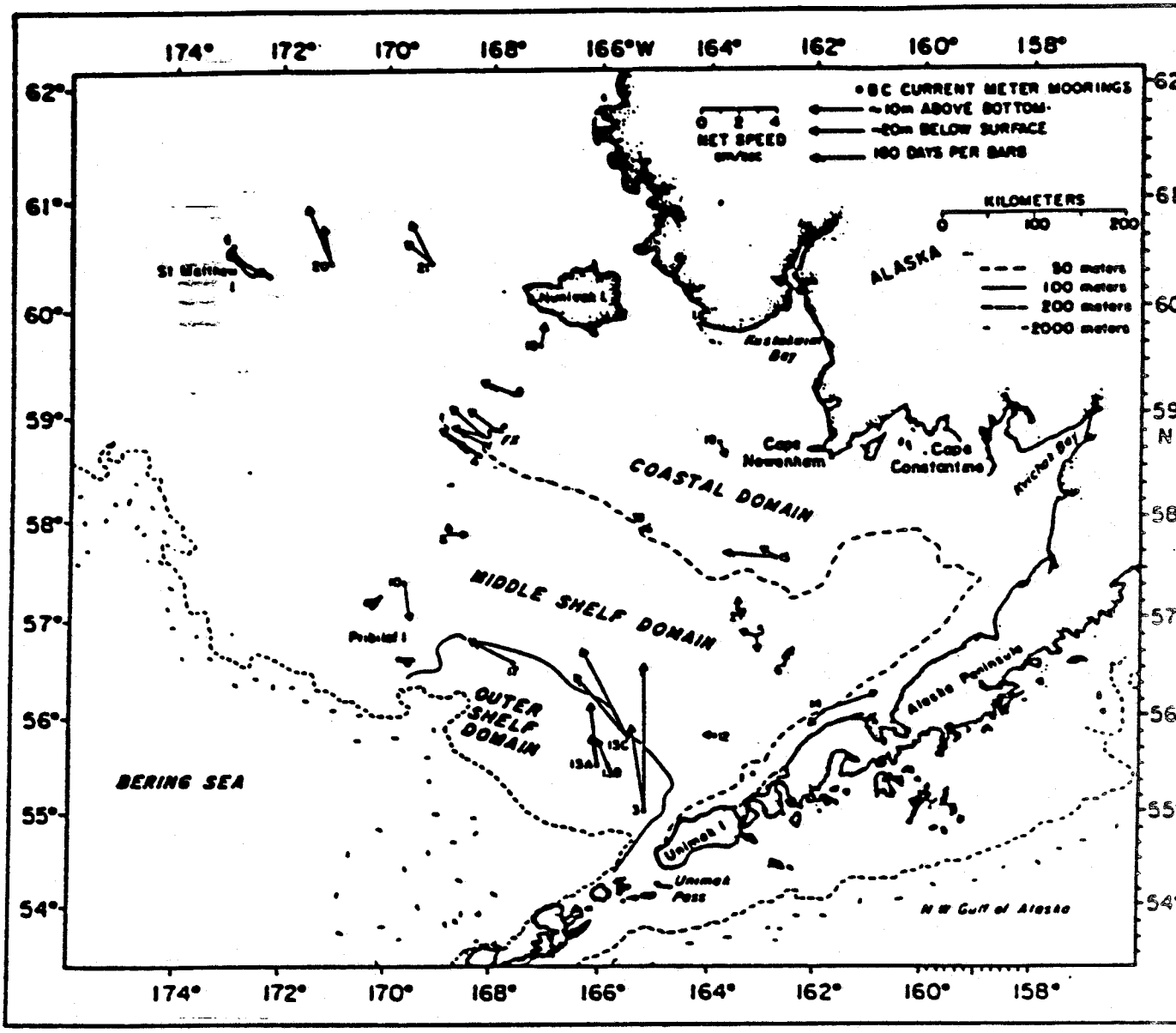


Figure D.1 Mean flow. The mean for all records at each mooring site is shown. Coastal and outer regime moorings generally had statistically significant means, while middle shelf sites did not. The domains refer to hydrographic structure (preceding chapter), but the domains and flow regimes are nearly coincident.

Kinder, T.H. and J.D. Schumacher, 1981. Circulation over the continental shelf of the southeatern Bering Sea. In Hood, D.W. and J.A. Calder (eds.): The eastern Bering Sea shelf: oceanography and resources, Vol.1. Univ. of Washington Press, Seattle, Washington: 53-76.

the outer shelf waters intrude shoreward near the bottom, while middle shelf waters spread seaward above them. Beyond the outer shelf domain, the shelf break front separates shelf waters from the oceanic domain, with its more saline, less aerobic waters overlying the Bering Sea slope and deep basin.

Net circulation in the Bering Sea is generally sluggish. However, moderate to strong tidal and wind-driven currents can be established over the shelf. Nearshore coastal currents from the Gulf of Alaska shelf flow into the Bering Sea through Unimak Pass and then apparently continue northeastward along the Alaska Peninsula. Within Bristol Bay, the flow becomes counterclockwise and follows the 50 m depth contour toward Nunivak Island. In the middle shelf domain (water depths from 50-100 m), currents are weak and variable, responding temporarily as wind-driven pulses. In the outer shelf domain, a mean northwestward flow exists along the shelf edge and upper slope following depth contours.

With respect to the physiographic regimes and hydrographic domains of the Bering Sea, king crabs cross boundaries during seasonal and spawning migrations from one domain to another. Shelf dwellers, during the winter period king crabs move shoreward during the late winter and early spring and congregate on molting and spawning shoals. Crabs may occupy shoals from 50 to less than 20 fathoms at this time of year. Other crab species (Chionoecetes sp.) also may make off-on shelf migrations for spawning and molting.

Habitat Areas of Particular Concern.

With the possible exception of the ice-covered surface layer of the shelf during winter, there is not an area of the Bering Sea, water depth, or time of year when one or several species of commercial importance are not present at some life stage. It is difficult, therefore, to designate particular habitats that can be spatially and temporally defined as holding substantially more important resource values than other areas.

Habitat can also be partitioned according to depth both between crab species and among different life history stages of a given species. Shallow inshore areas (less than 50 m depth) are very important to king crab reproduction. King crabs move into these areas in the spring to molt and mate. King crabs lay eggs in the spring which are carried on the female for 12 months and hatch out the next spring as pelagic larvae. These weakly swimming larval stages are distributed according to their own buoyancy, vertical swimming abilities, and the currents, mixing, or water stratification on their nursery grounds. Generally, the larval stages occupy the upper mixed layer of the water column, often at or near the sea surface, until they grow and molt into more actively swimming larval stages that are able to seek a preferred depth of rearing habitat. After molting through four larval stages, king crab larvae develop into glaucothoe, which are young crabs that settle in the benthic environment usually in nearshore shallow areas with significant cover (macroalgae,

cobbles, shale, debris). Tanner crab have three larval stages before molting into their settling stage or megalops. The area north and adjacent to the Alaska peninsula (Unimak Island to Port Moller) and the eastern portion of Bristol Bay are locations known to be particularly important for king crab spawning and probably for juvenile rearing (Personal Communication, Dr. Jerry E. Reeves, Northwest and Alaska Fisheries Center, Resource Ecology & Fisheries Management Division, 7600 Sand Point Way, NE., Bin C15700, Seattle, WA 98115).

Appendix E

Description of the Fisheries and Management

The red king crab resource in the eastern Bering Sea was exploited by Japan in the 1930s and small amounts of Tanner crab were harvested beginning in 1953 (Zahn 1970, Otto 1981).

The king crab fishery in the BS/AI area has gone through rapid development in the last 25 years (Table E.1). After a short-lived, small-scale American fishery in the late 1940s and 1950s, the Japanese reentered the fishery in 1953 and the Soviet Union entered the fishery in 1958. During 1964, the United States arranged bilateral agreements with Japan and the U.S.S.R. The foreign fisheries were gradually supplanted by an entirely American fishery which has had more than enough capacity to harvest and process the total resource since the late 1960s. Foreign fisheries for king crabs ceased in 1974 and those for Tanner crabs ceased in 1980.

Prior to Alaska statehood, the U.S. Bureau of Commercial Fisheries managed the crab fishery off Alaska. The Bureau established a minimum size limit, prohibited retention of soft shell and female crabs, and prohibited the use of tangle nets and set a minimum size for trawl nets. After achieving statehood, regulatory authority was vested in the Board with management

Table E.1. Historical catch of red, blue, and brown king crabs by registration area for the BS/AI Fishery (in thousands of pounds), 1950 to 1988.

| Year | Dutch Harbor | Adak W.Aleutian | Bering Sea | Bristol Bay | Foreign[1] |
|---|---|---|---|---|---|
| 1950 | NF | NF | NF | NF | 0 |
| 1951 | NF | NF | NF | NF | 0 |
| 1952 | NF | NF | NF | NF | 0 |
| 1953 | NF | NF | NF | 2,000.0 | 11,356.0 |
| 1954 | NF | NF | NF | 2,329.0 | 8,086.0 |
| 1955 | NF | NF | NF | 1,878.0 | 8,693.0 |
| 1956 | NF | NF | NF | 1,896.0 | 8,308.0 |
| 1957 | NF | NF | NF | 588.0 | 8,548.0 |
| 1958 | NF | NF | NF | 7.0 | 8,136.0 |
| 1959 | NF | NF | NF | NF | 11,602.0 |
| Subtotal | | | | 8,698.0 | 64,729.0 |
| Average | | | | 1,449.7 | 9,247.0 |
| 1960-61[2] | NF | 2,093.7 | NF | 598.0 | 24,611.0 |
| 1961-62 | 533.0 | 4,776.0 | NF | 459.0 | 40,404.0 |
| 1962-63 | 1,536.0 | 8,006.5 | NF | 74.0 | 49,516.2 |
| 1963-64 | 3,893.0 | 17,903.7 | NF | 747.0 | 56,671.0 |
| 1964-65 | 13,761.0 | 21,193.8 | NF | 910.0 | 63,076.0 |
| 1965-66 | 19,196.0 | 8,040.4 | NF | 1,762.0 | 41,405.0 |
| 1966-67 | 32,852.0 | 5,883.1 | NF | 997.0 | 43,998.0 |
| 1967-68 | 22,709.0 | 16,948.9 | NF | 3,102.0 | 32,528.0 |
| 1968-69 | 11,300.0 | 19,874.8 | NF | 8,687.0 | 27,681.0 |
| 1969-70 | 8,950.0 | 19,055.4 | NF | 10,403.0 | 14,113.0 |
| Subtotal | 114,730.0 | 123,776.3 | | 27,739.0 | 394,003.2 |
| Average | 12,747.8 | 12,377.6 | | 2,773.9 | 39,400.3 |

Table E.1. Historical catch of red, blue, and brown king crabs by registration area for the BS/AI Fishery (in thousands of pounds), 1950-1988.

| Year | Dutch Harbor | Adak W.Aleutian | Bering Sea | Bristol Bay | Foreign |
|---|---|---|---|---|---|
| 1970-71 | 9,652.0 | 16,057.0 | NF | 8,559.2 | 12,930.0 |
| 1971-72 | 9,391.6 | 15,475.9 | NF | 12,995.8 | 6,188.0 |
| 1972-73 | 10,450.4 | 18,724.1 | NF | 21,744.9 | 4,721.0 |
| 1973-74 | 12,722.7 | 9,741.5 | 1,276.6 | 26,913.6 | 1,279.0 |
| 1974-75 | 13,991.1 | 2,775.0 | 7,107.3 | 42,266.3 | 2,618.0 |
| 1975-76 | 15,906.6 | 437.1 | 2,433.7 | 51,326.2 | NF |
| 1976-77 | 10,198.4 | 2.3 | 8,356.1 | 63,919.7 | NF |
| 1977-78 | 3,684.4 | 953.0 | 8,201.8 | 69,967.8 | NF |
| 1978-79 | 6,824.1 | 807.2 | 10,387.7 | 87,618.3 | NF |
| 1979-80 | 15,010.9 | 490.7 | 9,230.3 | 107,828.0 | NF |
| Subtotal | 107,832.2 | 65,463.8 | 46,993.5 | 493,139.8 | 27,736.0 |
| Average | 10,783.2 | 6,546.4 | 6,713.4 | 49,313.9 | 5,547.2 |
| 1980-81 | 19,053.6 | 1,478.4 | 11,543.8 | 129,948.5 | NF |
| 1981-82 | 5,231.1 | 2,843.0 | 13,772.5 | 33,591.4 | NF |
| 1982-83 | 1,616.2[3,4] | 9,708.1 | 13,447.3 | 3,001.2 | NF |
| 1983-84 | 1,810.0[3,4] | 10,109.6 | 11,701.9 | CLOSED | NF |
| 1984-85 | 1,521.1[3,4] | 5,508.7 | 4,701.3 | 4,182.4 | NF |
| 1985-86 | 1,968.2[3,4] | 11,931.0 | 2,959.8 | 4,174.9 | NF |
| 1986-87 | 1,869.2[3,4] | 13,510.2 | 1,262.1 | 11,393.9 | NF |
| 1987-88 | 1,383.2[3,4] | 3,190.0[5] | 2,200.9 | 12,289.1 | NF |
| Subtotal | 34,452.6 | 58,279.0 | 61,589.6 | 198,581.4 | NF |
| Average | 4,306.6 | 7,284.9 | 7,698.7 | 28,368.8 | NF |

1 Foreign includes catch from Bristol Bay and Bering Sea.
2 Registration year.
3 Brown crab only.
4 Calendar year.
5 Through January 31.

Source: Westward Region Shellfish Report to the Alaska Board of Fisheries, Alaska Department of Fish and Game, Kodiak, Alaska, April 1988, with corrections made.

responsibility assigned to the ADF&G. 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 GHLs, which were expressed as a range instead of a point estimate. This gave the State 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.

The domestic Tanner crab fishery in the BS/AI area has undergone rapid development in recent years (Table E.2). Both C. bairdi and C. opilio are harvested in the Bering Sea and C. bairdi is harvested in the waters off the Aleutian Islands. The first reported catch of C. bairdi within the management unit was 17,900 pounds taken incidental to the Bering Sea king crab fishery in 1968. C. bairdi soon became a target species, and by 1976

Table E.2. Historical catch of C. bairdi and C. opilio Tanner crabs by registration area (in pounds) for the BS/AI Fishery, 1965-1987.

| Year[1] | Eastern Aleutians | Western Aleutians | Bering Sea C. opilio | Bering Sea C. bairdi | Total Foreign Harvest |
|---|---|---|---|---|---|
| 1965 | 0 | 0 | 0 | 0 | 3,936,000 |
| 1966 | 0 | 0 | 0 | 0 | 7,290,000 |
| 1967 | 0 | 0 | 0 | 0 | 24,000,000 |
| 1968 | 0 | 0 | 0 | 17,900 | 30,940,000 |
| 1969 | 0 | 0 | 0 | 1,008,900 | 47,668,000 |
| 1970 | 0 | 0 | 0 | 1,014,700 | 47,828,000 |
| 1971 | 0 | 0 | 0 | 166,100 | 39,886,000 |
| 1972 | 0 | 0 | 0 | 107,761 | 31,186,000 |
| 1973 | 62,128 | 168,354 | 0 | 231,668 | 27,886,000 |
| 1974 | 498,836 | 71,887 | 0 | 5,044,197 | 27,912,000 |
| 1975 | 77,164 | 3,350 | 0 | 7,284,378 | 18,456,000 |
| 1976 | 534,295 | 62,180 | 0 | 22,341,475 | 19,286,000 |
| 1977 | 1,301,654 | 0 | 0 | 51,455,221 | 21,520,173 |
| 1978 | 2,624,016 | 237,512 | 1,716,124 | 66,648,954 | 33,057,796 |
| 1979 | 1,092,311 | 197,244 | 31,102,832 | 42,547,174 | 32,914,536 |
| 1980 | 879,807 | 337,297 | 39,344,323 | 36,614,315 | 15,636,125 |
| 1981 | 654,514 | 220,716 | 50,483,055 | 29,732,086 | NF |
| 1982 | 739,694 | 838,627 | 29,351,474 | 11,008,779 | NF |
| 1983 | 547,830 | 448,399 | 26,128,410 | 5,273,881 | NF |
| 1984 | 239,395 | 191,954 | 26,813,074 | 1,208,223 | NF |
| 1985 | 165,529 | 66,549 | 65,998,875 | 3,151,498 | NF |
| 1986 | 166,939 | 72,441 | 97,984,539 | NF | NF |
| 1987 | 160,292 | 42,761 | 101,903,388 | NF | NF |
| 1988[2] | 309,042 | 130,790 | 126,800,000 | 1,951,022 | NF |
| TOTAL | 10,053,446 | 3,090,061 | 597,626,094 | 286,808,232 | 429,402,630 |
| AVERAGE | 628,340 | 206,004 | 54,329,645 | 15,095,170 | 26,837,664 |

SOURCE: Westward Region Shellfish Report to the Alaska Board of Fisheries, Alaska Department of Fish and Game, Kodiak, Alaska, April 1988.

1 Calendar year.
2 Preliminary data for this year.

approximately 22.9 million pounds were landed from the BS/AI area. A Japanese fishery for C. opilio was displaced by a completely domestic fishery in 1981. The first reported catches of C. opilio occurred in 1978 with about 1.7 million pounds landed. As C. bairdi stocks declined, C. opilio harvest increased rapidly, and since 1980, C. opilio harvests have exceeded C. bairdi total harvests for the management unit.

Currently, 17 separate stocks of king and Tanner crab are managed in the BS/AI area (Table E.3). In most cases, these stocks are geographically separable on the basis of distribution and differing biological characteristics and interchange with adjacent groups is limited to oceanographic transport of planktonic larvae. In some cases, however, stocks are merely defined by existing regulatory boundaries either for statistical purposes or because pertinent information is lacking.

Scarlet king crab and grooved and triangle Tanner crab are unlikely to become the target of a large commercial fishery due to the great depths they inhabit; however, the increasing value of crab and the fluctuating supply of other Alaskan crab species may stimulate technological developments making deepwater crab fishing more economical.

Table E.3. Stocks of king and Tanner crab in the BS/AI area.[1]

| | |
|---|---|
| Adak brown king crab | Separation from E. Aleutians is arbitrary, there may be various distinct biological groups in the area (see Otto and Cummiskey 1985). |
| Adak red king crab | One or more distinct groups separated from E. Aleutians by deep water trenches in passes between islands. |
| E. Aleutians brown | Probably separated from Bering Sea stocks by an area king crab of sparse abundance north of Unimak Pass, note relative to Adak applies. |
| E. Aleutians red king crab | One or several distinct groups (generally separated by district lines) that are geographically separated from Adak and Bering Sea stocks by passes between islands. |
| Bristol Bay red king crab | A distinct biological group. Blue king crab also occur here in low abundance but are not separately managed. |
| Bristol Bay brown king crab | Probably not distinct group but recognized for statistical purposes. |
| Pribilof blue king crab | A distinct biological and geographic group. |
| Pribilof red king crab | A distinct biological and geographic group. |
| Pribilof brown king crab | Probably two biological groups (Pribilof and Zhemchus canyons) that are not entirely geographically distinct from each other or from brown king crab found in Bristol Bay or the Northern District. |
| St. Matthew blue king crab | A distinct biological and geographic group. |
| St. Lawrence blue king crab | Probably distinct from groups to the south but may actually be several groups. |
| Northern District brown king crab | A group that has unique biological characteristics but may not be geographically distinct. |
| Norton Sound red king crab | A distinct biological and geographic group. |

Table E.3. Stocks of king and Tanner crab in the BS/AI area.

| | |
|---|---|
| Adak *C. bairdi* | Perhaps several groups but not geographically separated from E. Aleutians, grouping for statistical purposes and fishery almost entirely incidental to king crab fishing. |
| E. Aleutians *C. bairdi* | Not geographically distinct, grouping for statistical purposes, fishery largely incidental. |
| Bering Sea *C. bairdi* | Probably distinct from group(s) in Aleutian Islands, may consist of two groups (east and west) that differ biologically (see Somerton 1981). |
| Bering Sea *C. opilio* | Considered as distinct because species is almost absent from Aleutians. Gradations in biological characteristics over their geographical range. Probably continuous with populations found in Soviet waters. |

1 Stock information on scarlet king crab, grooved Tanner crab, and triangle Tanner crab is unknown.

Current Status of Stocks

Dutch Harbor - Eastern Aleutians

Red King Crab

ADF&G crab surveys conducted during August 1986 and 1987 found no significant increase in the area's red king crab population with the stocks remaining severely depressed (Westward Region Shellfish Report to the Alaska Board of Fisheries April 1987 and April 1988). The surveys showed that few males are recruiting into an already low legal male population. Very few juvenile female crabs were found to be present. This indicates that current reproductive problems will most likely continue into the future. There was found to be no increase in the total adult female population. The surveys also found a significant reproductive problem, suggesting that older adult females may have died off and that there are insufficient numbers of males to complete mating. Therefore, the red king crab stocks are in extremely poor condition and recovery to a fishable stock size will take many years.

Brown King Crab

Historically, Dutch Harbor brown king crab have been taken incidental to red king crab. No brown king crab landings were recorded prior to the 1981-82 season. Effort and interest in

brown king crab has increased with the decline of the red king crab stocks.

The stocks status is unknown but should maintain a healthy future based on the previous years' fisheries.

C. bairdi-Tanner crab

The Dutch Harbor-Eastern Aleutians is apparently a marginal habitat for C. bairdi, since the crab are found in commercial quantities in only a few of the major bays and inlets.

The stock status is unknown but appears to remain stable based on commercial catch and survey results. Effort is expected to remain stable with little change in the stock condition in the near future.

Adak-Western Aleutians

Red King Crab

The Adak red king crab fishery began in 1961, reached a peak of 21 million pounds by the 1964-65 season, and declined sharply after the 1972-73 season. Increased effort in the longline brown king crab fishery has reduced the catch of red king crab over the last few years.

Stock condition is presently unknown, but will most likely remain at a low level for several years.

Brown King Crab

The brown king crab fishery began during the 1975-76 season as an incidental catch in the red king crab fishery. Fishermen began targeting on brown king crab during the 1981-82 season, and in recent years, the brown king crab fishery has become the dominant fishery.

This is a new fishery with no survey and little information available on the stock condition. Future GHLs will most likely be based on fishery performance.

C. bairdi-Tanner Crab

C. bairdi Tanner crab from the western Aleutians have been harvested with the red king crab fishery. With continued effort concentrated on brown king crab, future harvests of C. bairdi are not expected to increase. Little change in the stock condition is expected in the near future.

## Bering Sea

### Red King Crab

In the Bering Sea, the major distribution of red king crab occurs in Bristol Bay. Due to a low abundance of males and a record low abundance of mature females, the ADF&G closed the Bristol Bay portion of the Bering Sea to king crab fishing in 1983. The fishery was reopened in 1984. From 1985 to 1986, the abundance of legal males increased by 140 percent, largely due to pre-recruit growth (Stevens et al., 1986). From 1986 to 1987, the abundance of legal males in Bristol Bay increased by 34 percent and the abundance of large females increased by 236 percent (Stevens et al., 1987). The total catch for the 1987-88 season was 12.3 million pounds (Table E.1). Preliminary data from the 1988 NMFS summer trawl survey indicates the probable future condition of the stocks will be depressed, since prerecruit males and immature females have greatly decreased (personal communications, B.G. Stevens, NMFS). For 1988-89, a red king crab harvest of 7.5 million pounds is predicted for Bristol Bay and no fishery for the Pribilofs.

### Blue King Crab

This species is concentrated in the vicinity of the Pribilof Islands and St. Matthew Island. The abundance of legal-sized crab in the Pribilofs was stable from 1978 to 1981, but

declined about 50 percent per year through 1985 (Stevens et al., 1987). There was a slight but insignificant increase in abundance of legal males from 1986 to 1987. The overall population appears stable with a total catch of about 253,000 pounds in 1987 and 690,000 pounds in 1988 (Preliminary Westward Region King Crab Catch Report, July 17, 1988). The 1988 NMFS survey showed a significant decrease in legal size males, and adult females. There will be no blue king crab fishery during the 1988-89 season. There is no clear relationship between the abundance of pre-recruits and later abundance of legal males, and the habitat of smaller crabs is rocky and untrawlable, so no long-term forecast can be made on the probable future condition of the stocks.

The abundance of pre-recruit and legal crab in the St. Matthew Island area (Northern District) declined from 1982-1986 (Stevens et al., 1987). Approximately 1.0 million pounds were landed during the 1987 fishery. The 1988 NMFS survey indicated that the population was similar to that found in 1987, with a slight increase in legal males. The stocks are considered depressed on a historical basis. Post-recruit abundance is low, while pre-recruit abundance is considered stable, although extremely hard to assess due to survey problems. The probable future harvest for the 1988 season is about 1 million pounds.

Brown King Crab

The stock status for this species is unknown.

C. bairdi-Tanner Crab

The abundance of legal size male crabs has been declining since 1975 and reached a low of 3.1 million crabs in 1986 (Stevens et al., 1987). The fishery was closed during 1986 and 1987. During 1987 and 1988, the declining trend reversed with increases in pre-recruit and legal males as well as females. During the 1988 season, less than 2 million pounds were taken. The probable future of the stocks looks encouraging, with increases expected for next year.

C. opilio-Tanner Crab

Analysis of the 1987 summer NMFS trawl survey showed that the abundance of males increased by 60 percent from the 1986 survey (Stevens, et al., 1987). Also large numbers of small crab were found, however, these crab are several years from reaching exploitable sizes and it is not possible to accurately predict their future availability. Recruitment patterns are not entirely clear as recruitment evidently occurs both through localized production and by immigration. Recent annual catches, 1986-1988, have averaged over 100 million pounds. The 1988 NMFS survey data has not been analyzed yet to determine the status of the opilio

stocks but, based on the 1987 NMFS survey, one would expect an increase in large males.

During the 1988 season, a dinoflagellate infection causing the bitter crab disease was detected in the C. opilio catch. Analysis is currently underway to determine the extent of this infection in the C. opilio stocks.

The distribution of legal size red and blue king crab and C. bairdi and C. opilio Tanner crab stocks as determined by the 1987 NMFS trawl survey of the BS/AI area (Stevens, et al. 1987) is shown in Figures E.1, E.2, E.3 and E.4.

Bering Sea/Aleutian Islands

Little information is available on the stock status of scarlet king crab and grooved and triangle Tanner crab. Limited quantities, 0.04 crab/mt and 0.0005 crab/mt of grooved and triangle Tanner crab were taken in the winter of 1988 during the Bering Sea groundfish trawl fisheries compared to 3.95 crab/mt, 2.56 crab/mt, 1.74 crab/mt and 0.03 crab/mt for C. opilio, C. bairdi, red king crab, and brown king crab, respectively, according to limited observer coverage of DAP trawl vessels which may not be representative of the overall DAP catch (Hare and Wall, 1985).

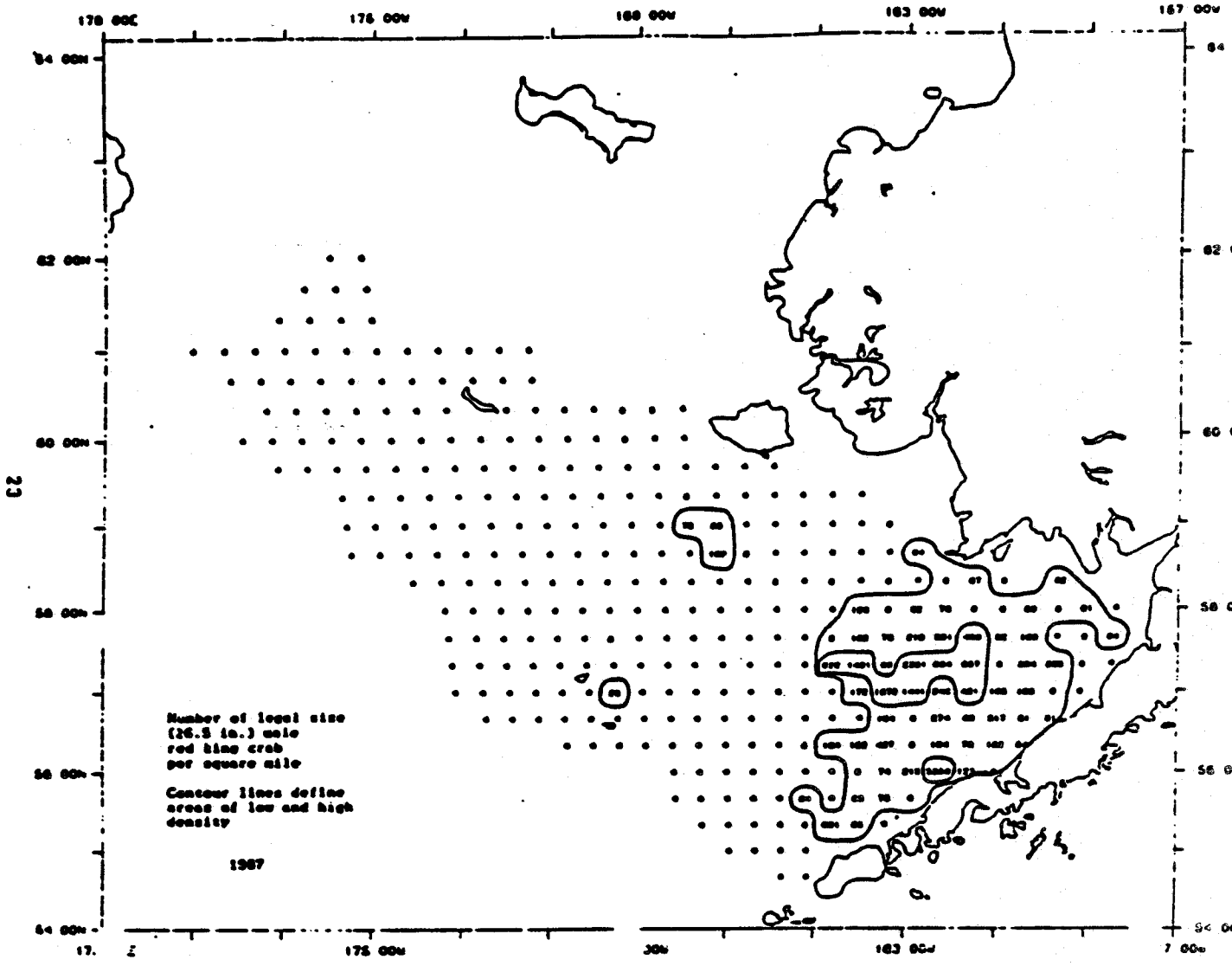


Figure E.1 The distribution of legal size male red king crab in the BS/AI area as determined by the 1987 NMFS trawl survey.

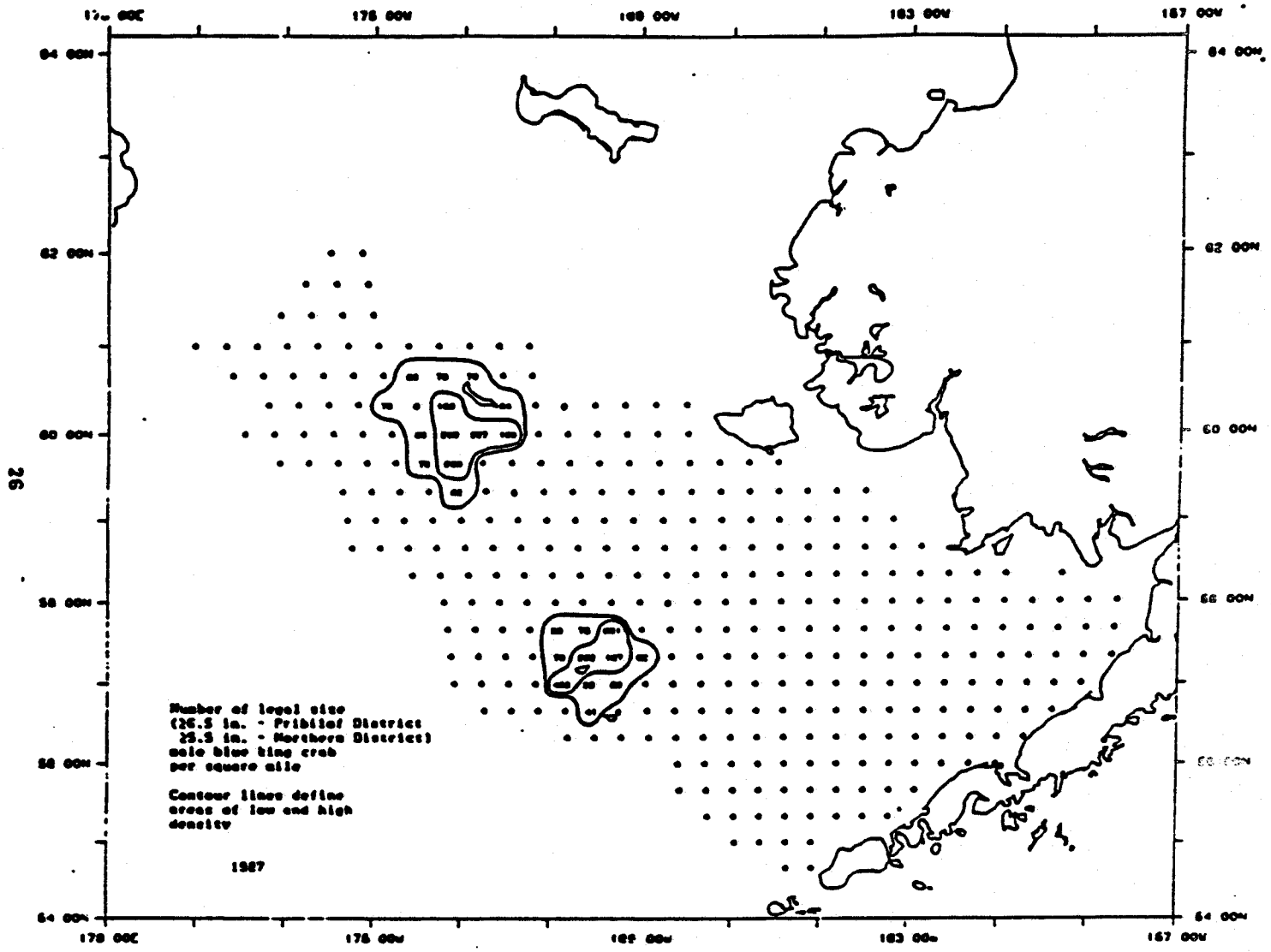


Figure E.2 The distribution of legal size male blue king crab in the BS/AI area as determined by the 1987 NMFS trawl survey.

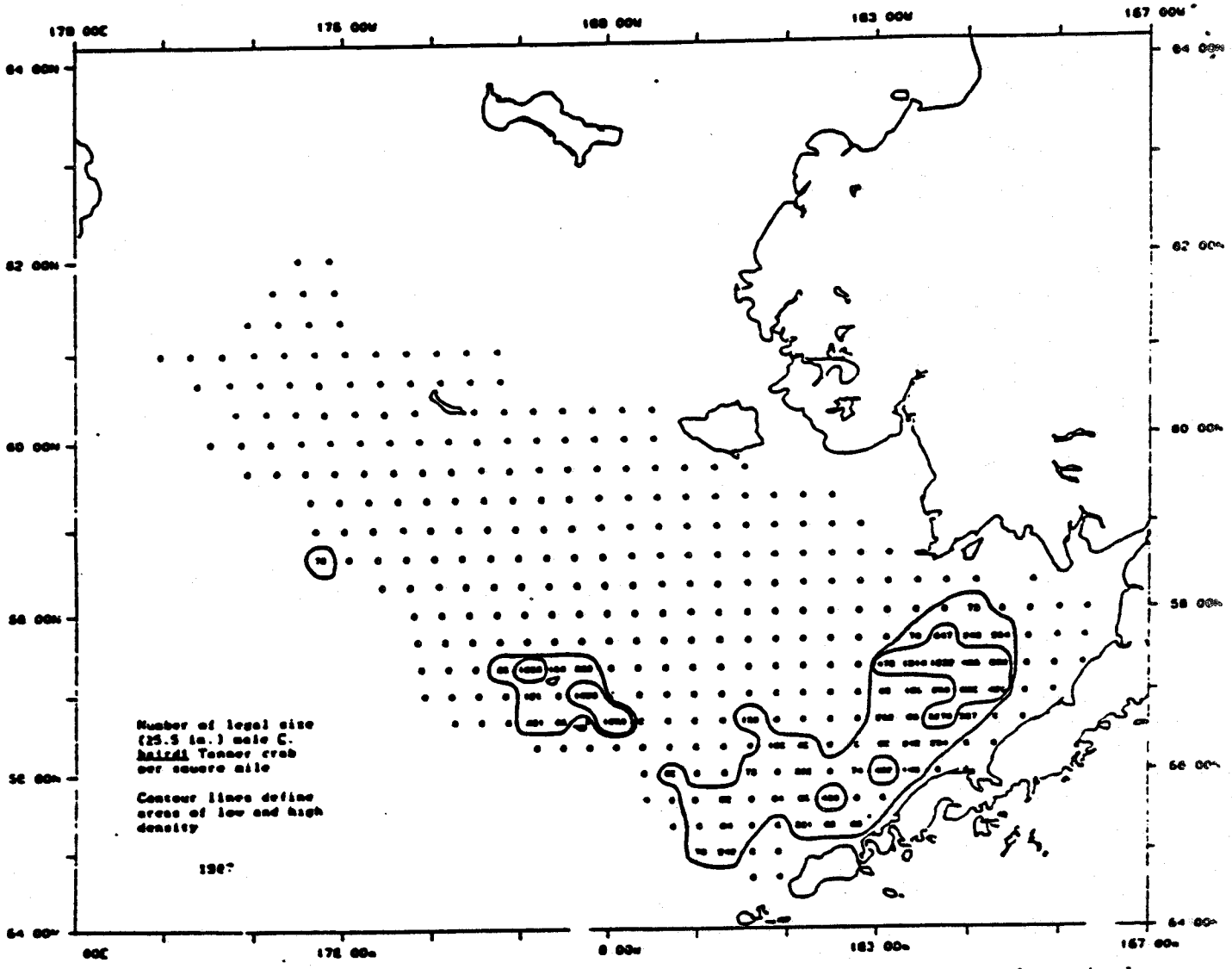


Figure E.3 The distribution of legal size male C. bairdi in the BS/AI area as determined by the 1987 NMFS trawl survey.

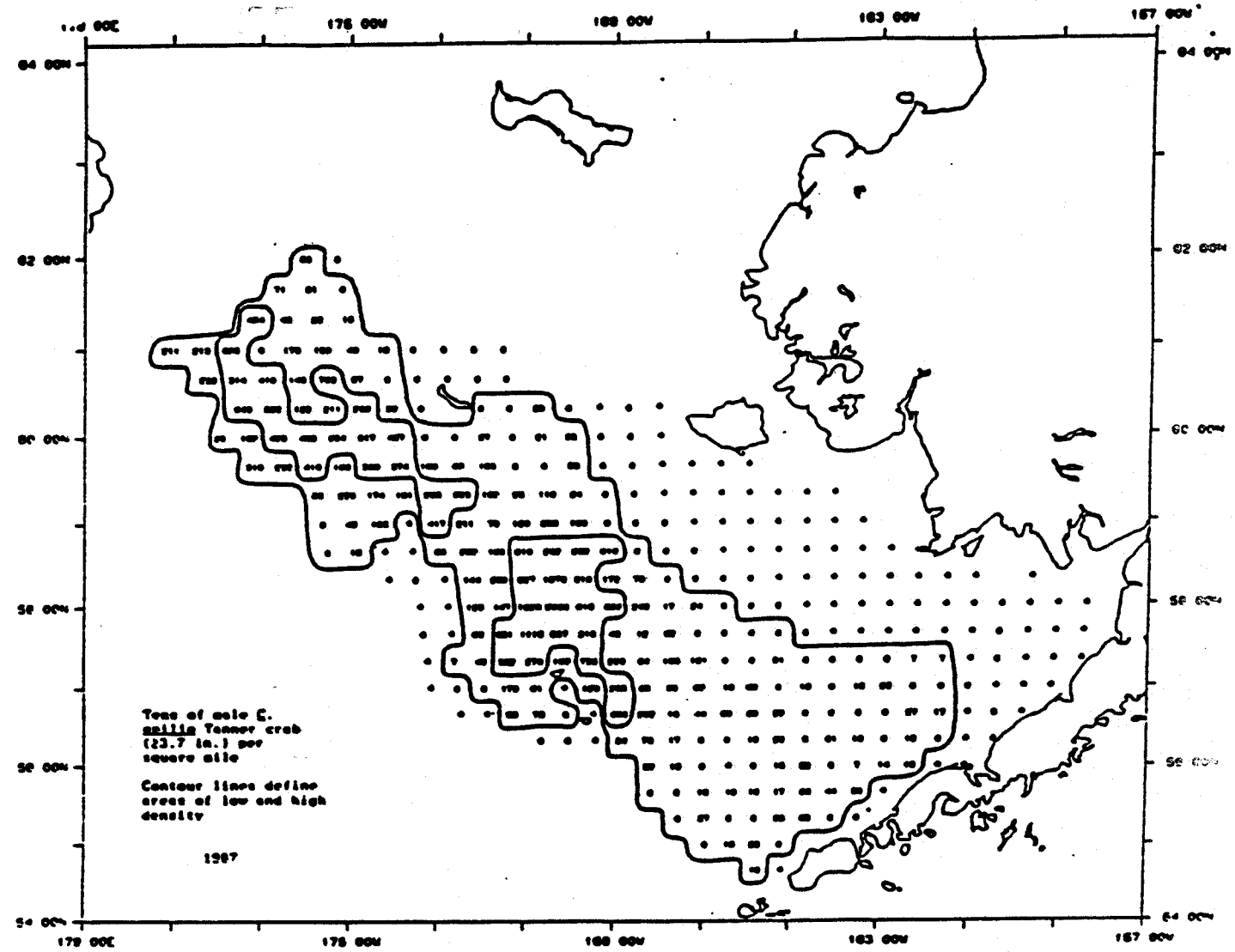


Figure E.4 The distribution of legal size male C. opilio in the BS/AI area as determined by the 1987 NMFS trawl survey.

Benthic sampling surveys infrequently reach the depths inhabited by these species, with the exception of a 1979 NMFS survey of seamounts in the Gulf of Alaska in which scarlet king crab were sampled (Somerton 1981).

The stock status for these species is unknown.

Appendix F

## Habitat Concerns

### Potential for Habitat Alteration.

This section discusses types of human activities that have a potential to cause pollution and habitat degradation that could affect king and Tanner crab populations in the BS/AI area. It is not intended as a statement of present conditions; rather, it is designed to identify those areas of uncertainty that may reasonably deserve Council attention in the future. Whether the likelihood and level of these activities or events may cause harm to crab resources and their habitats can be better judged on a case-by-case basis when the details of a proposed activity's location, magnitude, timing, and duration are more fully known.

Habitat alteration may lower both the quantity and quality of king or Tanner crab products through physical changes or chemical contamination. Life stages differ in their habitat requirements and tolerance to effects of habitat alteration. It is possible for the timing of a major alteration event and the occurrence of a large concentration of living marine resources to coincide in a manner that may affect fishery stocks and their supporting habitats. The effects of such events may be masked by natural phenomena and may not be detected for a variety of reasons, or may be delayed in becoming evident. However, the

process of habitat degradation more characteristically begins with small-scale projects that result in only minor losses or temporary disruptions to organisms and habitat. As the number and rate of occurrence of these and other major projects increases, their cumulative and synergistic effects become apparent over larger areas. It is often difficult to separate the effects of habitat alteration from other factors such as fishing mortality, predation, and natural environmental fluctuations.

Species such as king and Tanner crab that are dependent on coastal areas during various stages of their life, particularly for reproduction, are more vulnerable to habitat alterations than are species that remain offshore. Also, the effects of habitat alteration on species offshore are not as apparent as they are in coastal areas. Concern is warranted, however, to the degree that (1) the offshore environment is subject to habitat degradation from either inshore activities or offshore uses, and (2) to the extent that some species living offshore depend directly or indirectly on coastal habitats for reproduction and food supply.

At present, there are no indications that human activities in the BS/AI area have had any measurable effect on the existing habitats of king or Tanner crab. The present primary human use of the offshore area is commercial fishing. While the establishment of other activities could potentially generate user conflicts, pollution, and habitat deterioration, it is the collective opinion of the Council and NMFS that the status of the

habitat in this management area is generally unaffected by other human activities at this time. Activities that could adversely affect habitat in this area are discussed below.

1. Offshore petroleum production.

Information can be found in Berg (1977); Deis (1984); OCSEAP Synthesis Reports on the St. George Basin (1982), the Navarin Basin (1984), and the North Aleutian Shelf (1984); Thorsteinson and Thorsteinson (1982); and the University of Aberdeen (1978).

The Alaska offshore area comprises 74 percent of the total area of the U.S. continental shelf. Because of its size, the Alaska outer continental shelf (OCS) is divided into three subregions--Arctic, Bering Sea, and Gulf of Alaska. Areas where oil and gas leases have occurred or are scheduled in the BS/AI area include the Navarin Basin (1989)(Morris, 1981), St. George Basin (1990)(NMFS, 1979), North Aleutian Basin (1990)(NMFS, 1980) and the Shumagin Basin (1992) (Morris, 1987).

If a commercial quantity of petroleum is found in the Bering Sea, its production would require construction of facilities and all the necessary infrastructure for pipelines to onshore storage and shipment terminals or for the construction of offshore loading facilities. Offshore-loading terminals may be more feasible than onshore pipelines for transportation from Alaska. Unlike exploration, development and production would continue year

round and would have to surmount the problems imposed by winter sea ice in many areas. Norton Basin and perhaps Navarin Basin might require ice-breaking tanker capabilities. There are also occasional proposals for moving oil from Arctic fields via the Bering Sea, which would also require ice-breaking capabilities.

Oil and gas related activities in the BS/AI area have the potential to cause pollution of habitats, loss of resources, and use conflicts. Physical alterations in the quality and quantity of existing local habitats may occur because of the location and construction of offshore drilling rigs and platforms, loading platforms, tanker terminals, pipelines, and tankering of oil. We have noted oil tankers and transportation are the major causes of oil spills.

Large oil spills are the most serious potential source of oil and gas development-related pollution in the eastern Bering Sea and Navarin Basin. Offshore oil and gas development will inevitably result in some oil entering the environment. Most spills are expected to be of small size, although there is a potential for large spills to occur. Chronic oil spills which build up in the sediments around rigs and facilities are also a problem. In whatever quantities, lost oil can affect habitats and living marine resources. Many factors determine the degree of damage from a spill; the most important variables are the type of oil, size and duration of the spill, geographic location of the spill, and the season. Although oil is toxic to all marine

organisms at high concentrations, certain species are more sensitive than others. In general, the early life stages (eggs and larvae) are most sensitive; juveniles are less sensitive, and adults least so (Rice et al., 1984).

Habitats most sensitive to oil pollution are typically located in those coastal areas with the lowest physical energy because once oiled, these areas are the slowest to repurify. Examples of low energy environments include tidal marshes, lagoons, and seafloor sediments. Exposed rocky shores and ocean surface waters are higher energy environments where physical processes will more rapidly remove or actively weather spilled oil.

It is possible for a major oil spill (i.e., 50,000 bbls and greater) to produce a surface slick covering up to several hundred square kilometers of surface area. Oil would generally be at toxic levels to some organisms within this slick. Beneath and surrounding the surface slick, there would be some oil-contaminated waters. Mixing and current dispersal would act to reduce the oil concentrations with depth and distance. If the oil spill trajectory moves toward land, habitats and species could be affected by the loading of oil into contained areas of the nearshore environment. In the shallower waters, an oil spill could be mixed throughout the water column and contaminate the seabed sediments. Suspended sediment can also act to carry oil to the seabed. It is believed up to 70 percent of spilled oil may be

incorporated in seafloor sediments where it is available to deposit feeding organisms (crab) and their prey items.

Toxic fractions of oil mixed to depth and under the surface slick could cause mortalities and sublethal effects to individuals and populations. However, the area contaminated by a moderately large spill would appear negligible in relation to the overall size of the area, though not necessarily negligible in terms of areas important for red king crab settling, rearing, or mature commercial crab species in the North Aleutian and Bering Sea. For example, Thorsteinson and Thorsteinson (1982) calculated that a 50,000 barrel spill in the St. George Basin would impact less than 0.002 percent of the total size of this area. Oil spills at sea generally are believed to be local and transitory, having only minor effects on fish and shellfish populations overall. Measurable damage to fishery stocks from an oilspill would appear to be the exception rather than the rule. Even if concentrations of oil are sufficiently diluted not to be physically damaging to marine organisms or their consumers, it still could be detected by them, and alter certain of their behavior patterns. If an oil spill reaches nearshore areas with productive nursery grounds or areas containing high densities of eggs and larvae, a year class of a commercially important species of fish or shellfish could be reduced, and any fishery dependent on it may be affected in later years. An oil spill at an especially important habitat (e.g., a gyre where larvae are

concentrated) could also result in disproportionately high losses of the resource compared to other areas.

Tainting of crab is a potential problem in areas subject to either chronic or acute oil pollution which the Bering Sea and Aleutian areas are. Crab exposed to oily conditions acquire an oily or objectionable taste. Environmental Protection Agency criteria governing tainting in fisheries products state: "materials should not be present in concentration that individually or in combination produce undesirable flavors which are detectable by organoleptic tests performed on edible portions." Tainting is, therefore, of great concern to fishermen due to the fear that tainted catches will be refused at the processing plant as well as potential damage and loss of gear due to contamination.

Other sources of potential habitat degradation and pollution from oil and gas activities include the disposal of drilling muds and cuttings to the water and seabed and of drilling fluids and produced waters in the water column. These materials contain heavy metals, hydrocarbons, or other chemical compounds that would be released to the environment. In the Gulf of Mexico it is estimated that approximately five million barrels of drilling muds containing 2.3 million pounds of toxic metals are discharged yearly by oil and gas industries (U.S. Environmental Protection Agency, 1985). Congress is scheduled to determine by June 1988 as to whether oil and gas waste should be regulated as hazardous

waste. Dredged materials from pipeline laying may also be released into the environment. These materials may contain toxic heavy metals, particularly in portions of Norton Sound.

2. Coastal development and filling.

Minimal developmental pressure has occurred in the coastal habitat of the BS/AI area. An extension of the airport runway at the village of Unalaska into water approximately 50 feet in depth has received the necessary permits and is under construction. Construction of a large-scale port facility is planned for the city of Nome and smaller-scale harbors are currently under construction on St. Paul and St. George Islands. The Dutch Harbor area has had intertidal areas filled for fish processing facilities. Beyond these specific projects, development activity in the coastal areas of the Bering Sea and the Aleutian Islands has been largely limited to construction of erosion control measures and breakwaters. Because of the desirability of finding protection from Bering Sea storms, suitable port development sites often are valuable to fishery resources for similar related reasons. Without special considerations these facilities could affect local flushing, water temperatures, water quality, and access by fishes and crustaceans. In other areas, shallow water depth requires construction of long structures projected seaward in order to provide direct access from the uplands to deeper-draft ocean going vessels. These causeways could alter

both along-shore physical processes and the migration and movement of marine organisms in the area.

3. Marine mining.

At present, mining activity has been limited to extraction of gravel and gold in the Bering Sea and the Aleutian peninsula. Gravel is needed for almost all construction projects throughout the area and is relatively unavailable from upland sources. Consequently, gravel is obtained by mining gravel beaches along the Bristol Bay coast (e.g., Goodnews Bay, Kangirlvar Bay) and in the lower reaches of the Yukon and Kuskokwim Rivers. Mining of large quantities of beach gravel can significantly affect the removal, transport, and deposition of sand and gravel along shore, both at the mining site and at other more distant areas. During mining, water turbidity increases and the resuspension of organic materials could affect less motile organisms (i.e., eggs and recently hatched larvae), and displace the more motile species from the area. Spawning and rearing habitats could be damaged or destroyed by these actions. Neither the future extent of this activity nor the effects of such mortality on the abundance of marine species is known. The demand for gravel is likely to increase if the economy and associated development expands.

Dredging for gold has been attempted at various sites along the Aleutians and as of 1988, a major gold dredging project is

underway within State waters in Norton Sound. In addition to mining in State waters, plans are being made to lease approximately 178,000 acres of Federal sea bottom in Norton Sound beginning in July of 1989. A total of 80 million cubic meters of sea bottom may be dredged from Federal waters during the life of the project. Such activity has the potential to cause direct and indirect damage to benthic habitat and to fish and shellfish within the influence of the sediment discharge plume. Re-suspension of trace metals, especially mercury, which co-occur with placer gold deposits and potential subsequent contamination of commercial and subsistence species such as red king crab or marine mammal species is of particular concern with marine gold dredging. As onshore mineral reserves dwindle or economic value increases, there will likely be increasing interest in mining of marine ore deposits in the Bering Sea EEZ.

4. Ocean discharge and dumping.

At present, there are only two areas in the BS/AI area where the ocean discharge of nonorganic materials is known to occur on a large scale. Both of the areas are dredged material disposal sites near the city of Nome and have been in use for approximately 50 years. Recently, the two areas were given final designation as ocean dredged material disposal sites by the Environmental Protection Agency. Use of these sites presents no new habitat concerns.

The return of materials dredged from the ocean to the water column is considered a discharge activity. Depending upon the chemical constituency of the local bottom sediments and any alterations of dredged materials prior to discharge, living marine resources in the area may be exposed to elevated levels of heavy metals. For example, natural deposits of mercury occur in eastern Norton Sound and elemental mercury, measured at levels ranging from 250-1300 ug/l, has been identified in marine sediments in that area (Nelson et al., 1975). The levels of this heavy metal exceed the 3.7 ug/l set by the EPA Marine Quality Standards as the maximum allowable concentration; although no measurements of the more toxic methyl and dimethyl forms of mercury have been made in this area, Wood (1974) demonstrated that mercury available to the aquatic environment in any form can result in steady state concentrations of methyl, dimethyl, and metallic mercury through microbial catalysis and chemical equilibrium. Large-scale gold dredging projects in eastern Norton Sound will result in the discharge and resuspension of sediments that could introduce mercury to the water column.

Accumulation of heavy metals in fish is usually natural, but also may be an indication of habitat deterioration. The Federal Drug Administration's (FDA) safety limit for mercury is presently 1.0 ppm of methyl mercury or about 1.1 ppm of mercury. No heavy metal problems have been encountered to date with fish or shellfish products from the BS/AI area.

5. Derelict fragments of fishing gear and general litter.

The introduction of persistent plastic debris into the marine environment occurs when commercial fisheries take place. The debris includes synthetic netting, pots, longline gear, packing bands, and other material. Because of the lack of a monitoring program, estimates of debris have been based on (1) observations of debris at sea and on beaches, and (2) occasional reports of accidental or deliberate discards of fishing gear. Studies by Merrell (1984) and others have shown that much of the observed debris consists of fragments of trawl netting. Much of this netting has been discarded incidentally as a result of net repair activities.

The quantity of marine debris that is produced by commercial fisheries depends on a variety of factors including the types and amount of gear used and the efforts fishermen make to reduce both accidental and deliberate discards.

Debris may result in the mortality of marine fish and shellfish, marine mammals, and birds that become entangled in or ingest it. Derelict monofilament gillnet such as that used on the high seas for salmon and squid will catch fish, birds and marine mammals. Discarded trawl netting that floats is not a threat to most fish, but it has been identified as a source of mortality for marine mammals and birds. Similarly, discarded packing bands have been identified as a source of mortality for

marine mammals. Other discarded gear, such as lost pots, continues to fish unattended for varying lengths of time. It is estimated that 10 percent of the crab pots used each season by the crab fleet are lost. Derelict pots without degradable panels could, particularly with natural rebaiting which occurs when organisms wander into the pots and die, fish for up to 15 years before finally deteriorating to the point where they lose structural integrity (High and Worlund, 1979). Presently, all shellfish pots used in the Bering Sea must, by State Regulation 5 AAC 39.145, be equipped with a degradable, untreated cotton panel large enough for shellfish to escape the pot should it be lost. Neither the extent of debris-related mortality nor the effects of such mortality on the abundance of various species is known at this time.

6. Benthic habitat damage by bottom gear.

Bottom trawls are presently the predominant gear used to harvest groundfish in the BS/AI management area, and are likely to continue as the major gear for the flatfish and Pacific cod fisheries of the Bering Sea shelf. The generally flat and uniform bottom composed of sand and mud presents a good substrate for bottom trawling. Any effect of gear dragged along the bottom depends on the type of gear, its rigging, and the type of bottom and its biota. Trawl doors dragging on sand and soft bottom stir up sand and silt which resettles quickly. On muddy bottoms, the disturbed mud settles in a few hours, depending on the current

speed and resulting turbulence near the bottom. Any damaged organisms, as well as the infauna which might have been dug up by the trawl, are likely quickly preyed upon by fish and crabs.

Although the substrate itself is likely only temporarily affected by trawling, the direct effect upon king and Tanner crab stocks could be substantial dependent upon the type and intensity of gear use and the area in question. Crab are mobile species, yet could experience high mortality as a result of mechanical crushing and bycatch in trawls (Johnsen, 1985). Research on gear selectivity in the Bering Sea could result in enforceable gear rigging standards that would minimize bycatch of non-target species without significantly reducing catch rates for target groundfish species.

7. Discharge of seafood processing wastes.

Seafood processing has been conducted for years in processing ports in Alaska. Crab and fish have been processed in various ports such as Kodiak, Dutch Harbor and Akutan by floating and shoreside processors with little impact upon habitat for crab and other species. However, localized damage to benthic environment consisting of up to several acres of bottom being driven anoxic by rotting processing waste and piles of waste up to 26 feet deep have been recorded. Discharges from these processors now require National Pollutant Discharge Elimination System (NPDES) permits from the Environmental Protection Agency.

At-sea floating processors are covered by a general NPDES permit which requires that processing waste be ground into finer than one-half inch particles and discharged below the surface (Personal Communication, Dr. Bruce Duncan, U.S. Environmental Protection Agency, 701 C Street, Box 19, Anchorage, AK 99513).

Although seafood has been processed at sea by foreign fishing vessels in the past without apparent harm to the marine habitat, there has been one instance reported of unusual quantities of fish carcasses (not ground in conformance with the general NPDES permit) accompanied by dead scallops brought up in scallop dredges (Capt. Louie Audet, F/V Shayline Nicholas). It will be important to be alert to similar possible perturbations of the environment resulting from at-sea processing discharges.

Existing Programs for Habitat Protection.

This section describes (1) general legislative programs, portions of which are particularly directed or related to the protection, maintenance, or restoration of the habitat of living marine resources; and (2) specific actions taken by the Council and NMFS within the BS/AI area for the same purpose.

1. Federal legislative programs and responsibilities related to protection of crab habitat. The Department of Commerce, through NOAA, is responsible for, or involved in, protecting living marine resources and their habitats under a

number of Congressional authorities that call for varying degrees of interagency participation, consultation, or review. A potential for further Council participation exists wherever Federal review is required or encouraged. In some cases, State agencies may share the Federal responsibility.

(a) Magnuson Fishery Conservation and Management Act (Magnuson Act). This Act provides for the conservation and management of U.S. fishery resources within the 200-mile exclusive economic zone, and is the primary authority for Council action. Conservation and management is defined as referring to "all of the rules, regulations, conditions, methods, and other measures which are required to rebuild, restore, or maintain, and which are useful in rebuilding, restoring, or maintaining, any fishery resource and the marine environment, and which are designed to assure that-- ...irreversible or long-term adverse effects on fishery resources and the marine environment are avoided." Fishery resource is defined to include habitat of fish. The North Pacific Council is charged with developing FMPs, FMP amendments, and regulations for the fisheries needing conservation and management within its geographical area of authority. FMPs are developed in consideration of habitat-related problems and other factors relating to resource productivity. After approval of FMPs or FMP amendments, NMFS is charged with their implementation.

The National Oceanic and Atmospheric Administration Marine Fisheries Program Authorization Act, P.L. 99-659, added Section 302(i) to the Magnuson Act. The new section states as follows:

> "Each Council may comment on, or make recommendations concerning, any activity undertaken, or proposed to be undertaken, by any State or Federal agency that, in the view of the Council, may affect the habitat of a fishery resource under its jurisdiction. Within 45 days after receiving such a comment or recommendation from a Council, a Federal agency must provide a detailed response, in writing, to the Council regarding the matter."

Section 303(a)(7) of the Magnuson Act requires any fishery management plan or plan amendment to include readily available information on the habitat and an assessment of the effects of habitat changes on the fishery.

(b) Fish and Wildlife Coordination Act of 1958 (FWCA). The FWCA provides the primary expression of Federal policy for fish and wildlife habitat. It requires interagency consultation to assure that fish and wildlife are given equal consideration when a Federal or Federally-authorized project is proposed which controls, modifies, or develops the Nation's waters. For example, NMFS is a consulting resource agency in processing Department of the Army permits for dredge and fill and construction projects in navigable waters, Environmental Protection Agency (EPA) ocean dumping permits, Federal Energy Regulatory Commission hydroelectric power project proposals, and Department of the

Interior (DOI) Outer Continental Shelf (OCS) oil and gas and mineral leasing activities, among others.

(c) National Environmental Policy Act of 1969 (NEPA). NEPA requires that the effects of Federal activities on the environment be assessed. Its purpose is to insure that Federal officials weigh and give appropriate consideration to environmental values in policy formulation, decisionmaking and administrative actions, and that the public is provided adequate opportunity to review and comment on the major Federal actions. An EIS or environmental assessment for a finding of no significant impact is prepared for FMPs and their amendments. NEPA requires preparation of an Environmental Impact Statement (EIS) only for major Federal actions that significantly affect the quality of the human environment; an environmental assessment is sufficient if it justifies a finding of no significant impact (FONSI). NMFS reviews EISs and provides recommendations to mitigate any expected impacts to living marine resources and habitats.

(d) Clean Water Act (CWA). The purpose of the CWA, which amends the Federal Water Pollution Control Act, is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters; to eliminate the discharge of pollutants into navigable waters; and to prohibit the discharge of toxic pollutants in toxic amounts. Discharge of oil or hazardous substances into or upon navigable waters, contiguous zone and ocean is prohibited. NMFS reviews and comments on

Section 404 permits for deposition of fill or dredged materials into U.S. waters, and on EPA National Pollutant Discharge Elimination System permits for point source discharges.

(e) River and Harbor Act of 1899. Section 10 of this Act prohibits the unauthorized obstruction or alteration of any navigable water of the United States, the excavation from or deposition of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such water. Authority was later extended to artificial islands and fixed structures located on the Outer Continental Shelf. The Act authorizes the Department of the Army to regulate all construction and dredge and fill activities in navigable waters to mean high water shoreline. NMFS reviews and comments on Public Notices the Corps of Engineers circulates for proposed projects.

(f) Endangered Species Act of 1973 (ESA). ESA provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by DOI (terrestrial, freshwater, and some marine species such as walrus) and DOC (marine fish, and some marine mammals including the great whales). Federal actions that may affect an endangered or threatened species are resolved by a consultation process between the project agency and DOC or DOI, as appropriate. For actions related to FMPs, NMFS provides biological assessments and Section 7 consultations if the Federal action may affect endangered or

threatened species or cause destruction or adverse modification of any designated critical habitat.

(g) Coastal Zone Management Act of 1972 (CZMA). The principal objective of the CZMA is to encourage and assist States in developing coastal zone management programs, to coordinate State activities, and to safeguard the regional and national interests in the coastal zone. Section 307(c) requires that any Federal activity directly affecting the coastal zone of a State be consistent with that State's approved coastal zone management program to the maximum extent practicable. The Alaska Coastal Management Act requires consistency of all state and local governments with the Alaska coastal management program and any subsequent district programs. Under present policy, FMPs undergo consistency review. Alaska's State coastal management program contains a section on standards for coastal development, energy facilities, mining and mineral processing, habitats, and direct land and water quality which gives the State the ability to influence the location and design of activities which may effect fishery habitat. District coastal management programs may incorporate more specific habitat protection requirements for marine areas. Following a January 1984 U.S. Supreme Court ruling, the sale of OCS oil and gas leases no longer requires a consistency review; such a review is triggered at the exploratory drilling stage.

(h) Marine Protection, Research and Sanctuaries Act (MPRSA). Title I of the MPRSA establishes a system to regulate dumping of all types of materials into ocean waters and to prevent or strictly limit the dumping into ocean waters of any material which would adversely affect "human health, welfare or amenities or the marine environment, ecological systems, or economic potentialities." NMFS may provide comments to EPA on proposed sites of ocean dumping if the marine environment or ecological systems may be adversely affected. Title III of the MPRSA authorizes the Secretary of Commerce (NOAA) to designate as marine sanctuaries areas of the marine environment that have been identified as having special national significance due to their resource or human-use values. The Marine Sanctuaries Amendments of 1984 amend this Title to include, as consultative agencies in determining whether the proposal meets the sanctuary designation standards, the Councils affected by the proposed designation. The Amendments also provide the Council affected with the opportunity to prepare draft regulations, consistent with the Magnuson Act national standards, for fishing within the FCZ as it may deem necessary to implement a proposed designation.

(i) Outer Continental Shelf Lands Act of 1953, as amended (OCSLA). The OCSLA authorizes the Department of Interior's Minerals Management Service (MMS) to lease lands seaward of state marine boundaries, design and oversee environmental studies, enforce special lease stipulations, and issue pipeline rights-of-way. It specifies that no exploratory

drilling permit can be issued unless MMS determines that "such exploration will not be unduly harmful to aquatic life in the area, result in pollution, create hazardous or unsafe conditions, unreasonably interfere with other uses of the area, or disturb any site, structure or object of historical or archaeological significance." Drilling and production discharges related to OCS exploration and development are subject to EPA NPDES permit regulations under the CWA. Sharing responsibility for the protection of fish and wildlife resources and their habitats, NOAA/NMFS, FWS, EPA and the States act in an advisory capacity in the formulation of OCS leasing stipulations that MMS develops for conditions or resources that are believed to warrant special regulation or protection. Some of these stipulations address protection of biological resources and their habitats. Interagency Regional Biological Task Forces and Technical Working Groups have been established by MMS to offer advice on various aspects of leasing, transport, and environmental studies. NMFS is represented on both groups in Alaska.

The Secretary of the Interior is required to maintain an oil and gas leasing program that "consists of a schedule of proposed lease sales indicating, as precisely as possible, the size, timing, and location of leasing activity" that will best meet national energy needs for a 5-year period following its approval or reapproval. In developing the schedule of proposed lease sales, the Secretary is required to take into account the

potential impacts of oil and gas exploration on other offshore resources, including the marine, coastal, and human environments.

Once a lease is awarded, before exploratory drilling can begin in any location, the lessee must submit an exploration plan to the Minerals Management Service for approval. An oilspill contingency plan must be contained within the exploration plan. If approved by MMS and having obtained other necessary permits, the lessee may conduct exploratory drilling and testing in keeping with lease sale stipulations and MMS Operating Orders. If discoveries are made, before development and production can begin in a frontier lease area, a development plan must be submitted and a second EIS process begun. At this time, a better understanding of the location, magnitude, and nature of activity can be expected, and resource concerns may once again be addressed before development can be permitted to proceed.

(j) National Fishing Enhancement Act of 1984. Title II of this Act authorizes the Secretary of Commerce (NOAA) to develop and publish a National Artificial Reef Plan in consultation with specified public agencies, including the Councils, for the purpose of enhancing fishery resources. Permits for the site, construction, and monitoring of such reefs are to be issued by the Department of the Army under Section 10 of the River and Harbor Act, Section 404 of the Clean Water Act, or Section 4(e) of the Outer Continental Shelf Lands Act, in consultation with

appropriate Federal agencies, States, local governments and other interested parties. NMFS will be included in this consultation process.

(k) Marine Mammal Protection Act (MMPA). The Marine Mammal Protection Act establishes a moratorium on the taking of marine mammals and a ban on the importation of marine mammal products with certain exceptions. Responsibility is divided between DOC (whales, porpoises, seals, and sea lions) and DOI (other marine mammals) to issue permits and to waive the moratorium for specified purposes, including incidental takings during commercial fishing operations. The Magnuson Act amended the MMPA to extend its jurisdiction to the EEZ. If the FMP has effect on marine mammal populations, certain information must be included in the EIS, and the FMP should indicate whether permits are available for any incidental takings.

2. Specific actions taken by the Council and NMFS related to habitat for the BS/AI fisheries.

(a) Gear limitations that act to protect habitat or critical life stages. Section 611.16 of the foreign fishing regulations prohibit discard of fishing gear and other debris by foreign fishing vessels.

(b) The establishment of fishing seasons for crabs and restrictions on pot tunnel diameter serve to protect critical life stages of the crab resource.

(c) Other management measures that acts, yet could experience high mortality as a result of mechanical crushing and bycatch in trawls (Johnsen, 1985). Research on gear selectivity in the Bering Sea could result in enforceable gear rigging standards that would minimize bycatch of non-target species without significantly reducing catch rates for target groundfish species.

(d) Recommendations to permitting agencies regarding lease sales. Recommendations have been made to permitting agencies on all past proposed lease sales on the Alaska OCS, in the interests of protecting or maintaining the marine environment. These recommendations have ranged from calling for delay or postponement of certain scheduled sales such as in Bristol Bay and Kodiak, requesting deletions of certain areas from sales, identifying need for additional environmental Studies and for protective measures such as burial of pipelines, seasonal drilling limitations, and oilspill countermeasure planning. For example, in 1979, the Council unanimously requested an indefinite postponement of the St. George Basin lease sale, citing incomplete research results and a concern for the possibility of oil spills in an area of great economic and biologic importance. The comment was transmitted to the NMFS Central Office for transmittal to the Department of the Interior.

Non-regulatory techniques to address identified habitat problems.

The following is a list of "real time" possible non-regulatory actions or strategies the Council may wish to take in the future, based on concerns expressed and data presented or referenced in this FMP. Actions taken must also be consistent with the goal and objectives of the FMP.

(a) Hold hearings to gather information or opinions about specific proposed projects having a potentially adverse effect on habitats of species in the Bering Sea/Aleutian Island king or Tanner crab fishery.

(b) Write comments to Federal and State regulatory agencies (during project review periods) to express concerns or make recommendations about (issuance or denial of) a particular project. The 1986 amendments to the MFCMA require that Federal agencies respond, in writing, within 45 days of receipt of comments from a Council.

(c) Respond to "Calls for Information" from MMS regarding upcoming oil and gas lease areas affecting the Bering Sea/Aleutian Islands.

(d) Identify research needs and recommend funding for studies related to habitat issues of new or continuing concern and for which the data base is limited.

(e) Establish review panels or an ad hoc task force to coordinate or screen habitat issues.

(f) Propose to other regulatory agencies additional restrictions on industries operating in the fisheries management area, for purposes of protecting the habitat against loss or degradation.

(g) Join as amicus curiae in litigation brought in furtherance of critical habitat conservation, consistent with FMP goals and objectives.

Council Habitat Information Needs.

1. The Bering Sea is fished extensively for groundfish by trawlers. The effect on the bottom habitat from the action of trawls (crushing, bycatch, changes in fauna and flora) is largely unknown. It may be possible, through use of submarine submersibles, to view different kinds of bottom habitat which have experienced various levels of impact by trawlers and determine degree of human-induced changes. The Council, therefore, recommends NMFS coordinate such research.

2. Loss of fishing gear, crab pots, and plastic debris may be impacting the crab stocks. The amount of debris-related mortality on crab is largely unknown. Derelict crab pots, where natural rebaiting would occur when organisms wander into the pots and die, have been discussed as likely sources of mortality. Though pots are now required to have degradable panels, other debris in the waters could be entrapping crab. The Council recommends studies be designed to determine sources and extent of debris-related mortality and methods of reducing it.

3. Research in the form of monitoring ongoing gold dredging operations in Norton Sound is appropriate and recommended. A program testing for tissue levels of trace metals including mercury should be initiated for red king crab in Norton Sound. Such testing may help determine the marketability of red king crab from the Norton Sound area in the future. Monitoring tissue levels of trace metals in subsistence species such as pinnipeds would also be advisable in Norton Sound.

Council Habitat Recommendations with Regard to Crab Management

-- fishery management regulations continue to be examined for possible conflict with protection of crab habitats.

-- oil and gas and non-energy mineral lease sales within the management area should be critically reviewed by Council staff for possible negative impacts to crab fisheries.

Appendix G

Boundaries for Registration Areas and Fishing Districts, Subdistricts and Sections

Registration areas (statistical areas) within the BS/AI Management Unit are as follows:

King Crab

Bering Sea Registration Area (Statistical Area Q): has as its southern boundary a line from 54°36' N. lat., 168° W. long., to 54°36' N. lat, 171° W. long., to 55°30' N. lat., 171° W. long., to 55°30' N. lat., 173°30' E. long., as its northern boundary the latitude of Point Hope (68°21' N. lat.), as its eastern boundary a line from 54°36' N. lat., 168° W. long., to 58°39' N. lat., 168° W. long., to Cape Newenham (58°39' N. lat.), and as is western boundary a line from 55°30' N. lat., 173°30' E. long., to 65°32' N. lat., 168°55' W. long., to 68°21' N. lat., 168°55' W. long. (the U.S.-Russian Convention line of 1867).

Bristol Bay Registration Area (Statistical Area T): has as its northern boundary the latitude of Cape Newenham (58°39' N. lat.), as its southern boundary the latitude of Cape Sarichef (54°36' N. lat.), as its western boundary 168° W. long. and includes all waters of Bristol Bay.

Adak Registration Area (Statistical Area R): has as its eastern boundary 171° W. long., as its western boundary a line from 52° N. lat., 168°35' E. long. to 55°30' N. lat., 173°30' E. long. (the U.S.-Russian Convention line of 1867), as its northern boundary 55°30' N. lat., and as its Pacific Ocean boundary, the seaward boundary as fixed by State regulation.

Dutch Harbor Registration Area (Statistical Area O): has as its northern boundary the latitude of Cape Sarichef (54°36' N. lat.), as its eastern boundary the longitude of Scotch Cap Light, and as its western boundary 171° W. long., as its seaward boundary, the seaward boundary as fixed by State regulation, excluding the waters of statistical area Q.

Tanner Crab

Westward Registration Area (Statistical Area J): all Bering Sea waters east of 172° E. long., and all waters between the longitude of Scotch Cap Light (164°44'36" W. long.) and east of 172° E. long. to the seaward boundary as fixed by State regulation and all Bering Sea waters east of 172° E. longitude.

Current State boundaries for king and Tanner crab districts, subdistricts, and sections within the BS/AI management unit are as follows:

King Crab

Bering Sea Registration Area

(a) Pribilof District: waters of Statistical Area Q south of the latitude of Cape Newenham (58°39' N. lat.).

(b) Northern District: waters of Statistical Area Q north of latitude of Cape Newenham (58°39' N. lat.).

(1) Norton Sound Section: waters east of 168° W. long., and north of latitude of Cape Romanzof (61°49' N. lat.) and south of the latitude of Cape Prince of Wales (65°36' N. lat.);

(2) Saint Matthew Island Section: waters north of the latitude of Cape Newenham (58°39' N. lat.) and south of the latitude of Cape Romanzof (61°49' N. lat.);

(3) Saint Lawrence Island Section: all remaining waters of the district.

Adak Registration Area

(a) North Amlia District: all Bering Sea waters of Statistical Area R east of the longitude of North Cape on Atka

Island (174°09' W. long.), north of the latitude of Cape Utalug (52°06' N. lat.) including all waters of Nazan Bay.

(b) South Amlia District: Pacific Ocean waters of Statistical Area R east of the longitude of Cape Kigum on Atka Island (175°20'30" W. long.) and south of a line from Cape Kigum to Cape Utalug on Atka Island, to the westernmost point of Amlia Island 171° W. long.

(c) North Atka District: all Bering Sea waters of Statistical Area R east of longitude of Cape Kigum on Atka Island (175°20'30" W. long.) west of the longitude of North Cape on Atka Island (174°09' W. long.) and northerly of a line from Cape Kigum to Cape Utalug on Atka Island excluding all waters of Nazan Bay.

(d) Adak District: all waters of Statistical Area R west of the longitude of Cape Kigum on Atka Island (175°20'30" W. long.), and east of 179°15' W. long.

(e) Petrel Bank District: waters of Statistical Area R west of 179°15' W. long., east of 179° E. long., south of 55°30' N. lat., and north of 51°45' N. lat.

(f) Western Aleutians District: all waters of Statistical Area R west of 179°15' W. long., excluding the Petrel Bank district.

Dutch Harbor Registration Area

(a) Akun District: all waters of Statistical Area O east of 165°34' W. long., and north of the latitude of Jackass Point (54°06'35" N. lat.).

(b) Akutan District: all Bering Sea waters of Statistical Area O west of 165°34' W. long., east of the long. of Koriga Point on Unalaska Island (166°59'50" W. long.) and north of a line from Erskine Point on Unalaska Island to Jackass Point on Akun Island.

(c) Egg Island District: all Pacific Ocean waters of Statistical Area O east of the longitude of Udagak Strait on Unalaska Island (166°15' W. long.) south of a line from Erskine Point on Unalaska Island (53°59' N. lat, 166°16'45" W. long.) to Jackass Point on Akun Island, then to 54°06'35" N. lat., 164°44'45" W. long., including the waters of Beaver Inlet and Udagak Strait.

(d) Unalaska District: all Bering Sea waters of Statistical Area O west of the longitude of Koriga Point on Unalaska Island (166°59'50" W. long.) east of Cape Tanak on Umnak Island (168° W. long.) and north of a line from Kettle Cape on Umnak Island (53°16'40" N.lat., 168°07' W. long.), to Konets Head on Unalaska Island (53°19' N. lat., 167°51' W. long.).

(e) Western District: all Bering Sea waters of Statistical Area O west of the longitude of Cape Tanak on Umnak Island and all Pacific Ocean waters of king crab Registration Area O west of the longitude of Udagak Strait (166°16' W. long.) and south of a line from Kettle Cape on Umnak Island (53°16'40" N. lat., 168°07' W. long.) to Konets Head (53°19' N. lat., 167°51' W. long.) on Unalaska Island, excluding the waters of Udagak Strait and Beaver Inlet.

Tanner Crab

Westward Registration Area

(a) Eastern Aleutian District: all waters of Statistical Area J between the longitude of Scotch Cap Light and 172° W. long., and south of 54°36' N. lat.

(b) Western Aleutian District: all waters of Statistical Area J west of 172° W. long. and south of 54°36' N. lat.

(c) Bering Sea District: all Bering Sea waters of Statistical Area J north of 54°36' N. lat.

(1) Eastern Subdistrict: all waters of the Bering Sea District east of 173° W. long., including the waters of Bristol Bay.

(2) Western Subdistrict: all waters of the Bering Sea District west of 173° W. long.

(A) Norton Sound Section: all waters east of 168° W. long. and north of the latitude of Cape Romanzof;

(B) General Section: all waters of the Eastern Subdistrict not included in the Norton Sound Section.

Appendix H

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