AMENDMENT 7
to the Fishery Management Plan for the Commercial King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands

(1) Replace the January 24, 1989 draft of the FMP with the FMP dated July 18, 1998.

The FMP was updated with housekeeping changes which are outlined in the EA.

(2) In Chapter 6.0 entitled "Specification of Maximum Sustainable Yield, Optimum Yield, Minimum Stock Size Threshold, Overfishing Levels, Annual Harvest, and Annual Processing," (a) add the following as the second paragraph:

The following definitions are based on the national standard 1 guidelines (50 CFR 600.310) and bring the FMP into compliance with the Magnuson-Stevens Act. These definitions provide objective and measurable criteria for identifying when the BSAI crab fisheries are overfished or overfishing is occurring. Table 6.1 provides the MSST, MSY, OY and MSY control rule estimates for the BSAI king and Tanner crab stocks. The MSY was recalculated for Adak red king crab, Aleutian golden king crab, and St. Matthew golden king crab since the public draft of the EA dated May 6, 1998. The Crab Plan Team will reevaluate these estimates every five years or when environmental conditions indicate a regime shift.

(b) add the following definitions and table after "Optimum Yield"

Maximum sustainable yield (MSY) is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. MSY is estimated from the best information available. Proxy stocks are used for BSAI crab stocks where insufficient scientific data exists to estimate biological reference points and stock dynamics are inadequately understood. MSY for crab species is computed on the basis of the estimated biomass of the mature portion of the male and female population or total mature biomass (MB) of a stock. A fraction of the *MB* is considered sustained yield (*SY*) for a given year and the average of the *SY*s over a suitable period of time is considered the MSY.

Overfishing: The term "overfishing" and "overfished" mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce MSY on a continuing basis. Overfishing is defined for king and Tanner crab stocks in the BSAI management area as any rate of fishing mortality in excess of the maximum fishing mortality threshold, F_{msy}, for a period of 1 year or more. Should the actual size of the stock in a given year fall below the minimum stock size threshold, the stock is considered overfished. If a stock or stock complex is considered overfished or if overfishing is occurring, the Secretary will notify the Council to take action to rebuild the stock or stock complex.

MSY control rule means a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY. The MSY control rule for king and Tanner crabs is the mature biomass of a stock under prevailing environmental conditions, or proxy thereof, exploited at a fishing mortality rate equal to a conservative estimate of natural mortality.

MSY stock size is the average size of the stock, measured in terms of mature biomass of a stock under

prevailing environmental conditions, or a proxy thereof. It is the stock size that would be achieved under the MSY control rule. It is also the minimum standard for a rebuilding target when remedial management action is required. For king and Tanner crab, the MSY stock size is the average mature biomass observed over the past 15 years, from 1983 to 1997.

Maximum fishing mortality threshold (MFMT) is defined by the MSY control rule, and is expressed as the fishing mortality rate. The MSY fishing mortality rate $F_{msy} = M$, is a conservative natural mortality value set equal to 0.20 for all species of king crab, and 0.30 for all *Chionoecetes* species.

Minimum stock size threshold (MSST) is whichever is greater: one half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold. The minimum stock size threshold is expressed in terms of mature biomass of a stock under prevailing environmental conditions, or a proxy thereof.

Table 6.1. MSST, MSY, OY, and the MSY control rule estimates for BSAI king and Tanner crab stocks. Estimated values are in millions of pounds. (NA indicates that insufficient data exists at this time to estimate the value)

Stock	MSST	MSY	OY range	MSY control rule
Adak red king	NA	1.5	0 - 1.5	0.2
Bristol Bay red king	44.8	17.9	0 - 17.9	0.2
Dutch Harbor red king	NA	NA	NA	0.2
Pribilof Islands red king	3.3	1.3	0 - 1.3	0.2
Norton Sound red king	NA	0.5	0 - 0.5	0.2
Pribilof Islands blue king	6.6	2.6	0 - 2.6	0.2
St Matthew blue king	11.0	4.4	0 - 4.4	0.2
St Lawrence blue king	NA	0.1	0 - 0.1	0.2
Aleutian Is. golden king	NA	15.0	0 - 15.0	0.2
Pribilof Is. golden king	NA	0.3	0 - 0.3	0.2
St. Matthew golden king	NA	0.3	0 - 0.3	0.2
Aleutian Is. scarlet king	NA	NA	NA	0.2
EBS scarlet king	NA	NA	NA	0.2
TOTAL king crab		**43.9**	**0 - 43.9**	
E. Aleutian Is. Tanner	NA	0.7	0 - 0.7	0.3
EBS Tanner	94.8	56.9	0 - 56.9	0.3
W. Aleutian Is. Tanner	NA	0.4	0 - 0.4	0.3
TOTAL Tanner crab		**58.0**	**0 - 58.0**	
EBS snow	NA	276.5	0 - 276.5	0.3
TOTAL snow crab		**276.5**	**0 - 276.5**	
E. Aleutian Is. angulatus	NA	1.0	0 - 1.0	0.3
EBS angulatus	NA	0.3	0 - 0.3	0.3
E. Aleutian Is. tanneri	NA	1.8	0 - 1.8	0.3
EBS tanneri	NA	1.5	0 - 1.5	0.3
W. Aleutian Is. Tanneri	NA	0.2	0 - 0.2	0.3
TOTAL other Tanners		**4.8**	**0 - 4.8**	

AMENDMENT 6
to the Fishery Management Plan for the Scallop Fishery off Alaska

In chapter 1.0 "Introduction", section 1.3.3 "Longevity and natural mortality" is replaced. In chapter 4.0 "Optimum Yield and Overfishing", the introductory paragraphs, section 4.1 "Assessment of the available scientific data", *Implications of Natural Mortality Rate*, and section 4.2 "Specification of OY and Overfishing" are replaced. In chapter 6.0 "Data Assessment and Collection" section 6.1 "At-Sea Catch Sampling" is added.

1.3.3 Longevity and natural mortality

Weathervane scallops are long-lived; individuals may live 28 years or more (Hennick 1973). The natural mortality rate (M) is thought to be low, although estimates vary. Instantaneous natural mortality (M) for weathervane scallops has been estimated by Kruse and Funk (1995), based on data presented in published papers (Kaiser 1986, Hennick 1973). A median M value of 0.13 was estimated using the methodology of Alverson and Carney (1975) based on growth parameters, Robson and Chapman (1961) based on catch curves, and Hoenig (1983) and Beverton (1963) based on maximum age. Little is known about the causes of natural mortality for scallops. Scallops are likely prey for various fish and invertebrates during the early part of their life cycle. Flounders are known to prey on juvenile weathervane scallops and seastars also may be important predators (Bourne 1991).

4.0 Optimum Yield and Overfishing

According to the Magnuson-Stevens Act, a fishery management plan for scallops must specify an optimum yield (OY) for the scallop fishery. The OY for a fishery means the amount of fish which will provide the greatest overall benefit to the nation, with particular reference to food production and recreational activities. The OY is specified on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factors. The national standard 1 guidelines (50 CFR 600.310) state that the most important limitation on the specification of OY is that the choice of OY, and the conservation and management measures proposed to achieve it, must prevent overfishing. If a stock or stock complex becomes overfished, OY provides for rebuilding to the MSY level.

Overfishing is a level of fishing mortality that jeopardizes the long-term capacity of a stock or stock complex to produce MSY on a continuing basis. The definition of overfishing for a stock or stock complex may be expressed in terms of maximum level of fishing mortality or minimum stock size threshold. Overfishing must be defined in a way to enable the Council and the Secretary to monitor and evaluate the condition of the stock or stock complex relative to the definition. Overfishing definitions must be based on the best scientific information available and reflect appropriate consideration of risk. Risk assessments should take into account uncertainties in estimating harvest levels, stock conditions, or the effects of environmental factors.

4.1 Assessment of the available scientific data

Implications of Natural Mortality Rate. Natural mortality is one of the biological reference points commonly used in fisheries management to establish appropriate exploitation rates (Clark 1991). As discussed in section [1.3.3], the longevity (28 years) of weathervane scallops in Alaska implies that this species experiences a very low natural mortality rate (M = 0.13 percent annual mortality). The

biological reference point, obtained by setting instantaneous fishing mortality (F) equal to M, implies that scallop harvest rates should not exceed 13 percent annually on any given stock. Unfortunately, other potentially useful benchmarks that would bear on the choice of appropriate exploitation rates for weathervane scallops are not presently available.

The biological reference point, F=M=0.13, implies that weathervane scallop stocks are at greater risk of overfishing than red king crab (Paralithodes camtschaticus) and Tanner crab (Chionoecetes bairdi) for which M=0.2 and M=0.3, respectively (NPFMC 1998). Also, unlike many crab stocks off Alaska, stock assessments of weathervane scallop biomass have not been made. Given these two observations, maintenance of healthy weathervane scallop stocks poses a serious challenge to fishery managers.

4.2 Specification of OY and Overfishing

The following definitions are based on the national standard 1 guidelines (50 CFR 600.310).

Maximum Sustainable Yield (MSY). MSY is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. The long-term average stock size obtained by fishing year after year at this rate under average recruitment may be a reasonable proxy for the MSY stock size, and the long-term average catch so obtained may be a reasonable proxy for MSY

MSY for weathervane scallops is 1.24 million lbs. (562.46 metric tons) of shucked adductor muscles. MSY was estimated based on the average catch from 1990-1997, (1995 data not included as fishery was closed most of the year), which was 1,240,000 lbs. (562.46 metric tons) of shucked meats. The time period from 1990 to 1997 reflects prevailing ecological conditions. The fishery was fully capitalized during this time period, and all areas of the state where scallops could be harvested were being exploited. Prior to that time period, vessels moved into and out of the scallop fishery, in part in response to economic opportunities available in other fisheries (Shirley and Kruse, 1995). However, since 1993, the fishery has been somewhat limited by crab bycatch limits, closure areas, and season length. As a consequence, a stable period during the history of this fishery does not exist. MSY estimation by averaging catches is problematic, however, a better solution does not exist at this point.

MSY Control Rule (F_{msy}). The MSY control rule is a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY. The MSY control rule establishes a maximum fishing mortality threshold (MFMT), which may be expressed either as a single number or as a function of spawning biomass or other measure of productive capacity. The MFMT is set at the fishing mortality rate or level associated with the relevant MSY control rule. Exceeding the MFMT for a period of 1 year or more constitutes overfishing

In choosing an MSY control rule, Councils should be guided by the characteristics of the fishery, the FMP's objectives, and the best scientific information available. In any MSY control rule, a given stock size is associated with a given level of fishing mortality and a given level of potential harvest, where the long-term average of these potential harvests provides an estimate of MSY. The MSY control rule is based on natural mortality, using the estimate of M = 0.13, the MSY control rule F_{msy} equals M, or F_{msy} = 0.13. No control rule for spiny, pink, or rock scallops is recommended at this time.

MSY Stock Size (B_{msy}). The MSY stock size is the long term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate units, associated with the production of MSY. It is the stock size that would be achieved under an appropriate MSY control rule. It is also the

minimum standard for a rebuilding target when remedial management action is required.

As noted earlier, MSY for weathervane scallops is established at 1.24 million lbs. (562.46 mt) of shucked adductor muscles. Therefore, MSY stock size is estimated as MSY/M = 9.54 million lbs. (4,326.6 mt) of shucked meat biomass. In terms of whole animals (including shells and gurry) B_{msy} would be 95.4 million lbs. (43,273 mt), as expanded by a product recovery rate of 10%.

Minimum Stock Size Threshold (MSST). The minimum stock size threshold (MSST), to the extent possible, should equal whichever is greater: one half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold. Should the actual size of the stock or stock complex in a given year fall below MSST, the stock or stock complex is considered overfished. The MSST should be expressed in terms of spawning biomass or other measure of reproductive capacity. Based on the national standard guidelines, a MSST for weathervane scallops is established based on ½ MSY stock size = $½B_{msy}$ = 4.77 million lbs. (2,163.7 mt) of shucked adductor muscles.

Overfishing Control Rule ($F_{overfishing}$). The national standard guidelines define the terms "overfishing" and "overfished" to mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce MSY on a continuing basis. Overfishing is established for weathervane scallop stocks as a fishing rate in excess of the natural mortality rate. Hence, $F_{overfishing} = M = 0.13$.

Optimum Yield (OY). Optimum yield should be established on the basis of MSY. OY is upper bounded by MSY = $F_{msy} B_{msy} = M B_{msy}$ (= 1,240,000 lbs or 562.46 mt.). Hence, a numerical range for OY of 0-1,240,000 lbs. (562.46 mt) can thus be established for Alaska weathervane scallops. Because MSY cannot be estimated for the other scallop species, OY cannot be quantified for rock scallops, pink scallops, or spiny scallops.

Sufficient conservatism is built into establishing an annual OY cap of 1.24 million lbs. (562.46 mt) for the following reasons:

1. the years of averaging include years when no fishing occurred in the Bering Sea, but obviously some sustainable harvest was possible;
2. the period of averaging includes other areas and years when the harvest was constrained by fishery controls, such as recently by bycatch PSCs, and therefore the resulting catch underestimates the productivity of scallop stocks;
3. substantial areas are closed to scallop dredging due to concerns about bycatch, yet these areas have substantial productivity;
4. closed areas can almost be thought of as marine refuges and potential yields from these areas are not factored into MSY estimates;
5. there are years during the history of the fishery when effort was low due to market (not abundance) conditions;
6. $F_{30\%}$ is probably a better estimator of $F_{overfishing}$ than is F=M, yet $M<F_{30\%}$ so the overfishing rule is conservative; and
7. In years of good recruitment, the stocks are likely greater than B_{msy}, thus we will fish at $F<F_{overfishing}$ to achieve OY=MSY (recall MSY = $F_{msy} B_{msy}$, so if $B>B_{msy}$, then $F<F_{msy}$).

In the future, better quantitative estimates of appropriate scallop yields by area may be generated based on observer data analysis. Additional information on biomass and long-term potential yield of pink, spiny and rock scallops also may be available in the future. At such time, MSY and OY would be re-

estimated and the FMP amended.

Because scallops only have been harvested by U.S. vessels in the past, and effort remains high, it is likely that the OY can be fully harvested by U.S. vessels and fully processed by U.S. processors in future years. In fact, current capacity of the U.S. scallop fleet in Alaska exceeds current guideline harvest levels for scallops. Hence, no considerations have been made to allow a foreign fishery on Alaskan scallops.

6.1 At-Sea Catch Sampling

The focus of the State of Alaska's onboard scallop observer program is two-fold. One is to monitor bycatch, and the second is to collect biological and commercial fishing information relating to the weathervane scallop. Onboard sampling is designed to answer questions necessary to the successful management of the resource.

The scallop observer program collects a variety of biological data on a daily basis. The daily goal is to sample a single dredge from one tow for species haul composition and a single dredge from six different tows for crab and halibut bycatch and discarded scallop catch as well as sampling two tows for scallop meat (adductor muscle) recovery data.

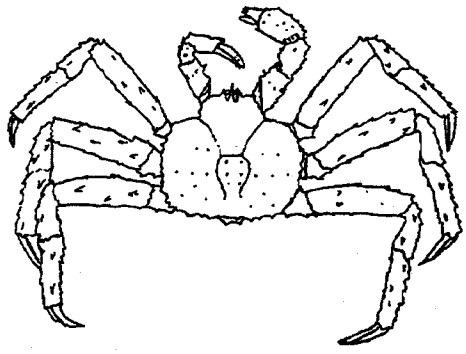
Haul composition sampling is used to document all species of bycatch by weight. Dredge contents, including noncommercial species, are sorted into baskets by species and weighed. Observer haul composition samples are summarized and reported by management area and district. Data from each management area and district is then summarized.

From each of the six tows sampled daily for crab and halibut bycatch, one dredge per tow is examined. Observers identify, count, and record the number of crab and halibut encountered as well as examining both the retained and discarded scallop catch. In addition to enumerating crab, carapace measurements, shell age, sex, injuries and mortality are recorded. All Pacific halibut encountered are measured for length and examined for injuries and overall body condition. The discarded scallop catch is collected from the deck and weighed. A subsample is examined to determine the weight and number of broken and intact scallops, and shell heights. From the retained scallop catch; shell height, sex, and gonad development is collected. Shells are collected from both the retained and discarded scallop catch for shell aging.

DRAFT
for
SECRETARIAL REVIEW

ENVIRONMENTAL ASSESSMENT
for
AMENDMENT 7
to the Fishery Management Plan for the Commercial
King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands
to

1. Revise Definitions of Overfishing, MSY, and OY
2. Update the BSAI Crab FMP



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Executive Summary

This Environmental Assessment (EA) addresses alternatives for meeting the NMFS proposed guidelines drafted to in response to the Magnuson-Stevens Act provisions for national standard 1. National standard 1 states that 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. The Act did not change the standard, but did change the definition of optimum yield and overfishing.

Language from the Magnuson-Stevens Act 1996.

Optimum Yield: The term 'optimum', with respect to the yield from a fishery, means the amount of fish which --

(a) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;

(b) is prescribed as such on the basis of maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and

(c) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Overfishing: The terms "overfishing" and "overfished" mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis.

The Magnuson-Stevens Act also requires the Secretary of Commerce to establish advisory guidelines (which shall not have the force and effect of law), based on the national standards, to assist in the development of fishery management plans. Proposed guidelines were published in the Federal Register on August 4. This document examines alternative definitions of overfishing, maximum sustainable yield (MSY), and optimum yield (OY), for Bering Sea and Aleutian Islands (BSAI) king and Tanner crab in accordance with the proposed rule.

This EA/RIR also examines potential impacts of updating the BSAI Crab FMP from its original 1989 version. Proposed updates to the FMP include general housekeeping and clarifying language on license limitation implementation schedule. A revised draft FMP is attached as Appendix 1.

Two alternatives were considered:

Alternative 1: Status Quo. No revisions to the current MSY, OY, and overfishing definitions would be made, and the FMP would not be updated.

Alternative 2: (Preferred) Redefine overfishing, OY, and MSY, and update the FMP. Updates to the FMP include general housekeeping as well as clarifying language on license limitation implementation schedule.

Alternative 2 would improve management of the BSAI crab fisheries by instituting the following conservation measures:

1. Requirement that OY take into account protection of marine ecosystems, that OY be no greater than MSY on a continuing basis, and the OY for an overfished fishery allow rebuilding to the MSY level.

2. Revised definitions for MSY based on prevailing ecological and environmental conditions;

3. Revised definitions of overfishing that include both fishing mortality and biomass thresholds; and

4. An updated and user-friendly BSAI King and Tanner Crab FMP.

Under Alternative 2, the following criteria definitions be established for estimation of optimum yield and overfishing of BSAI crab stocks. These definitions, as recommended by the BSAI Crab Plan Team, were based on species life history characteristics and trends in stock biomass estimates.

MSY Control Rule = the natural mortality rate, M; M=0.2 for king crab and M=0.3 for *Chionoecetes* species.
MSY Stock Size = the average mature biomass observed over the past 15 years, 1983-1997.
Overfishing Rate = fishing rate > M.
Minimum Stock Size Threshold = ½ MSY stock size.

Application of these definitions to each stock is shown in the following table. MSY and threshold estimates were derived from average of 1983-1997 survey data when possible. Values of M were estimated from longevity data (Hoenig 1982). Thresholds were calculated as one-half of the biomass level that produces MSY. Survey data were adjusted for catchability for king crabs, but not for *Chionoecetes* species.

Estimated values of recommending criteria to define optimum yield and overfishing of selected BSAI king and Tanner crabs. Biomass, MSY, and threshold levels reported in millions of pounds.

	1997 Mature Biomass[1]	MSY Control Rule	MSY[1]	Minimum Stock Size Threshold[1]	Current Status (1997)
Red King Crab					
Bristol Bay	89.0	0.2	17.9	44.8	Above threshold
Pribilof Islands	7.1	0.2	1.3	3.3	Above threshold
Blue King Crab					
Pribilof Islands	8.0	0.2	2.6	6.6	Above threshold
St. Matthew I.	22.5	0.2	4.4	11.0	Above threshold
Tanner Crab (C. bairdi)					
Eastern Bering Sea	64.2	0.3	56.9	94.8	**Below threshold**
Snow Crab (C. opilio)					
Eastern Bering Sea	994.3	0.3	276.5	460.8	Above threshold

Note that Tanner crab spawning biomass is below the minimum stock size threshold, and hence would be deemed 'overfished', based on the proposed rule. If adopted by the Secretary of Commerce, the Council will be required to develop a rebuilding plan for this stock within one year.

None of the alternatives is expected to result in a "significant regulatory action" as defined in E.O. 12866. None of the alternatives are likely to significantly affect the quality of the human environment, and the preparation of an environmental impact statement for the proposed action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations, fisheries, regulations, gear used, revenues generated, etc.

Table 1. MSY estimates for BSAI king and Tanner crab stocks. Estimated values are in millions of pounds. Long-term average catch represents MSY as it would have been calculated under the old FMP. Current average catch is that over the same years as the MSY estimate and may be taken as the average of OY determinations in the same period.

	Long-term Average		Current Average			
Stock	**Years**	**Ave. Landings**	**Years**	**Ave. Landings**	**MSY Estimate**	**Comments**
Adak red king	1960-95	5.8	1983-95	1.2	1.8	Closed 1996, 1997.
Bristol Bay red king	1953-97	30.8	1983-97	10.6	17.9	MSY from survey history; Closed 1983, 1994-95.
Dutch Harbor red king	1961-82	11.3	1983-97	0.0	NA	No current MSY; Fishery closed since 1982.
Pribilof Islands red king	1980-97	0.9	1983-97	1.0	1.3	MSY from survey history; No fishing or closed 1984-92
Norton Sound red king	1977-97	0.6	1983-97	0.3	0.5	Closed 1991.
Pribilof Islands blue king	1966-97	3.3	1983-97	0.8	2.6	MSY from survey history; Closed 1988-94.
St Matthew blue king	1977-97	3.0	1983-97	3.0	4.4	MSY from survey history.
St Lawrence blue king	1979-95	<0.1	1983-95	<0.1	0.1	MSY provisional; Fished in 1979, 1983, 1989, 1995.
Aleutian Is. golden king	1980-96	8.0	1983-96	8.8	17.9	1997-98 season in progress.
Pribilof Is. golden king	1981-96	0.1	1983-97	0.1	0.3	No fishing in 1984, 1990.
St. Matthew golden king	-	-	1983-96	0.1	0.4	MSY provisional; No fishing 1987-89, 1990-91, 1997.
Aleutian Is. scarlet king	-	-	1992-97	<0.1	NA	MSY = 0.06 provisional
EBS scarlet king	-	-	1995-96	<0.1	NA	MSY = 0.04 provisional
E. Aleutian Is. Tanner	1974-95	0.5	1983-95	0.2	0.7	No fishing 1996-97.
EBS Tanner	1965-96	30.0	1983-96	13.9	56.9	MSY from survey history; closed 1986-87, 1997.
W. Aleutian Is. Tanner	1973-95	0.2	1983-95	0.1	0.4	Closed 1976, 93-94, 96-97.
EBS snow	1965-97	70.7	1983-97	136.6	276.5	MSY from survey history.
E. Aleutian Is. angulatus	-	-	1995-96	0.3	1.0	MSY provisional; no fishing in 1997.
EBS angulatus	-	-	1995-96	0.1	0.3	MSY provisional; no fishing in 1997.
E. Aleutian Is. tanneri	-	-	1993-96	0.5	1.8	MSY provisional; no fishing in 1997.
EBS tanneri	-	-	1992-96	0.5	1.5	MSY provisional; no fishing in 1997.
W. Aleutian Is. Tanneri	-	-	1992-96	<0.1	0.2	MSY provisional; no fishing in 1997.

1.0 INTRODUCTION

The king and Tanner crab fisheries in the Exclusive Economic Zone (EEZ) (3 to 200 miles offshore) of the Bering Sea and Aleutian Islands off Alaska are managed under the Fishery Management Plan for King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands. This fishery management plan (FMP) was developed by the North Pacific Fishery Management Council (Council) under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The BSAI King and Tanner crab FMP was approved by the Secretary of Commerce and became effective in 1989.

Actions taken to amend the FMPs or implement other regulations governing the BSAI crab fisheries must meet the requirements of Federal laws and regulations. In addition to the Magnuson-Stevens Act, the most important of these are the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), Executive Order (E.O.) 12866, and the Regulatory Flexibility Act (RFA). None of the alternatives contain implementing regulations and therefore the Regulatory Flexibility Act does not apply and review under Executive Order 12866 is not required.

Section 1 contains a description of the purpose and need for the proposed action as well as a description of alternative actions which may address the problem. Section 2 contains information on the biological and environmental impacts of the alternatives as required by NEPA. Impacts on endangered species and marine mammals are also addressed in this section. Section 3 contains a brief analysis of the economic impacts of the alternatives considered.

This Environmental Assessment (EA) addresses alternatives for meeting the NMFS proposed guidelines drafted to in response to the revised Magnuson-Stevens Act provisions for national standard 1.

1.1 Purpose of and Need for the Action

The Magnuson-Stevens Act was amended in 1996. Section 301(a) of the Magnuson-Stevens Act contains 10 national standards for fishery conservation and management, with which all FMPs and amendments prepared by the Councils and the Secretary must comply. Section 303(b) requires that the Secretary establish advisory guidelines, based on the national standards, to assist in the development of FMPs. One major provision of the Act necessitates significant revisions to the guidelines for national standard 1 (optimum yield), which were published as a proposed rule in the Federal Register on August 4, 1997. The proposed guidelines are intended as an aid to decision making, with responsible conservation and management of valued national resources as the goal.

Language from the Magnuson-Stevens Act 1996.

National Standard 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.

Optimum Yield: The term 'optimum', with respect to the yield from a fishery, means the amount of fish which --

(a) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;

(b) is prescribed as such on the basis of maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and

(c) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Overfishing: The terms "overfishing" and "overfished" mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis.

The new and revised national standards apply to all FMPs and implementing regulations, existing and future. However, as Congress recognized by allowing the Councils 2 years from enactment (i.e., until October 11, 1998) to submit FMP amendments to comply with the related new requirements in section

303(a), it will take considerable time and effort to bring all FMPs into compliance with the Magnuson-Stevens Act. Once issued in final, NMFS will use these guidelines to review all new FMPs and amendments to determine whether they comply with the new and revised national standards. The Councils are required to submit necessary amendments to comply with the standards by October 11, 1998.

National standard 1 guidelines were last revised in July 1989; that revision focused on establishing a conservation standard, with the requirement that specific, objective, and measurable definitions of overfishing be established for each fishery managed under the Magnuson- Stevens Act (then called the Magnuson Act). By 1993, more than 100 such definitions had been approved by NMFS. At that time, NMFS convened a panel of scientists from inside and outside the agency to review the approved definitions, investigate their strengths and shortcomings, and standardize, as much as possible, the criteria and basis for future evaluations of overfishing definitions. The goal of the review was to develop a scientific consensus as to the appropriateness of the definitions and the criteria used in their evaluation. The resulting analysis and report (Rosenberg et al., 1994) provided a set of scientific principles for defining overfishing. However, these principles were not incorporated into the national standard guidelines. The SFA introduced or revised definitions for a number of terms and introduced several new requirements for contents of FMPs. As a consequence of the 1994 report and the statutory amendments, revisions to the national standard 1 guidelines are proposed as described below.

Overview of Issues

Revisions to the guidelines for national standard 1 center on the Magnuson-Stevens Act's definitions of ``overfishing,'' ``overfished,'' and ``optimum yield (OY);'' the requirement for the establishment of objective and measurable criteria for determining the status of a stock or stock complex; and the requirement for remedial action in the event that overfishing is occurring or that a stock or stock complex is overfished.

The Magnuson-Stevens Act, in section 3(29), defines both ``overfishing'' and ``overfished'' as a rate or level of fishing mortality that jeopardizes a fishery's capacity to produce maximum sustainable yield (MSY) on a continuing basis. Neither term was defined statutorily, prior to passage of the SFA. The existing national standard guidelines define overfishing somewhat differently, by qualifying ``capacity'' with the phrase ``long-term,'' and do not include a definition of ``overfished.'' The Magnuson-Stevens Act, in section 3(28), defines OY as the amount of fish that: (1) Will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; (2) is prescribed on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological factors; and (3) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY in such fishery. The main changes relative to the pre-SFA definition include the requirements that OY take into account protection of marine ecosystems, that OY be no greater than MSY, and that OY for an overfished fishery allow rebuilding to the MSY level. The Magnuson-Stevens Act, in section 303(a)(10), requires each FMP to specify objective and measurable criteria for identifying when the fishery to which the FMP applies is overfished (also referred to as ``criteria for overfishing''), with an analysis of how the criteria were determined and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery. The Magnuson- Stevens Act also requires, in section 304(e), the Secretary to report annually to Congress and the Councils on the status of fisheries within each Council's geographical area of authority and identify those fisheries that are overfished or are approaching a condition of being overfished. For each fishery managed under an FMP or international agreement, the status is to be determined using the criteria for overfishing specified in that FMP or agreement. A fishery is to be classified as approaching a condition of being overfished if, based on trends in fishing effort, fishery resource size, and other appropriate factors, the Secretary estimates that it will become overfished within 2 years.

If the Secretary determines at any time that a fishery is overfished or approaching an overfished condition or that existing remedial action taken for the purpose of ending any previously identified overfishing has not resulted in adequate progress, the Secretary must notify the Council and request that remedial action be taken. Section 304(e)(3) of the Magnuson-Stevens Act requires that the Council then, within 1 year of notification, prepare an FMP, FMP amendment, or proposed regulations for the purposes of ending (or preventing) overfishing and rebuilding (or sustaining) affected stocks of fish.

Overview of Approach

In developing the proposed revised guidelines, policy guidance was taken from the Magnuson-Stevens Act and other applicable law. Because the guidelines deal with technical subject matter, guidance was also taken from the scientific literature. In particular, the report by Rosenberg et al. (1994) was used to the extent that it is consistent with the Magnuson-Stevens Act and other applicable law.

Sustainability

Sustainable fisheries is a key theme within the Magnuson-Stevens Act. The idea of sustainability is inherent in MSY, a quantity that is central to the Magnuson-Stevens Act's definitions of both overfishing and OY. Closely related to the idea of sustainability is the phrase ``on a continuing basis,'' which is used both in the Magnuson-Stevens Act's definition of overfishing and in national standard 1. The appropriate interpretation of sustainability or the phrase ``on a continuing basis'' is the one generally accepted in the fishery science literature, which relates to an average stock level and/or average potential yield from a stock over a long period of time.

It is important to distinguish between the theoretical concept of MSY as an unconditional maximum independent of management practice, and actual estimates of MSY, which are necessarily conditional on some type of (perhaps hypothetical) management practice. Specifically, the proposed guidelines, in Sec. 600.310(c), describe the role of ``control rules'' in estimating MSY, where an MSY control rule is any harvest strategy that, if implemented, would be expected to result in a long-term average catch close to MSY. A Council could choose an MSY control rule in which fishing mortality is held constant over time at an appropriate rate, one in which escapement is held constant over time at an appropriate level, or some other control rule, so long as that control rule is consistent with the Magnuson-Stevens Act.

Although the Magnuson-Stevens Act's definition of overfishing is expressed in terms of a stock's capacity to produce MSY on a continuing basis, nothing in the Magnuson-Stevens Act implies that such production, in the form of harvest, must actually occur. That is, a stock does not actually need to produce MSY on a continuing basis in order to have the capacity to do so.

Use of the Terms ``Overfishing'' and ``Overfished''

The relationship between the terms ``overfishing'' and ``overfished'' can be confusing. As used in the Magnuson-Stevens Act, the verb ``to overfish'' means to fish at a rate or level that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis. ``Overfishing,'' then, occurs whenever a stock or stock complex is subjected to any such rate or level of fishing mortality. Interpreting the term ``overfished'' is more complicated. In the Magnuson-Stevens Act, this term is used in two senses: First, to describe any stock or stock complex that is subjected to overfishing; and second, to describe any stock or stock complex for which a change in management practices is required in order to achieve an appropriate level and rate of rebuilding. (See, for example, section 303(a)(1)(A) and section 304(e)(1)) To avoid confusion, the proposed guidelines use ``overfished'' in the second sense only. Both terms would be defined in Sec. 600.310(d).

Status Determination Criteria

The Magnuson-Stevens Act, in section 303(a)(10), requires that each FMP specify objective and measurable criteria (status determination criteria) for identifying when stocks or stock complexes covered by the FMP are overfished. To fulfill the intent of the Magnuson-Stevens Act, such status determination criteria are comprised of two components: A maximum fishing mortality threshold and a minimum stock size threshold (see Sec. 600.310(d)(2)). The maximum fishing mortality threshold should be set at the fishing mortality rate or level defined by the chosen MSY control rule. The minimum stock size threshold should be set at one-half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold, whichever is greater. When data are insufficient to estimate any of these quantities, use of reasonable proxies would be required.

It is important to note that, even if no minimum stock size threshold were set, the maximum fishing mortality threshold would define a minimum limit on the rate of rebuilding for a stock that falls below its MSY level. The reason for requiring a minimum stock size threshold in addition to a maximum fishing mortality threshold is to define the point at which this minimum rebuilding rate is no longer prudent. For example, in the case of a slow-growing stock, a rebuilding rate that satisfies the statutory deadline of 10 years would be considered prudent management. However, for a fast-growing stock, it might be possible to fall to an extremely low level of abundance and still rebuild to the MSY level within 10 years, which would not be considered prudent management. Thus, the definition of the minimum stock size threshold includes a constraint, equal to one-half the MSY stock size, to ensure that the 10-year allowance is not abused in the case of fast-growing stocks.

Choosing an MSY control rule is thus key to satisfying national standard 1, because it defines the maximum fishing mortality threshold and plays a role in defining the minimum stock size threshold. Any MSY control rule defines a relationship between fishing mortality rate and stock size. This relationship is the maximum fishing mortality threshold, which may be a single number or a mathematical function. In addition, any MSY control rule defines a rate of rebuilding for stocks that are below the level that would produce MSY. The smallest stock size at which rebuilding to the level that would produce MSY is achieved within 10 years defines the minimum stock size threshold for that rule, unless such a stock size is less than one-half the MSY stock size. The MSY control rule also defines an upper bound on any OY control rule that might be specified.

The proposed status determination criteria in Sec. 600.310(d)(2) would play a fundamental role in developing the Secretary's annual report to Congress and the Councils, as required by section 304(e) of the Magnuson-Stevens Act. Under the proposed guidelines, the Secretary's annual report would list all stocks or stock complexes for which the maximum fishing mortality rate has been exceeded or for which the minimum stock size has not been achieved. Thus, the Secretary's decision as to whether a stock or stock complex is listed in the annual report of overfished stocks would be based on either the current rate of fishing mortality or the current condition of the stock, regardless of whether that condition is associated with either previous or current overfishing.

Preventing Overfishing

The Magnuson-Stevens Act is clear in its requirement to prevent overfishing. Except under very limited conditions, discussed below, this requirement must be satisfied. The Magnuson-Stevens Act's requirement to take remedial action in the event that a stock becomes overfished is not a substitute for the requirement to prevent overfishing in the first place.

Previous versions of the national standard guidelines have described limited conditions under which some amount of overfishing is permissible. Some of these conditions are retained in Sec. 600.310(d)(6) in the proposed revision, but they are tightened considerably. Although the Magnuson-Stevens Act requires that OY and overfishing criteria be specified for each fishery, it does not require a one-to-one relationship between the fisheries for which OYs are specified and the fisheries for which overfishing criteria are specified. For example, in a mixed-stock fishery, overfishing criteria may be specified for the individual stocks, even if OY is specified for the fishery as a whole (see Sec. 600.310(c)(2)(iii)). Thus, it is conceivable that OY could be achieved for the fishery as a whole, even while overfishing of an individual stock is occurring.

Ending Overfishing and Rebuilding Overfished Stocks

In the event that overfishing occurs or is projected to occur within 2 years, or in the event that a stock or stock complex is overfished or is projected to become overfished within 2 years, the Magnuson-Stevens Act, in section 304(e), gives detailed requirements for Council action that must be undertaken in response. As described in Sec. 600.310(e) of the proposed guidelines, if overfishing is occurring, Council action must be designed to reduce fishing mortality to a rate or level no greater than the maximum fishing mortality threshold. If a stock or stock complex is overfished, fishing at a rate or level equal to the maximum fishing mortality threshold will not meet the required rate and level of rebuilding. In such cases, Council action must go beyond that required for situations involving only overfishing.

Although the Magnuson-Stevens Act implicitly sets the rebuilding target equal to the MSY stock size, this constitutes a minimum standard only. In general, management practices should be designed to achieve an average stock size equal to the stock size associated with OY (or the average OY, in cases where OY is determined annually), and rebuilding plans should be consistent with this goal. Because OY cannot exceed MSY on average, the stock size that would produce OY will generally be greater than the stock size that would produce MSY. Remedial action should do more than merely assure that the stock reaches the target level; rather, the goal should be to restore the stock's capacity to remain at that level on a continuing basis, consistent with the stock's natural variability. For example, a stock should not be considered rebuilt just because its current size matches the target level, which could result from a single good year class, if the stock's condition would not likely be sustained by succeeding year classes. In order to conclude that a stock has fully recovered, it may be necessary to rebuild the age structure, in addition to achieving a particular biomass target. This generally requires keeping fishing mortality at an appropriately low level for several years (approximately one generation of the species).

Remedial action should be designed to make consistent and reasonably rapid progress towards recovery. ``Consistent progress'' means that no grace period exists beyond the statutory timeframe of 1 year for taking remedial action, and that such action should include explicit milestones expressed in terms of measurable improvement of the stock with respect to its status determination criteria. The Magnuson- Stevens Act, in section 304(e)(4), requires that the time period for rebuilding be as short as possible, but always less than 10 years, except in cases where the biology of the stock of fish, other environmental conditions, or management measures under an international agreement in which the United States participates dictate otherwise.

Optimum Yield

One of the most significant changes made by the SFA is a requirement that OY not exceed MSY on a continuing basis. Further, for overfished fisheries, OY must be based upon a rebuilding schedule that increases stock levels to those that would produce MSY. These changes are expressions of a precautionary

approach, which should contain three features (see Sec. 600.310(f)(5)). First, target reference points, such as OY, should be set safely below limit reference points, such as the catch level associated with the maximum fishing mortality threshold. Second, a stock that is below its MSY level should be harvested at a lower rate or level of fishing mortality than if it were above its MSY level. Third, the criteria used to set target catch levels should be explicitly risk averse, so that greater uncertainty regarding a stock's status or productive capacity corresponds to greater caution in setting target catch levels. Because specification of a precautionary approach can be a complicated exercise, NMFS plans to supplement these guidelines in the near future with technical guidance for use in implementing such an approach. This additional guidance may be provided in a form similar to that developed to implement the 1994 amendments to the MMPA.

The Magnuson-Stevens Act is clear in its requirement that specification of OY take into account protection of marine ecosystems. This is reflected in the new provisions concerning the identification and description of essential fish habitat (EFH). Proposed guidelines for designation of EFH were published in the Federal Register on April 23, 1997, at 62 FR 19723. Final Guidelines were published on May 1, 1998, at 63 FR 24212. Due to the complex nature of marine ecosystem structure and function, qualitative methods may be used to satisfy this requirement wherever data or scientific understanding are insufficient to permit use of quantitative methods.

NMFS recognizes the growing importance of non-consumptive uses of marine fishery resources. Such activities include ecotourism, fish watching, recreational diving, and marine education. The guidelines are intended to accommodate such uses in specifying OY.

1.2 Alternatives Considered

1.2.1 Alternative 1: Status Quo. No revisions to the current MSY, OY, and overfishing definitions would be made, and the FMP would not be updated.

1.2.2 Alternative 2: (Preferred) Redefine overfishing, OY, and MSY, and update the FMP. Updates to the FMP include general housekeeping as well as clarifying language on license limitation implementation schedule.

1.3 NMFS Guidance on National Standard 1

Below is the Final Rule guidelines on National Standard 1 (Section 600.310), published in the Federal Register on May 1, 1998.

Sec. 600.310 National Standard 1--Optimum Yield.

(a) Standard 1. Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the U.S. fishing industry.

(b) General. The determination of OY is a decisional mechanism for resolving the Magnuson-Stevens Act's multiple purposes and policies, implementing an FMP's objectives, and balancing the various interests that comprise the national welfare. OY is based on MSY, or on MSY as it may be reduced under paragraph (f)(3) of this section. The most important limitation on the specification of OY is that the choice of OY and the conservation and management measures proposed to achieve it must prevent overfishing.

(c) MSY. Each FMP should include an estimate of MSY as explained in this section.

(1) Definitions.

(i) ``MSY'' is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions.
(ii) ``MSY control rule'' means a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY.
(iii) ``MSY stock size'' means the long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate units, that would be achieved under an MSY control rule in which the fishing mortality rate is constant.

(2) Options in specifying MSY.

(i) Because MSY is a theoretical concept, its estimation in practice is conditional on the choice of an MSY control rule. In choosing an MSY control rule, Councils should be guided by the characteristics of the fishery, the FMP's objectives, and the best scientific information available. The simplest MSY control rule is to remove a constant catch in each year that the estimated stock size exceeds an appropriate lower bound, where this catch is chosen so as to maximize the resulting long-term average yield. Other examples include the following: Remove a constant fraction of the biomass in each year, where this fraction is chosen so as to maximize the resulting long-term average yield; allow a constant level of escapement in each year, where this level is chosen so as to maximize the resulting long-term average yield; vary the fishing mortality rate as a continuous function of stock size, where the parameters of this function are constant and chosen so as to maximize the resulting long- term average yield. In any MSY control rule, a given stock size is associated with a given level of fishing mortality and a given level of potential harvest, where the long-term average of these potential harvests provides an estimate of MSY.
(ii) Any MSY values used in determining OY will necessarily be estimates, and these will typically be associated with some level of uncertainty. Such estimates must be based on the best scientific information available (see Sec. 600.315) and must incorporate appropriate consideration of risk (see Sec. 600.335). Beyond these requirements, however, Councils have a reasonable degree of latitude in determining which estimates to use and how these estimates are to be expressed. For example, a point estimate of MSY may be expressed by itself or together with a confidence interval around that estimate.
(iii) In the case of a mixed-stock fishery, MSY should be specified on a stock-by-stock basis. However, where MSY cannot be specified for each stock, then MSY may be specified on the basis of one or more species as an indicator for the mixed stock as a whole or for the fishery as a whole.
(iv) Because MSY is a long-term average, it need not be estimated annually, but it must be based on the best scientific information available, and should be re-estimated as required by changes in environmental or ecological conditions or new scientific information.

(3) Alternatives to specifying MSY. When data are insufficient to estimate MSY directly, Councils should adopt other measures of productive capacity that can serve as reasonable proxies for MSY, to the extent possible. Examples include various reference points defined in terms of relative spawning per recruit. For instance, the fishing mortality rate that reduces the long-term average level of spawning per recruit to 30-40 percent of the long-term average that would be expected in the absence of fishing may be a reasonable proxy for the MSY fishing mortality rate. The long-term average stock size obtained by fishing year after year at this rate under average recruitment may be a reasonable proxy for the MSY stock size, and the long-term average catch so obtained may be a reasonable proxy for MSY. The natural mortality rate may also be a reasonable proxy for the MSY fishing mortality rate. If a reliable estimate of pristine stock size (i.e., the long-term average stock size that would be expected in the absence of fishing) is available, a stock size approximately 40 percent of this value may be a reasonable proxy for the MSY stock size, and the product of this stock size and the natural mortality rate may be a reasonable proxy for MSY.

(d) Overfishing--(1) Definitions.

(i) ``To overfish'' means to fish at a rate or level that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis.
(ii) ``Overfishing'' occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis.

(iii) In the Magnuson-Stevens Act, the term ``overfished'' is used in two senses: First, to describe any stock or stock complex that is subjected to a rate or level of fishing mortality meeting the criterion in paragraph (d)(1)(i) of this section, and second, to describe any stock or stock complex whose size is sufficiently small that a change in management practices is required in order to achieve an appropriate level and rate of rebuilding. To avoid confusion, this section uses ``overfished'' in the second sense only.

(2) Specification of status determination criteria. Each FMP must specify, to the extent possible, objective and measurable status determination criteria for each stock or stock complex covered by that FMP and provide an analysis of how the status determination criteria were chosen and how they relate to reproductive potential. Status determination criteria must be expressed in a way that enables the Council and the Secretary to monitor the stock or stock complex and determine annually whether overfishing is occurring and whether the stock or stock complex is overfished. In all cases, status determination criteria must specify both of the following:

(i) A maximum fishing mortality threshold or reasonable proxy thereof. The fishing mortality threshold may be expressed either as a single number or as a function of spawning biomass or other measure of productive capacity. The fishing mortality threshold must not exceed the fishing mortality rate or level associated with the relevant MSY control rule. Exceeding the fishing mortality threshold for a period of 1 year or more constitutes overfishing.
(ii) A minimum stock size threshold or reasonable proxy thereof. The stock size threshold should be expressed in terms of spawning biomass or other measure of productive capacity. To the extent possible, the stock size threshold should equal whichever of the following is greater: One-half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold specified under paragraph (d)(2)(i) of this section. Should the actual size of the stock or stock complex in a given year fall below this threshold, the stock or stock complex is considered overfished.

(3) Relationship of status determination criteria to other national standards

(i) National standard 2. Status determination criteria must be based on the best scientific information available (see Sec. 600.315). When data are insufficient to estimate MSY, Councils should base status determination criteria on reasonable proxies thereof to the extent possible (also see paragraph (c)(3) of this section). In cases where scientific data are severely limited, effort should also be directed to identifying and gathering the needed data.
(ii) National standard 3. The requirement to manage interrelated stocks of fish as a unit or in close coordination notwithstanding (see Sec. 600.320), status determination criteria should generally be specified in terms of the level of stock aggregation for which the best scientific information is available (also see paragraph (c)(2)(iii) of this section).
(iii) National standard 6. Councils must build into the status determination criteria appropriate consideration of risk, taking into account uncertainties in estimating harvest, stock conditions, life history parameters, or the effects of environmental factors (see Sec. 600.335).

(4) Relationship of status determination criteria to environmental change. Some short-term environmental changes can alter the current size of a stock or stock complex without affecting the long-term productive capacity of the stock or stock complex. Other environmental changes affect both the current size of the stock or stock complex and the long-term productive capacity of the stock or stock complex.

(i) If environmental changes cause a stock or stock complex to fall below the minimum stock size threshold without affecting the long-term productive capacity of the stock or stock complex, fishing mortality must be constrained sufficiently to allow rebuilding within an acceptable time frame (also see paragraph (e)(4)(ii) of this section). Status determination criteria need not be respecified.
(ii) If environmental changes affect the long-term productive capacity of the stock or stock complex, one or more components of the status determination criteria must be respecified. Once status determination criteria have been respecified, fishing mortality may or may not have to be reduced, depending on the status of the stock or stock complex with respect to the new criteria.

(iii) If manmade environmental changes are partially responsible for a stock or stock complex being in an overfished condition, in addition to controlling effort, Councils should recommend restoration of habitat and other ameliorative programs, to the extent possible (see also the guidelines issued pursuant to section 305(b) of the Magnuson- Stevens Act for Council actions concerning essential fish habitat).

(5) Secretarial approval of status determination criteria. Secretarial approval or disapproval of proposed status determination criteria will be based on consideration of whether the proposal:

(i) Has sufficient scientific merit.
(ii) Contains the elements described in paragraph (d)(2) of this section.
(iii) Provides a basis for objective measurement of the status of the stock or stock complex against the criteria.
(iv) Is operationally feasible.

(6) Exceptions. There are certain limited exceptions to the requirement to prevent overfishing. Harvesting one species of a mixed- stock complex at its optimum level may result in the overfishing of another stock component in the complex. A Council may decide to permit this type of overfishing only if all of the following conditions are satisfied:

(i) It is demonstrated by analysis (paragraph (f)(6) of this section) that such action will result in long-term net benefits to the Nation.
(ii) It is demonstrated by analysis that mitigating measures have been considered and that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/ configuration, or other technical characteristic in a manner such that no overfishing would occur.
(iii) The resulting rate or level of fishing mortality will not cause any species or evolutionary significant unit thereof to require protection under the ESA.

(e) Ending overfishing and rebuilding overfished stocks-- (1) Definition. A threshold, either maximum fishing mortality or minimum stock size, is being ``approached'' whenever it is projected that the threshold will be breached within 2 years, based on trends in fishing effort, fishery resource size, and other appropriate factors.

(2) Notification. The Secretary will immediately notify a Council and request that remedial action be taken whenever the Secretary determines that:

(i) Overfishing is occurring;
(ii) A stock or stock complex is overfished;
(iii) The rate or level of fishing mortality for a stock or stock complex is approaching the maximum fishing mortality threshold;
(iv) A stock or stock complex is approaching its minimum stock size threshold; or
(v) Existing remedial action taken for the purpose of ending previously identified overfishing or rebuilding a previously identified overfished stock or stock complex has not resulted in adequate progress.

(3) Council action. Within 1 year of such time as the Secretary may identify that overfishing is occurring, that a stock or stock complex is overfished, or that a threshold is being approached, or such time as a Council may be notified of the same under paragraph (e)(2) of this section, the Council must take remedial action by preparing an FMP, FMP amendment, or proposed regulations. This remedial action must be designed to accomplish all of the following purposes that apply:

(i) If overfishing is occurring, the purpose of the action is to end overfishing.
(ii) If the stock or stock complex is overfished, the purpose of the action is to rebuild the stock or stock complex to the MSY level within an appropriate time frame.
(iii) If the rate or level of fishing mortality is approaching the maximum fishing mortality threshold (from below), the purpose of the action is to prevent this threshold from being reached.
(iv) If the stock or stock complex is approaching the minimum stock size threshold (from above), the purpose of the action is to prevent this threshold from being reached.

(4) Constraints on Council action.

(i) In cases where overfishing is occurring, Council action must be sufficient to end overfishing.
(ii) In cases where a stock or stock complex is overfished, Council action must specify a time period for rebuilding the stock or stock complex that satisfies the requirements of section 304(e)(4)(A) of the Magnuson-Stevens Act.

(A) A number of factors enter into the specification of the time period for rebuilding:

(1) The status and biology of the stock or stock complex;

(2) Interactions between the stock or stock complex and other components of the marine ecosystem (also referred to as ``other environmental conditions'');

(3) The needs of fishing communities;

(4) Recommendations by international organizations in which the United States participates; and

(5) Management measures under an international agreement in which the United States participates.

(B) These factors enter into the specification of the time period for rebuilding as follows:

(1) The lower limit of the specified time period for rebuilding is determined by the status and biology of the stock or stock complex and its interactions with other components of the marine ecosystem, and is defined as the amount of time that would be required for rebuilding if fishing mortality were eliminated entirely.

(2) If the lower limit is less than 10 years, then the specified time period for rebuilding may be adjusted upward to the extent warranted by the needs of fishing communities and recommendations by international organizations in which the United States participates, except that no such upward adjustment can result in the specified time period exceeding 10 years, unless management measures under an international agreement in which the United States participates dictate otherwise.

(3) If the lower limit is 10 years or greater, then the specified time period for rebuilding may be adjusted upward to the extent warranted by the needs of fishing communities and recommendations by international organizations in which the United States participates, except that no such upward adjustment can exceed the rebuilding period calculated in the absence of fishing mortality, plus one mean generation time or equivalent period based on the species' life-history characteristics. For example, suppose a stock could be rebuilt within 12 years in the absence of any fishing mortality, and has a mean generation time of 8 years. The rebuilding period, in this case, could be as long as 20 years.

(C) A rebuilding program undertaken after May 1, 1998 commences as soon as the first measures to rebuild the stock or stock complex are implemented.

(D) In the case of rebuilding plans that were already in place as of May 1, 1998, such rebuilding plans must be reviewed to determine whether they are in compliance with all requirements of the Magnuson- Stevens Act, as amended by the Sustainable Fisheries Act.

(iii) For fisheries managed under an international agreement, Council action must reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States.

(5) Interim measures. The Secretary, on his/her own initiative or in response to a Council request, may implement interim measures to reduce overfishing under section 305(c) of the Magnuson-Stevens Act, until such measures can be replaced by an FMP, FMP amendment, or regulations taking remedial action.

(i) These measures may remain in effect for no more than 180 days, but may be extended for an additional 180 days if the public has had an opportunity to comment on the measures and, in the case of Council-recommended measures, the Council is actively preparing an FMP, FMP amendment, or proposed regulations to address overfishing on a permanent basis. Such measures, if otherwise in compliance with the provisions of the Magnuson-Stevens Act, may be implemented even though they are not sufficient by themselves to stop overfishing of a fishery.
(ii) If interim measures are made effective without prior notice and opportunity for comment, they should be reserved for exceptional situations, because they affect fishermen without providing the usual procedural safeguards. A Council recommendation for interim measures without notice-and-comment rulemaking will be considered favorably if the short-term benefits of the measures in reducing overfishing outweigh the value of advance notice, public comment, and deliberative consideration of the impacts on participants in the fishery.

(f) OY--(1) Definitions.

(i) The term ``optimum,'' with respect to the yield from a fishery, means the amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems; that is prescribed on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological factor; and, in the case of an overfished fishery, that provides for rebuilding to a level consistent with producing the MSY in such fishery.
(ii) In national standard 1, use of the phrase ``achieving, on a continuing basis, the OY from each fishery'' means producing, from each fishery, a long-term series of catches such that the average catch is equal to the average OY and such that status determination criteria are met.

(2) Values in determination. In determining the greatest benefit to the Nation, these values that should be weighed are food production, recreational opportunities, and protection afforded to marine ecosystems. They should receive serious attention when considering the economic, social, or ecological factors used in reducing MSY to obtain OY.

(i) The benefits of food production are derived from providing seafood to consumers, maintaining an economically viable fishery together with its attendant contributions to the national, regional, and local economies, and utilizing the capacity of the Nation's fishery resources to meet nutritional needs.
(ii) The benefits of recreational opportunities reflect the quality of both the recreational fishing experience and non-consumptive fishery uses such as ecotourism, fish watching, and recreational diving, and the contribution of recreational fishing to the national, regional, and local economies and food supplies.
(iii) The benefits of protection afforded to marine ecosystems are those resulting from maintaining viable populations (including those of unexploited species), maintaining evolutionary and ecological processes (e.g., disturbance regimes, hydrological processes, nutrient cycles), maintaining the evolutionary potential of species and ecosystems, and accommodating human use.

(3) Factors relevant to OY. Because fisheries have finite capacities, any attempt to maximize the measures of benefit described in paragraph (f)(2) of this section will inevitably encounter practical constraints. One of these is MSY. Moreover, various factors can constrain the optimum level of catch to a value less than MSY. The Magnuson-Stevens Act's definition of OY identifies three categories of such factors: Social, economic, and ecological. Not every factor will be relevant in every fishery. For some fisheries, insufficient information may be available with respect to some factors to provide a basis for corresponding reductions in MSY.

(i) Social factors. Examples are enjoyment gained from recreational fishing, avoidance of gear conflicts and resulting disputes, preservation of a way of life for fishermen and their families, and dependence of local communities on a fishery. Other factors that may be considered include the cultural place of subsistence fishing, obligations under Indian treaties, and worldwide nutritional needs.
(ii) Economic factors. Examples are prudent consideration of the risk of overharvesting when a stock's size or productive capacity is uncertain, satisfaction of consumer and recreational needs, and encouragement of domestic and export markets for U.S.-harvested fish. Other factors that may be considered include the value

of fisheries, the level of capitalization, the decrease in cost per unit of catch afforded by an increase in stock size, and the attendant increase in catch per unit of effort, alternate employment opportunities, and economies of coastal areas.

(iii) Ecological factors. Examples are stock size and age composition, the vulnerability of incidental or unregulated stocks in a mixed-stock fishery, predator-prey or competitive interactions, and dependence of marine mammals and birds or endangered species on a stock of fish. Also important are ecological or environmental conditions that stress marine organisms, such as natural and manmade changes in wetlands or nursery grounds, and effects of pollutants on habitat and stocks.

(4) Specification.

(i) The amount of fish that constitutes the OY should be expressed in terms of numbers or weight of fish. However, OY may be expressed as a formula that converts periodic stock assessments into target harvest levels; in terms of an annual harvest of fish or shellfish having a minimum weight, length, or other measurement; or as an amount of fish taken only in certain areas, in certain seasons, with particular gear, or by a specified amount of fishing effort. (ii) Either a range or a single value may be specified for OY. Specification of a numerical, fixed-value OY does not preclude use of annual target harvest levels that vary with stock size. Such target harvest levels may be prescribed on the basis of an OY control rule similar to the MSY control rule described in paragraph (c)(1)(ii) of this section, but designed to achieve OY on average, rather than MSY. The annual harvest level obtained under an OY control rule must always be less than or equal to the harvest level that would be obtained under the MSY control rule.

(iii) All fishing mortality must be counted against OY, including that resulting from bycatch, scientific research, and any other fishing activities.

(iv) The OY specification should be translatable into an annual numerical estimate for the purposes of establishing any TALFF and analyzing impacts of the management regime. There should be a mechanism in the FMP for periodic reassessment of the OY specification, so that it is responsive to changing circumstances in the fishery. (v) The determination of OY requires a specification of MSY, which may not always be possible or meaningful. However, even where sufficient scientific data as to the biological characteristics of the stock do not exist, or where the period of exploitation or investigation has not been long enough for adequate understanding of stock dynamics, or where frequent large-scale fluctuations in stock size diminish the meaningfulness of the MSY concept, the OY must still be based on the best scientific information available. When data are insufficient to estimate MSY directly, Councils should adopt other measures of productive capacity that can serve as reasonable proxies for MSY to the extent possible (also see paragraph (c)(3) of this section).

(vi) In a mixed-stock fishery, specification of a fishery-wide OY may be accompanied by management measures establishing separate annual target harvest levels for the individual stocks. In such cases, the sum of the individual target levels should not exceed OY.

(5) OY and the precautionary approach. In general, Councils should adopt a precautionary approach to specification of OY. A precautionary approach is characterized by three features:

(i) Target reference points, such as OY, should be set safely below limit reference points, such as the catch level associated with the fishing mortality rate or level defined by the status determination criteria. Because it is a target reference point, OY does not constitute an absolute ceiling, but rather a desired result. An FMP must contain conservation and management measures to achieve OY, and provisions for information collection that are designed to determine the degree to which OY is achieved on a continuing basis--that is, to result in a long-term average catch equal to the long-term average OY, while meeting the status determination criteria. These measures should allow for practical and effective implementation and enforcement of the management regime, so that the harvest is allowed to reach OY, but not to exceed OY by a substantial amount. The Secretary has an obligation to implement and enforce the FMP so that OY is achieved. If management measures prove unenforceable--or too restrictive, or not rigorous enough to realize OY--they should be modified; an alternative is to reexamine the adequacy of the OY specification. Exceeding OY does not necessarily constitute overfishing. However, even if no overfishing resulted from exceeding OY, continual

harvest at a level above OY would violate national standard 1, because OY was not achieved on a continuing basis.

(ii) A stock or stock complex that is below the size that would produce MSY should be harvested at a lower rate or level of fishing mortality than if the stock or stock complex were above the size that would produce MSY.

(iii) Criteria used to set target catch levels should be explicitly risk averse, so that greater uncertainty regarding the status or productive capacity of a stock or stock complex corresponds to greater caution in setting target catch levels. Part of the OY may be held as a reserve to allow for factors such as uncertainties in estimates of stock size and DAH. If an OY reserve is established, an adequate mechanism should be included in the FMP to permit timely release of the reserve to domestic or foreign fishermen, if necessary.

(6) Analysis. An FMP must contain an assessment of how its OY specification was determined (section 303(a)(3) of the Magnuson-Stevens Act). It should relate the explanation of overfishing in paragraph (d) of this section to conditions in the particular fishery and explain how its choice of OY and conservation and management measures will prevent overfishing in that fishery. A Council must identify those economic, social, and ecological factors relevant to management of a particular fishery, then evaluate them to determine the amount, if any, by which MSY exceeds OY. The choice of a particular OY must be carefully defined and documented to show that the OY selected will produce the greatest benefit to the Nation. If overfishing is permitted under paragraph (d)(6) of this section, the assessment must contain a justification in terms of overall benefits, including a comparison of benefits under alternative management measures, and an analysis of the risk of any species or ecologically significant unit thereof reaching a threatened or endangered status, as well as the risk of any stock or stock complex falling below its minimum stock size threshold.

(7) OY and foreign fishing. Section 201(d) of the Magnuson-Stevens Act provides that fishing by foreign nations is limited to that portion of the OY that will not be harvested by vessels of the United States.

(i) DAH. Councils must consider the capacity of, and the extent to which, U.S. vessels will harvest the OY on an annual basis. Estimating the amount that U.S. fishing vessels will actually harvest is required to determine the surplus.

(ii) DAP. Each FMP must assess the capacity of U.S. processors. It must also assess the amount of DAP, which is the sum of two estimates: The estimated amount of U.S. harvest that domestic processors will process, which may be based on historical performance or on surveys of the expressed intention of manufacturers to process, supported by evidence of contracts, plant expansion, or other relevant information; and the estimated amount of fish that will be harvested by domestic vessels, but not processed (e.g., marketed as fresh whole fish, used for private consumption, or used for bait).

(iii) JVP. When DAH exceeds DAP, the surplus is available for JVP. JVP is derived from DAH.

1.4 Draft Plan Team Recommendations on overfishing, OY, and MSY

Crab fisheries in the Bering Sea and Aleutian Islands (BSAI) area have been prosecuted quite differently compared to finfish fisheries. In the latter, the entire mature segment of a population or spawning biomass is typically vulnerable to fishing. Sustainable yield (SY) or its maximum (MSY) can be regarded for finfish as a biological parameter related to stock productivity and mortality. In contrast BS/AI crab fisheries have been subject to various constraints since their inception, restricting the fishery from harvesting substantial portions of the mature population. Paramount among these have been a prohibition against harvesting of females. Additionally minimum size limits were set to ensure that males would have at least one opportunity to breed before reaching legal size unless market preferences dictate acceptance of only crabs larger than legal size. Crab fisheries in the BSAI have been constrained by guideline harvest levels (GHLs) that are intended to promote stability in the face of variable recruitment.

The Crab Plan Team carefully debated interpretation of the Magnuson-Stevens Act Provisions; National Standard Guidelines during their discussions of optimum yield, maximum sustainable yield and overfishing.

The team respectfully submitted comments on guidelines but proceeded in their definition of terms and evaluations of biological reference points for National Standard 1 in deference to the guidelines.

A suitable time period for MSY computations requires that environmental (including ecological) conditions remain reasonably constant over the period sustainable yields are considered. The team debated three definitions of the term "long-term" necessary for definition of terms; more than a life span, a life span, or a recruitment cycle. The team concluded the definition should depend on the species, the number of years of available catch data for a stock, and the length of environmental regimes. The team interpreted "prevailing" conditions as those at the current time implying the average yield may be based on something less than the longest available series of data. A period of 15 years from 1983 to 1997 was chosen to evaluate biological reference points as it was considered representative of the present ecological regime and environmental conditions. The Team considered the 15 years (1983-1997) as representative of current environmental conditions because: (1) many crab stocks seem to have declined until the early 1980s and then stabilized; (2) finfish populations that increased sharply during the late 1970s (regime shift) seem to have stabilized somewhat by 1983; (3) recruitment from the generally high crab populations of the 1970s would have been evident or have dissipated by 1983; and (4) conditions in crab populations (particularly red and blue king crabs) are relatively stable over this period. In choosing this time period the plan team recognized that MSY would be much lower, for many stocks, as compared to using a longer time series. The Team felt that it was extremely important to adhere to the available guidelines and select a time period that was representative of current environmental conditions. The Team recognized that MSY estimates have to be periodically evaluated as more information becomes available. The Team agreed to review estimates on a 5 year review cycle or in the event that environmental conditions signal a regime shift.

1.4.1 Proposed New Definitions

The definition of optimum yield, MSY, and threshold levels proposed by Alternative 2, are derived from definitions contained in the Magnuson-Stevens Act or based on the proposed rule. These definitions have been incorporated into the draft FMP update (see appendix).

Optimum Yield: The term 'optimum', with respect to the yield from a fishery, means the amount of crab which --

(a) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;

(b) is prescribed as such on the basis of maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and

(c) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Maximum sustainable yield (MSY) is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. MSY was estimated from the best information available. Several BSAI crab stocks have insufficient scientific data to estimate biological reference points and stock dynamics are inadequately understood.

Overfishing: The term "overfishing "and "overfished " mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce MSY on a continuing basis. Overfishing is defined for king and Tanner crab stocks in the BSAI management area as any rate of fishing mortality in excess of the maximum fishing mortality threshold, F_{msy}, for a period of 1 year or more. Should the actual size of the stock in a given year fall below the minimum stock size threshold, the stock is considered overfished.

MSY control rule means a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY. The MSY control rule for king and Tanner crabs is the mature biomass of a stock under prevailing environmental conditions, or proxy there of, exploited at a fishing mortality rate equal to a conservative estimate of natural mortality.

MSY stock size is the average size of the stock, measured in terms of mature biomass, or a proxy there of, under prevailing environmental conditions. It is the stock size that would be achieved under the MSY control rule. It is also the minimum standard for a rebuilding target when remedial management action is required.

Maximum fishing mortality threshold is defined by the MSY control rule, and is expressed as the fishing mortality rate. The MSY fishing mortality rate $F_{msy} = M$, a conservative natural mortality value set equal to 0.20 for all species of king crab, and 0.30 for all *Chionoecetes* species.

Minimum stock size threshold, is whichever is greater: one half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold. The minimum stock size threshold is expressed in terms of mature biomass.

1.4.2 Management of BSAI Crab Stocks Relative to MSY

The FMP establishes a State/Federal cooperative management regime that defers crab management to the State of Alaska with Federal oversight. The Alaska Department of Fish and Game (ADF&G) in consultation with the National Marine Fisheries Service recommends appropriate management measures for a given year and geographical area consistent with the Alaska Board of Fisheries (Board) policy on King and Tanner Crab Resource Management (Finding No. 90-04-FB; ADF&G 1992), the FMP, the Magnuson-Stevens Fisheries Conservation and Management Act, and other State and Federal laws. Furthermore, the Board has adopted a harvest strategy for king and Tanner crab stocks that is to be consistent with the Board's policy on king and Tanner crab management (ADF&G 1997). The harvest strategy specifies ADF&G shall establish, if adequate data are available, threshold level of abundance and shall close the fishery during the entire fishing season on any stock that is below its threshold level of abundance. This harvest strategy controls the removal of legal male crabs from a stock by establishing a guideline harvest level (GHL) for the commercial fishery. Data used to determine GHLs and, if appropriate, exploitations rates, may include estimates of exploitable biomass, estimates of recruitment, estimates of threshold, estimates accepted biological catch, historical fishery performance data, estimates of reproductive potential, and market or other economic considerations. The harvest strategy is set to minimize the risk of overfishing.

1.4.3 Adequacy of Current Overfishing Definition

Scientific review of the FMP definitions of overfishing for BSAI crab stocks was limited to the Bristol Bay red king crab (*Paralithodes camtschaticus*) stock and the Bering Sea Tanner crab (*C. bairdi*) stock (Rosenberg et. al. 1994). The overfishing definition for these two stocks was found neutrally conservative as a threshold rather than a target. The review pointed out that handling and discard mortality strongly affect the calculation of the maximum fishing mortality rate since only males greater than a specific size can be legally harvested. The scientific review stated that handling and discard mortality need to be investigated further. Several recent and current studies should provide guidance on the magnitude of handling mortality in the directed pot and bottom trawl fisheries (Murphy and Kruse 1995, Zheng et. al. 1995, Zhou and Shirley 1996, MacIntosh et. al. 1996, Tracy and Pengilly 1996, Heifetz 1997). The scientific review noted some ambiguity in the current overfishing definition because who should decide which tier to assign a stock to was not specified. All stocks were assigned to one of the three tiers by the NPFMC Crab Plan Team in its Environmental Assessment for Amendment 1 of the Fishery Management Plan (NPFMC 1990).

1.4.4 Analysis of OY, MSY and Overfishing

Estimation of Optimum Yield

Considering the history of regulations for BSAI crabs and in light of the MSFCMA, the catch history for the stocks actually reflects OY rule making. This is because the regulatory process considers social (e.g., desire for stabilized economy) and economic factors (e.g., marketability of females and small males) as well as biological (e.g., growth, mortality, abundance) factors. Under alternative two optimum yield is estimated for BSAI king crabs to be on average less than MSY. Crab in the BSAI are currently managed to optimize yield. As a result, a set of OY control rules is already in operation to reduce MSY by appropriate factors.

OY Control Rules

Sex restriction, no harvest of female crabs;
Size restriction, only crabs greater than or equal to a minimum size limit may be harvested;
Guideline Harvest Levels estimated from exploitation rate strategy or fishery performance data;
Non-retained catch of directed harvest;
Non-directed harvest including subsistence, sport, and bycatch.

Proposed OY ranges are shown in Table 2.

Estimation of Maximum Sustained Yield

Harvest strategies have evolved for stocks of Bering Sea and Aleutian Islands crab species as more data have been collected. Management of king crabs has varied from *size and sex (2-S), to size, sex and season (3-S)*, to *fishery performance management* to *exploitation rate management* (Kruse 1993). Integral to the type of management is the presence or absence of biomass estimates. The Bering Sea red and blue king crab stocks have a long history of surveys and been studied extensively allowing estimation of stock biomass. Harvests of Bering Sea red and blue king crab stocks have been determined using exploitation rates for some time. The Bering Sea Tanner and snow crab stocks have also been surveyed and studied for sufficient time to allow estimation of biomass. Harvests have been projected using exploitation rate management. Red king and Tanner crab stocks in the Aleutian Islands were first prosecuted with 2-S and 3-S management and once supported fisheries in the multi-million pound range but these fisheries are now closed. The remaining stocks of deep water king crab and *Chionoecetes* species have limited or no survey data precluding estimation of biomass. Harvest of golden king crabs began under 2-S management but more recently has

been based on fishery performance as measured by average catch from the stocks. The harvest of scarlet king crabs and *Chionoecetes* species has been by developing fisheries permit or incidental to harvest from other directed crab fisheries.

In the BSAI crab FMP, the mean harvest over the history of a fully developed fishery was considered MSY for a given stock (Alternative 1, status quo). Under Alternative 2 we depart from past practice and attempt to compute MSY on the basis of what is known of the biomass of the male and female portion of the mature population or total mature biomass (*MB*) of a stock. Note that *MB* is simply an estimate of the total biomass of individuals that are physiologically mature and makes no assumptions as to what proportion of them actually spawn.

Stocks that are not surveyed or only have limited years of survey data require different methods to estimate *MB* and MSY than stocks that are regularly surveyed. For data poor stocks, *MB* was estimated in part using a ratio of legal biomass to mature biomass and corresponding utilization rate for representative stocks. The Bristol Bay red, Pribilof Island red and blue, and St. Matthew Island blue king crab stocks were selected to estimate the proxy mature biomass and utilization rates for the Western Aleutian Islands stock of red king crabs. These stocks were also used as the proxy stocks for the deep water king crabs: Aleutian Islands and Bering Sea scarlet king crabs, and the Aleutian Islands, Pribilof Islands and St. Matthew Island golden king crab stocks. Both Bering Sea Tanner and snow crabs were chosen as being representative proxy stocks for the Eastern and Western Aleutian Islands Tanner crab stocks and deep water Tanner crabs *Chionoecetes tanneri* and *C. angulatus* crab stocks in the Eastern and Western Aleutians and Eastern Bering Sea.

A fraction of the *MB* is considered sustained yield (*SY*) for a given year and the average of the *SY*s over a suitable period of time is considered the MSY. In this approach, the assumed level of fishing mortality (*F*) that corresponds to MSY is equal to the natural mortality (M) of an unfished stock. This value of M was determined by taking the largest crab size observed during surveys or other sampling opportunities prior to the development of substantial fishing (Wallace et al 1949, NMFS unpublished), converting this roughly to age and then computing M from equations given by Hoenig (1983).

The longevity of Bristol Bay red king crab was considered as representative for all king crabs (*Paralithodes* and *Lithodes*) while that of the EBS Tanner crab (*C. bairdi*) as representative of all members of the genus *Chionoecetes*. The largest red king crab observed was 197 mm in carapace length (CL) (Wallace et al 1949) and the largest known from Bristol bay fisheries was 205 mm CL. Growth models (e.g. Balsiger 1974) indicate that a crab of 157 mm is about 14 years old while tagging studies indicate that a king crab of this size may be recovered as much as 6 years later. The maximum age of red king crab near Kodiak (ADF&G unpublished, news release) has been estimated at 24 years. For the purposes of computing MSY, values of 22 to 24 years were considered as maximum age and these correspond to *F* values of .20 and .19; F=0.20 was chosen for king crabs. During the 1969 and 1970 NMFS trawl surveys 20,117 Tanner crabs were measured and a maximum size of 199 mm carapace width (CW) was obtained. Using Somerton's (1981) growth model as well as tagging data, a Tanner crab of this size would be approximately 15 years of age which corresponds to F= 0.295. F=0.30 was chosen for Chionoecetes species.

Estimation of MSY for Stocks Using Proxy Estimate of MSY

Use of a proxy measure of *MB* requires assumptions be made for both the proxy stock and data poor stock. The procedure assumes the ratio of legal to mature crab biomass of the proxy stock reflects its' status given the environment and utilization over time. We also assumed population structure of a data poor stock responded similarly to the proxy stock under the same environmental regime. Since *MB* of the data poor stock is unknown, utilization rates could not be estimated and were assumed to equal those of the proxy stock. Given the ratio of legal to mature biomass is a function of the utilization rates for the proxy stock,

then application of the ratio to data poor stocks assumes the same history of utilization rates was experienced.

$MSY = \Sigma SY_n/N$

SY_n is the sustainable yield in year n
N is the number of catch years ≡ 15 years (1983-1997)

$SY_n = MB_n * F_{msy}$

MB_n is the average total mature biomass available for year n.
$MB_n = C_n * 1/U_{an} * 1/R_n$

C_n is the harvest of legal male crabs landed in year n and expressed in millions of pounds.

U_{an} is the assumed rate of utilization or fraction of the number of legal-sized male crabs landed in year n for stocks with no estimates of mature biomass.
U_{an} is the average of the utilization rates in year n for N_p representative or proxy stocks.
$U_{an} = \Sigma U_{anp}/N_p$

U_{anp} is the ratio of the harvest of legal male crabs (in millions of pounds), C_{np}, in year n, from proxy stock p, to the total legal biomass, LB_{np}, of proxy stock p, in year n.
$U_{anp} = C_{np}/LB_{np}$

N_p is the number of representative or proxy stocks.
1. $N_p = 4$ for non-surveyed stocks of king crab. Designated proxy stocks include Bristol Bay red king crabs, Pribilof Islands red king crabs, Pribilof Islands blue king crabs, and St. Matthew Island blue king crabs.
2. $N_p = 2$ for non-surveyed *Chionoecetes* stocks. Proxy stocks are Bering Sea Tanner and snow crabs.

R_n is the average of the ratios R_{np} of biomass of legal-sized male crabs, LB_{np}, to total mature female and male crab biomass MB_{np} in year n for N_p representative or proxy stocks.
$R_n = \Sigma R_{np}/N_p$
$R_n = \Sigma (LB_{np}/MB_{np})/N_p$

N_p is the number of representative or proxy stocks.
1. $N_p = 4$ for non-surveyed stocks of king crab. Designated proxy stocks include Bristol Bay red king crabs, Pribilof Islands red king crabs, Pribilof Islands blue king crabs, and St. Matthew Island blue king crabs.
2. $N_p = 2$ for non-surveyed *Chionoecetes* stocks. Proxy stocks are Bering Sea Tanner and snow crabs.

F_{msy} is the instantaneous fishing mortality rate at MSY.
$F_{msy} = M$, a conservative estimate of the instantaneous rate of natural mortality.
$F_{msy} = 0.2$ for king crabs
$F_{msy} = 0.3$ for *Chionoecetes* species

Estimation of MSY for Stocks with Mature Biomass Estimates

The *MB* for surveyed king crab stocks was computed by considering the catchability or probability of capture in survey trawl of each 5 mm size group of crabs, the proportion mature, the mean weight, and unadjusted survey index of abundance for each size and sex group. The *MB* for surveyed Tanner and snow crabs was computed by considering the proportion mature, the mean weight, and unadjusted survey index of abundance for each size and sex group. The *MB* for a given year is taken as the sum of biomass over size and sex and considered as the annual average biomass for a single annual cohort. Baranov's catch equation is then simplified to $C_n = F * MB_n$. This was done because the timing of fisheries relative to the survey or to recruitment is in part an optimum yield consideration and also varies from stock to stock.

$MSY = \Sigma SY_n/N$

SY_n is the sustainable yield in year n.
N is the number of catch years ≈ 15 years (1983-1997).

$SY_n = MB_n * F_{msy}$

MB_n is the average total mature biomass available for year n.
$MB_n = B_{mn} + B_{fn}$

B_{mn} is the sum of the biomass of mature male crabs of size l, in year n.
$B_{mn} = \Sigma((A_{mln} * P_{ml}) * W_{ml})/ q_{ml}$

B_{fn} is the sum of the biomass of mature female crabs of size l, in year n.
$B_{fn} = \Sigma((A_{fln} * P_{fl}) * W_{fl})/ q_{fl}$

A_{mln} and A_{fln} are abundance of male and female crabs by 5 mm length category l, in year n, as estimated by area swept methods using annual NMFS survey data.

q_{ml} and q_{fl} are the probability of capture of male and female crabs by 5mm length category l.

P_{ml} and P_{fl} are the proportion of mature male and female crabs by 5mm length category l.

W_{ml} and W_{fl} are the factors for conversion of length L, to weight W, for male and female crabs by 5mm length category l.

F_{msy} is the instantaneous fishing mortality rate at MSY.
$F_{msy} = M$, a conservative estimate of the instantaneous rate of natural mortality.
$F_{msy} = 0.2$ for king crabs.
$F_{msy} = 0.3$ for *Chionoecetes* species.

1.4.5 Definition of Available Data Tiers

Three tiers of data are characterized for evaluation of OY, MSY, and overfishing according to the data available to quantify biological reference points. Each of the 20 stocks of crab in the BSAI management area is assigned to one of the tiers.

Tier 1) Crab stock is not surveyed. Harvest data range from minimal due to exploratory fishing to continuous historic landings to developing fisheries with onboard monitoring of catch. Crab stocks in the BSAI with a developing fishery designation have not been surveyed, harvests are incidental to other directed fisheries or directed fishing has only recently developed. Catch, effort and biological data have been collected from fisheries on these stocks beginning in 1994 and will provide good data for estimation of biological reference points in the future since they are permit only fisheries requiring 100% observer coverage. Magnitude of catches from developing fisheries for BSAI crab are largely market driven and are therefore a function of both domestic and foreign harvest levels on stocks with developed fisheries. Fisheries on stocks of the deep water scarlet king crab, *Lithodes couesi*, and deep water triangle and grooved Tanner crabs, *Chionoecetes angulatus* and *C. tanneri* are all managed as developing fisheries.

Alternative 1. Status Quo. Do not evaluate MSY.
Alternative 2. MSY is estimated from a proxy of the mature biomass and stock utilization rate.

Tier 2) Sporadic or limited years of survey data. Catch and effort data on each crab stock is well documented.

Alternative 1. Status Quo. Do not evaluate MSY.
Alternative 2. MSY is estimated from a proxy of the mature biomass and stock utilization rate.

Tier 3) Data available: Historical catch, continuous inseason catch and effort data, stock assessment, growth, maturity, limited natural mortality and stock recruitment relationship information.

Alternative 1. Status Quo. MSY equals the mean of the available year so harvest data.
Alternative 2. MSY equals the product of the estimated mature biomass and the instantaneous fishing mortality rate at MSY.

Crab Stocks Characterized by Tier 1 Data

Pribilof Islands golden king crab: This stock is characterized by tier 1 data as there is no survey of golden king crab in the area. Harvest of Pribilof Islands brown king crab is by permit issued by the Commissioner of ADF&G (ADF&G, 1997). No fishing mortality rate has been estimated for Pribilof Islands golden king crabs. The maximum fishing mortality threshold for this stock F_{msy}= M = 0.2.

Northern District golden king crab: This stock is characterized by tier one data because there is no survey of the stock. Harvest of Northern District golden king crab is by permit issued by the Commissioner of ADF&G (ADF&G 1997). Sporadic harvest of this stock has occurred since 1982 (Morrison et al. 1997). No fishing mortality rate has been estimated though as no landings were made in 1997. The maximum fishing mortality threshold for Northern District golden king crabs is F_{msy}= M = 0.2.

Adak *C. bairdi* Tanner crab (Western Aleutian): This stock is characterized by tier one data because there is no survey of Adak Tanner crabs. This stock of crabs has generally been harvested incidental to Adak red king crab (Morrison et al. 1997b). There have only been two confidential landings of Adak Tanner crabs since 1991.No fishing mortality rate has been estimated for this stock as there were no landings in 1997. The maximum fishing mortality threshold should be F_{msy}= M = 0.3.

Saint Lawrence Island blue king crab: This stock is characterized by unique tier 1 data that should be considered to determine if OY, MSY and overfishing should be evaluated. The St. Lawrence Island blue king crab stock has been subject to limited intermittent harvest. The first and largest catch from the area

occurred in 1983 when 52,557 pounds of blue king crab were taken near the southeast shore of the Island (Lean and Brennan 1997). The following year the waters within 10 miles of all inhabited Islands in the St. Lawrence Island area were closed to protect king crab stocks targeted by local fisherman and reduce impacts on subsistence marine mammals. Commercial harvest has occurred in only three years since closure of nearshore waters: total catches in 1989 and 1992 were 984 pounds and 53 pounds while catch in 1995 was 7,913 pounds. The combination of closed waters and sporadic catch suggest harvest in offshore waters is extremely limited. A nearshore winter fishery is allowed by regulation. However, local residents have decided not to export any of their winter catch for commercial sale. No fishing mortality rate has been estimated for this stock since there has been no commercial harvest since 1995. The maximum fishing mortality threshold for St. Lawrence Island blue king crabs should be $F_{msy} = M = 0.2$.

Aleutian Islands Scarlet king crab: This stock is characterized by tier 1 data. Scarlet king crabs in the Aleutian Islands are harvested as incidental catch in the Aleutian golden king crab fisheries (historic Dutch Harbor and Adak areas) and the Eastern and Western Aleutian Deep Water Tanner crab fisheries. In the Bering Sea, scarlet king crabs are harvested incidentally in the Bering Sea triangle Tanner crab and golden king crab fisheries. No fishing mortality rate has been estimated for this stock since there are no directed fisheries for Aleutian Islands scarlet king crab. The maximum fishing mortality threshold should be $F_{msy} = M = 0.2$.

Bering Sea triangle Tanner crab: This stock is characterized by tier 1 data. Bering Sea triangle Tanner crabs were harvested as incidental catch in the grooved Tanner crab fishery until 1995 when the first landings from directed fishing for the species was reported. Catch data have been collected for 1995 and 1996. No fishing mortality rate has been estimated for this stock since there were no landings of triangle Tanner crab reported from the Bering Sea in 1997. The maximum fishing mortality threshold should be $F_{msy} = M = 0.3$.

Eastern Aleutian Islands triangle Tanner crab: This stock is characterized by tier 1 data. Eastern Aleutian Islands triangle Tanner crab were harvested as incidental catch in the grooved Tanner crab fishery until 1995 when the first landings from directed fishing for the species were reported. No fishing mortality rate is estimated for this stock because no harvest was reported from the Eastern Aleutian Islands in 1997. The maximum fishing mortality threshold should be $F_{msy} = M = 0.3$.

Eastern Aleutian Islands grooved Tanner crabs: This stock is characterized by tier 1 data. In the early 1980's grooved Tanner crabs were occasionally landed from the Eastern Aleutian Island waters incidental to the developing golden king crab fishery. No directed harvest of grooved Tanner crab in the area was reported until 1993. Catch peaked at over 880,000 pounds in 1995 was incidental to the golden king crab fishery again in 1996. No fishing mortality rate has been estimated for this stock since there were no landings of grooved Tanner crabs reported from the Eastern Aleutian Islands in 1997. The maximum fishing mortality threshold should be $F_{msy} = M = 0.3$.

Western Aleutian Islands grooved Tanner crab: This stock is characterized by tier 1 data. Grooved Tanner crabs have been noted in catches of the Adak area golden king crab fishery since it began developing the 1970s. Harvest was first reported in 1992 but directed fishing effort for grooved Tanner crabs didn't occur until 1994. Catch history is confidential for three out of four years harvests have been reported. No fishing mortality rate is estimated for this stock. The maximum fishing mortality threshold should be $F_{msy} = M = 0.3$.

Bering Sea grooved Tanner crab: This stock is characterized by tier 1 data. The first landing of grooved Tanner crab from the Bering Sea were reported in 1988 but no further harvest followed until 1994. Harvest peaked at over 1 million pounds in 1995, declined sharply in 1996 and no landings were made in 1997 (Morrison et. al. 1997c.). No fishing mortality rate has been estimated for this stock since there were no

landings of grooved Tanner crabs reported from the Bering Sea in 1997. The maximum fishing mortality threshold should be F_{msy}= M = 0.3.

Crab Stocks Characterized by Tier 2 Data

Aleutian Islands red king crab (Dutch Harbor and Adak red king crab stocks): The Dutch Harbor red king crab stock has unique tier 2 data as the stock has not been fished since 1983. As such the catch and effort data for this stock do not reflect the prevailing ecological and environmental conditions. A survey of the E. Aleutians in 1991 and 1994 indicated no significant improvement in stock status since the fishery was closed. A survey in 1995, indicated further reductions in the Dutch Harbor stock as no red king crab were caught. Based on these results rebuilding of the Dutch Harbor red king crab stock is not expected in the near future (Morrison et. al. 1997a., 1997b.). The Adak stock of red king crab is characterized by tier 2 data, however, the stock has not been surveyed since 1977. The fishery for Adak red king crab was closed in 1996. Analysis of recent catch statistics indicates the population abundance is depressed and no commercial fishery is anticipated in the near future. The maximum fishing mortality threshold for these stocks of red king crab in the Aleutian Islands should be F_{msy}= M = 0.2.

Norton Sound red king crab: This stock is characterized by tier 2 data. Sporadic surveys using variable gear types have been conducted in Norton Sound to assess status of the red king crab stock. An abundance index was estimated for Norton Sound red king crab in 1996, the first, since it was last surveyed in 1991. The legal male crab abundance was estimated to have declined dramatically (Fair 1997). The maximum fishing mortality threshold for Norton Sound red king crab should be F_{msy}= M = 0.2. An overfishing mortality rate for Norton Sound red king crabs was evaluated by Kruse et. al. (1996) and $F_{0.3}$ was estimated to equal 0.27. The 1997 GHL was 80,000 pounds and 93,000 pounds were landed in the fishery. The 1997 fishing mortality rate was also below $F_{0.3}$. A length-based stock synthesis model is now available to estimate legal male crab abundance (Zheng et. al. MS).

Aleutian Islands golden king crab (Eastern Aleutians (Dutch Harbor) and Adak golden king crab stocks): These stocks are characterized by tier 2 data. Two surveys (1991and 1997) have been conducted in a portion of the area considered golden king crab habitat. The 1997/98 GHL for the Aleutians golden king crab stocks was set at 3.2 million pounds east of 174° W. longitude, and 2.7 million pounds west of 174° W. longitude. Total harvest in 1997 from the area east of 174° W. longitude was 3.56 million pounds. The fishery west of 174° W longitude is still open. The maximum fishing mortality threshold should be F_{msy}= M = 0.2.

Eastern Aleutian Islands *C. bairdi* Tanner crab: This stock is characterized by tier 2 data. Four surveys of the area since 1990 indicate the population has been in decline. No fishing mortality rate is estimated for this stock because the fishery has been closed since 1995. The maximum fishing mortality threshold for Eastern Aleutian Tanner crabs should be F_{msy}= M = 0.3.

Crab Stocks characterized by Tier 3 Data

Bristol Bay red king crab: This stock is characterized by tier 3 data. Despite stock improvements, the abundance of red king crab in Bristol Bay remains low relative to historic levels. The Length-based Analysis (LBA) estimate of effective spawning biomass was 31.4 million pounds in 1997, less than half the target rebuilding level of 55 million pounds but above the State's threshold level of 14.5 million pounds (Zheng et. al. 1997). The LBA estimate of mature female abundance was 10.2 million crabs also in excess of the threshold level of 8.4 million crabs. A GHL of 7.0 million pounds was set for 1997. Harvest exceeded the GHL by 1.4 million pounds but the total fishing mortality rate was below the proposed maximum fishing mortality threshold F_{msy} = M = 0.2.

Pribilof Islands red king crab: This stock is characterized by tier 3 data. Historically red king crabs have not been abundant in the Pribilof Islands and landings were taken incidentally during the blue king crab fishery (Otto et. al. 1997). The series of survey indices of abundance and fishery catch data indicate a long-term population decline (Stevens et. al. 1998). Pribilof Islands red king crabs are harvested in a combined fishery for blue and red king crab in the Pribilof Islands District. The combined GHL in 1997 was 1.5 million pounds. Total harvest of red king crabs was estimated to be 685,000 pounds and the total fishing mortality rate was below the proposed maximum fishing mortality threshold $F_{msy} = M = 0.2$.

Pribilof Islands blue king crab: This stock is characterized by tier 3 data. The stock abundance index for Pribilof Islands blue king crabs has declined and is well below the historic average (Stevens et. al.1998). Mature male crab abundance was estimated at 1.1 million crabs using catch survey analysis (CSA) (Zheng et. al. 1997) and was above the threshold of 770,000 crabs (Pengilly and Schmidt 1995). Pribilof Islands blue king crabs are harvested in a combined fishery for blue and red king crab in the Pribilof Islands District. The 1997 GHL was 1.5 million pounds. Total harvest of blue king crabs was estimated to be 696,000 pounds and the total fishing mortality rate was below the proposed maximum fishing mortality threshold $F_{msy} = M = 0.2$.

Saint Matthew Island blue king crab: This stock is characterized by tier 3 data. The 1997 index of abundance for Blue king crabs in waters around Saint Matthew Island was relatively unchanged from 1996 at 10 million crabs. The abundance of mature male crabs was estimated to be 5.3 million crabs, greater than the threshold of 600,000 crabs (Zheng et. al. 1997, Pengilly and Schmidt 1995). The 1997 GHL for Saint Matthew Island blue king crab was 5.0 million pounds. The fishery was closed with an estimated total harvest of 4.7 million pounds. The fishing mortality rate was below the proposed maximum fishing mortality threshold $F_{msy} = M = 0.2$.

Bering Sea *C. bairdi* Tanner crab: This stock is characterized by tier 3 data. Total abundance of Bering Sea Tanner crab continues to decline. This trend is not expected to change for several years as little recruitment is apparent (Stevens et. al.1998). No GHL was set for Bering Sea Tanner crab in the 1997/98 fishing season. Furthermore, retention of incidentally harvested C. bairdi during the Bristol Bay red king crab fishery was prohibited. Bering Sea Tanner crab are considered overfished as the mature biomass as estimated from the 1997 survey is less than 50% of the MSY biomass.

Bering Sea *C. opilio* snow crab: This stock is characterized by tier 3 data. Total abundance of Bering Sea snow crab continues to decline. However, a strong year class that probably hatched in the period 1988-1990 has resulted in good recruitment to the fishery. Continued recruitment to the large size category should offset losses due to fishing and mortality in 1998 but the lack of very small crabs may indicate declining abundance over a longer term (Stevens et. al. 1998). The 1998 GHL for Bering Sea snow crab was set at 226 million pounds for large male crabs $\geq$ 4.0 in carapace width. Total harvest was estimated to be 245 million pounds and the fishing mortality rate was below the proposed maximum fishing mortality threshold $F_{msy} = M = 0.3$.

Evaluating overfishing

In evaluating stock status relative to overfishing a number of factors are taken into account including: overall stock status; estimates of representative components of the stock biomass; previous fishing season performance; and projected total harvest for the upcoming season. For stocks lacking survey estimates of biomass, Tier 1 and Tier 2 stocks, methods of evaluating overfishing rely on fishery data, proxy estimates of biomass from surveyed stocks, and catch-length analysis. The methods for surveyed stocks, those with Tier 3 data, are well illustrated by the Bering Sea *C. bairdi* Tanner crab as described below. In either case, overfishing is evaluated prior to the fishing season using two approaches. First by comparison of the

estimated mature biomass to the minimum stock size threshold and second by comparison of the expected utilization rate to the maximum fishing mortality threshold. The expected utilization rate is the projected guideline harvest level divided by the estimate of legal male abundance.

Tier 1 and 2 Stocks

For stocks without survey estimates of abundance, fishery data is relied upon to generate estimates of harvestable population size or biomass and to provide estimates of the harvest rate incurred in a previous and upcoming fishing season or fishery in progress. In increasing order of detail, fish tickets, dockside sampling, and on-board observers provide the principal sources of fishery data. The detail of data collected from a fishery season will depend upon the degree of coverage by dockside samplers and onboard observers. Fish tickets are available from each landing of each vessel and provide catch and effort data for each statistical area for a landing. Dockside samplers and observers onboard floating processors augment fish ticket data by obtaining size and shell condition data from delivered crabs and by interviewing skippers to obtain data on daily catch and effort by statistical area. Observers on board fishing vessels collect the same data as dockside samplers and observers onboard floating processors, but also randomly sample pot lifts during the commercial fisheries to obtain data on directed catch, bycatch, (species-sex-size composition of incidental catch), soak time, and exact locations of pot lifts. The more detailed information provided by interview or, especially observer data can be used to assess and correct for the conditions assumed for use of the abundance estimator. Observer data from fishing vessels, for example, can provide an estimate of the distribution of the exploited portion of the stock, data on changes in the geographic distribution of fishery effort during or between seasons, information on localized depletion, and data on changes in catch composition during or between seasons. For Tier 1 stocks and for those Tier 2 stocks without recent survey or fisheries, depletion estimators of abundance using fisheries data must be relied upon. Catch-length analysis models (Zheng et al. 1995) have potential as abundance estimators for some Tier 2 stocks with long and unbroken time series of fishery catch and effort data. A triennial pot survey for the Aleutians golden king crab stock east of 174° W will provide abundance indices and data on stock distribution that is independent of fishery data that can be used to calibrate a catch-length analysis. For evaluating stock level and fishing mortality relative to overfishing criteria, spawning biomass estimates and the fishing mortality of mature males can be generated by applying estimates of legal male abundance to the "proxy" stock mature-to-legal biomass ratios (see Estimation of MSY for Stocks Using Proxy Biomass Estimate of MSY).

Tier 3 Stocks (e.g. Bering Sea *C. bairdi* Tanner Crab)

The total population abundance of Bering Sea Tanner crabs has declined steadily since 1989 when the strong cohort of crabs (apparently 1988-1992) recruited to the fishery then began decline due to natural mortality and fishery removals. As this cohort ages, the proportion of oldshell and very oldshell crabs has increased and that of newshell crabs decreased. Old shell crab are not expected to molt again in their life span which further contributes to lack of new recruits to the legal portion of the population. The abundance index of large male, pre-recruit male and large female crabs decreased over 60% from 1996 to 1997. This is the second lowest estimate of large male crabs and the lowest estimate of large female crabs in the history of the fishery. Low abundance of recruit size crabs suggests that the population will continue to decline for several years.

In 1996, the GHL for Bering Sea Tanner crabs was set at 6.2 million pounds based on a 40% exploitation of legal male crabs. A total of 1.8 million pounds of *C. bairdi* were harvested before the fishery was closed due to low catch per pot. This poor fishery performance coupled to depressed stock abundance was instrumental in the management decision to forego the 1997 fishery that had an estimated guideline harvest level of 3.4 million pounds. Stock conservation concerns particularly for potential overfishing were paramount in this decision.

Overfishing for Bering Sea Tanner crabs under alternative one (status quo) is defined as a fishing mortality rate in excess of F_{MSY} estimated as $F_{0.1} = 0.34$ based on the size of first maturity for male crabs. Evaluating the fishing mortality rate based on the midpoint and 95% confidence interval of mature male abundance indicated that the forgone GHL for the directed fishery would not have risked overfishing. Fishing mortality from the anticipated Bering Sea Tanner crab PSC for 1998 (average of 1996 and 1997) would not approach $F_{0.1}$ either. Cumulatively, the opposite may have been true, an important fact that was considered in the 1997 decision to close the fishery.

Overfishing for Bering Sea Tanner crabs under alternative two is defined as a fishing mortality rate in excess of F_{MSY} estimated as $F = M = 0.3$ based on longevity of Tanner crab. Alternative two definition of overfishing is more conservative than the status quo. The fishing mortality rate associated with either the foregone harvest in 1997 or the anticipated Bering Sea Tanner crab PSC for 1998 alone would not have risked overfishing. However, under alternative two a minimum stock size threshold (MSST) is specified for Bering Sea Tanner crabs to equal ½ the MSY stock size. Estimated spawning biomass of Tanner crabs from the 1997 survey was 64.2 million pounds below the MSST of 94.8 million pounds. Under alternative two, the Bering Sea *C. bairdi* Tanner crab stock would be designated overfished.

1.5 List of Housekeeping Changes to Crab FMP

The BSAI Crab FMP has never updated from the original draft of January 24, 1989. Since that time, six plan amendments have been approved, but the amendment language has not been incorporated. The current plan draft therefore, does not provide readers with a clear understanding of conservation and management measures that have been implemented for the BSAI crab fishery. In addition, additional catch data and other scientific information has become available in the past 10 years. Other changes have also occurred, including Magnuson-Stevens Act requirements and other Laws, a Russian/U.S. boundary agreement, and development of a Federal/State Action Plan.

Because the reasons stated above, the Crab Plan Team has revised the FMP to bring it up to date. These proposed changes were discussed and reviewed over the course of several public meetings that occurred in the period 1995-1998. A revised draft FMP is attached as an Appendix. A list of changes made from the January 24, 1989 draft are listed below.

1) Added amendment language changes
   - Amendment 1 Overfishing definition
   - Amendment 2 Norton Sound superexclusive
   - Amendment 3 Research Plan
   - Amendment 4: Moratorium
   - Amendment 5: License Limitation Program
   - Amendment 6: Repeal Research Plan / Implement Modified Observer Program
   - NOTE: language was added to convey that Moratorium (Amd 4) is effective through Dec 31, 1998 unless replaced by components of the approved License Limitation Program (Amd 5) that have not all been implemented in regulation; or until the Council extends the Moratorium

2) Updated Figure
   - Figure 2.1 (Annual decision making process flow chart)
   - Figure 2.2 (Season opening dates)
   - Figure 2.3 (Inseason management decision process flow chart)
   - Revised Figure 5.1 to show Russian/U.S. boundary based on 1988 agreement.
   - Figure E.3 (updated registration areas)
   - Figure E.4 (Added map showing location of fisheries)

3) Updated/Revised Tables

Table 8.1 (Management measures by category)
Table D.1 (added life history summary table)
Table D.2 (added habitat association summary table)
Table E.1 (crab harvests through 1997)
Table E.3 (stock structure)
Table E.4 (size at maturity)
Deleted Table showing Current Status of Stocks- refer to SAFE instead.
Deleted Table showing catch of king crab by registration area - redundant info.
Deleted Table showing catch of Tanner crab by registration area - redundant info.

4) Updated Appendix language

Appendix E: Current Status of Stocks

Changed text to lead reader to Annual SAFE Report
Inserted Species Profiles section to summarize current fishery and management measures
Removed 1987 distribution maps

5) Other changes

Changed name of FMP to clarify, updated NPFMC address
Text printed single spaced with New Times Roman 11 point font and full justification
Added an Executive Summary
Include Federal State Action Plan
Various minor typos and edits made

(e.g., "Magnuson Act" now Magnuson-Stevens Act; "Regional Director" now Regional Administrator)

Removed references to foreign and joint venture management
Revised definition of commercial fishing to reflect State definition.
Added new BOF regulations on category 2 petitions
Updated the summary of applicable Acts and Laws
Added a section called Species Profiles to summarize recent information on the fisheries, regulations, gear used, revenues generated, etc.
Added a section on coastal communities
Revised section on nomenclature of crab to update and clarify.
Added new and more recent references.

6) Added language relative to Magnuson-Stevens Act amendments

Added new national standards
Revised OY definition
Added information on bycatch reporting and bycatch minimization measures

(e.g., noted that seasons could be modified to minimize bycatch)

Table 1. MSY estimates for BSAI king and Tanner crab stocks. Estimated values are in millions of pounds. Long-term average catch represents MSY as it would have been calculated under the old FMP. Current average catch is that over the same years as the MSY estimate and may be taken as the average of OY determinations in the same period.

	Long-term Average		Current Average			
Stock	**Years**	**Ave. Landings**	**Years**	**Ave. Landings**	**MSY Estimate**	**Comments**
Adak red king	1960-95	5.8	1983-95	1.2	1.8	Closed 1996, 1997.
Bristol Bay red king	1953-97	30.8	1983-97	10.6	17.9	MSY from survey history; Closed 1983, 1994-95.
Dutch Harbor red king	1961-82	11.3	1983-97	0.0	NA	No current MSY; Fishery closed since 1982.
Pribilof Islands red king	1980-97	0.9	1983-97	1.0	1.3	MSY from survey history; No fishing or closed 1984-92
Norton Sound red king	1977-97	0.6	1983-97	0.3	0.5	Closed 1991.
Pribilof Islands blue king	1966-97	3.3	1983-97	0.8	2.6	MSY from survey history; Closed 1988-94.
St Matthew blue king	1977-97	3.0	1983-97	3.0	4.4	MSY from survey history.
St Lawrence blue king	1979-95	<0.1	1983-95	<0.1	0.1	MSY provisional; Fished in 1979, 1983, 1989, 1995.
Aleutian Is. golden king	1980-96	8.0	1983-96	8.8	17.9	1997-98 season in progress.
Pribilof Is. golden king	1981-96	0.1	1983-97	0.1	0.3	No fishing in 1984, 1990.
St. Matthew golden king	-	-	1983-96	0.1	0.4	MSY provisional; No fishing 1987-89, 1990-91, 1997.
Aleutian Is. scarlet king	-	-	1992-97	<0.1	NA	MSY = 0.06 provisional
EBS scarlet king	-	-	1995-96	<0.1	NA	MSY = 0.04 provisional
E. Aleutian Is. Tanner	1974-95	0.5	1983-95	0.2	0.7	No fishing 1996-97.
EBS Tanner	1965-96	30.0	1983-96	13.9	56.9	MSY from survey history; closed 1986-87, 1997.
W. Aleutian Is. Tanner	1973-95	0.2	1983-95	0.1	0.4	Closed 1976, 93-94, 96-97.
EBS snow	1965-97	70.7	1983-97	136.6	276.5	MSY from survey history.
E. Aleutian Is. angulatus	-	-	1995-96	0.3	1.0	MSY provisional; no fishing in 1997.
EBS angulatus	-	-	1995-96	0.1	0.3	MSY provisional; no fishing in 1997.
E. Aleutian Is. tanneri	-	-	1993-96	0.5	1.8	MSY provisional; no fishing in 1997.
EBS tanneri	-	-	1992-96	0.5	1.5	MSY provisional; no fishing in 1997.
W. Aleutian Is. Tanneri	-	-	1992-96	<0.1	0.2	MSY provisional; no fishing in 1997.

Table 2. Comparison of current and proposed MSY and OY estimates for BSAI king and Tanner crab stocks. Estimated values are in millions of pounds.

Stock	Current MSY	Current OY range	Proposed MSY	Proposed OY range	1997/98 Catch
Adak red king	7	-	1.8	0 - 1.8	0
Bristol Bay red king	35	-	17.9	0 - 17.9	8.8
Dutch Harbor red king	11.2	-	NA	NA	0
Pribilof Islands red king	NA	-	1.3	0 - 1.3	*
Norton Sound red king	1	-	0.5	0 - 0.5	0.09
Pribilof Islands blue king	4	-	2.6	0 - 2.6	0.7
St Matthew blue king	3	-	4.4	0 - 4.4	4.6
St Lawrence blue king	NA	-	0.1	0 - 0.1	0
Aleutian Is. golden king	8.8	-	17.9	0 - 17.9	4.1
Pribilof Is. golden king	NA	-	0.3	0 - 0.3	0.01
St. Matthew golden king	NA	-	0.4	0 - 0.4	0
Aleutian Is. scarlet king	NA	-	NA	NA	*
EBS scarlet king	NA	-	NA	NA	0.007
TOTAL king crab	**70**	**0 to 200**	**47.2**	**0 - 47.2**	**18.3**
E. Aleutian Is. Tanner	0.7	-	0.7	0 - 0.7	0
EBS Tanner	27	-	56.9	0 - 56.9	0
W. Aleutian Is. Tanner	0.2	-	0.4	0 - 0.4	0
TOTAL Tanner crab	**27.9**	**0 to 108**	**58.0**	**0 - 58.0**	**0**
EBS snow	35	-	276.5	0 - 276.5	240
TOTAL snow crab	**35**	**0 to 333**	**276.5**	**0 - 276.5**	**240**
E. Aleutian Is. angulatus	NA	NA	1.0	0 - 1.0	0
EBS angulatus	NA	NA	0.3	0 - 0.3	0
E. Aleutian Is. tanneri	NA	NA	1.8	0 - 1.8	0
EBS tanneri	NA	NA	1.5	0 - 1.5	0
W. Aleutian Is. Tanneri	NA	NA	0.2	0 - 0.2	0
TOTAL other Tanners	**NA**	**NA**	**4.8**	**0 - 4.8**	**0**

2.0 NEPA REQUIREMENTS: ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

An environmental assessment (EA) is required by the National Environmental Policy Act of 1969 (NEPA) to determine whether the action considered will result in significant impact on the human environment. If the action is determined not to be significant based on an analysis of relevant considerations, the EA and resulting finding of no significant impact (FONSI) would be the final environmental documents required by NEPA. An environmental impact statement (EIS) must be prepared for major Federal actions significantly affecting the human environment.

An EA must include a brief discussion of the need for the proposal, the alternatives considered, the environmental impacts of the proposed action and the alternatives, and a list of document preparers. The purpose and alternatives were discussed in Sections 1.1 and 1.2, and the list of preparers is in Section 6. This section contains the discussion of the environmental impacts of the alternatives including impacts on threatened and endangered species and marine mammals.

2.1 Environmental Impacts of the Alternatives

The environmental impacts generally associated with fishery management actions are effects resulting from (1) harvest of fish stocks which may result in changes in food availability to predators and scavengers, changes in the population structure of target fish stocks, and changes in the marine ecosystem community structure; (2) changes in the physical and biological structure of the marine environment as a result of fishing practices, e.g., effects of gear use and fish processing discards; and (3) entanglement/entrapment of non-target organisms in active or inactive fishing gear.

A summary of the effects of the annual groundfish harvests on the biological environment and associated impacts on marine mammals, seabirds, and other threatened or endangered species are discussed in the final environmental assessment for the annual groundfish total allowable catch specifications.

2.2 Impacts on Endangered or Threatened Species

Background. The ESA provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by the Department of Commerce (NMFS) for most marine species, and the U.S. Fish and Wildlife Service (FWS) for terrestrial and freshwater species.

The ESA procedure for identifying or listing imperiled species involves a two-tiered process, classifying species as either threatened or endangered, based on the biological health of a species. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. '1532(20)]. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. ' 1532(20)]. The Secretary, acting through NMFS, is authorized to list marine mammal and fish species. The Secretary of Interior, acting through the FWS, is authorized to list all other organisms.

In addition to listing species under the ESA, the critical habitat of a newly listed species must be designated concurrent with its listing to the "maximum extent prudent and determinable" [16 U.S.C. ' 1533(b)(1)(A)]. The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. The primary benefit of critical habitat designation is that it informs Federal agencies that listed species are dependent upon these areas for their continued existence, and that consultation with NMFS on any Federal action that may affect these areas is required. Some species, primarily the cetaceans, listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

Listed Species. The following species are currently listed as endangered or threatened under the ESA and occur in the GOA and/or BSAI:

Endangered

Northern Right Whale	*Balaena glacialis*
Bowhead Whale	*Balaena mysticetus*
Sei Whale	*Balaenoptera borealis*
Blue Whale	*Balaenoptera musculus*
Fin Whale	*Balaenoptera physalus*
Humpback Whale	*Megaptera novaeangliae*
Sperm Whale	*Physeter macrocephalus*
Snake River Sockeye Salmon	*Oncorhynchus nerka*
Short-tailed Albatross	*Diomedia albatrus*
Steller Sea Lion[1]	*Eumetopias jubatus*

Threatened

Snake River Fall Chinook Salmon	*Oncorhynchus tshawytscha*
Snake River Spring/Summer Chinook	*Oncorhynchus tshawytscha*
Steller Sea Lion[2]	*Eumetopias jubatus*
Spectacled Eider	*Somateria fishcheri*

Section 7 Consultations. Because groundfish, crab, scallop, and EEZ salmon fisheries are federally regulated activities, any negative affects of the fisheries on listed species or critical habitat and any takings[3] that may occur are subject to ESA section 7 consultation. NMFS initiates the consultation and the resulting biological opinions are issued to NMFS. The Council may be invited to participate in the compilation, review, and analysis of data used in the consultations. The determination of whether the action "is likely to jeopardize the continued existence of" endangered or threatened species or to result in the destruction or modification of critical habitat, however, is the responsibility of the appropriate agency (NMFS or FWS). If the action is determined to result in jeopardy, the opinion includes reasonable and prudent measures that are necessary to alter the action so that jeopardy is avoided. If an incidental take of a listed species is expected to occur under normal promulgation of the action, an incidental take statement is appended to the biological opinion.

Section 7 consultations have been done for all the above listed species, some individually and some as groups. Many of the consultations have been done specifically for the groundfish fisheries, but their conclusions are applicable to some extent for BSAI king and Tanner crab fisheries, so they are included here as well. Below are summaries of the consultations.

Endangered Cetaceans. NMFS concluded a formal Section 7 consultation on the effects of the BSAI and GOA groundfish fisheries on endangered cetaceans within the BSAI and GOA on December 14, 1979, and April 19, 1991, respectively. These opinions concluded that the fisheries are unlikely to jeopardize the continued existence or recovery of endangered whales. Consideration of the bowhead whale as one of the

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[1]listed as endangered in waters west of Cape Suckling.

[2]listed as threatened in waters east of Cape Suckling.

[3] the term "take" under the ESA means "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct" (16 U.S.C. ' 1538(a)(1)(B).

listed species present within the area of the Bering Sea fishery was not recognized in the 1979 opinion, however, its range and status are not known to have changed. No new information exists that would cause NMFS to alter the conclusion of the 1979 or 1991 opinions. NMFS has no plan to reopen Section 7 consultations on the listed cetaceans for this action. Of note, however, are observations of Northern Right Whales during Bering Sea stock assessment cruises in the summer of 1997 (NMFS per. com). Prior to these sightings, and one observation of a group of two whales in 1996, confirmed sightings had not occurred.

Steller sea lion. The Steller sea lion range extends from California and associated waters to Alaska, including the Gulf of Alaska and Aleutian Islands, and into the Bering Sea and North Pacific and into Russian waters and territory. In 1997, based on biological information collected since the species was listed as threatened in 1990 (60 FR 51968), NMFS reclassified Steller sea lions as two distinct population segments under the ESA (62 FR 24345). The Steller sea lion population segment west of 144EW. longitude (a line near Cape Suckling, Alaska) is listed as endangered; the remainder of the U.S. Steller sea lion population maintains the threatened listing.

NMFS designated critical habitat in 1993 (58 FR 45278) for the Steller sea lion based on the Recovery Team's determination of habitat sites essential to reproduction, rest, refuge, and feeding. Listed critical habitats in Alaska include all rookeries, major haul-outs, and specific aquatic foraging habitats of the BSAI and GOA. The designation does not place any additional restrictions on human activities within designated areas. No changes in critical habitat designation were made as result of the 1997 re-listing.

Beginning in 1990 when Steller sea lions were first listed under the ESA, NMFS determined that both groundfish fisheries may adversely affect Steller sea lions, and therefore conducted Section 7 consultation on the overall fisheries (NMFS 1991), and subsequent changes in the fisheries (NMFS 1992). The most recent biological opinion on the BSAI and GOA fisheries effects on Steller sea lions was issued by NMFS January 26, 1996. It concluded that these fisheries and harvest levels are unlikely to jeopardize the continued existence and recovery of the Steller sea lion or adversely modify critical habitat. NMFS has no plan to reopen Section 7 consultations on Steller sea lions for this action.

Pacific Salmon. No species of Pacific salmon originating from freshwater habitat in Alaska are listed under the ESA. These listed species originate in freshwater habitat in the headwaters of the Columbia (Snake) River. During ocean migration to the Pacific marine waters a small (undetermined) portion of the stock go into the Gulf of Alaska as far east as the AI. In that habitat they are mixed with hundreds to thousands of other stocks originating from the Columbia River, British Columbia, Alaska, and Asia. The listed fish are not visually distinguishable from the other, unlisted, stocks. Mortal take of them in the chinook salmon bycatch portion of the fisheries is assumed based on sketchy abundance, timing, and migration pattern information.

NMFS designated critical habitat in 1992 (57 FR 57051) for the for the Snake River sockeye, Snake River spring/summer chinook, and Snake River fall chinook salmon. The designations did not include any marine waters, therefore, does not include any of the habitat where the groundfish fisheries are promulgated.

NMFS has issued two biological opinions and no-jeopardy determinations for listed Pacific salmon in the Alaska groundfish fisheries (NMFS 1994, NMFS 1995). Conservation measures were recommended to reduce salmon bycatch and improve the level of information about the salmon bycatch. The no jeopardy determination was based on the assumption that if total salmon bycatch is controlled, the impacts to listed salmon are also controlled. The incidental take statement appended to the second biological opinion allowed for take of one Snake River fall chinook and zero take of either Snake River spring/summer chinook or Snake River sockeye, per year. As explained above, it is not technically possible to know if any have been taken. Compliance with the biological opinion is stated in terms of limiting salmon bycatch per year to under

55,000 and 40,000 for chinook salmon, and 200 and 100 sockeye salmon in the BSAI and GOA fisheries, respectively.

Short-tailed albatross. The entire world population in 1995 was estimated as 800 birds; 350 adults breed on two small islands near Japan. The population is growing but is still critically endangered because of its small size and restricted breeding range. Past observations indicate that older short-tailed albatrosses are present in Alaska primarily during the summer and fall months along the shelf break from the Alaska Peninsula to the Gulf of Alaska, although 1- and 2-year old juveniles may be present at other times of the year (FWS 1993). Consequently, these albatrosses generally would be exposed to fishery interactions most often during the summer and fall--during the latter part of the second and the whole of the third fishing quarters.

Short-tailed albatrosses reported caught in the longline fishery include two in 1995, one in October 1996, and none in 1997. Both 1995 birds were caught in the vicinity of Unimak Pass and were taken outside the observer's statistical samples.

Formal consultation on the effects of the groundfish fisheries on the short-tailed albatross under the jurisdiction of the FWS concluded that BSAI and GOA groundfish fisheries would adversely affect the short-tailed albatross and would result in the incidental take of up to two birds per year, but would not jeopardize the continued existence of that species (FWS 1989). Subsequent consultations for changes to the fishery that might affect the short-tailed albatross also concluded no jeopardy (FWS 1995, FWS 1997). The US Fish and Wildlife Service does not intend to renew consultation for the 1998 groundfish fisheries.

Spectacled Eider. These sea ducks feed on benthic mollusks and crustaceans taken in shallow marine waters or on pelagic crustaceans. The marine range for spectacled eider is not known, although Dau and Kitchinski (1977) review evidence that they winter near the pack ice in the northern Bering Sea. Spectacled eider are rarely seen in U.S. waters except in August through September when they molt in northeast Norton Sound and in migration near St. Lawrence Island. The lack of observations in U.S. waters suggests that, if not confined to sea ice polyneas, they likely winter near the Russian coast (FWS 1993). Although the species is noted as occurring in the GOA and BSAI management areas no evidence that they interact with these groundfish fisheries exists.

Since 1994, NMFS has consulted with the USFWS annually on the crab FMP, which includes the winter Bering Sea opilio fishery, pursuant to section 7 of the ESA. In the past, section 7 consultations on this fishery have been formal because it was perceived that the fishery was likely to adversely affect spectacled eiders (Somateria fischeri), a threatened seaduck. This perception of a likelihood of an adverse effect resulted from: (1) a lack of knowledge concerning the at-sea range of spectacled eiders and; (2) a lack of knowledge of the species of eiders that have struck, or were likely to strike crabbing vessels.

Beginning in 1995, observer aboard crabbing vessels received training in bird identification and reporting. Observer were instructed to report all sightings of spectacled eiders to the USFWS either directly or through ADF&G. To date, no take of spectacled eiders associated with this fishery has been reported.

Since the initial determination that this fishery was likely to adversely affect spectacled eiders, the USFWS has learned much about the at-sea distribution of spectacled eiders. Satellite telemetry data and 3 years of late winter aerial surveys indicate that spectacled eiders spend the winter in exposed waters between St. Matthew and St. Lawrence Islands, or in open leads slightly west of the inter-island area. Opilio crab fishing has been largely concentrated around the Bering Sea continental shelf, which in the Bering Sea, runs from Unimak Island to the northwest, passing well south and wet of St. Matthew Island. Crabbing occurs along the shelf because this is where the greatest opilio crab concentrations occur, and not because of fishing

ground access restrictions imposed by sea-ice conditions between January and March. Thus, even if sea ice conditions were to make it possible for crabbing vessels to venture into the waters used by wintering spectacled eiders, they would not likely do so, due both to the time and expense of vessels traveling that far and the relatively fewer number of opilio crabs present there.

Crab fishery observers will continue to be placed aboard the catcher-processor vessels participating in this fishery, and that, in the future, these catcher-processor vessel observers will continue to receive training and refresher training in seabird identification and seabird reporting procedures.

Therefore, USFWS concurs with NMFS's determination that the opilio crab fishery is not likely to adversely affect threatened or endangered species under the jurisdiction of the USFWS, including the threatened spectacled eider. This concludes section 7 consultation on the opilio crab fishery. Preparation of a biological assessment or further consultation under section 7 of the ESA regarding this fishery is not necessary at this time. If project plans change, additional information on listed or proposed species becomes available, or new species are listed that may be affected by the project, consultation should be reinitiated.

Conditions for Reinitiation of Consultation. For all ESA listed species, consultation must be reinitiated if: the amount or extent of taking specified in the Incidental Take Statement is exceeded, new information reveals effects of the action that may affect listed species in a way not previously considered, the action is subsequently modified in a manner that causes an effect to listed species that was not considered in the biological opinion, or a new species is listed or critical habitat is designated that may be affected by the action.

Impacts of the Alternatives on Endangered or Threatened Species. None of the alternatives under consideration would affect the prosecution of the crab or groundfish fisheries of the BSAI in a way not previously considered in the above consultations. The proposed alternatives are designed to improve the long-term productivity of BSAI crab stocks. None of the alternatives would affect takes of listed species. Therefore, none of the alternatives are expected to have a significant impact on endangered, threatened, or candidate species.

2.3 Impacts on Marine Mammals

Marine mammals not listed under the ESA that may be present in the BSAI include cetaceans, [minke whale (*Balaenoptera acutorostrata*), killer whale (*Orcinus orca*), Dall's porpoise *(Phocoenoides dalli*), harbor porpoise (*Phocoena phocoena*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), and the beaked whales (e.g., *Berardius bairdii* and *Mesoplodon spp.*)] as well as pinnipeds [northern fur seals (*Callorhinus ursinus*), and Pacific harbor seals (*Phoca vitulina*)] and the sea otter (*Enhydra lutris*).

None of the alternatives would affect overall TAC amounts, PSC limits, or takes of marine mammals. Therefore, none of the alternatives are expected to have a significant impact on marine mammals.

2.4 Coastal Zone Management Act

Implementation of each of the alternatives would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of Section 30(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.

2.5 Conclusions or Finding of No Significant Impact

None of the alternatives are likely to significantly affect the quality of the human environment, and the preparation of an environmental impact statement for the proposed action is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

_____ _____

Assistant Administrator for Fisheries, NOAA Date

3.0 ECONOMIC AND SOCIOECONOMIC IMPACTS

This section provides information to aid future analysis of the economic and socioeconomic impacts of the alternatives including identification of the individuals or groups that may be affected by the action, the nature of these impacts, quantification of the economic impacts if possible, and discussion of the trade offs between qualitative and quantitative benefits and costs.

The following tables present data summarizing the number of vessels by gear and area that harvested Alaska groundfish, scallops and crab in 1996. These data include some vessels with a gross annual revenue that exceeds $3 million, although the preponderance of vessels experience annual revenues less than this amount.

Number of vessels that caught groundfish in the BSAI area in 1996, by vessel length class (measured by length overall (LOA) in feet), catcher type, and gear.

	<60'	60-124'	>125'	Total
Catcher vessels				
Fixed gear	64	125	17	206
Trawl gear	6	91	31	128
Catcher/processors				
Fixed gear	1	21	32	54
Trawl gear	0	7	55	62
Total all vessels	71	244	135	450

Number of vessels that caught groundfish in the GOA area in 1996, by vessel length class (measured by length overall (LOA) in feet), catcher type, and gear.

	<60'	60-124'	>125'	Total
Catcher vessels				
Fixed gear	1116	179	7	1302
Trawl gear	63	82	17	162
Catcher/processors				
Fixed gear	4	13	11	28
Trawl gear	0	7	30	37
Total all vessels	1183	281	65	1529

Number of vessels that landed scallops in Alaska in 1996 and 1997, by vessel length class (measured by length overall (LOA) in feet).

	<60'	60-124'	>125'	Total
Cook Inlet				
1996	0	4	0	4
1997	1	2	0	3
Outside Cook Inlet				
1996	0	4	0	4
1997	0	6	0	6

Number of vessels that caught crab in the BSAI area in 1996, by vessel length class (measured by length overall (LOA) in feet), catcher type, and gear.

	Catcher vessels			Catcher/
	<60'	60-124'	>125'	proc.s
Bristol Bay red king	0	130	62	4
Bering Sea Tanner	0	102	40	4
Bering Sea Snow crab	0	154	70	15
Norton Sound red king	41	0	0	0

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7.0 Appendix 1: Sources of Fishing Mortality on BSAI Crabs

The proposed rule for National Standard 1 specifies that all fishing mortality must be counted against the OY, including that resulting from bycatch, research fishing, and any other fishing activities.

Survival of juvenile crab after settlement until they reach maturity depends on natural mortality (due to predation, disease, and other sources) and fishing mortality. Natural mortality is estimated to be about 20% (M=0.2) for king crab, and about 25% (M=0.3) for Tanner crab and snow crab (NPFMC 1990). Fishing mortality due to crab fisheries occurs through fishery removals of large males, handling mortality, ghost fishing by lost pots, direct gear impacts, and unobserved mortality caused by cannibalism and predation inside pots. Fishing mortality attributed to groundfish and scallop fisheries include bycatch mortality, unobserved gear induced mortality, and indirect impacts of habitat alteration. Very few crabs are killed due to research fishing, and thus are not analyzed further in this section.

Crab Harvests

Harvest policies set by the State of Alaska for major BSAI crab stocks are based on an exploitation rate strategy, with additional size, sex, and season regulations. Total amount of crab harvested in the directed fisheries is detailed in the FMP tables. Catch figures of crab harvested include "deadloss", which is the portion of the harvest that dies prior to processing and is wasted. In recent years, deadloss in Bering Sea king and Tanner crab fisheries has amounted to about 1%- 2% of the total harvest.

Bycatch Mortality in Crab Fisheries

Another source of mortality is crab bycatch in directed crab fisheries. Crab bycatch includes females of target species, sublegal males of target species, and non-target crab. Numbers of crab taken as bycatch in recent major Bering Sea crab fisheries are listed in **Appendix Table 1**. Due to the difference in legal size versus market size for snow crab, a portion of the legal crabs are not retained as harvest, and are thus considered bycatch. For example, in 1994, over 57 million legal sized snow crab were discarded. Additional crab are bycaught in other fisheries for red king crab (Dutch Harbor, Adak), blue king crab (Pribilof Islands, St. Matthew), golden king crab (Dutch Harbor, Adak), Tanner crab (Aleutian Islands), and hair crab fisheries.

Some crabs taken as bycatch die due to handling mortality. Several laboratory and field studies have been conducted to determine mortality caused by handling juvenile and female crab taken in crab fisheries. There are a variety of effects caused by handling, ranging from sublethal (reduced growth rates, molting probabilities, decreased visual acuity from bright lights, and vigor) to lethal effects. Studies have shown a range of mortality due to handling based on gear type, species, molting stage, number of times handled, temperature, and exposure time (Murphy and Kruse 1995). Handling mortality may have contributed to the high natural mortality levels observed for Bristol Bay red king crab in the early 1980's (65% for males and 82% for females), that along with high harvest rates, resulted in stock collapse (Zheng et al. 1995). However, another study concluded that handling mortality from deck and temperature impacts was not responsible for the decline on the red king crab fishery (Zhou and Shirley 1995, 1996).

Byersdorfer and Watson (1992, 1993) examined red king crab and Tanner crab taken as bycatch during the 1991 and 1992 red king crab test fisheries. Instantaneous handling mortality of red king crab was <1% in 1991, and 11.2% in 1992. Stevens and MacIntosh (1993) found average overall mortality of 5.2% for red king crabs and 11% for Tanner crabs on one commercial crab vessel. Authors recommend these results be viewed with caution, noting that experimental conditions were conservative. Mortality for red king crab held 48 hours was 8% (Stevens and MacIntosh 1993, as cited in Queirolo et al. 1995). A laboratory study that

examined the effects of multiple handling indicated that mortality of discarded red king crabs was negligible (2%), although body damage increased with handling (Zhou and Shirley 1995).

Delayed mortality due to handling does not appear to be influenced by method of release. In an experiment done during a test fishery, red king crab thrown off the deck while the vessel was moving versus those gently placed back into the ocean showed no differences in tag return rates (Watson and Pengilly 1994). Handling methods on mortality have been shown to be non-significant in laboratory experiments with red king crab (Zhou and Shirley 1995, 1996) and Tanner crab (MacIntosh et al. 1995). Although handling did not cause mortality, injury rates were directly related to the number of times handled.

Mortality of crabs is also related to time out of water and air temperature. A study of red king crabs and Tanner crabs found that crabs exposed to air exhibited reduced vigor and righting times, feeding rates (Tanner crabs), and growth (red king crabs) (Carls and Clair 1989). For surviving females, there was no impact on survival of eggs or larvae. Cold air resulted in leg loss or immediate mortality for Tanner crabs, whereas red king crabs exhibited delayed mortality that occurred during molting. A relationship was developed to predict mortality as the product of temperature and duration of exposure (measured as degree hours). Median lethal exposure was -8°C for red king crab and -4.3°C for Tanner crab. For example, if crabs were held on deck for 10 minutes and it was -23°C or 10 degrees below zero (Fahrenheit) outside, about 15% of the king crab and 50% of the Tanner crab would die of exposure. Because BSAI crab fisheries occur from November through March, cold exposure could cause significant handling mortality to crabs not immediately returned to the ocean. Zhou and Shirley (1995) observed that average time on deck was generally 2 to 3 minutes, and they concluded that handling mortality was not a significant source of mortality.

Unobserved Mortality

Catching mortality is ascribed to those crabs that enter a pot and are eaten by other pot inhabitants before the pot is retrieved. Catching mortality likely occurs during the molting period, when crabs are more susceptible to cannibalism. Most crab fisheries are set to occur outside of the molting season, and catching mortality in these fisheries may be limited to octopus or large fish entering a pot. Because no evidence of crab is left in the pot, these mortalities remain unassessed.

Mortality is also caused by ghost fishing of lost crab pots and groundfish pots. Ghost fishing is the term used to describe continued fishing by lost or derelict gear. The impact of ghost fishing on crab stocks remains unknown. It has been estimated that 10-20% of crab pots are lost each year (Meyer 1971, Kruse and Kimker 1993). Based on skipper interviews, about 10,000 pots were estimated lost in the 1992 Bristol Bay red king, and Bering Sea Tanner and snow crab fisheries (Tracy 1994). Fewer pots are expected to be lost under pot limit regulations and shorter seasons. Bob Schofield, a major crab pot manufacturer, testified at the January 1996 Council meeting that he was making fewer pots since inception of the pot limit. He estimated that 6,461 pots were replaced in 1995. It is not known how long lost pots may persist and continue to fish, or just litter the bottom.

A sonar survey of inner Chiniak Bay (Kodiak, Alaska) found a high density of lost crab pots (190 pots) in an area of about 4.5 km^2 (Stevens 1995). Underwater observations indicated that crabs and fish were common residents of crab pots, whether or not the pot mesh was intact. Eight intact pots recovered from the Chiniak Bay study area contained an average of 4 crabs and 0.5 octopus (Stevens 1995). High (1985) and High and Worlund (1979) observed that 20% of legal sized male red king crab and 8% of the sublegals captured by lost pots failed to escape.

Crabs captured in lost pots may die of starvation or by predation. Captured crab are subject to cannibalism (Paul et al. 1993), and predation by octopus, halibut and Pacific cod (High 1976). Crabs also have limited abilities to withstand starvation. In a simulated field study, 39% mortality of Tanner crabs was observed after 119 days of starvation (Kimker 1992). In a laboratory study, 10% of the Tanner crabs tested died of starvation in 90 days. Of the 90% that had survived 90 days, all later died even though they were freely fed (Paul et al. 1993). To reduce starvation mortality in lost pots, crab pots have been required be fitted with degradable escape mechanisms. Regulations required #120 cotton thread from 1977-1993. Beginning in 1993, regulations required #30 cotton thread or 30-day galvanic timed release mechanisms. A #30 cotton thread section is also required in groundfish pots. The average time for #30 cotton twine to degrade is 89 days, and the galvanic timed release about 30 days to degrade. Pots fitted with an escape mechanism of #72 cotton twine had a fishable life of 3-8 years and documented retention of up to 100 crabs per lost pot (Meyer 1971). High and Wolund (1979) estimated an effective fishing life of 15 years for king crab pots. Pots without escape mechanisms could continue to catch and kill crabs for many years, however testimony from crabbers and pot manufacturers indicate that all pots currently fished in Bering Sea crab fisheries contain escape mechanisms.

Mortality of crab caused by ghost fishing is difficult to estimate with precision given existing information. Mortality caused by continuous fishing of lost pots has not been estimated, but unbaited crab pots continue to catch crabs (Breen 1987, Meyer 1971), and pots are subject to rebaiting due to capture of Pacific cod, halibut, sablefish, and flatfish. In addition to mortality of trapped crab by ghost pots, and predation by octopus and fish, pot mesh itself can kill crabs. Lost pots retrieved by NMFS trawl surveys occasionally contain dead crabs trapped in loose webbing (Stevens 1995). Pot limits and escape mechanisms may have greatly minimized ghost fishing due to pot loss in recent years.

Another minor source of human induced crab mortality is direct gear impacts. Direct gear impacts result from a pot landing on the ocean floor when it is being set, presumably damaging any crab on which it lands. With reasonable assumptions, direct gear impacts is only a very minor source of mortality, however. An estimate of the impact of pot bombing can be derived by multiplying the number of pot lifts, the area they occupy, and relative crab density within areas fished in the Bering Sea. Assuming that pots land on different areas after each lift, and crab pots are set non-randomly over areas with relatively high density of crabs in directed fisheries, the total number of crab impacted can be roughly estimated. For 1993 the red king crab fishery, assuming a density of 5,000 red king crab of all sizes per square mile (density data from Stevens et al. 1994), a maximum of about two thousand red king crab were impacted (NPFMC 1996). Similarly, a maximum of 9,000 Tanner crabs (assuming 10,000 crab/mile^2) and 110 thousand snow crabs (assuming 75,000 crab/mile^2) were impacted by direct gear impacts in respective crab fisheries in 1993. It is not known what proportion of these crab die when a crab pot lands on them.

Bycatch of Crab in Groundfish Trawl Fisheries

Crab bycatch is estimated by the National Marine Fisheries Service through the groundfish Observer Program. Observer coverage depends on vessel length; 100% observers on vessels > 125 feet, 30% coverage on vessels 60-125 feet, and 0% coverage on vessels <60 feet. Shoreside processors have 100% coverage. 100% coverage means that an observer is always onboard; it does not mean that every haul or landing is observed.

Bycatch data for crab are available for the 1992-1995 groundfish trawl fisheries in the BSAI by target fishery and regulatory areas. (NPFMC, 1996). The observer data base categorizes crab bycatch into king crab, Tanner crab (C. bairdi), and "other" crab categories. In the Bering Sea, the "other" crab category is comprised almost entirely of snow crab (C. opilio), whereas in the GOA, "other" crab consists mostly of C. tanneri and C. angulatus, with the bycatch of snow crab virtually nil.

Bycatch of red king crab in BSAI groundfish fisheries totaled 48,191 in 1995, which was down significantly from a recent high of 281,023 in 1994. Most red king crab bycatch is taken in the trawl fisheries (97%) and to a lesser extent in the longline (1%) and groundfish pot fisheries (2%). Although red king crabs are bycaught in nearly every trawl fishery, the rock sole/other flatfish fishery accounts for a majority of red king crab bycatch. Bycatch has been consistently highest in NMFS statistical areas 509 and 516. Bycatch of red king crab was significantly lower in 1995 due in part to the implementation of the Pribilof Islands Habitat Conservation Area and the Bristol Bay Red King Crab Savings Area. The recent level of red king crab bycatch in trawl fisheries (1991-1995 average of 0.16 million) is low relative to the 1978-1989 average of 0.44 million red king crab. This reduction may be due in part to reduced crab abundance and increased regulation of the trawl fishery. Regulations in effect in 1989 and thereafter for domestic fisheries included current crab PSC limits and trawl closure areas.

A total of 2.3 million Tanner crab (C. bairdi) were taken as bycatch in the 1995 BSAI groundfish fisheries. Bycatch of Tanner crab has been reduced in recent years, down significantly from 4.3 million in 1992. Most Tanner crab bycatch is taken in the trawl fisheries (about 98%) and to a lesser extent in the longline (1.5%) and groundfish pot fisheries (0.5%). Although Tanner crabs are bycaught in nearly every trawl fishery, the yellowfin sole fishery takes the largest share, followed by the rock sole/other flatfish fisheries. Bycatch has been highest in NMFS statistical areas 509 and 513; and large numbers of Tanner crab area have also been consistently taken in areas 517 and 521. The recent level of Tanner crab bycatch in trawl fisheries (1992-1995 average of 3.06 million) is high relative to the 1978-1987 average of 2.06 million.

Bycatch of snow crab (C. opilio) in BSAI groundfish fisheries totaled 5.4 million crab in 1995. Bycatch has been drastically reduced since 1992, when 17.66 million snow crab were taken in groundfish fisheries. Most snow crab bycatch is taken in the trawl fisheries (99%) and to a lesser extent in the longline (0.7%) and groundfish pot fisheries (0.3%). Although snow crabs are bycaught in nearly every trawl fishery, the yellowfin sole fishery takes the vast majority (70% on average 1992-1994). Bycatch is highest in the areas north and east of the Pribilof Islands, corresponding to NMFS statistical areas 513, 514, and 521 (NPFMC 1996). Average snow crab bycatch in Zone 2 was about 10.8 million crabs, or about 0.11% of the NMFS total population index on average, 1992-1994. Bycatch of snow crab in 1995 was much lower than in previous years, totaling 5,395,788 crabs.

Bycatch Mortality

The effect of crab bycatch on crab stocks is somewhat tempered by survival of discarded crabs. There have been numerous studies conducted on crab bycatch mortality, with each study having different objectives, methodology, and results. A summary of these studies is provided below, but many questions remain unanswered. Stevens (1990) found that 21% of the king crabs and 22% of the Tanner crabs captured incidentally in BSAI trawl fisheries survived at least 2 days following capture. Blackburn and Schmidt (1988) made observations on instantaneous mortality of crab taken by domestic trawl fisheries in the Kodiak area. They found acute mortality for softshell red king crab averaged 21%, hard shelled red king crab 1.2%, and 12.6% for Tanner crab. Another trawl study indicated that trawl induced mortalities aboard ship were 12% for Tanner crab and 19% for red king crab (Owen 1988). Fukuhara and Worlund (1973) observed an overall Tanner crab mortality of 60-70% in the foreign Bering Sea trawl fisheries. They also noted that mortality was higher in the summer (95%) than in the spring (50%). Hayes (1973) found that mortality of Tanner crab captured by trawl gear was due to time out of water, with 50% mortality after 12 hours. Natural Resource Consultants (1988) reported that overall survival of red king crab and Tanner crab bycaught and held in circulation tanks for 24-48 hours was <22%. In other analyses, the estimated mortality rate of trawl bycaught red king crab and Tanner crab was 80% (NPFMC 1993).

Unobserved Mortality

Not all crab in the path of a trawl are captured. Some crab pass under the gear, or pass through the trawl meshes. Non-retained crab may be subject to mortality from contact with trawl doors, bridles, footrope, or trawl mesh, as well as exposure to silt clouds produced by trawl and dredge gear. Only two studies have been conducted to estimate catchability of crabs by trawl gear, and these studies are summarized below.

In one experiment to measure non-observable mortality, 169 red king crab were tethered in the path of an Aleutian combination trawl (Donaldson 1990). The trawl was equipped with a footrope constructed of 14 inch bobbins spaced every 3 feet, separated by 6.5 inch discs. Thirty-six crabs (21.3%) were recovered onboard the vessel in the trawl. Divers recovered 46.2% of the crabs not captured by the trawl. Another 32.5% were not recovered but assumed to have interacted with the trawl. Of the 78 crab not retained in the trawl, but captured by divers, only 2.6% were injured. If all injured crabs die, the non-observable mortality rate for trawl gear on red king crab is estimated at 2.6% (Donaldson 1990). It should be noted that hard shelled crabs were used in this experiment; higher impacts would be expected if softshelled crabs were tested. Additionally, some areas have had higher intensity of bottom trawling than other areas, thus potentially exposing some crab to multiple interactions with trawl gear.

In 1995, NMFS used underwater video cameras to observe the interaction of trawl gear with king and Tanner crabs (Craig Rose, NMFS, unpublished data). The experiment was conducted in Bristol Bay in an area with large red king crabs and C. bairdi Tanner crabs. Three types of trawl footropes were examined and they are as follows: a footrope with 3-4 foot lengths of 6" discs separated by 10" discs (called disc gear), a footrope with 24" rollers (tire gear), and an experimental float/chain footrope with the groundgear suspended about 8" off the seafloor. For disc gear, preliminary analysis indicated that all red king crab encountered entered the trawl and about 76% of the Tanner crab were caught. Tire gear captured fewer king crab (42%) and Tanner crab (1%). The float/chain gear did not catch any of the crabs encountered. At the December 1995 Council meeting, excerpts of the NMFS video were shown to the Council and public. Trawl industry representatives testified that groundgear used to harvest finfish in this area depended on target species and bottom type, with tire gear type footropes used in hard bottom areas, and disc type gear used on smooth bottom areas. Testimony also indicated that there was also variability in groundgear used among vessels, but that on average, most gear used in Bristol Bay trawl fisheries would be comprised of groundgear with discs or rollers larger than the disc gear tested and smaller that the tire gear tested.

In order to compare the impacts of unobserved mortality caused by trawling with other sources of fishing mortality, it would be necessary to have reasonable estimates of retention rates and mortality of those crab not retained. At this time, however, there are too many uncertainties to generate valid estimates of unobserved crab mortality (C. Rose, NMFS, personal communication).

Bycatch Mortality in Other Groundfish Fisheries

Some crabs are caught incidentally by non-trawl gear in pursuit of groundfish, and a portion of these crabs die. No field or laboratory studies have been made to estimate mortality of crab discarded in these fisheries. However, based on condition factor information from the trawl survey, mortality of crab bycatch has been estimated and used in previous analyses (NPFMC 1993). Discard mortality rates for red king crab were estimated at 37% in longline fisheries and 37% in pot fisheries. Estimated bycatch mortality rates for Tanner crab were 45% in longline fisheries and 30% in pot fisheries. No observations had been made for snow crab, but mortality rates are likely similar to Tanner crab. In the analysis made in Section 5, a 37% mortality rate was assumed for red king crab taken in longline fisheries and an 8% rate for pot fisheries. Observer data on condition factors collected for crab during the 1991 domestic fisheries suggested lower mortality of red king crab taken in groundfish pot fisheries. Bycatch mortality rates used in the analysis of Amendment 37 (NPFMC 1996) for Tanner crab were 45% in longline fisheries and 30% in pot fisheries, based on previous analyses.

Bycatch Mortality in the Scallop Fishery

In 1993, the scallop fishery in the Bering Sea caught 6 red king crab, 276,000 Tanner crab, and 15,000 snow crab (D. Pengilly, ADF&G, unpublished data). Average sizes of crabs were 110 mm carapace length for red king crab, 100 mm carapace width for Tanner crab, and 100 mm carapace width for snow crab. The sex ratio was about 50:50 for red king and Tanner crab, but almost all snow crab taken were males. In 1994, 55 red king crab and 262,500 Tanner crab were captured incidental to scallop fishing in the Bering Sea (NPFMC 1995b). No fishery occurred in 1995.

Observations from scallop fisheries across the state suggest that mortality of crab bycatch is low relative to trawl gear due to shorter tow times, shorter exposure times, and lower catch weight and volume. For crab taken as bycatch in the Gulf of Alaska weathervane scallop fishery, Hennick (1973) estimated that about 30% of Tanner crabs and 42% of the red king crabs bycaught in scallop dredges were killed or injured. Hammerstrom and Merrit (1985) estimated mortality of Tanner crab at 8% in Cook Inlet. Kaiser (1986) estimated mortality rates of 19% for Tanner crab and 48% for red king crab bycaught off Kodiak Island. Urban el al. (1994) recorded that in 1992, 13-35% of the Tanner crab bycaught were dead or moribund before being discarded, with the highest mortality rate occurring on small (<40 mm cw) and large (>120 mm cw) crabs. Delayed mortality resulting from injury or stress was not estimated. Mortality in the Bering Sea appears to be lower than in the Gulf of Alaska, in part due to different sizes of crab taken. Observations from the 1993 Bering Sea scallop fishery indicated lower bycatch mortality of red king crab (10%), Tanner crab (11%) and snow crab (19%). As with observations from the Gulf of Alaska, mortality appeared to be related to size, with larger and smaller crabs having higher mortality rates on average than mid-sized crabs (D. Pengilly, ADF&G, unpublished data). Delayed mortality was not estimated. In the analysis made in Section 5, a 40% discard mortality rate was assumed for all crab species.

Summary of Management Actions Taken to Control and Reduce Crab Bycatch Mortality

The NPFMC, the ADF&G, and the Secretary of Commerce have taken numerous actions to control the incidental bycatch and mortality of crabs in BSAI fisheries. The State has adopted seasons, escape rings, biodegradable panels, mesh size, and maximum entrance size requirements to reduce bycatch and associated mortality of non-target crab in the directed crab pot fisheries. The NPFMC has adopted numerous area closures and bycatch limit regulations to control and reduce crab mortality due to trawling and dredging. These regulations are consistent with National Standard 9, which states that conservation and management measures shall, to the extent practicable, minimize bycatch and to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

Catch (numbers of animals) of selected crab and fish species taken in recent Bering Sea crab fisheries. Source: Tracy 1994, 1995.

	Bairdi Tanner Crab Fishery		Opilio Snow Crab Fishery		Red King Crab Fishery	
	1993	1994	1993	1994	1992	1993
red king crab						
legal male	23,700	3,600	9,300	not reported	1,070,500	2,022,200
sub-legal male	83,600	14,400	5,100	not reported	2,305,600	2,668,000
female	125,800	600	10,100	not reported	2,408,600	2,814,500
bairdi						
legal male	7,209,900	3,793,000	776,800	429,900	864,600	2,170,400
sub-legal male	12,952,800	5,939,100	5,049,400	6,468,700	597,000	1,231,200
female	5,197,900	3,643,300	873,900	2,292,900	82,300	566,700
opilio						
legal male	1,425,200	49,900	226,487,100	172,539,000	20,586	15,400
sub-legal male	41,900	16,200	2,136,300	4,657,400	not reported	2,700
female	18,700	not reported	2,427,600	1,146,400	not reported	1,800
hybrid Tanners						
mixed size/sex	293,400	74,900	9,613,400	965,000	not reported	not reported
Pacific cod						
mixed size/sex	712,611	224,600	1,068,150	788,200	82,344	183,750
Halibut						
mixed size/sex	17,033	9,600	6,749	71,700	4,986	3,184

Note: shaded areas indicate legal crab catch. Not all legal snow crab are retained, however.
ADF&G estimates that 58,928,258 legal snow crab were discarded in 1993, and 57,759,986 discarded in 1994.

Appendix Table 1. Catch (numbers of animals) of selected crab and fish species taken in recent Bering Sea crab fisheries. Source: Tracy 1994, 1995.

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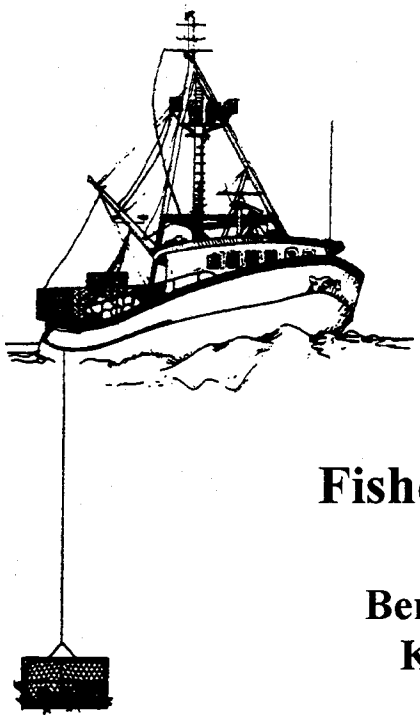
8.0 Appendix 2: Revised Draft FMP



Fishery Management Plan

for

Bering Sea/Aleutian Islands
King and Tanner Crabs

July 18, 1998

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EXECUTIVE SUMMARY

The Fishery Management Plan (FMP) for the Commercial King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands (BSAI) was approved by the Secretary of Commerce on June 2, 1989. The FMP establishes a State/Federal cooperative management regime that defers crab management to the State of Alaska with Federal oversight. State regulations are subject to the provisions of the FMP, including its goals and objectives, the Magnuson-Stevens Act national standards, and other applicable federal laws. The FMP has been amended several times since its implementation.

Amendments to the BSAI king and Tanner crab FMP.

1. Defined overfishing
2. Established Norton Sound superexclusive area registration
3. Established a Research Plan
4. Established a moratorium on new vessels
5. Established a vessel License Limitation Program
6. Repealed the Research Plan
7. Revised overfishing definition and updated FMP (proposed)
8. Defined essential fish habitat (proposed)

The king and Tanner crab FMP is a "framework" plan, allowing for long-term management of the fishery without needing frequent amendments. Therefore, the plan is more general than other FMPs, and establishes objectives and alternative solutions instead of selecting specific management measures. Within the scope of the management goal, the FMP identifies seven management objectives and a number of relevant management measures used to meet these objectives. 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.

FMP Management Goal

The management goal in the FMP is to maximize the overall long-term benefit to the nation of Bering Sea Aleutian Islands (BSAI) king and Tanner crab stocks by coordinated federal and state management, consistent with responsible stewardship for conservation of the crab resources and their habitats.

FMP Management Objectives

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

2. Economic and Social Objective. *Maximize economic and social benefits to the nation over time.*

3. Gear Conflict Objective. *Minimize gear conflict among fisheries.*

4. Habitat Objective. *Preserve the quality and extent of suitable habitat.*

5. Vessel Safety Objective. *Provide public access to the regulatory process for vessel safety considerations.*

6. Due Process Objective. *Ensure that access to the regulatory process and opportunity for redress are available to interested parties.*

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

FMP Management Measures

The FMP defers much of the management of the BSAI crab fisheries to the State of Alaska using the following three categories of management measures:

1. Those that are fixed in the FMP and require a FMP amendment to change;
2. Those that are framework-type measures that 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.

Management measures in category 1 may be addressed through submission of a proposal to the North Pacific Fishery Management Council (NPFMC). Management measures in categories 2 and 3 may be adopted under state laws subject to the appeals process provided for in the FMP.

Management measures implemented for the BSAI king and Tanner crab fisheries, as defined by the federal crab FMP, 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
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
	* Closed Waters	* Bycatch Limits (in crab fisheries)
	* Pot Limits	* Other
	* Registration Areas	

Category 1 Management Measures

Legal Gear-The FMP specifically prohibits the use of trawls and tanglenet gear for catching king and Tanner crab because of the high mortality rates that could be inflicted on nonlegal crab.

Permit Requirements-The FMP assumes that all crab fishermen are licenced 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-Stevens Act, and other applicable law. Hence, no fishing permits are required for harvesting vessels, except as required by the Moratorium and, in the future, the License Limitation Program.

Federal Observer Requirements - Any vessel fishing for or processing king and Tanner crab in the BSAI shall be required to carry an observer if requested so by the NMFS Regional Administrator.

Limited Access - A system of limited access is a type of allocation of fishing privileges that may be used to promote economic efficiency or conservation. Beginning in 1996, a moratorium on vessels entering the BSAI crab fisheries was implemented. This moratorium will be in effect until superseded by implementation of the License Limitation System that was approved by the Secretary in 1997.

Norton Sound Superexclusive Area Registration - The FMP establishes the Norton Sound section of the Norther District king crab fishery as a superexclusive registration area. Any vessel registered and participating in this fishery would not be able to participate in other BSAI king crab fisheries.

Category 2 Management Measures

Minimum Size Limits-Under the FMP, the state can adjust size limits within the constraints of available information. Biological considerations are used to establish minimum legal size limits to ensure that conservation needs are served. Preference for larger crabs based upon market and other economic considerations is accommodated by industry rather than through regulation.

Guideline Harvest Levels - The FMP authorizes the state to set preseason guideline harvest levels (GHLs), which limit the total annual harvest of crab. Seasons or areas may be closed when the GHL is reached, or earlier or later based on current inseason information.

Inseason Adjustments - When an event occurs inseason that affects preseason predictions, or a preseason prediction proves to be incorrect, compensatory inseason adjustments must be made to keep the management system on track toward meeting the biological and economic objectives of the FMP. The FMP authorizes the state to make inseason adjustments to GHLs, to fishing period lengths, and to close areas under state regulations.

District, Subdistrict, and Section Boundaries - The FMP authorizes the state to adjust district, subdistrict, and section boundaries to manage reasonably distinct stock of crab.

Fishing Seasons- Under the FMP, fisheries should be closed during sensitive biological 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 should prevent any irreparable damage to the stocks.

Sex Restrictions - The FMP authorizes an experimental harvest and processing of females when a surplus is determined to be available; otherwise female crabs may not be taken. The surplus would be dependent on the number of crabs above the threshold amount used in the spawning stock calculation of optimum yield. When a surplus of crabs exists, harvest is by state permit if fishermen provide accurate documentation of harvest rates and location, and processing and marketing results are made available to the management agency.

Pot Limits - The FMP authorizes the state to use pot limits to attain the biological conservation objective and the economic and social objective of the FMP. Pot limits must be designed in a nondiscriminatory manner. Pot limits are warranted to restrict deployment of excessive amounts of gear to attain the biological conservation objective in the event of pot loss to advancing ice cover that may result in wastage. Pot limits may also be warranted to restrict excessive amounts of gear to allow a small guideline harvest level from a depressed stock to attain the economic and social objective within biological conservation constraints.

Registration Areas - The FMP adopts existing state registration areas within the BSAI fishery management unit. The management unit is divided by the state into three king crab registration areas - Bering Sea, Bristol Bay, and Aleutian Islands and one Tanner crab registration area - Westward. Registration areas may be further divided into fishing districts, subdistricts, and sections for purposes of management and reporting. State regulations require vessels to register for fishing in these areas, and may require vessels to register for specific districts within a registration area. Registration areas may be designated as either exclusive or nonexclusive. Vessels can register for any one exclusive area but cannot fish in any other exclusive area during the registration year. Vessels can fish any or all nonexclusive areas.

Closed Waters - 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 state closure to protect the Norton Sound subsistence king crab

fishery. The state may designate new closed water areas or expand or reduce existing state closed water areas in order to meet state subsistence requirements.

Category 3 Management Measures

Reporting Requirements - Reporting requirements for catchers and processors are important component in achieving the biological conservation, economic, social, research, and management objectives of the FMP.

Gear Placement and Removal - Placement of unbaited gear, with doors secured open on the fishing grounds before and after a season, has been allowed within certain limits.

Gear Storage - Crab pots are generally stored on land or in designated storage areas at sea.

Vessel Tank Inspections - Vessel tank (or live-hold) and freezer inspections are required before the opening of a king or Tanner crab fishing season to meet the legal requirements of the states landing laws, provide effort information, and provide for a fair start to the fishery.

Gear Modifications - Pots are the specified legal commercial gear for capturing crab in the BSAI area. An escape mechanism is required on all pots. This mechanism will terminate a pots catching and holding ability in case the pot is lost. Escape areas may be incorporated or mesh size adjusted to allow the escape of nonlegal crabs. Various devices may be added to pots to prevent capture of other species.

Bycatch Limits - The state may implement bycatch limits of crab in crab fisheries managed under the FMP.

State Observer Requirements - The state may place observers aboard crab fishing or processing vessels to obtain catch, effort, and biological data. The state currently has a mandatory observer requirement on all catcher/processors and floating processors participating in the king, Tanner, and snow crab fisheries as a condition of obtaining a processing permit. It is important that the state observer program and any future federal observer program be coordinated.

Other - State government is not limited to only the management measures described in the FMP. Implementation of other management measures not described in the FMP must be consistent with the FMP, the Magnuson-Stevens Act, and other applicable federal laws, and may occur only after consultation with the NPFMC. Other management measures the state may implement are subject to the review and appeals procedures described in the FMP.

1.0 INTRODUCTION

The king and Tanner crab populations of Alaska have had a history of extensive commercial exploitation for 30 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-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801, et seq.) (Magnuson-Stevens Act) 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 address 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 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 the Magnuson-Stevens Act, 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)[1] 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

[1] Hereafter the term "Board" will be used to denote the "Alaska Board of Fisheries" or its successor entities.

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-Stevens 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 Tanner crab 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-Stevens 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-Stevens 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-Stevens Act, and 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 area management report discussing the current biological and economic status of the fisheries, guideline harvest level (GHL) ranges, and support for different management decisions or changes in harvest strategies as outlined on page 2-11. The Board currently receives proposals for king and/or Tanner crab regulation changes every third year, although the schedule may be modified if necessary. Management decision-making for king and Tanner crab stocks currently follows a relatively predictable schedule. The procedure for managing the fishery and how it encompasses research and fishing input is described in detail in Otto (1985) and Otto (1986) with respect to king crabs, and for this FMP, are illustrated in Figure 2.1. 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 regulations applicable to all vessels registered with the State governing the fisheries in the EEZ that are consistent with the FMP, Magnuson-Stevens Act, and other applicable Federal law. The FMP contains three types of management measures: (1) specific Federal management measures that require an FMP 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 Board meeting for the purpose of assisting the State in determining the extent to which proposed management measures are consistent with the FMP, Magnuson-Stevens Act, and other applicable Federal law. However, these representatives will not vote on the various management measures. The Secretary will review measures adopted by the State to determine if they are consistent with the FMP, the Magnuson-Stevens Act and its national standards in accordance with Chapters 9 and 10.

3. The Secretary will issue Federal regulations to supersede in the EEZ any State laws that are inconsistent with the FMP, the Magnuson-Stevens Act, or other applicable Federal law. The Secretary will consider only those appeals asserting that a State law is inconsistent with the Magnuson-Stevens 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-Stevens 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 Administrator, 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-Stevens 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. A special means of access to the BS/AI king and Tanner crab regulatory process 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 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 Board. 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, as may any other Board advisory committee.

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 Administrator, 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 that 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 that 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 that 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.

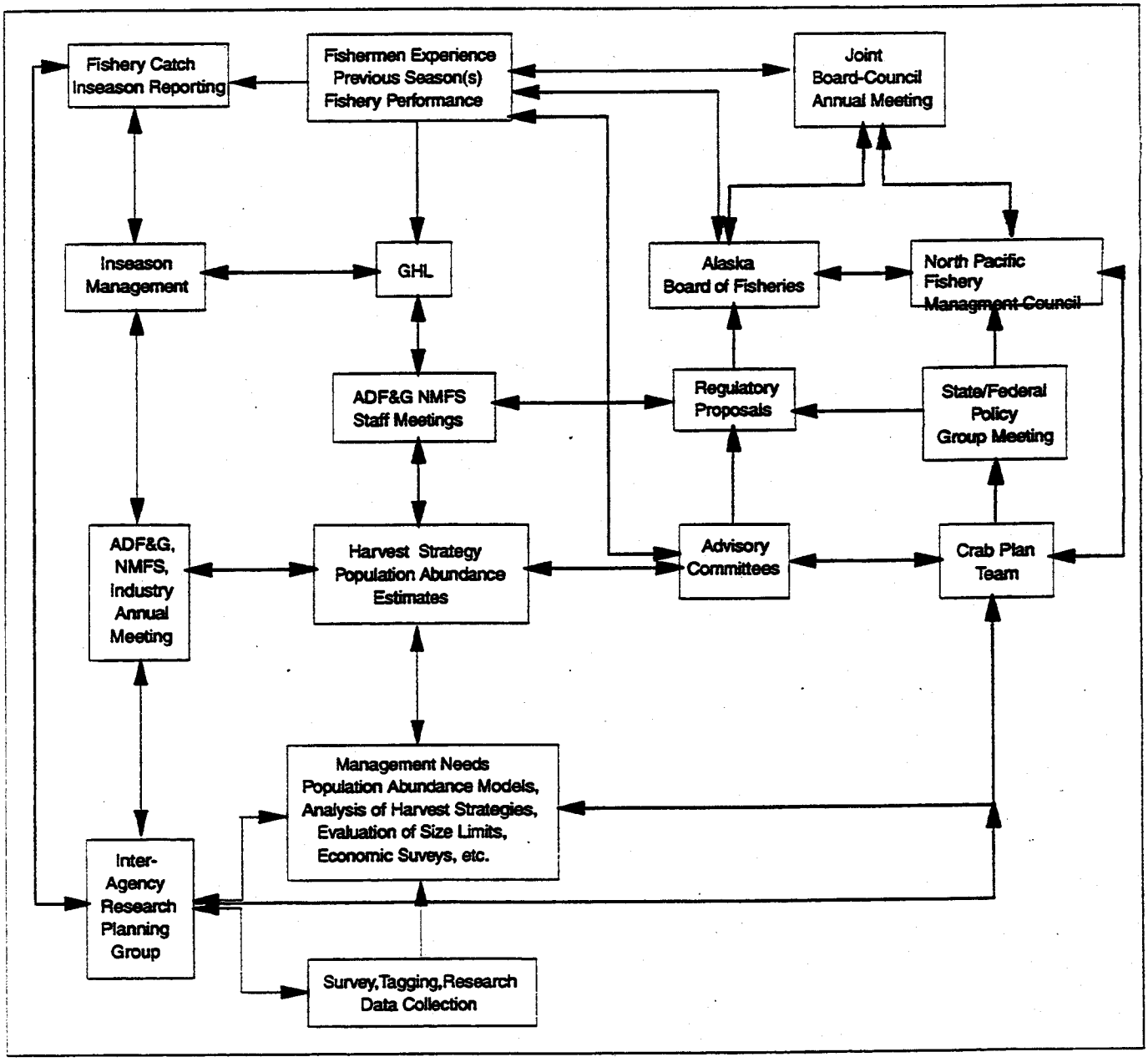
The CIAC shall function similarly to the Council's "Interim Action Committee." The CIAC shall consider each request for review to determine whether the management measure(s) or other relevant matter(s) is consistent with this FMP (including compliance with framework criteria), the Magnuson-Stevens Act, 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. 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 report will be available for public comment and presented to the Council on an annual basis. GHLs will be revised when new information is available. Such information will be made available to the public.

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

Figure 2.1. Annual cycle of management decision making for king and Tanner crab stocks and its interaction with fisheries and resource assessment. Regulatory proposals are addressed every three years by the Alaska Board of Fisheries.



3.0 FINDING OF CONSISTENCY OF EXISTING STATE REGULATIONS WITH THE FMP, THE MAGNUSON-STEVENS 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 date the Secretary approves this FMP and the next regularly scheduled meeting of the Board 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-Stevens 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 the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. MSY was estimated from the best information available. Several BSAI crab stocks have insufficient scientific data to estimate biological reference points and stock dynamics are inadequately understood.

MSY control rule means a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY. The MSY control rule for king and Tanner crabs is the mature biomass of a stock under prevailing environmental conditions, or proxy there of, exploited at a fishing mortality rate equal to a conservative estimate of natural mortality.

MSY stock size is the average size of the stock, measured in terms of mature biomass, or a proxy there of, under prevailing environmental conditions. It is the stock size that would be achieved under the MSY control rule. It is also the minimum standard for a rebuilding target when remedial management action is required.

Maximum fishing mortality threshold is defined by the MSY control rule, and is expressed as the fishing mortality rate. The MSY fishing mortality rate $F_{msy} = M$, a conservative natural mortality value set equal to 0.20 for all species of king crab, and 0.30 for all *Chionoecetes* species.

Minimum stock size threshold, is whichever is greater: one half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold. The minimum stock size threshold is expressed in terms of mature biomass.

Optimum Yield (OY) The term 'optimum', with respect to the yield from a fishery, means the amount of crab which --

(a) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;
(b) is prescribed as such on the basis of maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and
(c) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

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) means the preseason estimated level of allowable fish harvest which will not jeopardize the sustained yield of the fish stocks. A GHL may be expressed as a range of allowable harvests for a species or species group of crab for each registration area, district, subdistrict, or section.

Overfishing is defined as any rate of fishing mortality in excess of Fmsy for king and Tanner crab stocks in the Bering Sea/Aleutian Islands management area.

Registration (statistical) area. State regulations define a registration area as all the waters within the registration area which are territorial waters of Alaska; and an adjacent exclusive economic zone comprised

of all the waters adjacent to a crab registration area and seaward to a boundary line drawn in such a manner that each point on the line is 200 nautical miles from the baseline from which the territorial sea is measured.

Commercial fishing means the taking, fishing for, or possession of fish, shellfish, or other fishery resources with the intent of disposing of them for profit, or by sale, barter, trade, or in commercial channels.

Subsistence Uses means the noncommercial, customary and traditional uses of wild, renewable resources by resident domiciled in a rural area of the state for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption.

5.0 DESCRIPTION OF FISHERY MANAGEMENT UNIT

This FMP applies to commercial fisheries for red king crab Paralithodes camtschaticus, blue king crab P. platypus, golden (or brown) king crab Lithodes aequispinus, scarlet (or deep sea) king crab Lithodes couesi, and Tanner crab Chionoecetes bairdi, snow (or queen) crab C. opilio , grooved Tanner crab, C. tanneri, and triangle Tanner crab C. angulatus in the BS/AI area. The common and scientific names used in this FMP are those included in Williams et al. (1988), appropriately amended, with secondary common names sometimes used in the fishery included in parentheses. Members of the genus Chionoecetes are often collectively referred to as Tanner crabs; where confusion might arise the name bairdi Tanner crab is used to distinguish the species. Through 1989, commercial landings had only been reported for red, blue, and golden king crab; and Tanner, snow and hybrids of these two species. The other species of king and Tanner crabs 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 Point Hope (68°21'N.), east of the U.S.-U.S.S.R. convention line of 1988, 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 1988 agreement between the two parties shifted the boundary westward from the convention line of 1867. The U.S. ratified the agreement in 1990, but the Russian Federation had yet to do so as of February 1998. Nevertheless, the Russian Federation is provisionally applying the maritime boundary agreement and the U.S. position is that the maritime boundary is in force.

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.

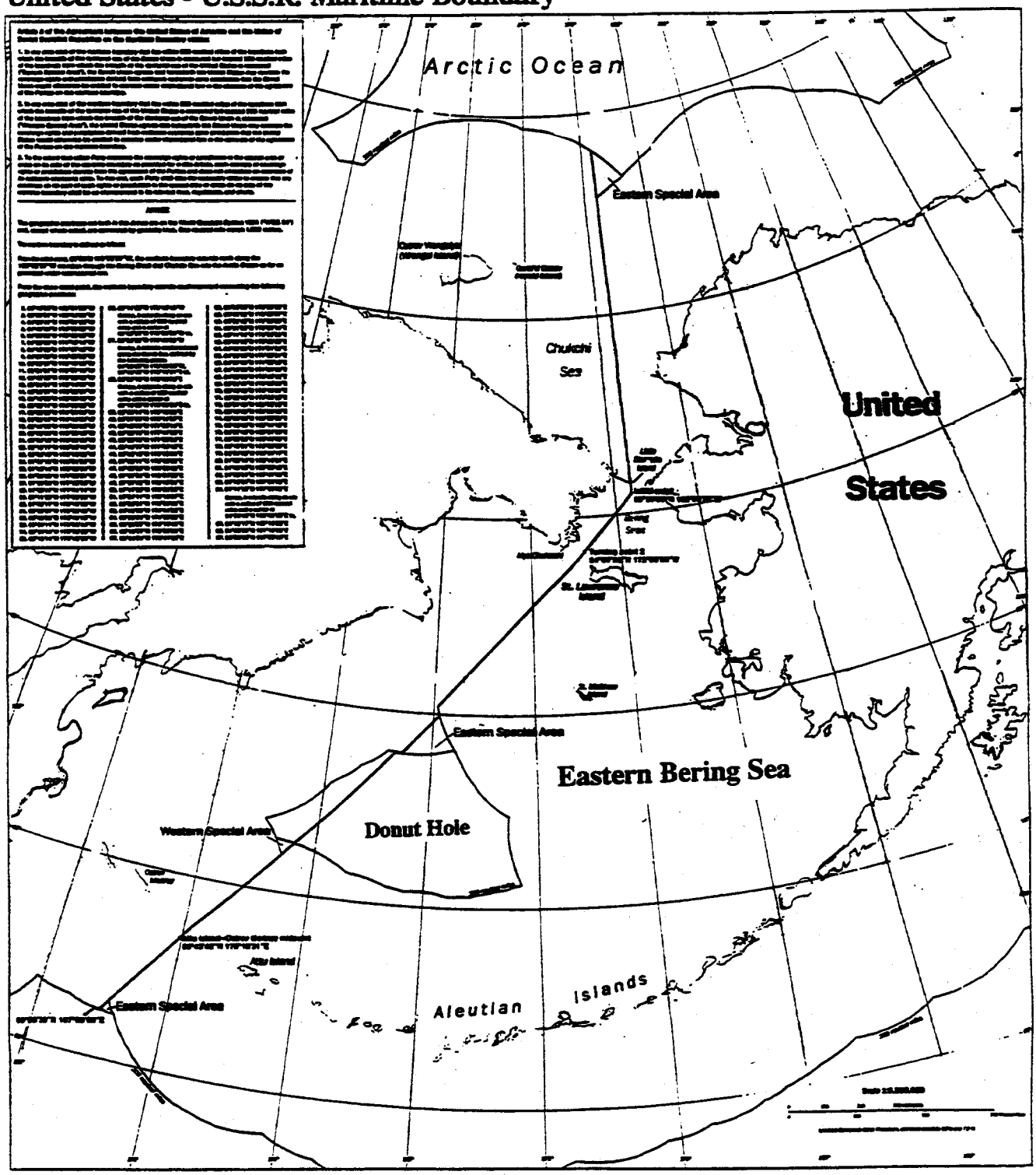
The Council considered the following in determining the boundaries for the management unit:

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 golden 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 mostly by residents of Washington and Oregon). 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.

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.

Figure 5.1

United States - U.S.S.R. Maritime Boundary



6.0 SPECIFICATION OF MAXIMUM SUSTAINABLE YIELD, OPTIMUM YIELD, MINIMUM STOCK SIZE THRESHOLDS, OVERFISHING LEVELS, ANNUAL HARVEST, AND ANNUAL PROCESSING

The total allowable level of harvest and processing depends upon specification of MSY and OY. 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.

The following definitions are based on the national standard 1 guidelines (50 CFR 600.310) and bring the FMP into compliance with the Magnuson-Stevens Act. These definitions provide objective and measurable criteria for identifying when the BSAI crab fisheries are overfished or overfishing is occurring. Table 6.1 provides the MSST, MSY, OY and MSY control rule estimates for the BSAI king and Tanner crab stocks. The MSY was recalculated for Adak red king crab, Aleutian golden king crab, and St. Matthew golden king crab since the public draft of the EA dated May 6, 1998. The Crab Plan Team will reevaluate these estimates every five years or when environmental conditions indicate a regime shift.

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. The term 'optimum', with respect to the yield from a fishery, means the amount of crab which --

(a) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;

(b) is prescribed as such on the basis of maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and

(c) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Maximum sustainable yield (MSY) is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. MSY is estimated from the best information available. Proxy stocks are used for BSAI crab stocks where insufficient scientific data exists to estimate biological reference points and stock dynamics are inadequately understood. MSY for crab species is computed on the basis of the estimated biomass of the mature portion of the male and female population or total mature biomass (MB) of a stock. A fraction of the *MB* is considered sustained yield (*SY*) for a given year and the average of the *SY*s over a suitable period of time is considered the MSY.

Overfishing: The term "overfishing" and "overfished" mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce MSY on a continuing basis. Overfishing is defined for king and Tanner crab stocks in the BSAI management area as any rate of fishing mortality in excess of the maximum fishing mortality threshold, F_{msy}, for a period of 1 year or more. Should the actual size of the stock in a given year fall below the minimum stock size threshold, the stock is considered overfished. If a stock or stock complex is considered overfished or if overfishing is occurring, the Secretary will notify the Council to take action to rebuild the stock or stock complex.

MSY control rule means a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY. The MSY control rule for king and Tanner crabs is the mature biomass of a stock under prevailing environmental conditions, or proxy thereof, exploited at a fishing mortality rate equal to a conservative estimate of natural mortality.

MSY stock size is the average size of the stock, measured in terms of mature biomass of a stock under prevailing environmental conditions, or a proxy thereof. It is the stock size that would be achieved under the MSY control rule. It is also the minimum standard for a rebuilding target when remedial management action is required. For king and Tanner crab, the MSY stock size is the average mature biomass observed over the past 15 years, from 1983 to 1997.

Maximum fishing mortality threshold (MFMT) is defined by the MSY control rule, and is expressed as the fishing mortality rate. The MSY fishing mortality rate $F_{msy} = M$, is a conservative natural mortality value set equal to 0.20 for all species of king crab, and 0.30 for all *Chionoecetes* species.

Minimum stock size threshold (MSST) is whichever is greater: one half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold. The minimum stock size threshold is expressed in terms of mature biomass of a stock under prevailing environmental conditions, or a proxy thereof.

Table 6.1. MSST, MSY, OY, and the MSY control rule estimates for BSAI king and Tanner crab stocks. Estimated values are in millions of pounds. (NA indicates that insufficient data exists at this time to estimate the value)

Stock	MSST	MSY	OY range	MSY control rule
Adak red king	NA	1.5	0 - 1.5	0.2
Bristol Bay red king	44.8	17.9	0 - 17.9	0.2
Dutch Harbor red king	NA	NA	NA	0.2
Pribilof Islands red king	3.3	1.3	0 - 1.3	0.2
Norton Sound red king	NA	0.5	0 - 0.5	0.2
Pribilof Islands blue king	6.6	2.6	0 - 2.6	0.2
St Matthew blue king	11.0	4.4	0 - 4.4	0.2
St Lawrence blue king	NA	0.1	0 - 0.1	0.2
Aleutian Is. golden king	NA	15.0	0 - 15.0	0.2
Pribilof Is. golden king	NA	0.3	0 - 0.3	0.2
St. Matthew golden king	NA	0.3	0 - 0.3	0.2
Aleutian Is. scarlet king	NA	NA	NA	0.2
EBS scarlet king	NA	NA	NA	0.2
TOTAL king crab		**43.9**	**0 - 43.9**	
E. Aleutian Is. Tanner	NA	0.7	0 - 0.7	0.3
EBS Tanner	94.8	56.9	0 - 56.9	0.3
W. Aleutian Is. Tanner	NA	0.4	0 - 0.4	0.3
TOTAL Tanner crab		**58.0**	**0 - 58.0**	
EBS snow	NA	276.5	0 - 276.5	0.3
TOTAL snow crab		**276.5**	**0 - 276.5**	
E. Aleutian Is. angulatus	NA	1.0	0 - 1.0	0.3
EBS angulatus	NA	0.3	0 - 0.3	0.3
E. Aleutian Is. tanneri	NA	1.8	0 - 1.8	0.3
EBS tanneri	NA	1.5	0 - 1.5	0.3
W. Aleutian Is. Tanneri	NA	0.2	0 - 0.2	0.3
TOTAL other Tanners		**4.8**	**0 - 4.8**	

Pursuant to the Magnuson-Stevens Act, Section 201(d), there is no allowable level of foreign fishing or joint venture processing for the fisheries covered by this FMP. Fishing vessels of the United States will harvest the OY. As such none of the OY will be made available for foreign fishing. Similarly, United states fish processors have more than enough capacity to process the OY. The U.S. fishing and fish processing industries have achieved OY since 1981.

Incidental 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 to allow the State to account for these removals in management of the directed crab fisheries.

7.0 GOAL AND OBJECTIVES

The Council, in cooperation with the State, is committed to developing 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-Stevens 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 any 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 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. 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 considered,

2. The future value of crab, based on 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 law. Basically, State law requires that a reasonable opportunity be provided for subsistence use before other consumptive use is allowed. 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 the Magnuson-Stevens 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 when 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. Insofar 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, conversations with members of the plan team or officials of regulatory agencies, and by commenting on the FMP, any subsequent amendments and any 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. 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-Stevens 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 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 when appropriate. This will be available for public comment, and presented to the Council on an annual basis. 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 that 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): Category 1 measures are those that are specifically fixed in the FMP, and require an FMP amendment to change. Category 2 measures are those that are framework-type measures which the State can change following criteria set out in the FMP. Category 3 measures are those measures that are neither rigidly specified nor frameworked in the FMP. The measures in Categories two and three 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-Stevens Act, and other applicable Federal law, and may occur only after consultation with the Council.

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-Stevens Act and other applicable Federal law.

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
Federal Observer Requirements	In-season Adjustments	Gear Storage
Limited Access	Districts, Subdistricts and Sections	Vessel Tank Inspections
Norton Sound Superexclusive Registration	Fishing Seasons	Gear Modifications
	Sex Restrictions	Bycatch Limits (in crab fisheries)
	Pot Limits	State Observer Requirements
	Registration Areas	Other
	Closed Waters	

8.1 Category 1—Federal Management Measures Fixed By The FMP

8.1.1 Legal Gear

Trawls and tangle nets are specifically prohibited because of the high mortality rates which they inflict on nonlegal crab. 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, except as required by the Moratorium on new vessels entering the fishery as described in Section 8.1.4. and regulated by 50 CFR 679. Vessel moratorium permits are required through December 31, 1998, unless the moratorium is extended by the Council. Upon expiration of the vessel moratorium, an approved License Limitation Program, as described in Section 8.1.4. and regulated by 50 CFR 679, would require a Federal Crab License for vessels. As noted in Section 8.1.4, a Federal Crab License will be required on vessels participating in the BSAI king and Tanner crab fisheries. 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. This assumption is based on the requirement of lending institutions and insurance companies that the crab vessels be registered with the State of Alaska and be able to enter State waters. If, in the future, vessels participate in the fishery without registering with the State, it is likely that a plan amendment will be required. State registered vessels are subject to enforcement sanctions issued pursuant to State procedures.

8.1.3 Federal 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 Administrator 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 soft-shell 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

8.1.4.1 Moratorium on Vessels Entering the Fisheries

Beginning on January 1, 1996 a moratorium on harvesting vessels (including harvester/processors) entering the BSAI King and Tanner Crab fisheries is in effect. Vessels fishing in State waters will be exempt. The vessel moratorium will last until the Council replaces or rescinds the action, but in any case will end on December 31, 1998. The Council may however extend the moratorium up to 2 additional years, if a permanent limited access program is imminent.

Elements of the Moratorium

1. Qualifying Period. In order to qualify, a harvesting vessel must have made a reported landing in one of the designated moratorium fisheries during the period beginning January 1, 1988, and ending February 9, 1992, including landings of moratorium species from State waters. Moratorium species are those managed under Council FMPs and include groundfish (other than fixed gear sablefish) in the BSAI and GOA and BSAI king and Tanner crab.

2. Eligible Fisheries. If a vessel qualifies based on Item 1 above, the following provisions apply:

   a. A vessel that made a qualifying landing in the BSAI crab fisheries would be eligible to participate in the BSAI crab fisheries under the moratorium.

   b. A vessel that made a qualifying landing in the BSAI or GOA groundfish fisheries would be eligible to participate in the BSAI/GOA groundfish fisheries **AND** the BSAI crab fisheries under the moratorium providing:
      (1) it uses only the same fishing gear in the BSAI crab fisheries that it used in the groundfish fisheries to qualify for the moratorium, and
      (2) it does not use any fishing gear prohibited in the BSAI crab fisheries.

   c. A vessel that made a qualifying landing in the BSAI or GOA groundfish fisheries, and during the period February 9, 1992, through December 11, 1994, made a landing in the BSAI crab fisheries would be eligible to continue to participate in the BSAI crab fisheries under the moratorium using the gear with which the crab landing was made.

3. Length Increases During the Moratorium: The 20% Rule. Moratorium qualified vessels will be limited to a 20% increase in length overall (LOA) as long as the increase does not result in a vessel greater than 125 ft LOA. The 20% increase will be based on the LOA of the original qualified vessel. Vessels over 125 ft LOA may not be lengthened under any circumstance.

4. Reconstruction of Vessels During the Moratorium. An eligible vessel that is reconstructed during the moratorium retains its privilege to participate in all fisheries under the Council's jurisdiction subject to the following provisions: (1) If reconstruction is completed prior to June 24, 1992, the new size is unrestricted and length increases subject to the 20% Rule discussed above are allowed between June 24, 1992 and the end of the moratorium. (2) If reconstruction began prior to June 24, 1992 but was not completed until after that date, the new size would be unrestricted but no more length increases would be allowed. (3) If reconstruction commences on or after June 24, 1992, increases in length may not exceed the 20% Rule. (4) Other types of vessel reconstructions or upgrades may occur as long as they do not result in the lengthening of a vessel.

5. Replacement of Vessels During the Moratorium. During the moratorium, qualifying vessels can be replaced with non-qualifying vessels so long as the replaced vessel leaves the fishery. Though multiple or sequential replacements are allowed, vessel length can only be increased subject to the 20% Rule. In the case of existing qualified vessels over 125 ft LOA, the replacement vessel cannot exceed the length of the original vessel. In the event of a combined replacement/reconstruction, increases in LOA may not exceed the 20% Rule.

6. Replacement of Vessels Lost or Destroyed On or After January 1, 1989 But Before January 1, 1996. Vessels lost or destroyed on or after January 1, 1989 may be replaced provided the following conditions are met. (1) The LOA of the replacement vessel does not exceed the 20% rule. (2) The replacement vessel must make a landing in a moratorium fishery prior to December 31, 1997 to remain a qualified vessel. The replaced vessel would no longer be a moratorium qualified vessel.

7. Replacement of Vessels Lost or Destroyed After January 1, 1996. Vessels lost or destroyed after January 1, 1996 may be replaced subject to the 20% Rule and the replaced vessel would no longer be a moratorium qualified vessel.

8. Salvage of Vessels Lost or Destroyed On or After January 1, 1989. A moratorium qualified vessel lost or destroyed between January 1, 1989 and the end of the moratorium may be salvaged and will be considered a moratorium qualified vessel, as long as it has not already been replaced, as per item 5 above.

9. Salvage of Vessels Lost or Destroyed Before January 1, 1989. A moratorium qualified vessel lost or destroyed before January 1, 1989 may not be replaced. The lost or destroyed vessel may be salvaged and become moratorium qualified if it meets the following two conditions: (1) Salvage operations must have been ongoing as of June 24, 1992. (2) The salvaged vessel must make a landing in a moratorium fishery prior to December 31, 1997.

10. Small Vessel Exemptions. Vessels 32 ft or less LOA would be exempted from the moratorium in the Bering Sea and Aleutian Islands.

11. Disadvantaged Communities. New vessels constructed after implementation of Community Development Quota (CDQ) programs, pursuant to an approved CDQ project, will be exempt from the moratorium. In order to qualify for such exemption the vessel must: (1) be constructed solely for the purpose of furthering the goals of a community CDQ project, and (2) be a specialized vessel designed and equipped to meet the needs of a community or group of communities that have specific and unique operating requirements. Such exemptions would be limited to vessels 125 ft LOA and under. These vessels may fish in both CDQ and non-CDQ fisheries. Vessels built pursuant to a CDQ project under this exemption that are transferred to a non-CDQ entity during the life of the moratorium may not be considered eligible under the moratorium.

12. Halibut and Sablefish Fixed Gear Vessels. Halibut and sablefish fixed gear vessels operating under the provisions of the proposed IFQ Amendment will be exempted from the vessel moratorium as it affects directed halibut and sablefish operations. Such an exemption becomes effective at the time of implementation of the IFQ program. Non-qualifying vessels entering the halibut and sablefish fisheries under this exemption may not participate in any other directed fisheries under the Council's authority. If the total retained catch of species other than halibut and sablefish exceeds 20% of the total weight of all species of fish on board, then the vessel must be a moratorium-qualified vessel.

13. Transfer of Moratorium Rights. It shall be assumed that any transfer of vessel ownership includes a transfer of moratorium fishing rights. Moratorium rights may however be transferred without a transfer of ownership of the original qualifying vessel or any subsequently qualified vessel. The recipient of such transfers of rights will bear the burden of proof for moratorium qualification. Transfers of moratorium rights may not be used to circumvent the 20% Rule. Moratorium permits may be transferred only in their entirety; i.e., species or gear endorsements may not be separated and transferred independently.

8.1.4.2 Vessel License Limitation

A vessel license limitation program (LLP) was approved as Amendment 5 on September 12, 1997 and requires a Federal Crab License on harvesting vessels (including harvester/processors) participating in the BSAI King and Tanner Crab fisheries. Vessels fishing in State waters will be exempt, as will vessels < 32'. The LLP will replace the vessel moratorium and will last until the Council replaces or rescinds the action. The crab CDQ portion of Amendment 5 became effective March 23, 1998. The crab CDQ program establishes the crab CDQ reserve and authorizes the State of Alaska to allocate the crab CDQ reserve among CDQ groups and to manage crab harvesting activity of the BS/AI CDQ groups.

Elements of the License Limitation Program

1. Nature of Licenses. General crab licenses will be issued, based on historical landings defined in Federal regulations, for BSAI king and Tanner crab fisheries covered under the FMP, with the following species/area endorsements:

   a. Pribilof red and Pribilof blue king crab
   b. *C. opilio* and *C. bairdi*
   c. St. Matthew blue king crab
   d. Adak golden king crab
   e. Adak red king crab
   f. Bristol Bay red king crab
   g. Norton Sound red and Norton Sound blue summer king crab

   Species/area combinations not listed above may be fished by any vessel that holds a valid Federal crab license regardless of the endorsements attached to the license, if those fisheries are open and the vessel meets all other State and Federal regulatory requirements.

2. License Recipients. Licenses will be issued to current owners (as of June 17, 1995) of qualified vessels, except in the Norton Sound summer red and blue king crab fisheries. Licenses for these fisheries would be issued to:

   a. Individuals who held a State of Alaska Permit for the Norton Sound summer king crab fisheries and made at least one landing; or

   b. Vessel owners as of June 17, 1995 in instances where a vessel was corporate owned, but operated by a skipper who was a temporary contract employee.

   The owners as of this date must be "persons eligible to document a fishing vessel" under Chapter 121, Title 46, U.S.C. In cases where the vessel was sold on or before June 17, 1995, and the disposition of the license qualification history was not mentioned in the contract, the license qualification history would go with the vessel. If the transfer occurred after June 17, 1995, the license qualification history would stay with the seller of the vessel unless the contract specified otherwise.

3. License Designations. Licenses and endorsements will be designated as Catcher Vessel or Catcher Processor and with one of three vessel length classes (<60', ≥60' but < 125', or ≥ 125' LOA).

4. Who May Purchase Licenses. Licenses may be transferred only to "persons" defined as those "eligible to document a fishing vessel" under Chapter 121, Title 46, U.S.C. Licenses may not be leased.

5. Vessel/License Linkages. Licenses may be transferred without a vessel, i.e., licenses may be applied to vessels other than the one to which the license was initially issued. However, the new vessel is still subject to the license designations, vessel upgrade provisions, 20% upgrade rule (defined in provision seven) , and the no leasing provision. Licenses may be applied to vessels shorter than the "maximum LOA" regardless of the length of the vessel class designations. Vessels may also use catcher processor licenses on catcher vessels. However, the reverse is not allowed. It was the Council's intent that vessels be allowed to "downgrade".

6. Separability of General Licenses and Endorsements. General licenses may be issued for the Bering Sea /Aleutian Islands groundfish, Gulf of Alaska groundfish, and Bering Sea /Aleutian Islands crab fisheries. Those general licenses initially issued to a person based on a particular vessel's catch history are not separable and shall remain as a single "package". General licenses transferred after initial allocation shall remain separate "packages" in the form they were initially issued, and will not be combined with other general groundfish or crab licenses the person may own. Species/area endorsements are not separable from the general license they are initially issued under, and shall remain as a single "package," which includes the assigned catcher vessel/catcher processor and length designations.

7. Vessel Replacements and Upgrades. Vessels may be replaced or upgraded within the bounds of the vessel length designations and the "20% rule". This rule was originally defined for the vessel moratorium program. The maximum length over all (MLOA) with respect to a vessel means the greatest LOA of that vessel or its replacement that may qualify it to conduct directed fishing for groundfish covered under the license program, except as provided at § 676.4(d). The MLOA of a vessel with license qualification will be determined by the Regional Director as follows:

   (a) For a vessel with license qualification that is less than 125' LOA, the maximum LOA will be equal to 1.2 times the vessel's original qualifying length or 125', which ever is less; and

   (b) For a vessel with license qualification that is equal to or greater that 125', the maximum LOA will be equal to the vessel's original qualifying length.

   If a vessel upgrades under the "20% rule" to a length which falls into a larger license length designation after June 17, 1995, then the vessel owner would be initially allocated a license and endorsement(s) based on the vessels June 17, 1995 length. Those licenses and endorsements could not be used on the qualifying vessel, and the owner would be required to obtain a license for that vessel's designation before it could be fished. Vessels in the Norton Sound summer king crab fisheries may upgrade more than 20% (as defined in the 20% rule) so long as the vessel does not exceed 32' LOA after the upgrade is complete.

8. License Ownership Caps. No more than five general crab licenses may be purchased or controlled by a "person," with grandfather rights to those persons who exceed this limit in the initial allocation. Persons with grandfather rights from the initial allocation must be under the five general license cap before they will be allowed to purchase any additional licenses. A "person" is defined as those eligible to document a fishing vessel under Chapter 121, Title 46, U.S.C. For corporations, the cap would apply to the corporation and not to share holders within the corporation.

9. Vessel License Use Caps. There is no limit on the number of licenses (or endorsements) which may be used on a vessel.

10. Changing Vessel Designations. If a vessel qualifies as a catcher processor, it may select a one time (permanent) conversion to a catcher vessel designation.

11. Implement a Skipper Reporting System. NMFS will implement a skipper reporting system which requires crab license holders to report skipper names, addresses, and service records.

12. CDQ Vessel Exemption. Vessels < 125' obtained under an approved CDQ plan to participate in both CDQ and non-CDQ target fisheries, will be allowed to continue to fish both fisheries without a license. If the vessel is sold outside the CDQ plan, the vessel will no longer be exempt from the rules of the crab license program.

13. Lost Vessels. Vessels which qualified for the moratorium and were lost, damaged, or otherwise out of the fishery due to factors beyond the control of the owner and which were replaced or otherwise reentered the fishery in accordance with the moratorium rules, and which made a landing any time between the time the vessel left the fishery and June 17, 1995, will be qualified for a general license and endorsement for that species/area combination.

14. Licenses Represent a use Privilege. The Council may alter or rescind this program without compensation to license holders; further, licenses may be suspended or revoked for (serious and/or multiple) violations of fisheries regulations.

CDQ Allocation.

CDQs will be issued for 3.5% in 1998; 5% in 1999; and 7.5% in 2000 of all BSAI crab fisheries that have a Guideline Harvest Level set by the State of Alaska. The program will be patterned after the pollock CDQ program (defined in section 14.4.11.6 of the BSAI groundfish FMP), but will not contain a sunset provision. Also, Akutan will be included in the list of eligible CDQ communities.

8.1.5 Superexclusive Registration in Norton Sound

This FMP establishes the Norton Sound Section of the Northern District of the king crab fishery as a superexclusive registration area. Any vessel registered and participating in this fishery would not be able to participate in other BSAI king crab fisheries, such as Adak, Bristol Bay, Dutch Harbor, Pribilof, St. Lawrence, or St. Matthew, during that registration year. The Norton Sound fishery is the only superexclusive registration area authorized by 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) size at maturity (physiological, functional, or morphometric), (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 is 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. bairdi from 5.5" to 5.0" have met with resistance, also because of market 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 may be expressed as a range about a point estimate. 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 BSAI crab fisheries are regulated using this term. 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 MSY or OY, 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, acceptable biological catch (ABC), is set to achieve the biological conservation objective of preventing 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 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 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 soft-shell conditions result in wasted product and nonquantified harvests to the crab stocks. 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 previously discussed.

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 soft-shell 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.

If a crab stock has been customarily or traditionally used for subsistence diminishes so that all consumptive uses of that stock cannot be accommodated, State law requires that in most areas of Alaska, subsistence uses have a priority over other uses. 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 soft-shell periods.

4. Consideration of increasing product quality.

5. Minimization of bycatch.

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 golden king crab. The information that is available for golden 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 soft-shell 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, and

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 in achieving 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 fishermen provide accurate documentation of harvest rates and location, and processing and marketing results are made available to the management agency.

8.2.7 Pot Limits

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 shall 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 mortality 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 length overall (LOA)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.

8.2.8 Registration Areas

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 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 Norton Sound registration area has been designated as a superexclusive area by Federal law.

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).

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

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, and

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 and tend to overharvest some stocks and underharvest others.

8.2.9 Closed Waters

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 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' N. 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.

The State may designate new closed waters areas or expand or reduce existing State closed waters areas. In making such changes, the State shall consider appropriate factors to the extent data are available on: (1) the need to protect subsistence fisheries, (2) the need to protect critical habitat for target or non-target species, (3) the prevention of conflict between harvesting of species, and (4) the creation of navigational hazard.

8.3 Category 3—Management Measures Deferred to State

8.3.1 Reporting Requirements

Assuming that all vessels participating in the fishery are licensed and 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 State of Alaska obtains timely information through its current reporting requirements for all vessels participating in the fishery. Additional information is currently available from the State of Alaska shellfish observer program. The price paid for 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.

Because of regulations which allow gear placement on the grounds prior to, and immediately following a season, 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 (golden) king crab, scarlet king crab (Lithodes couesi), grooved Tanner crab (C. tanneri), and triangle Tanner crab (C. angulatus) fisheries. Various devices may be added to pots to prevent capture of other species; to minimize king crab bycatch, the State currently requires tunnel-eye heights to not exceed 3 inches in pots fishing for C. bairdi or C. opilio in the Bering Sea. Escape mechanisms may be incorporated or mesh size adjusted to allow female and sublegal male crab to escape; the State currently specifies escape rings or mesh panels in regulation for pots used in the BS/AI C. bairdi, C. opilio, and brown (golden) king crab fisheries, in the Bristol Bay king crab fishery, and in the Pribilof District king crab fishery. State regulations also currently require incorporation of biodegradable twine as an escape mechanism on all pots which will terminate a pot's catching and holding ability in case the pot is lost.

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 State Observer Requirements

The FMP defers the State Observer requirements to the State. The State may place observers aboard crab fishing and/or processing vessels when the State finds that observers provide the only practical mechanism to obtain essential biological and management data or when observers provide the only effective means to enforce regulations. Data collected by onboard observers in crab fisheries include effort data and data on the species, sex, size, and shell-age/shell-hardness composition of the catch. The State currently requires onboard observers on all catcher/processor or floating-processor vessels processing king or Tanner crab and on all vessels participating in the Aleutian Islands red or brown (golden) king crab fisheries. The State currently may require observers as part of a permit requirement for any vessel participating in the scarlet king crab (Lithodes couesi), grooved Tanner crab (C. tanneri), or triangle Tanner crab (C. angulatus) fisheries. The State currently may require observers on selected catcher vessels taking red or blue king crab in the Norton Sound section, if ADF&G provides funding for the observer presence. The State currently may require observers on vessels taking red or blue king crab in the St. Lawrence Island Section. The State may also require onboard observers in other crab fisheries (e.g., the Pribilof Islands Korean hair crab Erimacrus isenbeckii fishery) to, in part, monitor bycatch of king or Tanner crab. Observers provide data on the amount and type of bycatch occurring in each observed fishery and estimates of bycatch by species, sex, size, and shell-age/shell-hardness for each observed fishery are currently provided in annual reports by ADF&G.

8.3.8 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-Stevens 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.

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

Prior to the Board Meeting

Commencing on the date the Secretary approves this FMP, and until the next regularly scheduled Board meeting concerning crab regulations, 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-Stevens Act, and other applicable Federal law.

At the Board Meeting

Before the annual Board meeting, the public has an opportunity to petition the State for new regulations or repeal of existing regulations. Copies of all 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-Stevens Act, and other applicable Federal Law. However, these representatives will not vote on the various management measures.

After the Board 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-Stevens 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-Stevens 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-Stevens 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. The Secretary may hold an informal hearing, if time permits, to gather further information

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

concerning the regulations under review. The Secretary will consider only comments on whether the new regulations are consistent with the FMP, the Magnuson-Stevens 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-Stevens 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-Stevens 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-Stevens Act, and 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-Stevens 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 meeting which takes place later in the year than anticipated here, or if there is not time to follow the procedure described in this chapter so that any final Federal rule that may be necessary can be effected in a timely fashion, 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-Stevens 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, 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-Stevens Act, or other applicable Federal law. For example, where State in-season, discretionary action is alleged to violate a Magnuson-Stevens 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-Stevens 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-Stevens 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-Stevens 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-Stevens 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-Stevens 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.

Appendix A State/Federal Action Plan

The following document is the State/Federal Action Plan for the commercial king and Tanner crab fisheries. This Action Plan details the cooperative management system for BSAI crab fisheries between the North Pacific Fishery Management Council and the State of Alaska.

ALASKA DEPARTMENT OF
FISH & GAME
DIVISION OF COMMERCIAL FISHERIES
JUNEAU, ALASKA

NATIONAL MARINE FISHERIES
SERVICE
ALASKA REGION
JUNEAU, ALASKA

STATE/FEDERAL ACTION PLAN
FOR MANAGEMENT OF
COMMERCIAL KING AND TANNER CRAB FISHERIES
OCTOBER, 1993

PURPOSE: To foster improved coordination and communication between National Marine Fisheries Service (NMFS) and Alaska Department of Fish & Game (ADF&G) with respect to crab management under the Fishery Management Plan for the Commercial King and Tanner Crab Fisheries in the Bering Sea and Aleutian Islands Area (FMP). Interagency action groups will implement this coordination.

BACKGROUND: The FMP approved in 1989 establishes a State/Federal cooperative management regime that defers crab management to the State of Alaska with Federal oversight. The Secretary of Commerce defers to the State's regulatory regime providing it is consistent with the FMP, the Magnuson Fishery Conservation and Management Act (Magnuson Act) and other Federal law.

A management goal and specific objectives are identified in the FMP. ADF&G, in consultation with NMFS, recommends to the Alaska Board of Fisheries (Board) appropriate management measure(s) for a given year and geographical area to accomplish the objectives. Three categories of management measures are available for consideration: (1) those that are specifically fixed and require an FMP amendment to change, (2) those that are framework-type measures which the State can change without an FMP amendment but following specified criteria, and (3) measures that are neither rigidly specified nor frameworked in the FMP. The measures in categories (2) and (3) may be adopted as State laws subject to the appeals process outlined in the FMP.

The State is not limited to the measures outlined above. Any other management measures must be justified based upon consistency with the FMP objectives, the Magnuson Act, and other applicable Federal law.

Overall, the FMP has efficiently managed the crab fisheries. The framework approach has worked well for the majority of crab management issues. However, Category 2 management measures have been appealed to the Secretary (specifically, pot limits and registration areas). Members of the industry also have criticized Board actions with respect to Category 2 measures

(setting of guideline harvest levels). In order to avoid future contentious problems, NMFS and ADF&G will adopt this action plan to more formally implement State/Federal cooperation in crab management.

ACTION: Three action groups, described below, will facilitate this joint coordination.

a) Research Planning Group
b) Crab Plan Team
c) State/Federal Policy Group

Research Planning Group

The purpose of this group will be to consider long-term crab research priorities, current research activities, and each agency's particular research interests. The group will include NMFS, ADF&G and university crab biologists as well as other representatives from NMFS/Fisheries Management Division; Alaska Fisheries Science Center and ADF&G/Division of Commercial Fisheries. Some of these individuals also may be members of the Crab Plan Team.

This group will work on the development of a long-term plan for applied crab research which will help foster a healthy exchange of ideas among fishery biologists and managers on particular needs. The plan will focus on development of optimal long-term harvest policies. The plan will be updated annually and will function as a vehicle to coordinate the expenditure of crab funds between ADF&G and NMFS and to seek additional funding for critical research.

The group will meet annually for a one- or two-day period at a time and place convenient for the majority of group members.

Crab Plan Team

The annual development of the preseason guideline harvest levels (GHLs) is a dynamic process dependent on using the most current information available and applying this information via analysis and statistical modeling. Scientists from NMFS and ADF&G are currently involved in this process.

Though individual members of the Plan Team have always participated in the development of GHLs, public perception is that this is an ad hoc process. Due to the timing of the Bering Sea surveys and the openings of the early fall fisheries, only a limited amount of time exists to analyze, discuss, amend and release the GHLs to the public in a timely fashion. To release preseason GHLs that have been reviewed using a Council process, such as that used to establish annual groundfish harvest specifications under the groundfish FMPs, would require that

current season opening dates for the fall fisheries be delayed and/or rescheduled, or the previous year's survey information would have to be used to set GHLs in the current year. The latter option could interfere with the FMP management objective of biological conservation. In addition, the Council would have to schedule a special meeting or allow time during the September meeting to address crab management after the survey information became available.

The purpose of a Plan Team review will be to formally incorporate its input in the GHL process. The FMP calls for Plan Team input in the preparation of an annual area management report to the Board. This report includes a discussion of the current status of GHLs and support for different management decisions. This report is reviewed by the State, NMFS, and the Council, and available for public comment on an annual basis.

The Plan Team will meet annually to review GHLs in a session that is open to the public.

State/Federal Policy Group

The purpose of the State/Federal Policy Group will be to review and discuss crab management issues prior to Board and/or Council review. This group will include senior staff and legal counsel and will meet annually, or more often if necessary. Many issues may be resolved through interagency agreement. For instance, prior to final Board action, this Policy Group could review whether crab management proposals and petitions are consistent with the FMP and reflect an appropriate and desired management strategy. Also, this group will review FMP amendment proposals. Their recommendations will be forwarded to the Board and the Council, providing guidance as the Board establishes management regulations.

OTHER ACTION:

In addition to the above action groups, NMFS and ADF&G will meet annually with crab industry representatives to discuss crab management issues such as, but not limited to, setting of GHLs, stock analysis, current research, and harvest strategies. The location of meetings will alternate between Washington and Alaska. These meetings will provide an opportunity for review of crab management issues and industry input to management agencies.

Council and Board members have agreed to form a Consultation Group composed of a subcommittee of Council and Board members that will meet publicly on an annual basis to focus on crab issues. (These meetings could occur at one of the regularly scheduled Council or Board meetings.) This joint subcommittee could review staff data on the status of crab stocks and fisheries and both public and staff information regarding crab

management and then provide guidance to the respective Council and Board on pertinent crab issues. Council and Board representatives would benefit by meeting for the sole purpose of discussing crab-related issues.

Both NMFS and ADF&G agree to jointly request Council and Board concurrence on these action groups and their role in the cooperative management of the king and Tanner crab fisheries in the Bering Sea and Aleutian Islands.

This State/Federal Action Plan for Management of Commercial King and Tanner Crab Fisheries has been approved by:

Steven Pennoyer
Director, Alaska Region
National Marine Fisheries Service

10/12/93
Date

Carl L. Rosier
Commissioner
Alaska Department of Fish & Game

10/15/93
Date

Appendix B National Standards of the Magnuson-Stevens 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.

8. Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

9. Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

10. Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

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 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) South Central, (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 (see Chapter 2). 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 resource would be unavailable in the future.

In 1995, the Board of Fisheries modified its petition policy for category 2 measures in the BSAI king and Tanner crab FMP (see State Regulation 5 AAC 39.998). The Board of Fisheries recognizes that in rare instances, circumstances may require regulatory changes outside the process described in 5 AAC 96.625(b) - (d). Notwithstanding 5 AAC 96.625(f), a petition for a regulatory change may be submitted under this section and 5 AAC 96.625(a) for a Category 2 management measure in a Bering Sea/Aleutian Islands king or Tanner crab fishery described in the federal Fishery Management Plan (FMP) for the Commercial King

and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands. It is the policy of the Board of Fisheries that a petition submitted under this section will be denied and not scheduled for hearing unless the petition:

(1) addresses a Category 2 management measure and is filed within 30 days from the date that the board adopted that Category 2 management measure;

(2) presents an issue that is not solely allocative; and

(3) presents new legal, biological, or management information that indicates the regulation may not be consistent with the federal FMP."

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: A summary of the life history of king and Tanner crabs in the BS/AI area can be found in the Essential Fish Habitat Assessment for BSAI king and Tanner crabs (NPFMC 1998). A summary of life history traits for BSAI king and Tanner crab species is provided in Table D-1.

Description of Habitat Types: The Bering Sea covers almost 3 million km^2 and is unusual in having an extremely wide continental shelf, ranging from 500 km wide in the southeast region to over 800 km wide in the north (NRC 1996). 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, 1981). The Bering Sea shelf is flat and relatively featureless, with the exception of three large and some small islands. Its gradient is 0.24 m /km sloping gradually to a depth of about 170 m at the shelf break. (Niebauer et al. 1995, Sharma 1977). The geography of the coastal area bordering the Bering Sea has been shaped by geologic forces, strong erosion of the Bering itself, and the subarctic climate.

The southern border of the Bering Sea is bounded by the Aleutian Islands, a chain of volcanic islands, many of which are still active, driven by tectonic forces (NRC 1996). The islands extend more than 1,770 km and consist of more than 50 islands, in five groups, separating the Bering Sea from the North Pacific Ocean. The Aleutian and Shumagin Islands are low mountains with steep to moderate slopes and rolling topography. Plateaus and uplands occur in some places in the chain. Elevations of the islands range from sea level to nearly 1,524 m. A number of the islands have wave-derived terraces up to 183 m above sea level, and are bordered by lower sea cliffs from previous sea level stands. Broad and flat intertidal platforms derived from glacial period sea level changes surround some islands. Those islands with peaks higher than 914 m were heavily glaciated and include fjords extending up to 610 m into the sea.

The Pribilof Islands are five small islands in the Bering Sea that lie 322 km north of the Aleutian Island of Unalaska. St George Island is characterized by hills and ridges with steep cliffs rising up to 274 m. In contrast St. Paul Island has a rolling plateau with some extinct volcanic peaks. The islands of St. Matthew, Pinnacle and Hall are located north of the Pribilof Islands and about 324 km west of mainland Alaska. These islands have steep shorelines and volcanic ridges with volcanic cones rising up to 458 m (NRC 1996).

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 (Table D.2). 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. Maximum ice extent occurs in March or April and the seasonal ice advance and retreat in the Bering Sea on the average extends over a distance 920 km along 170°W (Konishi and Saito, 1974). 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 cooing 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, 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. While there is a relatively strong current at the shelf break (about 0.10 m s^{-1}), net flow over the shelf is weak at 0.01-0.03 m s^{-1} directed toward the northwest and

parallel to the isobaths. However, moderate to strong tidal and wind-driven currents can be established over the shelf. Tidal current speed is about 0.3 m s^{-1} (Niebauer et al. 1995). The hydrography over the shelf is dominated by a system of three fronts, located approximately parallel to the 50 and 100-isobaths and the shelf break (Coachman, 1986). 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 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. Chionoecetes species also may make off-on shelf migrations for spawning and molting. A summary of habitat associations for life stages of BSAI king and Tanner crab species is provided Table D.3.

Habitat Areas of Particular Concern: Shallow inshore areas (less than 50 m depth) are very important to king crab reproduction. After molting through four larval (zoea) stages, king crab larvae develop into glaucothoe which are young crabs that settle in the benthic environment in nearshore shallow areas with significant cover, particularly those with living substrates (macroalgae, tube building polychaete worms, kelp, mussels, and erect bryozoans). 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 rearing juvenile king crab.

Table D.1 Life history traits for BSAI king and Tanner crab species.

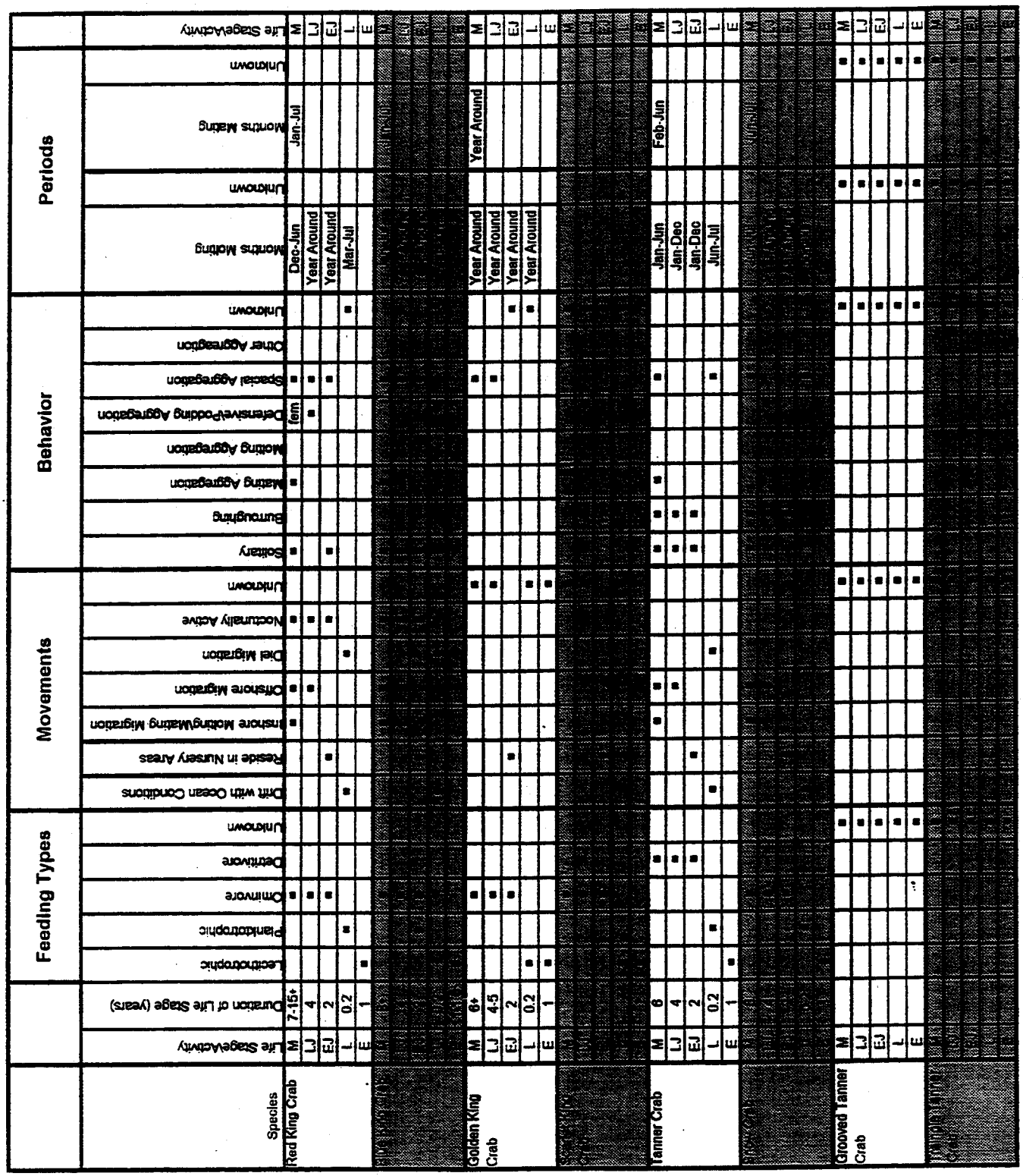


Table D.2 Characteristic features of the eastern Bering Sea shelf ecosystem.

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 biota Accumulation of generations
High runoff	Low salinities (near coasts) High turbidities Presence of eurohaline faunas
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	Flexible feeding and breeding habits, special environmental adaption
Pollock dominant semidemersal species	Abundant benthos food supply
Yellowfin sole dominant demersal species	Important forage species in the ecosystem Large, relatively shallow shelf
Herring and capelin dominant pelagic species	Few predators on adults, special environmental adaption Abundant food supply, no enemies, insignificant hunting
Abundant crab resources	Compete with man for fishery resources
Abundant marine mammals	Ecosystem in near-natural state, not yet fully adjusted to effects of extensive fishery
Man-related features	Ample space for breeding colonies of mammals and birds
Fisheries development rather recent	Very limited local fisheries, no pollution
Little-inhabited coasts	

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.

Table D.3 Habitat associations for BSAI king and Tanner crab species.

Habitat Associations for BSAI King and Tanner Crab Species

Species	Life Stage/Activity	Pelagic Domain										Benthic Domain	Shelf				Slope			Canyon		
		Estuarine	Inshore Water (0-3 miles)	Offshore Water (3+ miles)	Surface Water	Midwater	Near Bottom	Vertical Depth (m)	Epipelagic (<200m)	Mesopelagic (200-1000m)	Bathypelagic (>1000m)	Bottom Depth Range (m)	Intertidal	Subtidal (<30m)	Middle (30-100m)	Outer (100-200m)	Upper (Break-500m)	Intermediate (500-1000m)	Lower (>500m)	Head (<100m)	Upper and Middle (100-500m)	Lower (>500m)
Red King Crab	M											3-300		●	●	●	●					
	LJ											0-200	●	●	●		●					
	EJ											0-60	●	●	●	●	●					
	L	●	●	●	●	●	●					0-100										
	E											0-200	●	●	●	●	●					
[illegible]	M																					
	LJ																					
	EJ																					
	L																					
	E																					
Golden King Crab	M											100-1000				●	●	●	●		●	●
	LJ											>1000							●			●
	EJ											>1000							●			●
	L						●			●												
	E											100-1000				●	●	●	●		●	●
[illegible]	M																					
	LJ																					
	EJ																					
	L																					
	E																					
Tanner Crab	M											3-700		●	●	●	●	●	●	●	●	●
	LJ											3-200		●	●	●				●	●	
	EJ											3-200		●	●	●				●	●	
	L	●	●	●	●	●	●	0-100	●													
	E											3-700		●	●	●	●	●	●	●	●	●
[illegible]	M																					
	LJ																					
	EJ																					
	L																					
	E																					
Grooved Tanner Crab	M											200-1000				●	●	●			●	●
	LJ																					
	EJ																					
	L																					
	E																					
[illegible]	M																					
	LJ																					
	EJ																					
	L																					
	E																					

Species	Life Stage/Activity	Structure										Substrate							
		Bars	Banks	Sinks	Stumps/Rockfalls/Debris Field	Channels	Ledges	Pinnacles	Reefs	Vertical Walls	Man-made	Organic Debris	Mud/Clay/Silt	Sand/Granule	Gravel	Pebble	Cobble	Boulder	Bedrock
Red King Crab	M	●	●	●	●	●	●		●			●	●	●	●	●	●		
	LJ	●	●	●	●	●	●		●			●	●	●	●	●	●		
	EJ																		
	L																		
	E	●	●	●	●	●	●		●			●	●	●	●	●	●		
[illegible]	M																		
	LJ																		
	EJ																		
	L																		
	E																		
Golden King Crab	M		●		●	●	●	●	●	●				●	●	●	●	●	●
	LJ		●		●	●	●	●	●	●				●	●	●	●	●	●
	EJ																		
	L																		
	E		●		●	●	●	●	●	●				●	●	●	●	●	●
[illegible]	M																		
	LJ																		
	EJ																		
	L																		
	E																		
Tanner Crab	M	●	●	●	●	●					●	●	●	●	●	●	●		
	LJ	●	●	●	●	●					●	●	●	●	●	●	●		
	EJ	●	●	●	●	●					●	●	●	●	●	●	●		
	L																		
	E	●	●	●	●	●					●	●	●	●	●	●	●		
[illegible]	M																		
	LJ																		
	EJ																		
	L																		
	E																		
Grooved Tanner Crab	M																		
	LJ																		
	EJ																		
	L																		
	E																		
[illegible]	M																		
	LJ																		
	EJ																		
	L																		
	E																		

Species	Life Stage/Activity	Community											Ocean		
		Algal Cover	Anemones	Echinoderms	Corals (soft)	Mollusca	Drift Algae/Kelp	Kelp Forest	Polychaetes	Sea Grasses	Sea Onions	Tunicates	Temperature (Celsius)	Salinity (ppt)	Life Stage/Activity
Red King Crab	M		●	●	●	●	●	●	●		●	●	<6'	>20	M
	LJ	●	●	●	●	●	●	●	●		●	●			LJ
	EJ													>20	EJ
	L												<12	>20	L
	E		●	●	●	●	●	●	●		●	●	<6	>20	E
[illegible]	M														M
	LJ														LJ
	EJ														EJ
	L														L
	E														E
Golden King Crab	M		●	●	●	●			●				<6	>30	M
	LJ		●	●	●	●			●				<6	>30	LJ
	EJ												<6	>30	EJ
	L												<6	>30	L
	E		●	●	●	●			●				<6	>30	E
[illegible]	M														M
	LJ														LJ
	EJ														EJ
	L														L
	E														E
Tanner Crab	M		●	●	●	●	●	●	●		●	●	<10	>30	M
	LJ		●	●	●	●	●	●	●		●	●	<10	>30	LJ
	EJ		●	●	●	●	●	●	●		●	●	<10	>30	EJ
	L												<10	>30	L
	E		●	●	●	●	●	●	●		●	●	<10	>30	E
[illegible]	M														M
	LJ														LJ
	EJ														EJ
	L														L
	E														E
Grooved Tanner Crab	M														M
	LJ														LJ
	EJ														EJ
	L														L
	E														E
[illegible]	M														M
	LJ														LJ
	EJ														EJ
	L														L
	E														E

Appendix E Description of the Fisheries and Stocks

E1.1 History of the Fishery

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. 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. Historical harvests of BSAI king and Tanner crab are listed in Tables E1-E3

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 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 underwent rapid development in the 1970's. 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 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 harvests for the management unit.

Currently, 17 separate stocks of king and Tanner crab are managed in the BS/AI area (Table E.4). 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.

A map showing the general location of BSAI crab fisheries is shown in Figure E.4.

E1.2 Status of BSAI Crab Stocks

The most current status of the resource is found in the annual Stock Assessment and Fishery Evaluation Report (SAFE). The report consists of the ADF&G annual management report, status of stocks report and shellfish observer program report, a summary of the NMFS survey of BSAI crab stocks, and a list of recently published literature pertinent to BSAI crab management (NPFMC, 1997). The report details stock condition, fishery resource size, fishing effort, catch statistics, current biological and economic status of the fisheries, guideline harvest levels and ranges, and harvest strategies.

Table E.1. Commercial BSAI red and blue king crab harvest (pounds).

Commercial red and blue king crab harvests by year in pounds.

Year	Bristol Bay Red King	Pribilof Islnds. Blue King	Pribilof Islnds. Red King	St. Matthew Blue King	Norton Sound Red King	Dutch Harbor Red King	Adak Red King	Aleutian Red King	Dutch Harbor Scarlet King	Adak Scarlet King	Aleutian Scarlet King	Bering Sea Scarlet King
1953	13,228,800											
1954	10,392,800											
1955	10,549,000											
1956	10,183,800											
1957	9,116,800											
1958	8,126,800											
1959	11,578,600											
1960	25,157,000						2,074,000					
1961	40,777,000					533,000	6,114,000					
1962	53,229,000					1,536,000	8,006,000					
1963	57,299,000					3,693,000	17,804,000					
1964	63,852,800					13,761,000	21,193,000					
1965	43,076,000					19,196,000	12,915,000					
1966	42,895,600	2,006,400				32,852,000	5,883,000					
1967	33,145,200	2,409,000				22,709,000	14,131,000					
1968	34,698,400	1,595,000				11,300,000	16,100,000					
1969	18,994,800	5,471,400				8,950,000	18,016,000					
1970	20,165,200	1,280,400				9,652,000	16,057,000					
1971	17,914,800	1,227,600				9,391,615	15,475,924					
1972	26,109,600	299,200				10,450,380	18,724,144					
1973	29,363,400	1,320,000				12,722,696	9,741,464					
1974	50,153,400	8,819,800				13,991,129	2,774,983					
1975	51,328,259	2,433,714				15,906,666	411,583					
1976	63,919,726	6,611,084				10,198,423	0					
1977	69,967,868	6,456,738		1,202,066	520,000	3,684,417	905,527					
1978	87,618,320	6,395,512		1,984,251	2,090,000	6,824,793	807,195					
1979	107,828,057	5,995,231		210,819	2,930,000	15,010,874	467,229					
1980	129,948,463	10,970,346		219,777	1,190,000	17,660,642	1,419,513					
1981	33,591,388	9,080,729		4,627,761	1,380,000	1,392,923	1,648,926					
1982	3,001,210	4,405,353		8,844,789	230,000	5,155,345	1,701,818					
1983	0	2,193,395		9,454,323	370,000	431,179	1,981,579					
1984	4,182,406	306,699		3,764,592	390,000	0	1,367,672					
1985	4,174,953	532,735		2,427,110	430,000	0	906,293					
1986	11,393,934	258,939		1,003,162	480,000	0	712,243					
1987	12,269,067	701,337		1,075,179	330,000	0	1,213,933					
1988	7,387,795	0		1,325,185	240,000	0	1,567,314					
1989	10,264,791	0		1,166,258	250,000	0	1,118,566					
1990	20,362,342	0		1,725,349	190,000	0	828,105					
1991	17,177,694	0		3,372,066	0	0	951,278					
1992	8,043,018	0		2,474,080	70,000	0	1,286,424					
1993	14,628,639	0	2,607,634	2,999,921	336,000	0	698,077					
1994	0	0	1,338,953	3,764,262	328,000	0	196,967		Confidential	21,269		
1995	0	1,267,454	871,173	3,166,093	318,000	0	38,941		13,671	49,126		26,684
1996	8,405,614	937,032	200,304	3,080,916	224,000	0	0	0	20,924	24,076		Confidential
1997	8,772,144	512,374	756,818	4,649,660	93,000	0	0	0			Confidential	7,170

*Bristol Bay red king crab data from 1953 to 1974 and Pribilof Islands blue king crab data from 1966 to 1974 are from Otto, R.S. 1986. Management and Assessment of Eastern Bering Sea King Crab Stocks. Pages 107-116 *in* Jamieson, G.S., and N. Bourne [ed.]. North Pacific Workshop on Stock Assessment and Management of Invertebrates. Can. Spec. Publ. Fish. Aquat. Sci. 92: 430 p.

*All other data are from Alaska Dept. of Fish and Game, Annual Management Report for the Shellfish Fisheries of the Westward Region, 1996. Regional Information Report No. 4K97-41.

Table E.2. Commercial BSAI golden king crab harvest by year in pounds.

Commercial golden king crab harvest by year in pounds.							
	Dutch Harbor	Aleutian E174	Adak	Aleutian W174	Pribilof Islnds.	Northern Dist.	
		Sequam Stock		Adak Stock			
Year	Golden King	Golden King	Golden King	Golden King	Golden King	Golden King	
1975			25,490				
1976			2,285				
1977			47,445				
1978			0				
1979			23,485				
1980			58,914				
1981	115,715		1,194,046				
1982	1,184,971		8,006,274		69,970	193,507	
1983	1,810,973		8,128,029		856,475		
1984	1,521,142		3,180,095				
1985	1,968,213		11,124,759		Confidential		
1986	1,869,180		12,798,004		Confidential		
1987	1,383,198		8,001,177		Confidential	424,394	
1988	1,545,113		9,080,196		Confidential	160,441	
1989	1,852,249		10,162,400		Confidential	Confidential	
1990	1,718,848		5,250,687				
1991	1,447,732		6,254,409		Confidential		
1992	1,357,048		4,916,149		Confidential	Confidential	
1993	915,460		4,635,683		67,458		
1994	1,750,267		6,135,965		88,985	Confidential	
1995	1,993,980		4,896,911		341,700	1,200	
1996		3,255,523		4,644,748	329,009	Confidential	
1997		3,564,292		In Progress	179,249	0	
*Data are from Alaska Dept. of Fish and Game, Annual Management Report for the Shellfish Fisheries of the Westward Region, 1996. Regional Information Report No. 4K97-41.							

Table E.3. Commercial BSAI Chionoecetes crab harvest by year in pounds.

Commercial *Chionoecetes* species harvest by year in pounds.									
	W. Aleutians Adak	W. Aleutians	E. Aleutians Dutch Harbor	E. Aleutians	E. Aleutians	Bering Sea	Bering Sea	Bering Sea	Bering Sea
Year	*C. bairdi*	*C. tanneri*	*C. bairdi*	*C. tanneri*	*C. angulatus*	*C. bairdi*	*C. Opilio*	*C. tanneri*	*C. angulatus*
1965						4,746,000			
1966						6,034,000			
1967						33,600,000			
1968						43,333,900			
1969						70,127,500			
1970						48,178,180	2,182,800		
1971						49,337,717	2,596,935		
1972						38,622,471	1,169,475		
1973	71,887		498,836			22,889,043	7,320,075		
1974	Confidential		77,164			33,285,695	502,416		
1975	Confidential		534,295			38,968,507	3,875,760		
1976			1,239,569			66,156,221	5,639,400		
1977	237,512		2,494,631			78,282,654	11,906,052		
1978	197,244		1,280,115			47,631,924	59,644,689		
1979	337,297		443,244			22,890,958	53,523,102		
1980	220,716		443,244			23,864,183	34,000,619		
1981	838,697		654,514			29,630,492	52,750,034		
1982	488,399		739,694			11,008,779	29,355,374		
1983	384,146		547,830			5,273,881	26,128,410		
1984	163,460		239,585			1,208,223	26,813,074		
1985	206,814		165,529			3,151,498	65,998,875		
1986	42,761		167,339			0	97,984,539		
1987	141,390		160,292			0	101,903,388		
1988	148,997		309,918			2,210,394	134,030,185		
1989	48,746		326,396			7,012,965	149,455,848		
1990	14,779		171,785			44,590,077	161,821,350		
1991	7,825		50,038			51,837,159	328,647,269		
1992	Confidential	Confidential	98,703			35,130,866	315,302,034	Confidential	
1993		0	118,609	Confidential		16,891,320	230,787,000	658,796	
1994		Confidential	166,545	759,239		7,766,886	149,775,765	332,454	
1995	Confidential	145,795	0	882,667	Confidential	4,233,061	75,252,677	1,005,721	49,007
1996		Confidential	0	106,071	Confidential	1,806,077	65,712,797	106,886	Confidential
1997	0	0	0	0	0	0	119,452,070	0	0

*Harvest of Bering Sea *Chionoecetes bairdi* and *C. opilio* from 1965 to 1980 include foreign harvests as calculated in Table E.2.c.

*All other data are from Alaska Dept. of Fish and Game, Annual Management Report for the Shellfish Fisheriesin the Westward Region. Regional Information Report No. 4K97-41.

Table E.4. Stocks of king and Tanner crab in the BS/AI area.*

Aleutian Islands golden king crab	Probably separated from Bering Sea stocks by an area of sparse king crab abundance north of Unimak Pass. There may be various distinct biological groups in the area (see Otto and Cummiskey 1985, Somerton and Otto 1986).
Aleutian Islands red king crab	One or several distinct groups that are geographically separated by deep water trenches in passes between islands and from Bering Sea stocks by an area of sparse king crab abundance north of Unimak Pass.
Bristol Bay red king crab	A distinct biological group (see Otto et al. 1989). Blue and golden king crab also occur here in low abundance but are not separately managed.
Pribilof District blue king crab	A distinct biological and geographic group (see Otto and Cummiskey 1990, Somerton and MacIntosh 1983a, 1983b).
Pribilof District red king crab	A distinct biological and geographic group.
Pribilof District golden king crab	Probably two biological groups (Pribilof and Zhemchug Canyons) that are not entirely geographically distinct from each other or from golden king crab found in Bristol Bay or the Northern District (see Otto and Cummiskey 1985, Somerton and Otto 1986).
St. Matthew Section blue king crab	A distinct biological and geographic group (see Otto and Cummiskey 1990, Somerton and MacIntosh 1983a, 1983b).
St. Lawrence Section blue king	Probably distinct from groups to the south crab but may actually be several groups. Not available in commercial abundance.
Northern District golden king crab	A group that has unique biological characteristics but may not be geographically distinct (see Otto and Cummiskey 1985, Somerton and Otto 1986).
Norton Sound Section red king crab	A distinct biological and geographic group (see Powell et al. 1983, Otto et al. 1989).
Western Aleutians C. bairdi	Perhaps several groups but not geographically separated from E. Aleutians. Separate grouping from Eastern Aleutians for statistical purposes. Fishery almost entirely incidental to king crab fishing.
Eastern Aleutians C. bairdi	Not geographically distinct from Western Aleutians. Grouping for statistical purposes. Fishery is largely incidental.
Bering Sea District C. bairdi	Probably distinct from group(s) in Aleutian Islands. Probably consists of two groups (east and west) that differ biologically (see Somerton 1981).
Bering Sea District 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.

* Limited stock information is available for scarlet king crab, grooved Tanner crab, and triangle Tanner crab. For purposes of reporting, harvest of these deepwater crabs is grouped by existing king and Tanner crab registration areas.

Table E.5. Estimated size of maturity for king crab (carapace length, mm) and Tanner crab (carapace width not including spines, mm) and minimum legal size (carapace width including spines, inches) currently in regulation for fisheries within the BS/AI management unit.

Area	Species	Size of Carapace at Maturity: Males	Size of Carapace at Maturity: Females	Source	Minimum Size
Aleutian Islands	red king	-	89 [1]	Blau 1990	6.50
	golden king	109-130 [2]	106-113 [1]	Otto and Cummiskey 1985	6.00
Bristol Bay	red king	103 [2,3]	89 [1]	males: Somerton 1980 females: Otto et al. 1990	6.50
Pribilof District	red king	-	102 [1]	Otto et al. 1990	6.50
	blue king	108 [2,4]	96 [1]	Somerton and MacIntosh 1983 Somerton & Otto 1986	6.50
	golden king	107 [2]	100 [1]		5.50
St. Matthew Section	blue king	77 [2,5]	81 [1]	Somerton and MacIntosh 1983 Somerton & Otto 1986	5.50
	golden king	92 [2]	98 [1]		5.50
Norton Sound Section	red king	-	71 [1]	Otto et al., 1990	4.75
	blue king	-	-		5.50
St. Lawrence Section	blue king	-	-		5.50
Bering Sea/ Aleutian Is.	bairdi	105-116 [6]	78-94 [7]	Somerton 1981b	5.50
	C. opilio	75 [6]	56 [7]	Otto 1988	3.10
	C. tanneri	119 [6]	79 [7]	Somerton and Donaldson 1996	-
	C. angulatus	91 [6]	58 [7]	Somerton and Donaldson 1996	-
	scarlet king	91 [8]	80 [9]	Somerton 1981a	-

[1] Size at which 50% are mature (SM_{50}) as determined by presence of eggs or empty egg cases.
[2] Intersection point of lines fit to characterize two phases of growth in the right chela.
[3] Size at functional maturity used for fishery management is 120 mm carapace length.
[4] Size at functional maturity used for fishery management is 120 mm carapace length.
[5] Size at functional maturity used for fishery management is 105 mm carapace length.
[6] Size at which 50% are mature (SM_{50}) as determined by chela allometry; Bering Sea.
[7] Mean size of mature animals as determined by presence of eggs or empty egg cases; Bering Sea.
[8] Size at which 50% are mature (SM_{50}) as determined by chela allometry; Gulf of Alaska.
[9] Size at which 50% are mature (SM_{50}) as determined by presence of eggs or empty egg cases; Gulf of Alaska.

Figure E.1. In-season management decision making by Alaska Department of Fish and Game (ADF&G) based on preseason specification of guideline harvest level (GHL). Area management biologists may issue emergency orders closing fisheries, but final decisions are made by the Commissioner or his designee.

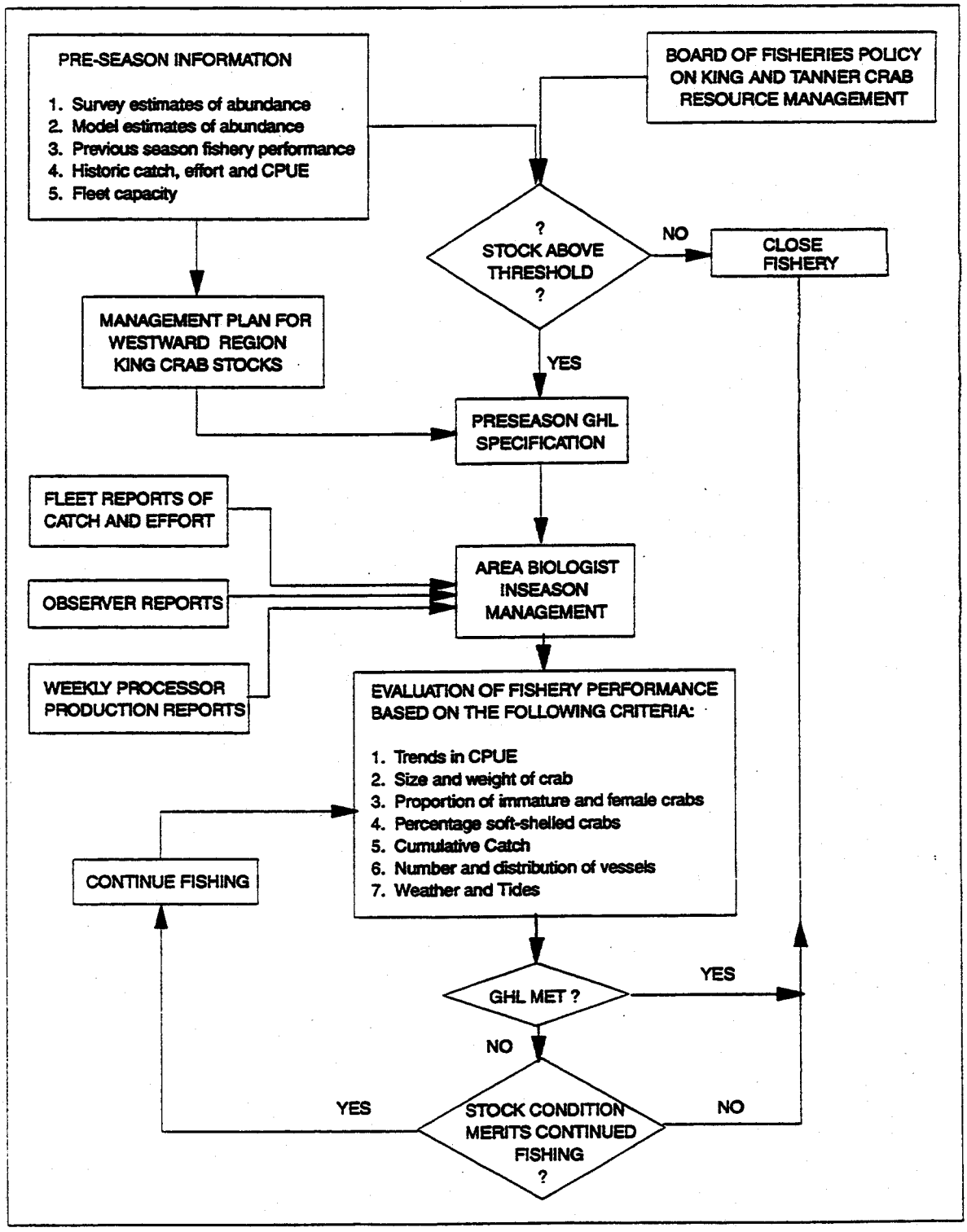
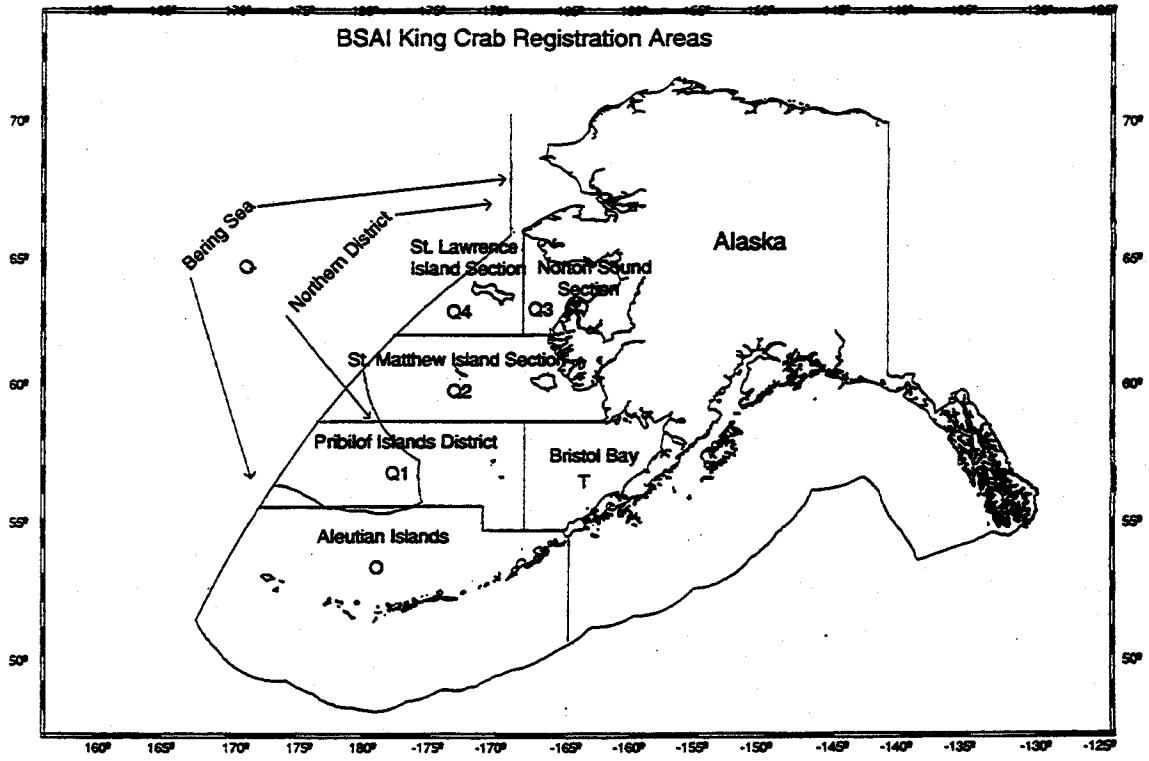


Figure E.2 Current fishing seasons for king and Tanner crab stocks in the BS/AI area (second seasons for larger crabs are also possible by State emergency order (EO). Source: Alaska Department of Fish and Game Commercial Shellfish Regulations.

Figure E.3. Bering Sea and Aleutian Islands management unit showing State of Alaska registration areas for king and Tanner crab. 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.



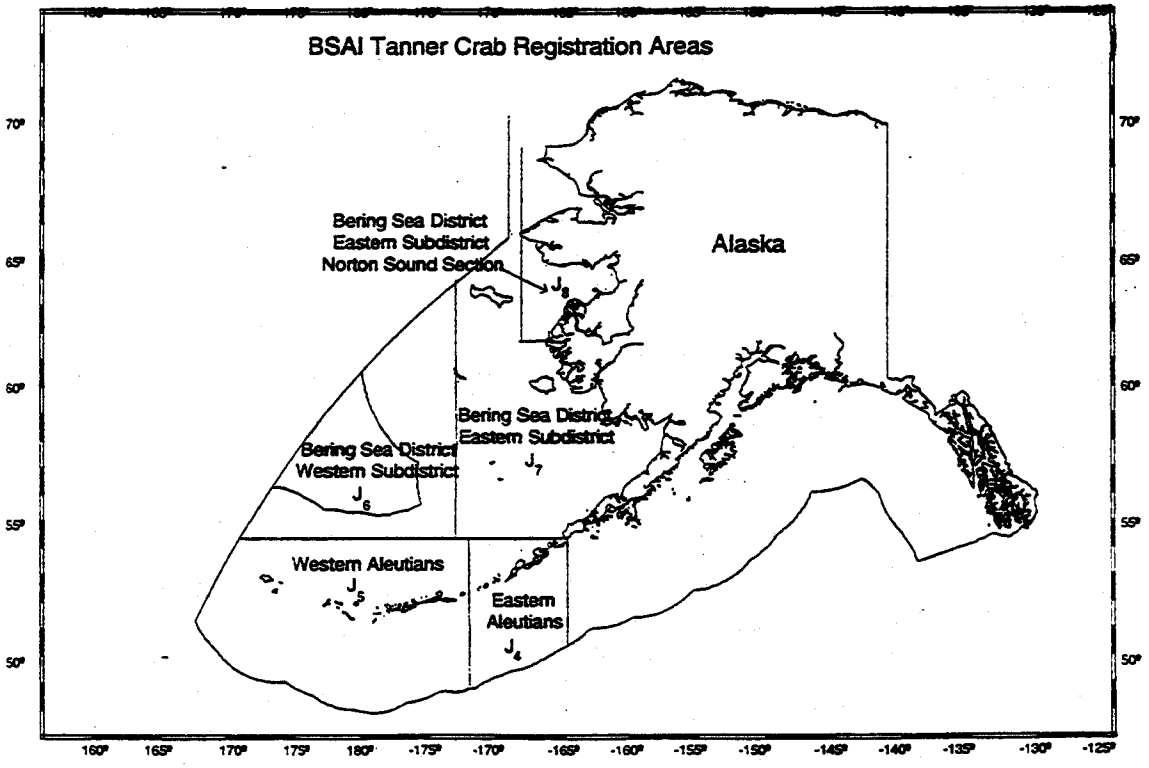


Figure E.4. Map showing general location of crab fisheries in the BSAI.

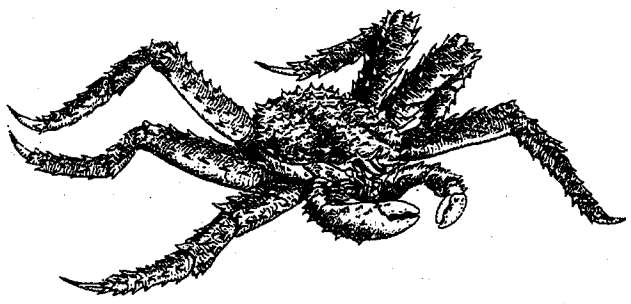
Red King Crab

Biology: Red king crab (*Paralithodes camtshaticus*) is widely distributed throughout the Bering Sea and Aleutian Islands, Gulf of Alaska, Sea of Okhotsk, and along the Kamchatka shelf. King crab molt multiple times per year through age 3 after which molting is annual. At larger sizes, king crab may skip molt as growth slows. Females grow slower and do not get as large as males. In Bristol Bay, fifty percent maturity is attained by males at 120 mm CL and 90 mm CL by females (about 7 years). Red king crab in the Norton Sound area mature at smaller sizes and do not attain maximum sizes found in other areas. In Bristol Bay, red king crab mate when they enter shallower waters (<50 m), generally beginning in January and continuing through June. Males grasp females just prior to female molting, after which the eggs (43,000 to 500,000 eggs) are fertilized and extruded on the female's abdomen. The female red king crab carries the eggs for 11 months before they hatch, generally in April. Red king crab spend 2- 3 months in larval stages before settling to the benthic life stage. Young-of-the-year crab occur at depths of 50 m or less. They are solitary and need high relief habitat or coarse substrate such as boulders, cobble, shell hash, and living substrates such as bryozoans and stalked ascidians. Between the ages of two and four years, there is a decreasing reliance on habitat and a tendency for the crab to form pods consisting of thousands of crabs. Podding generally continues until four years of age (about 65 mm), when the crab move to deeper water and join adults in the spring migration to shallow water for spawning and deep water for the remainder of the year. Mean age at recruitment is 8-9 years.

Management: Red king crab stocks in the Bering Sea and Aleutian Islands are managed by the State of Alaska through a federal king and Tanner crab fishery management plan (FMP). Under the FMP, management measures fall into three categories: (1) those that are fixed in the FMP under Council control, (2) those that are frameworked so the State can change them following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. During the 1970s and 1980s, preseason guideline harvest levels were set at 20-60% of legal male abundance based on several indicators of stock condition. Between 1989 and 1995, the State set guideline harvest levels for red king crab based on a mature male harvest rate of 20%, with a harvest cap of 60% of legal male abundance. In 1996, the harvest rate for Bristol Bay red king crabs was reduced to 10% of the mature males to allow stock rebuilding. A threshold of 8.4 million mature females, equating to an effective spawning biomass of 14.5 million pounds, has been established as a minimum benchmark for harvesting this stock. Current minimum legal size for Bristol Bay, Aleutian Islands, and Pribilof Islands red king crab is 165 mm, or 6.5 inches in carapace width. Minimum legal size for Norton Sound, St. Matthew, and St. Lawrence Island red king crab is 4.75" carapace width.

Management measures implemented for the BSAI king and Tanner crab fisheries, as defined by the federal crab FMP, 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
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
	* Closed Waters	* Bycatch Limits (in crab fisheries)
	* Pot Limits	* Other
	* Registration Areas	



In addition to minimum size and sex restrictions, the State has instituted numerous other regulations for the Eastern Bering Sea crab fisheries. The State requires vessels to register with the state by obtaining licenses and permits, and register for each fishery and each area. Areas established for king crab are shown in the adjacent figure. Norton Sound has been designated a superexclusive area, meaning that vessels fishing this fishery are not allowed in other fisheries, and vice-versa. A 10-mile area around King Islands has been closed to commercial crabbing for local subsistence reasons. Observers are required on all vessels processing crab in the Bering Sea and Aleutian Islands area. Season opening dates are set to maximize

meat yield and minimize handling of softshell crabs. The season opening date for Bristol Bay red king crab fisheries is November 1. Beginning in 1996, the Aleutian Islands area (formally Adak and Dutch Harbor) opens September 1. The Norton Sound summer season opens on July 1, and a though-the-ice fishery occurs from November 15 to May 15. Pot limits have been established based on vessel size and guideline harvest level. In Norton Sound, the pot limits are 50 for vessels > 125 feet, and 40 for vessels < 125 feet. A minimum size of 9" stretched mesh on one vertical panel is required for pots used in the Bristol Bay red king crab fishery. Other gear restrictions include a requirement that crab pots be fitted with a degradable escape mechanism consisting of #30 cotton thread (max. diameter) or a 30-day galvanic timed release mechanism.

Stock Structure: Three discrete stocks of red king crab are actively managed in the BSAI region: Bristol Bay, Norton Sound, and Aleutian Islands stocks. The Aleutian Islands stock consists of Adak and Dutch Harbor populations. Other populations of red king crab are found in the Pribilof Islands area, St. Matthew, and St Lawrence Island area, but are managed in conjunction with blue king crab fisheries. Red king crab stocks are managed separately to accommodate different life histories and fishery characteristics.

Bristol Bay Stock: Area swept estimates of abundance for the Bristol Bay red king crab stock are obtained through the NMFS annual bottom trawl surveys. A length-based analysis, developed by the Alaska Department of Fish and Game, incorporates survey and commercial catch and observer data into more precise abundance estimates. Abundance estimates generated by this model are used to set guideline harvest levels. After declining abundance throughout the 1960s and reaching a low during the years 1970-1972, recruitment to the Bristol Bay red king crab stock increased dramatically in the mid- and late 1970s. Recruitment was much lower during the 1980s and 1990s. By 1994, recruitment was about 1/20th of what it was in 1977. Since then, the length-based model indicates a slight but steady increase in the abundance of small males and females.

During the fishery's heyday, new all-time record landings were established in each year from 1977 to 1980 (peaking at 129.9 million pounds). This was followed by a stock collapse in 1981 and 1982, leading to a total closure of the Bristol Bay fishery in 1983. In 1984, the stock showed some recovery and a limited fishery was reestablished. Between 1984 and 1993, the fishery continued at levels considerably below those of the late 1970s. Annual landings during this period ranged from 4.2 million to 20.4 million pounds. After 1993, the stock declined again, and no fishery occurred in 1994 and 1995. Pot limits have been established based on vessel size and harvest level.

Abundance of legal males (millions of crab from LBA model), pre-season guideline harvest levels (GHL, in millions of pounds), and total catches (millions of pounds, including deadloss) of Bristol Bay red king crab, 1980-1996.

Year	Abundance	GHL	Catch
1980	44.2	70.0 - 120	129.9
1981	9.5	70.0 - 100	35.1
1982	2.9	10.0 - 20	3.0
1983	2.5	0	0
1984	2.3	2.5 - 6.0	4.2
1985	1.8	3.0 - 5.0	4.2
1986	4.3	6.0 - 13.0	11.4
1987	6.7	8.5 - 17.7	12.3
1988	8.3	7.5	7.4
1989	9.7	16.5	10.3
1990	10.1	17.1	20.4
1991	8.5	18.0	17.2
1992	6.6	10.3	8.0
1993	5.8	16.8	14.6
1994	4.5	0	0
1995	5.1	0	0
1996	5.9	5.0	8.4
1997	5.9	7.0	8.8

Note: abundance through 1994 included Pribilof area red king crab.

Total harvest (thousands of pounds) of red king crab from the Dutch Harbor, Adak, and Norton Sound area, 1980-1996.

Year	Dutch Harbor	Adak	Norton Sound
1980	17,661	1,420	1,190
1981	1,393	1,649	1,380
1982	5,155	1,702	230
1983	431	1,982	370
1984	0	1,368	390
1985	0	908	430
1986	0	712	480
1987	0	1,214	330
1988	0	1,567	240
1989	0	1,119	250
1990	0	828	190
1991	0	951	0
1992	0	1,266	70
1993	0	698	336
1994	0	197	328
1995	0	36	323
1996	0	0	220
1997	0	0	93

The Bristol Bay red king crab fishery is prosecuted using mesh covered pots (generally 7 or 8 foot square) set on single lines. Over 280 vessels participated in the Bristol Bay red king crab fishery in recent years when a guideline harvest level was established (1991-1993). The season begins on November 1, and generally has lasted less than 10 days in recent years.

These crab average about 6.5 pounds and fetch a high ex-vessel price; $3 to $5 per pound was paid during the 1989-1993 fisheries. Total ex-vessel value ranged from $40,000,000 to $100,000,000 in those years.

Norton Sound and Aleutian Islands Stocks: Surveys of these populations are not regularly conducted, and abundance is not estimated each year. Consequently, aside from years when surveys are conducted, fisheries for these stocks are generally managed based on catch history and in-season catch performance monitoring.

Prior to 1977, red king crab were taken in Norton Sound for subsistence uses only. Commercial landings peaked at 3 million pounds in 1979, and declined to average about 300,000 pounds annually. The 1995 summer fishery was prosecuted by 48 vessels, which landed 323,000 pounds. Average weight of crab landed was 3 pounds, with an ex-vessel price of $2.87 per pound. A winter fishery occurs from November 15 to May 15. Holes are chopped through the ice, and pots are tended by fishermen on snow machines. In 1995, 42 fishermen participated in the commercial fishery, harvesting 7,538 red king crabs. These crabs were sold locally fresh (or fresh frozen) for $6 each, or shipped live to Anchorage. A winter subsistence fishery is prosecuted by local people either using hand lines or with commercial-style pots set through the ice. In 1995, 57 subsistence fishermen harvested over 4,000 crabs.

Harvest of red king crab from the Dutch Harbor area began in 1961, and peaked at 33 million pounds in 1966. Thereafter, harvests declined, averaging about 11 million pounds annually through 1976. A secondary peak harvest occurred in 1980 with 17.7 million pounds taken, after which the stock collapsed and has not recovered. No red king crab fishery has been allowed in this area since 1983.

The Adak red king crab fishery began in 1960, and peaked at 21 million pounds in 1964. Catches remained high at about 16 million pounds annually through 1972. During 1977 to 1993, landings were low (about 1 million pounds annually) but stable. Since then the stock has declined. A small portion of the red king crab harvest in this area is taken as bycatch in the golden king crab longline pot fishery. The majority, however, is harvested by golden king crab vessels with single line pots in a directed fishery. The 1995 fishery was prosecuted by 10 vessels, which harvested 36,000 pounds of red king crab with an ex-vessel value of $5.50 per pound. Average weight of landed crab was 7 pounds. No fishery was allowed in 1996 or 1997.

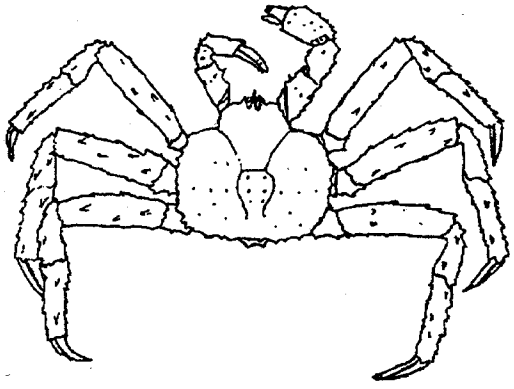
Blue King Crab

Biology: Blue king crab (*Paralithodes platypus*) has a discontinuous distribution throughout their range (Hokkaido Japan to Southeast Alaska). In the Bering Sea, discrete populations exist around the Pribilof Islands, St. Matthew Island, and St. Lawrence Island. Smaller populations have been found around Nunivak and King Island. Blue king crab molt multiple times as juveniles. Skip molting occurs with increasing probability for those males larger than 100 mm carapace length. Average molt increment for adult males is 14 mm. In the Pribilof area, 50% maturity of females is attained at 96 mm (about 3.8 inches) carapace length, which occurs at about 5 years of age. Blue king crab in the St. Matthew area mature at smaller sizes (50% maturity at 81 mm CL for females) and do not get as large overall. Blue king crab have a biennial ovarian cycle and a 14 month embryonic period. Juvenile blue king crab require cobble habitat with shell hash. These habitat areas have been found at 40-60 m around the Pribilofs Islands. Unlike red king crab, juvenile blue king crab do not form pods, instead relying on cryptic coloration for protection from predators. Adult male blue king crab occur at an average depth of 70 m and an average temperature of 0.6°C.

Management: Blue king crab stocks in the Bering Sea are managed by the State of Alaska through a federal BSAI king and Tanner crab fishery management plan (FMP). Under the FMP, management measures fall into three categories: (1) those that are fixed in the FMP under Council control, (2) those that are frameworked so the State can change following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. The State generally sets pre-season guideline harvest levels for blue king crab based on a mature male harvest rate of 20%. Threshold levels have been established for these stocks, below which a fishery will not occur. A threshold level of 0.77 million crabs >119 mm CL has been established for the Pribilof stock; the St. Matthew threshold is 0.6 million males >104 mm CL. Current minimum legal size for the Pribilof District blue king crab is 6.5" in carapace width. Minimum legal size for blue king crab in the St. Matthew Island area is 5.5" carapace width.

Management measures implemented for the BSAI king and Tanner crab fisheries, as defined by the federal crab FMP, 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
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
	* Closed Waters	* Bycatch Limits (in crab fisheries)
	* Pot Limits	* Other
	* Registration Areas	



In addition to minimum size and sex restrictions, the State has instituted numerous other regulations for BSAI crab fisheries. The State requires vessels to register with the state by obtaining licenses and permits, and register for each fishery and each area. Observers are required on all vessels processing king and Tanner crab in the BSAI. Season opening dates are set to maximize meat yield and minimize handling of softshell crabs. The season opening date for Pribilof District blue king crab fishery is September 15. In 1995, a combined GHL for red king and blue king crab fisheries in the Pribilof District was established. Pot limits have been established based on vessel size; the current pot limits are 50 for vessels > 125 feet, and 40 for vessels < 125 feet in the Pribilof District. In the St. Matthew area, the current pot limits are 75 for vessels > 125 feet, and 60 for vessels < 125 feet. Other gear restrictions include a requirement that crab pots be fitted with a degradable escape mechanism consisting of #30 cotton thread (max. diameter) or a 30-day galvanic timed release mechanism. Also, for the Pribilofs district, king crab pots must have 1/3 of one vertical surface comprised of 9" stretched-mesh webbing.

Stock Structure: Two discrete stocks of blue king crab are actively managed in the BSAI region: the Pribilof Islands and St. Matthew Island stocks. Other smaller populations of blue king crab are found in the vicinity of St. Lawrence Island and Nunivak Island, as well as isolated populations in the Gulf of Alaska. Blue king crab stocks are managed separately to accommodate different life histories and fishery characteristics.

Pribilof District Stock: Abundance estimates for the Pribilof Islands blue king crab stock are obtained through the NMFS annual bottom trawl surveys using an area-swept method. Survey data indicate a series of good recruitment in the early 1970s. Recruitment fell off in the early 1980s, but improved signs of recruitment were observed in the early 1990's. Recent survey data indicate that total stock size has generally increased over the past 10 years.

During the late 1970s, landings of blue king crab from the Pribilof District increased to peak at 11 million pounds in the 1980-81 season. This was followed by a rapid decline in the early 1980s, leading to a total closure of the fishery in 1988. No fishery occurred from 1988-1994. By 1995, stock conditions had improved such that a combined GHL for red and blue king crab of 2.5 million pounds was established.

Like the Bristol Bay red king crab fishery, the blue king crab fisheries are prosecuted using square, mesh covered pots (generally 7 by 7 foot square pots -"7 by's" or larger) set on single lines. In 1995, 119 vessels participated in the Pribilof District red and blue king crab fishery. The season began on September 15 and lasted 7 days. Blue king crab fetched $3 per pound exvessel, making the total fishery worth $3.6 million. Average weight of blue king crab harvested was 7.3 pounds. For 1997, 48 vessels, including one catcher-processor, fished Pribilof blue king crabs. The 1997 season lasted 14 days and yielded crabs with an average weight of 7.5 pounds, valued at $2.82 per pound exvessel.

Abundance of legal males (millions of crab from catch-survey estimates), pre-season guideline harvest levels (GHL, in millions of pounds), and total catches (millions of pounds, including deadloss) of Pribilof District blue king crab, 1980-1997.

Year	Abundance	GHL	Catch
1980	5.32	5.0 - 8.0	11.0
1981	3.20	5.0 - 8.0	9.1
1982	1.77	5.0 - 8.0	4.4
1983	1.04	4.0	2.2
1984	0.71	0.5 - 1.0	0.3
1985	0.65	0.3 - 0.8	0.5
1986	0.51	0.3 - 0.8	0.3
1987	0.41	0.3 - 1.7	0.7
1988	0.25	0	0
1989	0.19	0	0
1990	0.49	0	0
1991	1.00	0	0
1992	1.13	0	0
1993	1.21	0	0
1994	1.12	0	0
1995	1.22	2.5	1.3
1996	0.88	1.8	1.1
1997	0.82	1.5	0.7

Note: Since 1995, GHL includes both red and blue king crab combined.

St. Matthew Stock: Abundance estimates for the St. Matthew blue king crab stock are obtained through the NMFS annual bottom trawl surveys using an area-swept method. Survey data indicated the presence of relatively high numbers of juvenile males in the late 1970s. These crabs recruited to fisheries in the early 1980s. Recent survey data indicate that the stock is at average abundance levels, but may be declining slightly.

Abundance of legal males (millions of crab from catch-survey estimates), pre-season guideline harvest levels (GHL, in millions of pounds), and total catches (millions of pounds, including deadloss) of St. Matthew District blue king crab, 1980-1997.

Year	Abundance	GHL	Catch
1980	2.90	na	na
1981	3.78	1.5 - 3.0	4.6
1982	4.98	5.6	8.8
1983	3.41	8.0	9.5
1984	1.70	2.0 - 4.0	3.8
1985	0.99	0.9 - 1.9	2.4
1986	0.54	0.2 - 0.5	1.0
1987	0.84	0.6 - 1.3	1.1
1988	1.09	0.7 - 1.5	1.3
1989	1.53	1.7	1.2
1990	1.82	1.9	1.7
1991	2.39	3.2	3.4
1992	2.47	3.1	2.5
1993	2.61	4.4	3.0
1994	2.54	3.0	3.8
1995	2.30	2.4	3.2
1996	3.13	2.4	1.1
1997	4.10	5.0	4.6

Harvest of blue king crab from the St. Matthew District began in 1977, peaking at 9.5 million pounds in 1983. This was followed by reduced harvests in the late 1980s. By the early 1990's, abundance of large males had increased, and GHLs were increased to over 3 million pounds.

In 1995, a total of 90 vessels (1 catcher-processor, 89 catcher vessels) participated in the St. Matthew blue king crab fishery. The season began on September 15 and lasted 5 days, during which time 3.2 million pounds were landed. Blue king crab fetched $2.32 per pound exvessel, making the total fishery worth $7.1 million. The average crab size was 4.8 pounds. In 1997, 117 vessels participated and harvested 4.6 million pounds in 7 days. Crab averaged 4.9 pounds each and brought $2.21 per pound exvessel, making the total fishery worth $9.8 million.

The Alaska Department of Fish and Game applied catch-survey analysis to St. Matthew Island and Pribilof Islands blue king crab stock beginning

in 1996. It is particularly suited for blue king crabs that occupy untrawlable areas.

Golden King Crab

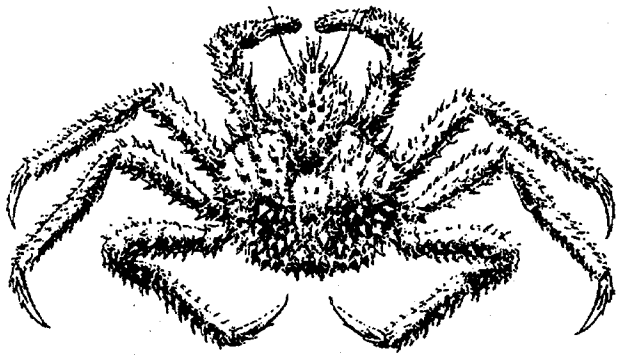
Biology: Golden king crab (*Lithodes aequispinus*), also called brown king crab, range from Japan to British Columbia. In the Bering Sea and Aleutian Islands (BSAI), golden king crab are found at depths from 200 m to 1,000 m, generally in high relief habitat such as inter-island passes. Size at sexual maturity depends on latitude, with crabs in the northern areas maturing at smaller sizes. In the St. Matthew area, golden king crab are 50% mature at 92 mm carapace length (males) and 98 mm carapace length (females). In the Pribilof and western Aleutian Islands area, 50% maturity of males is attained at 107 mm (about 3.5 inches) carapace length and 100 mm (about 3.3 inches) carapace length for females. Further south, in the eastern Aleutian Islands, fifty percent maturity is attained at 130 mm carapace length (males) and 111 mm carapace length (females). Little information is known about the biology of a related species, scarlet king crab (*Lithodes couesi*), found in the Bering Sea and Aleutian Islands area. This species occurs in deep water and have been harvested incidental to golden king crab and *Chionoecetes tanneri* fisheries. A total of 13,871 pounds of scarlet king crab were harvested in 1995. In 1997, 7,170 pounds of scarlet king crab were landed.

Management: King crab stocks in the Bering Sea are managed by the State of Alaska through a federal BSAI king and Tanner crab fishery management plan (FMP). Under the FMP, management measures fall into three categories: (1) those that are fixed in the FMP and under Council control, (2) those that are frameworked so that the State can change following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. Current minimum legal size for golden king crab is 6.0 inches in carapace width for Area O; elsewhere in the Bering Sea minimum size is 5.5" cw. Minimum size for *L. couesi* is 5.5 inches. As with other king crab, only males are harvested. Maximum allowable fishing mortality for the mature male golden king crab stock, as established by the FMP, is $F_{OFL} = F_{MSY} = M$.

Management measures implemented for the BSAI king and Tanner crab fisheries, as defined in the federal crab FMP, 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
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
	* Closed Waters	* Bycatch Limits (in crab fisheries)
	* Pot Limits	* Other
	* Registration Areas	

In addition to minimum size and sex restrictions, the State has instituted numerous other regulations for the Eastern Bering Sea crab fisheries. The State requires vessels to register with the state by obtaining licenses and permits, and register for each fishery and each area. For Bering Sea golden king crabs, a commissioners permit is also required. Areas established for king crab are shown in the adjacent figure. Observers are required on all vessels processing king and Tanner crab in the BSAI. By regulation, observers are also required on all vessels fishing for golden king crab in the Aleutian Islands. Observers collect needed biological data and also provide enforcement monitoring for the longline fishery. Season opening dates are set to maximize yield per recruit and minimize handling of softshell crabs. The season opening date for golden king crab s in the Aleutian Islands area is September 1. By regulation, pots used in the Aleutian Islands golden king crab fishery must be longlined to reduce gear loss. A minimum of 10 pots must be linked together. Escape rings were adopted by the Board in 1996 to reduce capture and handling mortality of non-target crab; a minimum of four 5.5" rings are required on pots used in golden king crab fisheries. Other gear restrictions include a requirement that crab pots be fitted with a degradable escape mechanism consisting of #30 cotton thread (max. diameter) or a 30-day galvanic timed release mechanism.



Stock Structure: Several discrete stocks of golden king crab are thought to exist in the BSAI region. Until 1996, the Aleutian Islands stock was separated into two management areas, Adak and Dutch Harbor. The entire area is now managed as one area; Dutch Harbor Area O. Based on historic landing data, two

golden crab stocks have been identified and are managed as the Sequam and Adak stocks separated at 174° W longitude.

Bering Sea and Aleutian Islands Stocks: Abundance estimates for golden king crab are not available as no surveys have been routinely undertaken. Golden crab are found over habitat not suitable for trawl surveys. Pot surveys and fishery performance are utilized as indices of abundance, however.

The golden king crab fishery is prosecuted using mesh covered pots set on longlines. There is no limit to the number of pots a vessel can fish at one time. In recent Adak golden king crab fisheries, vessels set an average of 500 pots, with larger vessels generally fishing more pots.

A total of 34 vessels participated in the 1994-1995 Adak golden king crab fishery. The fishery lasted 288 days, with a total harvest was 6.4 million pounds. Average weight of golden crab harvested was 4.1 pounds in the Adak area. These crab were worth $3.33 per pound exvessel, for a total season value of $20.3 million.

The 1995 Dutch Harbor golden king crab fishery was prosecuted by 17 vessels. The season opened on September 1, and lasted 38 days. A total of 2 million pounds were landed at an exvessel price of $2.60 per pound. Average weight of Dutch Harbor golden king crab was 4.6 pounds.

Total catches (thousands of pounds, including deadloss) of BSAI golden king crab, by management area, 1980-1997.

	Dutch	Adak	Pribilof	Saint
Year	Harbor	District	District	Matthew
1980	na	59	0	na
1981	116	1,194	8	na
1982	1,185	8,006	70	na
1983	1,811	8,128	856	194
1984	1,521	3,180	0	0
1985	1,968	11,125	trace	0
1986	1,869	12,798	4	0
1987	1,383	8,001	26	424
1988	1,545	9,080	3	160
1989	1,852	10,162	7	4
1990	1,719	5,251	0	0
1991	1,448	6,254	6	0
1992	1,357	4,916	3	trace
1993	915	4,636	67	0
1994	1,750	6,378	89	13
1995	1,994	4,897	conf.	1
	Aleutians Area O			
	East	West		
1996	3,256	4,665	329	conf.
1997	3,564	628	179	0

Tanner Crab

Biology: Tanner crab (*Chionoecetes bairdi*) are distributed on the continental shelf of the North Pacific Ocean and Bering Sea from Kamchatka to Oregon. Off Alaska, Tanner crab are concentrated around the Pribilof Islands and immediately north of the Alaska Peninsula, and are found in lower abundance in the Gulf of Alaska. Size at 50% maturity, as measured by carapace width, is 110 mm for males and 90 mm for females in the Bering Sea. The corresponding age of maturity for male Tanner crab is about 6 years. Growth during the next molt increases the size of males to about 120-140 mm. Mature male Tanner crabs may skip a year of molting as they attain maturity. Natural mortality of adult Tanner crab is estimated at about 25% per year (M=0.3). Tanner crab females are known to form high-density mating aggregations, or pods, consisting of hundreds of crabs per mound. These mounds may provide protection from predators and also attract males for mating. Mating need not occur every year, as some female Tanner crabs can retain viable sperm in spermathecae up to 2 years or more. Females have clutches of 50,000 to 400,000 eggs. Little information is known about the biology of two other closely related species of Tanner crab found in the Bering Sea and Aleutian Islands area. The grooved Tanner crab (*Chionoecetes tanneri*) and triangle Tanner crab (*Chionoecetes angulatus*) occur in deep water (> 400 fathoms) and have been commercially harvested only in the past few years.

Management: Tanner crab stocks in the Bering Sea are managed by the State of Alaska through a federal BSAI king and Tanner crab fishery management plan (FMP). Under the FMP, management measures fall into three categories: (1) those that are fixed in the FMP under Council control, (2) those that are frameworked so that the State can change following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. The State sets pre-season guideline harvest levels for Tanner crab based on a mature male harvest rate of 40%. Minimum legal size for Bering Sea Tanner crab, *C. bairdi*, is 5.5 inches carapace width. Minimum legal sizes for other Tanner species are: *C. tanneri* 5.0 inches; *C. angulatus* 4.5 inches.

Management measures implemented in the BSAI king and Tanner crab fisheries, as defined by the federal crab FMP, 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
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
	* Closed Waters	* Bycatch Limits (in crab fisheries)
	* Pot Limits	* Other
	* Registration Areas	

In addition to minimum size and sex restrictions, the State has instituted numerous other regulations for the Eastern Bering Sea crab fisheries. The State requires vessels to register with the state by obtaining licenses and permits, and register for each fishery and each area. Observers are required on all vessels processing king and Tanner crab in the BSAI. Season opening dates are set to maximize meat yield and minimize handling of softshell crabs. The season opening date for the Bering Sea Tanner crab fishery is November 1. Pot limits have been established for the *C. bairdi* Tanner crab fishery based on vessel size; the current pot limits are 250 for vessels > 125 feet, and 200 for vessels < 125 feet. In the Bering Sea, a 3" maximum tunnel height opening for Tanner crab pots is required to inhibit the bycatch of red king crab. Escape rings were adopted by the Board in 1996 to reduce capture and handling mortality of non-target crab; a minimum of four 5.0" rings, or 1/3 of the web on one panel of 7 1/4" stretched mesh, is required on pots used in Tanner crab fisheries. Other gear restrictions include a requirement that crab pots be fitted with a degradable escape mechanism consisting of #30 cotton thread (max. diameter) or a 30-day galvanic timed release mechanism. In years when no GHL is established for the Bristol Bay red king crab stock, the Tanner crab fishery is restricted to the area west of 163° W longitude.

Stock Structure: Tanner crab (*C. bairdi*) are managed into 3 separate stocks: eastern Bering Sea, eastern Aleutian Islands, and western Aleutian Islands. The grooved Tanner crab (*C. tanneri*) fishery is likewise regulated by these management areas.

Eastern Bering Sea Stock: The eastern Bering Sea Tanner crab (*C. bairdi*) stock is currently at very low abundance. The 1995 NMFS bottom trawl survey indicated relatively low levels of juveniles, pre-recruits, females, and large males. Data indicate poor recruitment in coming years.

The Bering Sea Tanner stock has undergone two large fluctuations. Catches increased from 5 million pounds in 1965 to over 78 million pounds in 1977. After that, the stock declined to the point where no fishery occurred in 1986 and 1987. The fishery reopened in 1988, and landings increased to over 40 million pounds in 1990. Another decline ensued, and the 1995 Tanner crab season produced only 4.2 million pounds. The 1995 fishery was prosecuted by 196 vessels and lasted 15 days. Average weight of crab landed was 2.3 pounds valued at $2.80 per pound exvessel. Total value of the 1995 fishery was $11.7 million. In 1994 and 1995, fishing was prohibited east of 163°W to reduce bycatch of red king crab. In 1996, 196 vessels harvested 1.8 million pounds of Tanner crab in the directed fishery (12 days) and incidental to a red king crab fishery (4 days). Average weight was 2.5 pounds valued at $2.50 per pound. Due to the depressed nature of the stock and predominance of old shell crab, no fishery was allowed in 1997.

Abundance of large males (millions of crab ≥5.3" from NMFS trawl survey), pre-season guideline harvest levels (millions of pounds), and total catches (millions of pounds, including deadloss) of Bering Sea Tanner crab (*C. bairdi*), 1980-1996.

Year	Abundance	GHL	Catch
1980	31.0	28 - 36	36.6
1981	14.0	28 - 36	29.6
1982	10.1	12 - 16	11.0
1983	6.7	5.6	5.3
1984	5.8	7.1	1.2
1985	4.4	3.0	3.1
1986	3.1	0	0
1987	8.3	0	0
1988	17.4	5.6	2.2
1989	42.3	13.5	7.0
1990	53.7	72.3	64.6
1991	45.5	32.8	31.8
1992	52.8	39.2	35.1
1993	27.2	19.8	16.9
1994	20.0	7.5	7.8
1995	13.3	5.5	4.2
1996	12.5	6.2	1.8

Note: abundance through 1988 included Pribilof area Tanner crab.

Aleutian Islands Stock: The Tanner crab stock of the Aleutian Islands is very small, and populations are found in only a few large bays and inlets. As such, the fishery is limited. Annual harvests in the Aleutian Islands area were 200,000 to 800,000 pounds through 1985. Thereafter, stocks declined, and landings were reduced. Alaska Department of Fish and Game trawl surveys indicated a dramatic decline from 1991 to 1994. No landings were made in either area in 1995. Due to depressed stocks, no fishery was allowed in the Eastern Aleutians in 1996 or 1997.

Fisheries for deepwater species of Tanner crab have been developing in recent years. A directed fishery for grooved Tanner crab began in 1993, and about 200,000 pounds were landed in 1995. These crab weighed an average of 1.9 pounds, and sold for $1.50 per pound exvessel. Less than 3 vessels reported landings of *C. angulatus* in 1995 and 1996, and consequently, catches are confidential. There were no landings of *C. angulatus* in 1997.

Total harvest (thousands of pounds) of Tanner crab (C. bairdi) from the Aleutian Islands area, 1980-1996.

Year	Western AI	Eastern AI
1980	221	886
1981	839	655
1982	488	740
1983	384	548
1984	163	240
1985	207	166
1986	43	167
1987	141	160
1988	149	310
1989	49	326
1990	15	172
1991	8	50
1992	conf.	99
1993	0	119
1994	0	167
1995	0	0
1996	conf.	0
1997	0	0

Total harvest (thousands of pounds, deadloss included) of deepwater Tanner crab (C. tanneri) from the BSAI, by management area, 1993-1997.

Year	Western AI	Eastern AI	Bering Sea
1993	0	conf.	659
1994	conf.	759	332
1995	146	882	1,005
1996	conf.	106	106
1997	0	0	0

Snow Crab

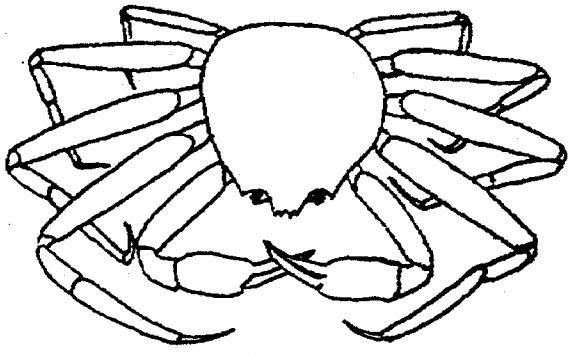
Biology: Snow crabs (*Chionoecetes opilio*) are distributed on the continental shelf of the Bering Sea, Chukchi Sea, and in the western Atlantic Ocean as far south as Maine. Snow crab are not present in the Gulf of Alaska. In the Bering Sea, snow crabs are common at depths less than 200 meters. The eastern Bering Sea population within U.S. waters is managed as a single stock, however, the distribution of the population extends into Russian waters to an unknown degree. While 50% of the females are mature at 50 mm, the mean size of mature females varies from year to year over a range of 63 mm to 72 mm carapace width. Females cease growing with a terminal molt upon reaching maturity, and rarely exceed 80 mm carapace width. Males similarly cease growing upon reaching a terminal molt when they acquire the large claw characteristic of maturity. The median size of maturity for males is 65 mm carapace width (approximately 4 years old). Males larger than 60 mm grow at about 20 mm per molt, but individuals vary widely in this regard. Female snow crabs are able to store spermatophores in seminal vesicles and fertilize subsequent egg clutches without mating. At least two clutches can be fertilized from stored spermatophores, but the frequency of this occurring in nature is not known. Snow crab feed on an extensive variety of benthic organisms including bivalves, brittle stars, crustaceans (including other snow crabs), polychaetes and other worms, gastropods, and fish. In turn, they are consumed by a wide variety of predators including bearded seals, Pacific cod, halibut and other flatfish, eel pouts, sculpins, and skates.

Management: The Bering Sea snow crab stock is managed by the State of Alaska through a federal BSAI king and Tanner crab fishery management plan (FMP). Under the FMP, management measures fall into three categories: (1) those that are fixed in the FMP under Council control, (2) those that are frameworked so that the State can change following criteria outlined in the FMP, and (3) those measures under complete discretion of the State. The State sets pre-season guideline harvest levels for snow crab based on a mature male harvest rate of 58% for snow crab larger than 4 inches. Although the minimum legal size for snow crab is 78 mm (3.1 inches), the fishery has generally harvests crabs over 4 inches in carapace width.

Management measures implemented in the BSAI king and Tanner crab fisheries, as defined by the federal crab FMP, 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
* Federal Observer Requirements	* Inseason Adjustments	* Gear Storage
* Limited Access	* Districts, Subdistricts and Sections	* Gear Modifications
* Norton Sound Superexclusive Registration Area	* Fishing Seasons	* Vessel Tank Inspections
	* Sex Restrictions	* State Observer Requirements
	* Closed Waters	* Bycatch Limits (in crab fisheries)
	* Pot Limits	* Other
	* Registration Areas	

In addition to minimum size and sex restrictions, the State has numerous other regulations for the Eastern Bering Sea crab fisheries. The State requires vessels to register with the state by obtaining licenses and permits, and register for each fishery and each area. Observers are required on all vessels processing crab in the BSAI. Season opening dates are set to maximize yield per recruit and minimize handling of softshell crabs. The season opening date for snow crab fisheries is January 15. Pot limits have been established based on vessel size; the current pot limits are 250 for vessels > 125 feet, and 200 for vessels < 125 feet. A 3" maximum tunnel height opening for snow crab pots is required to inhibit the bycatch of red king crab. Escape rings were adopted by the Board in 1996 to reduce capture and handling mortality of non-target crab; a minimum of four 3.75" rings are required on snow crab pots or, instead of rings, 1/3 of one vertical mesh panel can be 5" stretched mesh. Other gear restrictions include a requirement that crab pots be fitted with a degradable escape mechanism consisting of #30 cotton thread (max. diameter) or a 30-day galvanic timed release mechanism.



Stock Structure: Snow crab are thought to be one stock throughout its range in the BSAI area. However, management the area is divided into two subdistricts, and NMFS estimates abundance and sets GHL by subdistrict.

Eastern Bering Sea Stock: Abundance of large male snow crab increased dramatically from 1983 to 1991, but has since declined. The 1993 NMFS Bering Sea trawl survey indicated the total abundance of large males (over 4 inches) at 135 million crab, a 48% decrease

from 1992. Small (3-4") legal-size males also declined in abundance, consistent with the decline in large males observed since 1991. The 1995 NMFS bottom trawl survey indicated relatively low levels of large male crab. However, the survey indicated an 88% increase in the numbers of pre-recruits, and a 44% increase in the number of large females. These signs of strong recruitment were apparent in the 1996 survey, as survey results indicated the number of large crab doubled.

Catch of Bering Sea snow crab increased from under 1 million pounds in 1974 to over 315 million pounds in 1992. The 1992 peak catch was followed by reduced landings thereafter. The 1995 opilio fishery was prosecuted by 253 vessels. The season began on January 15 and lasted 33 days. A total of 74 million pounds were landed. Average weight of crab retained was 1.2 pounds worth $2.43 per pound exvessel. Total value of the 1995 snow crab fishery was $180 million exvessel.

Increased landings occurred in recent years due to good recruitment of sublegal males. In 1997, 119.4 million pounds of snow crab were harvested. Average weight of crab taken was 1.2 pounds. A total of 226 vessels have participated. Exvessel price was $0.79/lb, for a total fishery value of $92.5 million. The 1998 fishery opened with a GHL of 234 million pounds, of which 3.5% was allocated as community development quota, CDQ.

Abundance of large males (millions of crab ≥4.0" from NMFS trawl survey), pre-season guideline harvest levels (millions of pounds), and total catches (millions of pounds, including deadloss) of Bering Sea snow crab, 1980-1998.

Year	Abundance	GHL	Catch
1980	na	n/a	39.6
1981	na	39.5 - 91.0	52.8
1982	na	16.0 - 22.0	29.4
1983	na	15.8	26.1
1984	na	49.0	26.8
1985	153	98.0	66.0
1986	75	57.0	98.0
1987	83	56.4	101.9
1988	151	110.7	134.0
1989	171	132.0	149.5
1990	187	139.8	161.8
1991	420	315.0	328.6
1992	484	333.0	315.3
1993	256	207.2	230.8
1994	135	105.8	149.8
1995	72	73.6	75.3
1996	69	50.7	65.7
1997	172	117.0	119.4
1998	306	234	239.9

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 oil spill 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 patterns of their behavior. 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. 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 up/l, has been identified in marine sediments in that area (Nelson, et al. 1975). The levels of this heavy metal exceed the 3.7 up/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). Present, 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-Stevens Fishery Conservation and Management Act (Magnuson-Stevens 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-Stevens 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-Stevens 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, decision making 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-Stevens 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 oil spill 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) as amended in 1994. The MMPA establishes a moratorium on the taking and importing of marine mammals and marine mammal products, with certain exception. Takings of marine mammals is authorized under limited circumstances, including incidental takings during commercial fishing operations. Such takes are regulated by Federal agencies. Maintaining the original aspirations of the MMPA, the amendments continue to protect marine mammals, seeking to maintain stocks at, or recover stocks to, their optimum sustainable

population levels. To achieve that goal, protection of essential habitats including rookeries, mating grounds, and areas of similar significance is emphasized.

The most significant amendments involved establishing a new regime to govern the taking of marine mammals incidental to commercial fishing. Three new sections were added to the MMPA to address commercial fishing: the preparation of stock assessments for all marine mammal stocks in waters under U.S. jurisdiction; development and implementation of take reduction plans for stocks that may be reduced or are being maintained below their optimum sustainable population levels due to interactions with commercial fisheries; and studies of pinniped-fishery interactions.

(l) Marine Plastic Pollution Research and Control Act of 1987. This Act prohibits dumping of plastics (including fishing gear) at sea, and restricts dumping of ship-generated garbage at sea and in navigable waters of the United States.

(m) Regulatory Flexibility Act as amended in 1996. The Regulatory Flexibility Act (RFA) requires agencies to assess impacts of its proposed regulations on small entities. The objective of the RFA is to require consideration of the capacity of those affected by regulations to bear the direct and indirect costs of regulation. The intent is to encourage Federal agencies to utilize innovative administrative procedures when dealing with small entities that would otherwise be unnecessarily adversely affected by Federal regulations.

(n) Executive Order 12866 (E.O. 12866) of 1993. To achieve the purpose of the Regulatory Flexibility Act, E.O. 12866 directs agencies to promulgate only such regulations as are required by law and to assess all costs and benefits of available regulatory alternatives, including not regulating, and providing economic incentives to encourage the desired behavior. The assessment of costs and benefits includes both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. The agency should choose the regulatory approach that maximizes net benefits, including economic, environmental, public health and safety, distributive impacts, equity, and where the agency has determined that the benefits of the intended regulation justify its cost.

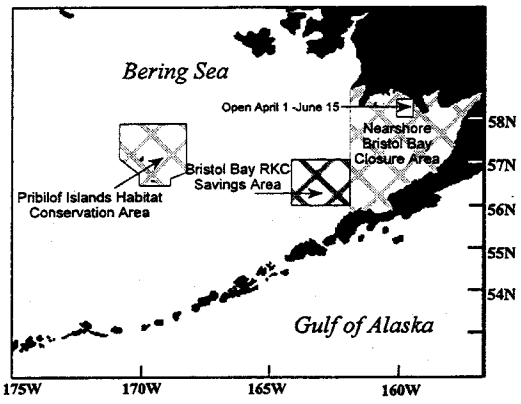
The agency shall base its decision on the best reasonably obtainable scientific, technical, economic and other information concerning the need for, and consequences of, the intended regulation.

Appendix G. Overview of Measures to Minimize Crab Bycatch in Other Fisheries

The Council and the Alaska Board of Fisheries have adopted numerous regulations designed to protect habitat and minimize bycatch and bycatch mortality of crab taken incidentally in groundfish and scallop fisheries. An overview of these measures is provided below.

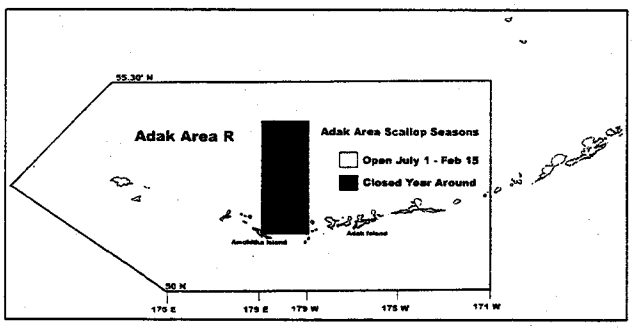
Closure Areas

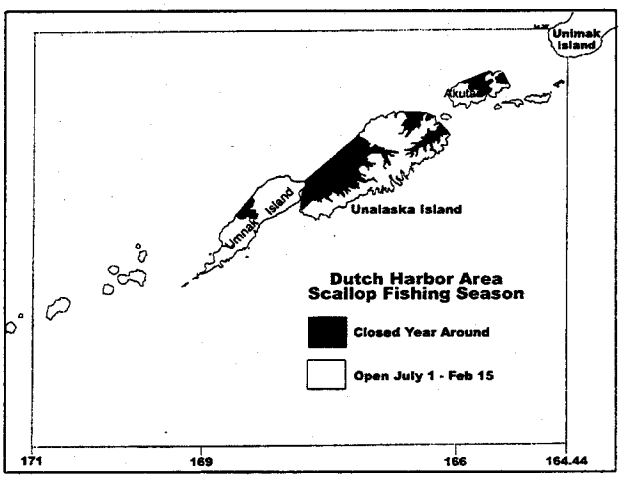
Several areas of the Bering Sea have been closed to groundfish trawling and scallop dredging to reduce potential adverse impacts on the habitat for crab and other resources. Beginning in 1995, the Pribilof Islands Conservation Area was closed to all trawling and dredging year-round to protect blue king crab habitat (NPFMC 1994b). Also beginning in 1995, the Red King Crab Savings Area was established as a year-round bottom trawl and dredge closure area (NPFMC 1995). This area was known to have high densities of adult red king crab, and closure of the area greatly reduced bycatch of this species. To protect juvenile red king crab and critical rearing habitat (stalked ascidians and other living substrate), another year-round closure to all trawling was implemented for the nearshore waters of Bristol Bay. Specifically, the area east of 162° W (i.e., all of Bristol Bay) is closed to trawling and dredging, with the exception of an area bounded by 159° to 160° W and 58° to 58°43' N that remains open to trawling during the period April 1 to June 15 each year.



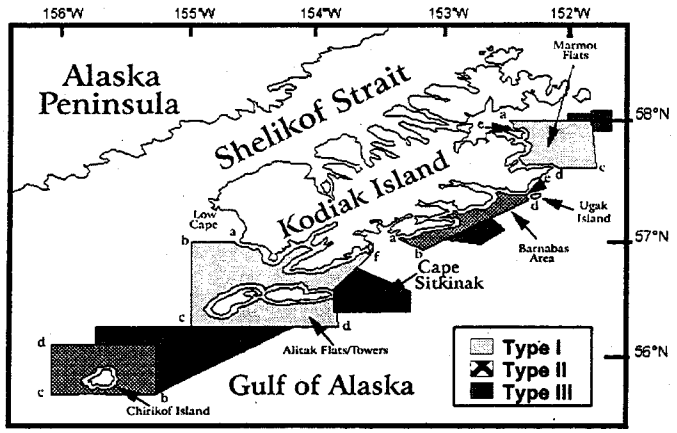
Location of trawl closure areas to protect red and blue king crab habitats.

The figures below show locations of other areas in the BSAI closed to scallop dredging.





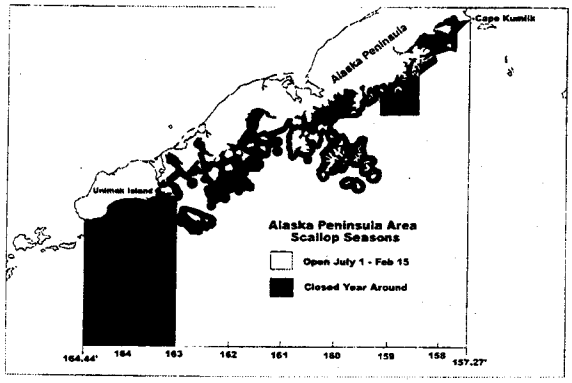
There are also trawl and dredge closure areas in the Gulf of Alaska to protect king crab and crab habitat. In the Kodiak Island area, trawl closure areas were designed based on the use of areas by crab life stage and level of recruitment (NPFMC 1993). Three types of areas are designated. Type I areas have very high king crab concentrations and, to promote rebuilding of the crab stocks, are closed all year to all trawling except with pelagic gear. Type II areas have lower crab concentrations and are only closed to non-pelagic gear from February 15 through June 15. Type III areas are adjacent to Type I and II areas and have been identified as important juvenile king crab rearing or migratory areas. Type III areas become operational following a determination that a "recruitment event" has occurred. The Regional Director will classify the expanded Type III area as either Type I or II, depending on the information available. A "recruitment event" is defined as the appearance of female king crab in substantially increased numbers (when the total number of females estimated for a given district equals the number of females established as a threshold criterion for opening that district to commercial crab fishing). A recruitment event closure will continue until a commercial crab fishery opens for that district or the number of crabs drops below the threshold level for that district.

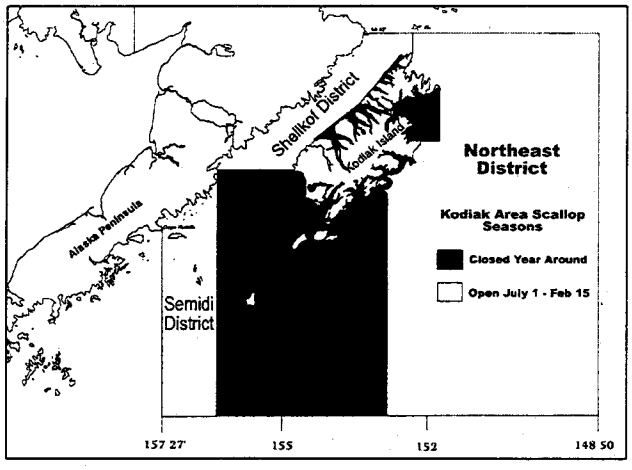


22*Location of trawl closure areas in the Gulf of Alaska to protect red king crabs.*

No trawling is allowed in the eastern Gulf of Alaska as of March 23, 1998. This area was closed as part of the license limitation system that was adopted as GOA Groundfish FMP Amendment 41.

The figures below show areas closed to scallop dredging in the Gulf of Alaska.





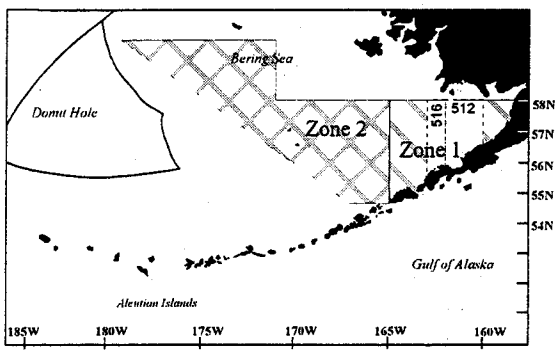
Bycatch Limits

The Council has adopted numerous limits on the incidental capture of crabs taken in groundfish and scallop fisheries. A summary is provided below.

Prescribed bottom trawl fisheries in specific areas are closed when prohibited species catch (PSC) limits of *C. bairdi* Tanner crab, *C. opilio* crab, and red king crab are taken. Bycatch limitation zones for Tanner and red king crab PSC are shown in the figure below. Crab PSC limits for groundfish trawl fisheries are based on crab abundance as shown in the adjacent table.

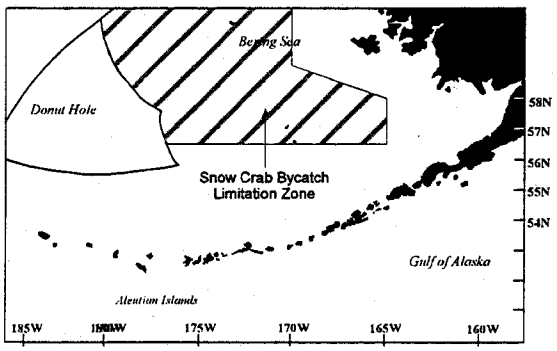
PSC limits for red king crab and C. bairdi Tanner crab.

Species	Zone	Crab Abundance	PSC Limit
Red King Crab	Zone 1	Below threshold or 14.5 million lbs of effective spawning biomass (EBS)	35,000
		Above threshold, but below 55 million lbs of EBS	100,000
		Above 55 million lbs of EBS	200,000
Tanner Crab	Zone 1	0-150 million crabs	0.5% of abundance
		150-270 million crabs	750,000
		270-400 million crabs	850,000
		over 400 million crabs	1,000,000
Tanner Crab	Zone 2	0-175 million crabs	1.2% of abundance
		175-290 million crabs	2,100,000
		290-400 million crabs	2,550,000
		over 400 million crabs	3,000,000



Location of the crab bycatch limitation zones.

Under Amendment 40, PSC limits for snow crab (*C. opilio*) taken in groundfish fisheries are based on total abundance of *opilio* crab as indicated by the NMFS standard trawl survey (NPFMC 1996). The snow crab PSC cap is set at 0.1133% of the Bering Sea snow crab abundance index, with a minimum PSC of 4.5 million snow crab and a maximum of 13 million snow crab. Snow crab taken within the "Snow Crab Bycatch Limitation Zone"accrue towards the PSC limits established for individual trawl fisheries. Upon attainment of a snow crab PSC limit apportioned to a particular trawl target fishery, that fishery are prohibited from fishing within the snow crab zone.



27 *Location of the snow crab bycatch limitation zone.*

Crab bycatch limits have also been established for the Alaska scallop fisheries. Annual crab bycatch limits (CBLs) are specified for red king crab and Tanner crab species in each registration area or district thereof. In Registration Area Q (the Bering Sea), the annual CBLs shall equal the following amounts:

1. The CBL of red king crab caught while conducting any fishery for scallops shall be within the range of 500 to 3,000 crab based on specific considerations.

2. The CBL of *C. opilio* Tanner crab caught while conducting any fishery for scallops is 0.003176 percent of the most recent estimate of *C. opilio* abundance in Registration Area Q.

3. The CBL of *C. bairdi* Tanner crab caught while conducting any fishery for scallops is 0.13542 percent of the most recent estimate of *C. bairdi* abundance in Registration Area Q.

In other Registration Areas (Gulf of Alaska and Aleutian Islands), CBLs will be based on the biological condition of each crab species, historical bycatch rates in the scallop fishery, and other socioeconomic considerations that are consistent with the goals and objectives of the FMP.

Weathervane scallop registration areas, seasons, GHL's (pounds, shucked), and crab bycatch limits established for the 1997 scallop fishery, by area.

			Crab Bycatch Limits		
	GHL	Fishing	king	Tanner	Snow
Area	(pounds)	Season	crab	crab	crab
D - District 16	0 - 35,000	Jan 10 - Dec 31	n/a	n/a	n/a
D - Yakutat	0 - 250,000	Jan 10 - Dec 31	n/a	n/a	n/a
E - Eastern PWS	0 - 50,000	Jan 10 - Dec 31	n/a	500	n/a
Western PWS	combined	Jan 10 - Dec 31	n/a	130	n/a
H - Cook Inlet (Kamishak)	0 - 20,000	Aug 15 - Oct 31	60	24,992	n/a
Cook Inlet (Outer area)	combined	Jan 1 - Dec 31	98	2,170	n/a
K - Kodiak (Shelikof)	0 - 400,000	July 1 - Feb 15	35	51,000	n/a
Kodiak (Northeast)	combined	July 1 - Feb 15	50	91,600	n/a
M - AK Peninsula	0 - 200,000	July 1 - Feb 15	79	45,300	n/a
O - Dutch Harbor	0 - 170,000	July 1 - Feb 15	10	10,700	n/a
Q - Bering Sea	0 - 600,000	July 1 - Feb 15	500	238,000	172,000
R - Adak	0 - 75,000	July 1 - Feb 15	50	10,000	n/a

Appendix H. Current (1998) and Historic Boundaries for Registration Areas and Fishing Districts, Sub-districts, and Sections within the BSAI Management Unit

Current Registration Areas

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).

Pribilof District Q_1: waters of Statistical Area Q south of the latitude of Cape Newenham (58°39' N. lat.).

Northern District: waters of Statistical Area Q north of latitude of Cape Newenham (58°39' N. lat.).

Saint Matthew Island Section Q_2: waters north of the latitude of Cape Newenham (58°39' N. lat.) and south of the latitude of Cape Romanzof (61°49' N. lat.);

Norton Sound Section Q_3: 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.);

Saint Lawrence Island Section Q_4: all remaining waters of the district.

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.

Aleutian Islands Registration Area (Statistical Area O): has as its eastern boundary the longitude of Scotch Cap Light (164°44' W. long.), its western boundary the U.S.-Russian Convention line of 1867, and its northern boundary a line from the latitude of Cape Sarichef (54°36' N. lat.) to 171° W. long., north to 55°30' N. lat., and west to the U.S.-Russian convention line of 1867.
[1] *This registration area no longer contains any districts or Sub-districts. The area's two distinct golden king crab stocks, as identified from historic commercial landings, are managed separately at the 174° W. long. line.*

Tanner Crab

BS/AI Portion of the Westward Registration Area (BS/AI Portion of 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.

Eastern Aleutian District J_4: all waters of Statistical Area J between the longitude of Scotch Cap Light and 172° W. long., and south of 54°36' N. lat.

Western Aleutian District J_5: all waters of Statistical Area J west of 172° W. long. and south of 54°36' N. lat.

Bering Sea District: all Bering Sea waters of Statistical Area J north of 54°36' N. lat.

Western Sub-district J_6: all waters of the Bering Sea District west of 173° W. long.

Eastern Sub-district J_7: all waters of the Bering Sea District east of 173° W. long., including the waters of Bristol Bay.

Norton Sound Section J_8: all waters east of 168° W. long. and north of the latitude of Cape Romanzof;

General Section: all waters of the Eastern Sub-district not included in the Norton Sound Section.

Historic Registration Areas

King Crab

Historic Adak Registration Area R

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.

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.

(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.

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.

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.

Western Aleutians District: all waters of Statistical Area R west of 179°15' W. long., excluding the Petrel Bank district.

Historic Dutch Harbor Registration Area O

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.).

Akutan District: all Bering Sea waters of Statistical Area O west of 165°34' W. long., east of the longitude 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.

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.

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.).

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.

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Appendix J. Community Profiles

National Standard 8 of the Magnuson-Stevens Act mandates that conservation and management shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to provide for the sustained participation of such communities, and to the extent practicable, minimize adverse economic impacts on such communities. The following is a community profile for of one community in the BSAI region. Copies of profiles for other coastal communities, entitled "Faces of the Fisheries", are available from the Council office.

"Faces of the Fisheries"

A publication of Community Profiles by the North Pacific Fishery Management Council

1994 Printing

These profiles are intended to provide a snapshot of various coastal communities, highlighting their involvement in fisheries off Alaska. Data through 1992 are included with the following regional packages available:

- Western Alaska
- Pribilof Islands
- Alaska Peninsula/Aleutian Islands
- South Central Alaska
- Prince William Sound
- Kodiak Island
- Southeast Alaska
- Washington (Puget Sound)
- Oregon

The information in this publication was compiled and edited by Krys Holmes of Winterholm Press, drawing on a variety of data sources including: Alaska Department of Fish & Game's Community Profile Database; Commercial Fisheries Entry Commission's Fish Ticket Databases; International Pacific Halibut Commission; National Marine Fisheries Service; U.S. Department of Labor; Alaska Department of Labor; Minerals Management Service Social Indicators Studies; Alaska Regional Development Organizations; and various local and regional Chambers of Commerce. For more information, or copies of specific regional profiles, contact the North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, Alaska, 99501, or call (907) 271-2809.

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ST. PAUL

Zip code: 99660
County: 16
FIPS: 66470
Census area code: 586 - Aleutians West

General profile --

The community of St. Paul, the only settlement on St. Paul Island, is located on a narrow thumb of land on the southern tip of the 44-square-mile island, 47 miles from St. George. Here, fur seal rookeries and thousands of sea bird rookeries explode with life in summertime, and windswept, icy shorelines hug and pummel the island through the winter. More than 210 species of sea birds nest here, some from as far away as Argentina. Tourists fly here too, to view the largest single herd of sea mammals in the world — 1.3 million or so fur seals distributed among 14 rookeries and haul-outs. There is also a reindeer herd on St. Paul Island, a holdover from a previous commercial venture.

St. Paul is trying with all its might to become a commercial fishing town. The city has built dock and breakwater, and is completing a 700-foot dock expansion, cold storage, surimi plant and warehouse facility. There is a state-maintained airport with a 5,075-ft. gravel runway that accommodates regular air service. St. Paul is the major port for ships operating in the Central Bering Sea area, but the full potential for developing portside business has not yet been developed because the infrastructure has been so slow in coming.

The community --

St. Paul is the largest community of Aleut people in the world. With a population of 763 and 66.1% Alaska Native, St. Paul's 504 Aleut residents represent the largest remaining concentration of a community of seafaring Natives that once spread throughout the Aleutian Islands and the Alaska Peninsula. The proportion of men to women is uncommonly high (62.6% to 37.4%, respectively). Young people often leave the island for work or schooling, and women are more likely than men to marry or settle into other areas; male residents are more likely to return to their home town, according to a 1988 study (Kevin Waring Associates).

This is a struggling community, with alcohol and drug problems rising in direct proportion to the uncertainty of the economic and political climate. Yet the strong sense of direction and self-determination that the community demonstrates in the face of its sorrowful past and uncertain future is also evident. St. Paul has a 10.8% unemployment rate and a per capita income of $15,115, and 7.1% of the population is below poverty level. Though per capita income is nearly as high as the statewide average, the cost of living is far higher here, 500 miles offshore, than it is in most villages.

Of the 433 residents over 25 years old, 61.7% have high school diplomas, and only 3.2 have college degrees or higher. Some 88 residents speak their Native language, with 58 of them unable to speak English well, and 25 residents speak an Asian or Pacific Island language and do not speak English very well.

Schoolchildren up to 10th grade attend school in St. Paul, but high school juniors and seniors have to leave the island for the school year. The Russian Orthodox church is strong here; St. Paul is one of the few communities with a resident Russian Orthodox priest. There is also an Assembly of God church, attended primarily by non-Natives.

Population data:

Community	Saint Paul
1990 Population	763
Non-Native Population	259
Native Population	504
Percent Native	66.1

Housing Units	177
Vacant Units	23
Owner-Occup Housing Units	105
Median Value of Housing Units	$84,100
Renter-Occup Housing Units	49
Median Rent Paid	$508
Number of Households	161
# Family Households	132
# Non Related Households	29
Median Family Income	$48,000
Persons in Poverty	50
Percent in Poverty	7.11
(Source: ADCRA)	

The city of St. Paul, 1990	
Males	478
Females	285
White	21.5%
Black	1.5%
Pacific Islanders	5.8%
American Indian, Eskimo or Aleut	66.1%
Other races	5.1%
Median age	28.0
Median household income (1989)	$39,922
Median family income	$48,000
Median per capita income	$15,115
# people with nonfarm self emp. income	9
Mean non-farm self employment income	$12,400
# people on public assistance	20
Mean public assistance income	$4,089
Under poverty level	7.1%
High school graduates (of pop. 25+)	61.7%
College graduates (of pop 25+)	3.2%
Total households	161
Single women raising families	13
(Source: US Census)	

The city --

Form of government: The City of St. Paul is a second-class city (incorporated in 1971) and, as primary beneficiary of the St. Paul Trust set up by the federal government in 1983 to facilitate the transition from federal to local control, is also the city's largest employer. The city is run by a city manager and a seven-member city council, and levies a 3% sales tax.

The local Native corporation organized under ANCSA is Tanadgusix (or TDX) Corp., and while not a political force in itself, the corporation is the major land owner and is the major economic development force in the community.

The Aleut Community of St. Paul was organized under the Indian Reorganization Act, and it also is instrumental in fisheries development and other economic activities here. The IRA Council does act as a political institution on the island, and is also a force in helping preserve the Aleut culture in the face of increasing intrusion by Anglo-Americans.

Housing costs: Housing was constructed by the federal government and was extremely limited until the early 1980s. Since then some higher-quality homes have been built, the average household size has decreased, and housing for families and local workers is a lot closer to adequate.

Of the 93 owner-occupied homes in St. Paul, 73 are valued between $50,000 and $99,000, with a median value of $84,100. There are 32 mortgaged homes in St. Paul, with a

median mortgage payment of $414, and the average non-mortgage house payment is $394. Median rent is $688

Municipal facilities: St. Paul has a 300-foot city dock, a 300-foot private dock, a boat harbor, water, electrical, sewer, refuse removal and telephone services. The city has also started a solid waste reduction and recycling program, and is planning a new landfill area.

Community care: The City of St. Paul provides public safety, fire, police, search and rescue and airport fire, crash and rescue services. There is a three-bed Indian Health Service clinic, with three physician's assistants and a paraprofessional social worker. A dentist visits periodically, and an EMT team provides stabilization care in emergencies. The nearest hospital is Anchorage, 800 miles away; emergency patients are evacuated by air.

The economy --

Today, St. Paul is a supply and processing port for a portion of the Bering Sea groundfish and crab fleets. The city and the TDX Corp. have put forth major efforts to increase processing capacity, to build docks and breakwaters to accommodate the Bering Sea fleet, and to find ways to help local fishermen participate more in the region's fisheries. Those efforts themselves, fueled by federal grants and state funding, have generated a certain amount of economic activity.

Also, the magnificent local habitat for Arctic birds, marine mammals and other rare sights have attracted an increasing number of tourists to St. Paul Island. But the primary focus is increasing participation in the Bering Sea fisheries, the industry the U.S. government hoped would provide an economic future for St. Paul after their previous economic structure, and way of life, was shut down in 1983.

The 1990 census showed St. Paul had a 10.8% unemployment rate, and that the economic community supported 330 jobs, as outlined below:

St. Paul jobs, 1990	
Manufacturing non-durable goods	71 jobs
Ag/forestry/fisheries	44
Public administration	41
Educational services	34
Construction	32
Other professional services	28
Health services	19
Communications/utilities	15
Transportation	12
Personal services	12
Retail trade	12
Wholesale trade	6
Business/repair services	2
Entertainment/recreation	2
Total jobs	**330**

The median wage/salary income was $42,026 in 1990. Median self-employment income, among the nine people who reported it, was $12,400.

In 1980, when there were only 244 jobs in St. Paul, 18 people worked in reindeer antler processing, a business not highlighted but which is probably included in the "manufacturing non-durable goods" category, above. Back then, 180 of the 244 jobs — 73.7% — were only part-time jobs. There is no current information on now many of the 330 jobs in 1990 were full-time or part-time.

Subsistence activities --

Subsistence hunting, fishing and gathering has always been an important part of life on the Pribilof Islands. The ADF&G estimated in 1981 that St. Paul residents consumed approximately 307 lbs. of subsistence resources per capita annually (Schroeder, et al). Halibut, cod and sculpin are the primary marine fishes harvested for subsistence purposes. Salmon and

Dolly Varden are absent in the Pribilofs, and clams and marine invertebrates are less abundant than on the mainland or in the Aleutians.

Fur seals are by far the most important marine mammal taken for subsistence use. Though it is illegal under the Fur Seal Act, to commercially harvest these animals, Natives are allowed to take them for subsistence purposes only. Sea lions are also taken frequently, and harbor seals once in a while. The abundance of sea birds, ducks, geese, murre, kittiwakes, cormorants, and least auklets that nest on the island have led to the enthusiastic use of those birds and their eggs by the local Natives. The only land mammal harvested in any number is reindeer.

Following a house-by-house survey in 1981, ADF&G estimated the per-household use of seals, sea lions, halibut and reindeer as follows:

Estimated consumption per household for subsistence purposes, 1981

Total fur seal	1,020 lbs.
Summer harvest	320
Winter harvest	700
Sea lion	105
Halibut	513
Reindeer	54
Total weight:	**1,692**

Fisheries activities --

Though fisheries activities are the prime mover in the economy and the hopes of St. Paul, their participation has been relatively small so far. The local fleet fishes primarily for halibut; local processors produce crab and several species of groundfish. Several obstacles currently hold back fisheries activities: Though $75 million in federal, state and private funds have been spent building ocean breakwaters, docks and other marine improvements, those improvements have come slowly and the fact that they're not finished yet means the community is missing out on a lot of fisheries activity. So while the fisheries remain St. Paul's primary focus, actual participation is still pretty minimal until the city's fisheries development program can get on line.

St. Paul is the only member of the Central Bering Sea Fishermen's Association (CBSFA), a CDQ corporation, and so has received some pollock quota. CBSFA is using its new groundfish quotas to further develop the port's seafood processing capacities.

Fishing: The St. Paul fleet does not have the vessels or equipment to participate in the cod, pollock or crab fisheries, nor do they have the capital or the expertise to jump into those fisheries right now. All the local boats are under 50' in length. Most fishermen harvest only halibut, in the pulse fisheries in the Bering Sea areas. They began halibut fishing in about 1982 because, though there were no docks or harbor facilities to support a large fleet, the small locally-owned boats could fish off resources close to the island in small boats, which could be hauled out of the water.

The most halibut the St. Paul fleet has ever taken was 75% of the Halibut Area 4C quota in 1990, a year when most longliners preferred to fish elsewhere for regulatory reasons. Most years, the local fleet averages about 35% of the Area 4C harvest, primarily because the size of their boats means they have to sit out bad weather or rough seas while larger boats from outside the area continue fishing. St. Paul has applied some of its partnership funds gained from CDQ arrangements to helping fishermen invest in larger, more competitive vessels. Under the proposed IFQ program, St. Paul and St. George fishermen will be allocated quota shares that, assuming 1992 quotas, would bring in 400,000 to 550,000 lbs. of halibut quota according to CBSFA.

There are no salmon or herring fisheries in the Pribilofs, and the fleet is made up of boats too small to cross the Bering Sea to participate in other small-boat fisheries nearer the mainland. The St. Paul fleet hopes to expand its flexibility to participate in Pacific cod, pollock, flounder, crab, sea urchin and other fisheries.

Table 1: Number of permit holders in St. Paul, by species

YEAR	POUNDS	VALUE	PERMITS	SPECIES	
81	19,213	17,976.00	21	HALIBUT	

83	58,476	47,297.00	44	HALIBUT	
84	142,145	100,960.00	31	HALIBUT	
85	143,350	100,342.00	17	HALIBUT	
86	77,693	114,440.00	11	HALIBUT	
87	98,716	118,459.00	8	HALIBUT	
88	353,545	330,210.00	13	HALIBUT	
89	214,922	203,531.00	15	HALIBUT	
90	144,638	255,720.00	17	HALIBUT	
91	189,036	257,597.00	18	HALIBUT	
92	**	**	2	CRAB	
92	**	**	2	SALMON	

Table 2: Vessels home-ported in St. Paul, by species fished

YEAR	POUNDS	VALUE	VESSELS	SPECIES	
81	19,263	18,021.00	22	HALIBUT	
83	39,163	33,561.00	29	HALIBUT	
83	**	**	1	SALMON	
84	137,739	97,506.00	30	HALIBUT	
85	131,378	91,962.00	14	HALIBUT	
85	**	**	2	SALMON	
86	78,025	114,929.00	12	HALIBUT	
86	**	**	1	SALMON	
87	98,716	118,459.00	8	HALIBUT	
87	**	**	1	HERRIN	
88	353,545	330,210.00	13	HALIBUT	
89	216,362	204,895.00	16	HALIBUT	
89	**	**	1	SALMON	
90	145,152	256,629.00	18	HALIBUT	
91	189,036	257,597.00	18	HALIBUT	
92	**	**	1	OTHER	
92	**	**	1	SALMON	

Table 3: St. Paul permit holders by gear type

YEAR	GEAR	POUNDS	VALUE	PERMITS	SPECIES
81	LGL	11,048	10,425.00	5	HALIBUT
81	JIG	8,165	7,551.00	16	HALIBUT
83	TRL	**	**	1	HALIBUT
83	LGL	19,914	20,209.00	13	HALIBUT
83	JIG	38,220	26,817.00	30	HALIBUT
84	TRL	**	**	1	HALIBUT
84	JIG	9,018	7,663.00	14	HALIBUT
84	LGL	132,353	92,635.00	16	HALIBUT
85	JIG	6,213	4,347.00	6	HALIBUT
85	LGL	137,137	95,995.00	14	HALIBUT
86	JIG	3,495	5,148.00	6	HALIBUT
86	LGL	74,198	109,292.00	7	HALIBUT
87	JIG	7,483	8,980.00	5	HALIBUT
87	LGL	91,233	109,479.00	5	HALIBUT
88	JIG	27,812	25,976.00	6	HALIBUT
88	LGL	325,733	304,234.00	7	HALIBUT

89	JIG	**	**	3	HALIBUT
89	TRL	**	**	3	HALIBUT
89	LGL	208,039	197,013.00	9	HALIBUT
90	JIG	**	**	2	HALIBUT
90	TRL	**	**	2	HALIBUT
90	LGL	140,062	247,629.00	13	HALIBUT
91	TRL	**	**	1	HALIBUT
91	JIG	**	**	3	HALIBUT
91	LGL	185,504	252,794.00	14	HALIBUT
92	NET	**	**	2	SALMON
92	POT	**	**	2	CRAB

Processing: The only processing plant on St. Paul is Pribilof Island Processors (PIP), which underwent Chapter 11 bankruptcy in 1990 and was facing reorganization. However, it geared up for the 1991 season and, according to a 1991 report by Impact Assessment, Inc., took delivery from 18 or 19 crab boats and hired between 55 and 180 people, depending on how busy the plant is. The plant also processes halibut and Pacific cod.

In 1991, reports showed that the PIP plant paid $7/hour to locals, and $5.50/hour to non-locals (the lower wage to compensate for travel, room and board costs). However, many locals are unwilling or unable to work for $7/hour, especially the primary breadwinners of a household. Cost of living studies here show that it requires at least $9.59/hour to barely survive on the most meager budget in St. Paul — and that budget would not provide off-island travel, a motorized vehicle on the island, or any other such "amenities."

In addition, a Japanese-financed group called St. Paul Seafood has been developing a shore-based processing facility and already has invested $28 million, but in 1991 needed additional financing to construct a waste outflow system. This plant was originally designed to process surimi.

The CBSFA is working to attract a major shore-based processor to St. Paul to produce the groundfish made available through the CDQ program. The corporation is also considering chartering a 98' crab boat to tender halibut for the 1993 season.

Economic development plans --

In a study conducted at the end of the federal control of the Pribilofs, four areas were identified as potential economic development opportunities for St. Paul: fisheries, tourism, fur sealing and offshore oil and gas development. Tourism is a small, seasonal activity that contributes some, but not much, to the local economy, and probably is limited because of the expense of flying out to the Pribilofs from the mainland. Fur sealing had already become uneconomical even before it was politically incorrect — and subsequently was outlawed. Offshore oil and gas development was attempted for a while, but regulatory uncertainties concerning oil and gas leases in the Bering Sea killed that idea. Fisheries development is the area's only remaining realistic hope.

The City of St. Paul and the TDX Corp. are struggling through a long-term plan to build a 700-foot dock, surimi plant, a floating processor, cold storage and warehouse facilities along with a bulk fuel terminal, airport terminal, container storage and transfer, a new hotel, restaurant and recreation building. These plans are enhanced by the CBSFA's program to repair the old East Landing dock, develop temporary floating moorage for the local fishing fleet, and boost the harbor development project, which is the most pressing need right now in St. Paul's fisheries development progress.

At the same time that the St. Paul community hopes to develop new opportunities in the Bering Sea fisheries, residents are also concerned that the sea surrounding their island may be overfished. Many residents struggle with their resentment against the gigantic, efficient factory trawl fleet that is designed to potentially degrade the marine environment for lucrative short-term gains, while at the same time hoping that their own fleet can develop enough to participate in the groundfish fisheries as well. There is also discomfort at the idea of developing new fisheries from underutilized resources, after a bad experience in the hair crab fishery when, after local fishermen

opened up the fishery, large Outside boats came in and exploited most of the resource before the locals could catch up to them.

ST. GEORGE

Zip code: 99660
County: 16
FIPS: 65800
Census area code: 586 - Aleutians West

General profile --

St. George is a smaller island and a smaller town than St. Paul and has lived in its larger brother's shadow for most of its 20th Century life. It is the second largest of the five Pribilof Islands, and is 11 miles long and 5 miles wide. A 6,000-ft. gravel runway accommodates regular commercial air traffic from Anchorage and the Aleutians, and most freight and supplies come by barge from Anchorage every month. Like St. Paul, St. George is strategically located in the middle of the groundfish and crab fisheries of the Bering Sea, and is a major breeding ground for fur seals, sea lions and arctic birds.

The climate here is typical of northern maritime regions, with cool, cloudy weather the year round and temperatures ranging from 24°F to 52°F. Average precipitation is 23" annually, and average snowfall is 57".

The community --

With only 143 residents, St. George is tied economically, socially and culturally to St. Paul. The community here is 94.9% Aleut; only seven residents (at the time of the 1990 census) were white. Median age is 28.4, some 64.6% of adults over 25 have finished high school, and 5.1% have a bachelor's degree or higher. St. George residents are considerably poorer than St. Paul residents; here, 42% of the people — ten families out of 36 — are under the poverty line (compared to 7.1% in St. Paul.)

Most residents in this tightly knit community are Russian Orthodox. There are quite a few organized recreational activities for the community, as well as a few continuing education programs for adults, including on-the-job training and academic programs in hatchery management, sponsored by the St. George Aquaculture Association. The local school educates children through the 8th grade; high school students have to leave the island for schooling.

Population data:

Community	Saint George
1990 Population	138
Non-Native Population	7
Native Population	131
Percent Native	94.9
Housing Units	67
Vacant Units	22
Owner-Occup Housing Units	31
Median Value of Housing Units	$55,600
Renter-Occup Housing Units	14
Median Rent Paid	$133
Number of Households	43
# Family Households	36
# Non Related Households	7
Median Family Income	$26,000
Persons in Poverty	60
Percent in Poverty	41.96

(Source: ADCRA)

The city of St. George, 1990	
Males	66
Females	77
Median age	28.4
Median household income (1989)	$25,250
Median family income	$26,000
Median per capita income	$9,332
Under poverty level	42%
# people on public assistance	5
Mean public assistance income	$13,152
High school graduates (of pop. 25+)	64.6%
College graduates (of pop 25+)	5.1%
Total households	43
Single women raising families	2

(Source: US Census)

The city --

Form of government: St. George is a second-class city, (incorporated in 1983) with a seven-member city council and a mayor elected from that council. The seven-member St. George Traditional Council is the tribal government, owns and operates the clinic, publishes a local newspaper, administers recreational programs and also oversees other community development projects and job training for the community. The St. George Tanaq Corp., the local Native corporation, owns the store, hotel, the port and most of the land on the island.

Housing costs: There are 28 owner-occupied homes in St. George, with a median value of $55,600. None of them is mortgaged; the median non-mortgage house payment is $325 per month, and median rent is $475 per month.

Municipal facilities: St. George's new 6,000-foot runway is the only one in the Pribilofs that can accommodate jet traffic. The 8-acre Zapadni Bay Harbor is still under construction, but has been open for use. The City harbor provides 60-ft. and 75-ft. docks, with 250 feet of additional moorage.

The City of St. George also provides electric services, water, sewer, solid waste disposal at the local landfill, public safety and fire protection, and distributes fuel to the community.

Community care: A Village Public Safety Officer acts as the city policeman. A volunteer fire department takes care of fire protection, and there is a four-bed clinic staffed by a physician's assistant and two community health aides. The state public health nurse, a dentist, a doctor and an optometrist visit the community a few times a year.

The economy --

Most of the employment in St. George is government-related. Together government, education and Native corporation jobs make up 60% of the jobs available to St. George residents. The St. George Aquaculture Assoc. has begun developing salmon and shellfish aquaculture programs, with the first salmon returns expected in 1993. In addition, there are several private concerns here, including a day care, gas station, grocery and hardware stores, lumber yard and marine supply, movie rental, restaurant, taxi and underwater construction company.

At the time of the 1990 Census, St. George residents reported 40 jobs among a labor force of 47 people, leaving 7 people unemployed. Census data does not differentiate between full- and part-time jobs. The jobs were distributed as follows:

St. George jobs, 1990 (Source: U.S. Census)	
Educational services	10
Construction	10
Public administration	5
Health services	5
Retail trade	4
Transportation	2
Personal services	2
Professional/related services	2
Total jobs	**40**

Subsistence activities --

Subsistence is as crucial to the cultural and nutritional life of St. George as it is to any rural Alaskan village, though St. George residents usually take less per capita in subsistence resources than St. Paul residents do. The ADF&G estimated in 1981 that St. George residents consumed approximately 270 lbs. of subsistence resources per capita annually (Schroeder, et al). Halibut, cod and sculpin are the primary marine fishes harvested for subsistence purposes. Salmon and Dolly Varden are absent in the Pribilofs, and clams and marine invertebrates are less abundant than on the mainland or in the Aleutians.

Fur seals are by far the most important marine mammal taken for subsistence use. Though it is illegal under the Fur Seal Act, to commercially harvest these animals, Natives are allowed to take them for subsistence purposes only. Sea lions are also taken frequently, and harbor seals once in a while. The abundance of sea birds, ducks, geese, murre, kittiwakes, cormorants, and least auklets that nest on the island have led to the enthusiastic use of those birds and their eggs by the local Natives.

Following a house-by-house survey in 1981, ADF&G estimated the per-household use of seals, sea lions, halibut and reindeer as follows:

Estimated consumption per household for subsistence purposes, 1981	
Total fur seal	561 lbs.
Local harvest	331
From St. Paul	230
Sea lion	324
Halibut	270
Total lbs. per household:	**1,155 lbs.**

Fisheries activities --

Like St. Paul, St. George is struggling to develop a groundfish and crab fishery, and to build up its harbor facilities enough to attract business from the Bering Sea commercial fishing fleets. The City of St. George hopes to develop a shoreside seafood processing facility in Zapadni Bay Harbor, though there are some reservations about how a large processing plant might affect the social structure of this small, isolated and close-knit community.

St. George is a member of the Aleutian Pribilof Island Community Development Association (APICDA), a CDQ organization that also includes Aleutian villages from Adak east to Nelson Lagoon.

Fishing: There are 28 fishermen and 12 fishing vessels in St. George, and the vessels range in size from 16' to 30' in length, according to the Aleutian Pribilof Island Community Development Association. They primarily longline for halibut and cod, though their participation is sometimes limited by bad weather and high seas. Fishing the Bering Sea with vessels of this size is quite a challenge, and the fishing community will have to upgrade the size and safety of its fleet before fishermen can expand their participation in Bering Sea fisheries.

Table 1: Number of permit holders in St. George, by species					
YEAR	POUNDS	VALUE	PERMITS	SPECIES	
83	95,484	68,169.00	41	HALIBUT	
84	5,913	849.00	33	GRNDFISH	
84	104,729	73,080.00	46	HALIBUT	
85	126,999	88,897.00	40	HALIBUT	
86	5,858	1,781.00	8	GRNDFISH	
86	43,189	63,619.00	13	HALIBUT	
87	36,834	44,200.00	9	HALIBUT	
88	138,345	129,214.00	9	HALIBUT	
89	47,016	44,523.00	15	HALIBUT	
90	43,587	77,061.00	17	HALIBUT	

Table 2: Vessels home-ported in St. George, by species fished					
YEAR	POUNDS	VALUE	VESSELS	SPECIES	
83	82,731	57,976.00	34	HALIBUT	
83	**	**	1	SALMON	
84	4,958	712.00	29	GRNDFISH	
84	99,697	69,568.00	44	HALIBUT	
84	**	**	2	SALMON	
85	114,143	79,898.00	37	HALIBUT	
86	5,858	1,781.00	8	GRNDFISH	
86	43,189	63,619.00	13	HALIBUT	
87	36,834	44,200.00	9	HALIBUT	
88	138,345	129,214.00	9	HALIBUT	
89	47,016	44,523.00	15	HALIBUT	
90	43,587	77,061.00	17	HALIBUT	
90	**	**	2	SALMON	

Table 3: St. George permit holders by gear type					
YEAR	GEAR	POUNDS	VALUE	PERMITS	SPECIES
83	TRL	**	**	3	HALIBUT
83	LGL	6,149	6,581.00	12	HALIBUT
83	JIG	87,960	60,577.00	26	HALIBUT
84	LGL	3,712	536.00	16	GRNDFISH
84	JIG	2,201	313.00	17	GRNDFISH
84	LGL	18,878	13,159.00	18	HALIBUT
84	JIG	85,851	59,921.00	28	HALIBUT
85	LGL	36,470	25,528.00	15	HALIBUT
85	JIG	90,529	63,369.00	26	HALIBUT
86	JIG	**	**	2	HALIBUT
86	LGL	5,858	1,781.00	8	GRNDFISH
86	LGL	42,130	62,059.00	11	HALIBUT
87	JIG	**	**	2	HALIBUT
87	LGL	34,944	41,932.00	7	HALIBUT
88	TRL	**	**	1	HALIBUT
88	JIG	**	**	2	HALIBUT
88	LGL	111,775	104,398.00	6	HALIBUT
89	JIG	**	**	3	HALIBUT

89	LGL	22,816	21,606.00	6	HALIBUT
89	TRL	9,862	9,340.00	6	HALIBUT
90	JIG	**	**	3	HALIBUT
90	TRL	**	**	4	HALIBUT
90	LGL	30,200	53,394.00	10	HALIBUT

Processing: Two floating processors operated within the Zapadni Bay Harbor in recent years, but because the harbor itself is incomplete there is no shoreside processing facility operating here. As soon as the harbor is complete, establishing shoreside processing capabilities will become the top priority at St. George Tanaq Corp. The community is looking for a small processor that could operate on a year-round basis, rather than a large plant that would bring in a large influx of new people.

Economic development plans --

Finishing the harbor and finding a shoreside processor are the two economic development priorities for this community. In the past ten years, $30 million has been invested in literally carving the harbor out of the island, but more dredging and construction work is required before the port is usable. The APIDCA has set aside approximately $2.27 million of its CDQ-generated funds to to construct docks and complete upland construction at the harbor. They are seeking $3.3 million from the state legislature to complete the project.

APICDA has entered an agreement with Snopac Products, Inc. to develop a shoreside processing facility on Zapadni Bay after the harbor project is complete. In addition, some CDQ-generated Fishery Investment Funds will be used to help local fishermen upgrade their vessels, gain training with operating larger vessels, and to purchase halibut and sablefish quota shares after the new IFQ program is implemented.