FAO-BASED RESPONSIBLE FISHERIES MANAGEMENT CERTIFICATION
FULL ASSESSMENT AND CERTIFICATION REPORT

For The

U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries

(200 mile EEZ)

Applicant Group

Alaska Seafood Marketing Institute (ASMI)

March 2012

Global Trust Certification Ltd.

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Contents

I. Summary and Recommendations

Summary

The Alaska Seafood Marketing Institute (ASMI), on behalf of the U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries, has requested it's assessment to the requirements of the United Nations Food and Agriculture Organisation (FAO) Code of Conduct for Responsible Fisheries (CCRF, 1995) based Responsible Fisheries Management (RFM) Certification Program. The FAO CCRF was initiated in 1991 by the FAO Committee on Fisheries and unanimously adopted on 31 October 1995 by the over 170 member Governments of the FAO Conference.

The ASMI application was made in April 2010. After Validation Assessment was completed in December 2011, a full Assessment Team was formed to undertake the assessment and final certification determination was given on the **16th April 2012**.

Red King Crab *(Paralithodes camtschaticus)* in Bristol Bay, Snow Crab *(Chionoecetes opilio)* in the Eastern Bering Sea and Blue King Crab (*Paralithodes platypus)* in St. Matthew Island are the three stocks of focus in this Assessment and Certification Report (generally referred to from here forward as U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries). The U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries employ pot gear within Alaska jurisdiction (200 nautical miles EEZ) and are subject to a federal [National Marine Fisheries Service (NMFS)/North Pacific Fishery Management Council (NPFMC)] and state [Alaska Department of Fish and Game (ADFG) & Board of Fisheries (BOF)] Joint management regime.

The FAO CCRF was presented to an ISO 65/EN45011 accredited Certification Body, Global Trust Certification, to be used as the Standard for the assessment of Alaska Fisheries. The conformance reference points from the published FAO CCRF (now referred to as Standard) were converted into the audit checklist criteria [FAO-Based RFM Conformance Criteria (Version 1.2, Sept 2011)] by the ISO 65/EN45011 Accredited Certification Body to ensure audit ability and feasibility for accreditation.

The audit checklist criteria were cross-referenced back to the FAO CCRF Clauses. A further FAO document, the Guidelines on Eco-labelling of Fish and Fishery Products from Marine Capture Fisheries (FAO 2005) was used to help contextualize and add clarity to the audit criteria. The FAO CCRF and the FAO-Based RFM Conformance Criteria were submitted to a National Accreditation Board of the International Accreditation Forum for further cross reference and ISO 65/EN45011 accreditation validity. ISO 65/EN45011 accreditation of the FAO-Based RFM Assessment and Certification Program was awarded by INAB to Global Trust Certification Ltd. on the 7th of February 2012.

This Full Assessment Report should be read in conjunction with the Certification Summary attached in Appendix 3 of this document. The assessment was conducted according to the Global Trust procedures for FAO-Based RFM Certification using the FAO-Based Conformance Criteria (Version 1.2, September 2011). Whilst the FAO CCRF contains Articles with differing focuses, the "remit" of the FAO-Based Conformance Criteria focuses on responsible fisheries management, including enhancement practices (but excluding full cycle aquaculture), up to the point of landing, with the main objective being the biological sustainability of the "stock under consideration", with consideration for conservation, biodiversity and ecosystem integrity; and due regard to social responsibility and the economic viability of the fishery.

During the assessment process the key outcomes evaluated and documented by the Assessment Team included:

A. The Fisheries Management System

B. Science and Stock Assessment Activities

C. The Precautionary Approach

D. Management Measures

E. Implementation, Monitoring and Control

F. Serious Impacts of the Fishery on the Ecosystem

Outcome summaries for Section A-F of the Full Assessment and Certification Report can be found in Section 6. Click here to jump to section 6.

Please note that the website references provided in this report were correct at the time of the assessment.

Recommendations

Recommendation of the Assessment Team

The Assessment Team recommend that the management system of the applicant fishery, the U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries [Bristol Bay Red King Crab *(Paralithodes camtschaticus)*, Eastern Bering Sea Snow Crab *(Chionoecetes opilio)* and St. Matthew Island Blue King Crab (*Paralithodes platypus)*] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) and subject to a federal [National Marine Fisheries Service (NMFS)/North Pacific Fishery Management Council (NPFMC)] and state [Alaska Department of Fish and Game (ADFG) & Board of Fisheries (BOF)] joint management regime, is certified against the FAO-Based Responsible Fisheries Management Certification Program.

Peer Reviewer A's main summary and recommendation states:

The three stocks being considered for certification meet the FAO definition of responsible fisheries management which requires that stocks under consideration are not overfished, are maintained at a level which promotes the objective of optimal utilization and maintains its availability for present and future generations, taking into account that longer term changes in productivity can occur due to natural variability and/or impacts other than fishing. The management program in place stipulates that if biomass drops below target levels, measures will be taken to ensure restoration within reasonable timeframes of the stocks to sustaining levels.

I found that the information presented in the background sections of the report proved sufficient to support a broad understanding of the general history, development and main management entities and management systems in use by the fishery. It provided the reader with sufficient background information to enable the evidence provided in later sections to be placed in sufficient context for interpretation. In my opinion, the evidence based rationales and summaries, presented for each clause of the Conformance Criteria, were consistent with the proposed confidence rating. There were no findings of non-conformance with any clauses and I found no clauses where I believed that non-conformance was warranted.

The assessment team who compiled the assessment review were obviously competent professionals who possessed a good grasp of the BSAI crab fisheries under review. I encourage the Certification committee to award Certification to the BSAI crab fisheries for these Red and Blue king crab and the *Opilio* crab fisheries.

Peer Reviewer B's main summary and recommendation states:

The evidence presented in Section 7 of this report clearly supports high confidence ratings for all 13 fundamental clauses of the Conformance Criteria and each of the three units of assessment merits certification under the FAO-Based RFM Certification Program.

For the most part, high confidence ratings for sub-clauses are well supported by the evidence, however, there are shortcomings, detailed below, in a fair number that the assessment team will be able to address fairly readily. Given that survey biomass estimates are treated as absolute values, more details on catchability values and how they were derived should be provided. A source of confusion and some concern relates to many sub-clauses dealing with issues involving other "States". In some cases it is clear that this means other countries, in others it seems to mean other adjacent States of the Union (US), of which there are none for Alaska. Whether States consistently means other countries should be made clear up front. In some instances, the evidence presented does not address the issue, in others the issue is not really applicable. Nonetheless, much of the information is well worth providing in the context of the big picture. All of these should be re-visited and a determination made regarding applicability of the issue and whether the evidence presented actually addresses it. If the issue is not applicable, a simple statement to that effect along with a brief explanation and no confidence rating should suffice.

Note. All Peer Review comments were addressed by the Assessment Team. The Peer Review reports can be found in Section 8 along with the Assessment Team responses to comments made.

Determination: The appointed members of the Global Trust Certification Committee met on the **16th April 2012**. After a detailed discussion, the Committee determined that the management system of the applicant U.S. Alaska King and Snow Crab Bering Sea commercial fisheries [Bristol Bay Red King Crab *(Paralithodes camtschaticus)*, Eastern Bering Sea Snow Crab *(Chionoecetes opilio)* and St. Matthew Island Blue King Crab (*Paralithodes platypus)*] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) and subject to a federal [National Marine Fisheries Service (NMFS)/North Pacific Fishery Management Council (NPFMC)] and state [Alaska Department of Fish and Game (ADFG) & Board of Fisheries (BOF)] joint management regime, is certified against the FAO-Based Responsible Fisheries Management Certification Program.

II. Schedule of Key Assessment Activities

Assessment Activities	Date (s)
Application Date	April 2010
Initial Site Visit Consultation Meetings	June –July 2010
Initial Validation Assessment Report	December 2011
Appointment of Full Assessment Team	January 2012
On-site Witnessed Assessment and Consultation Meetings	January 2012
Draft Assessment Report	February 2012
External Peer Review	March 2012
Final Assessment Report	**April 2012**
Certification Review/Decision	**16th April 2012**

III. Assessment Team Details

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IV. Acronyms

ABC	Allowable Biological Catch
ACL	Annual Catch Limits
ADFG	Alaska Department of Fish and Game
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center
ASMI	Alaska Seafood Marketing Institute
AWT	Alaska Wildlife Troopers
BOF	Board of Fisheries
BSAI	Bering Sea and Aleutian Islands
BSFRF	Bering Sea Fisheries Research Foundation
CCRF	Code of Conduct for Responsible Fisheries
CDQ	Community Development Quota
CFEC	Commercial Fisheries Entry Commission
CPUE	Catch per Unit Effort
CPT	Crab Plan Team
EIS	Environmental Impact Statement
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
ESA	Endangered Species Act
FAO	Food and Agriculture Organization of the United Nations
FMP	Fishery Management Plan
GOA	Gulf of Alaska
GHL	Guideline Harvest Level
IFQ	Individual Fishing Quota
IPQ	Individual Processing Quota
IRFA	Initial Regulatory Flexibility Analysis
LLP	License Limitation Program
MSA	Magnuson-Stevens Act
mt	Metric tons
MSY	Maximum Sustainable Yield
NEPA	National Environmental Policy Act
nm	Nautical miles
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
OFL	Overfishing Level
OLE	Office for Law Enforcement
PSC	Prohibited Species Catch
RACE	Resource Assessment and Conservation Engineering
REFM	Resource Ecology and Fisheries Management
RFM	Responsible Fisheries Management
SAFE	Stock Assessment and Fishery Evaluation (Report)
SSC	Scientific and Statistical Committee
TAC	Total Allowable Catch
USCG	U.S. Coast Guard

Stock Status Definitions

Acceptable biological catch (ABC) is a level of annual catch of a stock that accounts for the scientific uncertainty in the estimate of OFL and any other specified scientific uncertainty and is set to prevent, with a greater than 50 percent probability, the OFL from being exceeded. The ABC is set below the OFL.

ABC Control Rule is the specified approach in the five-tier system for setting the maximum permissible ABC for each stock as a function of the scientific uncertainty in the estimate of OFL and any other specified scientific uncertainty.

Annual catch limit (ACL) is the level of annual catch of a stock that serves as the basis for invoking accountability measures. For crab stocks, the ACL will be set at the ABC.

Total allowable catch (TAC) is the annual catch target for the directed fishery for a stock, set to prevent exceeding the ACL for that stock and in accordance with section 8.2.2 of the BSAI crab 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 is estimated from the best information available.

F_{MSY} control rule means a harvest strategy which, if implemented, would be expected to result in a long term average catch approximating MSY.

B_{MSY} stock size is the biomass that results from fishing at constant F_{MSY} and is the minimum standard for a rebuilding target when a rebuilding plan is required.

Maximum fishing mortality threshold (MFMT) is defined by the F_{OFL} control rule, and is expressed as the fishing mortality rate.

Minimum stock size threshold (MSST) is one half the B_{MSY} stock size.

Overfished is determined by comparing annual biomass estimates to the established MSST. For stocks where MSST (or proxies) are defined, if the biomass drops below the MSST (or proxy thereof) then the stock is considered to be overfished.

Overfishing is defined as any amount of catch in excess of the overfishing level (OFL). The OFL is calculated by applying the F_{OFL} control rule annually estimated using the tier system in Chapter 6.0 of the BSAI crab FMP to abundance estimates.

1. Introduction

The U.S. Alaska King and Snow Crab Bering Sea commercial fisheries employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) and subject to a federal [National Marine Fisheries Service (NMFS)/North Pacific Fishery Management Council (NPFMC)] and state [Alaska Department of Fish and Game (ADFG) & Board of Fisheries (BOF)] joint management regime was assessed against the requirements of the FAO-Based RFM Conformance Criteria Version 1.2. The application was made by the Alaska Seafood Marketing Institute (ASMI) on behalf of the Alaska King and Snow Crab Bering Sea commercial fisheries and participants, and was validated by Global Trust Certification Ltd.

This Assessment and Certification Report documents the assessment procedure for the certification of commercially exploited Alaska King and Snow Crab Bering Sea fisheries to the FAO-Based RFM Certification Program. This is a voluntary program for Alaska fisheries that has been supported by ASMI who wishes to provide an independent, third-party certification program that can be used to verify that Alaska King and Snow Crab Bering Sea commercial fisheries are responsibly managed according to the FAO Code of Conduct for Responsible Fisheries and the FAO Eco-Labeling of Fish and Fishery Products from Marine Capture Fisheries.

The assessment was conducted according to the Global Trust procedures for FAO-Based RFM Certification in accordance with EN45011/ISO/IEC Guide 65 accredited certification procedures. The assessment is based on the criteria specified in the FAO CCRF and the minimum criteria set out for marine fisheries in the FAO Guidelines for the Eco-Labeling of Fish and Fishery Products from Marine Capture Fisheries (2005/2009), hereafter referred to as the FAO-Based RFM Conformance Criteria.

The assessment is based on 6 major components of responsible management derived from the FAO CCRF and Guidelines for the Eco-labeling of products from marine capture fisheries.

A The Fisheries Management System
B Science and Stock Assessment Activities
C The Precautionary Approach
D Management Measures
E Implementation, Monitoring and Control
F Serious Impacts of the Fishery on the Ecosystem

These six major components are supported by 13 fundamental clauses which in turn are sustained by 122 sub-clauses. Collectively, these form the FAO-Based Conformance Criteria Version 1.2 against which a capture fishery applying for RFM assessment and certification is assessed.

The assessment comprised of application review, validation reporting, assessment planning, assessment and verification reporting, Peer Review and Certification Committee review and decision. Two site visits were made to the fishery during the assessment. A summary of the consultation meetings is presented in Section 5. Assessors comprised of both externally contracted fishery experts and Global Trust internal staff (Appendix 1). Peer Reviewers comprised of externally contracted fisheries experts (Appendix 2).

This report documents each step in the assessment process and the recommendation to the Certification Committee of Global Trust who presided over the certification decision, the 16th April 2012, according to the requirements of ISO/IEC Guide 65 accredited certification.

1.1 Recommendations of the Assessment Team

Recommendation of the Assessment Team

The Assessment Team recommend that the management system of the applicant fishery, the U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries [Bristol Bay Red King Crab *(Paralithodes camtschaticus)*, Eastern Bering Sea Snow Crab *(Chionoecetes opilio)* and St. Matthew Island Blue King Crab (*Paralithodes platypus)*] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) and subject to a federal [National Marine Fisheries Service (NMFS)/North Pacific Fishery Management Council (NPFMC)] and state [Alaska Department of Fish and Game (ADFG) & Board of Fisheries (BOF)] joint management regime, is certified against the FAO-Based Responsible Fisheries Management Certification Program.

2. Fishery Applicant Details

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3. Background to the Fishery

3.1. Species Biology

General Life History Information for Crab

Shallow inshore areas (less than 50 m depth) are very important to king crab reproduction as they move onshore to molt and mate. Tanner crabs also occupy shallower depths during molting and mating. Tanner crabs (*Chionoecetes bairdi and C. opilio*) are brachyuran (meaning short-tailed) or true crab. All Bering Sea and Aleutian Islands (BSAI) crab are highly vulnerable to predation and damage during molting when they shed their exoskeleton. Female king crab molt annually to mate while Tanner and snow crab exhibit terminal molt and carry sperm for future clutch fertilization. The habitat occupied by molting and mating crab differs from that occupied by mature crabs during the remainder of the year. The Essential Fish Habitat (EFH) Environmental Impact Statement (EIS) crab technical team noted protection of crab in molting mating habitat during this sensitive life history stage is important.

Larval stages are distributed according to vertical swimming abilities, and the currents, mixing, or stratification of the water column. Generally, the larval stages occupy the upper 30 m, often in the mixed layer near the sea surface. As the larvae molt and grow into more actively swimming stages they are able to seek a preferred depth. After molting through multiple larval stages, crabs settle on the bottom. Settlement on habitat with adequate shelter, food, and temperature is imperative to survival of first settling crabs. Young of the year red and blue king crabs require nearshore shallow habitat with significant cover that offers protection (e.g., sea stars, anemones, macroalgae, shell hash, cobble, shale) to this frequently molting life stage.

Early juvenile stage Tanner and snow crab also occupy shallow waters and are found on mud habitat. Late juvenile stage crab are most active at night when they feed and molt. The EFH EIS crab technical team emphasized the importance of shallow areas to all early juvenile stage crabs and in particular the importance to red and blue king crabs of high relief habitat nearshore with extensive biogenic assemblages. The area north and adjacent to the Alaska peninsula (Unimak Island to Port Moller), the eastern portion of Bristol Bay, and nearshore areas of the Pribilof and Saint Matthew Islands are locations known to be particularly important for king crab spawning and juvenile rearing.

Egg Stage

Female king and Tanner crabs extrude eggs, carry and nurture them outside the maternal body. The number of eggs developed by the female increases with body size and is linked to nutrition at favorable temperatures. Information on egg bearing females is used to define habitat for the egg stage of crabs.

Larval Stage

Successful hatch of king and Tanner crab larvae is a function of temperature and concentration of diatoms, so presence of larvae in the water column can vary accordingly. Larvae are planktonic. Their sustained horizontal swimming is inconsequential compared to horizontal advection by oceanographic conditions. Larvae vertically migrate within the water column to feed. Diel vertical migration may be a retention mechanism to transport larvae inshore.

Early Juvenile Stage

The early juvenile stage includes crabs first settling on the bottom (glacothoe and megalops), young of the year crabs, and crabs up to a size approximating age 2. Habitat relief is obligatory for red and blue King crabs of this life stage. Individuals are typically less than 20 mm Carapace Length (CL), and distributed in nearshore waters among niches provided by sea star arms, anemones, shell hash, rocks and other bottom relief. Early juvenile Tanner crab settle on mud, are known to occur there during summer but are not easily found in this habitat in winter.

Late Juvenile Stage

The late juvenile stage for crab is defined as the size at about age 2 to the first size of functional maturity. Late juvenile crabs are typically found further offshore in cooler water than early juvenile crabs. Smaller red king crabs of this life stage form pods during the day that break apart during the night when the crabs forage and molt. As these crabs increase in size, podding behavior declines and the animals are found to forage throughout the day.

Mature Stage

Mature crabs are defined as those crabs of a size that is functionally mature. Functional maturity is based on size observed in mating pairs of crabs. This maturity definition differs from morphometric maturity based on chela height and physiological maturity when sperm or eggs can be produced. The mature stage includes crabs from the first size of functional maturity to senescence.

1. **Red king Crab (*Paralithodes camtschaticus)***

General description

Red king crabs (*Paralithodes camtschaticus*) are a species of large crab that appear dark red or burgundy in colour. Red king crabs are a member of a superfamily of decapod crustaceans also know as stone crabs. They are closely related to blue king crabs (*Paralithodes platypus*) and golden (brown) king crabs (*Lithodes aequispinus*). Red king crabs can grow very large with carapace (the shell covering their back) lengths up to 11 inches and a five foot leg span. Red king crabs have "tails," or abdomens, that are distinctive, being fan-shaped and tucked underneath the rear of the shell. They also have five pairs of legs; the first bears their claws or pincers, the right claw is usually the largest on the adults, the next three pairs are their walking legs, and the fifth pair of legs are small and normally tucked underneath the rear portion of their carapace. These specialized legs are used by adult females to clean their embryos (fertilized eggs) and the male uses them to transfer sperm to the female during mating.

Size and Sex Determination

Male red king crabs grow larger than females and their sex is determined by examining their abdomens. Male red king crabs have a narrow abdominal flap whereas female red king crabs have a wide abdominal flap that covers most of the underside of the abdomen. Females grow to smaller sizes smaller than legal males. Females and juvenile crabs represent a small degree of the bycatch in the BSAI crab fisheries and are released back to sea during the sorting process. Escape mechanisms for juvenile and female crabs are mandatory and present in all crab pots.

Reproduction and Development

Adult females brood thousands of embryos underneath their tail flap for about a year's time. When the embryos are fully developed they hatch as swimming larvae, but they are still susceptible to the movements of tides and currents. After feeding on plant and animal plankton for several months and undergoing several body changes with each molt, the larvae settle to the ocean bottom and molt into non-swimmers, looking for the first time like king crabs, except they are smaller than a dime. Red king crabs settle in waters less than 90 feet deep.

Growth

Because a crab's skeleton is its shell (made mostly of calcium), it must molt its shell in order to grow. Juveniles molt many times in their first few years, then less frequently until they reach sexual maturity in four or five years. Mature red king crab reach legal size at 165 mm and weight around 2 kg. Adult females must molt in order to mate but males do not. Adult males often skip a molt and keep the same shell for one or two years. Red king crabs can grow very large with the record female and male weighing 10.5 and 24 pounds, respectively. These large crabs were estimated to be 20–30 years old.

Movements

Adult red king crabs exhibit near shore to offshore (or shallow to deep) and back, annual migrations. They come to shallow water in late winter and by spring the female's embryos hatch. Adult females and some adult males molt and mate before they start their offshore feeding migration to deeper waters. Adult crabs tend to segregate by sex off the mating-molting grounds. Red, blue, and golden king crabs are seldom found co-existing with one another even though the depth ranges they live in and habitats may overlap. Adult male red king crabs in the Kodiak area have been known to migrate up to 100 miles round-trip annually, moving at times as fast as a mile per day.

Diet/Role in the Ecosystem

Red king crab diet varies with crab size and depth inhabited. Larval crab consume phytoplankton and zooplankton; juveniles feed on diatoms, protozoa, hydroids, crab, and other benthic organisms. Adults eat an assortment of worms, clams, mussels, snails, brittle stars, sea stars, sea urchin, sand dollars, barnacle, fish and algae. King crabs fall prey to a wide variety of species, including Pacific cod, rock sole, yellowfin sole, pollock, octopus and other king crab.

2. Blue King Crab (*Paralithodes platypus*)

General description

Blue king crab are anomurans in the family Lithodidae which also includes the red king crab *Paralithodes camtschaticus* and golden or brown king crab *Lithodes aequispinus* in Alaska. Blue king crab, like all king crabs are decapod or “ten-legged” crustaceans that have "tails," or abdomens, that are distinctive, being fan-shaped and tucked underneath the rear of the shell. They also have five pairs of legs; the first bears their claws or pincers, the right claw is usually the largest on the adults, the next three pairs are their walking legs, and the fifth pair of legs are small and normally tucked underneath the rear portion of their carapace (the shell covering their back). These specialized legs are used by adult females to clean their embryos (fertilized eggs) and the male uses them to transfer sperm to the female during mating.

Growth and Reproduction

Blue king crab are similar in size and appearance, except for colour, to the more widespread red king crab, but are typically biennial spawners with lesser fecundity and somewhat larger sized eggs. It may not be possible for large female blue king crabs to support the energy requirements for annual ovary development, growth, and egg extrusion due to limitations imposed by their habitat, such as poor quality or low abundance of food or reduced feeding activity due to cold water. Both the large size reached by blue king crab and the generally high productivity of the Pribilof and St Matthew island areas, however, act against such environmental constraints. Development of the fertilized embryos occurs in the egg cases attached to the pleopods beneath the abdomen of the female crab and hatching occurs February through April. After larvae are released, large female blue king crab will molt, mate, and extrude their clutches the following year in late March through mid April. Female crabs require an average of 29 days to release larvae, and release an average of about 110,000 larvae. The larval stage is estimated to last for 2.5 to 4 months and larvae metamorphose and settle during July through early September.

Blue king crab molt frequently as juveniles, growing a few millimeters in size with each molt. Unlike red king crab juveniles, blue king crab juveniles are not known to form pods. Female king crabs typically reach sexual maturity at approximately five years of age while males may reach maturity one year later, at six years of age. Longevity is unknown for the species, due to the absence of hard parts retained through molts with which to age crabs. Estimates of 20 to 30 years in age have been suggested.

Feeding Ecology

Food eaten by king crabs varies by species, size, and depth inhabited. King crabs are known to eat a wide assortment of marine life including worms, clams, mussels, snails, brittle stars, sea stars, sea urchins, sand dollars, barnacles, crabs, other crustaceans, fish parts, sponges, and algae. King crabs are eaten by a wide variety of organisms including but not limited to fishes (Pacific cod, sculpins, halibut, yellowfin sole), octopuses, king crabs (they can be cannibalistic), sea otters, and several new species of nemertean worms, which have been found to eat king crab embryos.

Migration

Adult blue king crabs exhibit nearshore to offshore (or shallow to deep) and back, annual migrations. They come to shallow water in late winter and by spring the female's embryos hatch. Adult females and some adult males molt and mate before they start their offshore feeding migration to deeper waters. Adult crabs tend to segregate by sex off the mating-molting grounds. Red, blue, and golden king crabs are seldom found co-existing with one another even though the depth ranges they live in and habitats may overlap.

3. Snow crab (*Chionoecetes opilio*)

General description

Tanner crabs (*Chionoecetes bairdi and C. opilio*) are brachyuran (meaning short-tailed) or true crab and constitute some of the most highly specialized of all crustaceans. The body is composed mainly of a chitinous shell or carapace with a small abdominal flap. They have five pairs of legs with the first pair equipped with pincers. Males of commercial size usually range from 7 to 11 years of age and vary in weight from 1 to 2 pounds for *C. opilio* and 2 to 4 pounds for *C. bairdi* crabs. *C. opilio* species occurs on soft bottoms at depths of 60-400 m where temperature remains below 5°C. Members of the genus *Chionoecetes* are often collectively referred to as Tanner crabs; to avoid confusion, the name Tanner crab is used for *C. bairdi* and snow crab is used for *C. opilio*. Tanner crab are often marketed under the name “snow crab.”

Reproduction

Female crab mate with adult males for the first time during their last molt (maturity molt). The male crab is attracted by a chemical attractant (pheromone) released by the female. Females stop growing after the puberty molt, when they reach adulthood. At the puberty molt, there is a dramatic readily recognisable change in the relative width of the abdominal flap or pleon. Male chelae undergo allometric growth, a disproportionate increase in size relative to CW, at the pubertal molt. An allometric increase in abdominal area, relative to CW, for females at puberty facilitates egg brooding. The pubertal molt in both sexes is probably a terminal molt. Males that have gone through puberty are termed morphologically mature (MM) and readily copulate. However, morphologically immature (MI), or juvenile, males that have not undergone pubertal molt can have fully formed spermatophores in their vas deferens. Field studies where morphometrics of male partners in copulating pairs has been recorded indicate that MI males can mate with both primiparous and multiparous females.

Females molt to sexual maturity and mate in the softshell condition while grasped by the male. Older hardshelled females are also mated by adult males, but in the absence of a male they are capable of producing an egg clutch with sperm stored from a previous mating. Snow crab mate in the late winter to early spring. Female snow crab carry between 6000 and 140000 eggs for approximately two years in cold waters. Fertilization is internal, and the eggs are usually ovulated (extruded) within 48 hours onto the female's abdominal flap where they incubate for a year. Hatching occurs late the following winter and spring with the peak hatching period usually during April to June. Female snow crab are able to store spermatophores in spemathecae and fertilize subsequent egg clutches without mating. At least two clutches can be fertilised from stored spermatophores, but the frequency of this occurring in nature is not known. Egg hatch usually coincides with peak of the spring plankton bloom, resulting in high availability of food for the larvae crab. Snow and tanner crabs naturally crossbreed and the young displays traits from both parents.

Growth

The young, free-swimming larvae molt many times and grow through several distinct stages. Growth during this period is usually dependent on water temperature but lasts about 63 to 66 days, after which the larvae loose their swimming ability and settle to the ocean bottom. After numerous molts and several years of growth, females mature at approximately 5 years of age while males mature at about 6 years and may live to an estimated maximum age of 14 years. There is a large size disparity between the sexes. Males can grow to between - 50 and 160 mm carapace width (CW) and females attain a maximum size of between 47 and 95 mm CW. Male legal width size is 78 mm and legal weight is 200 grams. Snow crab grows to a maximum age of 12 years.

Diet/Role in the Ecosystem

The diet of snow crab depends on the life stage. Larvae feed primarily on phytoplankton. Juveniles and adults are opportunistic omnivores and will eat almost anything. Major components of their diet include bivalves, polychaete worms, gastropods, crabs (including other snow crab), shrimp, and fish. In turn, they are consumed by a wide variety of predators, including groundfish, bearded seals, Pacific cod, halibut or other flatfish, eelpouts, sculpins, and many skate species.

References

http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf
http://www.adfg.alaska.gov/index.cfm?adfg=redkingcrab.main
http://www.adfg.alaska.gov/index.cfm?adfg=bluekingcrab.main
http://www.adfg.alaska.gov/index.cfm?adfg=tannercrab.main
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http://www.afsc.noaa.gov/Education/factsheets/10_rkc_fs.pdf
http://www.afsc.noaa.gov/Education/factsheets/10_bkc_fs.pdf
http://www.sciencedirect.com/science/article/pii/0022098195001123

3.2. Fishery Location and Method

The federal crab FMP applies to commercial fisheries for red king crab *Paralithodes camtschaticus*, blue king crab *P. platypus*, golden (or brown) king crab *Lithodes aequispinus*, Tanner crab *Chionoecetes bairdi*, and snow crab *C. opilio* in the BS/AI area, except for the following stocks exclusively managed by the State of Alaska: Aleutian Islands Tanner crab, Dutch Harbor red king crab, St. Matthew golden king crab, and St. Lawrence blue king crab.

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 BS/AI area is defined as those waters of the EEZ lying south of the Chukchi Sea statistical area as described in the coordinates to Figure 1 to 50 CFR part 679, east of the 1990 U.S./Russian maritime boundary line, and extending south of the Aleutian Islands for 200 miles between the convention line and Scotch Cap Light (164E44'36"W. longitude) (Figure 1). The 1988 agreement between the two parties shifted the boundary westward from the convention line of 1867.

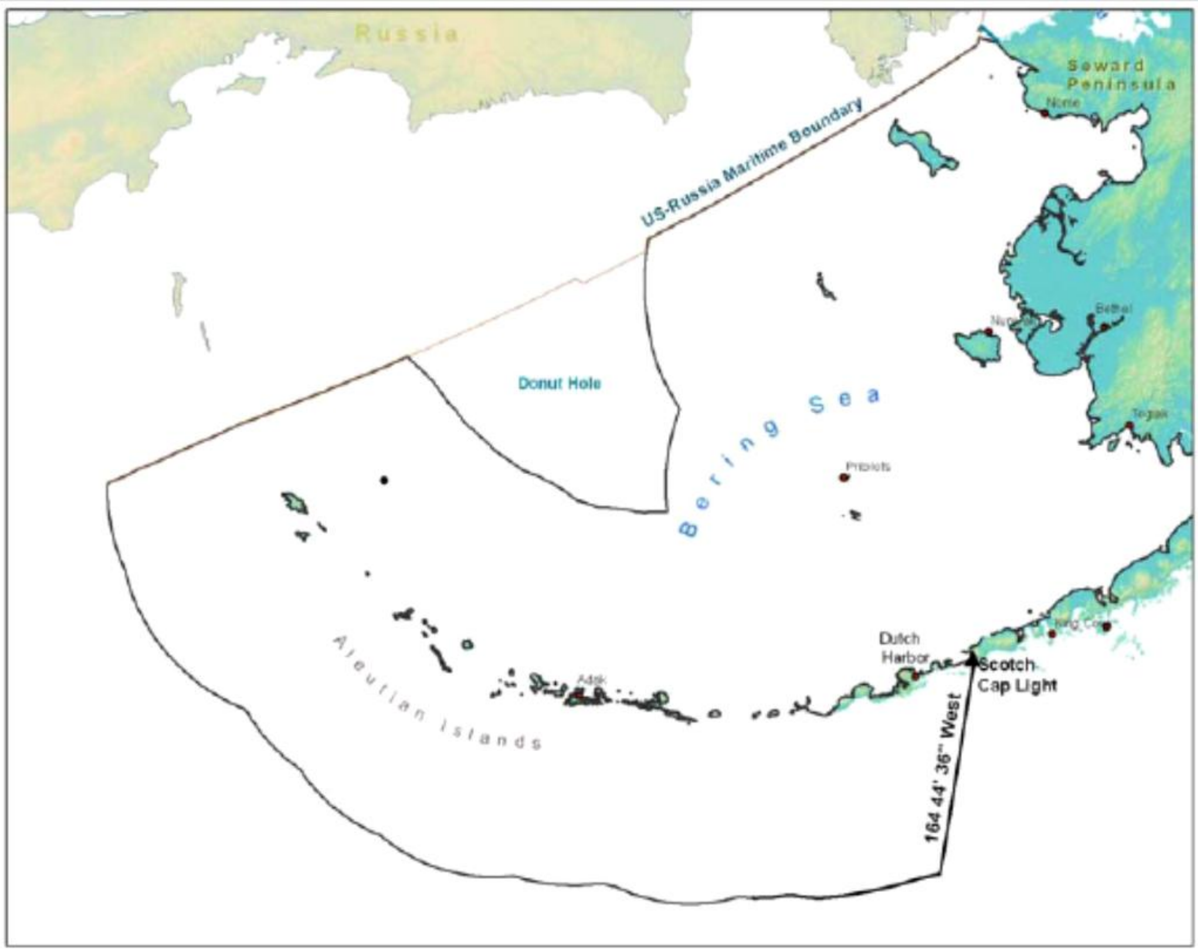


Figure 1. The Bering Sea/Aleutian Islands Management Area.
http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf

Eastern Bearing Sea (EBS) snow crab

Snow crab (*Chionoecetes opilio*) is distributed on the continental shelf of the Bering Sea, Chukchi Sea, and in the western Atlantic Ocean as far south as Maine. In the Bering Sea, snow crab are common at depths less than about 200 meters. The eastern Bering Sea population within U.S. waters is managed as a single stock; however, the distribution of the population may extend into Russian waters to an unknown degree. The population within US waters, specifically occurring in within the Eastern Bering Sea (EBS) Shelf, appears to live and migrate within US waters (Figure 2). A recent paper by Parada et al (2010) highlighted the spatial dynamics of Eastern Bering Sea snow crab using a biophysical model. The mature snow crabs which are sampled in the surveys for stock assessment purposes do not move outside US waters, rather they remain within the EBS shelf up to depths of 200 m and are generally found between the 50m (juveniles) and the 200 m (mature adults) isobaths. Ontogenic migration (from juvenile to adult) tends to keep snow crab within US waters; snow crabs move largely south from a northerly direction within the Eastern Bearing Sea shelf. More details are provided in clause 1.2 of Section 7.

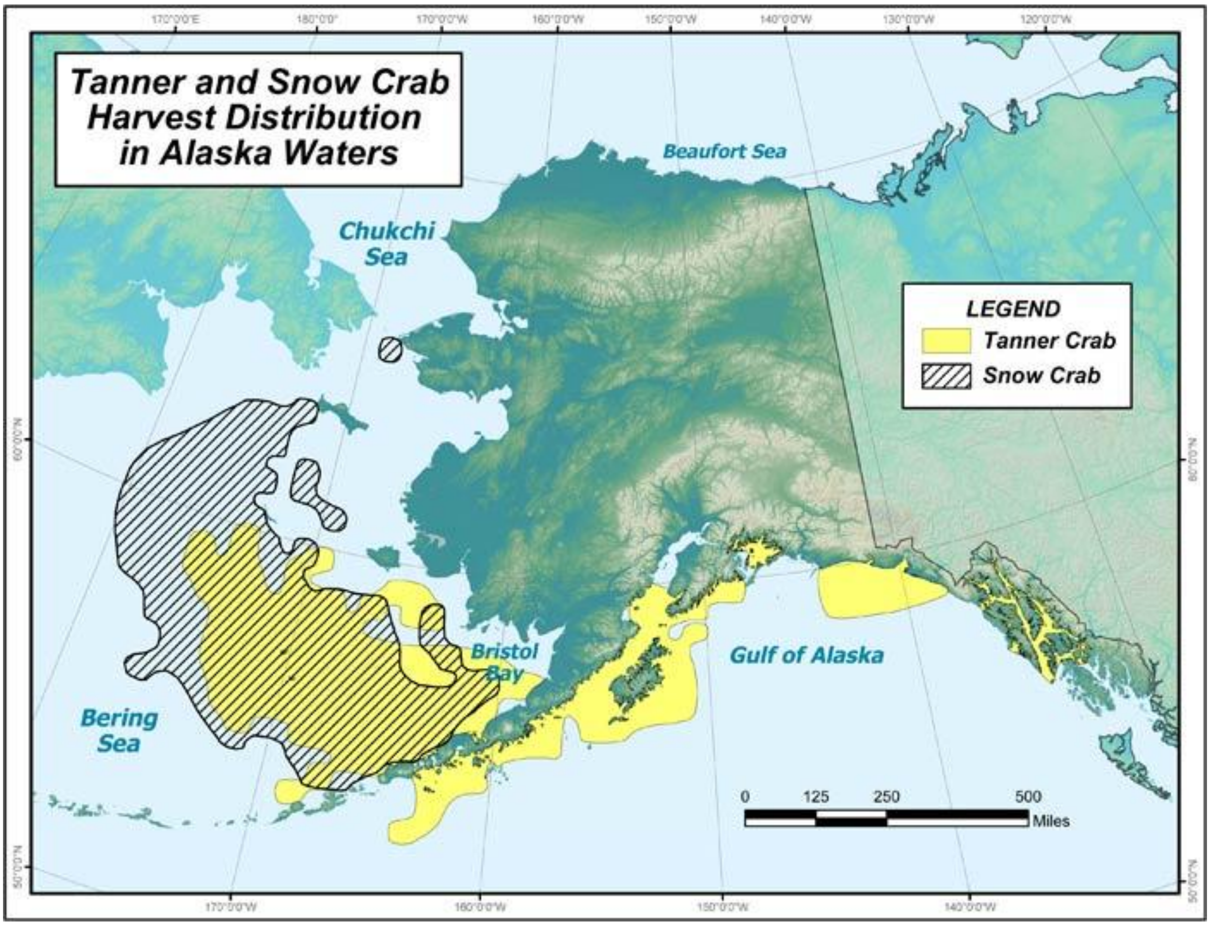


Figure 2. Tanner and Snow Crab Harvest Distribution in Alaska Waters.
http://www.adfg.alaska.gov/index.cfm?adfg=tannercrab.main

Bristol Bay red king crab (BBRKC)

Red king crab (*Paralithodes camtschaticus*) inhabit intertidal waters to depths >200 m of the North Pacific Ocean from British Columbia, Canada, to the Bering Sea, and south to Hokkaido, Japan. RKC are found in several areas of the Aleutian Islands and eastern Bering Sea.

Stock Structure

Genetically, it is possible to distinguish between populations of red king crab in Alaska. This was demonstrated in 1989 with work completed by the ADFG's Gene Conservation Lab. Horizontal starch-gel electrophoresis of proteins has proven to be a powerful tool for the management of many marine species. This technique provides data on the genetic relationships of reproductively isolated stocks, thereby helping scientists to optimally manage these self-recruiting stocks. The lab examined collections of red king crab from thirteen localities in Southeast Alaska, the Aleutian Islands, and the eastern Bering Sea for genetic variation at 42 protein coding loci. Two highly polymorphic loci, Pgdh (Phosphogluconate dehydrogenase) and Alp (Alkaline phosphatase), were useful for discriminating stock differences between major geographic areas. The eastern Bering Sea collections from Bristol Bay and Norton Sound were very different from all other collections. Further, southeast Alaska collections appear to form a stock unit discrete from the Kenai, Alaska Peninsula, and Aleutian collections. The State of Alaska divides the Aleutian Islands and eastern Bering Sea into three management registration areas to manage RKC fisheries: Aleutian Islands, Bristol Bay, and Bering Sea. The Aleutian Islands area covers two stocks, Adak and Dutch Harbor, and the Bering Sea area contains two other stocks, the Pribilof Islands and Norton Sound. The largest stock is found in the Bristol Bay area, which includes all waters north of the latitude of Cape Sarichef (54^{o}36' N lat.), east of 168^{o}00' W long., and south of the latitude of Cape Newenham (58^{o}39' N lat.) (ADFG 2005). Besides these five stocks, RKC stocks elsewhere in the Aleutian Islands and eastern Bering Sea are currently too small to support a commercial fishery (Figure 3).

Figure 3. Stock distribution of the Red King Crab Stock in Alaska Waters
Seeb, J. E., G. H. Kruse, L. W. Seeb, and R. G. Weck. Genetic structure of red king crab stocks in Alaska facilitates enforcement of fishing regulations. Pp. 491-502 Proceedings of the International Symposium on King and Tanner Crabs, Anchorage, Alaska, USA, November 28-30, 1989. Alaska Sea Grant College Program, Fairbanks. http://www.adfg.alaska.gov/index.cfm?adfg=redkingcrab.main , http://www.fishwatch.gov/seafood_profiles/species/crab/species_pages/red_king_crab.htm .

St Matthew blue king crab (SMBKC)

Distribution

Blue king crabs (*Paralithodes platypus*) are discontinuously distributed throughout their range in the North Pacific Ocean from Hokkaido, Japan to southeastern Alaska. In the eastern Bering Sea small populations are distributed around St. Matthew Island, the Pribilof Islands, St. Lawrence Island, and Nunivak Island. Isolated populations also exist in some other cold water areas of the Gulf of Alaska (NPFMC 1998). The St. Matthew Island Section for blue king crab is within Area Q2 (Figure 3), which is the Northern District of the Bering Sea king crab registration area and includes the waters north of Cape Newenham (58°39’ N. lat.) and south of Cape Romanzof (61°49’ N. Lat).

Stock Structure

The ADFG’s Gene Conservation Laboratory division has detected regional population differences (e.g., discrete stocks) between blue king crab collected from St. Matthew Island and the Pribilof Islands based on a limited number of variable genetic markers using allozyme electrophoresis methods (1997, NOAA grant Bering Sea Crab Research II, NA16FN2621). Tag-return data from studies by the National Marine Fisheries Service (NMFS) on blue king crab in the Pribilof Islands (n = 317) and St. Matthew Island (n = 253) support the idea that legal-sized males do not migrate between the two areas (Otto and Cummiskey 1990) and that larvae are also restricted to each area (Figure 4). St. Matthew Island blue king crab (SMBKC) tend to be smaller than their Pribilof conspecifics, and the two stocks are managed separately, with legal sizes of 5.5 in carapace width (CW) in the St. Matthew Island Section and 6.5 in CW in the Pribilof District.

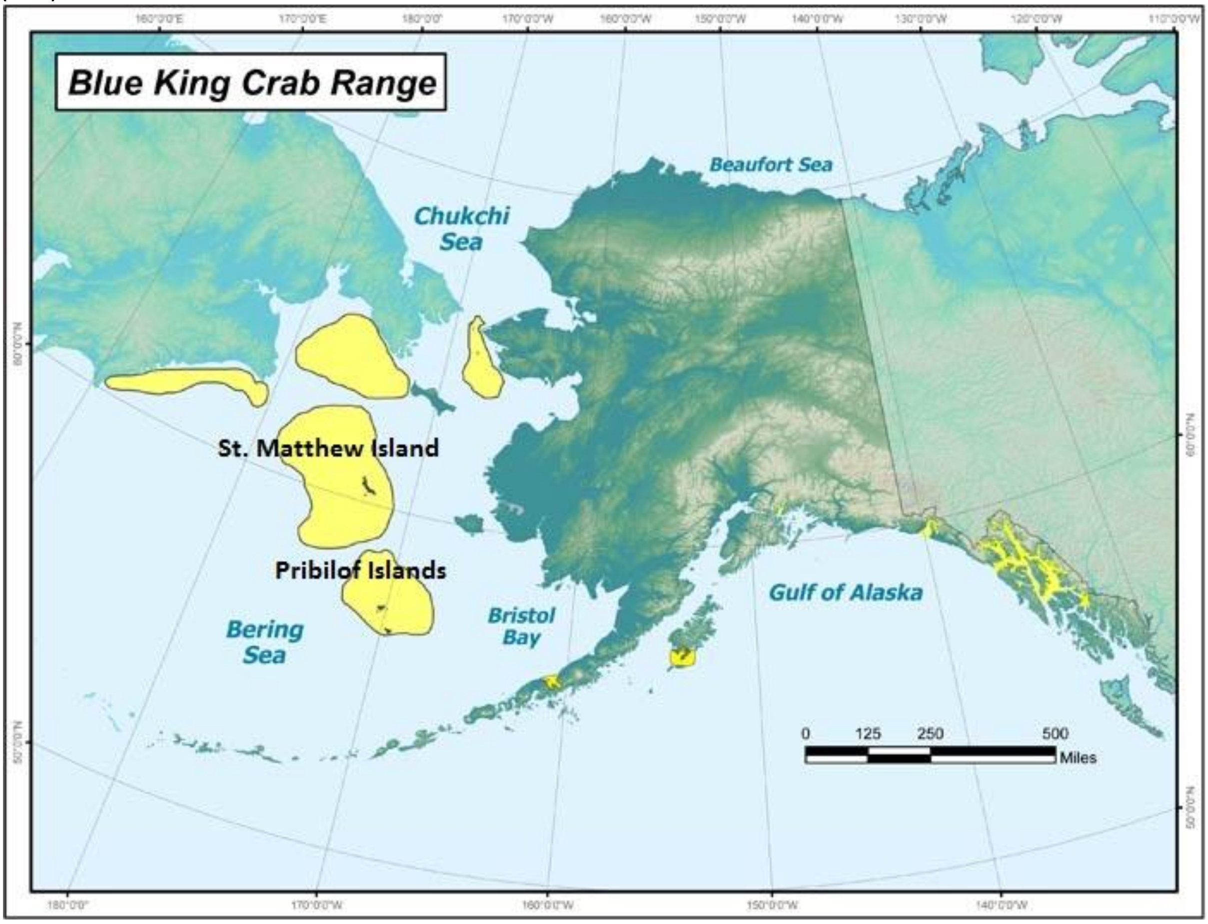
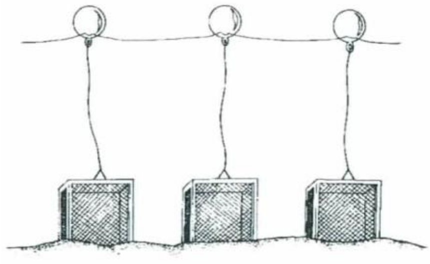


Figure 4. Blue King Crab stock distribution in the Bering Sea and Gulf of Alaska. http://www.adfg.alaska.gov/index.cfm?adfg=bluekingcrab.main

Fishing Method

The Federal Bering Sea/Aleutian Islands Fishery Management Plan authorizes the use of pot gear (and ring nets, although not used) to harvest the crab resources. Trawls and tangle nets are specifically prohibited because of the high mortality rates which they inflict on non legal crab.
Title 5 of Fish and Game, Chapter 34 and 35 of the Alaska Administrative Code (5 AAC 34 and 35) specify "lawful gear" (i.e. size, dimension, internal structure etc...) for king and tanner crab respectively (http://www.touchngo.com/lglcntr/akstats/aac/title05.htm). Crabbers target Dungeness, king, Tanner, and snow crab using twine or wire meshed steel pots (traps). Mesh sizes are specified to allow escapement of sublegal-sized crabs and females. The pots must also have escape rings located on the sides of the pots to aid in the escape of smaller crabs. A degradable panel made of cotton twine is also required to allow escape of crabs if a pot is lost. Baited with herring or other fresh bait, the pots are left to soak for one or more days. A line extends from each pot to a surface buoy that marks its location. Bait is placed within the trap, usually in a "bait bag," which is then secured to the trap so that it does not float away. Usually additional bait referred to as "hanging bait" is also attached to the inside of the pot. The bait attracts crabs, who circle around to partake of it. Most crab pots used in Alaskan waters have sides that do not collapse, but are designed to allow for a crab to climb in via doors and eat the bait. Once inside the cage, the design of the pot is such crab cannot climb back out. There are several configurations for the pots, though in general, the smaller round pots are fished for Dungeness in shallow bays and estuaries, and the large, heavy, rectangular pots are fished in waters deeper than 100 feet for king and Tanner crab in the Bering Sea. A conical pot has become almost the standard pot for the Tanner and snow crab fishery and is gaining more widespread usage in the king crab fishery in the Gulf of Alaska. Once aboard, a pot is opened and the catch is sorted. Females, and undersized males are discarded alive down inclined ramps over the side and legal-sized males are retained in aerated seawater tanks. The inclined ramps prevent the crabs from receiving damage that would have occurred if the crabs had fallen and impact the water. Crab boats in the Bering Sea are usually 100 feet or more in length. When heading to a fishing ground, pots are usually stacked on the decks. Crabs are delivered live to shore stations where they are cooked and then either canned or sold as fresh or frozen product. Several modifications to pot gear have been introduced to reduce bycatch mortality. In the 1978/79 season, pots used in the snow crab fishery first contained escape panels to prevent ghost fishing. Escape panels consisted of an opening with one-half the perimeter of the tunnel eye laced with untreated cotton twine. The size of the cotton laced panel to prevent ghost fishing was increased in 1991 to at least 18 inches in length. No escape mechanisms for undersized crabs were required until the 1997 season when at least one-third of one vertical surface had to contain not less than 5 inches stretched mesh webbing or have no less than four circular rings of no less than 3 3/4 inches inside diameter. In the 2001 season the escapement for undersize crab was increased to at least eight escape rings of no less than 4 inches placed within one mesh measurement from the bottom of the pot, with four escape rings on each side of the two sides of a four-sided pot, or one-half of one side of the pot must have a side panel composed of not less than 5 1/4 inch stretched mesh webbing.


Crab pots.

http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/whatkindofboat_cf.pdf
http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf

3.3. Fishery Management and Organization

The North Pacific Fishery Management Council (NPFMC). The NPFMC is one of eight regional councils established by the Magnuson Fishery Conservation and Management Act [short Magnuson-Stevens Act (MSA)] in 1976 to oversee management of the nation's fisheries. Pursuant to the MSA, the Council has responsibility for preparing Fishery Management Plans (FMP) and amendments to FMPs for the conservation and management of fisheries in the Alaskan EEZ. 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.

The king and Tanner crab FMP attempts to avoid unnecessary duplication of effort and defers much of the management to the State (already managing crab resources throughout the BSAI prior to inception and implementation of the MSA), while the most controversial measures are fixed in the FMP and require Plan amendment to change. 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. Federal management oversight to determine if a management action is consistent with the FMP, the MSA, 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.

The FMP contains three types of management measures: (1) specific Federal management measures that require an FMP amendment to change (i.e. legal gear, permit requirements, federal observer requirements, limited access, essential fish habitats, habitat areas of particular concern), (2) framework type management measures, with criteria set out in the FMP that the State must follow when implementing changes in State regulations (i.e. minimum size limits, guideline harvest levels, in-season adjustments, fishing seasons and areas, sex restrictions and pot limits, registration areas and closed waters) and (3) measures that are neither rigidly specified nor frameworked in the FMP, and which may be freely adopted or modified by the State (i.e. reporting requirements, gear placement, removal and storage, gear modifications, vessel tank inspections, bycatch limits in crab fisheries, state observer requirements etc...) subject to an appeals process or other Federal law.

A feature of the Council expertise is provided by Plan Teams. The Crab Plan Teams'(CPT) primary function is to provide the Council with the best available scientific information, including scientifically based recommendations regarding appropriate measures for the conservation and management of the Bering Sea and Aleutian Islands (BS/AI) king and Tanner crab fisheries. The Crab Plan Team CPT is composed of scientists from ADFG (HQ, Kodiak and Dutch Harbor), the AFSC (Kodiak and Seattle), NMFS/Regional Office, the NPFMC, and the universities: UAF, UBC and UW. The CPT normally meets 2 to 3 times a year.

The National Marine Fisheries Service. The NOAA's NMFS is responsible for the management, conservation, and protection of living marine resources within the US EEZ. The NMFS Alaska Regional Office oversees fisheries in federal waters (3-200 nm) that produce about half the fish caught in US waters, with responsibilities covering 842,000 square nautical miles off Alaska. NOAA's Alaska Fisheries Science Center (AFSC) conducts yearly trawl survey in the eastern Bering Sea (EBS) to determine the distribution and abundance of crab and groundfish resources. Surveys are conducted in three legs throughout the summer with two vessels dedicated to each leg. The EBS survey is augmented every year by the addition of special projects. The cumulative data collected during each annual survey help fisheries managers regulate commercial crab fishing activities.

NMFS and the ADFG use this information to determine the status of the stocks and to set the harvest levels. In addition to biological studies, stock survey and stock assessment reports, NMFS is charged with carrying out the federal mandates of the U.S. Department of Commerce with regard to commercial fisheries such as approving and implementing FMPs and FMP amendments recommended by the Council. The U.S. Coast Guard partners the NMFS's Office for Law Enforcement (OLE) and the State's Alaska Wildlife Troopers (AWT) for effective monitoring, control and enforcement of crab fisheries regulations.

Alaska Department of Fish and Game. The Alaska Department of Fish and Game (ADFG) has responsibility for developing the information upon which to base State fishing regulations, with continued assistance from NMFS. In carrying out this responsibility, ADFG consults actively with the NMFS (Alaska Regional Office and Northwest and Alaska Fisheries Center), NOAA General Counsel, the Council's 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. The FMP provides that the Commissioner of ADFG, 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.

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 is prepared annually by ADFG, with NMFS and crab plan team input incorporated as appropriate. This report is available for public comment and presented to the Council on an annual basis. GHLs are revised whenever new information is available, and made available to the public. Federal enforcement agents (NOAA) and the U.S. Coast Guard (USCG) work effectively in cooperation with the State's Alaska Wildlife Troopers to enforce king and Tanner crab regulations in the BS/AI area.

Figure 5 (from the BSAI crab FMP) shows the annual cycle of management decision making for king and Tanner crab stocks and its interaction with fisheries and resources assessments. Regulatory proposals are addressed every three years by the Alaska Board of Fisheries

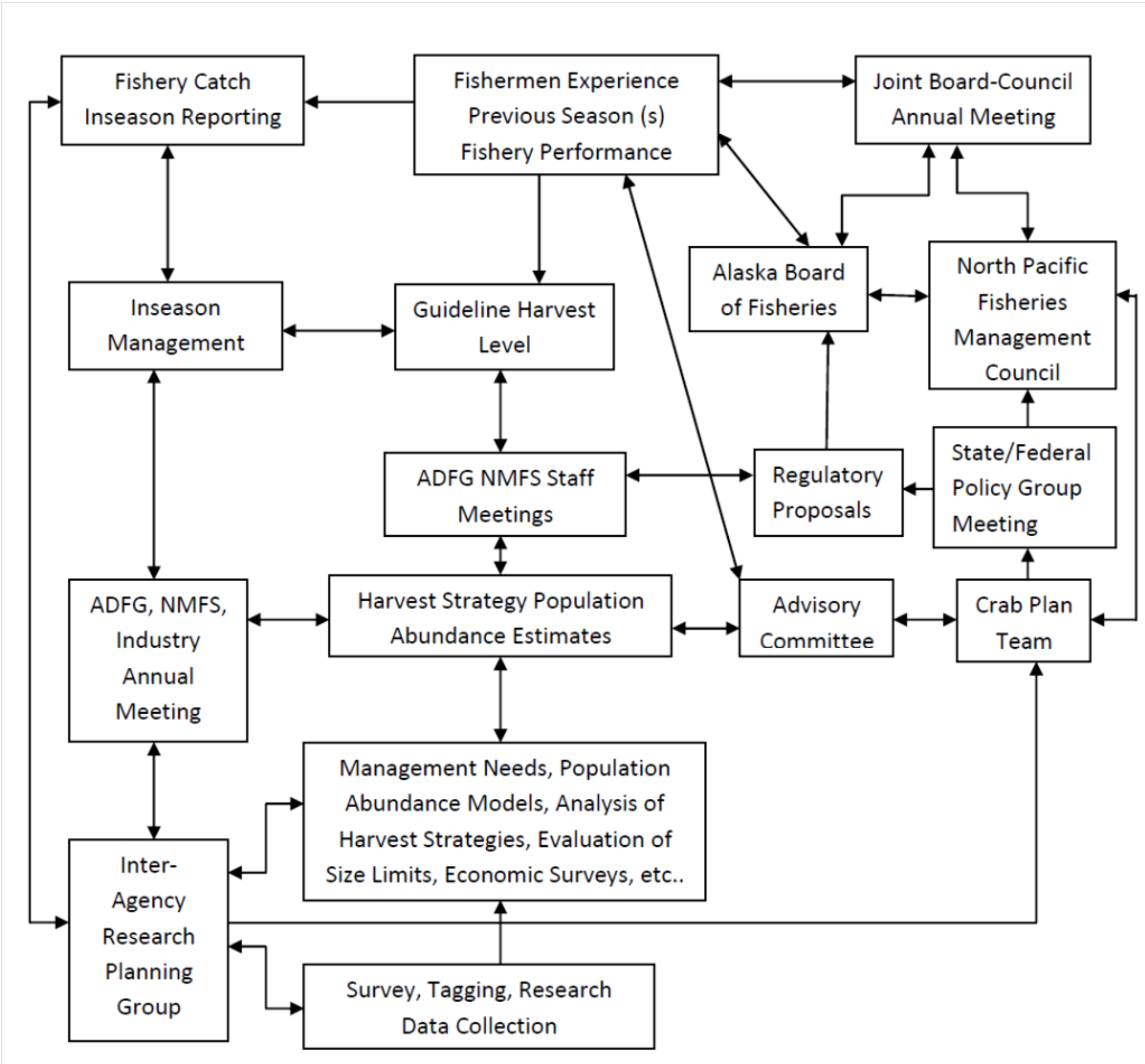


Figure 5. Annual cycle of management decision making for king and Tanner crab stocks and its interaction with fisheries and resources assessments
http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf
http://www.afsc.noaa.gov/Kodiak/shellfish/crabebs/crabsurvey.htm

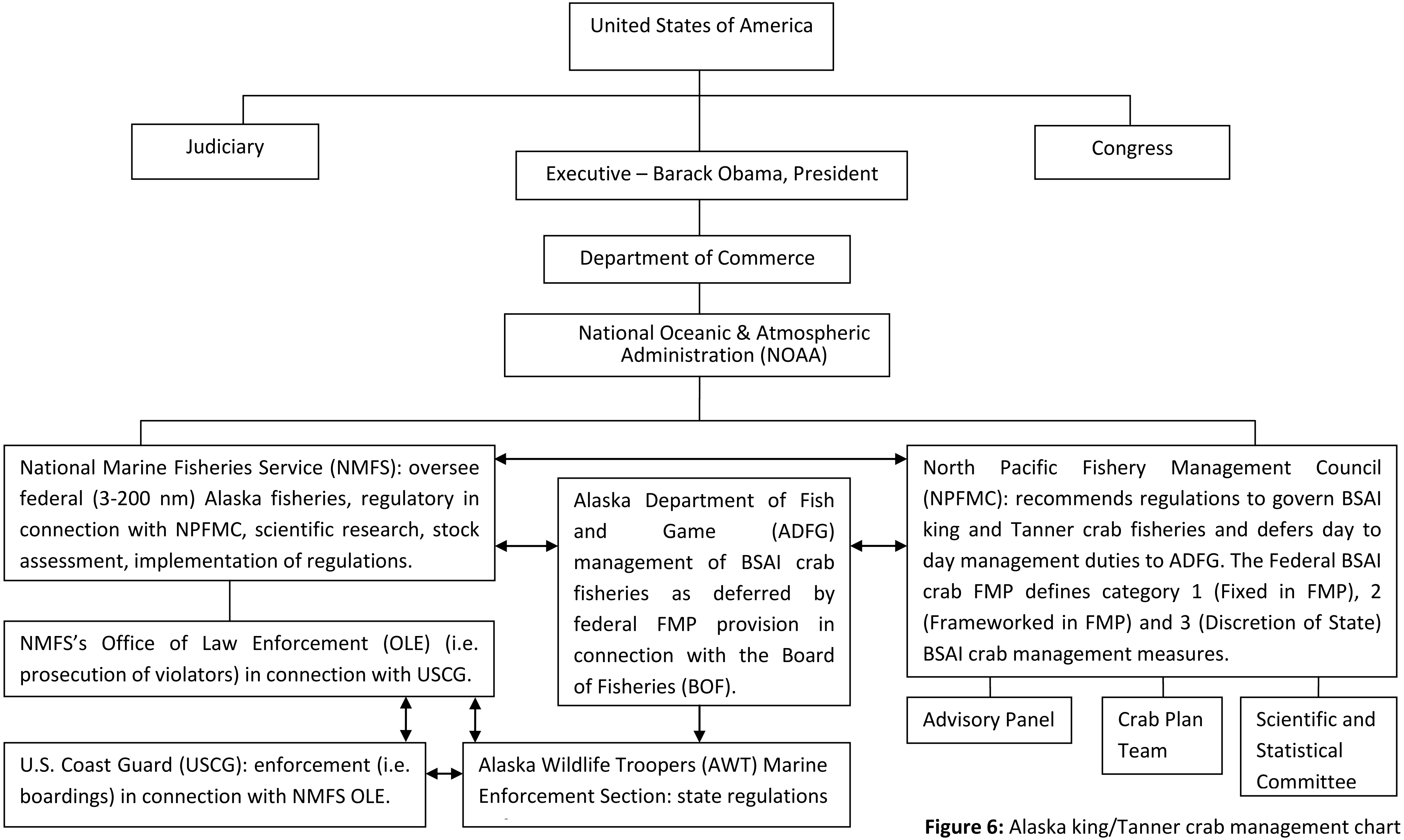


Figure 6: Alaska king/Tanner crab management chart

3.4. Stock Assessments Methods and Practices

NMFS EBS trawl survey

<u>Survey methodology</u>

NMFS conducts an annual trawl survey in the eastern Bering Sea to determine the distribution and abundance of crab and groundfish fishery resources and the survey is used to provide fishery-independent estimates of abundance and biological data. The surveys have been conducted annually since 1975 by the Resource Conservation and Engineering Division (RACE) of the Alaska Fisheries Science Center. The surveys are conducted in three legs with the main survey grid conducted from early June to late July with two chartered fishing vessels dedicated to each leg.

Since 1988, 376 standard stations have been sampled in the survey covering an area of approximately 150,000 nmi^2 with station depths ranging from 20 to 150 meters (Figure 7).

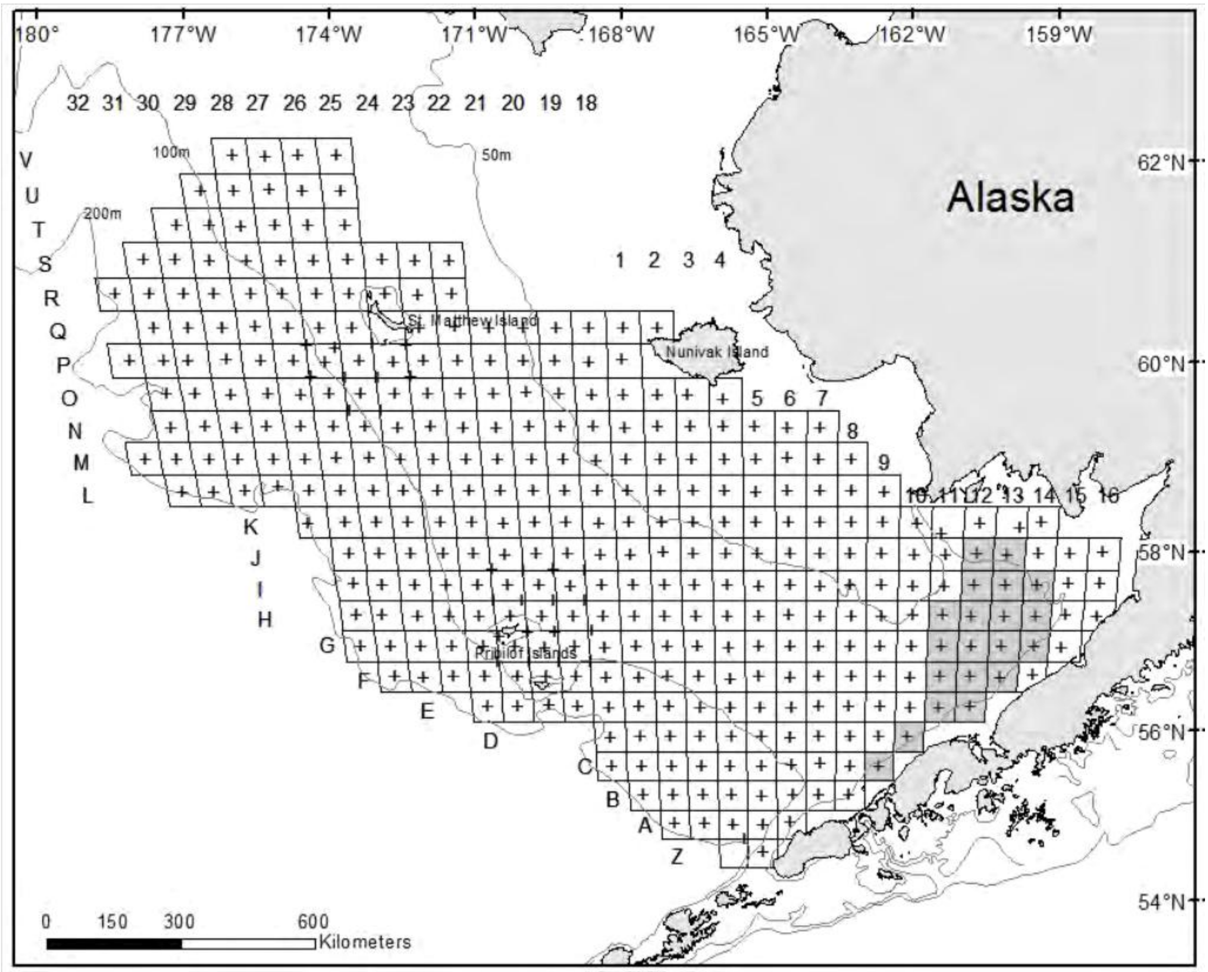


Figure 7. National Marine Fisheries Service eastern Bering Sea standard bottom trawl area surveyed by FV *Alaska Knight* and FV *Aldebaran* from 5 June to 31 July 2011. Shaded area depicts Bristol Bay resample stations, 25 to 31 July 2011. http://www.afsc.noaa.gov/kodiak/shellfish/crabebs/2011EBSSurveyTechMemoDraft.pdf

The survey stations are divided into multiple districts, which are defined by ADF&G commercial crab management units. Management units are defined by registration areas and districts, which are further divided into strata with standard or high station densities. Standard-density strata have stations centered in 20 × 20 nmi (37.04 × 37.04 km) cells while high-density strata include additional stations at the corners of the 20 × 20 nmi cells around the St. Matthew and Pribilof Islands. The chartered fishing vessels each tow a standard eastern otter trawl with a 83 ft headrope and a 112 ft footrope. Survey trawls were towed behind 816 kg, 1.8 × 2.7 m, steel V-doors and paired 54.9 m (30-fathom) dandylines. Each lower dandyline had a 61 cm chain extension connected to the lower wing edge to improve bottom-tending characteristics. The trawls on each vessel were rotated every 25-30 consecutive tows to mitigate potential impacts from changes in net configuration due to fishing. Each tow was approximately 30 minutes in duration and 1.5 nmi (2.8 km) in length at a speed of 3 knots (1.54 m/sec), and conducted in strict compliance with established NMFS groundfish bottom trawl protocols (Stauffer 2004). Net mensuration equipment was used to monitor the net's fishing performance during each tow. A bottom contact sensor was attached to the center of the footrope to measure bottom contact of the net at 1-second intervals. The net mensuration system also consisted of an acoustic sensor attached to the headrope and two sensors attached to the port and starboard dandylines to measure net height and width during trawling operations. The bottom contact of the footrope and GPS data were used to calculate distance fished. Fishing power was assumed to be equal between the two vessels.

The standard sampling stations may be complemented by additional tows. Firstly in years when colder water temperatures delay the reproductive cycle in red king crabs, a small section of the inner Bristol Bay area is resampled after the completion of the standard survey to assess mature female abundance. Secondly, multiple additional tows are undertaken in crab "hotspots" identified on the standard survey. Hotspots are defined as any station at which ≥ 100 legal-sized male crabs are caught.

Biological sampling

At each station, crabs are sorted by species and sex, and a total catch weight calculated for each species. Crabs are measured to provide a size frequency distribution from a sample of the catch, carapace shell condition is assessed for each crab sampled, reproductive condition of females is recorded, and egg clutch and egg condition codes are used to assess the stage in the molt-mate cycle of mature female red king crab.

Crab biomass estimates

Crab density (weight/nmi^2) was estimated at each station for legal males, mature and immature males and females of each stock. The area swept by the trawl (nmi^2) was calculated as the product of the distance travelled while the net had bottom contact by the mean net width over the duration of the tow. Population biomass estimates are calculated using the variable net width based on net mensuration data. The effective width of the trawl typically ranges from 14.6 to 18.3 m when towing at a speed of 3 knots and changes with the depth of the tow due to changes in scope of the trawl wire. Crab densities were calculated using the mean net width recorded for the duration of each tow and a mean net width-inverse scope regression relationship was calculated when net width values were not recorded during a tow. Distance travelled by the trawl was determined from ship positions recorded at the beginning and end of each tow using GPS equipment.

For each species, crab biomass estimates are calculated for each 1mm size category using a size-weight relationship estimated from a linear regression fitted to log-transformed size-weight data.

The weights calculated at the 1 mm size category are summed within the legal male, mature and immature size categories for each species and sex caught at a station. The crab biomass within a district or section was estimated by averaging crab densities from all stations within the defined district or section and multiplied by the total area of the district or section specific to that stock. Total biomass was calculated using a stratified design based on management units (standard-density, high-density, ADF&G defined districts, or sections). Population biomass estimates were calculated in each stratum and then summed among strata. Variance of the total biomass estimate for each size class was calculated by summing the variance of each stratum. The 95% confidence intervals were calculated using the standard error of the total population multiplied by 1.96.

In 2011, the total population estimate for Bristol Bay red king crab males was calculated by averaging data collected at the original stations in early June with data collected at the 20 resample stations in late July. Bristol Bay female red king crab biomass was calculated by replacing data collected at the original stations with data collected at the resample stations due to crab movement into the sampling area during the time between the standard survey and the resampling event.

The survey report authors acknowledge that these population biomass estimates are point estimates and have substantial uncertainty due to the broad-scale nature of the survey area being sampled and the spatial and temporal distributions of the crab resource. These point estimates are thought to be least precise for small crabs due to gear selectivity, and for females of some stocks due to crab behaviour. For consistent analyses and in the absence of available data, catchability is essentially assumed to be 1.0, and therefore these estimates are effectively indices of relative abundance and do not represent absolute abundance.

1. Eastern Bering Sea Snow Crab

Data and assessment methodology

The Eastern Bering Sea snow crab stock assessment is based on a size and sex structured model in which crabs are categorized into immature, mature, new and old shell. The model is fitted to abundance data from the NMFS trawl survey (yearly survey across the EBS), total catch data from the directed fishery and the bycatch data from the trawl fishery (i.e. groundfish/flatfish), size frequency data by maturity status for the male crab pot fishery, female bycatch in the crab pot fishery, trawl fishery bycatch. The model is also fitted to the 2009 and 2010 Bering Sea fisheries Research foundation (BSFRF) study area biomass estimates and length frequency data. Changes to the model for 2011 include: i) immature natural mortality (M) for male and females, ii) mature male M that is either fixed or estimated depending on the model scenario, iii) reformulation of the survey selectivity in the BSFRF study areas in 2009 and 2010, iv) a nonparametric availability curve for the BSFRF study area in 2009 and 2010, v) model scenarios with a fixed growth curve based on data from a 2011 growth study. A total of 13 alternative model scenarios were evaluated. The base model chosen was scenario 7 where natural mortality rates for all stages were fixed at 0.23 yr-1 and a logistic curve was used for the availability BSFRF survey data. The Crab Plan Team (CPT) recommended scenario 6, where a nonparametric availability model was used and natural mortality rates were estimated in conjunction with an informative prior for adult M (see CPT minutes in 2011 crab SAFE report for discussions regarding model selection and natural mortality rates).

Model Scenarios

The analysis presented in the 2011 Crab Stock Assessment and Fishery Evaluation (SAFE) report builds on earlier analyses by addressing key recommendations from the February 2011 crab modeling workshop, the SSC April and June 2011 and May 2011 CPT recommendations. The CPT and

SSC in 2010 and 2011, recommended the use of the Bering Sea Fisheries Research Foundation (BSFRF) 2009 and 2010 survey data as an alternative survey in the assessment model to inform estimates of survey selectivity. The model used in the September 2010 assessment estimated natural mortality for mature male crab and growth parameters for male and female crab. Survey selectivities for the BSFRF and NMFS data in the study area are also estimated separately for males and females. Small crab (<40mm) were removed from the 2009 study area data to allow the use of three parameter logistic curves to estimate survey selectivity and obtain a good fit to length data. The removal of small crab solves the problem of lack of fit of very small crab confounding estimates of selectivity of larger crab. While a survey that has a consistent catchability of small crab is desirable for recruitment estimation, the purpose of the surveys in the study area was mainly to inform survey selectivity of mature and larger crab.

Following the recommendation of the CPT and the Scientific and Statistical Committee (SSC), abundance estimates by length as well as survey biomass for the study area for the BSFRF tows as well as the NMFS tows were added to the stock assessment model as an additional survey. Survey selectivities were estimated using logistic curves for males and females for the NMFS standard survey in the entire Bering Sea area and the BSFRF tows in the study area (Model scenarios 1,2,3,7,8,9,10). Model scenarios 4,5 and 6 use a smooth function for the BSFRF availability for male crab in the study areas. Likelihood equations were added to the model for fits to the length frequency by sex for the BSFRF tows in the study area and the NMFS tows in the study area. A likelihood equation was also added for fit to the mature biomass by sex in the study area for the BSFRF tows and NMFS tows separately. The Model scenarios presented in the 2011 crab SAFE include a formulation of the NMFS study area survey selectivity that has been revised from the September 2010 assessment model. The maximum selectivity in the September 2010 assessment for the NMFS study area was estimated by the product of the Q for the NMFS Bering Sea area and the Q for the BSFRF survey in the study area. The Q for the BSFRF survey in the study area was assumed to represent the fraction of crab available in the study area relative to the entire Bering Sea. The maximum catchability of the BSFRF net in the study area was assumed to be 1.0. The maximum survey selectivity (Q) estimated for the entire Bering Sea area in Somerton et al. 2010 was estimated at 0.76 at 140 mm. The maximum size bin in the model is 130-135, which for the Somerton curve has a maximum selectivity of 0.75.

Stock biomass and recruitment trends

All model scenarios investigated indicated that the stock is above the BMSY proxy. This indicates that under any model scenario the stock is rebuilt. Estimated trends (model 7) in mature male biomass (MMB) at mating have increased since 2002/03 to 2010/11, and 2011/12 estimates (179,000 t) are slightly less than 2010/11 (184,900 t). Observed survey mature male biomass increased from 157,310 t in summer 2010 to 167,400 t in summer 2011. Trends in recruits per mature male biomass have increased between 2001/02 and 2005/06, and the estimates of recruitment (25-50 mm size class) in the last 5 years are dominated by an above average cohort in 2009/10.

2. Bristol Bay red king crab

History of Modeling Approaches

To reduce annual measurement errors associated with abundance estimates derived from the area-swept method, the ADFG developed a length-based analysis (LBA) in 1994 that incorporates multiple years of data and multiple data sources in the estimation procedure (Zheng et al. 1995a). Annual abundance estimates of the Bristol Bay RKC stock from the LBA have been used to manage the directed crab fishery and to set crab bycatch limits in the groundfish fisheries since 1995.
An alternative LBA (research model) was developed in 2004 to include *Stock biomass and recruitment trends.* Model estimates of total survey biomass increased from 162.5 million lb (73.7 thousand t) in 1968 to 631.1 million lb (286.3 thousand t) in 1978, fell to 77.0 million lb (34.9 thousand t) in 1985, generally increased to 201.2 million lb (91.3 thousand t) in 2007, and declined to 166.9 million lb (75.7 thousand t) in 2011. Model estimates of mature male biomass at mating (15 February) generally increased from 48.3 million lb (21.9 thousand t) in 1993/94 to 73.8 million lb (33.5 thousand t) in 2009/10 and to 72.0 million lb (32.6 thousand t) in 2010/11; the projected value for mature male biomass on 15 February 2012 is 65.6 million lb (29.8 thousand t) if the 2011/12 catch equals the OFL. Estimated recruitment was high during the 1970s and early 1980s and has been generally low since 1985. Estimated recruitment to the modelled size classes (i.e., ≥65 mm CL) from the 2007−2011 surveys has been below the average for 1984−2011. The 2011 survey produced a high catch of juvenile males and females <65 mm CL, but that catch occurred in only one survey tow and hence has high uncertainty as a predictor of future recruitment.

The stock assessment model is based on a length-structured population dynamics model incorporating data from the NMFS eastern Bering Sea trawl survey, commercial catch, and at-sea observer data program. Annual stock abundance is estimated for male and female crabs ≥ 65-mm carapace length during 1968/69−2010/11 to the time of the 2011 survey and mature male biomass is projected for 15 February 2012. Catch data (retained catch numbers, retained catch weight, and pot lifts by statistical area and landing date from the fishery which targets males ≥ 165mm (6.5 in. carapace width) were obtained from ADFG fish tickets and reports, red king crab and Tanner crab fisheries bycatch data from the ADFG observer database, and groundfish trawl bycatch data from the NMFS trawl observer database.

Catch and bycatch data were updated with data from the 2010/11 crab fishery year. The 2011 assessment was based on model scenario 7ac. Model scenario 7ac assumed three levels of molting probabilities, a constant natural mortality M = 0.18yr-1 (but with additional natural mortality for males and females during 1980−1984 and for females during the “split period” 1976−1979 and 1985−1993), incorporates the BSFRF data, estimates effective sample sizes, estimates proportions in initial years, and (with respect to the “Bristol Bay retow data”) uses only the standard survey data for males and uses the retow data for females.

3. Saint Matthew blue king crab

Data and assessment methodology

A three-stage catch-survey analysis (CSA) is used to assess the male component of the stock. The CSA incorporates the following data: (1) commercial catch data from 1978 to 2010/11; (2) annual trawl survey data from 1978 to 2011; (3) triennial pot survey data from 1995 to 2010; (4) bycatch data in the groundfish trawl fishery from 1989 to 2006 and in the groundfish fixed-gear fishery from 1996 to 2008; and (5) ADFG crab-observer data for the years 1990/91-1998/99, 2009/10, and 2010/11. Fishery effort and catch data are the vessel numbers, pot lifts, catch number and weight, and Catch per unit effort (CPUE) for the directed pot fishery; total annual retained catches (including dead loss) were used in the catch-survey analysis. Trawl survey data are from summer trawl survey for stations within the St. Matthew Section. Trawl survey data provided estimates of density (number/nm^2) at each station for males in four size and shell-condition categories that were used in the assessment: 105–119 mm carapace length (CL); 90–104 mm CL; new shell 120–133 mm CL; and old-shell ≥120 mm CL and new-shell ≥134 mm CL) males. Pot survey data are from the July–August 1995, 1998, 2001, 2004, 2007, and 2010 ADFG triennial pot surveys for Saint Matthew Island blue king crab. The pot survey samples areas of important habitat for blue king crab, particularly females, that the NMFS trawl survey cannot sample. Data used are from only the 96 stations fished in common during each of the five surveys. The CPUE (catch per pot lift) indices from those 96 stations for the male sex and shell-condition categories listed above were used in the assessment. NMFS observer data were used to estimate groundfish trawl and fixed-gear bycatch. Bycatch composition data were not available so total biomass caught as bycatch was estimated by summing blue king crab biomass from federal reporting areas 524 and 521 according to gear type.

History of Modeling Approaches for this Stock

A four-stage catch-survey-analysis (CSA) assessment model has been used in recent years to estimate abundance and biomass and prescribe fishery quotas for the Saint Matthew blue king crab (SMBKC) stock (2010 SAFE, Zheng et al. 1997). The four-stage CSA is similar to a full length-based analysis, the major difference being coarser length groups, which are more suited to a small stock with consistently low survey catches. In this approach, the abundance of male crab with a CL of 90 mm or more is modeled in terms of four crab stages: stage 1 (90-104mm CL); stage 2 (105-119 mm CL); stage 3 (new shell 120-133 mm CL); and stage 4 (old shell ≥ 120 mm CL and new shell ≥ 134 mm CL). These stage definitions are motivated by an estimated average growth increment of about 14 mm per molt for SMBKC (Otto and Cummiskey 1990), with the slightly narrower stage-3 size range intended to buttress the assumption that all stage-3 crab transition to stage 4 after one year (J. Zheng, ADFG). To be of legal size in the SMBKC fishery, male crab must measure at least 5.5 in CW, including spines, for which 120 mm CL is considered a management proxy, whereas male crab measuring at least 105 mm CL are considered mature. It follows that for assessment purposes stages 3 and 4 comprise the “legal” crab, whereas stages 2, 3, and 4 comprise the “mature” crab. The model was implemented using the software AD Model Builder (ADMB Project 2009). Since the 2010 assessment, various concerns have arisen about use of the existing model, culminating in NPFMC crab modeling workshop, CPT, and SSC recommendations that include development of an alternative potentially simpler model and provisional assessment based on survey biomass or some other index of abundance (NPFMC March 2011, CPT May 2011, SSC June 2011). In the wake of discussions at the 2011 NPFMC crab modeling workshop, the author began development of an alternative 3-stage CSA model along the lines of Collie et al (2005) and presented a description of that model to the CPT in May 2011. The author has continued development of the alternative model and included documentation and 2011 assessment year results in Appendix A of the SAFE report. For estimation of required management quantities, the approach used here relies primarily on directed-fishery reported catch and results from the annual NMFS EBS trawl survey. ADFG crab-observer data are used to develop estimates of discard mortality biomass in the directed fishery, whereas estimates of groundfish bycatch mortality are based on NMFS groundfish observer bycatch biomass data. Note that NMFS survey area-swept estimates of SMBKC abundance and biomass come with considerable uncertainty and that any assessment methodology based primarily on them will necessarily suffer the same limitation.

Stock biomass and recruitment trends
The stock is estimated to have been above *B*MSY during 2008/09 through 2010/11 and is projected to be above *B*MSY in 2011/12. Mature male biomass (MMB) has fluctuated substantially over three periods. MMB increased during the first period (1978 to 1981) from 7.6 to over 17.6 million lb, followed by a steady decrease to 2.9 million lb. in 1985. The second period had a steady increase from the low in 1985 to 13.3 million lb. in 1997 followed by a rapid decrease to 2.8 million lb. in 1999. The third period had a steady increase in all size classes from the low in 1999 to the present high of over 15.8 million lb. in 2011/2012.

http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

3.5. Historical Biomass and Removals in the BSAI King and Snow Crab Fisheries

Snow crab fishery history

Snow crabs were harvested in the Bering Sea by the Japanese from the 1960s until 1980 when the Magnuson Act prohibited foreign fishing. Retained catch in the domestic snow crab fishery increased in the late 1980's to a high of about 149,110 t in 1991, declined to 29,820 t in 1996, increased to 110,410 t in 1998 then declined to 15,200 t in the 1999/2000 fishery. Due to low abundance and a reduced harvest rate, retained catches from 2000/01 to 2006/07 ranged from a low of about 10,860 t to 16,780 t. The retained catch for the 2007/08 fishery increased to 28,600 t and was 26,560 t in 2008/09 due to increasing biomass. The retained catch for the 2009/10 fishery was 21,820 t. The total catch for the 2009/10 fishery was estimated at 23,780 t, and below the 2009/10 overfishing level (OFL) of 33,100 t total catch (Figure 8).

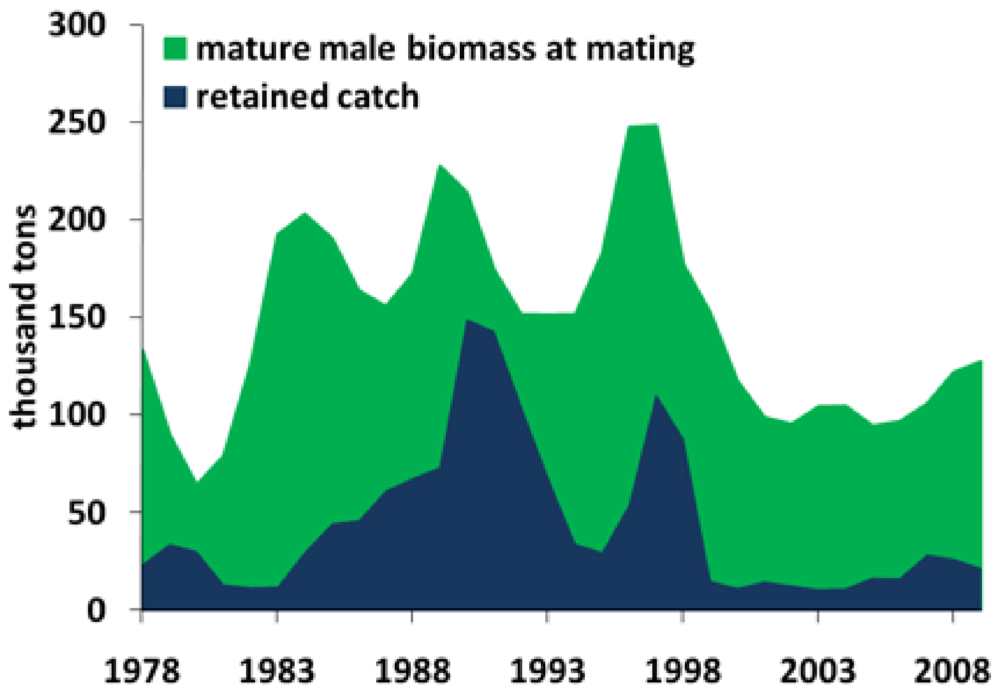


Figure 8. Eastern Bering sea snow crab biomass and landings from 1978-present.
http://www.nmfs.noaa.gov/fishwatch/species/snow_crab.htm

Discard from the directed pot fishery was estimated from observer data since 1992 and ranged from 11% to 64% (average 33%) of the retained catch of male crab biomass. Female discard catch is very low and not thought to be a significant source of mortality. In 1992 groundfish trawl discard mortality was about 1,950 t, increased to about 3,550 t in 1995, then declined to about 900 t to 1,500 t until 1999. Trawl bycatch in 2008/09 and 2009/10 was 300 t and 680 t respectively. Discard in groundfish (GF) fisheries from highest to lowest snow crab bycatch is the yellowfin sole trawl fishery, flathead sole trawl fishery, Pacific cod bottom trawl fishery, rock sole trawl fishery and the Pacific cod hook and line and pot fisheries.

Size frequency data and catch per pot have been collected by observers on snow crab fishery vessels since 1992. Observer coverage was 10% on catcher vessels larger than 125 ft (since 2001), and 100% coverage on catcher processors (since 1992). The average size of retained crabs has remained fairly constant over time ranging between 105 mm and 118 mm, and most recently about 110 mm to 111 mm. The percentage of new shell animals in the catch has varied between 69% (2002 fishery) to 98% (1999), and was 87% for the 2005/6 fishery and 93% in the 2007/8 fishery. In the 2007/8 fishery 94% of the new shell males >101mm CW were retained, while 78% of the old shell males >101mm CW were retained. Only 3% of crabs were retained between 78 mm and 101 mm CW. The average weight of retained crab has varied between 0.5 kg (1983-1984) and 0.73 kg (1979), and 0.59 kg in the recent fisheries.

Several modifications to pot gear have been introduced to reduce bycatch mortality. In the 1978/79 season, pots used in the snow crab fishery first contained escape panels to prevent ghost fishing. Escape panels consisted of an opening with one-half the perimeter of the tunnel eye laced with untreated cotton twine. The size of the cotton laced panel to prevent ghost fishing was increased in 1991 to at least 18 inches in length. No escape mechanisms for undersized crabs were required until the 1997 season when at least one-third of one vertical surface had to contain not less than 5 inches stretched mesh webbing or have no less than four circular rings of no less than 3 3/4 inches inside diameter. In the 2001 season the escapement for undersize crab was increased to at least eight escape rings of no less than 4 inches placed within one mesh measurement from the bottom of the pot, with four escape rings on each side of the two sides of a four-sided pot, or one-half of one side of the pot must have a side panel composed of not less than 5 1/4 inch stretched mesh webbing.

Harvest rates

The harvest rate used to set the GHL (Guideline Harvest Level of retained crab only) previous to 2000 was 58% of the number of male crab over 101 mm carapace width estimated from the survey. The minimum legal size limit for snow crab is 78 mm CW, however, the snow crab market generally accepts animals greater than 101 mm. In 2000, due to the decline in abundance and the declaration of the stock as overfished, the harvest rate for calculation of the GHL was reduced to 20% of male crab over 101 mm. After 2000, a rebuilding strategy was developed based on simulations by Zheng (2002). The realized retained catch typically exceeded the GHL historically, resulting in exploitation rates for the retained catch (using survey numbers) ranging from about 60% to 100% for most years. The exploitation fraction is calculated using the abundance for male crab over 101 mm estimated from the survey data reduced by the natural mortality from the time of the survey until the fishery occurs, approximately 7 months later, since the late 1980's. The historical GHL calculation did not include the correction for time lapsed between the survey and the fishery. In 1986 and 1987 the exploitation rate exceeded 1.0 because some crabs are retained that are less than 102 mm, discard mortality of small crabs is also included, and survey catchability may be less than 1.0. The exploitation fraction was derived using the total catch divided by the mature male biomass estimated from the model, ranged from 10% to 60%. The exploitation fraction estimated by dividing the total catch by the model estimate of the crabs over 101 mm ranged from about 15% to 85%. The total exploitation rate on males > 101 mm was 50% to 85% for 1988 to 1994 and 50% to 60% for 1998 and 1999 (year when fishery occurred).

Prior to adoption of Amendment 24, BMSY (921.6 million lbs (418,150 t)) was defined as the average total mature biomass (males and females) estimated from the survey for the years 1983 to 1997 (NPFMC 1998). MSST was defined as 50% of the BMSY value (MSST=460 million lbs of total mature biomass (209,074 t)). The harvest strategy since 2000/1 used a retained crab harvest rate on the mature male biomass of 0.10 on levels of total mature biomass greater than ½ MSST (230 million lbs), increasing linearly to 0.225 when biomass is equal to or greater than BMSY (921.6 million lbs) (Zheng et al. 2002). The GHL was actually set as the number of retained crab allowed in the harvest, calculated by dividing the GHL in lbs by the average weight of a male crab > 101 mm. If the GHL in numbers was greater than 58% of the estimated number of new shell crabs greater than 101 mm plus 25% of the old shell crab greater than 101 mm, the GHL is capped at 58%. If natural mortality is 0.2, then this actually results in a realized exploitation rate cap for the retained catch of 66% at the time of the fishery, occurring approximately 7 months after the survey. The fishing mortality rate that results from this harvest strategy depends on the relationship between mature male size numbers and male numbers greater than 101 mm. The maximum full selection fishing mortality rate is close to 1.0 at the maximum harvest rate of 0.225 of mature male biomass.

St Matthew Blue King Crab fishery history

The SMBKC fishery developed subsequent to baseline ecological studies associated with oil exploration (Otto 1990). Ten U.S. vessels harvested 1.202 million pounds in 1977, and harvests peaked in 1983 when 164 vessels landed 9.454 million pounds. The fishing seasons were generally short, lasting less than a month. From 1986 to 1990 the fishery was fairly stable, harvesting a mean of 1.252 million pounds.
The fishery was declared overfished and closed in 1999 when the stock biomass estimate was below the minimum stock size threshold (MSST) of 11.0 million pounds as defined by the Fishery Management Plan for the Bering Sea/Aleutian Islands King and Tanner crabs (NPFMC 1999) (Figure 9).

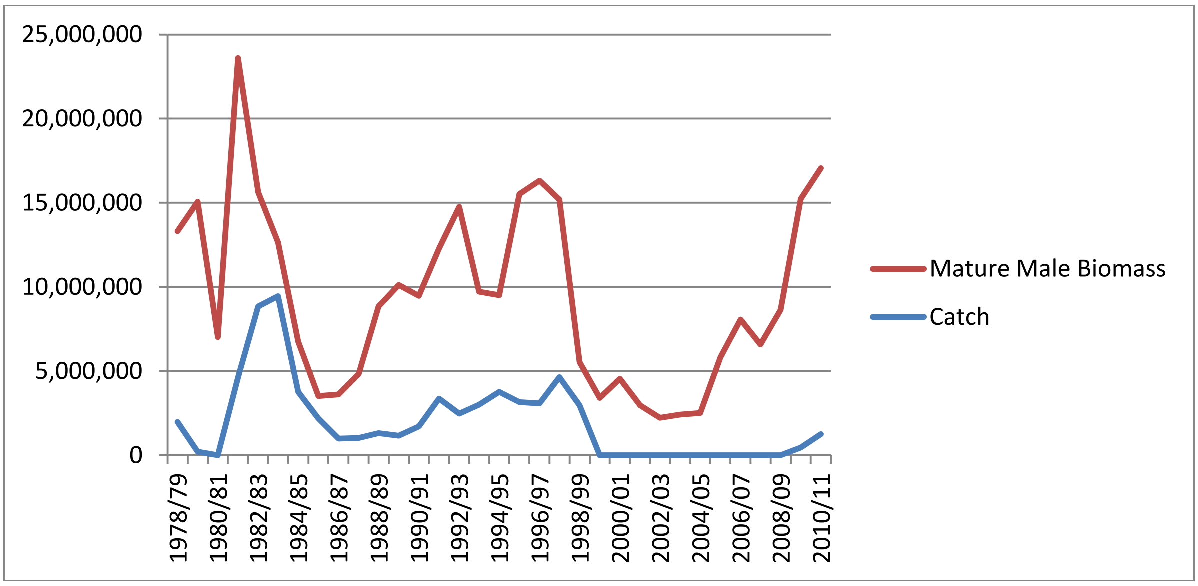


Figure 9. St Matthew blue king crab mature male biomass (MMB) at time of mating and catch (pounds) from 1979 to 2011. Data taken from Table 1 and 8 of the SMBKC SAFE report for 2011. http://www.fakr.noaa.gov/npfmc/PDFdocuments/membership/PlanTeam/Crab/06-SMBKC.pdf

Zheng and Kruse (2002) hypothesized a high level of SMBKC natural mortality from 1998 to 1999 as an explanation for the low catch per unit effort (CPUE) in the 1998 commercial fishery and in the 1999 ADFG near-shore pot survey, as well as the low numbers across all male crab size groups caught in the annual NMFS eastern Bering Sea trawl survey from 1999 to 2005. In November of 2000, Amendment 15 to the FMP for the Bering Sea/Aleutian Islands King and Tanner crabs was approved to implement a rebuilding plan for the SMBKC stock (NPFMC 2000). The rebuilding plan included a harvest strategy established in regulation (5 AAC 34.917), which was adopted by the BOF in March 2000 and modified in 2009 by the Alaska Board of Fisheries, and area closures to control bycatch, as well as gear modifications and an area closure for habitat protection.

In addition, commercial crab fisheries near St. Matthew Island were scheduled in the fall and early winter to reduce the potential for bycatch mortality of vulnerable molting and mating crab.

NMFS declared the SMBKC stock rebuilt on Sept 21, 2009, and the fishery was reopened after a 10-year closure on Oct 15, 2009 with a TAC (total allowable catch) of 1.167 million pounds, closing again by regulation on Feb 1, 2010. Seven participating vessels landed a catch of 460,859 pounds with a reported effort of 10,484 pot lifts and an estimated CPUE of 9.9 retained crab per pot lift (Bowers et al. 2011). In 2010/11 ADFG increased the TAC to 1.600 million pounds. Harvest again fell short of the TAC, with the fishery reporting total landings of 1,263,982 pounds in 29,344 pot lifts for a CPUE of 10.2 retained crab per pot lift.

Though historical observer data are limited, bycatch of female and sublegal male crab from the directed blue king crab fishery off St. Matthew Island was relatively high in past years, with estimated total bycatch in terms of number of crab captured sometimes twice as high or higher than total catch of legal crab (Moore et al. 2000). By comparison, pot-lift sampling by ADFG crab observers in 2009/10 indicated a significant reduction in the bycatch of non target crabs (Gaeuman 2011), which may be attributable to the later timing of the contemporary fishery. In addition to bycatch in the directed fishery, some limited bycatch of non-retained SMBKC has historically been observed in the eastern Bering Sea snow crab fishery, although ADFG crab observers recorded no blue king crab in 1,646 sampled pot lifts during the 2009/10 snow crab season and just two sublegal males in 2,142 sampled pot lifts during the 2010/11 season (ADFG Crab Observer Database). The St. Matthew Island golden king crab fishery, the third commercial crab fishery in the area, typically occurs in areas with depths exceeding blue king crab distribution. Variable but mostly limited SMBKC bycatch has also occurred in the eastern Bering Sea groundfish fisheries.
http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

Bristol Bay Red King Crab (RKC)

The RKC stock in Bristol Bay, Alaska, supports one of the most valuable fisheries in the United States. The Japanese fleet started the fishery in the early 1930s, stopped fishing from 1940 to 1952. The Russian fleet fished for RKC from 1959 through 1971. The Japanese fleet employed primarily tangle nets with a very small proportion of catch from trawls and pots. The Russian fleet used only tangle nets. United States trawlers started to fish for Bristol Bay RKC in 1947, and effort and catch declined in the 1950s. The domestic RKC fishery began to expand in the late 1960s and peaked in 1980 with a catch of 129.95 million lbs (58,943 t), worth an estimated $115.3 million ex-vessel value (Bowers et al. 2008). The catch declined dramatically in the early 1980s and has stayed at low levels during the last two decades (Figure 10).

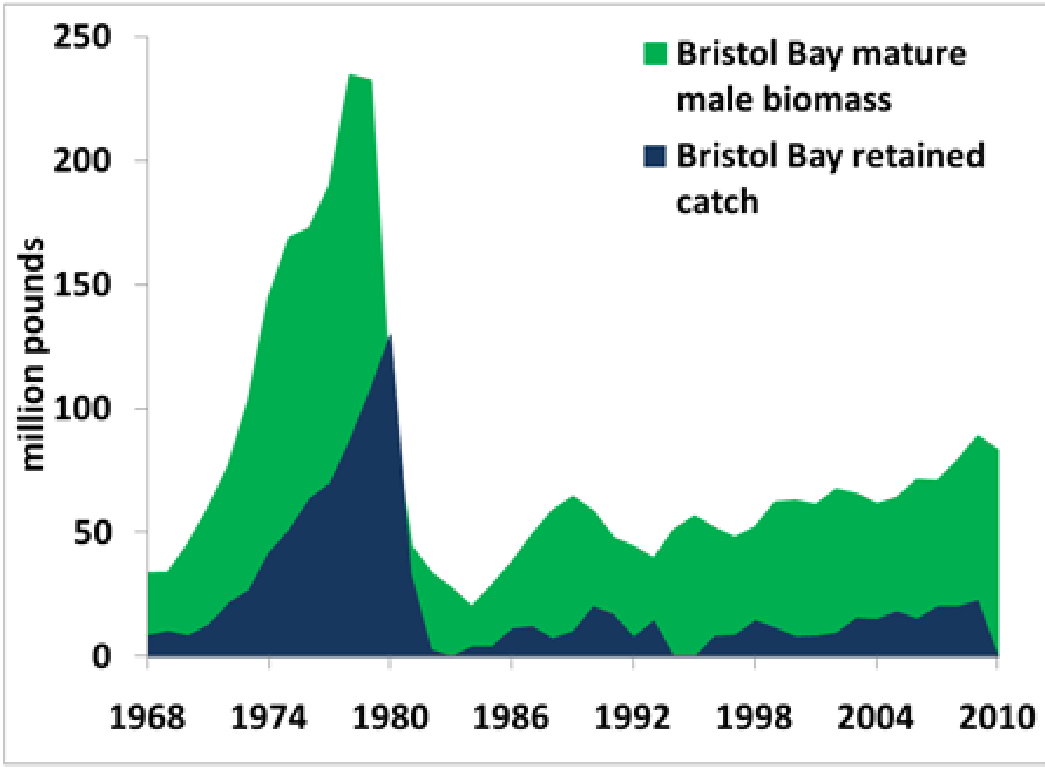


Figure 10. Bristol Bay red King Crab biomass and retained catch from 1968 to 2010.
http://www.nmfs.noaa.gov/fishwatch/species/red_king_crab.htm

After the stock collapse in the early 1980s (due to a well documented regime shift by Kruse and Hare), the Bristol Bay RKC fishery took place during a short period in the fall (usually lasting about a week), with the catch quota based on the stock assessment conducted in the previous summer (Zheng and Kruse 2002). As a result of new regulations for crab rationalization, the fishery was open longer from October 15 to January 15, beginning with the 2005/2006 season. With the implementation of crab rationalization, historical guideline harvest levels (GHL) were changed to a total allowable catch (TAC). The implementation errors were quite high for some years, and total actual catch from 1980 to 2007 was about 6% less than the sum of GHL/TAC over that period.
http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

3.6. Economic Value of the Alaska Crab Fisheries

The statistical information regarding economic activity in commercial crab fisheries managed under the Bering Sea and Aleutian Islands Crab Rationalization (CR) Program are provided, for 2011 in the Crab economic SAFE of 2011 available at http://www.afsc.noaa.gov/REFM/Socioeconomics/PDFs/crabsafe2011_draft.pdf.

Across all CR fisheries in Alaska the total sold, retained catch during 2008 was 82.25 million pounds, with an ex-vessel value of $214.31 million in 2008. Total finished pounds reported by processors in 2008 across all CR fisheries and product forms was 58.18 million pounds, with a first wholesale value of $312.6 million. Approximately 740 individuals were employed as fishing crew (including vessel captains) on crab vessels, earning a total of $49.5 million. An important result of rationalization has been the consolidation of catch onto a much smaller number of vessels, from a peak during this period of 244 in 2004 to 96 in 2008, including both catcher vessels and catcher processors. An important feature of the CR program is the implementation of the Economic Data Report (EDR) program, which requires mandatory submission of detailed operational and financial information by owners of participating vessels and processing plants. Broadly speaking, the objectives of this reporting requirement are to permit monitoring the economic performance of the rationalization program in terms of changes in the efficiency and profitability of the fisheries, and economic stability for harvesters, processors, and coastal communities, as a result of the rationalization of the fisheries and in response to ongoing management decision making. Several key elements in the data collection are currently limited by data quality and have been to the extent that they have been withheld from the current report and have not been used in analysis of the CR Program (AFSC, 2009). These include quantity and cost of fuel used in the fishery, prices and costs for IFQ leasing, and spending for factor inputs by individual location. Each of these are important elements required for examining changes in profitability and distribution of income generated by and within the fishery, limiting the analysis of several key performance metrics for the fishery. http://www.afsc.noaa.gov/REFM/Socioeconomics/PDFs/crabsafe2011_draft.pdf

The three figures below (Fig. 11, 12, 13) present effort (number of fishing vessels) and exvessel values (millions of dollars) for the BBRKC, BSSC, and the SMBKC fisheries over the last 30 years. Data and tables have been taken from the ADFG Annual Management Report for the commercial and subsistence shellfish fisheries of the Aleutian Islands, Bering Sea and Westward Region's Shellfish Observer Program, 2010.11. This is available at http://www.adfg.alaska.gov/FedAidpdfs/FMR12-22

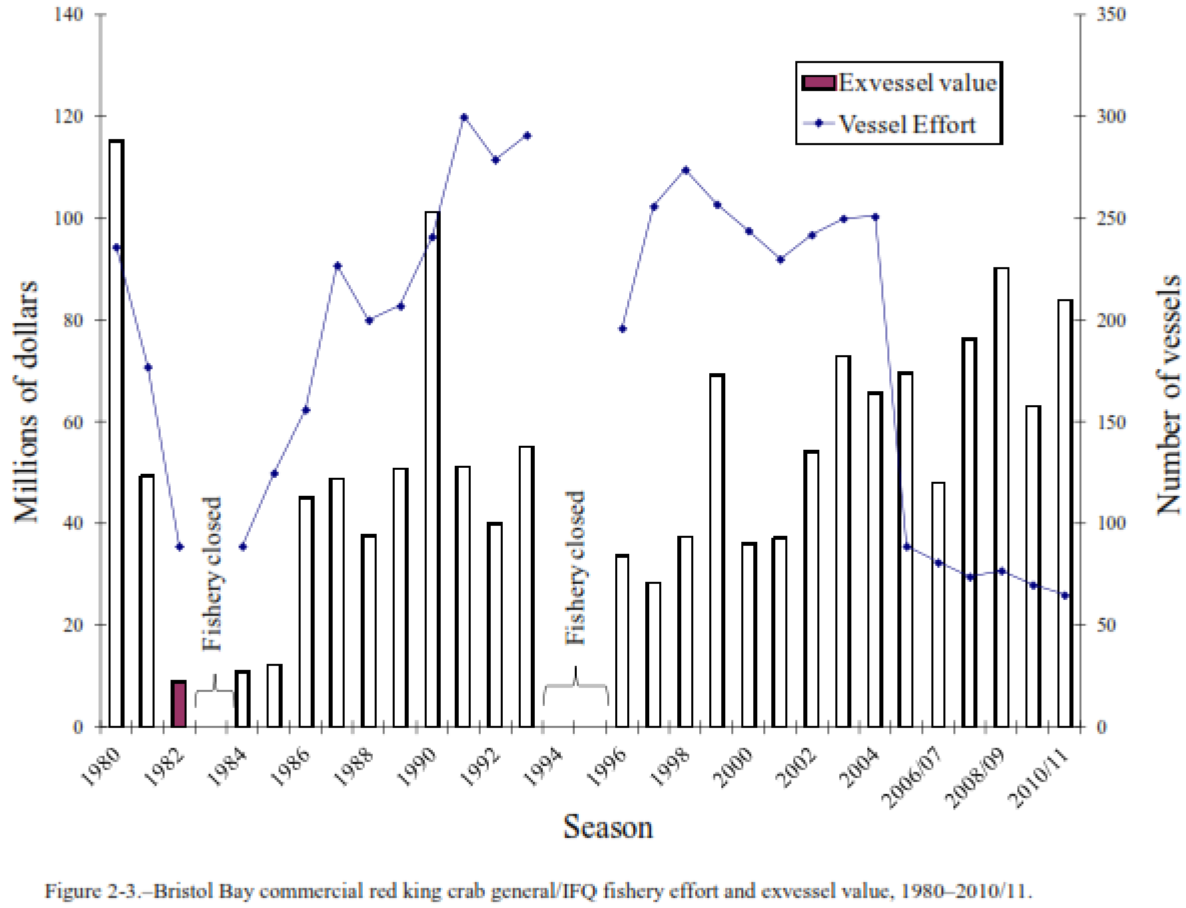


Figure 11. Bristol Bay commercial red king crab general/IFQ fishery effort and exvessel value. 1980-2010/2011 (http://www.adfg.alaska.gov/FedAidpdfs/FMR12-22)

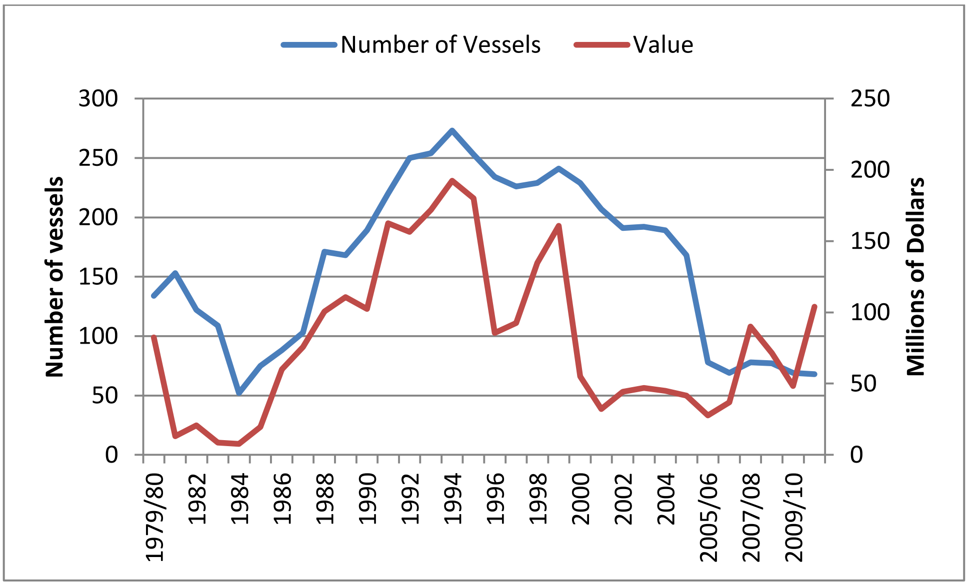


Figure 12. Bering Sea snow crab effort (number of vessels) and exvessel value (millions of dollars). 1979/80-2009/10. Data taken from http://www.adfg.alaska.gov/FedAidpdfs/FMR12-22

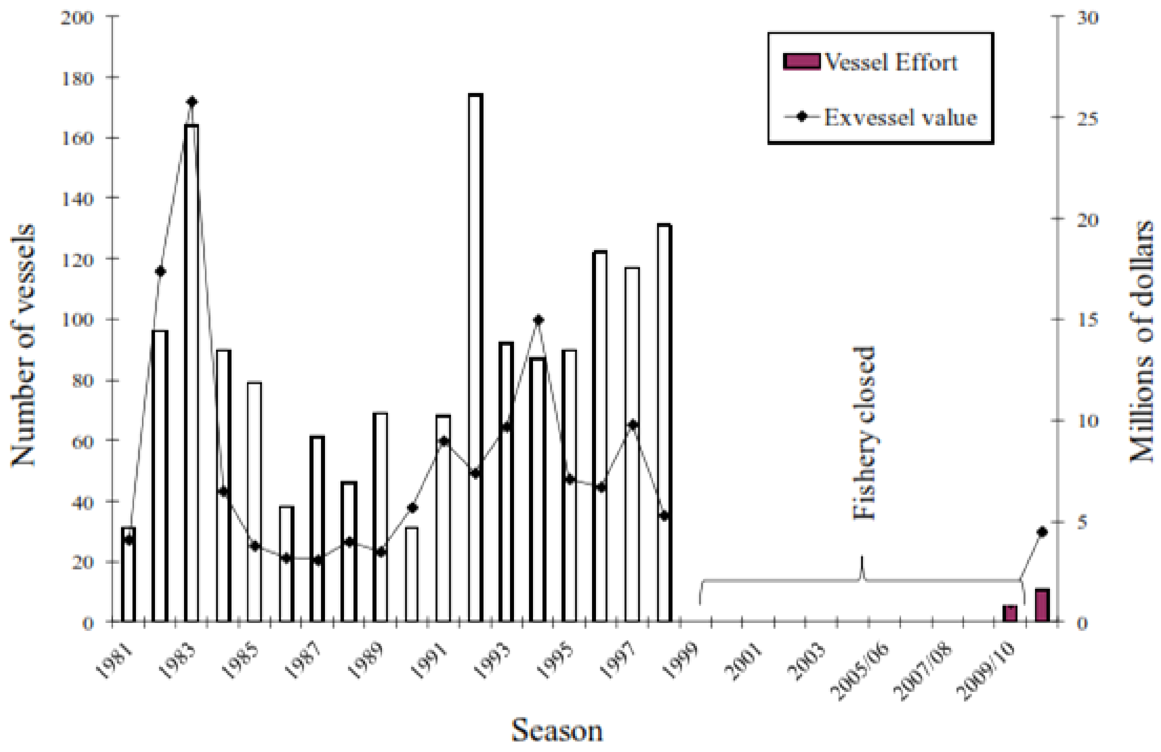


Figure 13. Saint Matthew Island Section commercial blue king crab effort and exvessel value. 1981-2010/11 (http://www.adfg.alaska.gov/FedAidpdfs/FMR12-22)

4.0. Proposed Units of Assessment

The proposed *Units of Assessment* submitted at the time of Application were reviewed with respect to their appropriateness for undertaking a full assessment. The assessors have reviewed the proposed units of assessment with respect to the application of management functions across all jurisdictions and species and to assess the similarities and potential differences during a full assessment of the Alaska BSAI king and snow crab fisheries.

The proposed Units of Assessment within the Unit of Certification are listed below.

<table>
<tr><th></th><th>Fish Species (Common & Scientific Name)</th><th>Geographical Location of Fishery</th><th>Gear Type</th><th>Principal Management Authority</th></tr>
<tr><td>1.</td><td>Red King Crab

(Paralithodes camtschaticus)</td><td>Bristol Bay</td><td>Trap gear (e.g. pot)</td><td rowspan="3">North Pacific Fisheries Management Council & National Marine Fisheries Service Alaska Region

In connection with

Alaska Department of Fish and Game & Alaska Board of Fisheries</td></tr>
<tr><td>2.</td><td>Snow Crab

(Chionoecetes opilio)</td><td>Eastern Bering Sea</td><td>Trap gear (e.g. pot)</td></tr>
<tr><td>3.</td><td>Blue King Crab

(Paralithodes platypus)</td><td>St Matthew Island</td><td>Trap gear (e.g. pot)</td></tr>
</table>

5.0. Site Meetings

5. 1. Initial Consultation Meetings

The objectives of the initial consultation meetings were to support information gathering and understanding of the role, functions and activities of the fishery management organizations responsible for US Alaska crab resources and to further investigate the approach that a full assessment might undertake with respect to the Unit of Certification and the Assessment Units that are proposed.

Consultation meetings were planned based on an initial review identifying the key management organizations and participants. The initial consultation meetings were not designed to be inclusive of all organizations and representatives of the Alaska crab fisheries. However, the consultation plan was designed to strategically capture sufficient information to ensure understanding and confidence with respect to validation reporting.

There were other important functions that the on-site consultation also served. These included:

- The provision of an overview of the FAO-based assessment and certification process to management organizations and fishery representative organizations,

- Responding to any questions and comments raised at this initial stage in the assessment. An overview of the key criteria of the FAO Code of Conduct for Responsible Fisheries, and minimum substantive requirements for eco-labelling of fisheries (FAO Guidelines for the Eco-labelling of Fisheries and Fishery Products) was presented.

A summary of items included in the standard approach to each meeting were as follows:

- Introduction to the Certifying Body
- Overview and confirmation of the assessment plan with a standard power point presentation was used which was also made available on ASMI website for all participants to review
- General discussion on the specifics of the particular meeting:

    - Units of Certification and Units of Assessment
    - Initial site visit objectives and investigative approach
    - Address any immediate questions raised by management and participatory organizations
    - Document information that would form part of the full assessment

All consultation meetings were conducted by Dave Garforth, Lead Assessor, and Stephen Grabacki, contracted Fishery Assessor. Randy Rice, ASMI Seafood Technical Program Director was also present at some meetings as representative of the fishery applicant representative organization.

Overview of Meeting Plan:

Meetings were held between the 28st June to 2nd July 2010, Alaska and in Seattle, Washington.

Summary of Consultation Meetings:

Each meeting served as the primary purpose to introduce the Certification Body, Global Trust, and provide an overview of the FAO assessment approach and process. Key timelines for assessments and the specifics of the proposed assessment and certification units were presented. Immediate questions and concerns expressed by management and participatory organizations were addressed and some key areas which will form part of the full assessment were also addressed. Consultation meetings are intended to provide a briefing of the certification process and link to management organizations for the purposes of carrying out the fishery assessments and to support the next step in the assessment, the planning of full assessments for the fisheries in application.

The following summary Table 1 provides the background to each organization met, and a description of the specific key items discussed.

Table 1. Initial Consultation Meetings

Date	Organization	Staff Represented	Overview/Key Items
28th June 2010	United Fishermen of Alaska, 211 4TH St. Suite 110 Juneau AK 99801-1172 (meeting took place at ASMI Juneau office)	Mark Vinsel, Executive Director	United Fishermen of Alaska (UFA) is an umbrella association representing 37 Alaska commercial fishing organizations from fisheries throughout Alaska and its offshore waters. Their mission is to promote and protect the common interest of Alaska's commercial fishing industry, as a vital component of Alaska's social and economic well-being. Core functions include; providing a legislative presence for members, act as a forum for communication within the fishing industry, maintain a state wide trade organization with staffed office and provide Public relations and educational programs on behalf of members.
28th June 2010	Alaska Department of Public Safety, Division of Alaska Wildlife Troopers, 2760 Sherwood Lane, Suite 1A PO Box 111201, Juneau AK 99811-1201	Lt. Steven Hall	Alaska Wildlife Troopers (AWT) is a Division of Alaska Department of Public Safety with responsibility for the protection of Alaska fisheries within State waters. They work intimately and routinely with NMFS OLE and the US Coast Guard to enforce fisheries regulations specific to crab stocks. The Division's resources and strategy for monitoring fishery activity and enforcement purposes and interaction with other agencies (ADFG, NMFS, US Coast Guard, Board of Fisheries) were discussed.
28th June 2010	U.S. Department of Commerce, National Oceanic & Atmospheric Administration, National Marine Fisheries Service, Alaska Region PO Box 21668; 709 W 9th St Juneau AK. 99802-1668	Robert ("Doug") Mecum, Deputy Regional Administrator, Alaska Region	NOAA National Marine Fisheries Service (NMFS, also called NOAA Fisheries) is responsible for the management, conservation, and protection of living marine resources within the U.S. Exclusive Economic Zone. The Alaska Region of NOAA Fisheries oversees fisheries that produce about half the fish caught in US waters, with responsibilities covering 842,000 square nautical miles off Alaska. NMFS works with the fishery management councils and commissions to develop and implement management regulations and also for the conservation of wildlife such as marine mammals and habitat conservation. The meeting provided an opportunity to provide an overview of NMFS programs and duties and discuss the assessment approach and outline the various steps in the assessment process.

28th June 2010	Alaska Department of Fish and Game, Division of Commercial Fisheries PO Box 115526 1255 W 8th St. Juneau AK 99811-5526	Eric Volk, Chief Scientist Sue Aspelund, Deputy Director Denby Lloyd, Commissioner (present for introductions)	ADFG's mission is to protect, maintain, and improve the fish, game, and aquatic plant resources of the state, and manage their use and development in the best interest of the economy and the well-being of the people of the state, consistent with the sustained yield principle. They managed the Crab resources in the BSAI as deferred from the federal FMP. Their main role is to conserve and develop the fishery resources of the state. This involves setting seasons, catch limits, management methods and means for the state's subsistence, commercial, sport, guided sport, and personal use fisheries, and it also involves setting policy and direction for the management of the state's fishery resources. The board is charged with making allocative decisions, and the department is responsible for management based on those decisions. The meeting provided an opportunity to present the key features of the assessment process, discuss the broad mission and responsibility of ADFG.
29th June 2010	U.S. Department of Homeland Security, Coast Guard, District 17 P.O Box 25517, Juneau, AK 99802-5517	Cpt. Michael Cerne	The United States Coast Guard is a military, multi-mission, maritime service within the Department of Homeland Security. Its core roles are to protect the public, the environment, and U.S. economic and security interests in any maritime region in which those interests may be at risk, including international waters and America's coasts, ports, and inland waterways. The US Coast Guard is responsible for fishery law enforcement beyond the 3 mile zone. Operations are combined with both State and other federal resources. The US Coast Guard shares intelligence and seacraft (often include AWT staff) with the other agencies involved in MCS (Monitoring, Control and Surveillance), including, NMFS and ADFG. Duties include Alaska crab fishery regulations enforcement. US Coast Guard also attends the fishery conferences and meetings of the principal management agencies, NPFMC where understanding and contribution through advice on the practical implementation of management proposals and regulations can be transferred to support effective enforcement-based activities. During the visit, attendance at the daily, morning briefing for staff and a visit to the surveillance control center also took place, discussions on US Coast Guard responsibilities for the 5 year strategic fishery plan and resources for monitoring, control and enforcement for all Alaska state fisheries.

29th June 2010	United Fishermen 211 4th St. Juneau AK 99801	Arni Thomson, President of UFA,	UFA's mission is to promote and protect the common interest of Alaska's commercial fishing industry, as a vital component of Alaska's social and economic well-being. Core functions include; providing a legislative presence for members, act as a forum for communication within the fishing industry, maintain a state wide trade organization with staffed office and provide Public relations and educational programs on behalf of members.
2nd July 2010	U.S. Department of Commerce, National Oceanic & Atmospheric Administration, National Marine Fisheries Service, Alaska Fishery Science Center, 7600 Sand Point Way NE. Seattle WA. 98115	Dr. Bill Karp, Deputy Director for Science and Research	The Alaska Fisheries Science Center is the research branch of the National Oceanic and Atmospheric Administration's National Marine Fisheries Service responsible for research on living marine resources in the coastal oceans off Alaska and off parts of the west coast of the United States. The mission of the Alaska Fisheries Science Center is to generate the scientific information and analysis necessary for the conservation, management, and utilization of the region's living marine resources. The Center provides scientific data and analysis and technical advice to the NMFS Alaska Regional Office, North Pacific Fishery Management Council, Alaskan coastal subsistence communities, and U.S. representatives participating in international fishery and marine mammal negotiations and to the fishing industry and its constituents. The Center also coordinates fisheries habitat and marine mammal research, with other Federal and state agencies, academic institutions, and foreign nations. Among other items, fishery stock surveys and assessments, observer programs, and Stock Assessment and Fishery Evaluation (SAFE) reports are routinely produced.
2nd July 2010	Pacific Seafood Processors Assn 199 W. Emerson Place Suite 205 Seattle WA 98119	Glenn Reed, President	PSPA is a non-profit trade organization established in 1914 to address issues of concern to member seafood companies including both at sea processors and shore based processors. Current Corporate members include: Alaska General Seafoods, Alyeska Seafoods, Inc., Golden Alaska Seafoods, LLC, North Pacific Seafoods, Inc., Peter Pan Seafoods, Inc., Phoenix Processor Limited Partnership, Trident Seafoods, Inc. and UniSea Inc., Westward Seafoods, Inc. PSPA members produce and market products from salmon, crab, halibut, cod, pollock and a variety of other seafood species. These products are marketed domestically and around the globe. Key points of discussion focused on the assessment approach, the definition of non conformances and the merits of eco-labelling in the supply chain.

5.2. On-Site Witnessed Assessment and Consultation Meetings

On-site visits took place in January 2012. These were additional visits to the initial consultation meetings reported in the previous section. There are two types of on-site assessment activities; meetings with fishery management organizations to discuss various aspects of the assessment and witnessed assessment, which takes the form of witnessing specific management processes and functions, such as publically accessible Council meetings where possible.

The schedule of on-site activities is provided in Table 2 with a summary of the activity, meeting and discussion. Meetings were used to document information that either confirmed, clarified or substantiated aspects of the assessment and provided an opportunity for organizations to contribute information to support the assessment.

Table 2. Summary of onsite meetings for BSAI Crab. January 2012.

Date	Organization/ Attendance	Meeting Summary: points of discussion
17th Jan 2012	Alaska Fisheries Science Center, Seattle. U.S.A Jack Turnock (Snow crab stock assessment), Lou Rugolo (Snow crab stock assessment). Anne Hollowed (supervisory fisheries biologist) Brian Garber Yonts (research economists) Vito Ciccia Romito (Assessor, GTC)	• Data collection: commercial fisheries data, research survey data from NFS trawl survey, biological data, climate variability data, and ecosystem data. • NPFMC sets OFL and ABC and ADFG sets the TAC (equal or lower than ABC). • Sampling of catch is carried out by ADFG observers. ADFG manages the observer program for the rationalized crab fisheries. Groundfish observer program is a program *per se*. Observers estimate multiple parameters including total catch and discards. Escape rings and cotton twines allow for escape of juvenile and female crabs. • Stock biomass conditions and reference points. • BSAI crab fisheries are rationalized since 2005. • Crab is bycaught in groundfish fisheries by trawl and pot gear. ADFG runs the dockside sampling program. All these data go into the assessment. • The NMFS yearly trawl survey catches all crab species apart from golden king crab in the Aleutian Islands. These are deeper waters and are sampled by ADFG pot surveys. • There may be some larval drift into Russian waters for snow crab. • Genetic makeup of snow crab is fairly homogeneous. • There is a very good understanding of crab movement and this is taken into account within stock assessment. • Fleet structure, most vessels are above100/125 feet. • Economic data is collected in the Economic SAFE document and some available in ADFG AMRs. • Once TAC is set by ADFG, NMFS splits it between participants. • BSERP research will be used for stock assessment purposes by including more detailed oceanographic data into biological knowledge (i.e. larval drift etc..). • Crab fisheries are managed as male only fisheries. These fisheries are being managed under a 5 tier system. The BSSC and BBRKC fisheries are managed under tier 3, BBRKC under tier 4. • Intensive council economic reviews pre and post rationalization. The federal

		government bought back part of the fleet for rationalization purposes. • Only few catcher processor vessels remain active, catcher vessels make up the majority. • Crab Community Development Quota (CDQ) makes up 10% of the total TAC. • Administrative order 216/100 updated confidentiality regulations. • Logbook requirements. • Economic data and requirements under CIE review. • Catch accounting system, dockside sampling program (100% coverage at dock). • ADFG and NMFS discuss stock assessment model and decide on model parameters. There is standardization of methodologies.
18th Jan 2012	Alaska Department of Fish and Game, Juneau. Alaska. U.S.A Jie Zheng (Bristol Bay red king crab and Norton Sound red king crab assessment) Doug Pengilly (St. Matthew blue king crab harvest strategy) Shareef Siddeek (shellfish biometrician) Vito Ciccia Romito (Assessor, GTC) Herman Savikko (Assessor GTC)	• Key documents for review: AMR (Annual Management Report), Observer Report, COAR (Commercial Operators Annual Report). • BSAI crab management day to day operation is deferred from NPFMC to ADFG. • Interaction with federal management but a lot of action happens at BOF. • In late 1990s new amendment to FMP defining overfishing and overfished status. • Bycatch of crabs is in other fisheries is strictly monitored and managed. • Since mid-late 1990s management of the stocks has been more conservative towards exploitation. • Minimum size limits. • Fisheries run as late as May then data is given to modelers around June. The models are run, stock assessments are written. The plan team meets in September. Crab plan team passes information to SSC and there is then more review from ADFG to set TAC. • BBRKC, EBSSC and SMBKC biological unit. • EBS Snow crab ontogenic movement keeps crab within EBS shelf in US waters. • Fisheries areas and biomass status. • NMFS allocation of catch privileges into quota share for vessels based on historical share. • BOF setting of pot limits. • Generally more data is available for BBRKC an EBSSC. • ADFG Observer program started in 1988 in response to elevated at sea processing activity.

		• State pays for some of the observer coverage and assign to different fisheries in respect to data collection needs. All catch is documented. • Check observer report for coverage and data collection information. • Pre tank inspection, • Crab SAFE and Ecosystem SAFE important documents. • No concerns for bycatch, well accounted for and mainly composed of other crab species. • Snow crab and tanner crab hybridization. • Catch reporting and E-landings usage. • Essential fish Habitats • FMP defines areas for protection of crab (spawning areas, trawling closures).
18th Jan 2012	National Marine Fisheries Service, Juneau. Alaska. U.S.A Glenn Merrill (Sustainable Fisheries Division NMFS, Assistant Regional Administrator) Rachel Baker (fishery management specialist) Gretchen Harrington (NEPA coordinator) Vito Ciccia Romito (Assessor, GTC) Herman Savikko (Assessor GTC)	• Coastal communities have input opportunities through public process. • Crab FMP defers part of management to the federal and part to the state government. • Council in charge of items including crab rationalization, Essential Fish Habitats (EFH), and stock assessment. • Allocation of IFQ: quota share % of the total was based on catch history and participation; specific for species, quota share is transferable within limits. • It is possible to lease or buy quota from other fisherman within limits. • Rationalization program came out of the council process. • About 40 amendments to the rationalization Program. • Important reports: SAFE AMR and RAM annual report. • Fishery participants must be US citizens. • IFQ fishery never exceeded the TAC since rationalization. • Regulatory Impact Review and Environmental Impact Assessment. • Category 1 measures in FMP decided through federal means. Category 2 measures in FMP are the decision of the State but with Federal oversight. Category 3 measures are of the State. • NMFS defines EFHs. • Bristol Bay Saving Area closed to bottom trawling. • Fishery Economics and budget appropriations.

		• NMFS share money with ADFG under the cost recovery program to help fund the observer program. • All gear specifications are under State authority. • Interagency Crab Meeting brings together various scientists. • Stock assessment modeling has international input. • USCG effort to improve crew safety by supplying training opportunities. • Companies privately train their fishermen. • Shares: 97% Vessel Owners, 3% Crew (incentive to make crew more valuable). • All vessels carry VMS as specified by VMS requirements. • Processor quota shares. • Catch accounting is done real time by NMFS. • Ecosystem considerations.
18th Jan 2012	Alaska Wildlife Troopers, Juneau. Alaska. U.S.A (Lt. Willard Ellis AWT) Vito Ciccia Romito (Assessor, GTC) Herman Savikko (Assessor GTC) Conference meeting.	• Management and enforcement by state (AWT) and federal (USCG, NMFS) authorities. • State requirements such as gear requirements and crab offloaded. • Violators have decreased considerably over rationalization. • Pot tags, escape mechanisms, biodegradable linings. • 2011 little or no violations. • Little interaction between observers and AWT as very little on board violations. • 90% effort is spent on dockside monitoring, 10% at sea. • If federal violations, they refer to NMFS. • IFQ holder must be on board of vessel, VMS activated, federal permit, these are typical violations from a federal side. • USCG, NMFS and AWT have outstanding interrelations. • NMFS is the major fishery enforcement organization. • USCG check permits and has the right platforms to place people at sea. • USCG at sea boardings. • AWT dockside sampling. • State violations are criminal violations (strict liability) • Misdemeanors are not administrative (violations may result in imprisonment) • Generally there are very minor infractions.

19th Jan 2012	North Pacific Fisheries Management Council, Anchorage, Alaska. U.S.A. Diana Stram, Plan Team coordinator. NPFMC Mark Fina, Resource Economist, NPFMC. Vito Ciccia Romito (Assessor, GTC)	• CDQ: 10% of it goes to 66 communities and 6 groups. • IFQ vessel can also fish CDQ ownership quota. Very integrated operations. • Small chunk of catcher processor vessels: only 3 are active. • Catcher processors cannot get processing quotas for land based processors. • 3% quota share for skippers make them more valuable in the industry. • 97% quota share linked to license. Have to meet active participation requirements. • Individual allocation as opposed to vessel allocation. • Licenses are moveable from 1 vessel to another one. • Original allocation was made to QS holder. If they join co-op then can harvest co-op allocation. • No season to season transfers are allowed. • Trading among co-op is common. • NMFS recognizes formally the co-op. • CAPS on QS and IFQ holdings. • 90% of total 97% quota shares are allocated to A shares, 10% allocated to B shares (open to negotiations in respect to processor delivery). • Processor quotas are allocated based on their history. • Percentages rather than minimum selling buying price (to avoid processors driving down crab prices). Arbitrators may be used in-season. • Processor shares insure each historic processing activity for community viability. • Snow crab (half of A shares goes to the Pribilofs, the rest goes to Akutan, Dutch Harbor and king Cove). • Red king crab (5% goes to the Pribilofs, the rest is processed in Akutan, Dutch Harbor and King Cove). • St. Matthew Blue King Crab (Pribilofs, Dutch Harbor and Kodiak). • Employment: now fewer but longer term jobs. Amount paid to crews has risen. • There is extensive economic data collection but want to scale back as there is need for more essential and consistent parameters. • Each amendment to the BSAI Crab FMP goes to NEPA process. • Council bases its analysis for regulatory analysis as they are more focused. • In 2005 there were high discard rates, ADFG lowered the TAC to reprove the fishermen exploiting the resource.

		•There are improved handling practices, sorting tables to keep and release crabs. Voluntary practices after rationalization. •Longer soak time helps juvenile and females escape. There are post-handling mortality rates in crab and groundfish fisheries. •Crab bycaught in trawls is estimated to have an 80% mortality rate. •Mortality is mainly related to air temperature. •Norton Sound fishery is outside rationalization protected by super-exclusive permit. •All 3 stocks under assessment have been under rebuilding plans. •Closed Areas (crab closure areas). •Interagency crab research meeting is on December each year. Bring together international scientists (Canada, Australia, New Zealand). •Ocean acidification, a lot of research going on. •BBRKC measures to protect spawning habitat. •Ecopath modeling has included groundfish and crab. This is present in the Ecosystem SAFE for trophic linkages.

6. Assessment Outcome Summary

This section provides a summary of the outcome of evidence that has been evaluated by the Assessment Team for the conformance of US Alaska BSAI king and snow crab fisheries to the FAO-Based RFM Conformance Criteria. The summary information is presented for each of the fundamental clauses (1 to 14) that form the FAO-Based RFM Conformance Criteria. These are divided into the 6 key components of responsible fisheries management (A-F).

A. The Fisheries Management System
B. Science and Stock Assessment Activities
C. The Precautionary Approach
D. Management measures
E. Implementation, Monitoring and Control
F. Serious Impacts of the Fishery on the Ecosystem

Section 7 documents the more detailed outcomes of the evidence that has been reviewed, evaluated and presented for each of the individual supporting clauses of the FAO-Based Conformance Criteria. Please note that the evidence provided for some clauses may be repetitious due to the overlapping nature of the FAO-Based Conformance Criteria clauses and relative requirements.

A. The Fisheries Management System

1. There shall be a structured and legally mandated management system based upon and respecting International, National and local fishery laws, for the responsible utilization of the stock under consideration and conservation of the marine environment.

Alaska's Bering Sea and Aleutian Islands (BSAI) crab stocks are managed under the Fishery Management Plan (FMP) for Commercial King and Tanner Crab approved by the United States Secretary of Commerce on June 2, 1989. The FMP was developed by the North Pacific Fishery Management Council (NPFMC) and their Crab Plan Team, submitted to the National Marine Fisheries Service (NMFS) for public review and comment, with the final product being sent to the Secretary of Commerce. The NPFMC is one of eight regional councils established by the Magnuson-Stevens Fishery Management and Conservation Act (MSFMCA or MSA) to oversee management of the nation's fisheries. MSA is the primary layer of governance for Bering Sea crab fisheries. The MSA sets out ten national standards for fishery conservation and management (16 U.S.C. § 1851), with which all FMPs must be consistent. Under the MSA, the NPFMC is authorized to prepare and submit to the Secretary of Commerce for approval, disapproval or partial approval, a FMP and any necessary amendments that regulate conservation and management for each fishery under its authority. While the NPFMC has responsibility for crab management in the BSAI, the FMP establishes a State/Federal cooperative management regime that defers crab management to the State of Alaska with partial Federal oversight.

The NMFS Alaska Fisheries Science Center (AFSC) in Seattle and the Kodiak Fisheries Research Center (KFRC) generate the scientific information and analysis necessary for the conservation, management, and utilization of the region's crab resources. The king and Tanner crab FMP is a "framework" plan, allowing for long-term management of the fishery without needing frequent amendments. All fisheries activities and decisions are subject to conditions established by the MSA as well as actions taken by the Alaska Board of Fisheries (BOF) for all management Category 2 and 3 measures (e.g size, season, sex, reporting requirements etc) under the FMP. The NMFS Office of Law Enforcement (OLE) with use of the United States Coast Guard's at-sea platforms is primarily responsible for enforcing crab regulations at sea, while the NMFS OLE and the State of Alaska's Division of Wildlife Troopers (AWT) have that responsibility ashore. Because the fishery was rationalized in 2005, most enforcement of IFQ/IPQ violations, as well as size, sex and season violations occur at offloading. Wildlife Troopers also perform pot and vessel holding tank inspections prior to each fishing season.

The three stocks here in question are not considered common, shared, trans-boundary, straddling, highly migratory fish stocks or high seas fish stocks exploited by two or more States and bound by international agreements. Biological characteristics such as growth, mortality rates, sexual maturity of male and females, effective spawning potential, weight, size and age, migration etc... are considered within existing stock survey and assessment procedures, TAC setting approaches, and existing regulations defining fishery boundaries and seasons. Each of the Bering Sea crab fisheries under assessment are considered discrete stocks (i.e. self sustaining sub-population) and treated as single stocks for management purposes.

Genetically, it is possible to distinguish between populations of red king crab in Alaska. Horizontal starch-gel electrophoresis of proteins has proven to be a powerful tool for the management of many marine species. This technique provides data on the genetic relationships of reproductively isolated stocks, thereby helping scientists to optimally manage these self-recruiting stocks. The lab examined collections of red king crab from thirteen localities in Southeast Alaska, the Aleutian Islands, and the eastern Bering Sea for genetic variation at 42 protein coding loci. The eastern Bering Sea collections from Bristol Bay and Norton Sound were very different from all other collections. The ADFG defines a succinct area under their regulation 5 AAC34.800 Description of Registration Area T, for the single stock red king crab fishery.

ADFG's Gene Conservation Laboratory division has detected regional population differences (e.g., discrete stocks) between blue king crab collected in the BSAI from St. Matthew Island and the Pribilof Islands based on a limited number of variable genetic markers using allozyme electrophoresis methods. Tag-return data from studies by the NMFS on blue king crab in the Pribilof Islands (n = 317) and St. Matthew Island (n = 253) support the idea that legal-sized males do not migrate between the two areas and that larvae are also restricted to each area. St. Matthew Island blue king crab (SMBKC) tend to be smaller than their Pribilof conspecifics, and the two stocks are managed separately. The St. Matthew Island blue king crab fishery is defined by specific district boundaries encompassing the fishable population's location, under 5 AAC 34.905 (C)(2) Description of Registration Area Q districts, Saint Matthew Island Section.

Currently, there is little known about snow crab *C. opilio* genetic population structure within their Pacific/Arctic range and the Eastern Bering Sea stock is managed as a single unstructured (random-mating) population. Genetic analysis of approximately 600 specimens from numerous locations throughout their range was conducted and results are currently being combined with ecological knowledge of the stock to identify whether or not distinct population subunits occur. Research conducted by the ADFG's Gene Conservation Lab found that low levels of geographic differentiation were detected among North Pacific populations of snow crab *C. Opilio* . The lab also included a geographic isolate, North Atlantic *C. opilio*, in the analyses and little differentiation was found in North Atlantic *C. opilio* despite significant geographic separation from Alaskan *C. opilio*.

A recent paper by Parada et al. 2010 highlighted the spatial dynamics of Eastern Bering sea shelf snow crab using an individual-based model (IBM). The mature snow crabs which are sampled in the yearly NMFS surveys for stock assessment purposes do not appear to move outside US waters, rather they remain within the EBS shelf up to depths of 200 m and are generally found between isobaths of 50m (juveniles) and 200 m (mature adults). Ontogenic migration tends to carry snow crab largely south from a northerly direction, within the Eastern Bearing Sea shelf. The district area boundaries for *C. opilio* (snow) crab are defined under 5 AAC 35.505 (e)(1) and (B)(2) Description of Registration Area J districts. The NMFS's snow crab model, vetted through the NPFMC's Crab Plan Team (CPT), treats the population as a single stock.

All sources of mortality and removals are considered by the management system and directed crab fisheries removals are well documented through the eLandings system. NFMS Restricted Access Management (RAM) Division tracks all IFQ/IPQ balances to account for crab catch. Crab bycatch in the groundfish bottom trawl fisheries is accounted for by the groundfish observer program, and crab bycatch caps are in place to limit take. Specific costs incurred during management, research and enforcement of the BSAI crab stocks are largely funded through Congressional appropriations for federal programs. ADFG receives funding from the Alaska Legislature and some from the NMFS.

The BOF and the NPFMC's management arrangements and decision-making processes for the fishery are organized in a very transparent manner. The BOF and the Council provide a great deal of information on their websites, including agenda of meetings, discussion papers, and records of decisions. Both the BOF and the Council actively encourage stakeholder participation, and all BOF and Council deliberations are conducted in open, public sessions. The Crab Rationalization program, first implemented in 1995, was subject to 18-month, two-year, and five-year program reviews. Refinements continue to occur as the program matures.

2. **Management organizations shall participate in coastal area management institutional frameworks, decision-making processes and activities related to the fishery and its users, in support of sustainable and integrated resource use, and conflict avoidance.**

The NMFS in connection with the Council manages all Category 1 measures for crab in the Bering Sea, as defined in the FMP. The NMFS and the NPFMC participate in coastal area management-related institutional frameworks through the federal National Environmental Policy Act (NEPA) processes. This usually happens whenever resources under their management may be affected by other developments and each time they create, renew or amend regulations. Every agency in the executive branch of the Federal Government has a responsibility to implement NEPA. In NEPA, Congress directed that, to the fullest extent possible, the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in NEPA. To implement NEPA's policies, Congress prescribed a procedure, commonly referred to as "the NEPA process" or "the environmental impact assessment process." The NEPA processes provide public information and opportunity for public involvement that are robust and inclusive at both the state and federal levels. When a company applies for a permit (for example, for crossing federal lands or impacting waters of the United States) the agency that is being asked to issue the permit must evaluate the environmental effects of the permit decision under NEPA. Each NPFMC fisheries package (amendments and developments) must go through the NEPA process.

All the fishery agencies have processes, committees and groups that allow potential coastal zone developments and issues to be brought to formal review and engagement such as the NPFMC meetings or the BOF meetings in the case of ADFG. The BOF, in conjunction with the ADFG, is responsible for all Category 2 and 3 BSAI crab management measures. Any proposed changes to the existing management regime by government, industry, or the public must go through a rigorous regulatory review process. During this process department scientists and biologists prepare detailed reports that include the best scientific data available at the time. These are delivered to the BOF and the public for their consideration.

The NPFMC and the BOF tend to avoid conflict by actively involving stakeholders in the process leading up to decision making. The NPFMC and the BOF also have a standing joint committee that meets to resolve management and allocation issues. Both entities provide a great deal of information on their websites, including agenda of meetings, discussion papers, and records of decisions. The Council and the BOF actively encourage stakeholder participation, and all their deliberations are conducted in open, public sessions. Effectively, these meetings provide forums for resolution of potential fisheries conflicts. In addition, stakeholders may review and submit written comments to the NMFS on proposed rules published in the Federal Register.

The primary job of the NPFMC and the BOF is allocation of resources to different users. To do so, they use biological and socio-economic information collected and analyzed by the NMFS and the ADFG. The NPFMC, NMFS and ADFG all have staff economists that participate in the economic, social and cultural evaluation and review process of fishery management proposals. They advise and report the NPFMC and BOF members, as well as their agency heads who help lead the regulation amendment process. On a higher level, the NEPA process has similar requirements - the biological and socio-economic aspects of the fishery must be accounted for before any decision can occur.

The Community Development Quota (CDQ) Program began in December of 1992 with the goal of promoting fisheries related economic development in western Alaska. The program is a federal fisheries program that involves eligible communities who have formed six regional organizations, referred to as CDQ groups. There are 65 communities within a fifty-mile radius of the Bering Sea coastline who participate in the program. The CDQ program allocated a portion of the Bering Sea and Aleutian Island harvest amounts to CDQ groups, including halibut, groundfish (Pollock, Pacific cod, flatfish and rockfish), crab and bycatch species. The CDQ program has been successfully contributing to fisheries infrastructure in western Alaska by funding docks, harbors, vessel acquisition and the construction of seafood processing facilities; and has allowed CDQ groups to acquire equity ownership interests in the halibut, groundfish, and crab sectors that provide additional revenues to fund local in-region economic development projects, and education and training programs.

The coastal zone is monitored as part of the coastal management process using physical, chemical, biological, economic and social parameters. Involvement include federal and state agencies and programs including the U.S. Forest Service, U.S. Fish and Wildlife Service, NMFS Pacific Marine Environmental Lab (PMEL), the Alaska Department of Environmental Conservation (ADEC) Division of Water, ADFG Habitat Division, the AFSC's *"Ecosystem Monitoring and Assessment Program",* The NMFS' Habitat Conservation Division (HCD) and their Essential Fish Habitats (EFH) monitoring and protection program, the U.S. Coast Guard, the NMFS Alaska Regional Office's Restricted Access Management Program (RAM), the Commercial Fisheries Entry commission (CFEC) the Alaska National Interest Lands Conservation Act (ANILCA) federal agencies cooperation directive, and the Department of Natural Resources (DNR) Office of Project Management and Permitting (OPMP) coordinating the review of large scale projects in the state of Alaska.

3. Management objectives shall be implemented through management rules and actions formulated in a plan or other framework.

The Bering Sea crab fishery is managed cooperatively by the ADFG's Division of Commercial Fisheries, the Alaska BOF, the NMFS and the NPFMC. Long-term objectives are outlined in the BSAI Crab FMP. NMFS conducts biological research that is used by the NPFMC's Crab Plan Team to recommend a Total Allowable Catch (TAC) in each fishery. ADFG uses their recommendations along with the best scientific data available at the time to establish catch limits for each of its crab fisheries in the Bering Sea. The BOF and the department also maintain long-term objectives for these fisheries established in regulation and in Annual Management Reports. State regulations for the king and Tanner crab fisheries are listed under the Alaska Administrative Code, Title 5, Chapter 34 and 35.

The MSA, as amended, sets out ten national standards for fishery conservation and management (16 U.S.C. § 1851), with which all fishery management plans must be consistent. In this respect, the BSAI king and Tanner crab FMP lists the following 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: To protect, conserve, and enhance adequate quantities of essential fish habitat (EFH) to support king and Tanner crab populations and maintain a healthy ecosystem; 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 all interested parties; 7) Research and Management Objective: Provide fisheries research, data collection, and analysis to ensure a sound information base for management decisions.

In 1995, NMFS implemented the NPFMC's program of Individual Fishing Quotas (IFQs) for sablefish and Pacific halibut, which were explicitly intended to alleviate excess fishing capacity and improve the economic viability of the fishing industry. In its first few years, the Alaska Commercial Fisheries Entry Commission (CFEC) monitored and evaluated the effects of the IFQ program. Since 1998, NMFS has performed that evaluation, to ensure that the IFQ program continues to achieve its goals. With a Congressionally approved approach creating Processor Quota Shares as well as Individual Fishing Quotas for rationalized crab fisheries in the BSAI in 2005, the numbers of buyers and sellers were capped, seasons were protracted and vessels were able to join cooperatives that resulted in fewer vessels deploying less gear on the grounds. The pot gear deployed is selective, with ADFG mandated escape rings to allow small crab to escape, and biodegradable twine to reduce ghost fishing from lost pots. Since the implementation of the crab rationalization program, the total allowable catch (TAC) for these target fisheries has never been exceeded.

The economic conditions under which fishing industries operate do promote responsible fisheries, as demonstrated in the analysis by NMFS. The NMFS produces a number of reports, including its Annual Report to the Fleet, as well as the mandatory Economic Data Report. ADFG also tracks ex-vessel value of the fisheries they manage, and produces Annual Management Reports. These comprehensive reports are available in either electronic or hard copy.

Conservation of aquatic habitats and biodiversity are integral parts of NPFMC's management process. These concerns and decisions are summarized in the Ecosystems Considerations chapter of the Council's annual Stock Assessment and Fishery Evaluation (SAFE) report. The Council and NMFS have a long history of restricting fishing operations in order to protect endangered and threatened species of marine mammals and birds. Many groundfish fisheries have closed areas or restricted harvest to protect crab and their habitat.

B. Science and Stock Assessment Activities

4. There shall be effective fishery data (dependent and independent) collection and analysis systems for stock management purposes.

The collection, aggregation and use of data in stock assessments for the BSAI crab fisheries are undertaken through collaboration between primarily the NPFMC, the NMFS and ADFG. The fisheries are managed by NPFMC and NMFS Alaska Region with day-to-day management devolved to ADFG. Data collection, analysis and stock assessment of the BSAI crab fisheries respect the NPFMC's BSAI crab FMP requirements.

ADFG and NMFS collect fishery dependant data and undertake fishery-independent surveys for all Bering Sea and Aleutian Islands (BSAI) crab fisheries providing the basis for the assessment of the crab stocks and their impact on the ecosystem. The NMFS annual trawl surveys of the eastern Bering Sea provide indices of relative abundance and biomass for all three fisheries. Full details of the datasets for the three fisheries and their time series can be found in the annual Stock Assessment and Fishery Evaluation (SAFE) reports.

Bristol Bay red king crab. Fisheries data were collected originally by the International North Pacific Fisheries Commission and since 1974 by ADFG. Bycatch data are collected by ADFG and NMFS, and fisheries-independent data from the NMFS annual trawl surveys of the eastern Bering Sea and two recent Bering Sea Fisheries Research Foundation (BSFRF) surveys are used to assess Bristol Bay red king crab. The data are described in the annual SAFE report include total catch, catch per unit effort (CPUE), pot bycatch, trawl bycatch, catch size composition (dependant data); and biomass, size composition and shell condition (independent data).

St Matthew blue king crab. Fisheries data are collected by ADFG, bycatch data by ADFG and NMFS, and fisheries-independent data from the NMFS annual trawl surveys of the eastern Bering Sea and the triennial ADFG pot survey are available for use in assessment of St. Matthew blue king crab, although not all datasets are used in all years. The data are described in the annual SAFE report and include total catch, CPUE, pot bycatch, trawl and fixed gear bycatch, catch size composition (dependant data); and biomass, size composition, shell condition, total catch and CPUE (independent data).

Eastern Bering Sea snow crab. Fisheries data are collected by ADFG, bycatch data by ADFG and NMFS, and fisheries-independent data from the NMFS annual trawl surveys of the eastern Bering Sea and two recent BSFRF surveys. The data are described in the annual SAFE report and include total catch, CPUE, pot bycatch, trawl bycatch, catch size composition (dependant data); and biomass, size composition and shell condition (independent data).

For all the tree units of assessment there are effective fishery data collection systems in place and surveys providing fishery-independent estimates of stock biomass and there are sufficiently long time series of both fishery-dependent and fishery-independent data. In addition to fishery data, annual SAFE reports provide information on ecosystem indicators which may have an impact on BSAI crab stocks. The report considers the physical environment of the BSAI ecosystem including climatic factors, sea ice trends, habitat and ocean acidification, the biological environment of the ecosystem including crab prey and predators of crab, and the physical and biological environmental impacts on crab biology including recruitment, growth and mortality, and provides trends in ecosystem-based management indicators. Recent trends reported in Ecosystem SAFE 2011 report included the

2010/11 winter in the Bering Sea was less cold than expected, sea ice coverage in January to March was less extensive than in recent years, invertebrate biomass was relatively stable and groundfish biomass (especially cod) is increasing in the EBS. The Ecosystem SAFE report also updates current research and identifies future research priorities for BSAI crab stocks with respect to ecosystem interactions. For example, the 2011 report provides a summary of recent modelling work on the potential links between ocean acidification and Bristol Bay red king crab recruitment.

ADFG runs and deploys ADFG observers on vessel participating in the BSAI crab fisheries as an important component of data collection and fishery management. Observers are deployed on all catcher-processor vessels in the crab fisheries, on randomly selected catcher vessels in the Bristol Bay red king crab (BBRKC) and Eastern Bering Sea snow crab (EBSSC) fisheries, but following the closure of the St Matthew blue king crab (SMBKC) fishery in 1999 and the subsequent re-building plan, all vessels in the fishery must carry an observer now that the fishery has re-opened. The on-board observers monitor the fishing position, depth, soak time etc. of the fishing gear, pot contents including samples of the size and shell condition frequency distributions for both total catch and retained crabs, and other biological information. The observers also document total catch, bycatch, effort (and hence catch per unit effort, CPUE), and so the data collected from this observer program can be used in both stock assessment of the fishery and in-season projections of fishery performance. Full observer sampling methods are provided in the 2010 ADFG Crab Observer Training and Deployment Manual.

The BSAI crab FMP also has an economic and social objective which is defined as maximising 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. The socio-economic data as set in the BSAI crab FMP include: 1) the value of crab harvested (adjusted for the amount of crab dying prior to processing and discarded, 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 is 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.

NOAA administrative order 216-100 prescribes policies and procedures for protecting the confidentiality of data submitted to and collected by NMFS. Under agreements with the State, each State data collector collecting confidential data will sign a statement at least as protective as the one signed by Federal employees, which affirms that the signer understands the applicable procedures and regulations and the penalties for unauthorised disclosure.

The Economic and Social Sciences Research Program within NMFS's REFM provides economic and socio-cultural information that assists NMFS in meeting its stewardship programs. Much of the existing economic data about Alaskan fisheries is collected and organized around different units of analysis, such as counties (boroughs), fishing firms, vessels, sectors, and gear groups. These data are reported annually in the Economic SAFE documents.

5. **There shall be regular stock assessment activities appropriate for the fishery, its range, the species biology and the ecosystem, undertaken in accordance with acknowledged scientific standards to support its optimum utilization.**

The NMFS undertakes shellfish stock assessments through its' Eastern Bering Sea trawl survey which provides the primary input to the shellfish assessments. NMFS shellfish assessment programs are coordinated between the ASFC's Kodiak Laboratory and the NOAA/NMFS AFSC in Seattle, Washington. The AFSC is split into a number of Divisions which contribute to research and stock assessment of shellfish. The Resource Assessment and Conservation Engineering (RACE) Division comprises scientists from a wide range of disciplines whose function is to conduct quantitative fishery surveys and related ecological and oceanographic research to describe the distribution and abundance of commercially important fish and crab stocks in the region, and to investigate ways to reduce bycatch, bycatch mortality and the effects of fishing on habitat. Information derived from both regular surveys and associated research are analysed by AFSC stock assessment scientists and supplied to fishery management agencies and to the commercial fishing industry.

Resource Ecology and Fisheries Management (REFM) Division conducts research and data collection to support an ecosystem approach to management of fish and crab resources. More than twenty-five groundfish and crab stock assessments are developed annually and used to set catch quotas. In addition, economic and ecosystem assessments are provided to the Council on an annual basis. The Division also has a socio-economic program whose work includes evaluating economic impacts of fisheries rationalization programs, and compiling and evaluating socio-cultural information on Alaskan communities and traditional ecological knowledge. The Fisheries Monitoring and Analysis Division (FMA) monitors groundfish fishing activities and conducts research associated with sampling commercial fishery catches and estimation of catch and bycatch mortality, and analysis of fishery-dependent data. In relation to the crab assessments, the key role is the oversight of observers who collect groundfish catch and crab bycatch data on board groundfish fishing vessels and quality assurance of the data provided by these observers. In addition an interdisciplinary program, the Habitat and Ecological Processes Research (HEPR) Program develops scientific research that supports implementation of an ecosystem approach to fishery management. Key projects which could be important for understanding crab population dynamics are focused on loss of sea ice, essential fish habitat and ocean acidification.

For the Bristol Bay red king crab fishery, a length-based analysis (LBA) model combines multiple sources of survey, catch and bycatch data using a maximum likelihood approach to estimate abundance, recruitment and catchabilities, catches and bycatch of the commercial pot fisheries and groundfish trawl fisheries.

For the St Matthew blue king crab fishery a three-stage catch-survey analysis (CSA) assesses the male component of the stock incorporating data from commercial catches from the directed fishery and its observer program, the annual EBS trawl survey, triennial pot surveys and bycatch data from the groundfish trawl fishery. This assessment model is in development and has not yet been approved by the CPT, so for 2011 a survey-based assessment was used.

For the Eastern Bering Sea snow crab fishery the stock assessment uses a size and sex-structured model which is fitted to time series of total catch data from the directed fishery and bycatch data from the trawl fishery, size frequency data from the catch in the pot fishery and the bycatch in both the pot and trawl fisheries, and abundance data from the NMFS trawl survey and two recent BSFRF surveys. The assessment provides a range of alternative model scenarios, but all model scenarios indicate that the stock is rebuilt.

Ecosystem SAFE documents are provided yearly to the NPFMC. These reports provide a concise summary of the status of marine ecosystems in Alaska for stock assessment scientists, fishery managers, and the public. One section of the report covers Ecosystem Status and Management Indicators, and provides detailed information and updates on the status and trends of ecosystem components as well as either early signals of direct human effects on ecosystem components that might warrant management intervention or to provide evidence of the efficacy of previous management actions. A major component of the report is an ecosystem assessment that synthesizes historical climate and fishing effects on the eastern Bering Sea/Aleutian Islands and Gulf of Alaska ecosystems using information from the Ecosystem Status and Management Indicators section and stock assessment reports. Notable trends that capture unique occurrences, changes in trend direction, or patterns across indicators are highlighted. An ongoing goal is to produce an ecosystem assessment utilizing a blend of data analysis and modelling to clearly communicate the current status and possible future directions of ecosystems.

The NEPA requires preparation of EISs for major Federal actions significantly affecting the quality of the human environment. An EIS for the BSAI crab fisheries was prepared in 2004 to provide decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative management/rationalization programs, including the rationalization selected by the Council. The EIS considered impacts on safety, harvester efficiency, processing efficiency, and the distribution of benefits between the harvesting and processing sectors, consumers, captains and crew, and affected coastal communities towards a rationalization program for the crab fleet (excluding Norton Sound).

C. The Precautionary Approach

6. **The current state of the stock shall be defined in relation to reference points or relevant proxies or verifiable substitutes allowing for effective management objectives and target. Remedial actions shall be available and taken where reference point or other suitable proxies are approached or exceeded.**

The biomass that is associated with MSY, Bmsy, is effectively treated as the target reference point since it is the desired stock condition (but effective harvest is always lower). Furthermore, MSY itself is treated as an upper limit rather than a target reference point because the overfishing limit (OFL) is based upon MSY. The (lower) limit reference point corresponds to ½ MSY. The harvest rate is decreased when stock biomass is moving from upper to the limit reference point and is reduced to zero when the stock reaches the limit reference point. At that point, a rebuilding plan is implemented.

For tier 3 stocks, the target reference point is $B_{35\%}$ (when spawning biomass is reduced to 35% of the unfished condition), a proxy for Bmsy. The terms “overfishing” and “overfished” are defined as a rate or level of fishing mortality that jeopardises the capacity of a fishery to produce maximum sustainable yield (MSY) on a continuing basis, and thus NPFMC prescribe that the overfishing level (OFL – the catch limit that should never be exceeded) should never exceed the amount that would be taken if the stock were fished at Fmsy or a proxy for Fmsy. Stock status of BSAI crabs are therefore determined by two metrics. Firstly, the stock is considered to be overfished if the stock size is estimated to be below the minimum stock size threshold (MSST). Secondly, overfishing is considered to have occurred if the exploitation level, or fishing mortality, exceeds the fishing mortality at the overfishing level (F_{OFL}), or more intuitively if the total catch exceeds the OFL value.

The NPFMC's fishery management plan (FMP) for BSAI crab stocks outlines the stock status definitions, the criteria used to determine stock status using a five-tier system and the step-by-step framework under which the NPFMC sets final overfishing levels (OFLs) and acceptable biological catches (ABCs). The OFL is the catch level above which overfishing is occurring, and the harvest control rules aim to prevent overfishing by establishing a maximum fishing mortality threshold and using this threshold value to determine annual catch limits. The ABC is the level of annual catch that accounts for scientific uncertainty in the estimate of OFL and other uncertainties. The ABC is set below the OFL. The Annual Catch Limits (ACL) is the level of catch that serves as the basis for invoking accountability measures, and for crab stocks the ACL is set at the ABC. Accountability measures could include seasonal, area and gear allocations, closed areas, bycatch limits, in-season fishery closures, gear restrictions, limited entry, catch shares and observer and vessel monitoring requirements. The TAC is the annual catch target for the fishery which is set at or below the ACL and may take into account uncertainty in the management process and socio-economic factors, or other biological concerns that may affect the reproductive potential of the stock but that are not reflected in the OFL itself.

The status determination criteria for crab stocks are calculated on an annual basis using a five-tier system that accommodates varying levels of uncertainty of information, and incorporates new scientific information providing a mechanism for continually improving the status determination criteria as more information becomes available. For 2010/11 the Crab Plan Team (CPT) recommended that Bristol Bay red king crab and Eastern Bering Sea snow crab should be allocated to Tier 3 and so the OFL should be determined by the $F_{35\%}$ control rule, and that St. Matthew blue king crab should be allocated to Tier 4. Tier 3 is for stocks where reliable estimates of the spawner-recruit relationship are not available, but proxies for Fmsy and Bmsy are estimated. Tier 4 is for stocks where there is insufficient population data to estimate the spawner-recruit relationship, but simulation modelling is used to derive OFLs which capture the historical performance of the fisheries and borrow information from other stocks. Estimation of F_{OFL} requires estimates of current survey biomass, natural mortality rate (M) or proxy, and a scalar, γ, which allows adjustments in the overfishing definitions to account for differences in biomass measures.

For the Bristol Bay red king crab stock the $B_{35\%}$ for 2010/2011 is estimated at 27.3 kt. Mature male biomass (MMB) was estimated at 32.64 kt which equates to 119% of $B_{35\%}$.
For the St Matthew blue king crab stock, the Bmsy proxy is estimated as 3.04 kt. Mature male biomass in 2010/11 was estimated as 6.70 kt which equates to 220% of Bmsy proxy.
For the Eastern Bering Sea snow crab stock, the $B_{35\%}$ for 2010/11 was estimated at 147.5 kt. Mature male biomass (MMB) was estimated at 196.6 kt which is 133% of $B_{35\%}$.

The five tier system was evaluated by a review team appointed by the Committee for Independent Experts (CIE) in 2006, whose report provided important input to the final version of the system now in operation. A full management strategy evaluation (MSE) to assess the robustness of the current Eastern Bering Sea snow crab model has been funded by NPRB for the period 2008-2011. There is strong evidence from the assessments that over the last few years the level of fishing permitted for all three crab stocks has been commensurate with the current state of the fishery resources.

7. **Management actions and measures for the conservation of stock and the aquatic environment shall be based on the Precautionary Approach. Where information is deficient a suitable method using risk assessment shall be adopted to take into account uncertainty.**

The precautionary approach is applied widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment. The MSA, as amended, sets out ten national standards for fishery conservation and management (16 U.S.C. § 1851), with which all fishery management plans must be consistent. The BSAI Crab FMP is consistent with MSA requirements, and the TAC for the three crab stock under assessment is always well below the OFL, corresponding to MSY levels. The FAO Guidelines for the Precautionary Approach (PA) (FAO 1995) advocate a comprehensive management process that includes data collection, monitoring, research, enforcement, and review, prior identification of desirable (target) and undesirable (limit) outcomes, and measures in place to avoid and correct undesirable outcomes, the action to be taken when specified deviations from operational targets are observed (i.e. harvest control rules) and an effective management plan. Lastly, the absence of adequate scientific information should not be used as a reason for postponing or failing to take measures to conserve target species, associated or dependent species as well as non-target species and their environment. The overall management for the Bristol Bay red king crab, Eastern Bearing Sea snow crab and St. Matthews blue king crab comprises all the elements specified in the FAO guidelines for the PA.

Furthermore, Article VIII, Section 4 of the State of Alaska's Constitution, drafted in 1959, is titled Sustained Yield and dictates that: *"Fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial users."* The principle of sustained yield management is a basic tenet of conservation: the annual harvest of a biological resource should not exceed the annual regeneration of that resource. Maximum sustained yield is the largest harvest that can be maintained year after year. State law defines maximum sustained yield as "the achievement and maintenance in perpetuity of a high level annual or regular periodic output of the various renewable resources of the state land consistent with multiple use" (Alaska Statute 38.04.910). The qualifying phrase "subject to preferences among beneficial uses" signals recognition by the delegates that not all the demands made upon resources can be satisfied, and that prudent resource management based on modern conservation principles necessarily involves prioritizing competing uses.

Absence of adequate scientific information and therefore uncertainties is not used as a reason for postponing or failing to take conservation and management measures. The three crab stocks part of this assessment are managed under a tier system rule based on stock knowledge. Status determination criteria for crab stocks are annually calculated using a five-tier system that accommodates varying levels of uncertainty of information. The five-tier system incorporates new scientific information and provides a mechanism to continually improve the status determination criteria as new information becomes available. The lower the tier, the less conservative the determination of OFL/ABC and ACL are. This is because more conservative determinations are at the higher tier levels. The NPFMC treats OFL (MSY) as an upper limit rather than a target. This system is intrinsically precautionary in nature resulting in catches always lower than the overfishing level.

Assessments of each of the three crab fisheries highlight priorities for future research and the assessment authors will respond to requests from a hierarchy of peer-reviewers through the CPT, SSC and external reviews (e.g. CIE) to conduct either re-analysis of data currently available or new research to generate additional data and/or information.

D. Management Measures

8. **Management shall adopt and implement effective measures including; harvest control rules and technical measures applicable to sustainable utilization of the fishery and based upon verifiable evidence and advice from available scientific and objective, traditional sources.**

The NPFMC's FMP for BSAI crab stocks outlines the harvest strategy and harvest control rule, the stock status definitions, the criteria used to determine stock status using a five-tier system and the step-by-step framework under which the NPFMC sets final overfishing levels (OFLs) and acceptable biological catches (ABCs). The MSA requires that the Science and Statistical Committee (SSC) of the NPFMC determines the scientific benchmarks while the Council itself recommends quotas based on these benchmarks. This separation of responsibilities is a key step forward in the goal of eliminating overfishing and enhancing recovery of overfished stocks.

Dynamiting, poisoning and other comparable destructive fishing practices are prohibited in Alaska. The Federal Bering Sea/Aleutian Islands Fishery Management Plan authorizes the use of pot gear (and ring nets, although not used) to harvest the crab resources. Trawls and tangle nets are specifically prohibited because of the high mortality rates which they inflict on non legal crab. Title 5 of Fish and Game, Chapter 34 and 35 of the Alaska Administrative Code (5 AAC 34 and 35) specify "lawful gear" (i.e. size, dimension, internal structure etc...) for king and tanner crab respectively (as well as all other state requirements).

The Crab rationalization program has experienced extensive public review. It allocates BSAI crab resources among harvesters, processors, and coastal communities who have been involved with and/or were dependent upon these fisheries. The NPFMC developed the Program over a 6-year period to accommodate the specific dynamics and needs of the BSAI crab fisheries. The Program was implemented in 2005 builds on the Council's experiences with the halibut and sablefish Individual Fishing Quota (IFQ) program and the American Fisheries Act (AFA) cooperative program for Bering Sea pollock. The Program is a limited access system that balances the interests of several groups who depend on these fisheries. The Program addresses conservation and management issues associated with the previous derby fishery, reduces bycatch and associated discard mortality, and increases the safety of crab fishermen by ending the race for fish. Share allocations to harvesters and processors, together with incentives to participate in fishery cooperatives, increases efficiencies, provides economic stability, and facilitates compensated reduction of excess capacities in the harvesting and processing sectors. Community interests are protected by Community Development Quota (CDQ) allocations and regional landing and processing requirements, as well as by several community protection measures.

The crab fisheries in the Bering Sea are limited entry rationalized fisheries. Capacity of these fisheries has been reduced since 2002. Fleet consolidation accompanying rationalization was substantial. In both the Bristol Bay red king crab and Bering Sea snow crab fisheries, the annual average post-rationalization fleet was roughly one-third of the size of the pre-rationalization fleet. The capacity of the crab fleet is fixed since 2006 and continuously monitored by RAM and CFEC. The NMFS's Restricted Access Management Program (RAM) responsibilities include: providing program information to the public, determining eligibility and issuing permits, processing transfers, collecting landing fees and related activities. The Alaska Commercial Fisheries Entry Commission (CFEC) helps to conserve and maintain the economic health of Alaska's commercial fisheries by limiting the number of participating fishers. CFEC issues permits and vessel licenses to qualified individuals in both limited and unlimited fisheries, and provides due process hearings and appeals as and when needed.

The BSAI crab 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 (but virtually only pots are used) for capturing crab in the BSAI area. Escape mechanisms may be incorporated or mesh size adjusted to allow female and sublegal male crab to escape. Crabbers are constructing pots with larger web on the panels to allow for female and juvenile crab to exit the pot before the gear is hauled back by the vessel. Also, fewer pots being used in the crab fisheries after rationalization of the BSAI fisheries results in less impact on the marine habitat. The yearly marine habitat footprint of the directed crab fisheries is now less than ½ square mile for the entire Bering Sea and Aleutian Islands. For escape of non-target crabs, a minimum size of 9" stretched mesh on one third of one vertical panel is required for pots used in the Bristol Bay Red king crab fishery. Pots used to take snow crab must have at least eight escape rings with an inside diameter measure of no less than four inches placed within one mesh measurement from the bottom of the pot, with four escape rings on each of two sides of a four-sided pot, or one-half of one side of a four-sided pot must have a side panel composed of not less than five and one-quarter inch stretched mesh webbing to permit escapement of undersize snow crab. In the Saint Matthew Island area, each king crab pot must have eight escape rings with an inside diameter measure of 5.8 inches placed within one mesh measurement from the bottom of the pot, with four escape rings on two sides of a four-sided pot, or if the pot has no escape rings as specified in this paragraph, then one-half of one side of a four-sided pot must have a side panel composed of net less than eight-inch stretched mesh webbing. A common requirement for the three fisheries is 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. Regulation imposes that undersized males and females must be promptly discarded from crab vessels to decrease handling mortality rates.

As the male crab of marketable size are separated from the rest of the catch and placed into circulating water tanks, the crab to be discarded are returned to the sea in a variety of methods including direct release at sea, chutes and ramps. With longer fishing seasons, fishermen are allowed to improve fishing methods, such as gear operation and sorting on deck, and improve handling methods and reduce handling mortality. Additional operational flexibility is being evaluated under NPRB project 917, evaluating handling mortality in the snow crab fishery. The final component of this study, field observations on the effects of cold weather on handling mortality, is been conducted during the winter's 2012 fishery. Also, State regulations impose marking requirements on pot gear used in the rationalized crab fisheries.

The Federal BSAI Crab FMB describes fishing season requirements. Fishing seasons are used to protect king and Tanner crabs during the molting and mating portions of their life cycle. Also there are groundfish closure areas, or trawl protection areas, to minimize the impact of groundfish harvests on crab resource. In addition, Section 4.0 of the BSAI Crab FMP addresses the requirement in EFH regulations (50 CFR 600.815(a)(2)(i)) that each FMP must contain an evaluation of the potential adverse effects of all regulated fishing activities on EFH. This evaluation assesses whether fishing adversely affects EFH in a manner that is more than minimal and not temporary in nature (50 CFR 600.815(a)(2)(ii)). This standard determines whether Councils are required to act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable.

9. There shall be defined management measures designed to maintain stocks at levels capable of producing maximum sustainable levels.

As specified in the BSAI crab FMP, there are clearly defined management measures designed to maintain the crab stocks at levels capable of producing maximum sustainable levels. These include harvest strategy and harvest control rule, stock status definitions, criteria used to determine stock status using a five-tier system and the step-by-step framework under which the NPFMC sets final overfishing levels (OFLs) and acceptable biological catches (ABCs).

After rationalization of the Crab fisheries in the BSAI, vessel numbers have decreased and there has been a slower paced fishery, with decreased rates of lost fishing gear and allowing for longer soak times and more time for the gear to work sorting undersized and females crab from the harvest. The selectivity of pot gear in regards to bycatch of juvenile and female crab is regulated by requirement of escape rings, specific mesh panel webbings, sorting tables and chutes on board of vessels (to decrease handling mortality) as discussed in the immediate clauses above. Pot gear used to fish for crab in the BSAI appears to be relatively selective. The vast majority of bycatch species in each of the three fisheries under assessment are mostly crab. No evidence is available to indicate that technical devices are negatively affecting or circumventing regulations aimed at defining requirements for fishing selectivity or to reduce fishing impacts.

The St Matthew Blue King crab fishery was declared overfished and closed in 1999 when the stock size estimate was below the MSST (limit reference point). In November of 2000, Amendment 15 to the FMP was approved to implement a rebuilding plan for the St. Matthew Island blue king crab stock. In 2008/09 and 2009/10, the MMB was above Bmsy for two years and was declared rebuilt in 2009.

In 2000, the decline in abundance of EBS snow crab caused the declaration of the stock as overfished. After 2000, a rebuilding strategy was developed based on simulations by Zheng (2002). The currency for estimating BMSY changed during the 10 year rebuilding period. Using the current definitions for estimating BMSY, and the Model results for any scenario presented in the 2011 Crab SAFE report, the snow crab stock was above BMSY for the last three years (2008/09, 2009/10 and 2010/11). The total mature observed survey biomass in 2011 was 447,400 t which is also above the Bmsy (418,150 t) in place under the rebuilding plan implemented in 2000.

Also, the MSA includes provisions concerning the identification and conservation of Essential Fish Habitat (EFH). The MSA defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” EFH are necessary to maintain stocks capable of producing maximum sustainable yields. The NMFS and the NPFMC must describe and identify EFH in FMPs, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other actions to encourage the conservation and enhancement of EFH. Federal agencies that authorize, fund, or undertake actions that may adversely affect EFH must consult with NMFS, and NMFS must provide conservation recommendations to federal and state agencies regarding actions that would adversely affect EFH.

At present, there is an area of overlap between current female red king crab distribution and areas where trawling occurs in the southern Bristol Bay. Most of the distribution of red king crab was to the north and east of the high fishing effects areas during the past 15 years. However, a high density of mature female crab were found in the heavy trawling area during 2008-2009, and it appears that mature female crab moved back to the historical important spawning ground in the southern Bristol Bay. Given the current overlap, trawling intensity in the southern Bristol Bay, and the importance of the spawning ground there, professional judgement indicates that trawling fisheries have currently adversely affected the EFH of red king crab. This heavy trawling could impact the stock recovery and jeopardize the ability of the stock to produce MSY over the long term. In this regard, a staff discussion paper is been developed by the Council and the NMFS in March 2012. Seven options for Council action have been proposed including establishment/extension of trawl closures, seasonal closures or designation of habitat areas of particular concern (HAPC). This specific item is scheduled next for discussion on the Council session post the October 2012 meeting.

The three BSAI crab fisheries under assessment are well developed commercial fisheries. The needs of rural coastal communities have been taken into account through the CDQ program. Those communities receive 10% of the total TAC for each of the crab species.

10. Fishing operations shall be carried out by fishers with appropriate standards of competence in accordance with international standards and guidelines and regulations.

The North Pacific Fishing Vessel Owners association (NPFVO) provides a large and diverse training program that many of the professional crew members must pass. Training ranges from firefighting on a vessel, damage control, man- overboard, MARPOL, etc., and The Sitka-based Alaska Marine Safety Education Association alone has trained more than 10,000 fishermen in marine safety and survival through a Coast Guard-required class on emergency drills. The State of Alaska, Department of Labor & Workforce Development (ADLWD) includes AVTEC (formerly called Alaska Vocational Training & Education Center, now called Alaska’s Institute of Technology).

One of AVTEC’s main divisions is the Alaska Maritime Training Center. The goal of the Alaska Maritime Training Center is to promote safe marine operations by effectively preparing captains and crew members for employment in the Alaskan maritime industry. The Alaska Maritime Training Center is a United States Coast Guard (USCG) approved training facility located in Seward, Alaska, and offers USCG/STCW-compliant maritime training. (STCW is the international Standards of Training, Certification, & Watchkeeping.) In addition to the standard courses offered, customized training is available to meet the specific needs of maritime companies. Courses are delivered through the use of their world class ship simulator, state-of-the-art computer-based navigational laboratory, and modern classrooms equipped with the latest instructional delivery technologies. The Center’s mission is to provide Alaskans with the skills and technical knowledge to enable them to be productive in Alaska’s continually evolving maritime industry. Supplemental to their on-campus classroom training, the Alaska Maritime Training Center has a partnership with the Maritime Learning System to provide mariners with online training for entry-level USCG Licenses, endorsements, and renewals.

The University of Alaska Sea Grant Marine Advisory Program (MAP) provides education and training in several sectors, including fisheries management, in the forms of seminars and workshops. MAP also conducts sessions of their Alaska Young Fishermen’s Summit. Each Summit is an intense course in all aspects of Alaska fisheries, from fisheries management & regulation (e.g. MSA), to seafood markets & marketing. The 2012 AYFS was held February 13th and 14th in Juneau, AK. The two-day conference aimed at providing crucial training and networking opportunities for fishermen entering the business or wishing to take a leadership role in their industry. The event took advantage of the Juneau location by introducing participants to the legislative process, and introducing the fish caucus of the legislature to the issues and concerns of Alaska’s emerging fishermen. In addition to this, MAP provides training and technical assistance to fishermen and seafood processors in Western Alaska. A number of training courses and workshops were developed in cooperation with local communities and CDQ groups. Additional education is provided by the Fishery Industrial Technology Center, in Kodiak, Alaska.

The Restricted Access Management Program (RAM) is responsible for managing Alaska Region permit programs, including those that limit access to the Federally-managed fisheries of the North Pacific. RAM responsibilities include: providing program information to the public, determining eligibility and issuing permits, processing transfers, collecting landing fees and related activities. The Alaska Commercial Fisheries Entry Commission (CFEC) helps to conserve and maintain the economic health of Alaska's commercial fisheries by limiting the number of participating fishers. CFEC issues permits and vessel licenses to qualified individuals in both limited and unlimited fisheries, and provides due process hearings and appeals as and when needed. The RAM division as well as the CFEC maintain on their websites, all the fishermen records for which fishing permits are issued.

E. Implementation, Monitoring and Control

11. **An effective legal and administrative framework shall be established and compliance ensured through effective mechanisms for monitoring, surveillance, control and enforcement for all fishing activities within the jurisdiction**.

The NMFS Office of Law Enforcement with use of the United States Coast Guard's at-sea platforms is primarily responsible for enforcing crab regulations at sea, while the NMFS Office of Law Enforcement and the State of Alaska's Division of Wildlife Troopers (AWT) have that responsibility ashore. AWT spends about 90% of their effort doing dockside enforcement of offloaded crab (although the AWT vessel E/V Stinson does at-sea enforcement, checking gear and catch for legal specification). Because the fishery was rationalized in 2005, most enforcement of IFQ/IPQ violations, as well as size, sex and season violations occur at offloading. Wildlife Troopers also perform pot and vessel holding tank inspections prior to each fishing season. More generally, AWT personnel check state regulations, permits, gear and catch.

Any vessel used to harvest crab in the rationalized crab fisheries must have a functioning VMS transmitter on board. NMFS'OLE is able to detect through the VMS signal whether a boat is fishing or transiting in an area and through those data they can base their enforcement decisions to act against potential violators.
Fishing vessels are not allowed to operate on the resource in question without specific authorization. All crab vessels participating in the BSAI rationalized crab fishery must obtain a Federal Crab Vessel Permit (FCVP). A copy of the permit must be on board any vessel of the fishery and must be available for inspection at any time by an authorized officer. As of January 1, 2000 a Federal License Limitation Program (LLP) license is required for vessels participating in directed fishing for LLP groundfish species in the GOA or BSAI, or fishing in any BSAI LLP crab fisheries. A vessel must be named on an original LLP license that is onboard the vessel. The LLP is authorized in Federal regulations at 50 CFR 679.4(k), definitions relevant to the program are at 679.2, and prohibitions are at 679.7. All such vessels will also possess a State of Alaska CFEC permit if they make a commercial landing. The entire crab harvests are conducted in Alaskan waters by American vessels. No foreign fleet is allowed to fish in the Alaska's EEZ. All fishing vessels must be at least 75% U.S. ownership.

12. There shall be a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations.

In Alaska waters, enforcement policy section 50CFR600.740 states:

(a) The MSA provides four basic enforcement remedies for violations, in ascending order of severity, as follows: (1) Issuance of a citation (a type of warning), usually at the scene of the offense (see 15 CFR part 904, subpart E). (2) Assessment by the Administrator of a civil money penalty. (3) For certain violations, judicial forfeiture action against the vessel and its catch. (4) Criminal prosecution of the owner or operator for some offenses. It shall be the policy of NMFS to enforce vigorously and equitably the provisions of the MSA by utilizing that form or combination of authorized remedies best suited in a particular case to this end.

(b) Processing a case under one remedial form usually means that other remedies are inappropriate in that case. However, further investigation or later review may indicate the case to be either more or less serious than initially considered, or may otherwise reveal that the penalty first pursued is inadequate to serve the purposes of the MSA. Under such circumstances, the Agency may pursue other remedies either in lieu of or in addition to the action originally taken. Forfeiture of the illegal catch does not fall within this general rule and is considered in most cases as only the initial step in remedying a violation by removing the ill-gotten gains of the offense.

(c) If a fishing vessel for which a permit has been issued under the MSA is used in the commission of an offense prohibited by section 307 of the MSA, NOAA may impose permit sanctions, whether or not civil or criminal action has been undertaken against the vessel or its owner or operator. In some cases, the MSA requires permit sanctions following the assessment of a civil penalty or the imposition of a criminal fine. In sum, the MSA treats sanctions against the fishing vessel permit to be the carrying out of a purpose separate from that accomplished by civil and criminal penalties against the vessel or its owner or operator.

The "Policy for the Assessment of Civil Administrative Penalties and Permit Sanctions" issued by NOAA Office of the General Counsel – Enforcement and Litigation on March 16, 2011, provides guidance for the assessment of civil administrative penalties and permit sanctions under the statutes and regulations enforced by NOAA. The purpose of this Policy is to ensure that: (1) civil administrative penalties and permit sanctions are assessed in accordance with the laws that NOAA enforces in a fair and consistent manner; (2) penalties and permit sanctions are appropriate for the gravity of the violation; (3) penalties and permit sanctions are sufficient to deter both individual violators and the regulated community as a whole from committing violations; (4) economic incentives for noncompliance are eliminated; and (5) compliance is expeditiously achieved and maintained to protect natural resources. Under this Policy, NOAA expects to improve consistency at a national level, provide greater predictability for the regulated community and the public, improve transparency in enforcement, and more effectively protect natural resources. For significant violations, the NOAA attorney may recommend charges under NOAA's civil administrative process (*see* 15 C.F.R. Part 904), through issuance of a Notice of Violation and Assessment of a penalty (NOVA), Notice of Permit Sanction (NOPS), Notice of Intent to Deny Permit (NIDP), or some combination thereof. Alternatively, the NOAA attorney may recommend that there is a violation of a criminal provision that is sufficiently significant to warrant referral to a U.S. Attorney's office for criminal prosecution.

The Marine Division of AWT and the State of Alaska Department of Law pursue a very aggressive enforcement policy. They attend the BOF and are integral into the process for regulation formulation and legislation, analogous to the USCG attendance and input in the Council process.

AWT has Statutory / Regulatory legislation pertaining to their Authority: AS 16 Fish & Game, 5AAC Fish & Game, 20 AAC Commercial Fishing, AS 11 Criminal, AS 46 Environment, AS 44 State Government, AS 02 Aeronautics, AS 18 Health & Safety. A State violation is a criminal violation (strict liability).

F. Serious Impacts of the Fishery on the Ecosystem

13. **Considerations of fishery interactions and effects on the ecosystem shall be based on best available science, local knowledge where it can be objectively verified and using a risk based management approach for determining most probable adverse impacts. Adverse impacts on the fishery on the ecosystem shall be appropriately assessed and effectively addressed.**

The purpose of the Crab Ecosystem Considerations and Indicators (CECI) report is to consolidate ecosystem information specific to the crab stocks in the BSAI FMP. The CECI report will serve as an appendix to the BSAI King and Tanner crab SAFE document.

First, the Ecosystem Assessment portion of the document provides a historical overview of the physical and biological environment of the BSAI ecosystem utilized by crab species as well as aspects of crab life history such as survival, recruitment, growth, maturity and natural mortality which are known to be impacted by changes in the BSAI ecosystem.
Secondly, the Current Status of Ecosystem Indicators chapter provides current information and updates on the status of pelagic and benthic habitat variables and biological components including prey availability, their abundance, and distribution and abundance of competitors and predators.
The final section, the Ecosystem-based Management Indicators, provides trends which could indicate early warning signals of direct fishery effects on crab-oriented BSAI ecosystem components, warranting management intervention or providing evidence of the efficacy of previous management actions. Specific indicators include the magnitude of directed fishery effects on BSAI habitat and resulting management efforts, and spatial and temporal removals of the target catch affecting other biological predators. In this section, potential fishery effects on crab biology such as changes in age and size at maturity, and reproduction are reviewed.
NOAA also supports the Fisheries And The Environment (FATE) program to ensure the sustainable use of US fishery resources under a changing climate. The focus of FATE is on the development, evaluation, and distribution of leading ecological and performance indicators.
The North Pacific ecosystem status report is a contribution by the North Pacific Marine Science Organization (PICES) to identify, describe, and integrate observations of change in the North Pacific Ocean that are occurring now, and have occurred during the past several years.
The North Pacific Research Board (NPRB) was created by Congress in 1997 to conduct research activities on or relating to the fisheries or marine ecosystems in the North Pacific Ocean, Bering Sea, and Arctic Ocean with a priority on cooperative research efforts designed to address pressing fishery management or marine ecosystem information needs. Also, for the Bering Sea, a large multiyear ecosystem project is winding towards completion. It consists of two large projects that will be integrated, the Bering Ecosystem Study (2007-2010) and the Bering Sea Integrated Ecosystem Research Program (2008-2012). The overlapping goals of these projects led to a partnership that brings together some $52 million worth of ecosystem research over six years, including important contributions by NOAA and the US Fish & Wildlife Service.

The Council has and will continue to consider habitat protection measures, they are particularly tasked with the assessment of Essential Fish Habitat as it pertains to managed species such as BSAI crab species. The largest impact resulting from human activities on the BSAI crab resources, and more specifically, on the 3 stocks here under consideration is fishing. Directed crab fishing as well as crab bycatch in other fisheries such as the groundfish fisheries is assessed yearly and corrected appropriately through yearly stock assessment activities, and through the formulation of overfishing levels, allowable biological catch and allowable catch limits. Also, effects on EFH caused by fishing activities such as trawling are routinely assessed and corrected where possible. The last EFH review (2010) identified impacts of trawling on EFH habitat of red King Crab in Bristol Bay. This is being considered by the NPFMC and is an active item for discussion past the October 2012 Council Session. In the BSAI crab fisheries Final Environmental Impact Statement (EIS), the impact of pot gear on benthic EBS species is discussed. Benthic species examined included fish, gastropods, coral, echinoderms (sea stars and sea urchins), non-target crab, and invertebrates (sponges, octopuses, anemones, tunicates, bryozoans, and hydroids). The total portion of the EBS impacted by commercial pot fishing may be less than 1% of the shelf area and with conclusion that BSAI crab fisheries have an insignificant effect on benthic habitat.

Habitat protection areas, prohibited species caps (PSC) and crab bycatch limits are in place to protect important benthic habitat for crab and other resources and reduce crab bycatch in the trawl and fixed gear fisheries. Beginning in 1995, the Pribilof Islands Conservation Area was closed to all trawling and dredging year-round to protect BKC habitat. Also beginning in 1995, the Red King Crab Savings Area was established as a year-round bottom trawl and dredge closure area. To protect juvenile RKC and critical rearing habitat (stalked ascidians and other living substrate), another year-round closure to all trawling was implemented in 1996 for the nearshore waters of Bristol Bay. The Bering Sea Habitat Conservation Area, Northern Bering Sea Research Area, Nunivak Island, Etolin Strait, and Kuskokwim Bay Habitat Conservation Area, St. Lawrence Island Habitat Conservation Area, and St. Matthew Island Habitat Conservation Area were closed to non-pelagic gear in 2008. PSC limits are in place for RKC, Tanner and snow crab. If PSC limits are reached in predetermined bottom trawl fisheries executed in specific areas, those fisheries are closed. A recent review of the PSC limits for commercial crab species in groundfish fisheries is detailed in *Crab Bycatch in the Bering Sea/Aleutian Island Fisheries* (NPFMC 2010). Annual crab bycatch limits (CBLs) are specified for RKC, Tanner and snow crab in the scallop fishery in the Bering Sea, Registration Area Q, and are calculated as a percentage of the most recent abundance estimate of RKC, Tanner and snow crab in Registration Area Q.

The CPT presented a discussion paper to the NPFMC in March 2011 evaluating the effects of groundfish fishing on essential fish habitat for RKC. The discussion paper highlighted the interaction between trawl fishing and ovigerous female RKC in the southwest area of Bristol Bay, an area with potentially higher survival rates for larval and juvenile RKC. The NPFMC requested further analysis on the effectiveness of the RKC Savings Area and the Nearshore Bristol Bay Trawl Closure with respect to the impact of fishing gear on seafloor habitat.

The EBS crab fisheries catch a small amount of other species as bycatch. A limited number of groundfish, such as Pacific cod, Pacific halibut, yellowfin sole, and sculpin are caught in the directed pot fishery. The invertebrate component of bycatch includes echinoderms (stars and sea urchin), snails, non-FMP crab (hermit crabs and lyre crabs), and other invertebrates (sponges, octopus, anemone, and jellyfish). Typically, low levels of bycatch of these species do not impact their abundance. As noted in the Endangered Species Act EIS report, crab fisheries do not adversely affect ESA listed species, destroy or modify their habitat, or comprise a measurable portion of their diet.

There are few species identified as predators of legal-sized male crab and specific information is limited due to the difficulty of identifying prey items to the species level with only partial carapace or dactyl pieces. Based on food habits data collected in the summer months during the annual EBS bottom trawl survey, Pacific cod, Pacific halibut and skates are the primary predators of large or legal size crab although legal-sized crab are a minimal component of these predators diets.

It is possible that male-only fisheries with minimum size limits reduce the abundance of large crab; however this has not been examined for Bering Sea crab stocks. Over time, size-at-maturity may be reduced due to fishing-induced mating selection in male-only fisheries. For example significant decline in size at 50% maturity of male Bristol Bay Tanner crab may be the result of genetic responses to the fishery. In the EBS, female snow crab sperm reserves increase with female size and appear to generally be lower than other snow crab stocks. Limited sperm reserve data from EBS snow and Tanner crab suggest that in 2005 less than one half of primiparous females sampled had sufficient sperm reserves to fertilize a full second clutch of eggs. Alternately, in northern California, nearly all molting female Dungeness crab mate regardless of size despite intense fishing on males. The short and long term effects of removing large male crab from a population are not well understood and may vary by species and population.

The EPA and Alaska Department of Environmental Conservation (ADEC) Regulations are in place that required used gear to be landed in ports for disposal. Other types of pollution (oil, chemicals, waste, harmful substances and garbage) are controlled under MARPOL and implemented under US Coast Guard, EPA or ADEC regulations. Their regulations are in many cases more stringent and broader in nature. All of these agencies have regulations that require individuals or industry to comply with their standards and expeditiously report any infractions to those regulations.

Please note that in the following Section (7), all mentions of “States” are meant as “countries.

6.1. Conformity statement

The Assessment Team recommend that the management system of the applicant fishery, the U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries [Bristol Bay Red King Crab *(Paralithodes camtschaticus)*, Eastern Bering Sea Snow Crab *(Chionoecetes opilio)* and St. Matthew Island Blue King Crab (*Paralithodes platypus)*] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) and subject to a federal [National Marine Fisheries Service (NMFS)/North Pacific Fishery Management Council (NPFMC)] and state [Alaska Department of Fish and Game (ADFG) & Board of Fisheries (BOF)] joint management regime, is certified against the FAO-Based Responsible Fisheries Management Certification Program.

6.2. Future Surveillance Actions

To maintain certification, surveillance assessments are carried out on an annual basis with a full re-assessment taking place for the fifth anniversary of certification. The surveillance assessment will be carried out as outlined for Global Trust Certification quality procedure. Two items are noted for future surveillance review.

Clauses 9.1, 13.1.1, 13.1.4, 13.5.	The last EFH review (2010) identified impacts of trawling on EFH habitat of red King Crab in Bristol Bay. These are being considered accordingly by the NPFMC. Summary of Effects - There is an area of overlap between current female red king crab distribution and areas where trawling occurs in the southern Bristol Bay. Southern Bristol Bay is an important spawning ground for red king crab and heavy trawling there could greatly impact the crab spawning success. Trawling in deeper waters also somewhat overlaps the migration route to mating areas. There are essentially no fishing effects in areas important to juvenile red king crab. All known juvenile rearing areas are currently protected by trawl closure areas. Most of the distribution of red king crab was to the north and east of the high fishing effects areas during the past 15 years. However, a high density of mature female crab were found in the heavy trawling area during 2008-2009, and it appears that mature female crab moved back to the historical important spawning ground in the southern Bristol Bay. **Given the current overlap, trawling intensity in the southern Bristol Bay, and the importance of the spawning ground there, professional judgement indicates that trawling fisheries have currently adversely affected the EFH of red king crab.** This heavy trawling could impact the stock recovery and jeopardize the ability of the stock to produce MSY over the long term. Beyond trawling in the southern Bristol Bay, other fishing may have minimum impacts on red king crab EFH. In this regard, a staff discussion paper is been developed by the Council and the NMFS in March 2012. Here, options for Council action include: •Revise the effects of EFH evaluations. •No management action, but encourage further research in this area to better understand adult, juvenile and larval distribution and habitat usage. •Extend or establish trawl closure areas in the affected area as EFH conservation measures. •Extend the range of the red king crab savings area to protect more of the stock. •Apply a seasonal closure to protect the adult female red king crab from March

	to May during molting and mating. •Close area southwest of Amak Island. •Designate a HAPC priority for areas important for red king crab egg hatching, and consider designating this area as a HAPC. This specific item is scheduled for discussion on the Council session post October 2012 meeting and will be reviewed accordingly by the assessment team. http://www.fakr.noaa.gov/npfmc/PDFdocuments/conservation_issues/EFH/EFHDiscPaper411.pdf
Clause 13.1.2	Directed Fishery Effects on Target Crab, Age-At-Maturity and Reproduction In the BSAI, minimum size limits for male crab are established based upon the estimated average size-at maturity with the intent of allowing males to mate at least once before becoming harvestable. Females are not harvested and fishing seasons are timed to protect the crab when they are molting and mating (NPFMC 2008). It is possible that male-only fisheries with minimum size limits reduce the abundance of large crab; however this has not been examined for Bering Sea crab stocks. The short and long term effects of removing large male crab from a population are not well understood and may vary by species and population according to available evidence. The assessment team will verify next year if new information has been made available to improve understanding of this delicate subject. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf

7. FAO-Based RFM Conformance Criteria Assessment Outcome

A. The Fisheries Management System

1. There shall be a structured and legally mandated management system based upon and respecting International, National and local fishery laws, for the responsible utilization of the stock under consideration and conservation of the marine environment. ***FAO CCRF 7.1.3/7.1.4/7.1.9/7.3.1/7.3.2/7.3.4/7.6.8/7.7.1/10.3.1*** ***FAO Eco 28***						
Confidence Ratings	**Low**	**0 out of 9**	**Medium**	**0 out of 9**	**High**	**9 out of 9**

Clause:

1.1 There shall be an effective legal and administrative framework established at the local and national level appropriate, for fishery resource conservation and management.

FAO CCRF *7.7.1*

FAO Eco 28

Evidence adequacy rating:

☑**High** ☐ **Medium** ☐ **Low**

Clause	Evidence
1.1	**There is an effective legal and administrative framework established at the local and national level appropriate, for fishery resource conservation and management.** Alaska's Bering Sea/Aleutian Islands (BSAI) crab are managed under the Fishery Management Plan (FMP) for Commercial King and Tanner Crab approved by the United States Secretary of Commerce on June 2, 1989. The FMP was developed by the North Pacific Fishery Management Council (NPFMC) and their Crab Plan Team, submitted to the National Marine Fisheries Service for public review and comment, with the final product being sent to the Secretary of Commerce. The NPFMC is one of eight regional councils established by the Magnuson-Stevens Fishery Management and Conservation Act (MSFMCA or MSA) to oversee management of the nation's fisheries. MSA is the primary layer of governance for Bering Sea crab fisheries. The MSA sets out ten national standards for fishery conservation and management (16 U.S.C. § 1851), with which all FMPs must be consistent. Under the MSA, the NPFMC is authorized to prepare and submit to the Secretary of Commerce for approval, disapproval or partial approval, a FMP and any necessary amendments

	that regulate conservation and management for each fishery under its authority. While the NPFMC has responsibility for crab management in the BSAI, the FMP establishes a State/Federal cooperative management regime that defers crab management to the State of Alaska with partial Federal oversight. http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf The NMFS Alaska Fisheries Science Center in Seattle and the Kodiak Fisheries Research Center (KFRC) generate the scientific information and analysis necessary for the conservation, management, and utilization of the region's crab resources. http://www.afsc.noaa.gov/ and http://www.afsc.noaa.gov/Kodiak/default.htm The KFRC has the primary facility for the Alaska Fisheries Science Center's (AFSC) RACE Shellfish Assessment Program. The king and Tanner crab FMP is a "framework" plan, allowing for long-term management of the fishery without needing frequent amendments. All fisheries activities and decisions are subject to conditions established by the MSA as well as actions taken by the Alaska Board of Fisheries for all management Category 2 and 3 measures (e.g size, season, sex, reporting requirements etc) under the FMP. The FMPs are written and amended subject to MSA. Category 2 and 3 management measures are subject to Alaska State Statutes and regulations. http://alaskafisheries.noaa.gov/npfmc/fishery-management-plans/crab.html http://www.adfg.alaska.gov/index.cfm?adfg=fishregulations.commercial The 1989 FMP was developed jointly with the BOF, ADFG, NPFMC, CPT and the public/stakeholders. The BOF rejected the first draft and the plan was not adopted until the state agreed on what it considered to be the proper state/federal balance to management. ADFG is clearly a strong participant in crab research, both at headquarters (HQ), Dutch Harbor and Kodiak, where a dedicated staff of approximately 30 individuals participate in management and research (e.g. most of the exploitation models used by the CPT were developed by HQ staff). The state annually spends $2 million, derived from state general fund and test fish funds, on Bering Sea crab research and management. It also receives approximately $800,000 in federal crab rationalization fees and some fees for Bering Sea crab research from Congress. The NMFS Office of Law Enforcement with use of the United States Coast Guard's at-sea platforms is primarily responsible for enforcing crab regulations at sea, while the NMFS Office of Law Enforcement and the State of Alaska's Division of Wildlife Troopers (AWT) have that responsibility ashore. Because the fishery was rationalized in 2005, most enforcement of IFQ/IPQ violations, as well as size, sex and season violations occur at offloading. Wildlife Troopers also perform pot and vessel holding tank inspections prior to each fishing season (personal communications with Lt. Will Ellis, AWT "C" Detachment Supervisor, January 18, 2011). The NPFMC and NMFS sets overfishing levels (OFL), determines all sources of mortality, and makes numerous management decisions via consultation with the NFMS Restricted Access Management Division (RAM) on Individual Fishing Quotas/Individual Processor Quotas. https://alaskafisheries.noaa.gov/webapps/crabaccounts/Login	

Clause:

1.2 Management measures shall take into account the whole stock unit over its entire area of stock distribution.

1.2.1 The area through which the species migrates during its life cycle shall be considered by the management system.

1.2.2 The biological unity and other biological characteristics of the stock shall be considered within the management system.

FAO ECO 30.3

1.2.3 All fishery removals and mortality of the target stock(s) shall be considered by management.

1.2.4 Previously-agreed management measures established and applied in the same region shall be taken into account by management.

FAO CCRF 7.3.1

Evidence adequacy rating:

☑**High** ☐ **Medium** ☐ **Low**

Clause	**Evidence:**
1.2	**Management measures take into account the whole stock unit over its entire area of stock distribution.** Each of the Bering Sea crab fisheries are considered discrete stocks and treated as single stocks for management purposes. The ADFG defines a succinct area under their regulation 5 AAC34.800 Description of Registration Area T, for the single stock red king crab fishery. Red king crabs were caught at 65 of the 136 NMFS Eastern Bering Sea continental shelf bottom trawl survey stations in the Bristol Bay management district in 2011. The NMFS survey illustrates a single stock fishery on their 2011 survey (Figure 14).

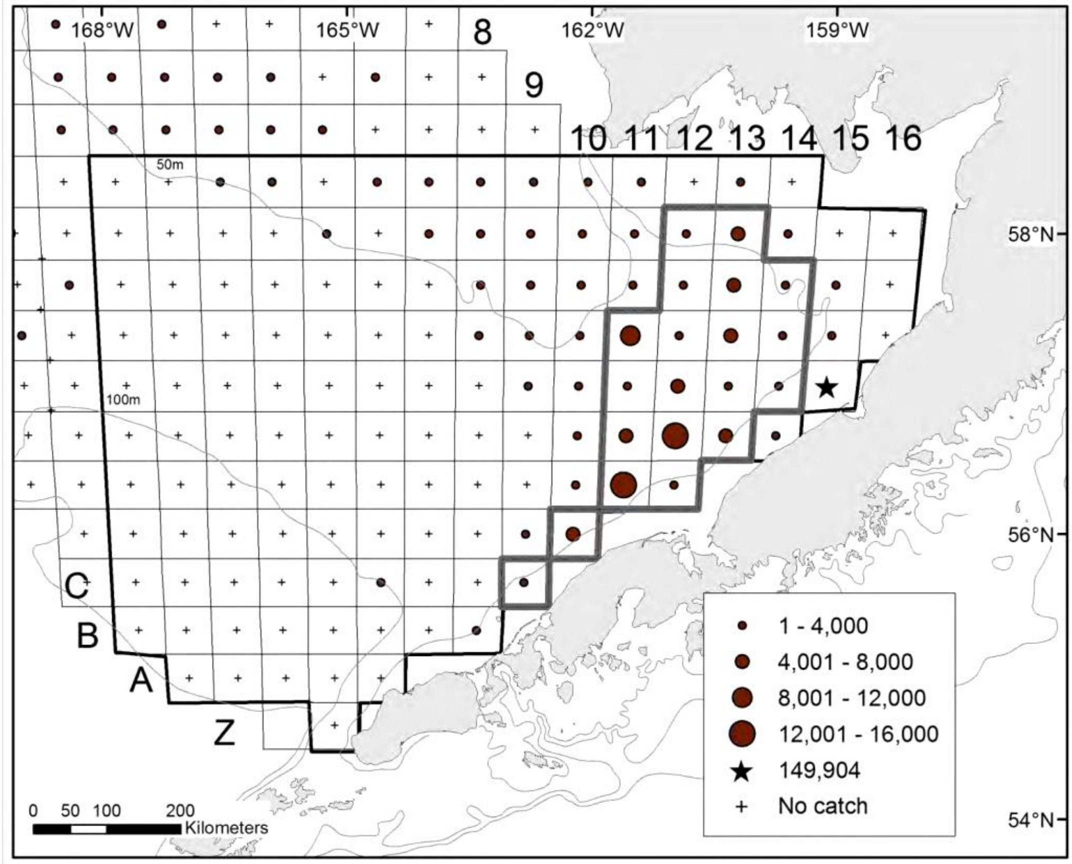


Figure 14. Total density (number/nmi2) of red king crab (*Paralithodes camtschaticus*) at each station sampled in the 2011 Bristol Bay District. Data depicted by circles are equal interval densities, while stars are densities larger than the standard scale. Outlined area depicts the management district and the resurveyed stations outlined in grey within the management district.
http://www.afsc.noaa.gov/kodiak/shellfish/crabebs/2011EBSSurveyTechMemoDraft.pdf

Genetically, it is possible to distinguish between populations of red king crab in Alaska. This was demonstrated in 1989 with work completed by the ADFG's Gene Conservation Lab. Horizontal starch-gel electrophoresis of proteins has proven to be a powerful tool for the management of many marine species. This technique provides data on the genetic relationships of reproductively isolated stocks, thereby helping scientists to optimally manage these self-recruiting stocks. Additionally, when large genetic differences are found between stocks, collections from unknown origin may be genetically screened and unambiguously classified. The lab examined collections of red king crab from thirteen localities in Southeast Alaska, the Aleutian Islands, and the eastern Bering Sea for genetic variation at 42 protein coding loci. Two highly polymorphic loci, Pgdh (Phosphogluconate dehydrogenase) and Alp (Alkaline phosphatase), were useful for discriminating stock differences between major geographic areas. The eastern Bering Sea collections from Bristol Bay and Norton Sound were very different from all other collections. Further, southeast Alaska collections appear to form a stock unit discrete from the Kenai, Alaska Peninsula, and Aleutian collections. Additional polymorphic loci appear to be useful in further differentiating stocks, and the lab continues with this work.

	In January 1989, the lab analyzed 89 red king crab samples of unknown origin. These samples were from a boatload of crabs allegedly caught near Adak Island in the Aleutian Islands. Enforcement personnel from Alaska Department of Public Safety and biologists from Alaska Department of Fish and Game believed that the crabs were actually caught in Bristol Bay during an area closure. Lab data clearly showed that the crabs could not have come from Adak Island and that they probably originated from the Norton Sound/Bristol Bay stock. Based on these findings the vessel owner and the skipper agreed to pay the state $565,000 in penalties for fishing violations. See: Seeb, J. E., G. H. Kruse, L. W. Seeb, and R. G. Weck. Genetic structure of red king crab stocks in Alaska facilitates enforcement of fishing regulations. Pp. 491-502 Proceedings of the International Symposium on King and Tanner Crabs, Anchorage, Alaska, USA, November 28-30, 1989. Alaska Sea Grant College Program, Fairbanks. http://seagrant.uaf.edu/research/projects/kingcrab/docs/progress-reports/performance-report-2010-Dec.pdf Grant, W.S., Zelinina, D, and Mugue, N. (submitted) Population genetics and phylogeography of red king crab: implications for management and stock enhancement. In B. Stevens ed. The king crabs. CRC Press Jorstad, K.E., C. T. Smith, Z. A. Grauvogel, and L. W. Seeb. 2006. A comparison of genetic variability in introduced red king crab (*Paralithodes camtschatica*) in the Barents Sea with samples from the Bering Sea and Kamchatka region, using eleven microsatellite loci. Hydrobiologia 590: 115-121. http://www.adfg.alaska.gov/FedAidPDFs/SP11-11.pdf Blue king crab range throughout the eastern Bering Sea from the Pribilof Islands to Little Diomede Island, Alaska, and in the western Bering Sea from the Gulf of Olyutorsk to the Gulf of Anadur, Russia. The Alaska Department of Fish and Game (ADFG) Gene Conservation Laboratory division has detected regional population differences (e.g., discrete stocks) between blue king crab collected from St. Matthew Island and the Pribilof Islands based on a limited number of variable genetic markers using allozyme electrophoresis methods (1997, NOAA grant Bering Sea Crab Research II, NA16FN2621). Tag-return data from studies by the National Marine Fisheries Service (NMFS) on blue king crab in the Pribilof Islands (n = 317) and St. Matthew Island (n = 253) support the idea that legal-sized males do not migrate between the two areas (Otto and Cummiskey 1990) and that larvae are also restricted to each area. St. Matthew Island blue king crab (SMBKC) tend to be smaller than their Pribilof conspecifics, and the two stocks are managed separately, with legal sizes of 5.5 in carapace width (CW) in the St. Matthew Island Section and 6.5 in CW in the Pribilof District. The St. Matthew Island blue king crab fishery is defined by specific district boundaries encompassing the fishable population's location, under 5 AAC 34.905 (C)(2) Description of Registration Area Q districts, Saint Matthew Island Section. Blue king crab were caught at 28 of the 57 total stations in the NMFS trawl survey's St. Matthew Island Section sampling strata in 2011 (Figure 15).

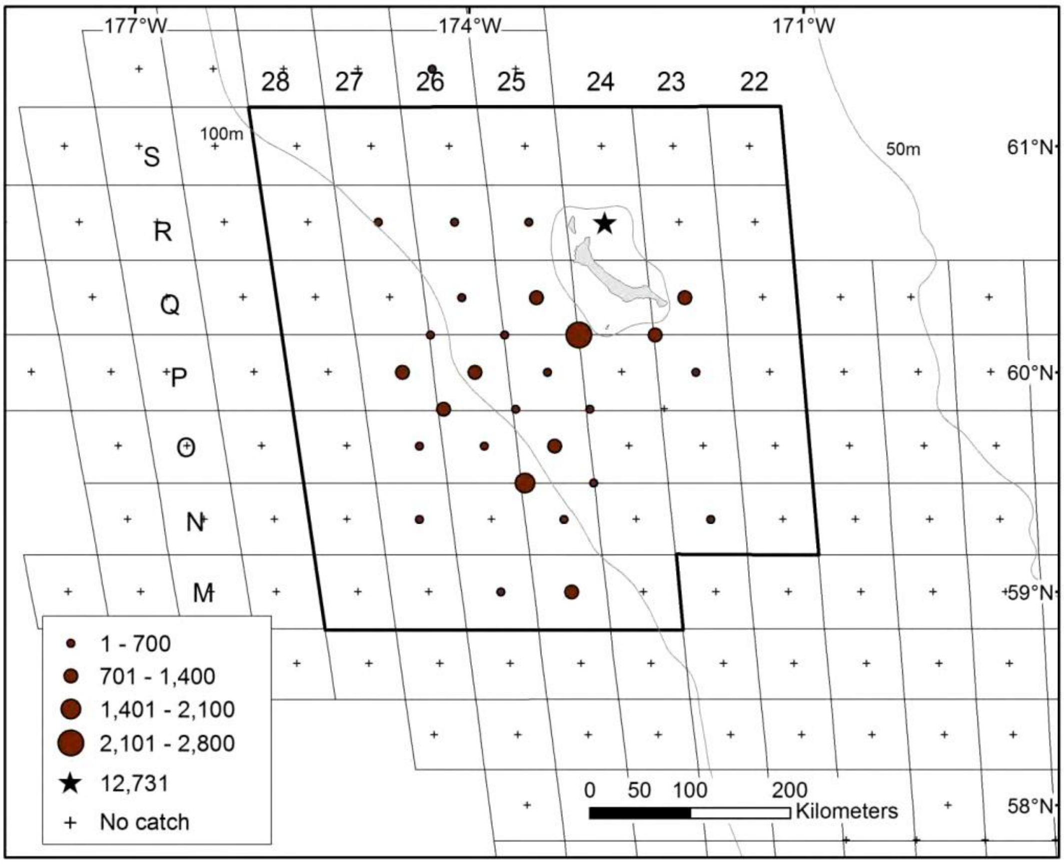


Figure 15. Total density (number/nmi^2) of blue king crab (*Paralithodes platypus*) at each station sampled in the St. Mathew Island Section of the Northern District in 2011. Data depicted by circles are equal interval densities, while stars are densities larger than the standard scale. The outlined area depicts stations within the management district. http://www.afsc.noaa.gov/kodiak/shellfish/crabebs/2011EBSSurveyTechMemoDraft.pdf

Genetic research on Alaskan king crab has been undertaken in the work to date by the Alaska King Crab Research Rehabilitation and Biology (AKCRRAB) program. This program was formed in 2006 with the goal of investigating the feasibility of stock enhancement of Alaskan red and blue king crab species for the purpose of population rehabilitation. Genetics research was conducted to understand king crab population structure in Alaska and potential genetic issues with population rehabilitation.

Researchers and managers in Russia believe that large aggregations of blue king crab from the Gulf of Olyutorsk to the Gulf of Anadyr are portions of a single Olyutorsk-Navarin population. The higher and steadier production of blue king crab in the WBS and Sea of Okhotsk may reflect more constant and colder conditions caused by a southerly current and proximity to a large continental land mass to the west. In the Eastern Bering Sea blue king crab populations form concentrations around offshore islands. Given the vast expanse of the Bering Sea and the spatial distribution of blue king crab, these distinct, disassociated groups of crab are managed as individual stocks.

http://seagrant.uaf.edu/research/projects/kingcrab/docs/progress-reports/performance-report-2010-Dec.pdf
http://seagrant.uaf.edu/staff/docs/Herter-Daly-et-al-morphometrics-2011.pdf

http://seagrant.uaf.edu/bookstore/pubs/AK-SG-02-01.html (see pp. 511-520)
ftp://pices.int/Outgoing/Julia/PICES-2011%20USB/Scientific%20Reports/Rep19.pdf

Although the *C. opilio* (snow) crab fishable population is much more broadly distributed, the district area boundaries are defined under 5 AAC 35.505 (e)(1) and (B)(2) Description of Registration Area J districts. The NMFS's snow crab model, vetted through the NPFMC's Crab Plan Team (CPT), treats the population as a single stock. Snow crabs were caught at 274 of the 376 stations in the combined areas of the Bristol Bay District, Pribilof District, and St. Matthew Island Section sampling strata (Figure 16).

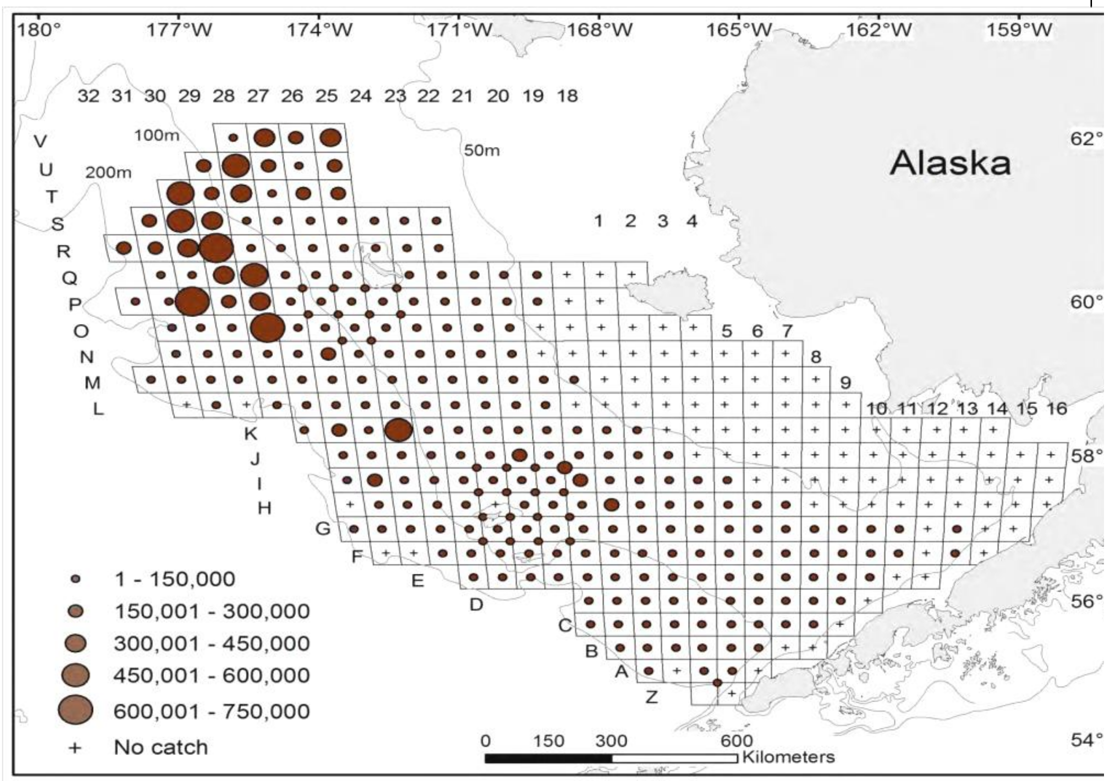
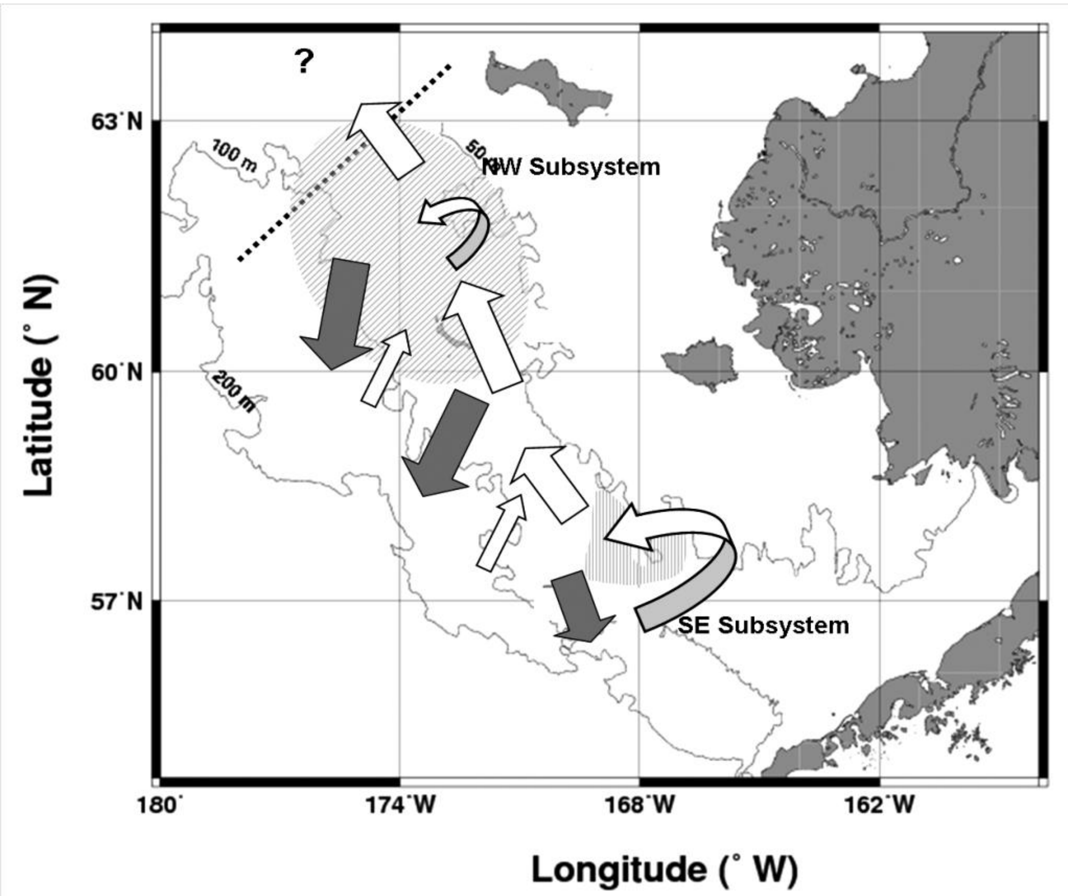


Figure 16. Total density (number/nmi^2) of snow crab (*Chionoecetes opilio*) at each station sampled in 2011. Data depicted by circles are crab densities at equal intervals. http://www.afsc.noaa.gov/kodiak/shellfish/crabebs/2011EBSSurveyTechMemoDraft.pdf

Currently, there is little known about the genetic population structure within their Pacific/Arctic range and the Eastern Bering Sea stock is managed as a single unstructured (random-mating) population. The goal of research is to better define population structure by using microsatellite analysis techniques. Genetic analysis of approximately 600 specimens from numerous locations throughout their range was conducted and results are currently being combined with ecological knowledge of the stock to identify whether or not distinct population subunits occur. Snow crab have a long larval dispersal phase lasting from approximately 2-4 months, which would support the hypothesis of a large degree of genetic mixing; however, areas of potential larval retention have recently been hypothesized which may support population divergence. Deciphering population structure throughout the highly exploited Bering Sea populations is not only important for proper management of the current fishery, but for areas of the arctic which are "downstream" and may see fishing pressures in the future. See: Genetic population structure of snow crab (*Chionoecetes opilio*), Greg Albrecht-Ph.D. candidate, University of

	Alaska, Fairbanks, Sarah M. Hardy, University of Alaska, Fairbanks, and Kris Hundertmark, University of Alaska, Fairbanks. http://www.adfg.alaska.gov/FedAidPDFs/SP11-11.pdf Similarly, research conducted by the ADFG's Gene Conservation Lab found that low levels of geographic differentiation were detected among populations of *C. bairdi* and *C. opilio*, and data suggest that subpopulations of *C. bairdi* exist within the Bering Sea. Further, evidence of gene introgression was found between *C. bairdi* and *C. opilio* in the Bering Sea. The lab also included a geographic isolate, North Atlantic *C. opilio*, in the analyses. Little differentiation was found, and no private alleles were detected in North Atlantic *C. opilio* despite significant geographic separation from Alaskan C. opilio. See: Merkouris S. E., L. W. Seeb, and M. C. Murphy. 1998. Low levels of genetic diversity in highly exploited populations of Alaskan Tanner crabs, *Chionoecetes bairdi*, and Alaskan and Atlantic snow crabs, C. opilio. Fishery Bulletin 96: 525-537. http://www.adfg.alaska.gov/FedAidPDFs/SP11-11.pdf Nonetheless, a recent paper by Parada et al. 2010 highlighted the spatial dynamics of Bering sea snow crab. Figure 17 below represents the conceptual hypothesis on shift of snow crab spatial dynamics in the eastern Bering Sea shelf. White arrows show direction of larval transport; curved arrows indicate retention. Shaded arrows indicate ontogenetic migrations. Hatching highlights hypothesized main regions of settlement and recruitment to the mature female stock.  **Figure 17.** Biophysical model'snow crab spatial dynamics in the eastern Bering Sea shelf. The mature snow crabs which are sampled in the surveys for stock assessment purposes

do not move outside US waters, rather they remain within the EBS shelf up to depths of 200 m and are generally found between isobaths of 50m (juveniles) and 200 m (mature adults). Ontogenic migration carries snow crab south from a northerly direction within the EBS shelf.

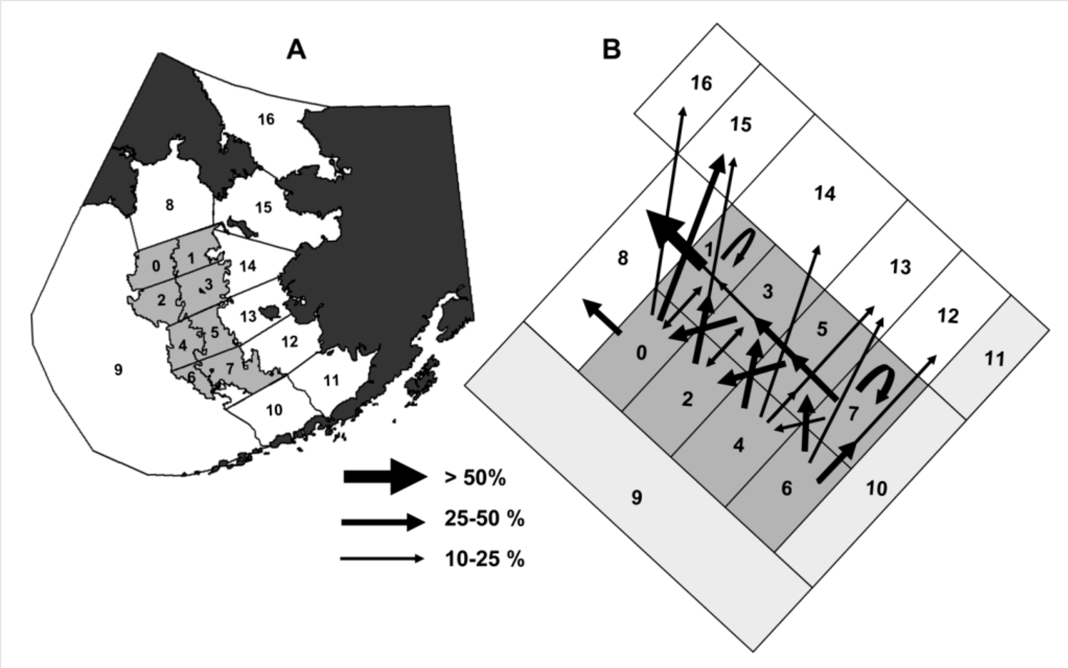


Figure 18. Eastern Bering sea snow crab connectivity predicted by the biophysical model by Parada et al 2010. (A) Areas defined for simulations of snow-crab larval transport with an individual-based model (IBM areas); shading, eight larval release IBM areas, capturing the historical distributions of the mature female stock surveyed by the U.S. National Marine Fisheries Service; IBM areas 8–16 are treated only as "sinks." (B) Schematic summary of connectivity patterns. Width of the arrows indicates the strength of connectivity; connectivity below 10% not represented. Horizontal hatching (IBM areas 9–11), areas outside the region of interest; dark shading, core region of interest.

Results from simulations with the IBM provided objective criteria to bound the region of interest for modelling the snow-crab population of the EBS. Lack of (i) southward transport along the middle and outer domains, (ii) eastward transport into Bristol Bay, and (iii) westward transport off the outer domain effectively leaves IBM areas 9, 10, and 11 out of the geographic region of interest.

IBM areas 8 (Gulf of Anadyr), 15 (northeastern Bering Sea), and 16 (Chukchi Sea) are likely sinks for larvae originating in the EBS, but crabs recruited in those down-current regions are unlikely to have a substantial influence on the dynamics of the EBS stock; post settlement migration to the EBS is highly unlikely in the case of the Chukchi and northeastern Bering seas, and larval advection is not favored in a direction toward the EBS. Information from the Gulf of Anadyr is limited (Sample and Nichol, 1994); so far, no conclusive evidence supports immigration from that region.
The NMFS also held a workshop in 2009 to discuss stock assessment and to produce a workshop report that provides guidance to assessment authors to improve existing assessment models (snow crab, Bristol Bay red king crab, St. Matthew blue king crab, and Norton Sound red king crab). The workshop had participants and speakers from many

	nations. The Council and NMFS produce annual Stock Assessment & Fishery Evaluation (SAFE) reports, for each fishery under federal jurisdiction, including Bering Sea crab. The NMFS Resource Assessment & Conservation Engineering (RACE) Division also produces additional reports http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf http://www.afsc.noaa.gov/quarterly/jas2011/divrptsRACE1.htm http://www.afsc.noaa.gov/Kodiak/shellfish/crabEBS/2011EBSSurveyTechMemoDraft.pdf http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/Appendix_CrabWKSHPreport909.pdf Personal communication with Doug Pengilly and Jie Zheng during Juneau ADFG HQ site visit January 18, 2012. Personal communication with Gretchen Harrington during the Juneau NMFS FAKR site visit January 18, 2012.
Evidence adequacy rating: ☑**High** ☐ **Medium** ☐ **Low**	
Clause	**Evidence:**
1.2.1	**The area through which the species migrates during its life cycle is considered by the management system.** The NMFS tracks and reports crab location in all life stages through their Eastern Bering Sea trawl survey. Crabs generally tend to migrate from shallow to slightly deeper areas. Adult red king crabs have nearshore to offshore (or shallow to deep) and back, annual migrations, although in many parts of their range, ovigerous females remain in shallow water embayments in large pods throughout the winter. In the spring usually coincident with the spring phytoplankton bloom, the female's embryos hatch. Adult females and some adult males molt and mate before they begin their offshore feeding migration to deeper waters. Adult crabs tend to segregate by sex off the mating and molting grounds. Red, blue, and golden king crabs are seldom found co-existing with one another even though the depth ranges they live in and habitats may overlap. Generally red king crabs occur in shallower depths, from 100 to 600 ft, while golden king crabs are found much deeper, in 300 to 2500 ft. depths. Blue king crabs have intermediate depth ranges, but generally are found in discrete locations, such as around the Pribilof Islands, St. Matthew, the Diomedes, St. Lawrence Island, or in certain bays. Adult male red king crabs in the Kodiak area have been known to migrate up to 100 miles round-trip annually, moving at times as fast as a mile per day. Adult blue king crabs exhibit nearshore to offshore (or shallow to deep) and back, annual migrations. The same is true for red king crab populations in suitable habitats. They come to shallow water in late winter and the embryos hatch in the spring, usually coincident with the spring bloom. Adult females molt and mate before they begin their offshore feeding migration to deeper waters. Adult males molt months prior to adult females so

	they are in a hard shell condition and ready to mate when adult females molt. Adult crabs tend to segregate by sex and size when not on the mating-molting grounds. Red, blue, and golden king crabs are seldom found co-existing with one another even though the depth ranges they live in and habitats may overlap. Generally red king crabs are in relatively shallow depths (50-600 ft. depths) while golden king crabs generally occur in deeper depths (300 ft. to 2500 ft. depths). Blue king crabs have more discrete distributions, occurring primarily in specific bays or only around certain islands, such as St. Matthew, St. Lawrence, the Pribilof Islands, or in specific embayments. The mature snow crabs which are sampled in the NMFS surveys for stock assessment purposes do not move outside US waters, rather they remain within the EBS shelf up to depths of 200 m and are generally found between isobaths of 50m (juveniles) and 200 m (mature adults). Ontogenic migration tends to carry snow crab largely south from a northerly direction within the Eastern Bearing Sea shelf (please see clause 1.2 for more details). source of evidence – http://www.afsc.noaa.gov/Kodiak/shellfish/crabEBS/2011EBSSurveyTechMemoDraft.pdf http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf http://www.adfg.alaska.gov/index.cfm?adfg=redkingcrab.main http://www.adfg.alaska.gov/index.cfm?adfg=bluekingcrab.main http://www.adfg.alaska.gov/index.cfm?adfg=tannercrab.main http://www.afsc.noaa.gov/Education/factsheets/10_opilio_fs.pdf http://www.afsc.noaa.gov/Education/factsheets/10_rkc_fs.pdf http://www.afsc.noaa.gov/Education/factsheets/10_bkc_fs.pdf
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence:**
1.2.2	**The biological unity and other biological characteristics of the stock are considered within the management system.** The biological unity of the BSAI crab stocks here under assessment are considered by the management system. The basis justifying stock management units are illustrated in clause 1.2. Other biological characteristics such as growth, mortality rates, sexual maturity of male and females, effective spawning potential, weight, size and age, migration etc... are considered within existing stock survey and assessment procedures, TAC setting approaches, and existing regulations defining fishery boundaries and seasons. sources of evidence – http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf http://www.afsc.noaa.gov/Kodiak/shellfish/crabEBS/2011EBSSurveyTechMemoDraft.pdf http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf (see 1.2 and 1.2.1 above)

<table>
<tr><td colspan="2">Evidence adequacy rating:

☑High ☐ Medium ☐ Low</td></tr>
<tr><td>Clause:</td><td>Evidence:</td></tr>
<tr><td>1.2.3</td><td>All fishery removals and mortality of the target stock(s) are considered by management.

All sources of mortality and removals are considered by the management system. The directed crab fisheries removals are well documented through the eLandings system. NFMS RAM Division tracks all IFQ/IPQ balances to account for crab catch. Crab bycatch in the groundfish bottom trawl fisheries is accounted for by the groundfish observer program, and crab bycatch caps are in place to limit take. Mortality in groundfish fisheries (mainly trawl) is assumed to be 80 percent. Distinctions are not made for red, blue or brown king crabs. Handling mortality of female and juvenile crabs is considered in models, or through the TAC generation process for fisheries without models in place. Female and Juvenile crab take is also documented in the 2011 ADFG Observer Data Report available at http://www.adfg.alaska.gov/FedAidPDFs/FDS11-04.pdf). Officers with AWT and OLE monitor offloads to track female or undersized male crab delivered to shore facilities.

sources of evidence –

http://alaskafisheries.noaa.gov/ram/
http://elandings.alaska.gov/
http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf
http://www.fakr.noaa.gov/npfmc/PDFdocuments/bycatch/CrabBycatchPSC510.pdf
(personal communications with Lt. Will Ellis, AWT “C” Detachment Supervisor, January 18, 2011).</td></tr>
<tr><td colspan="2">Evidence adequacy rating:

☑High ☐ Medium ☐ Low</td></tr>
<tr><td>Clause:</td><td>Evidence:</td></tr>
<tr><td>1.2.4</td><td>Previously agreed management measures established and applied in the same region are taken into account by management.

The Alaska Bering Sea crab management system (NPFMC, NMFS and ADFG) routinely takes into account all previously agreed upon management measures. For example, the fishery has been managed under a system of Individual Fishing/Processor Quotas (IFQ/IPQ) for several years. That IFQ/IPQ system, and the rules which govern it, are considered by NPFMC and NMFS whenever modifications (e.g.- Community protection measures, crew protection measures, etc.) are proposed. The state/federal management system has a long history of taking into account previous management measures and improving enforcement.</td></tr>
</table>

	Many years of public testimony through the NEPA process has slowly improved the management: moving from open access, to license limitation, to the IFQ/IPQ system. This is evidenced in the archival records of the NPFMC and the BOF ***sources of evidence –*** http://www.fakr.noaa.gov/npfmc/ www.fakr.noaa.gov/ram/ifq.htm

Clause:

1.3 Where trans-boundary, straddling or highly migratory fish stocks and high seas fish stocks are exploited by two or more States, the Applicant Management Organizations concerned shall cooperate and take part in formal fishery commission or arrangements that have been appointed to ensure effective conservation and management of the stock/s in question.

1.3.1 Conservation and management measures established for such stock within the jurisdiction of the relevant States for shared, straddling, high seas and highly migratory stocks, shall be compatible. Compatibility shall be achieved in a manner consistent with the rights, competences and interests of the States concerned.

FAO CCRF 7.1.3/7.1.4/7.3.2

☐ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence
1.3	**This clause is not applicable**. The three stocks here in question are not considered trans-boundary, straddling, highly migratory fish stocks or high seas fish stocks exploited by two or more States. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/Appendix_CrabWKSHPreport909.pdf Personal communication with Gretchen Harrington, NMFS FAKR site visit January 18, 2012. See evidence provided in clause 1.2

Evidence adequacy rating:		
☐ **High**	☐ **Medium**	☐ **Low**

Clause	Evidence
1.3.1	**This clause is not applicable**. The three stocks here in question are not considered trans-boundary, straddling, highly migratory fish stocks or high seas fish stocks exploited by two or more States. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/Appendix_CrabWKSHPreport909.pdf Personal communication with Gretchen Harrington, NMFS FAKR site visit January 18, 2012. See evidence provided in clause 1.2

Clause:
1.4 Organizations within the Management System shall cooperate with neighbouring coastal states with respect to common and shared fishery resources for their conservation and for the conservation of the environment. ***FAO CCRF 10.3,* 7.1.4 and 7.1.5** **1.4.1 A State not member/participant of a sub-regional or regional fisheries management organization shall cooperate, in accordance with relevant international agreements and law, in the conservation and management of the relevant fisheries resources by giving effect to any relevant measures adopted by such organization/arrangement.** ***FAO CCRF 7.1.5*** **1.4.2 States seeking to take any action through a non-fishery organization which may affect the conservation and management measures taken by a competent sub-regional or regional fisheries management organization or arrangement shall consult with the latter, in advance to the extent practicable, and take its views into account .** ***FAO CCRF 7.3.5***
Evidence adequacy rating: ☐ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence
1.4	**This clause is not applicable**. The three stocks here in question are not considered common or shared resources exploited by two or more States.

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence
1.4.1	**This clause is not applicable**. The three stocks here in question are not considered common or shared resources exploited by two or more States.

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence

1.4.2	**This clause is not applicable**. The three stocks here in question are not considered common or shared resources exploited by two or more States.	

Clause:

1.5 The Applicant fishery's management system shall actively foster cooperation between States with regard to:

- **Information gathering and exchange**
- **Fisheries research**
- **Fisheries management**
- **Fisheries development**

FAO CCRF 7.3.4

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence	
1.5	**This clause is not applicable**. The three stocks here in question are not considered common, shared, trans-boundary, straddling, highly migratory fish stocks or high seas fish stocks exploited by two or more States.	

Clause:

1.6. States and sub-regional or regional fisheries management organizations and arrangements, as appropriate, shall agree on the means by which the activities of such organizations and arrangements will be financed, bearing in mind, *inter alia*, the relative benefits derived from the fishery and the differing capacities of countries to provide financial and other contributions. Where appropriate, and when possible, such organizations and arrangements shall aim to recover the costs of fisheries conservation, management and research.

FAO CCRF 7.7.4

1.6.1 Without prejudice to relevant international agreements, States shall encourage banks and financial institutions not to require, as a condition of a loan or mortgage, fishing vessels or fishing support vessels to be flagged in a jurisdiction other than that of the State of beneficial ownership where such a requirement would have the effect of increasing the likelihood of non-compliance with international conservation and management measures.

FAO CCRF 7.8.1

Evidence adequacy rating:		
☑ High	☐ Medium	☐ Low

Clause	Evidence
1.6	**There are established means by which fisheries management activities, organisations and arrangements are financed.** Specific costs incurred during management, research and enforcement of the Bering Sea crab stocks are largely funded through Congressional appropriations for federal programs. The State of Alaska also receives some funding from the NMFS, in addition to funding from the Alaska Legislature. The Crab Observer Program is funded through industry funds as well as Test Fish funding sources (see www.adfg.alaska.gov/.../pdfs/2010_2011/king-tanner/&filename=FMR11-05a.pdf&contenttype=application/pdf) The state of Alaska annually spends $2 million for BSAI crab management and research, derived from state general fund and test fish funds. It also receives approximately $800,000 in federal crab rationalization fees and some fees for Bering Sea crab research from Congress. Research costs, including data analysis, and stock assessment are primarily financed through Congressional appropriations, other public sector funding, and industry funding. University scientists use funding from a variety of state, federal, private and international funding sources. 1) **Management;** conservation and management of the fishery and services for fishery participants, state and industry assistance programs, including marine fisheries commissions, disaster assistance are mainly financed through Congressional appropriations and industry. 2) **Enforcement;** vessel boarding, dockside monitoring, vessel monitoring system (VMS) implementation, auction inspection, aerial surveillance, criminal investigations are funded through Congressional appropriations and industry (for some VMS). **NOAA budget** The National Oceanic and Atmospheric Administration (NOAA) budget is divided into two primary accounts: Operations, Research and Facilities (ORF) and Procurement, Acquisition and Construction (PAC). These two accounts make up over 99 percent of the total Fiscal Year (FY) 2011 NOAA appropriation. Other accounts include Pacific Coastal Salmon Recovery, Coastal Impact Assistance Fund, Fishermen's Contingency Fund, Foreign Fishing Observer Fund, Fisheries Finance Program Account, Promote and Develop American Fishery Products and Research Pertaining to American Fisheries Fund, Damage Assessment and Restoration Revolving Fund, Coastal Zone Management Fund, Federal Ship Financing Fund, Limited Access System Administration Fund, Environmental Mammal Unusual Mortality Event Fund, and Medicare-Eligible Retiree Healthcare Fund.

NMFS is dedicated to the stewardship of living marine resources through science-based conservation and management within the 200-mile U.S. EEZ. NMFS also provides critical support and scientific and policy leadership in the international arena, and plays a key role in the management of living marine resources in coastal areas under state jurisdiction. The President's FY 2012 Budget requests a net increase of $20.9 million for NMFS over the FY 2010 enacted level (including the Pacific Coastal Salmon Recovery Fund). This includes $19.9 million in inflationary adjustments.

The NMFS budget generally covers **the following:**

1) Protected Species Research & Management;
2) Fisheries Research and Management;
3) Enforcement & Observers/Training;
4) Habitat Conservation & Restoration;
5) Other Activities Supporting Fisheries.

The **Fisheries Finance Program Account** provides direct loans that promote building sustainable fisheries. The program provides Individual Fishing Quota (IFQ) financing at the request of a Fishery Management Council. The program also makes long term fixed rate financing available to U.S. citizens who otherwise do not qualify for financing and refinancing of the construction, reconstruction, reconditioning, and in some cases, the purchasing of fishing vessels, shoreside processing, aquaculture, and mariculture facilities. These loans provide stability to at least one aspect of an otherwise volatile industry.

The **Promote and Develop American Fishery Products & Research Pertaining to American Fisheries Fund** receives 30 percent of the import duties the Department of Agriculture collects on fishery-related products. NOAA will use a portion of these funds to offset marine fishery resource programs in the Operations, Research and Facilities (ORF) appropriation in FY 2011. NOAA uses the remaining funds to promote industry development through competitively-awarded external grants for innovative research and development of projects in the fishing industry and for internal research that complements the external program.

The **Damage Assessment and Restoration Revolving Fund (DARRF)** receives proceeds from claims against responsible parties, as determined through court settlements or agreements, for damages to natural resources for which NOAA serves as trustee. In FY 1999 and prior years, NOAA transferred funds to the ORF account for purposes of damage assessment and restoration. Beginning in FY 2000, funds were expended in the DARRF and treated as mandatory budget authority.

NOAA utilizes funds transferred to this account to respond to hazardous materials spills in the coastal and marine environments, by conducting damage assessments, providing scientific support during litigation, and using recovered damages to restore injured resources.

The **Federal Ship Financing Fund** manages the loan guarantee portfolio that existed prior to the enactment of the Federal Credit Reform Act of 1990.

The **Limited Access System Administration Fund** (LASAF) was established under the

	authority of the Magnuson Stevens Fisheries Conservation and Management Act, Section 304(d)(2)(A), which stated that NMFS must collect a fee to recover the incremental costs of management, data collection, and enforcement of Limited Access Privilege Programs (LAPPs). These fees are deposited into the LASAF and are not to exceed 3 percent of the ex-vessel value of fish harvested under any such program. Also, a Regional Council can consider, and may provide, a program to collect royalties for the initial or any subsequent distribution of allocations; revenues from these royalties are deposited in the LASAF. The LASAF shall be available, without appropriation or fiscal year limitation, only for the purposes of administrating the central registry system; and administering and implementing the Magnuson-Stevens Act in the fishery in which the fees were collected. The **Environmental Improvement and Restoration Fund** was created by the Department of the Interior and Related Agencies Act, 1998, for the purpose of carrying out marine research activities in the North Pacific. These funds will provide grants to Federal, State, private or foreign organizations or individuals to conduct research activities on or relating to the fisheries or marine ecosystems in the North Pacific Ocean, Bering Sea, and Arctic Ocean. **Marine Mammal Unusual Mortality Event Fund** provides funds to support investigations and responses to unusual marine mammal mortality events. http://www.osec.doc.gov/bmi/budget/FY12BIB/2012_BIB.pdf http://books.google.com (Book: The Costs of Managing Fisheries, 2003, By OECD, OECD - Organisation for Economic Co-operation and Development). http://www.fakr.noaa.gov/npfmc/current_issues/observer/observer.htm http://www.nmfs.noaa.gov/ocs/mafac/meetings/2011_10/docs/mafac_october_2011_v6.pdf http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main http://www.fakr.noaa.gov/npfmc/ http://www.fakr.noaa.gov/npfmc/help/navigate-npfmc-process.html http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause	**Evidence**
1.6.1	**Not applicable**. The three stocks here in question are not considered common, shared, trans-boundary, straddling, highly migratory fish stocks or high seas fish stocks exploited by two or more States and bound by international agreements. All vessels fishing in the US must be at least 75 percent US ownership (see the Jones Act). All Bering Sea crab vessels must be US ownership vessels. No foreign fishing vessels are authorised to fish in Alaska. http://alaskafisheries.noaa.gov/regs/680/680a4.pdf 50CFR679: www.fakr.noaa.gov/regs/default.htm

Clause:

1.7 Procedures shall be in place to keep the efficacy of current conservation and management measures and their possible interactions under continuous review to revise or abolish them in the light of new information.

- **Review procedures shall be established within the management system.**
- **A mechanism for revision of management measures shall exist.**

FAO CCRF 7.6.8

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
1.7	**Procedures are in place to keep the efficacy of current conservation and management measures and their possible interactions under continuous review to revise or abolish them in the light of new information.** The BOF and the NPFMC's management arrangements and decision-making processes for the fishery are organized in a very transparent manner. The BOF and the Council provide a great deal of information on their websites, including agenda of meetings, discussion papers, and records of decisions. Both the BOF and the Council actively encourage stakeholder participation, and all BOF and Council deliberations are conducted in open, public session. Revisions to existing programs are accomplished through the process. The Crab Rationalization program, first implemented in 1995, was subject to 18-month, two-year, and five-year program reviews. It has been actively addressed at nearly every NPFMC meeting since its inception. Refinements continue to occur as the program matures. The annual crab SAFE assessment process evaluates crab stocks and current regulations by the CPT, SSC, the public and the NPFMC. Any need for program modification recognized during this annual review process can result in a proposed amendment to the FMP been brought forward by the CPT, SSC, the public or the Council. ***sources of evidence –*** http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main www.fakr.noaa.gov/npfmc/ http://www.adfg.alaska.gov/index.cfm?adfg=home.main www.fakr.noaa.gov/	

Clause:

1.8 The management arrangements and decision making processes for the fishery shall be organized in a transparent manner.

- **Management arrangements**
- **Decision-making**

FAO CCRF 7.1.9

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	Evidence	
1.8	**The management arrangements and decision making processes for the fishery are organized in a transparent manner.** NPFMC's management arrangements and decision-making processes for the fishery are organized in a very transparent manner. The Council (and NMFS) as well as the BOF (and ADFG) provides a great deal of information on their websites, including agenda of meetings, discussion papers, and records of decisions. The Council and the BOF actively encourages stakeholder participation, and all Council deliberations are conducted in open, public session. Anyone may submit regulatory proposals, and all such proposals are given due consideration by both the NPFMC and the BOF. Rules are in place so that all Board and Council members discussions are open to the public. Rules impose transparency. www.fakr.noaa.gov/npfmc/default.htm www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main	

Clause:		
1.9 **Management organizations not party to the Agreement to Promote Compliance with International Conservation and Management Measures by Vessels Fishing in the High Seas shall be encouraged to accept the Agreement and to adopt laws and regulations consistent with the provisions of the Agreement.** ***FAO CCRF 8.2.6***		
Evidence adequacy rating: ☐ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
1.9	**Not relevant**. The Bering Sea crab fisheries occur with the EEZ of the United States, operate under guidance from the MSA, and are governed by rules and regulations promulgated by the NPFMC and the State of Alaska's BOF. Laws and regulations adopted by these bodies are completely consistent with the provisions of the Agreement. The Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas ("Compliance Agreement") was adopted under the auspices of FAO, by FAO Conference Resolution 15/93 at the 27th Session of the FAO Conference in November 1993. It was adopted as part of FAO's work on the Code of Conduct for Responsible Fisheries (*see 9.1.3*) and was formally integrated as part of the Code when that instrument was adopted in 1995 (see Article 1(1) of the Code of Conduct). Unlike the other parts of the Code, however, the Compliance Agreement is a legally binding treaty. It entered into force on 24 April 2003, after acceptance by 25 Parties. The United States ratified the Agreement on the 19 December 1995. While there are currently no high seas harvest of crab considered under this assessment, the Compliance Agreement is important if climate change ever alters stock distribution such that high seas harvests become a concern. http://www.oceanlaw.net/projects/current/pdf/ifa_sample.pdf http://www.fao.org/Legal/treaties/012s-e.htm http://www.fao.org/fishery/topic/14766/en	

2. Management organizations shall participate in coastal area management institutional frameworks, decision-making processes and activities related to the fishery and its users, in support of sustainable and integrated resource use, and conflict avoidance. *FAO CCRF 10.1.1/10.1.2/10.1.4/10.2.1/10.2.2/10.2.4*						
Confidence Ratings	**Low**	**0 out of 15**	**Medium**	**0 out of 15**	**High**	**15 out of 15**

Clause:

2.1 An appropriate policy, legal and institutional framework shall be adopted in order to achieve sustainable and integrated use of living marine resources, taking into account the fragility of coastal ecosystems, the finite nature of their natural resources and the needs of coastal communities.

FAO CCRF 10.1.1

2.1.1 States shall develop, as appropriate, institutional and legal frameworks in order to determine the possible uses of coastal resources and to govern access to them taking into account the rights of coastal fishing communities and their customary practices to the extent compatible with sustainable development.

FAO CCRF 10.1.3

2.1.2 In setting policies for the management of coastal areas, States shall take due account of the risks and uncertainties involved.

FAO CCRF 10.2.3

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	Evidence
2.1	**An appropriate policy, legal and institutional framework is adopted in order to achieve sustainable and integrated use of living marine resources, taking into account the fragility of coastal ecosystems, the finite nature of their natural resources and the needs of coastal communities.** The NPFMC and the BOF are required to manage the crab resources in a sustainable manner, as mandated by the MSA National Standards and the Alaska Constitution, respectively. The NMFS in connection with the Council manages all Category 1 measures for crab in the Bering Sea, as defined in the FMP. These federal agencies participate in coastal area management-related institutional frameworks through the federal National

	Environmental Policy Act (NEPA) processes. This usually happens whenever resources under their management may be affected by other developments. Federal agencies, including the NPFMC, are responsible for producing NEPA documents each time they renew or amend regulations. Therefore, all of the NPFMC proposed regulations include NEPA considerations. NEPA, therefore, is a comprehensive process to provide checks and balances against changes to the environment that may impact ecosystems and the natural processes, as well as the socio-economic sphere of fisheries. Every agency in the executive branch of the Federal Government has a responsibility to implement NEPA. In NEPA, Congress directed that, to the fullest extent possible, the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in NEPA. To implement NEPA's policies, Congress prescribed a procedure, commonly referred to as "the NEPA process" or "the environmental impact assessment process". The NEPA processes provide public information and a robust opportunity for public involvement. Decisions are made through public processes and involvement of fishery managers, fishermen, fishing organizations and fishing communities. Stakeholders are actively invited through publicly advertised and scheduled meetings. The BOF, in conjunction with the ADFG, is responsible for all Category 2 and 3 management measures. Both the department and the Board routinely take into account the risks and uncertainties of fishery management. Any proposed changes to the existing management regime by government, industry, or the public must go through a rigorous regulatory review process. During this process department scientists and biologists prepare detailed reports that include the best scientific data available at the time. These are delivered to the board and the public for their consideration. http://ceq.hss.doe.gov/nepa/Citizens_Guide_Dec07.pdf http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main. **ACMP and NEPA** The crab fishery management organizations in Alaska participate in coastal area management-related institutional frameworks through the federal National Environmental Policy Act (NEPA) processes. The state is a cooperating agency in the NEPA process for federal actions, so that gives the State of AK another seat at the table for federal actions. This include decision-making processes and activities relevant to the fishery resource and its users in support of sustainable and integrated use of living marine resources and avoidance of conflict among users. **ACMP sets in July 2011** Up to July 2011, Alaska also participated in the Alaska Coastal Management Plan (ACMP), a program which included includes a state coastal plan, coastal district (local government) plans, standards for evaluating and managing uses and activities in the coastal zone, and a process to coordinate state resource agency permitting and approval of uses and activities in the coastal zone. The program was initially motivated by a desire to influence federal off-shore activities; however, over time it became an important planning and coordination tool for coastal zone related topics and interests. The program required management of habitats in the coastal area that are subject to the ACMP "so as to maintain or enhance the biological, physical, and chemical characteristics of the habitat which contribute to its capacity to support living resources." The ACMP was implemented through federal and state agencies and through local governments. State agencies involved include three divisions of ADFG, four divisions of the Department of Environmental Conservation, and nine divisions of the Department of Natural Resources. Federal agencies include the U.S. Forest Service, U.S. Fish and Wildlife Service, NMFS, U.S. Army Corps of Engineers, and the

Environmental Protection Agency.
http://coastalmanagement.noaa.gov/programs/czm.html

http://alaskacoast.state.ak.us/Clawhome/handbook/pdf/OCRM_Approval.pdf

All construction activities in the coastal zone (e.g., work on docks, breakwaters, harbors and other infrastructure) were subject to the ACMP review process as well as in many cases the NEPA process. These processes deliberately take into account all resources and users of those resources. Conflict resolution mechanisms include both administrative (through governmental agencies) and legal (through courts of law) procedures.

The ACMP up for ballot election in August 2012

In March 9 2012, Anchorage, AK – Lieutenant Governor Mead Treadwell certified the citizen initiative to establish an Alaska Coastal Management Program. The Division of Elections completed its review of signatures and determined they meet constitutional and statutory requirements for initiative petitions. Treadwell notified petition sponsors, the Senate President, and the Speaker of the House. The Division notified the lieutenant governor that the petition contains signatures of 29,991 qualified voters, exceeding the minimum requirement of 25,875 signatures. Alaska's prior coastal management program expired on July 1, 2011, after the legislature adjourned the second of two special sessions without passing legislation required to extend the program. The program coordinated state and federal permitting for development projects in coastal districts.
Under AS 15.45.190, upon a determination of proper filing, the initiative may appear on the next statewide general, special, or primary election that is held 120 days after a legislative session has convened and adjourned and a period of 120 days has expired since the adjournment of the legislative session.
Sponsors filed the petition with the Division of Elections on January 17, 2012. Determination of proper filing was made in March 2012 and the governor announced that the initiative is to become law subject to election ballot on August 28, 2012, barring unforeseen special election. If a majority of the votes cast on the initiative proposition favour its adoption, the proposed law will be enacted and become effective after 90 days.
http://ltgov.alaska.gov/treadwell/press-room/full-press-release.html?pr=112
http://www.elections.alaska.gov/petitions/11ACMP/Notice-of-Proper-Filing.pdf

DEC, ADFG, DNR and the USFWS

The Department of Environmental Conservation (DEC) implements statutes and regulations affecting air, land and water quality. DEC is the lead state agency for implementing the federal Clean Water Act and its authorities provide considerable opportunity to maintain high quality fish and wildlife habitat through pollution prevention (http://dec.alaska.gov/).

ADFG, on the hand, protects estuarine and marine habitats primarily through cooperative efforts involving other state and federal agencies and local governments. ADFG has jurisdiction over the mouths of designated anadromous fish streams and legislatively designated state special areas (critical habitat areas, sanctuaries and refuges). Some marine species also receive special consideration through the state Endangered Species program.
The Department of Natural Resources (DNR) manages all state-owned land, water and natural resources except for fish and game. This includes most of the state's tidelands out to the three mile limit and approximately 34,000 miles of coastline. DNR authorizes the

	use of log-transfer sites, access across state land and water, set-net sites for commercial gill net fishing, mariculture sites for shellfish farming, lodge sites and access for the tourism industry, and water rights and water use authorizations. DNR also uses the state Endangered Species Act to preserve natural habitat of species or subspecies of fish and wildlife that are threatened with extinction (http://dnr.alaska.gov/). The U.S. Fish and Wildlife Service (USFWS) is a bureau within the Department of the Interior. Its **objectives** include 1) Assisting in the development and application of an environmental stewardship ethic, based on ecological principles, scientific knowledge of fish and wildlife, and a sense of moral responsibility; 2) Guide the conservation, development, and management of the US's fish and wildlife resources. 3) Administer a national program to provide the public opportunities to understand, appreciate, and wisely use fish and wildlife resources. The USFWS functions include enforcement of federal wildlife laws, protection of endangered species, management of migratory birds, restoration of nationally significant fisheries, conservation and restoration of wildlife habitat such as wetlands, help of foreign governments with their international conservation efforts, and distribution of hundreds of millions of dollars, through the Wildlife Sport Fish and Restoration program, in excise taxes on fishing and hunting equipment to State fish and wildlife agencies http://www.fws.gov/help/about_us.html). **ANILCA** The Alaska National Interest Lands Conservation Act (ANILCA) directs federal agencies to consult and coordinate with the state of Alaska. State agencies responsible for natural resources, tourism, and transportation work as a team to provide input throughout federal planning processes (http://dnr.alaska.gov/commis/opmp/anilca/anilca.htm). **OPMP** The Department of Natural Resources (DNR) Office of Project Management and Permitting (OPMP) coordinates the review of larger scale projects in the state. Because of the complexity and potential impact of these projects on multiple divisions or agencies, these projects typically benefit from a single primary point of contact. A project coordinator is assigned to each project in order to facilitate interagency coordination and a cooperative working relationship with the project proponent. The office deals with a diverse mix of projects including transportation, oil and gas, mining, federal grants, ANILCA coordination, and land use planning. Every project is different and involves a different mix of agencies, permitting requirements, statutory responsibilities, and resource management responsibilities (http://dnr.alaska.gov/commis/opmp/). The assessment team feels that the NEPA process, existing agencies and processes (e.g. ADFG, ADEC, DNM, USFWS, ANILCA and OPMP), and the existing intimate and routine cooperation between federal and state agencies managing Alaska's coastal resources (living and non-living) is capable of planning and managing coastal developments in a transparent, organized and sustainable way. In addition, the recent developments from the public and upcoming ballot to reinstitute the Alaska Coastal Management Plan offer some insight in the possible return of the ACMP in 2012/2013. This development will be closely followed as part of next surveillance assessment and a determination will be made accordingly. In addition, the Board of Fisheries (BOF) public meetings process provides a regularly scheduled public forum for all interested individuals, fishermen, fishing organizations, environmental organizations, Alaskan Native organizations and other governmental and non-governmental entities to participate in the development of legal regulations for all

	fisheries managed or co-managed by the state. The BOF ensures that the process for the state's regulatory system relating to fish and wildlife resources operates publicly, efficiently and effectively. ADFG staff provides support for this public process, and ensures that the system is legal, timely, and accessible to the citizens of the state. The BOF is a seven member board appointed by the governor and confirmed by the legislature which sets fishing seasons, bag limits, methods and means for the state's commercial, subsistence, sport, guided sport, and personal use fisheries. It also sets policy and direction for management of the state's fishery resources and makes all decisions on allocation of those resources among users. The enabling statute for the BOF is AS 16.05.251. Regulations enacted by the BOF are found in the Alaska Administrative Code (AAC) Title 5, Chapters 1 – 77. The BOF and the NPFMC Council have openly public processes. Any individual or group can submit proposals for discussion of management and research for the crab fisheries in Alaska. The BOF meets in communities throughout coastal Alaska, while the NPFMC meets in communities in Alaska as well as in Washington and Oregon to provide public opportunities. Written comments are accepted when it is not possible to attend in person. http://www.fakr.noaa.gov/npfmc/ http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
2.1.1	**Alaska has appropriate, institutional and legal frameworks in order to determine the possible uses of coastal resources and to govern access to them taking into account the rights of coastal fishing communities and their customary practices to the extent compatible with sustainable development.** In addition to the information provided in clause 2.1, the management organizations within Alaska and their processes take into account the rights of coastal fishing communities and their customary practices to the extent compatible with sustainable development. The beginning of such processes is clearly demonstrated by the Council and Board of Fisheries public decision-making processes. **The BOF process.** The BOF main role is to conserve and develop the fishery resources of the state. The board is charged with making allocative decisions, and ADFG is responsible for management based on those decisions. The BOF meets four to six times per year in communities around the state to consider proposed changes to fisheries regulations around the state. The board uses the biological and socioeconomic information provided by the Alaska Department of Fish and Game, public comment received from people inside and outside of the state, and guidance from the Alaska Department of Public Safety and Alaska Department of Law when creating regulations that are sound and enforceable. Advisory committees are the local "grass roots" groups that meet to discuss fish and

	wildlife issues and to provide recommendations to the boards. There are 82 committees throughout the state each with expertise in a particular local area. This process ensures that the local communities' customary uses and practices are considered. As authorized by Alaska Statute 16.05.260 which originally passed in 1959, the Joint Board of Fisheries and Game established 82 Advisory committees for the purpose of providing a local forum for the collection and expression of opinions and recommendations on matters related to the management of fish and wildlife resources. The regulations governing the advisory committee are 5 AAC Chapter 96 and 97. Meetings are always open to the public and are generally attended by department staff and members of the public who can offer background information on agenda topics. Advisory Committees are intended to provide a local forum on fish and wildlife issues. http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main. Also see clause 1.4 noting the addition of PNCIAC. **The NPFMC process.** The Council system was designed so that fisheries management decisions were made at the regional level to allow input from affected stakeholders which assures that the rights of coastal communities and their historic access to the fishery is included in the decision process. Council meetings are open, and public testimony - both written and oral - is taken on each and every issue prior to deliberations and final decisions. Public comments are also taken at all Advisory Panel and Scientific and Statistical Committee meetings. While there is not a formal "call for proposals," interested stakeholders are welcome to draft letters to the Council. Each Council decision is made by recorded vote in public forum after public comment. Final decisions then go to NMFS for a second review, public comment, and final approval. Decisions must conform to the MSA, the NEPA, Endangered Species Act, Marine Mammal Protection Act, and other applicable law including several executive orders. Regulatory changes may take up to a year or longer to implement, particularly if complex or contentious, but the Council makes every attempt in being open and transparent throughout the process. The Council meets five times each year, usually in February, April, June, October and December, with three of the meetings held in Anchorage, one in a fishing community in Alaska and one either in Portland or Seattle. Most Council meetings take seven days, with the AP and SSC usually following the same agenda and meeting two days earlier (http://www.fakr.noaa.gov/npfmc/index.html). **CDQs.** The Community Development Quota (CDQ) Program began in December of 1992 with the goal of promoting fisheries related economic development in western Alaska. The program is a federal fisheries program that involves eligible communities who have formed six regional organizations, referred to as CDQ groups. There are 65 communities within a fifty-mile radius of the Bering Sea coastline who participate in the program. The CDQ program allocated a portion of the Bering Sea and Aleutian Island harvest amounts to CDQ groups, including halibut, groundfish (Pollock, Pacific cod, flatfish and rockfish), crab and bycatch species. The CDQ program was granted perpetuity status during the 1996 reauthorization of the Magnuson-Stevens Act.

The program was modelled after the Alaska Native Claims Settlement Act (ANCSA). However, the CDQ program was created with primary differences:

- Government oversight of all business activities (no longer a part of the CDQ program at present)
- Community based shareholders instead of individual shareholders
- Requirement that all investments be fisheries related

The six CDQ groups are located throughout the western Alaska coastline and South towards the Aleutian islands, these are:

- Aleutian Pribilof Island Community Development Association (6 communities)
- Bristol Bay Economic Development Corporation (17 communities)
- Central Bering Sea Fishermen's Association (1 community)
- Coastal Villages Region Fund (20 communities)
- Norton Sound Economic Development Corporation (15 communities)
- Yukon Delta Fisheries Development Association (6 communities).

A map of these communities is available at http://www.commerce.state.ak.us/bsc/CDQ/cdq.htm

The CDQ program has been successfully contributing to fisheries infrastructure in western Alaska by funding docks, harbors, vessel acquisition and the construction of seafood processing facilities. The CDQ program has allowed CDQ groups to acquire equity ownership interests in the halibut, groundfish, and crab sectors that provide additional revenues to fund local in-region economic development projects, and education and training programs.

NMFS' Habitat Conservation Division (HCD) works in coordination with industries, stakeholder groups, government agencies, and private citizens to avoid, minimize, or offset the adverse effects of human activities on Essential Fish Habitat (EFH) and living marine resources in Alaska. This work includes conducting and/or reviewing environmental analyses for a large variety of activities ranging from commercial fishing to coastal development to large transportation and energy projects.

HCD identifies technically and economically feasible alternatives and offers realistic recommendations for the conservation of valuable living marine resources. HCD focuses on activities in habitats used by federally managed fish species located offshore, nearshore, in estuaries, and in freshwater areas important to anadromous fish.

http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main
http://www.adfg.alaska.gov/index.cfm?adfg=process.advisory
http://www.fakr.noaa.gov/npfmc/public-meetings/meeting-calendar.html
http://www.dced.state.ak.us/bsc/cdq/cdq.htm
http://alaskafisheries.noaa.gov/habitat/

Evidence adequacy rating:	
☑High ☐ Medium ☐ Low	
Clause:	**Evidence**
2.1.2	**In setting policies for the management of coastal areas, Alaska takes due account of the risks and uncertainties involved.** Risks and uncertainties related to the policies set up for the management of coastal areas are taken into account within and throughout the various NEPA processes, NPFMC and BOF proceedings as well as through ANILCA and the Department of Natural Resources (DNR) Office of Project Management and Permitting (OPMP). Please see previous Clauses in this section for further information.

Clause:	
2.2	**Representatives of the fisheries sector and fishing communities shall be consulted in the decision-making processes involved in other activities related to coastal area management planning and development**. ***FAO CCRF 10.1.2***
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
2.2	**Representatives of the fisheries sector and fishing communities are consulted in the decision making processes involved in other activities related to coastal area management planning and development.** Representatives of the fisheries sector and fishing communities are consulted in the decision-making processes and in other activities related to coastal area management planning and development. This happens through the NEPA processes, the NPFMC and BOF proceedings as well as through public review processes organized by the National Marine Fisheries Service. Please refer to previous Clauses in this section for further information and references.

Clause:

2.3 Fisheries practices that avoid conflict among fishers and other users of the coastal area shall be adopted.

2.3.1 Procedures and mechanisms shall be established at the appropriate administrative level to settle conflicts which arise within the fisheries sector and between fisheries resource users and other users of the coastal area.

FAO CCRF 10.1.4, 10.15

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
2.3	**Fisheries practices that avoid conflict among fishers and other users of the coastal area are adopted.** Conflict is avoided in these Bering Sea crab fisheries because they operate under an IFQ/IPQ system. Fishermen have formed working cooperatives to reduce the number of vessels and pots on the fishing grounds. The groundfish fisheries in the Bering Sea operate under either the federal LLP program or the rationalized Pollock and flatfish programs. Additionally, several areas are closed to the groundfish fleet to protect crab habitat. Further, waters around traditional subsistence use areas have been closed to commercial fishing. These fisheries also operate in conjunction with the CDQ program, previously described, that protects the interest of coastal communities. In addition to these NPFMC/NMFS programs and regulations, the Council and the BOF offer a public forum for stakeholder involvement and conflict avoidance/resolution. Conflicts between fishermen and other coastal users are usually discussed and resolved at the NEPA Process level. Please see previous clauses in this Section for further information. http://www.fakr.noaa.gov/npfmc/catch-shares-allocation/bsai-crab-rationalization-program.html http://www.fakr.noaa.gov/npfmc/conservation-issues/habitat-protections.html http://www.fakr.noaa.gov/cdq/

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
2.3.1	**Procedures and mechanisms are established at the appropriate administrative level to settle conflicts which arise within the fisheries sector and between fisheries resource users and other users of the coastal area.** The NEPA process, deliberately takes into account all resources and users of coastal resources in order to resolve potential conflicts among users before project approvals are given. Conflict resolution mechanisms include both administrative (through governmental agencies) and legal (through courts of law) procedures. However, in most cases project approvals are withheld until substantive conflicts are resolved. NMFS and NPFMC will participate in the NEPA processes whenever resources under their management may be affected by other developments. Similarly, the State of Alaska resolves conflict through the BOF process, and through programs established by the Alaska Department of Natural Resources and ANILCA. Please see prior clauses. http://www.epa.gov/aboutepa/states/ak.html

Clause:

2.4 States and sub-regional or regional fisheries management organizations and arrangements shall give due publicity to conservation and management measures and ensure that laws, regulations and other legal rules governing their implementation are effectively disseminated. The bases and purposes of such measures shall be explained to users of the resource in order to facilitate their application and thus gain increased support in the implementation of such measures.

FAO CCRF 7.1.10

2.4.1 The public shall be kept aware on the need for the protection and management of coastal resources and the participation in the management process by those affected.

FAO CCRF 10.2.1

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
2.4	**States and sub-regional or regional fisheries management organizations and arrangements give due publicity to conservation and management measures and ensure that laws, regulations and other legal rules governing their implementation are effectively disseminated. The bases and purposes of such measures are explained**

	to users of the resource in order to facilitate their application and thus gain increased support in the implementation of such measures. National Public Radio is the main source as information for Alaska fisherman (http://www.npr.org/). All fishery report passes out through NPR and keep informed fishermen of development as they are implemented. In addition to local radio, the internet (NMFS and ADFG websites), and printed news releases and Emergency Orders (available at local harbourmaster's offices, marine supply outlets, etc) are also important sources of public information. The Marine Conservation Alliance (MCA) has a website that give links to all of the various State, federal plans and proposals, Industry and USCG information (http://www.marineconservationalliance.org/). NPR and MCA are widely used by industry and the communities. The NPFMC and BOF public processes encourage fisheries stakeholders to become involved in all the decision-making processes relative to the fishery resource in question. Many of these processes will result in legislation. These agencies provide vast amounts of written and electronic information related to the fisheries under their management on their websites, at local offices, and via radio updates. Fishery users are educated about conservation and management measures by simple virtue of involvement in the process, and by the public nature of the management system, starting from decision making to the final stages of law/regulation publication. Stakeholders involvement allows for facilitation in application and support in the implementation of fisheries management measures. **Sources of evidence:** http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main http://www.fakr.noaa.gov/npfmc/catch-shares-allocation/bsai-crab-rationalization-program.html http://www.fakr.noaa.gov/sustainablefisheries/crab/default.htm	
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
2.4.1	**The public is kept aware on the need for the protection and management of coastal resources and the participation in the management process by those affected.** National Public Radio is a common source as information for Alaska fisherman. All fishery reports pass out through NPR and keep informed fishermen of development as they are implemented. Additionally, both electronic and hard copies of regulatory actions are available from all NFMS and ADFG offices. Both the Council and the Board also make upcoming agendas and scientific materials to be discussed available on their web sites, and at local offices.	

	While NMFS Office for Law Enforcement (OLE) is tasked with enforcing the laws and regulations that serve to protect our nation's living marine resources, continuous education of the American public and ocean resource users is key in protection and conservation. OLE special agents, enforcement officers and support personnel routinely make presentations to school, scout and civic groups. These presentations cover a vast array of subjects within enforcement and conservation. Marine mammal protection, endangered species, sustainable fisheries, vessel monitoring systems, new Federal fishing regulations, and proper stranding procedures are just a few of the topics that they address. Special agents and enforcement officers are engaged in their communities and can be solicited directly through the local field office (http://www.nmfs.noaa.gov/pr/education/). NOAA's NMFS Protected Resources Outreach and Education Plan of 2006 strives to give direction to the myriad efforts currently underway across the NMFS Protected Resources (PR) regional and headquarters offices and NMFS science centers. This plan incorporates visions and mandates from NOAA, NMFS, and PR into an outline and plan of action addressing outreach and education for the next three to five years. Workshop participants identified challenges to outreach and education, most effectively addressed at a national level, which form the basis of the Outreach and Education plan. In all NMFS/PR offices and at NMFS science centers, outreach and education activities are successfully underway. The work is carried out by full time outreach specialists, program staff with partial outreach responsibilities, and by interested staff who integrate outreach and education into their regular duties. Outreach and education will improve the public's perspective of Protected Resource's programs by increasing the public's knowledge of the status of species, threats to their continued survival, and how NMFS science and management are working to address. (http://www.nmfs.noaa.gov/pr/pdfs/education/strategic_plan.pdf). http://www.adfg.alaska.gov/static/species/wildlife_action_plan/cwcs_main_text_combined.pdf Please see also Clause 2.4 as well as previous clauses in this Section.	

Clause:

2.5 The economic, social and cultural value of coastal resources shall be assessed in order to assist decision-making on their allocation and use.

- **Economic assessment**
- **Social and cultural assessment**

FAO CCRF 10.2.2

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
2.5	**The economic, social and cultural value of coastal resources are assessed in order to assist decision-making on their allocation and use.** MSA lists 10 National Standards, to be used to obtain policy objectives. National Standard five states that the federal government must consider efficiency in utilization; and not have economic allocation as a sole purpose in their decision making process. National Standard eight requires that the Council consider fishing communities to provide for their sustained participation, while to the extent practicable, minimizing adverse economic impacts. The Council considered both in the development of the Crab Rationalization program. The primary job of the NPFMC and the BOF is to manage the resources sustainably and to determine the allocation of resources to different users. To do so, they use biological and socio-economic information collected and analyzed by the NMFS and the ADFG. The NPFMC, NMFS and ADFG all have staff economists that participate in the economic, social and cultural evaluation and review process of fishery management proposals. They advise the NPFMC and BOF members, as well as their agency heads that help lead the regulation amendment process. Secondarily, on a higher level, the NEPA process has the same requirements, as the biological and socio-economic aspects of the fishery must be taken into account before such decision can occur. The Alaska Fishery Science Center (AFSC) began a large scale socio-economic and cultural assessment of the Alaskan fishery users in 2005. In that year, the AFSC compiled baseline socioeconomic information about the 136 Alaska communities most involved in commercial fisheries. Communities were selected by assessing fishery-involvement indicators including landings, processors, vessel homeports, vessel ownership, crew licenses, and gear operator permits. The profiles compiled information from the US Census, ADFG, the Commercial Fisheries Entry Commission (CFEC), NMFS Restricted Access Management Division, Alaska Department of Community and Economic Development, and various community groups, websites, and archives.

	The 5-page profiles for each community follow the same general outline: • People and Place (Location, Demographics, History). • Infrastructure (Current Economy, Governance, Facilities). • North Pacific Fisheries involvement (Commercial, Recreational, Subsistence Fishing). The profiles were published as NOAA Technical Memorandum NMFS-AFSC-160 in December 2005. The report can be downloaded as a complete document (17.6 MB) from http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-160/NOAA-TM-AFSC-160.pdf. The AFSC is planning to update the Alaskan community profiles to include new U.S. Census data from 2010 and input from the communities and industry. The Economic status of the fisheries off the BSAI area can be found in the Economic SAFE. These reports are published yearly along with the Ecosystem SAFEs and the various fishery Stock Assessment and Resource Evaluation (SAFE) reports. See also at http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-230.pdf. The Alaska Fisheries Information Network (AKFIN) was established in 1997 under the direction of the Pacific States Marine Fisheries Commission (PSMFC) to consolidate, manage and dispense information related to Alaska's commercial fisheries. AFKIN was founded in response to an increased need for detailed, organized fishery information to help in making management decisions with a mission to maintain an analytic database of both state and federal historic, commercial Alaska fisheries data relevant to the needs of fisheries analysts and economists and to provide that data in a usable format. http://www.akfin.org/about-akfin In August of 2005, fishing in the Bering Sea and Aleutian Island crab fisheries began under a new share-based management program (the “program”). As a part of the program, the Council developed an economic data collection program (referred to as “economic data reports” or EDR) to provide information to analysts to assess the effects of the program and future amendments to the program. http://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/CPU.php http://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/2011Crab_EDR_CIE_announcement.php

Clause:	
2.6	**In accordance with capacities, measures shall be taken to establish or promote systems to monitor the coastal environment as part of the coastal management process using physical, chemical, biological, economic and social parameters.** ***FAO CCRF 10.2.4, 10.2.5***
2.6.1	**States shall promote multidisciplinary research in support and improvement of coastal area management, in particular on its environmental, biological, economic, social, legal and institutional aspects.** ***FAO CCRF 10.2.5***

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	Evidence
2.6	**In accordance with capacities, measures are taken to establish or promote systems to monitor the coastal environment as part of the coastal management process using physical, chemical, biological, economic and social parameters.** Monitoring of the coastal environment in Alaska is performed by federal and state agencies including the U.S. Forest Service, U.S. Fish and Wildlife Service, and the NMFS, ADFG as well as many institutions of higher learning (such as the University of Alaska Institute of Marine Science (IMS)). IMS faculty and research staff provides expertise in marine biology, biological oceanography, physical, chemical and geological oceanography. With an annual research budget of approximately $5.5 million, current IMS projects include Northeast Pacific near-surface monitoring of temperature, salinity and fluorescence, polycyclic aromatic hydrocarbon research, and Arctic ocean biodiversity. (http://www.ims.uaf.edu/) Economic and social parameters are assessed by the staff of the NPFMC, NMFS and ADFG either during the NEPA review of plan amendments or during their on-going studies and evaluations. For Oceanography, the North Pacific Research board (NPRB) has funded million of dollars for numerous studies describing baseline oceanographic parameters and supported environmental buoy arrays (http://www.nprb.org). NPRB also have funded major ecosystem studies (currently ongoing) in the GOA and BSAI worth 10's of millions of US$ (see GOAIERP and BSIERP). The NPRB joined with NSF and their BASIS program to augment the special funding of BSIERP to nearly $52 million. The NPRB also funded individual projects to support management and conservation of Council related fisheries. Each grant of the NPRB includes a requirement that a portion of the funds be directed to community education and outreach. Additionally, NMFS Pacific Marine Environmental Lab (PMEL) regularly collects oceanographic and environmental data, which is important to understanding the changing habitat of crab and other marine species. (http://www.pmel.noaa.gov).

	ADEC The Alaska Department of Environmental Conservation (ADEC) Division of Water establishes standards for water cleanliness; regulates discharges to waters and wetlands; provides financial assistance for water and wastewater facility construction, and waterbody assessment and remediation; trains, certifies and assists water and wastewater system operators; and monitors and reports on water quality. This agency also monitors and enforces the discharges associated with fish and shellfish processing (http://dec.alaska.gov/water/ MoreAboutWater.htm). ADEC Division of Spill Prevention and Response prevents spills of oil and hazardous substances, prepares for when a spill occurs and responds rapidly to protect human health and the environment (http://dec.alaska.gov/spar/index.htm). **ADFG** ADFG Habitat Division conducts research on watersheds, active mining sites, fire-impacted woodlands, anadromous fish streams, and coastal and marine environments throughout Alaska in an effort to document and mitigate human-related impacts, changes in habitat & species abundance (http://www.adfg.alaska.gov/index.cfm?adfg=habitatresearch. main). The agency also collects physical and chemical data during their St. Matthew's pot survey using data loggers placed on the survey pots. Data includes temperature, depth, salinity and conductivity. **AFSC** The AFSC's *"Ecosystem Monitoring and Assessment Program"* (EMA) main goal is to improve and reduce uncertainty in stock assessment models of commercially important fish and shellfish species through the collection of observations of survey catch and oceanography. Fishery observers and survey scientists collect information regarding fish abundance, size, distribution, diet and energetic status. Oceanographic observations include temperature, conductivity, salinity, density, light transmission, photosynthetically available radiation (PAR), oxygen, Chlorophyll a, and estimates of the composition and biomass of phytoplankton and zooplankton (includes jellyfish) species. These fisheries and oceanographic observations are used to connect climate change and variability in large marine ecosystems to early marine survival of commercially important fish species in the GOA, Bering Sea, and Arctic. The oceanographic component of EMA investigates various physical and biological parameters in the eastern Bering Sea. Spatial and temporal patterns illustrated by these data provide critical insight into how the ecosystem functions. Oceanographic data are analyzed alone and in conjunction with fisheries data for comparisons of water mass characteristics. Water samples collected above and below the pycnocline are analyzed for chlorophyll a concentration to explore productivity and are used in primary production experiments to explore growth rates. Phytoplankton forms the base of the food web and perform a critical role in the Bering Sea ecosystem. Zooplankton and jellyfish are collected for species ID, biomass, and abundance. Zooplankton are an important prey item of numerous Bering Sea fishes including forage fishes and the juvenile stages of many commercially important species. Understanding the links among phytoplankton, zooplankton, and fishes will further AFSC's understanding changes in populations of fisheries stocks and the influence of climate change in this region (http://www.afsc.noaa.gov/ABL/EMA/EMA_Oceanography.php).

	In 2005, the AFSC also compiled baseline socioeconomic information about the 136 Alaska communities most involved in commercial fisheries. Their plan is now to update with 2010 information. Please see previous clause for more details. **NMFS** The NMFS' Habitat Conservation Division (HCD) works in coordination with industries, stakeholder groups, government agencies, and private citizens to avoid, minimize, or offset the adverse effects of human activities on Essential Fish Habitat (EFH) and living marine resources in Alaska. This work includes conducting and/or reviewing environmental analyses for a large variety of activities ranging from commercial fishing to coastal development to large transportation and energy projects. HCD identifies technically and economically feasible alternatives and offers realistic recommendations for the conservation of valuable living marine resources. HCD focuses on activities in habitats used by federally managed fish species located offshore, nearshore, in estuaries, and in freshwater areas (http://www.fakr.noaa.gov/habitat/default.htm). **USCG** Protecting the U.S. EEZ and key areas of the high seas is an important mission for the US Coast Guard. The Coast Guard enforces fisheries laws at sea, both domestic and international fishing agreements as tasked by the MSA. Furthermore, the goal of the USCG's marine protected species program is to assist the NMFS and the FWS in the development and enforcement of those regulations necessary to help recover and maintain the country's marine protected species and their marine ecosystems. Coast Guard objectives include assisting in preventing the decline of marine protected species populations, promoting the recovery of marine protected species and their habitats, partnering with other agencies and organizations to enhance stewardship of marine ecosystems and ensuring internal compliance with appropriate legislation, regulations and management practices (http:// www.uscg.mil/hq/cg5/cg531/LMR.asp). **RAM** The NMFS Alaska Regional Office's Restricted Access Management Program (RAM) is responsible for managing Alaska Region permit programs, including those that limit access to the Federally-managed fisheries of the North Pacific. RAM prepares and distributes reports on landings in the Bering Sea crab fisheries as well as all other federal fisheries (http://www.fakr. noaa.gov/ram/). **AFKIN.** The Alaska Fisheries Information Network (AKFIN) was established in 1997 under the direction of the Pacific States Marine Fisheries Commission (PSMFC) to consolidate, manage and dispense information related to Alaska's commercial fisheries. AFKIN was founded in response to an increased need for detailed, organized fishery information to help in making management decisions with a mission to maintain an analytic database of both state and federal historic, commercial Alaska fisheries data relevant to the needs of fisheries analysts and economists and to provide that data in a usable format (http://www.akfin.org/about-akfin).

	ANILCA In addition, the Alaska National Interest Lands Conservation Act (ANILCA) directs federal agencies to consult and coordinate with the state of Alaska. State agencies responsible for natural resources, tourism, and transportation work as a team to provide input throughout federal planning processes. (http://dnr.alaska.gov/commis/opmp/anilca/anilca.htm) **OPMP** Moreover, the Department of Natural Resources (DNR) Office of Project Management and Permitting (OPMP) coordinates the review of larger scale projects in the state. Because of the complexity and potential impact of these projects on multiple divisions or agencies, these projects typically benefit from a single primary point of contact. A project coordinator is assigned to each project in order to facilitate interagency coordination and a cooperative working relationship with the project proponent. The office deals with a diverse mix of projects including transportation, oil and gas, mining, federal grants, ANILCA coordination, and land use planning. Every project is different and involves a different mix of agencies, permitting requirements, statutory responsibilities, and resource management responsibilities (http://dnr.alaska.gov/commis/opmp/).
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
2.6.1	**Alaska fisheries management agencies promote multidisciplinary research in support and improvement of coastal area management, in particular on its environmental, biological, economic, social, legal and institutional aspects.** The agencies reported above (in clause 2.6) and their efforts are continuously aimed at improving the management of the coastal areas of Alaska. Environmental, biological, economic, social, legal and institutional aspects of the coastal zone are routinely researched, many times using a multidisciplinary approach. Please see clause 2.6 for some examples.

Clause:
2.7 **In the case of activities that may have an adverse transboundary environmental effect on coastal areas, States shall:** **a) Provide timely information and, if possible, prior notification to potentially affected States;** **b) Consult with those States as early as possible.** ***FAO CCRF 10.3.2***
Evidence adequacy rating: **☐ High** **☐ Medium** **☐ Low**

Clause:	Evidence
2.7	**This clause is not applicable**. The three stocks here in question are not considered trans-boundary, straddling, highly migratory fish stocks or high seas fish stocks exploited by two or more States. These management stocks occur are managed entirely within the Alaska EEZ for maximum sustainable yield.

Clause:
2.8 **States shall cooperate at the sub-regional and regional level in order to improve coastal area management.** ***FAO CCRF 10.3.3***
Evidence adequacy rating: **☑ High** **☐ Medium** **☐ Low**

Clause:	Evidence
2.8	**Alaska's fisheries management organisations cooperate at the sub-regional and regional level in order to improve coastal area management.** The BSAI crab 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. There is intimate, routine and compatible collaboration between state and federal management. This is highlighted by the Joint Protocol of 1997 between the NPFMC and ADFG, which intent is to provide long-term cooperative, compatible management systems that maintain the sustainability of the fisheries resources in

	State and Federal waters. The State/Federal Action Plan between NMFS and ADFG set out procedures for the two agencies to work together on crab management. The 1997 Joint Protocol was between the NPFMC and the BOF setting up an annual Joint Board/Council meeting on coordinating state/federal issues. The September 1999 addendum to the Joint Protocol and State/Federal Action Plan designated a subgroup of the Board and Council to their joint protocol committee and specified staffing issues. In addition, the federal agency tasked with management of Category 1 management measures participates in the NEPA processes whenever resources under their management may be affected by other developments. The NEPA processes seek and include extensive stakeholder participation. The Alaska National Interest Lands Conservation Act (ANILCA) directs federal agencies to consult and coordinate with the state of Alaska. Moreover, the Department of Natural Resources (DNR) Office of Project Management and Permitting (OPMP) coordinates the review of larger scale projects in the state. http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.findings http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/findings/ff97170a.pdf http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/findings/ff99183x.pdf http://dnr.alaska.gov/commis/opmp/ http://dnr.alaska.gov/commis/opmp/anilca/anilca.htm	

Clause:

2.9 States shall establish mechanisms for cooperation and coordination among national authorities involved in planning, development, conservation and management of coastal areas.

FAO CCRF 10.4.1

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
2.9	**There are established mechanisms for cooperation and coordination among national authorities involved in planning, development, conservation and management of coastal areas.** Alaska has established mechanisms for cooperation and coordination among national authorities involved in planning, development, conservation and management of coastal areas. The NMFS in connection with the Council managing the crab resource in the Bering Sea, participates in coastal area management-related institutional frameworks through the federal National Environmental Policy Act (NEPA) processes. This usually happens whenever resources under their management may be affected by other developments. Federal agencies, including the NPFMC, are responsible for producing NEPA documents each time they renew or amends regulations. Therefore, all of the NPFMC proposed regulations include NEPA considerations. NEPA, therefore, is a comprehensive process to provide checks and balances against changes to the environment that may impact ecosystems and the natural processes, as well as the socio-economic sphere of fisheries. Every agency in the executive branch of the Federal Government has a responsibility to implement NEPA. In NEPA, Congress directed that, to the fullest extent possible, the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in NEPA. To implement NEPA's policies, Congress prescribed a procedure, commonly referred to as "the NEPA process" or "the environmental impact assessment process." (http://ceq.hss.doe.gov/nepa/Citizens_Guide_Dec07.pdf). Stakeholders are actively invited through publicly advertised and scheduled meetings. The Alaska National Interest Lands Conservation Act (ANILCA) directs federal agencies to consult and coordinate with the state of Alaska. State agencies responsible for natural resources, tourism, and transportation work as a team to provide input throughout federal planning processes (http://dnr.alaska.gov/commis/opmp/anilca/anilca.htm). Moreover, the Department of Natural Resources (DNR) Office of Project Management and Permitting (OPMP) coordinates the review of larger scale projects in the state. Because of the complexity and potential impact of these projects on multiple divisions or agencies, these projects typically benefit from a single primary	

	point of contact. A project coordinator is assigned to each project in order to facilitate interagency coordination and a cooperative working relationship with the project proponent. The office deals with a diverse mix of projects including the Aleutian Island Ecosystem Plan, transportation, oil and gas, mining, federal grants, ANILCA coordination, and land use planning. Every project is different and involves a different mix of agencies, permitting requirements, statutory responsibilities, and resource management responsibilities (http://dnr.alaska.gov/commis/opmp/).	

Clause:

2.10 States shall ensure that the authority or authorities representing the fisheries sector in the coastal management process have the appropriate technical capacities and financial resources.

FAO CCRF 10.4.2

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	Evidence	
2.10	**Authorities representing the fisheries sector in the coastal management process have the appropriate technical capacities and financial resources.** The federal and State agencies involved in the management of crab resources in the waters off Alaska have the appropriate technical capacity and financial resources to carry out their mandates. Please see a discussion about the financing of fisheries in clause 1.6. The technical capacities of these agencies are covered by internationally recognized scientists, seasoned fishery managers and policy makers, which in most cases devote their entire career to the agency they work for and the resource they are trying to manage.	

Clause:
2.11 **States and fisheries management organizations and arrangements shall regulate fishing in such a way as to avoid the risk of conflict among fishers using different vessels, gear and fishing methods.**   ***FAO CCRF 7.6.5***
Evidence adequacy rating: **☑ High** **☐ Medium** **☐ Low**

Clause:	Evidence
2.11	**Fishing is regulated in such a way as to avoid the risk of conflict among fishers using different vessels, gear and fishing methods.** In the Bering Sea for both state and federal waters, crab is caught using pot gear only. There are well-established trawl closure areas where crabs are protected from groundfish gear, eliminating gear conflicts. Groundfish fisheries are also subject to crab bycatch caps which could result in major, valuable groundfish fishery closures if those caps are exceeded. http://www.fakr.noaa.gov/habitat/mpa/default.htm http://alaskafisheries.noaa.gov/npfmc/PDFdocuments/bycatch/Crab_bycatch_PSC909.pdf http://www.fakr.noaa.gov/2012/car250_psc_crab.csv

3. Management objectives shall be implemented through management rules and actions formulated in a plan or other framework. *FAO CCRF 7.3.3/7.2.2*						
Confidence Ratings	**Low**	**0 out of 6**	**Medium**	**0 out of 6**	**High**	**6 out of 6**

Clause:

3.1 Long-term management objectives shall be translated into a plan or other management document and be subscribed to by all interested parties.

FAO CCRF 7.3.3
ECO 28.1

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
3.1	**Long-term management objectives are translated into a plan or other management document and are subscribed to by all interested parties.** Long-term objectives are outlined in the BSAI Crab FMP as dictated by the MSA. **National Standards for Fishery Conservation and Management** The MSA, as amended, sets out ten national standards for fishery conservation and management (16 U.S.C. § 1851), with which all fishery management plans must be consistent. They are: 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 manner that no particular individual, corporation, or entity acquires an excessive share of such privileges.

5. Conservation and management measures shall, where practicable, consider 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 measures 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.

Management Objectives

The BSAI king and Tanner crab FMP lists the following objectives:

- Biological Conservation Objective: Ensure the long-term reproductive viability of king and Tanner crab populations.
- Economic and Social Objective: Maximize economic and social benefits to the nation over time.
- Gear Conflict Objective: Minimize gear conflict among fisheries.
- Habitat Objective: To protect, conserve, and enhance adequate quantities of essential fish habitat (EFH) to support king and Tanner crab populations and maintain a healthy ecosystem.
- Vessel Safety Objective: Provide public access to the regulatory process for vessel safety considerations.
- Due Process Objective: Ensure that access to the regulatory process and opportunity for redress are available to all interested parties.
- Research and Management Objective: Provide fisheries research, data collection, and analysis to ensure a sound information base for management decisions.

The national standards and management objectives defined in BSAI FMP provide adequate evidence to demonstrate the existence of long-term objectives clearly stated in management plans.

NMFS conducts biological research that is used by the NPFMC's Crab Plan Team to recommend a Total Allowable Catch (TAC) in each fishery. ADFG uses their recommendations along with the best scientific data available at the time to establish catch limits for each of its crab fisheries in the Bering Sea.

	The BOF and the department also maintain long-term objectives for these fisheries established in regulation and in Annual Management Reports. State regulations for the king and Tanner crab fisheries are listed under the Alaska Administrative Code, Title 5, Chapter 34 and 35. Long term objectives for State regulations are listed under 5 AAC 34.816 Bristol Bay red king crab harvest strategy, 5 AAC 34.917 St. Matthew Island Section blue king crab harvest strategy, and 5 AAC 35.517 Bering Sea *C. opilio* Tanner crab harvest strategy. Annual Management Reports may be found on the department's web site. (*C.opilio* is also known as "snow" crab). Evidence: See Clause 1.1 http://www.adfg.alaska.gov/FedAidPDFs/FMR11-05.pdf http://www.legis.state.ak.us/basis/folioproxy.asp?url=http://wwwjnu01.legis.state.ak.us/cgi-bin/folioisa.dll/aac/query=[jump!3A!275+aac+34!2E917!27]/doc/{@22966}?prev http://www.legis.state.ak.us/basis/folioproxy.asp?url=http://wwwjnu01.legis.state.ak.us/cgi-bin/folioisa.dll/aac/query=[JUMP:'5+aac+34!2E917']/doc/{@1}?firsthit http://www.legis.state.ak.us/basis/folioproxy.asp?url=http://wwwjnu01.legis.state.ak.us/cgi-bin/folioisa.dll/aac/query=[JUMP:'5+aac+35!2E517']/doc/{@1}?firsthit Similarly, the NPFMC maintains SAFE documents. All these materials are widely available via electronic or paper format from each agency. Management decisions are made by the BOF and Council, and implemented and enforced by AWT and NMFS. Both these processes are extremely transparent and inclusive of all stakeholders; all stakeholders are active participants. See prior discussions on enforcement. *Evidence:* http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main www.fakr.noaa.gov/npfmc/default.htm http://www.fakr.noaa.gov/sustainablefisheries/crab/default.htm	

Clause:	
3.2	**Management measures shall provide inter alia that:**
3.2.1	**Excess fishing capacity is avoided and exploitation of the stocks remains economically viable;**
3.2.2	**The economic conditions under which fishing industries operate promote responsible fisheries;**
3.2.3	**The interests of fishers, including those engaged in subsistence, small-scale and artisanal fisheries, are taken into account;**
3.2.4	**Biodiversity of aquatic habitats and ecosystems is conserved and endangered species are protected;**
3.2.5	**Depleted stocks are allowed to recover or, where appropriate, are actively restored;**
	FAO CCRF 7.2.2
	ECO 28.2

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	Evidence
3.2.1	**Excess fishing capacity is avoided and exploitation of the stocks remains economically viable.** In 1995, NMFS implemented the NPFMC's program of Individual Fishing Quotas (IFQs) for sablefish and Pacific halibut, which were explicitly intended to alleviate excess fishing capacity and improve the economic viability of the fishing industry. In its first few years, the Alaska Commercial Fisheries Entry Commission (CFEC) monitored and evaluated the effects of the IFQ program. Since 1998, NMFS has performed that evaluation, to ensure that the IFQ program continues to achieve its goals. The Bering Sea crab fishery followed suit in 2005, with a Congressionally approved approach creating Processor Quota Shares as well as Individual Fishing Quotas for rationalized crab fisheries in the BSAI. By capping the numbers of buyers and sellers, and providing greatly protracted seasons, vessels were able to join cooperatives that resulted in fewer vessels deploying less gear on the grounds. The pot gear deployed is selective, with ADFG mandated escape rings to allow small crab to escape, and biodegradable twine to reduce ghost fishing from lost pots. With the race for fishing no longer hanging over the fleet, this resulted in reduced pot losses, reduced damage from on-deck sorting, reduced deadloss, and a higher quality product. Additionally, a large, efficient fleet operating in a race for fish scenario can quickly surpass a harvest target when they locate high concentrations of crab.

Between 2000 and 2004, the guideline harvest level for Bristol Bay red king crab was exceeded in two out of five years; the GHL for Bering Sea *C. opilio* was exceeded in five out of six years; and the GHL for Aleutian Islands golden king crab was exceeded in two out of five years (NPFMC 2007). Since the implementation of the crab rationalization program, the total allowable catch (TAC) for these fisheries has never been exceeded.

Evidence:

http://www.fakr.noaa.gov/npfmc/PDFdocuments/catch_shares/Crab/5YearRev1210.pdf

http://www.fakr.noaa.gov/sustainablefisheries/crab/default.htm

www.fakr.noaa.gov/ram/ifq.htm

http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/default.htm

Evidence adequacy rating:

☑ High **☐ Medium** **☐ Low**

Clause:	Evidence
3.2.2	**The economic conditions under which fishing industries operate promote responsible fisheries.** The economic conditions under which fishing industries operate do promote responsible fisheries, as demonstrated in the analysis by NMFS. The NMFS produces a number of reports, including its Annual Report to the Fleet, as well as the mandatory Economic Data Report. The department also tracks exvessel value of the fisheries they manage, and produces Annual Management Reports. These comprehensive reports are available in either electronic or hard copy. For example, under a rationalized fishery, there were 245 Bristol Bay red king crab quota holders, 231 Bering Sea *C. opilio* (snow crab) holders, and 136 St. Matthew Island blue king crab holders. A quota share holder may hold quota in several (or all) fisheries, as they were an allocation derived from the historical volume of pounds legally landed, compared to the total pounds landed by the entire fleet. Prior to rationalization, more than 300 vessels would participate in the larger fisheries. Today, because of the use of cooperatives, many fewer boats are needed to take the TAC. For example, in the 2009/2010 season, there were seventy vessels that landed 14.3 million pounds in the Bristol Bay red king crab fishery. Those crab were worth $63.1 million exvessel. That season there were also seven vessels that participated in the St. Matthew fishery, landing a catch valued at approximately one million dollars exvessel. In the 2009/10 snow crab fishery, sixty-nine vessels harvested 43.2 million pounds worth of crab, with an exvessel value of $48.27 million. http://www.fakr.noaa.gov/sustainablefisheries/crab/default.htm http://www.fakr.noaa.gov/npfmc/PDFdocuments/catch_shares/Crab/CrabEDR212.pdf http://www.adfg.alaska.gov/FedAidPDFs/FMR11-05.pdf

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
3.2.3	**The interests of fishers, including those engaged in subsistence, small-scale and artisanal fisheries are taken into account.** The interests of all fishermen are taken into account. However, as this is an industrialized fishery that occurs far offshore, there is little to no subsistence take and small or artisanal vessels seldom fished. Rather, the interests of Alaska Natives in the region are taken into account by the Community Development Quota (CDQ) program. The CDQ program allocates a share of the Bering Sea crab resource (as well as the resources of several other fishes) among six groups of small Alaska Native communities along the Bering Sea coast. The intent of the CDQ program is to provide an economic base for that region. As the Bering Sea crab fishery is under an IFQ system that is fully utilized, there is no small-scale or artisanal fishery on those crab stocks. Those who had participated prior to rationalization, and met qualifying criteria, received some quota share at the time of program implementation. http://www.fakr.noaa.gov/sustainablefisheries/crab/default.htm

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
3.2.4	**Biodiversity of aquatic habitats and ecosystems is conserved and endangered species are protected.** Conservation of aquatic habitats and biodiversity are integral parts of NPFMC's management process. These concerns and decisions are summarized in the Ecosystems Considerations chapter of the Council's annual Stock Assessment and Fishery Evaluation (SAFE) report. The Council and NMFS have a long history of restricting fishing operations in order to protect endangered and threatened species of marine mammals and birds. Many groundfish fisheries have closed areas or restricted harvest to protect crab and their habitat. Physical damage to the habitat by pot gear depends on habitat type. Sand and soft sediments where the majority of EBS crab pot fishing occurs are less likely to be impacted, whereas coral, sponge, and gorgonian habitats are more likely to be damaged by commercial crab pots in the AI GKC fishery (Quandt 1999, NMFS 2004). The total portion of the EBS impacted by commercial pot fishing may be less than 1% of the shelf area (NMFS 2004). The report concludes that BSAI crab fisheries have an insignificant effect on benthic habitat. http://www.fakr.noaa.gov/habitat/default.htm

	http://access.afsc.noaa.gov/reem/ecoweb/index.cfm http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf	

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
3.2.5	**Depleted stocks are allowed to recover or, where appropriate, are actively restored.** The Department and the Crab Plan Team assess the health of the Bering Sea crab stocks annually. Several fisheries have been declared "overfished" when spawning stock biomass was below the minimum stock size threshold as outlined in the FMP. The overfished declaration was made despite the curtailment of fishing for many years and specific area closures. The NMFS has developed rebuilding plans for those fisheries, produced as amendments to the Crab FMP. http://www.fakr.noaa.gov/frules/amd14.pdf http://www.fakr.noaa.gov/frules/ktc15approval.pdf	

B. Science and Stock Assessment Activities

4. There shall be effective fishery data (dependent and independent) collection and analysis systems for stock management purposes. ***FAO CCRF 7.1.9/7.4.4/7.4.5/7.4.6/8.4.3/12.4*** ***FAO Eco 29.1-29.3***						
Confidence Ratings	**Low**	**0 out of 9**	**Medium**	**0 out of 9**	**High**	**9 out of 9**

Clause: **4.1 Reliable and accurate data required for assessing the status of fisheries and ecosystems - including data on retained catch of fish, by catch, discards and waste shall be collected.** **4.1.1 These data shall be collected, at an appropriate time and level of aggregation, by relevant management organizations connected with the fishery.** ***FAO CCRF 7.4.6, 7.4.7, 12.4*** ***Eco 29.1-29.3*** **4.1.2 Timely and reliable statistics shall be compiled on catch and fishing effort and maintained in accordance with applicable international standards and practices and in sufficient detail to allow sound statistical analysis for stock assessment. Such data shall be updated regularly and verified through an appropriate system. The use of research results as a basis for the setting of management objectives, reference points and performance criteria, as well as for ensuring adequate linkage, between applied research and fisheries management shall be promoted.** ***FAO CCRF 7.4.4, 12.13*** ***Eco 29.1***	
Evidence adequacy rating: **☑High ☐ Medium ☐ Low**	
Clause:	**Evidence**
4.1	**Reliable and accurate data required for assessing the status of fisheries and ecosystems - including data on retained catch of fish, by catch, discards and waste are collected.** ADFG and NMFS collect fishery data and undertake fishery-independent surveys for all Bering Sea and Aleutian Islands (BSAI) crab fisheries providing the basis for the assessment of the crab stocks and their impact on the ecosystem. For the three Units of Assessment within the Unit of Certification, Bristol Bay red king crab (*Paralithodes*

camtschaticus), St Matthew blue king crab (*Paralithodes platypus*) and the Eastern Bering Sea snow crab (*Chionoecetes opilio*), the available data are summarised below for each fishery. The NMFS annual trawl surveys of the eastern Bering Sea provide indices of relative abundance and biomass for all three fisheries. Full details of the datasets for the three fisheries and their time series can be found in the annual Stock Assessment and Fishery Evaluation (SAFE) reports.

Bristol Bay red king crab

Fisheries data collected originally by the International North Pacific Fisheries Commission and since 1974 by ADFG, bycatch data collected by ADFG and NMFS, and fisheries-independent data from the NMFS annual trawl surveys of the eastern Bering Sea and two recent Bering Sea Fisheries Research Foundation (BSFRF) surveys are used to assess Bristol Bay red king crab. The data are described in the annual SAFE report and are summarised below.

Source	**Data**	**Time series**
Fisheries	Total catch	1960-2010
	Catch per unit effort	1960-2010
	Pot bycatch	1990-2010
	Trawl bycatch	1976-2010
	Catch size composition	Retained catch 1968-2010 except 1983, 1994, 1995 Pot bycatch 1990-2010 except 1994, 1995 Trawl bycatch 1976-2010 except 1993
NMFS eastern Bering Sea trawl survey	Biomass, size composition, shell condition	1975-2011
BSFRF trawl survey	Biomass, size composition, shell condition	2007, 2008

Although the fishery for red king crabs in Bristol Bay was started in the early 1930s by the Japanese fleet, followed by United States trawlers and Russian tangle net vessels, catch data from 1960 onwards only are used in the assessment. Catches from 1960 to 1970 ranged from 9000 to 27000 tons and were dominated by the Russian and Japanese tangle net fisheries. From 1974 onwards the fishery was prosecuted solely by the US pot fleet (with a small bycatch from trawlers) and catches increased significantly to reach a peak of nearly 60000 tons in 1980. Catches declined significantly in the 1980s due to a well documented regime shift that resulted in warming ocean conditions. Crab stocks have stayed at a low level relative to historic catch levels up to the present day.

Landings data in the form of retained catch numbers and biomass, and fishing effort in terms of pot lifts are recorded on the ADFG eLandings system (previously reported on paper 'fish tickets'). Pot bycatch data are obtained from red king crab and Tanner crab fisheries bycatch data recorded on the ADFG observer database, and trawl bycatch data from the groundfish fishery are obtained from the NMFS trawl observer database. Estimates of bycatch mortality biomass assume handling mortality rates of 20% for pot bycatch and 80% for trawl bycatch.

The size composition and shell condition of the catches have been obtained from the ADFG at-sea observer data program and from measurements taken at the point of landing by ADFG, and from the NMFS groundfish observer database.

NMFS conducts an annual trawl survey in the EBS to determine the distribution and abundance of crab and groundfish fishery resources and hence provides fishery-independent estimates of abundance and biological data. Since 1972 the survey has covered the full stock distribution except for inshore waters. The assessment uses tow-by-tow survey data from 1975-2011. Abundance estimates by sex, size and shell condition are derived from the survey data using an area-swept approach. Biomass estimates are most precise for large crabs, but less precise for small crabs due to gear selectivity and also potentially for females for behavioural reasons. In some recent years a second survey was conducted to assess mature female abundance because a high proportion of the mature females had not yet molted prior to the standard annual survey. BSFRF conducted small mesh trawl surveys in 2007 and 2008 at a similar time to the NMFS surveys providing estimates of abundance of the different size groups.

In summary, the assessment is based upon reliable and accurate catch data from the fishery in conjunction with an extensive observer scheme which provides data on pot and trawl bycatch to enable an estimate of total removals, and very high levels of sampling of the catch by length and shell condition for both the retained catch and the pot bycatch. In addition the EBS trawl surveys provide estimates of length distribution of the trawl catch and a fisheries independent index of stock biomass. The recording of catch and pot lifts in the fishery permits the calculation of catch per unit effort (CPUE) which could provide an alternative index of stock biomass, but these data are not used in the assessment because reliable soak time information is not always available and so catchability cannot be estimated. There are long time series of all datasets, and the annual SAFE reports demonstrate that the assessment authors have a detailed knowledge and understanding of the datasets including any inconsistencies in the data, and where necessary, they have allowed for those inconsistencies in the assessment.

St Matthew blue king crab

Fisheries data collected by ADFG, bycatch data collected by ADFG and NMFS, and fisheries-independent data from the NMFS annual trawl surveys of the eastern Bering Sea and the triennial ADFG pot survey are available for use in assessment of St. Matthew blue king crab, although not all datasets are used in all years. The data are described in the annual SAFE report and are summarised below.

Source	**Data**	**Time series**
Fisheries	Total catch	1978/79 – 1998/99 2009/10 – 2010/11
	Catch per unit effort	1978/79 – 1998/99 2009/10 – 2010/11
	Pot bycatch	1990/91-1998/99 2009/10 – 2010/11
	Trawl and fixed gear bycatch	1992/93 – 2010/11
	Catch size composition	Retained catch 1978/79–1998/99, 2009/10-2010/11 Pot bycatch 1990/91-1998/99 Trawl/fixed gear bycatch 1992/93 – 2010/11
NMFS eastern Bering Sea trawl survey	Biomass, size composition, shell condition	1978-2011
ADFG pot survey	Total catch and CPUE	1995, 1998, 2001, 2004, 2007, 2010

The fishery for St Matthew blue king crab developed in the late 1970s and peaked in 1983/84 with landings of just under 10 million pounds. Landings were relatively stable around 1.25 million pounds from 1986 to 1990, but then increased slowly during the 1990s before the fishery was closed in 1999 when the stock biomass declined below the threshold for minimum stock size biomass (MSST). A rebuilding plan was implemented in 2000, and NMFS declared the stock rebuilt in 2009, with the fishery opening with a relatively low TAC for the following two seasons.

Landings data in the form of retained catch numbers and biomass, and fishing effort in terms of pot lifts are recorded on the ADFG eLandings system (previously reported on paper 'fish tickets'). Pot bycatch data are obtained from bycatch data recorded on the ADFG observer database, and trawl and fixed gear bycatch data from the groundfish fishery are obtained from the NMFS observer database. Estimates of bycatch mortality biomass assume handling mortality rates of 20% for pot bycatch and 80% and 50% for trawl and fixed gear bycatch respectively.

The size composition and shell condition of the catches have been obtained from the ADFG at-sea observer data program and from measurements taken at the point of landing. The size-frequency data from the NMFS groundfish observer database were not used in the 2011 assessment.

NMFS conducts an annual trawl survey in the EBS to determine the distribution and abundance of crab and groundfish fishery resources and hence provides fishery-independent estimates of abundance and biological data. The assessment uses tow-by-tow survey data from 1978-2011. Abundance estimates by sex, size and shell condition are derived from the survey data using an area-swept approach. Biomass estimates are most precise for large crabs, but less precise for small crabs due to gear selectivity and also potentially for females for behavioural reasons. ADFG conduct triennial pot surveys which provide CPUE by size class and estimates of mean pot biomass, but these data were not used in the 2011 assessment, although the data are potentially a valuable index of abundance.

In summary, the assessment is based upon reliable and accurate catch data from the fishery in conjunction with an extensive observer scheme which provides data on pot, trawl and fixed gear bycatch to enable an estimate of total removals, and sampling of the catch by length and shell condition for both the retained catch and the pot bycatch. In addition the EBS trawl surveys provide estimates of length distribution of the trawl catch and a fisheries independent index of stock biomass. The triennial pot surveys provide additional information on biomass which may be a valuable index of abundance even though it was not used in the 2011 assessment. There are reasonable lengths of time series of all datasets, although the catch data are obviously compromised by the closure of the fishery which has resulted in the fishery only being open for 2 of the last 12 seasons. The annual SAFE reports demonstrate that the assessment authors have a detailed knowledge and understanding of the datasets including any inconsistencies in the data, and where necessary, they have allowed for those inconsistencies in the assessment.

<u>Eastern Bering Sea snow crab</u>

Fisheries data collected by ADFG, bycatch data collected by ADFG and NMFS, and fisheries-independent data from the NMFS annual trawl surveys of the eastern Bering Sea and two recent Bering Sea Fisheries Research Foundation (BSFRF) surveys are used to assess Eastern Bering Sea snow crab. The data are described in the annual SAFE report and are summarised below.

Source	**Data**	**Time series**
Fisheries	Total catch	1978/79-2010/11
	Catch per unit effort	1978/79-2010/11
	Pot bycatch	1992/93-2010/11
	Trawl bycatch	1973-2010/11
	Catch size composition	Retained catch 1978/79-2010/11 Pot bycatch 1992/93-2010/11

		Trawl bycatch 1991-2010
NMFS eastern Bering Sea trawl survey	Biomass, size composition, shell condition	1978-2011
BSFRF trawl survey	Biomass, size composition, shell Condition	2009, 2010

The fishery for Eastern Bering Sea snow crab was undertaken by the Japanese fleet from the 1960s until it was prohibited under the Magnuson Stevens Act in 1980. The US fishery increased gradually in the 1980s to reach a peak of approximately 150,000 tonnes in 1990/91, and after another peak of 110,000 tons in 1997/98, the fishery declined to levels of retained catch varying from 10,000 to 28,000 tonnes from 1999/00 to the present day.

Landings data in the form of retained catch numbers and biomass, and fishing effort in terms of pot lifts are recorded on the ADFG eLandings system (previously reported on paper 'fish tickets'). Pot bycatch data are obtained from bycatch data recorded on the ADFG observer database, and trawl bycatch data from the groundfish fishery are obtained from the NMFS observer database. Estimates of bycatch mortality biomass assume handling mortality rates of 50% for pot bycatch (previously 25%) and 80% for trawl bycatch. New research, including cold water handling mortality assessment during the 2012 fishery, may modify this mortality rate for BS snow crab pot bycatch in the future.

The size composition and shell condition of the retained catches and discards have been obtained from the ADFG at-sea observer data program and measurements taken at the point of landing, and length frequency data are available from the NMFS groundfish observer database.

NMFS conducts an annual trawl survey in the EBS to determine the distribution and abundance of crab and groundfish fishery resources and hence provides fishery-independent estimates of abundance and biological data. The assessment uses tow-by-tow survey data from 1978-2011. Abundance estimates by sex, size and shell condition are derived from the survey data using an area-swept approach. Biomass estimates are most precise for large crabs, but less precise for small crabs due to gear selectivity and also potentially for females for behavioural reasons. BSFRF conducted trawl surveys in 2009 and 2010 providing estimates of abundance and length frequencies.

In summary, the assessment is based upon reliable and accurate catch data from the fishery in conjunction with extensive observer schemes which provide data on pot and trawl bycatch to enable an estimate of total retained catches and discards. High levels of sampling of the catch by length and shell condition are available for both the retained catch and the pot and trawl bycatch. In addition the EBS trawl surveys and two BSFRF surveys provide estimates of length distribution of the trawl catch and a fisheries independent index of stock biomass. There are relatively long time series of all datasets, and the annual SAFE reports demonstrate that the assessment authors have a detailed knowledge and understanding of the datasets including any inconsistencies in the data, and where necessary, they have allowed for those inconsistencies in the assessment.

	The summaries above demonstrate that for all three Units of Assessment there are effective fishery data collection systems in place and surveys providing fishery-independent estimates of stock biomass. There are sufficiently long time series of both fishery-dependent and fishery-independent data for all three Units of assessment. In addition to fishery data, annual SAFE reports provide information on ecosystem indicators which may have an impact on BSAI crab stocks. The report considers the physical environment of the BSAI ecosystem including climatic factors, sea ice trends, habitat and ocean acidification, the biological environment of the ecosystem including crab prey and predators of crab, and the physical and biological environmental impacts on crab biology including recruitment, growth and mortality, and provides trends in ecosystem-based management indicators. Recent trends reported in Ecosystem SAFE 2011 report included the 2010/11 winter in the Bering Sea was less cold than expected, sea ice coverage in January to March was less extensive than in recent years, invertebrate biomass was relatively stable and groundfish biomass (especially cod) is increasing in the EBS. The Ecosystem SAFE report also updates current research and identifies future research priorities for BSAI crab stocks with respect to ecosystem interactions. For example, the 2011 report provides a summary of recent modelling work on the potential links between ocean acidification and Bristol Bay red king crab recruitment. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf http://www.fakr.noaa.gov/sustainablefisheries/crab/default.htm http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf http://www.afsc.noaa.gov/REFM/Socioeconomics/PDFs/crabsafe2011_draft.pdf
Evidence adequacy rating: ☑**High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
4.1.1	**These data are collected, at an appropriate time and level of aggregation, by relevant management organizations connected with the fishery, and provided to relevant States and sub-regional, regional and global fisheries organizations.** The collection, aggregation and use of data in stock assessments for the BSAI crab fisheries are undertaken through collaboration between primarily the North Pacific Fishery Management Council (NPFMC), the National Marine Fisheries Service (NMFS) and the Alaska Department of Fish and Game (ADFG). The fisheries are managed by NPFMC and NMFS Alaska Region with day-to-day management devolved to ADFG. Data collection, analysis and stock assessment of the BSAI crab fisheries are driven by the NPFMC's BSAI crab Fishery Management Plans (FMPs).

NPFMC

A key requirement of the FMP is an annual stock assessment and fishery evaluation (SAFE) report which is produced by the Crab Plan Team (CPT), who are appointed by NPFMC. In the case of the Bristol Bay red king crab fishery, the St Matthew blue king crab fishery and the Eastern Bering Sea snow crab fishery the individual annual assessments of the data for 2011 were compiled by scientists from ADFG in Juneau, ADFG in Kodiak and NMFS respectively. These individual assessments are peer reviewed by the CPT whose members are from a range of agencies and universities. The CPT will provide comments and suggestions for improved methodology or presentation to the assessment authors who respond formally to all comments and suggestions. The CPT will then make recommendations to the Scientific and Statistical Committee (SSC) of the NPFMC. The SSC will itself provide a peer review of the assessment which will be addressed in future SAFE reports.

The SAFE report summarises the current biological and economic status of the Bristol Bay red king crab fishery, the St Matthew blue king crab fishery and the Eastern Bering Sea snow crab fishery, details of how the total allowable catch (TAC) is calculated and the analytical information used for management decisions. Full details of the datasets used for each species and the nature of the stock assessment model are provided, along with the determination of the tier to which each of the three fisheries are assigned under the five tier system for setting overfishing limits (OFLs) and acceptable biological catches (ABCs) for crab stocks. The SAFE report also includes a section on trends in both physical ecosystem indicators such as climate and sea ice coverage and biological ecosystem indicators such as crab predator abundance.

The crab FMPs and the BSAI crab SAFE can be found on the NPFMC website as follows:
http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html

http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

In addition, the NPFMC website contains a wealth of other information including the BSAI crab rationalisation program, details of public meetings and archives, and scientific papers and reports.

http://www.fakr.noaa.gov/npfmc/

ADFG

ADFG collects landings data for the BSAI crab fisheries through the eLandings system providing a method for the accurate reporting of commercial fishing activity. The eLandings system replaced the paper-based 'fish tickets', although both the fishing industry and scientists often refer colloquially to the eLandings returns as 'fish tickets'. The eLandings system, more formally named the Interagency Electronic Reporting System (IERS), is a collaboration between ADFG, the International Pacific Halibut Commission and NMFS Alaska Region, and provides consolidated landing, production, IFQ and electronic logbook reporting from a sole source.

http://elandings.alaska.gov/

ADFG undertake the triennial pot survey of the St Matthew blue king crab fishery, which surveys areas of important habitat for blue king crab which are not accessible to the NMFS EBS trawl survey. Legal male and mature female crabs are at their highest densities on rocky bottoms which are inadequately surveyed by the EBS trawl survey, so that abundance estimates of legal males are unreliable and virtually no information on mature females is provided by the trawl survey. The triennial pot survey provides catch per pot lift indices for different size and shell condition categories which are used in the SMBKC assessment.

Full details of the survey methodology can be found in the following documents:

Watson, L.J. 2008. The 2007 triennial St Matthew Island blue king crab survey and comparisons to historic surveys. Alaska Department of Fish and Game. Fishery Management Report no. 08-41, Anchorage.

http://www.sf.adfg.state.ak.us/fedaidpdfs/RIR.4K.2010.12.pdf

http://www.fakr.noaa.gov/npfmc/PDFdocuments/membership/PlanTeam/Crab/06-SMBKC.pdf

In-season management of the BSAI crab fisheries is provided by ADFG in Kodiak.

NMFS EBS trawl survey

Survey methodology

NMFS conducts an annual trawl survey in the eastern Bering Sea to determine the distribution and abundance of crab and groundfish fishery resources and the survey is used to provide fishery-independent estimates of abundance and biological data. The surveys have been conducted annually since 1975 by the Resource Conservation and Engineering Division (RACE) of the Alaska Fisheries Science Center. The surveys are conducted in three legs with the main survey grid conducted from early June to late July with two chartered fishing vessels dedicated to each leg.

Since 1988, 376 standard stations have been sampled in the survey covering an area of approximately 150,000 nmi^2 with station depths ranging from 20 to 150 meters (Figure 1). The survey stations are divided into multiple districts, which are defined by ADF&G commercial crab management units (Figure 2). Management units are defined by registration areas and districts, which are further divided into strata with standard or high station densities. Standard-density strata have stations centered in 20 × 20 nmi (37.04 × 37.04 km) cells while high-density strata include additional stations at the corners of the 20 × 20 nmi cells around the St. Matthew and Pribilof Islands. The chartered fishing vessels each tow a standard eastern otter trawl with a 83 ft headrope and a 112 ft footrope (Figure 3). Survey trawls were towed behind 816 kg, 1.8 × 2.7 m, steel V-doors and paired 54.9 m (30-fathom) dandylines. Each lower dandyline had a 61 cm chain extension connected to the lower wing edge to improve bottom-tending characteristics. The trawls on each vessel were rotated every 25-30 consecutive tows to mitigate potential impacts from changes in net configuration due to fishing. Each tow was approximately 30 minutes in duration and 1.5 nmi (2.8 km) in length at a speed of 3 knots (1.54 m/sec), and conducted in strict compliance with established NMFS groundfish bottom trawl protocols (Stauffer 2004). Net mensuration equipment was used to monitor the net's fishing performance during each tow. A bottom contact sensor was attached to the center of the footrope to measure bottom contact of the net at 1-second intervals. The net mensuration system also consisted of an acoustic sensor attached to the headrope and two sensors attached to the port and starboard dandylines to measure net height and width during trawling operations. The bottom contact of the footrope and GPS data were used to calculate distance fished. Fishing power was assumed to be equal between the two vessels.

The standard sampling stations may be complemented by additional tows. Firstly in years when colder water temperatures delay the reproductive cycle in red king crabs, a small section of the inner Bristol Bay area is resampled after the completion of the standard survey to assess mature female abundance. Secondly, multiple additional tows are undertaken in crab "hotspots" identified on the standard survey. Hotspots are defined as any station at which ≥ 100 legal-sized male crabs are caught.

<u>Biological sampling</u>

At each station, crabs are sorted by species and sex, and a total catch weight calculated for each species. Crabs are measured to provide a size frequency distribution from a sample of the catch, carapace shell condition is assessed for each crab sampled, reproductive condition of females is recorded, and egg clutch and egg condition codes are used to assess the stage in the molt-mate cycle of mature female red king crab.

<u>Crab biomass estimates</u>

Crab density (weight/nmi^2) was estimated at each station for legal males, mature and immature males and females of each stock. The area swept by the trawl (nmi^2) was calculated as the product of the distance travelled while the net had bottom contact by the mean net width over the duration of the tow. Population biomass estimates are calculated using the variable net width based on net mensuration data. The effective width of the trawl typically ranges from 14.6 to 18.3 m when towing at a speed of 3 knots and changes with the depth of the tow due to changes in scope of the trawl wire. Crab densities were calculated using the mean net width recorded for the duration of each tow and a mean net width-inverse scope regression relationship was calculated when net width values were not recorded during a tow. Distance travelled by the trawl was determined from ship positions recorded at the beginning and end of each tow using GPS equipment.

For each species, crab biomass estimates are calculated for each 1mm size category using a size-weight relationship estimated from a linear regression fitted to log-transformed size-weight data.

The weights calculated at the 1 mm size category are summed within the legal male, mature and immature size categories for each species and sex caught at a station. The crab biomass within a district or section was estimated by averaging crab densities from all stations within the defined district or section and multiplied by the total area of the district or section specific to that stock. Total biomass was calculated using a stratified design based on management units (standard-density, high-density, ADF&G defined districts, or sections). Population biomass estimates were calculated in each stratum and then summed among strata. Variance of the total biomass estimate for each size class was calculated by summing the variance of each stratum. The 95%

confidence intervals were calculated using the standard error of the total population multiplied by 1.96.

In 2011, the total population estimate for Bristol Bay red king crab males was calculated by averaging data collected at the original stations in early June with data collected at the 20 resample stations in late July. Bristol Bay female red king crab biomass was calculated by replacing data collected at the original stations with data collected at the resample stations due to crab movement into the sampling area during the time between the standard survey and the resampling event.

The survey report authors acknowledge that these population biomass estimates are point estimates and have substantial uncertainty due to the broad-scale nature of the survey area being sampled and the spatial and temporal distributions of the crab resource. These point estimates are thought to be least precise for small crabs due to gear selectivity, and for females of some stocks due to crab behaviour. For consistent analyses and in the absence of available data, catchability is essentially assumed to be 1.0, and therefore these estimates are effectively indices of relative abundance and do not represent absolute abundance.

Potential sources of bias

In summary there a number of aspects of the NMFS EBS trawl survey and the way in which stock biomass estimates are derived from the survey that have potential for causing bias in those biomass estimates. The sources of potential bias can be grouped into two broad categories – the rigging and selectivity of the gear, and the spatial and temporal extent of the survey. The survey is designed to sample a wide range of species and the way in which the trawl is rigged may have a significant influence on the efficiency of capture of crabs. Selectivity may be good for large crabs, but less good for small crabs, crabs may be able to avoid the net or may not be captured by the net, and crabs may exhibit behavioural patterns which influence selectivity and catchability. Secondly, the trawl survey is a broad-scale annual survey. The low intensity grid of stations may miss “hot-spots” of mature crabs or provide a poor description of a heterogeneously distributed population or it may not be possible to fish the gear on rough ground which has high densities of crabs. The survey is also a snapshot in time in the summer months when not all components of the population may be fully available to the trawl because of seasonal patterns in the reproductive cycle or directed movement of mature crabs out of the sampled area. Potential sources of bias for the Bristol Bay red king crab fishery are highlighted by Dew (2008).

The assessment teams for the three crab stocks are aware of these sources of potential bias in stock biomass estimates and have collected additional information where necessary to revise their estimates of stock biomass. For example, additional survey stations have been sampled for the Bristol Bay red king crab stock after the standard summer survey to ensure realistic assessment of mature female crabs which may not have molted prior to the main summer survey, and the Bering Sea Fisheries Research Foundation (BSFRF) also conducted small-meshed surveys in 2007 and 2008 to ensure that the trawl net captured nearly all crabs within the swept area. For the St. Matthew blue king crab stock there is an additional high density sampling area, and triennial pot surveys also potentially provide alternative indices of stock abundance. For the Eastern Bering Sea snow crab stock, additional trawl surveys were undertaken by BSFRF in 2009 and 2010.

For the Bristol Bay red king crab assessment catchability was assumed to be constant and was estimated from a trawl experiment to be 0.896 (except for 1970-72 when catchability was low), but was allowed to vary annually in some model scenarios. In the survey-based assessment for St Matthew blue king crab, trawl survey catchability was assumed to be 1.0. For the EBS snow crab assessment, survey catchability and selectivity curves were estimated for a range of assessment scenarios dependent on varying assumptions. For all three crab stocks there are uncertainties in the selectivity curves and estimate of catchability used in the assessments reported in the SAFE documents, and indeed in 2011 the CPT recommended that assessment authors clarify the parameter values, including catchability, used in the assessment models. Estimated trawl selectivity and catchability are critical to fisheries management because under or over-estimates of selectivity will cause a systematic upward or downward bias of abundance estimates. Information about crab availability to the survey area at survey time will aid estimates of survey selectivity. In view of these uncertainties, it is timely that an independent CIE review of the EBS crab and groundfish trawl survey has been commissioned for April 2012. The review will take a strategic look at the issues of potential bias in the estimates of stock biomass highlighted above. The survey data are used in more than 25 stock assessments conducted by the AFSC as well as the State of Alaska and the International Pacific Halibut Commission. Although the AFSC has conducted considerable research on factors affecting trawl performance and catchability and their impacts on resulting survey estimates of distribution and abundance, in recent years the trawl and survey performance and results of this multi-species survey have come under scrutiny by industry, particularly with respect to Bering Sea red king crab, snow crab, and Pacific cod.

Lauth, R. R. 2011. Results of the 2010 eastern and northern Bering Sea continental shelf bottom trawl survey of groundfish and invertebrate fauna. U.S. Dep. Commer., NOAA Tech. Memo. NMFSAFSC-
227, 256 p. http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-227.pdf

Chilton, E. A., Armistead, C.E. and Foy, R. in draft. The 2011 Eastern Bering Sea Continental Shelf Bottom Trawl Survey: Results for Commercial Crab Species. NOAA Technical Memorandum NMFS-ASFC.
http://www.afsc.noaa.gov/kodiak/shellfish/crabebs/crabsurvey.htm

http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

Dew, C.B. 2008. Red king crab mating success, sex ratio, spatial distribution, and abundance estimates as artifacts of survey time in Bristol Bay, Alaska. North American Journal of Fisheries Management **28:** 1618-1637. ftp://ftp.afsc.noaa.gov/afsc/public/crab/UnmateOct08.pdf

Stauffer, G. 2004. NOAA protocols for groundfish bottom trawl surveys of the Nation's fishery resources. U.S. Dep. Commer., NOAA Tech. Memo. NMFS/SPO-65, 205 p. http://spo.nmfs.noaa.gov/tm/tm65.pdf

Evidence adequacy rating:

☑ **High**	☐ **Medium**	☐ **Low**

Clause:	Evidence
4.1.2	**Timely, complete and reliable statistics are compiled on catch and fishing effort and maintained in accordance with applicable international standards and practices and in sufficient detail to allow sound statistical analysis for stock assessment. Such data are updated regularly and verified through an appropriate system. The use of research results as a basis for the setting of management objectives, reference points and performance criteria, as well as for ensuring adequate linkage, between applied research and fisheries management is promoted.** Landings data for BSAI crabs in the form of retained catch numbers and biomass, and fishing effort in terms of pot lifts are recorded on the ADFG eLandings system (previously reported on paper 'fish tickets'), which permits the calculation of catch per unit effort in the various crab fisheries. All eLandings report information is stored on one server and data are available to NMFS, ADFG, NPFMC and the International Pacific Halibut Commission for their scientific, management and enforcement purposes. The data are entered once by one person thus creating fewer data entry errors and the data are verified in real time. The data is clearly timely, since it is used to close or modify a fishery inseason. Sampling of catches and discards in the directed crab fisheries by on-board observers and sampling of retained catches by shore-based observers through the ADFG observer scheme, in conjunction with bycatch estimates from the NMFS groundfish observer scheme provides data on pot, trawl and fixed gear bycatch to enable an estimate of total removals. Catch and effort data are available from 1960-2010 for the Bristol Bay red king crab fishery, for 1978/79 to 1998/99 and 2009/10 to 2010/11 for the St Matthew blue king crab fishery and for 1978/79 to 2010/11 for the Eastern Bering Sea snow crab fishery. These significant time series of catch and effort are used in the assessments for the three crab species, although problems with accurate recording of soak time for the gear and estimating catchability precludes the use of some CPUE data. The datasets for catch and effort are updated each year as part of the assessment process described in the SAFE reports. At-sea sampling in the directed fishery by observers on the ADFG observer program record total catch, bycatch, effort and size frequency and other biological characteristics, , and so the data collected from this observer program can be used in both stock assessment of the fishery and in-season projections of fishery performance. Estimates of CPUE for the retained component of the catch from the observer program can therefore provide an independent estimate of fishery CPUE for comparison with estimates given in annual management reports based on eLandings, daily fishing logs and interviews with vessel captains. In addition, the NMFS Eastern Bering Sea trawl survey provides fishery-independent indices of crab abundance and biomass, which play a critical role in the stock assessment process.

	All estimates of catch and fishing effort, whether from direct recording on the eLandings system or from samples collected during the ADFG observer program, along with abundance estimates from research surveys, form the basis of the fishery assessment process which involves the setting of management objectives, reference points and performance criteria. The assessment authors for each of the three crab species which form the Unit of Assessment are very familiar with all of these datasets and the potential inconsistencies in the data or the method used for estimating population indices or metrics from these data. The assessment process involves rigorous peer review of the assessments by the whole Crab Plan Team, by the Scientific and Statistical Committee (SSC) of NPFMC, and through specially organised workshops with independent scientists and periodic reviews by the Center for Independent Experts (CIE) review panels. As a result the SAFE reports will note ways in which the use of research results in the assessments could be improved, and identifies gaps in the evidence base which need to be filled by new research. These data are ultimately used for setting management objectives, reference points and performance criteria as well as ensuring adequate linkages between applied research and fisheries management. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf http://www.adfg.alaska.gov/FedAidPDFs/FDS11-04.pdf http://www.ciereviews.org/	

Clause:

4.2 An observer scheme designed to collect accurate data for research and support compliance with applicable fishery management measures shall be established.

FAO CCRF 8.4.3

FAO Eco 29.2bis

Evidence adequacy rating:

☑**High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
4.2	**An observer scheme designed to collect accurate data for research and support compliance with applicable fishery management measures is established.** ADFG may deploy observers on any vessel participating in the BSAI crab fisheries as an important component of data collection and fishery management. Observers are deployed on all catcher-processor vessels in the crab fisheries, on randomly selected catcher vessels in the Bristol Bay red king crab (BBRKC) and Eastern Bering Sea snow crab (EBSSC) fisheries, but following the closure of the St Matthew blue king crab (SMBKC) fishery in 1999 and the subsequent re-building plan, all vessels in the fishery	

must carry an observer now that the fishery has re-opened.

The on-board observers monitor the fishing position, depth, soak time etc. of the fishing gear, pot contents including samples of the size and shell condition frequency distributions for both total catch and retained crabs, and other biological information. The observers also document total catch, bycatch, effort (and hence catch per unit effort, CPUE), and so the data collected from this observer program can be used in both stock assessment of the fishery and in-season projections of fishery performance. Estimates of CPUE for the retained component of the catch from the observer program can therefore provide an independent estimate of fishery CPUE for comparison with estimates given in annual management reports based on eLandings, daily fishing logs and interviews with vessel captains. Full observer sampling methods are provided in the 2010 ADFG Crab Observer Training and Deployment Manual.

In 2009/10, there were 2 catcher-processors and 68 catcher vessels in the BBRKC fishery. Both catcher-processor vessels had observers on board and 19 of the 68 catcher vessels had observer trips resulting in 1,950 observed pot lifts.

For the EBSSC fishery, there were 2 catcher-processors and 67 catcher vessels. Both catcher-processor vessels had observers on board and 26 of the 67 catcher vessels had observer trips resulting in 1,646 observed pot lifts.

There were 7 catcher vessels in the SMBKC fishery, all of which were sampled by observers resulting in 989 observed pot lifts.

These observed pot lifts represented 1.6%, 1.2% and 9.2% of the total pot lifts in the fishery for the BBRKC, EBSSC and SMBKC fisheries respectively. For the BBRKC fishery, on-board observers measured 92,005 males and 6,032 females from total pot lift content, and on-board or shore-based sampling measured 19,033 crabs from the retained catch. For the EBSSC fishery, on-board observers measured 155,592 males and 246 females from total pot lift content, and on-board or shore-based sampling measured 30,745 crabs from the retained catch. For the SMBKC fishery, on-board observers measured 21,368 males and 1,637 females from total pot lift content, and on-board sampling measured 1,433 crabs from the retained catch. Whilst the proportion sampled of total pot lifts in the BBRKC and EBSSC fisheries may appear relatively low, crab measurements from these observed pot lifts in conjunction with shore-based measurements translate into very high numbers of crabs measured to estimate size composition in the fishery.

Size frequency data on crab by-catch in trawls is provided also for the BBRKC and EBSSC fisheries and in trawls and fixed gear for the SMBKC fishery from the NMFS Groundfish Observer Program, which is a comprehensive industry-funded on-board observer program. This program is currently under review because of various operational concerns such as the lack of coverage for vessels under 60 feet in length, the bias inherent in the current system, and the inflexibility of the system that restricts NMFS from tailoring coverage levels and deployment strategies to respond to the management needs of individual fisheries. These concerns are associated with the harvest of halibut and groundfish, rather than the industrial crab fleet.

Full details of the ADFG observer program for 2009/10 can be found at:

	http://www.adfg.alaska.gov/FedAidPDFs/FDS11-04.pdf NMFS Groundfish Observer Program: http://www.afsc.noaa.gov/FMA/Manual_pages/MANUAL_pdfs/manual2011.pdf	

Clause:

4.3 Sufficient knowledge of social, economic and institutional factors relevant to the fishery in question shall be developed through data gathering, analysis and research.

FAO CCRF 7.4.5

4.3.1 **Sub-regional or regional fisheries management organizations or arrangements shall compile data and make them available, in a manner consistent with any applicable confidentiality requirements, in a timely manner and in an agreed format to all members of these organizations and other interested parties in accordance with agreed procedures.**

FAO CCRF 7.4.6, 7.4.7

Evidence adequacy rating:

☑High ☐ Medium ☐ Low

Clause	Evidence
4.3	**Sufficient knowledge of social, economic and institutional factors relevant to the fishery in question is developed through data gathering, analysis and research.** The MSA's National Standard 8 mandates that 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. Accordingly, the NPFMC and Board of Fisheries hold public meetings throughout the year in a variety of convenient locations. Participation is actively pursued. The BSAI crab FMP has an economic and social objective which is defined as maximising 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. Following the FMP: "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.

http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html

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. 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 ex-vessel 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. Data on subsistence red king crab fishing have been obtained in the Norton Sound-Bering Strait area of the BS/AI management unit, 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.

The economic status of the BSAI crab fisheries can be found at:
http://www.afsc.noaa.gov/REFM/Socioeconomics/PDFs/crabsafe2011_draft.pdf

NMFS economic and social information. The Economic and Social Sciences Research Program within NMFS's REFM provides economic and socio-cultural information that assists NMFS in meeting its stewardship programs. Much of the existing economic data about Alaskan fisheries is collected and organized around different units of analysis, such as counties (boroughs), fishing firms, vessels, sectors, and gear groups. It is often difficult to aggregate or disaggregate these data for analysis at the individual community or regional level. In addition, at present, some relevant community level economic data simply are not collected at all. As a result, the North Pacific Fishery Management Council (NPFMC), the AFSC, and community stakeholder organizations have identified ongoing collection of community-level socio-economic information that is specifically related to commercial fisheries as a priority. To address this need, the AFSC's Economic and Social Sciences Research (ESSR) Program has been preparing the implementation of the Alaska Community Survey, an annual voluntary data collection program initially focused on Alaska communities for feasibility reasons, in order to improve the socio-economic data available for consideration in North Pacific fisheries management.
http://www.afsc.noaa.gov/REFM/Socioeconomics/Default.php

In 2005, the AFSC compiled baseline socioeconomic information about the 136 Alaska communities most involved in commercial fisheries. Communities were selected by assessing fishery-involvement indicators including landings, processors, vessel homeports, vessel ownership, crew licenses, and gear operator permits. The profiles compiled information from the US Census, ADFG, CFEC, NMFS Restricted Access Management Division, Alaska Department of Community and Economic Development, and various community groups, websites, and archives.

The 5-page profiles for each community follow the same general outline:

- People and Place (Location, Demographics, History).
- Infrastructure (Current Economy, Governance, Facilities).
- North Pacific Fisheries involvement (Commercial, Recreational, Subsistence Fishing).

The profiles were published as NOAA Technical Memorandum NMFS-AFSC-160 in December 2005. The report can be downloaded as a complete document (17.6 MB) from http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-160/NOAA-TM-AFSC-160.pdf.

The AFSC is planning to update the Alaskan community profiles to include new U.S. Census data from 2010 and input from the communities and industry.

CDQ program. The Community Development Quota (CDQ) program which started in 1992 allocates a percentage of all BSAI crab quotas to eligible western Alaskan communities in order to provide an opportunity for those communities to participate in the BSAI crab fisheries, to support sustainable and diversified economic development and provide social benefits to those communities. CDQ fisheries are managed by ADFG with NMFS oversight. Allocations of crabs to the CDQ program from 2005 to present were 10% of the guideline harvest level (GHL) for each species.
http://www.fakr.noaa.gov/cdq/default.htm

Public process. The Alaska Board of Fisheries and the North Pacific Fishery Management Council are openly public processes. Any individual or group can submit proposals for discussion of management and research for crab fisheries in Alaska. The BOF and the NPFMC meet in communities across the region to provide public opportunities. Written

	comments are accepted when it is not possible to attend in person (http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main). NPFMC, as outlined in policy, also continues to incorporate local and traditional knowledge in fishery management, considers ways to enhance collection of local and traditional knowledge from communities, and incorporate such knowledge in fishery management where appropriate. They also actively work to increase Alaska Native participation and consultation in fishery management through community workshops. **AKFIN**. The Alaska Fisheries Information Network (AKFIN) was established in 1997 under the direction of the Pacific States Marine Fisheries Commission (PSMFC) to consolidate, manage and dispense information related to Alaska's commercial fisheries. AKFIN was founded in response to an increased need for detailed, organized fishery information to help in making management decisions with a mission to maintain an analytic database of both state and federal historic, commercial Alaska fisheries data relevant to the needs of fisheries analysts and economists and to provide that data in a usable format (http://www.akfin.org/about-akfin).
Evidence adequacy rating: ☑**High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
4.3.1	**Data are compiled and made available, in a manner consistent with any applicable confidentiality requirements, in a timely manner and in an agreed format to all members of appropriate organizations and other interested parties in accordance with agreed procedures.** See clauses 2.5, 2.6, and 4.3 which describe how data is collected and maintained. NOAA administrative order 216-100 prescribes policies and procedures for protecting the confidentiality of data submitted to and collected by the National Oceanic and Atmospheric Administration (NOAA)/National Marine Fisheries Service (NMFS). Confidential data are those identifiable with a person. Before release to the public, data must be aggregated to protect the individual identities. For fisheries data, this requires that there must be at least 3 entities contributing to any level of aggregated data. An example of where such confidentiality protection comes into force can be found in the time series of catch data for the St Matthew blue king crab fishery presented in the SAFE 2011 report where catch and effort data for the 1980/81 season are used in the assessment, but are not explicitly recorded in the report. Only authorized users have access to confidential data, they must have a need to collect or use these data in the performance of an official duty, and they must sign a statement of nondisclosure affirming their understanding of NMFS obligations with respect to confidential data and the penalties for unauthorized use and disclosure. Confidential data must be maintained in secure facilities. Data collected by a contractor, such as an observer contractor, must be transferred timely to authorized Federal employees; no copies of these data may be retained by the contractor. NMFS may permit contractors to retain aggregated data. A data return clause shall be included in the agreement. All procedures applicable to Federal employees must be followed by contractor employees collecting data with Federal authority.

	Under agreements with the State, each State data collector collecting confidential data will sign a statement at least as protective as the one signed by Federal employees, which affirms that the signer understands the applicable procedures and regulations and the penalties for unauthorised disclosure. http://www.st.nmfs.noaa.gov/st1/recreational/documents/Intercept_Appendices/Appendix%20M%20031408%20NOAA%20administrative%20order%20216-100.pdf http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf	

Clause: **4.4 States shall stimulate the research required to support national policies related to fish as food.** ***FAO CCRF 12.7***	
Evidence adequacy rating: **☑High ☐ Medium ☐ Low**	
Clause	**Evidence**
4.4	**The research required to support national policies related to fish as food is carried out.** State and national policies regarding seafood are guided and driven by the Alaska Seafood Marketing Institute (ASMI), Food and Drug Administration (FDA), Department of Agriculture (USDA), the National Institute of Health (NIH) and many others. ASMI is the state agency primarily responsible for increasing the economic value of Alaskan seafood through marketing programs, quality assurance, industry training, and sustainability certification. The powers of the ASMI board include: conducting or contracting for scientific research to develop and discover health, dietetic, or other uses of seafood harvested and processed in the state, and prepare market research and product development plans for the promotion of any species of seafood and their by products (Alaska Statute 16.51.090 Powers of Board). The State of Alaska also operates the Fishery Industrial Technology Center as a component of the University of Alaska (http://www.sfos.uaf/fitc/). The Fishery Technology Center provides training for harvesting, processing, and conservation of fisheries resources of Alaska, provides research and development activities to adapt existing or create new technologies to enhance the economic value of the industry, and encourages joint projects between the fishing industry and government to enhance the productivity of the fishing industry. Alaska regulations also stipulate that the harvest of the resource will be in a manner that emphasizes the quality and value of the fishery product. Also, the University Seafood Technical Center in Kodiak has had numerous development programs to utilize fish and

	shellfish. Furthermore, the Alaska Fisheries Development Foundation (AFDF) has a long history related to promoting and developing fish and fish species as food (see www.afdf.org). http://www.alaskaseafood.org/

Clause:

4.5 States shall ensure that the economic, social, marketing and institutional aspects of fisheries are adequately researched and that comparable data are generated for ongoing monitoring, analysis and policy formulation.

FAO CCRF 12.9

Evidence adequacy rating:

☑High **☐ Medium** **☐ Low**

Clause	Evidence	
4.5	**The economic, social, marketing and institutional aspects of fisheries are adequately researched and comparable data are generated for ongoing monitoring, analysis and policy formulation.** The Economic and Social Sciences Research Program within NMFS's REFM provides economic and socio-cultural information that assists NMFS in meeting its stewardship programs. Much of the existing economic data about Alaskan fisheries is collected and organized around different units of analysis, such as counties (boroughs), fishing firms, vessels, sectors, and gear groups. These data are reported annually in the Economic SAFE documents. Socio-economic and institutional factors relevant to the fisheries were collected by NMFS and analysed through the NEPA process before management decisions such as the CDQ program were implemented. See section 4.3 for details. In 2005, the AFSC compiled baseline socioeconomic information about the 136 Alaska communities most involved in commercial fisheries. Communities were selected by assessing fishery-involvement indicators including landings, processors, vessel homeports, vessel ownership, crew licenses, and gear operator permits. The profiles compiled information from the US Census, ADFG, CFEC, NMFS Restricted Access Management Division, Alaska Department of Community and Economic Development, and various community groups, websites, and archives. The 5-page profiles for each community follow the same general outline: • People and Place (Location, Demographics, History). • Infrastructure (Current Economy, Governance, Facilities). • North Pacific Fisheries involvement (Commercial, Recreational, Subsistence Fishing).	

	The profiles were published as NOAA Technical Memorandum NMFS-AFSC-160 in December 2005. The report can be downloaded as a complete document (17.6 MB) from http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-160/NOAA-TM-AFSC-160.pdf. The AFSC is planning to update the Alaskan community profiles to include new U.S. Census data from 2010 and input from the communities and industry. The economic status of the BSAI crab fisheries can be found at: http://www.afsc.noaa.gov/REFM/Socioeconomics/PDFs/crabsafe2011_draft.pdf **AKFIN.** The Alaska Fisheries Information Network (AKFIN) was established in 1997 under the direction of the Pacific States Marine Fisheries Commission (PSMFC) to consolidate, manage and dispense information related to Alaska's commercial fisheries. AKFIN was founded in response to an increased need for detailed, organized fishery information to help in making management decisions with a mission to maintain an analytic database of both state and federal historic, commercial Alaska fisheries data relevant to the needs of fisheries analysts and economists and to provide that data in a usable format. http://www.akfin.org/about-akfin	

Clause:

4.6 States shall investigate and document traditional fisheries knowledge and technologies, in particular those applied to small-scale fisheries, in order to assess their application to sustainable fisheries conservation, management and development.

FAO CCRF 12.12

Evidence adequacy rating:

☑High **☐ Medium** **☐ Low**

Clause	Evidence	
4.6	**There is investigation and documentation of traditional fisheries knowledge and technologies, in particular those applied to small-scale fisheries, in order to assess their application to sustainable fisheries conservation, management and development.** The fisheries for Bristol Bay red king crab, St. Matthew blue king crab and Eastern Bering Sea snow crab are fully developed industrialized fisheries which use modern technology in the capture process. The Bristol Bay red king crab fishery was started in the early 1930s by the Japanese fleet, followed by United States trawlers and Russian tangle net vessels, but from 1974 onwards the fishery was prosecuted solely by the US pot fleet (with a small bycatch from trawlers). The St. Matthew blue king crab fishery developed in the late 1970s and is prosecuted solely by the domestic US fleet. The fishery for Eastern Bering Sea snow crab was undertaken by the Japanese fleet from the 1960s until it was prohibited under the Magnuson Act	

	in 1980 and was then developed by the domestic US fleet. Traditional fisheries knowledge relating to the three crab fisheries has been collected and incorporated where appropriate into current fishery management regimes. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf	

Clause:

4.7 States conducting scientific research activities in waters under the jurisdiction of another State shall ensure that their vessels comply with the laws and regulations of that State and international law.

FAO CCRF 12.14

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence	
4.7	**Not applicable.** All the scientific stock assessment research is conducted within the Alaska EEZ.	

Clause:

4.8 States shall promote the adoption of uniform guidelines governing fisheries research conducted on the high seas and shall, where appropriate, support the establishment of mechanisms, including, *inter alia*, the adoption of uniform guidelines, to facilitate research at the sub-regional or regional level and shall encourage the sharing of the results of such research with other (high seas) regions.

FAO CCRF 12.15, 12.16

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence	
4.8	**Not applicable.** All the scientific stock assessment research is conducted within the Alaska EEZ.	

Clause:
4.9 States and relevant international organizations shall promote and enhance the research capacities of developing countries, *inter alia*, in the areas of data collection and analysis, information, science and technology, human resource development anti provision of research facilities, in order for them to participate effectively in the conservation, management and sustainable use of living aquatic resources.
FAO CCRF 12.18
Evidence adequacy rating:
☐ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence	
4.9	**Not applicable.** Developing countries do not participate in these three crab fisheries.	

Clause:
4.10 Competent national organizations shall, where appropriate, render technical and financial support to States upon request and when engaged in research investigations aimed at evaluating stocks which have been previously unfished or very lightly fished.
FAO CCRF 12.19
Evidence adequacy rating:
☐ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence	
4.10	**Not applicable.** The fisheries for Bristol Bay red king crab, St Matthew blue king crab and Eastern Bering Sea snow crab are fully developed fisheries which use modern technology in the capture process. Therefore, these three fisheries do not qualify as 'previously unfished or very lightly fished'.	

Clause: **4.11 Relevant technical and financial international organizations shall, upon request, support States in their research efforts, devoting special attention to developing countries, in particular the least developed among them and small island developing countries.** ***FAO CCRF 12.20***
Evidence adequacy rating: ☐**High** ☐ **Medium** ☐ **Low**

Clause	**Evidence**	
4.11	**Not applicable.** Developing countries, in particular, small Island developing countries, do not participate in these three crab fisheries.	

5.	There shall be regular stock assessment activities appropriate for the fishery, its range, the species biology and the ecosystem, undertaken in accordance with acknowledged scientific standards to support its optimum utilization. *FAO CCRF 7.2.1/12.2/12.3/12.5/12.6/12.7/12.17* *FAO Eco 29-29.3*				
Confidence Ratings	**Low**	**0 out of 11**	**Medium**	**0 out of 11**	**High**	**11 out of 11**

Clause:

5.1 States shall ensure that appropriate research is conducted into all aspects of fisheries including biology, ecology, technology, environmental science, economics, social science, aquaculture and nutritional science. The research shall be disseminated accordingly. States shall also ensure the availability of research facilities and provide appropriate training, staffing and institution building to conduct the research, taking into account the special needs of developing countries.

FAO CCRF 12.1, 7.4.2

5.1.1 An appropriate institutional framework shall be established to determine the applied research which is required and its proper use (i.e. assess/evaluate effectiveness of stock assessment model) for fishery management purposes.

FAO CCRF 12.2, 12.6

Evidence adequacy rating:

☑**High** ☐ **Medium** ☐ **Low**

Clause:	Evidence
5.1	**Appropriate research is conducted into all aspects of fisheries including biology, ecology, technology, environmental science, economics, social science, aquaculture and nutritional science. The research is disseminated accordingly. States, there is availability of research facilities that provide appropriate training, staffing and institution building to conduct research as needed.** In federal waters, the three Alaska crab fisheries here under assessment are Jointly managed by the North Pacific Fishery Management Council (NPFMC), the National Marine Fisheries Service Alaska Region, BOF and ADFG under the Bering Sea Aleutian Islands (BSAI) Fishery Management Plan (FMP). The day-to-day management decisions and enforcement are devolved to the State of Alaska through the ADFG (even though the day to day management is devolved to the State, the process of Joint Management occurs at the BOF and Council meetings, and at the Joint BOF/Council meeting). With passage of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) in 1976, management jurisdiction of the crab fisheries occurs out to 200

miles. MSFCMA sets out ten national standards for fishery conservation and management (16 U.S.C. § 1851), with which all fishery management plans must be consistent.
http://www.nmfs.noaa.gov/sfa/magact/mag3.html#s301

The research branch of the NMFS Alaska Region is the Alaska Fisheries Science Center (ASFC). Its mission is to plan, develop, and manage scientific research programs which generate the best scientific data available for understanding, managing, and conserving the region's living marine resources and the environmental quality essential for their existence.
http://www.afsc.noaa.gov/

The NMFS undertakes shellfish stock assessments through its' Eastern Bering Sea trawl survey which provides the primary input to the shellfish assessments. NMFS shellfish assessment programs are coordinated between the ASFC's Kodiak Laboratory and the NOAA/NMFS AFSC in Seattle, Washington.

The AFSC is split into a number of Divisions which contribute to research and stock assessment of shellfish. The Resource Assessment and Conservation Engineering (RACE) Division comprises scientists from a wide range of disciplines whose function is to conduct quantitative fishery surveys and related ecological and oceanographic research to describe the distribution and abundance of commercially important fish and crab stocks in the region, and to investigate ways to reduce bycatch, bycatch mortality and the effects of fishing on habitat. Information derived from both regular surveys and associated research are analysed by Center stock assessment scientists and supplied to fishery management agencies and to the commercial fishing industry.
http://www.afsc.noaa.gov/race/default.php

Resource Ecology and Fisheries Management (REFM) Division conducts research and data collection to support an ecosystem approach to management of fish and crab resources. More than twenty-five groundfish and crab stock assessments are developed annually and used to set catch quotas. In addition, economic and ecosystem assessments are provided to the Council on an annual basis. Division scientists evaluate how fish stocks, ecosystem relationships and user groups might be affected by fishery management actions and climate. The Division also has a socio-economic program whose work includes evaluating economic impacts of fisheries rationalization programs, and compiling and evaluating sociocultural information on Alaskan communities and traditional ecological knowledge.
http://www.afsc.noaa.gov/refm/default.php

The Fisheries Monitoring and Analysis Division (FMA) monitors groundfish fishing activities and conducts research associated with sampling commercial fishery catches and estimation of catch and bycatch mortality, and analysis of fishery-dependent data. In relation to the crab assessments, the key role is the oversight of observers who collect groundfish catch and crab bycatch data on board groundfish fishing vessels and quality assurance of the data provided by these observers.
http://www.afsc.noaa.gov/fma/default.htm

In addition an interdisciplinary program, The Habitat and Ecological Processes Research (HEPR) Program develops scientific research that supports implementation of an ecosystem approach to fishery management. Key projects which could be important

for understanding crab population dynamics are focused on loss of sea ice, essential fish habitat and ocean acidification.
http://www.afsc.noaa.gov/HEPR/default.php

The potential for aquaculture to contribute to the management of red and blue king crab stocks is being investigated currently through The Alaska King Crab Research, Rehabilitation and Biology (AKCRRAB) Program. The program is an Alaska Sea Grant partnership with regional fishermen's groups, coastal communities, NOAA Fisheries, the Alutiiq Pride Shellfish Hatchery and Chugach Regional Resources Commission, and the University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, to conduct a research program aimed at hatching and rearing wild red and blue king crabs in a large-scale hatchery setting. This coalition of state, federal, and stakeholder groups views the effort as important to the region's long-term economic development and sustainability. The project aims to understand the large-scale culturing needs of wild red and blue king crab stocks, and to perfect strategies for hatching and rearing king crab to a stage where they can be released into the wild and contribute to reversing low wild stock abundance in Alaska. Acquiring this knowledge base will aid policymakers in making informed decisions about whether to one day pursue active rehabilitation of depressed wild king crab stocks through hatchery enhancement

http://seagrant.uaf.edu/research/projects/initiatives/king_crab/general/

In terms of the collection and analysis of the key data sets that feed into the stock assessment model for all three crab fisheries, ADFG eLandings reports provide landings data in the form of retained catch numbers and biomass and fishing effort in terms of pot lifts. The ADFG at-sea observer program provides pot catch and bycatch data from the directed fisheries and the observer program along with measurements taken at the point of landing provide data on size composition and shell condition of the catches. The NMFS groundfish trawl observer program provides trawl bycatch data from the groundfish fishery including the size composition and shell condition of the catches. NMFS conducts an annual trawl survey in the EBS to determine the distribution and abundance of crab and groundfish fishery resources which provides fishery-independent estimates of abundance and biological data.

In addition, the Bering Sea Fisheries Research Foundation (BSFRF) has undertaken occasional trawl surveys in recent years for the Bristol Bay red king crab and Eastern Bering Sea snow crab fisheries, and ADFG have undertaken triennial pot surveys of the St Matthew blue king crab fishery to sample areas of important habitat for female blue king crab which are not accessible to the NMFS trawl survey. The NPFMC's FMP for BSAI crabs requires an annual stock assessment and fishery evaluation report (SAFE) which details the current biological and economic status, the total allowable catch (TAC) and the analysis from which the management decisions are derived for the three crab fisheries which form the Unit of Assessment. The SAFE report also includes a section on trends in both physical ecosystem indicators such as climate and sea ice coverage and biological ecosystem indicators such as crab predator abundance. SAFE reports are accessible to the public on the NPFMC and NMFS websites.

http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

	The National Environmental Policy Act (NEPA) requires preparation of EISs for major Federal actions significantly affecting the quality of the human environment. NEPA is a comprehensive process to provide checks and balances against changes to the environment that may impact ecosystems and the natural processes, as well as the socio-economic sphere of fisheries. An EIS for the BSAI crab fisheries was prepared in 2004 to provide decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative management programs. The EIS considered impacts on safety, harvester efficiency, processing efficiency, and the distribution of benefits between the harvesting and processing sectors, consumers, captains and crew, and affected coastal communities. http://www.epa.gov/compliance/basics/nepa.html http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/default.htm ASMI is a public-private partnership between the State of Alaska and the Alaska seafood industry established to foster economic development of a renewable natural resource. ASMI is playing a key role in the repositioning of Alaska's seafood industry as a competitive market-driven food production industry. Its work to boost the value of Alaska's seafood product portfolio is accomplished through partnerships with retail grocers, foodservice distributors, restaurant chains, foodservice operators, universities, culinary schools, and the media. It conducts consumer campaigns, public relations and advertising activities, and aligns with industry efforts for maximum effectiveness. ASMI also functions as a brand manager of the Alaska Seafood family of brands (http://pressroom.alaskaseafood.org/about/). Both ADFG & NMFS maintain research facilities, where professional staff are provided educational and advancement opportunities. No developing countries exploit these fisheries, so there is no need to provide appropriate research facilities and training to take into account the special needs of developing countries.	
Evidence adequacy rating: ☑**High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
5.1.1	**An appropriate institutional framework is established to determine the applied research which is required and its proper use (i.e. assess/evaluate stock assessment model/practices) for fishery management purposes.** The BSAI crab fisheries are jointly managed by the NPFMC and the BOF under the Fishery Management Plan (FMP). A requirement of this FMP is the production of an annual stock assessment and fishery evaluation (SAFE) report. For the Bristol Bay red king crab, St Matthew blue king crab and Eastern Bering Sea snow crab fisheries, the BSAI SAFE report provides a detailed description of the data used in the stock assessments, the stock assessment methodology used and any changes in approaches that may have been taken during the year, the estimated status of the stocks in relation to pre-determined fisheries management reference points, advice on appropriate harvest levels, and an assessment of the relative success of existing state	

and federal fishery management programs.

The BSAI SAFE report for 2011 can be found at:
http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

In addition to the stock assessment of the BSAI crab fisheries, the SAFE report contains a chapter which assesses the BSAI ecosystem trends, identifies and provides annual updates of ecosystem status indicators and research priorities for BSAI crab stocks, and updates management status indicators. A separate SAFE report describes the economic aspects of the BSAI crab fisheries.

http://www.afsc.noaa.gov/REFM/Socioeconomics/PDFs/crabsafe2011_draft.pdf

Extensive peer review is an integral part of the stock assessment process detailed in the BSAI crab SAFE reports ensuring a robust scientific analysis of fishery status. For the Bristol Bay red king crab fishery, the St Matthew blue king crab fishery and the Eastern Bering Sea snow crab fishery the annual assessments of the data for 2011 were compiled by scientists from ADFG in Juneau, ADFG in Kodiak and NMFS respectively. These individual assessments are then peer reviewed by the full CPT. Members of the CPT are employed by a range of agencies and institutes and have expertise in stock assessment and crab fisheries biology. Some members have additional expertise which provides a broader input to the assessment process. The CPT will provide comments and suggestions for improved methodology or presentation to the assessment authors who formally respond to all comments or suggestions. The CPT will then make recommendations on overfishing levels (OFL) determinations, acceptable biological catch (ABC), stock status specifications and any other issues related to crab stocks to the Scientific and Statistics Committee (SSC) of the NPFMC. The SSC will itself provide comments and suggestions on the assessment which will be addressed in future SAFE reports. The SSC make the final recommendation on OFL and ABC to the NPFMC. ADFG then set total allowable catch (TAC) levels in line with the Council's ABC recommendations of the SSC.

In addition to the rigorous annual peer review process that is integral to all SAFE reports, BSAI crab stock assessments are also reviewed periodically by external groups. Firstly there may be specially convened NPFMC stock assessment workshops. An Alaska Crab Stock Assessment Workshop was held in May 2009 attended by the CPT, assessment authors and other scientists involved with stock assessment in Alaska with the aim of determining how to calculate overfishing levels for Tier 4 stocks, improving existing assessment models for crab stocks, and providing guidance on standardising crab stock assessments and assessment reporting. In February 2011 there was a stock assessment workshop at which various improvements to the stock assessment methodology used for the Bristol Bay red king crab, the St Matthew blue king crab and the eastern Bering Sea snow crab fisheries were proposed and to which the assessment authors provided responses in the Crab SAFE 2001 report. A crab modelling workshop was also held in January 2012, and although the terms of reference of the workshop were primarily related to the Aleutian Islands golden king crab and the Bering Sea Tanner crab assessment models, the workshop also discussed methods for estimating probability distributions for the OFL, and the outcome of the workshop will inform future assessments of all BSAI crab fisheries.

	http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/Appendix_CrabWKSHPreport909.pdf ftp://ftp.afsc.noaa.gov/afsc/public/Crab_Plan_Team/crab%20workshop%20overview.pdf http://www.fakr.noaa.gov/npfmc/PDFdocuments/membership/PlanTeam/Crab/CrabWkshpSummary112.pdf Secondly, there are periodic comprehensive reviews of the crab assessments by the Center for Independent Experts (CIE), a review panel of national and international experts. Panel members are selected by the CIE Steering Committee and Coordination Team on the basis of their expertise in the stock assessment methodology, and the process is intended to provide a much wider review of the methodology than occurs during the normal annual cycle of assessments. CIE recommendations are considered by assessment authors, the CPT and the SSC. http://www.ciereviews.org/ A CIE review of the Bristol Bay red king crab fishery by two independent, international experts in stock assessment methodology was conducted in 2009 to review the strengths and weaknesses of the stock assessment and stock projection models, to recommend alternative model configurations, assumptions and estimators, and to examine the potential utility of conducting a dedicated crab survey for eastern Bering Sea crab stocks. The review made a series of recommendations on research priorities for improving the stock assessment. Similarly in 2008 a CIE review of the Bering Sea snow crab assessment recommended improvements to the population dynamics and harvest strategy models and highlighted a number of areas where research priorities should be channelled to improve the stock assessment process. ftp://ftp.afsc.noaa.gov/afsc/public/Crab_Plan_Team/CIE_Caputi.pdf ftp://ftp.afsc.noaa.gov/afsc/public/Crab_Plan_Team/CIE_Ernst.pdf ftp://ftp.afsc.noaa.gov/afsc/public/crab/CIE%20Review_EBS%20Opilio%20Assessment%20Model_Bell_March_2008.pdf ftp://ftp.afsc.noaa.gov/afsc/public/crab/CIE%20Review_EBS%20Opilio%20Assessment%20Model_Dichmont_March_2008.pdf There was also a CIE review of BSAI crab stock overfishing definitions in 2006 which informed the move to the five tier system of overfishing definitions currently used for BSAI crabs. ftp://ftp.afsc.noaa.gov/afsc/public/crab/CIE%20Review_OFL%20Definitions_Cordue_June_2006.pdf In addition the ASFC commissioned a CIE review in 2011 of the methodological practices employed in development and administration of the Crab Economic Data Report (EDR) program. The objective of the review was to identify appropriate methodological best practices and standards for survey design, evaluation, and testing, and to define quality assurance and quality control procedures to be employed in the EDR program redesign and subsequent administration. http://www.afsc.noaa.gov/REFM/Socioeconomics/PDFs/BSAICrabEDR_CIEreview_pub_announce.pdf	

	Whilst not a formal peer review activity, there are also annual interagency crab research meetings which provide a forum for researchers from each of the active crab research centers to present their work on Alaska crab species to their peers in an informal environment. http://www.sf.adfg.state.ak.us/fedaidpdfs/SP11-11.pdf

Clause:

5.2 The state of the stocks under management jurisdiction, including the impacts of ecosystem changes resulting from fishing pressure, pollution or habitat alteration shall be monitored.

Eco 31

5.2.1 The research capacity necessary to assess the effects of climate or environment change on fish stocks and aquatic ecosystems shall be established. The state of the stock under State Jurisdiction, including the impacts of ecosystem changes resulting from fishing pressure, pollution or habitat alteration shall be established.

FAO CCRF 12.5

Evidence adequacy rating:

☑ High **☐ Medium** **☐ Low**

Clause	Evidence
5.2	**The state of the stocks under management jurisdiction, including the impacts of ecosystem changes resulting from fishing pressure, pollution or habitat alteration is monitored.** Stock assessments are carried out annually for all BSAI crab species in Alaskan waters. These assessments involve the collection and analysis of data on catch and effort from the directed fisheries, catch size composition, and fishery independent indices of abundance and population size composition from surveys. Outputs of the assessments include estimates of population abundance, stock biomass, population size composition and recruitment, which are used to evaluate the performance of the management regime in relation to agreed harvest rules and management objectives. For the Bristol Bay red king crab fishery, a length-based analysis (LBA) model combines multiple sources of survey, catch and bycatch data using a maximum likelihood approach to estimate abundance, recruitment and catchabilities, catches and bycatch of the commercial pot fisheries and groundfish trawl fisheries. The 2011 SAFE report shows that recent catches have been among the highest during the last 15 years although catches in 2010/11 were less than in 2009/10. Bycatch from the groundfish trawl fishery is low. Estimated mature crab abundance is relatively high at present, although estimated recruitment has been extremely low over the last five years. In

	terms of management performance, the stock was above minimum stock size threshold (MSST) and so is not overfished, and the total catch for 2010/11 was well below the overfishing level (OFL). For the St Matthew blue king crab fishery a three-stage catch-survey analysis (CSA) assesses the male component of the stock incorporating data from commercial catches from the directed fishery and its observer program, the annual EBS trawl survey, triennial pot surveys and bycatch data from the groundfish trawl fishery. This assessment model is in development and has not yet been approved by the CPT, so for 2011 a survey-based assessment was used. The 2011 SAFE report shows that, following resumption of the commercial fishery after 10 years of fishery closure, the reported catch was significantly below the TAC with significant male discard mortality in the directed fishery, but negligible discard mortality in the trawl fishery. Survey indices suggest increased stock biomass in recent years and, although data are limited, trawl and pot surveys suggest strong recruitment in recent years. Estimated stock biomass in 2010/11 is well above MSST and estimated total catch is well below OFL with the conclusion that the stock is not overfished and that overfishing is not occurring. For the Eastern Bering Sea snow crab fishery the stock assessment uses a size and sex-structured model which is fitted to time series of total catch data from the directed fishery and bycatch data from the trawl fishery, size frequency data from the catch in the pot fishery and the bycatch in both the pot and trawl fisheries, and abundance data from the NMFS trawl survey and two recent BSFRF surveys. The assessment provides a range of alternative model scenarios, but all model scenarios indicate that the stock is rebuilt. The 2011 SAFE report shows that the retained catch in 2010/11 increased slightly from the level in the previous year, with significant model estimated bycatch in the pot fishery but with negligible bycatch in the trawl fishery. Mature male biomass has increased in recent years, and whilst recruitment has been dominated in the last few years by a single large cohort, recruitment trends were increasing in the early 2000s. The estimated total catch in 2010/11 was well below OFL, and estimated stock biomass is well above MSST indicating that overfishing is not occurring and that the stock is not overfished. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf In addition to the assessment of the status of the stocks of Bristol Bay red king crab, St Matthew blue king crab and Eastern Bering Sea snow crab, the BSAI Crab SAFE reports also includes a section on ecosystem considerations which provides information on ecosystem indicators which may have an impact on BSAI crab stocks. The report considers the physical environment of the BSAI ecosystem including climatic factors, sea ice trends, habitat and ocean acidification, the biological environment of the ecosystem including crab prey and predators of crab, and the physical and biological environmental impacts on crab biology including recruitment, growth and mortality, and provides trends in ecosystem-based management indicators. More comprehensive information is also available in the Ecosystem SAFE report prepared annually by the Plan Teams for groundfish in the BSAI and Gulf of Alaska and in 2010 a review of Essential Fish Habitats (EFH) was completed as a requirement under the MSA for fishery management plans (FMPs).	

http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf
http://access.afsc.noaa.gov/reem/ecoweb/Eco2011.pdf
http://www.fakr.noaa.gov/habitat/efh/review.htm

The Alaska Department of Environmental Conservation (DEC) implements statutes and regulations affecting air, land and water quality. DEC is the lead state agency for implementing the federal Clean Water Act and its authorities provide considerable opportunity to maintain high quality fish and wildlife habitat through pollution prevention. Alaskan waters are relatively free of industrial pollutants, which are aggressively monitored by the DEC. These include wastewater discharge, storm water discharge, seafood water discharge, placer mining discharge, log transfer discharge, and others. (http://www.dec.state.ak.us/).

As mandated by the United States Clean Water Act, each state must develop a program to monitor and report on the quality of its surface and ground waters and prepare a report describing the status of its water quality. The 2010 Integrated Report produced by DEC (available on its website) is a state-wide water quality assessment. It describes whether the existing condition of each Alaska water body is sufficient to maintain multiple designated uses of that water body. Alaska water quality standards designate seven uses for fresh waters (drinking water; agriculture; aquaculture; industrial; contact recreation; non-contact recreation; and growth and propagation of fish, shellfish, other aquatic life, and wildlife) and seven uses for marine waters (aquaculture; seafood processing; industrial; contact recreation; non-contact recreation; growth and propagation of fish, shellfish, other aquatic life, and wildlife; and harvesting raw mollusks or other raw aquatic life for human consumption). Sources of information used by DEC to develop the biannual water quality assessment include monitoring data (e.g., water testing), professional knowledge, and evaluations such as those provided by water resource managers, fish and wildlife biologists, and aquatic biologists. Alaska is rich in water quantity, water quality, and aquatic resources; almost half of the total surface waters of the United States are located within the state. Because of the size, sparse population, and remote character of Alaska, the vast majority of its water resources are in pristine condition. More than 99.9% of Alaska's waters are considered unimpaired. Among the state's vast water resources are more than 3 million lakes, 714,000 miles of streams and rivers, 44,000 miles of coastline, and approximately 174,683,900 acres of wetlands. Less than 0.1% of these water resources have been identified as impaired. DEC actively solicits all existing and readily available water quality data and information in accordance with EPA guidance. The information gathered is not limited to waters for which water quality problems have been reported by local, state, or federal agencies; members of the public; or academic institutions. Organizations and groups are contacted for research they may be conducting or reporting. University researchers, the U.S. Department of Agriculture, the National Oceanic and Atmospheric Administration (NOAA), the U.S. Geological Survey (USGS), and the U.S. Fish and Wildlife Service (USF&WS) are examples of such sources of field data. http://dec.alaska.gov/water/index.htm

The ADFG protects estuarine and marine habitats primarily through cooperative efforts involving other state and federal agencies and local governments. The Department of Natural Resources (DNR) manages all state-owned land, water and natural resources except for fish and game. This includes most of the state's tidelands out to the three mile limit and approximately 34,000 miles of coastline. DNR authorizes the use of log-

	transfer sites, access across state land and water, set-net sites for commercial gill net fishing, mariculture sites for shellfish farming, lodge sites and access for the tourism industry, and water rights and water use authorizations. DNR also uses the state Endangered Species Act to preserve natural habitat of species or subspecies of fish and wildlife that are threatened with extinction (http://dnr.alaska.gov/). The Bristol Bay red king crab, St Matthew blue king crab and Eastern Bering Sea snow crab fisheries are conducted exclusively by pots. The BSAI crab EIS considered the potential effects of pot gear on benthic habitat and species. Although most crab pot fishing occurs on sand and soft sediments which are relatively unlikely to be impacted, it was recognized that little research has been undertaken and that there are no equivalent studies in other fisheries where similar size gear is used. However the BSAI EIS report suggested that crab fishing will have an insignificant effect on benthic habitat. This issue is discussed in more detail in section 13. http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/default.htm Research on the effects of change in the environment or climate on crab stocks and aquatic ecosystems is discussed in section 13.

Evidence adequacy rating:

☑**High** ☐ **Medium** ☐ **Low**

Clause	**Evidence**
5.2.1	**The research capacity necessary to assess the effects of climate or environment change on fish stocks and aquatic ecosystems is established. The state of the stock under State Jurisdiction, including the impacts of ecosystem changes resulting from fishing pressure, pollution or habitat alteration is also established.** Resource Ecology and Fisheries Management (REFM) Division at the NMFS AFSC conducts a program of research and data collection to support an ecosystem approach to management of BSAI crab stocks, examining climate and/or environmental changes. Crab stock assessments are developed annually and used by the NPFMC to set catch quotas. In addition, annual economic and ecosystem assessments are provided to NPFMC. Scientists evaluate how fish stocks, ecosystem relationships and user groups might be affected by fishery management actions and climate. The Division also has a socio-economic program whose work includes evaluating economic impacts of fisheries rationalization programs, and compiling and evaluating sociocultural information on Alaskan communities and traditional ecological knowledge. http://www.afsc.noaa.gov/refm/default.php Within the AFSC there is also an interdisciplinary program, The Habitat and Ecological Processes Research (HEPR) Program which develops scientific research that supports implementation of an ecosystem approach to fishery management. Key projects which could be important for understanding crab population dynamics are focused on loss of sea ice, essential fish habitat and ocean acidification. http://www.afsc.noaa.gov/HEPR/default.php

	Annual results are published in the Ecosystem SAFE documents provided to the NPFMC. These reports provide a concise summary of the status of marine ecosystems in Alaska for stock assessment scientists, fishery managers, and the public. One section of the report covers Ecosystem Status and Management Indicators, and provides detailed information and updates on the status and trends of ecosystem components as well as either early signals of direct human effects on ecosystem components that might warrant management intervention or to provide evidence of the efficacy of previous management actions. In the first instance, the indicators are likely to be ones that summarize information about the characteristics of the human influences (particularly those related to fishing, such as catch composition, amount, and location) that are influencing a particular ecosystem component. A major component of the report is an ecosystem assessment that synthesizes historical climate and fishing effects on the eastern Bering Sea/Aleutian Islands and Gulf of Alaska ecosystems using information from the Ecosystem Status and Management Indicators section and stock assessment reports. Notable trends that capture unique occurrences, changes in trend direction, or patterns across indicators are highlighted. An ongoing goal is to produce an ecosystem assessment utilizing a blend of data analysis and modelling to clearly communicate the current status and possible future directions of ecosystems. The BSAI Crab SAFE report for 2011 summarises the status of the crab stocks. For all three crab stocks - Bristol Bay red king crab, St Matthew blue king crab and Eastern Bering Sea snow crab – estimated stock biomass was above the minimum stock size threshold (MSST) and so is not overfished, and the estimated total catch for 2010/11 was well below the overfishing level (OFL) so that overfishing is not occurring. In addition to the Ecosystem SAFE document described above which is reviewed by the groundfish plan teams, the BSAI crab SAFE report also includes a section on ecosystem considerations which provides information on ecosystem indicators which may have an impact on BSAI crab stocks. The report considers the physical environment of the BSAI ecosystem including climatic factors, sea ice trends, habitat and ocean acidification, the biological environment of the ecosystem including crab prey and predators of crab, and the physical and biological environmental impacts on crab biology including recruitment, growth and mortality, and provides trends in ecosystem-based management indicators. Recent trends reported in 2011 included the 2010/11 winter in the Bering Sea was less cold than expected, sea ice coverage in January to March was less extensive than in recent years, invertebrate biomass was relatively stable and groundfish biomass (especially cod) is increasing in the EBS. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf http://access.afsc.noaa.gov/reem/ecoweb/Eco2011.pdf	

Clause:

5.3 Management organizations shall cooperate with relevant international organizations to encourage research in order to ensure optimum utilization of fishery resources.

FAO CCRF 12.7

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
5.3	**Management organizations cooperate with relevant international organizations to encourage research in order to ensure optimum utilization of fishery resources.** Research output on the three crab fisheries are exchanged and discussed at meetings of the North Pacific Marine Science Organization (PICES), which has members from the US, Russia, Japan and Canada who have an interest in crab assessment and management. There may also be links with snow crab scientists on the Atlantic coast of Canada (invited and attended the Inter Agency Crab Research Meeting (at least once) and attended and participated in Waldo Wakefield Symposiums), who discuss their research at the International Council for the Exploration of the Sea (ICES), an organisation based in Copenhagen, Denmark which coordinates marine research in the North Atlantic. http://www.pmel.noaa.gov/foci/publications/2010/paraR709.pdf http://www.pices.int/	

Clause:
5.4 **The fishery management organizations shall directly, or in conjunction with other States, develop collaborative technical and research programs to improve understanding of the biology, environment and status of trans-boundary aquatic stocks.**
FAO CCRF 12.17
Evidence adequacy rating:
☑ High **☐ Medium** **☐ Low**

Clause:	**Evidence**	
5.4	**Despite the three crab stocks under assessment are not shared or straddling stocks there is a collaborative technical and research program to improve understanding of the biology, environment and status of trans-boundary aquatic stocks.** The United States and Russian Federation maintain the bilateral Intergovernmental Consultative Committee (ICC) fisheries forum pursuant to the U.S.-Soviet Comprehensive Fisheries Agreement, signed on May 31, 1988. The ICC is responsible for furthering the objectives of the Comprehensive Fisheries Agreement. The objectives include maintaining a mutually beneficial and equitable fisheries relationship through (1) cooperative scientific research and exchanges; (2) reciprocal allocation of surplus fish resources in the respective national 200-mile zones, consistent with each nation's laws and regulations; (3) cooperation in the establishment of fishery joint ventures; (4) general consultations on fisheries matters of mutual concern; and, (5) cooperation to address illegal or unregulated fishing activities on the high seas of the North Pacific Ocean and Bering Sea. Recent topics for discussions included illegal crab trade. The agreement was due to expire in December 2008 and is currently in the process of being renewed. http://www.nmfs.noaa.gov/ia/bilateral/docs/US-Russia_ICC_IA_Book.pdf	

Clause:
5.5 **Data generated by research shall be analyzed and the results of such analyses published in a way that confidentiality is respected where appropriate.**
5.5.1 **Results of analyses shall be distributed in a timely and readily understandable fashion in order that the best scientific evidence is made available as a contribution to fisheries conservation, management and development.**
5.5.2 **In the absence of adequate scientific information, appropriate research shall be initiated in a timely fashion.**
FAO CCRF 12.3

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence
5.5	**Data generated by research is analyzed and the results of such analyses are published in a way that confidentiality is respected where appropriate.** Data from the BSAI crab fisheries that are generated both through the data collection programs for commercial fisheries and through research surveys and other research programs form an integral part of the annual assessment process that determines the status of the stocks. The analysis of these data is published in reports of specific programs and the annual SAFE report describes how the various datasets have contributed to the assessment of the status of stocks. NOAA administrative order 216-100 prescribes policies and procedures for protecting the confidentiality of data submitted to and collected by the National Oceanic and Atmospheric Administration (NOAA)/National Marine Fisheries Service (NMFS). Confidential data are those identifiable with a person. Before release to the public, data must be aggregated to protect the individual identities. For fisheries data, this requires that there must be at least 3 entities contributing to any level of aggregated data. An example of where such confidentiality protection comes into force can be found in the time series of catch data for the St Matthew blue king crab fishery presented in the SAFE 2011 report where catch and effort data for the 1980/81 season are used in the assessment, but are not explicitly recorded in the report. Only authorized users have access to confidential data, they must have a need to collect or use these data in the performance of an official duty, and they must sign a statement of nondisclosure affirming their understanding of NMFS obligations with respect to confidential data and the penalties for unauthorized use and disclosure. Confidential data must be maintained in secure facilities. Data collected by a contractor, such as an observer contractor, must be transferred timely to authorized Federal employees; no copies of these data may be retained by the contractor. NMFS may permit contractors to retain aggregated data. A data return clause shall be included in the agreement. All procedures applicable to Federal employees must be followed by contractor employees collecting data with Federal authority. Under agreements with the State, each State data collector collecting confidential data will sign a statement at least as protective as the one signed by Federal employees, which affirms that the signer understands the applicable procedures and regulations and the penalties for unauthorised disclosure. http://www.st.nmfs.noaa.gov/st1/recreational/documents/Intercept_Appendices/Appendix%20M%20031408%20NOAA%20administrative%20order%20216-100.pdf http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

Evidence adequacy rating:		
☑ High	☐ Medium	☐ Low

Clause	Evidence
5.5.1	**Results of analyses are distributed in a timely and readily understandable fashion in order that the best scientific evidence is made available as a contribution to fisheries conservation, management and development.** The annual SAFE report which provides both stock summaries and full details of the stock assessments for the Bristol Bay red king crab, St Matthew blue king crab and Eastern Bering Sea snow crab fisheries are accessible to the public on the NPFMC and NMFS websites. The economic and ecosystem SAFE reports are also available providing a wider perspective on the status of the crab fisheries in the BSAI region. In addition, the NPFMC, NMFS and ADFG websites make available a wide range of documents that contribute towards the annual assessment of the status of the stocks. These documents include, for example, summaries of the sampling levels and population metrics derived from both the ADFG observer program on the directed crab fisheries and from the NMFS groundfish observer program, reports of the annual EBS trawl survey, and original research papers that have influenced development of the assessment methodology. In addition to the various scientific reports which provide the technical details of the assessment, the websites provide helpful summaries of the assessment process that are accessible to non-scientists. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf http://www.fakr.noaa.gov/npfmc/ http://www.fakr.noaa.gov/sustainablefisheries/default.htm http://www.adfg.alaska.gov/index.cfm?adfg=fishingCommercial.main

Evidence adequacy rating:		
☑ High	☐ Medium	☐ Low

Clause	Evidence
5.5.2	**The state of the stocks under management jurisdiction, including the impacts of ecosystem changes resulting from fishing pressure, pollution or habitat alteration is monitored.** A key component of the annual assessments and subsequent SAFE reports for the BSAI crab fisheries is the identification of components of the assessment where there are gaps in evidence and which require research to fill those gaps. The NPFMC and the NPRB both compile an annual list of needed research from their Board/Council members and their scientific advisors. Assessments of each of the three crab fisheries highlight priorities for future research and the assessment authors will respond to requests from a hierarchy of peer-reviewers through the CPT, SSC and external reviews (e.g. CIE) to conduct either re-

	analysis of data currently available or new research to generate additional data and/or information. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf	

Clause:

5.6 Studies shall be promoted which provide an understanding of the costs, benefits and effects of alternative management options designed to rationalize fishing, in particular, options relating to excess fishing capacity and excessive levels of fishing effort.

FAO CCRF 7.4.3

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause	Evidence	
5.6	**Studies are promoted which provide an understanding of the costs, benefits and effects of alternative management options designed to rationalize fishing, in particular, options relating to excess fishing capacity and excessive levels of fishing effort.** The National Environmental Policy Act (NEPA) requires preparation of EISs for major Federal actions significantly affecting the quality of the human environment. NEPA is a comprehensive process to provide checks and balances against changes to the environment that may impact ecosystems and the natural processes, as well as the socio-economic sphere of fisheries. An EIS for the BSAI crab fisheries was prepared in 2004 to provide decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative management/rationalization programs, including the rationalization selected by the Council. The EIS considered impacts on safety, harvester efficiency, processing efficiency, and the distribution of benefits between the harvesting and processing sectors, consumers, captains and crew, and affected coastal communities towards a rationalization program for the crab fleet (excluding Norton Sound). http://www.epa.gov/compliance/basics/nepa.html http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/default.htm	

Clause:		
5.7 **In the evaluation of alternative conservation and management measures, their cost-effectiveness and social impact shall be considered.** ***FAO CCRF 7.6.7***		
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
5.7	**In the evaluation of alternative conservation and management measures, their cost-effectiveness and social impact are considered.** The National Environmental Policy Act (NEPA) requires preparation of EISs for major Federal actions significantly affecting the quality of the human environment. NEPA is a comprehensive process to provide checks and balances against changes to the environment that may impact ecosystems and the natural processes, as well as the socio-economic sphere of fisheries. An EIS for the BSAI crab fisheries was prepared in 2004 to provide decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative management/rationalization programs, including the rationalization selected by the Council. The EIS considered impacts on safety, harvester efficiency, processing efficiency, and the distribution of benefits between the harvesting and processing sectors, consumers, captains and crew, and affected coastal communities. http://www.epa.gov/compliance/basics/nepa.html http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/default.htm	

C. The Precautionary Approach

6. The current state of the stock shall be defined in relation to reference points or relevant proxies or verifiable substitutes allowing for effective management objectives and target. Remedial actions shall be available and taken where reference point or other suitable proxies are approached or exceeded. ***FAO CCRF 7.5.2/7.5.3*** ***Eco 29.2/29.2bis/30-30.2***						
Confidence Ratings	**Low**	**0 out of 5**	**Medium**	**0 out of 5**	**High**	**5 out of 5**

Clause:

6.1 States shall determine for the stock both safe targets for management (Target Reference Points) and limits for exploitation (Limit Reference Points), and, at the same time, the action to be taken if they are exceeded.

6.1.1 Target reference point(s) shall be established.

6.1.2 Limit reference points shall be established. When a limit reference point is approached, measures shall be taken to ensure that it will not be exceeded.

6.1.3 Data and assessment procedures shall be installed measuring the position of the fishery in relation to the reference points. Accordingly, the level of fishing permitted shall be commensurate with the current state of the fishery resources.

FAO CCRF* 7.5.3, *7.6.1

FAO Eco 29.2-29.2bis,29.6,30-30.2

6.1.4 Management actions shall be agreed to in the eventuality that data sources and analyses indicate that these reference points have been exceeded.

FAO CCRF 7.5.3

FAO Eco 29.6, 30.2

6.1.5 In implementing the precautionary approach, States shall take into account, inter alia, uncertainties relating to the size and productivity of the stocks, reference points, stock condition in relation to such reference points , levels and distribution of fishing mortality and the impact of fishing activities, including discards, on non-target and associated or dependant species as well as environmental and socio-economic conditions.

FAO CCRF 7.5.2

Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
6.1	**For the stocks under consideration there are safe targets for management (Target Reference Points) and limits for exploitation (Limit Reference Points), and, at the same time, the action to be taken if they are exceeded is specified.** The biomass that is associated with MSY, Bmsy, is effectively treated as the target reference point since it is the desired stock condition (but effective harvest is always lower, consistent with ABC, ACL and TAC formulations as explained below), although MSY itself is treated as a upper limit rather than a target reference point because the overfishing limit (OFL) is based upon MSY. The (lower) limit reference point corresponds to ½ MSY. The harvest rate is decreased when stock biomass is moving from upper to limit reference point and is reduced to zero when the stock reaches the limit reference point. At that point, a rebuilding plan is implemented. For tier 3 stocks, the target reference point is $B_{35\%}$ (when spawning biomass is reduced to 35% of the unfished condition), a proxy for Bmsy. Under the Magnuson-Stevens Act (MSA) new statutory requirements were established in 2006 to end and prevent overfishing by the use of annual catch limits (ACLs) and appropriate accountability measures if those ACLs should be exceeded. The measures were required to be implemented by 2010 for all stocks subject to overfishing and by 2011 for all remaining stocks that were not currently subject to overfishing. The terms "overfishing" and "overfished" are defined as a rate or level of fishing mortality that jeopardises the capacity of a fishery to produce maximum sustainable yield (MSY) on a continuing basis, and thus NPFMC prescribe that the overfishing level (OFL – the catch limit that should never be exceeded) should never exceed the amount that would be taken if the stock were fished at Fmsy or a proxy for Fmsy. Stock status of BSAI crabs are therefore determined by two metrics. Firstly, the stock is considered to be overfished if the stock size is estimated to be below the minimum stock size threshold (MSST). Secondly, overfishing is considered to have occurred if the exploitation level, or fishing mortality, exceeds the fishing mortality at the overfishing level (F_{OFL}), or more intuitively if the total catch exceeds the OFL. The NPFMC's fishery management plan (FMP) for BSAI crab stocks outlines the stock status definitions, the criteria used to determine stock status using a five-tier system and the step-by-step framework under which the NPFMC sets final overfishing levels (OFLs) and acceptable biological catches (ABCs). The MSA requires that the Science and Statistical Committee (SSC) of the NPFMC determines the scientific benchmarks while the Council itself recommends quotas based on these benchmarks. This separation of responsibilities is a key step forward in the goal of eliminating overfishing and enhancing recovery of overfished stocks. The OFL is the catch level above which overfishing is occurring, and the harvest control rules aim to prevent overfishing by establishing a maximum fishing mortality threshold and using this threshold value to determine annual catch limits. The ABC is the level of

annual catch that accounts for scientific uncertainty in the estimate of OFL and other uncertainties. The ABC is set below the OFL. The ACL is the level of catch that serves as the basis for invoking accountability measures, and for crab stocks the ACL is set at the ABC. The TAC is the annual catch target for the fishery which is set at or below the ACL and may take into account uncertainty in the management process and socio-economic factors, or other biological concerns that may affect the reproductive potential of the stock but that are not reflected in the OFL itself.

The status determination criteria for crab stocks are calculated on an annual basis using a five-tier system that accommodates varying levels of uncertainty of information, and incorporates new scientific information providing a mechanism for continually improving the status determination criteria as more information becomes available. Under the system overfishing and overfished criteria and ABC (= ACL) levels are formulated. For crab stocks, the overfishing level equals MSY and is derived through the annual assessment process. Each crab stock is assessed annually to determine its status and if catch estimates exceed the OFL, then overfishing is occurring. If annual biomass estimates are below MSST (defined as 0.5 Bmsy) then the stock is overfished. If overfishing has occurred or the stock is overfished, the Magnuson-Stevens Act (MSA) requires NPFMC to immediately end overfishing and rebuild stocks. The MSA also requires that the FMP includes accountability measures to prevent ACLs from being exceeded and to correct overages if they do occur (see section 6.1.4 for further details).

Five-tier system

Crab stocks are assigned to one of five tiers based upon the availability of information for the stock, and then the OFL and ABC are estimated each year for the forthcoming season based on the tier to which the stock is assigned. Estimates of OFL and ABC take into account all fishery removals, i.e. retained catch + directed and non-directed fishery discard losses.

For tiers 1, 2 and 3 there must be reliable estimates of B, Bmsy and Fmsy (or their proxies) and for the first two tiers, there must be a reliable estimate of the spawner-recruit relationship enabling estimation of the limit reference points Bmsy and Fmsy. Tier 1 is for stocks where the probability density function (pdf) of Fmsy can be estimated, tier 2 is for stocks where only a point estimate (and not the pdf) of Fmsy is available, and tier 3 is for stocks where reliable estimates of the spawner-recruit relationship are not available, but proxies for Fmsy and Bmsy are estimated. For tier 3 stocks, the term $F_{35\%}$ refers to a fishing mortality associated with an equilibrium level of spawning per recruit equal to 35% of the equilibrium level of spawning per recruit in a virgin, unfished stock. Similarly, $B_{35\%}$ refers to the long term average biomass that would be expected under average recruitment and $F=F_{35\%}$.

Tier 4 is for stocks where there is insufficient population data to estimate the spawner-recruit relationship, but simulation modelling is used to derive OFLs which capture the historical performance of the fisheries and borrow information from other stocks. Estimation of F_{OFL} requires estimates of current survey biomass, natural mortality rate (M) or proxy, and a scalar, γ , which allows adjustments in the overfishing definitions to account for differences in biomass measures.

For tier 5 stocks there are no reliable estimates of biomass and only historical catch data are available. The OFL is then set equal to the average catch from a specified time period, and ABC is set at less than or equal to 0.9 x OFL.

Following the assignation of a stock to a particular tier, the determination of stock status is based on recent survey data and assessment models, and the stock status level determines the equation used in calculating the F_{OFL}. Three levels of stock status are specified. At stock status level 'a', current stock biomass exceeds Bmsy. At level 'b', biomass is less than Bmsy, but greater than the critical biomass threshold biomass (β) and at level 'c' the ratio of biomass to Bmsy is below β. At level 'c' directed fishing is prohibited and an F_{OFL} is calculated for all non-directed fishery removals as part of a re-building program. For stocks at tiers 1 to 3, α is set at 0.1 and β is set at 0.25. The BSAI Crab FMP provides a detailed explanation of the five tiers and a guide to understanding the system. The tiers are also described in more detail in section 7.

There is a prescribed framework for calculating OFLs and ABCs and subsequent decision making. The assessment authors undertake the stock assessment, calculate OFL by applying the F_{OFL} and using abundance estimates, and then calculate the proposed ABCs by applying the ABC control rule to the proposed OFL. These assessments specify how the probability distribution of the OFL used in the ABC control rule is calculated and the scientific uncertainty that is accounted for in that calculation. The CPT reviews these stock assessments and compiles the SAFE report and makes recommendations to the SSC on OFLs and ABCs. The SSC will review the SAFE report in the light of the assumptions underlying the stock assessment model, and the uncertainty underlying the calculations of OFL and ABC, and then make recommendations to the Council for the final OFL and ABC. The ABC can be set below the maximum ABC if required for a specific reason.
http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html

For 2010/11 the Crab Plan Team (CPT) recommended that Bristol Bay red king crab and Eastern Bering Sea snow crab should be allocated to Tier 3 and so the OFL should be determined by the $F_{35\%}$ control rule, and that St Matthew blue king crab should be allocated to Tier 4.
http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

The current system has been subjected to some peer review. The five tier system was evaluated by a review team appointed by the Committee for Independent Experts (CIE) in 2006, whose report provided important input to the final version of the system now in operation. A full management strategy evaluation (MSE) to assess the robustness of the current Eastern Bering Sea snow crab model has been funded by NPRB for the period 2008-2011. The NPFMC commissioned an independent panel to review the harvest strategy in Alaskan groundfish fisheries and concluded that the use of proxy reference points (equivalent to the $F_{35\%}$ used in the BSAI crab stock management system) was defensible.

ftp://ftp.afsc.noaa.gov/afsc/public/crab/CIE%20Review_OFL%20Definitions_Cordue_June_2006.pdf
http://project.nprb.org/view.jsp?id=07b5bbed-fbc8-4c97-b37a-10aaee891ef2
Goodman, D. et al. 2002. Scientific review of the harvest strategy currently used in the BSAI and GOA groundfish management plans. For the the NPFMC November 21, 2002.

Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
6.1.1	**Target reference point(s) are established.** The biomass that is associated with MSY, Bmsy, is effectively treated as the target reference point since it is the desired stock condition (but effective harvest is always lower, consistent with ABC, ACL and TAC formulations), although MSY itself is treated as a upper limit rather than a target reference point because the overfishing limit (OFL) is based upon MSY. The (lower) limit reference point corresponds to ½ MSY. The harvest rate is decreased when stock biomass is moving from upper to limit reference point and is reduced to zero when the stock reaches the limit reference point. At that point, a rebuilding plan is implemented. For tier 3 stocks, the target reference point is $B_{35\%}$, a proxy for Bmsy. For tier 4 simulation modelling is used to derive OFLs which capture the historical performance of the fisheries and borrow information from other stocks. http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html	
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
6.1.2	**Limit reference points are established. When a limit reference point is approached, measures are taken to ensure that it will not be exceeded.** As the annual catch limit (ACL) is never set at a level that would exceed the overfishing level (OFL), the OFL and its associated value of fishing mortality, F_{OFL}, can be considered as limit reference points established for all three crab stocks. As OFL is based upon MSY, then MSY is treated as a limit rather than a target reference point. In fact ACL (=ABC for crab stocks) is lower than OFL so the limit reference point is actually lower than MSY. The optimum yield (OY), which may range from 0 to <OFL, is also a limit reference point. OY is prescribed on the basis of MSY from the fishery reduced by any relevant social, economic or ecological factor, or in the case of an overfished stock, provides for rebuilding to a level consistent with producing MSY from that fishery. Effectively the minimum stock size threshold (MSST), defined as 0.5 x Bmsy, is a lower limit reference point because the stock is considered as overfished if the annual estimated biomass drops below the MSST. If overfishing has occurred (total catch exceeds OFL) or the stock is overfished (biomass is less than MSST), the Magnuson-Stevens Act (MSA) requires NPFMC to immediately	

end overfishing and rebuild stocks. The MSA also requires that the FMP includes accountability measures to prevent ACLs from being exceeded and to correct overages if they do occur.

http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html

Evidence adequacy rating:

☑ High **☐ Medium** **☐ Low**

Clause:	Evidence
6.1.3	**Data and assessment procedures are installed measuring the position of the fishery in relation to the reference points. Accordingly, the level of fishing permitted is commensurate with the current state of the fishery resources.**

The annual Crab SAFE report describes the data, assessment methodology and stock determination criteria which permit an assessment of the position of each of the three crab fisheries in relation to pre-defined reference points.
For the Bristol Bay red king crab stock, the CPT recommends that it is assigned to tier 3, and that the proxy for Bmsy ($B_{35\%}$) be the mature male biomass at mating calculated using the average recruitment from 1984-2011 multiplied by male biomass-per-recruit corresponding to $F_{35\%}$ minus the mature male catch under an $F_{35\%}$ harvest strategy. The assessment authors described 12 model scenarios that were evaluated, but present results from one scenario only (7ac) as agreed by the CPT. The assessment had been improved this year with the availability of stronger evidence to support the choice of 1984-2011 as the recruitment period for estimating $F_{35\%}$. The $B_{35\%}$ is estimated at 27.3 kt. Mature male biomass (MMB) was estimated at 32.64 kt which equates to 119% of $B_{35\%}$. MMB is significantly higher than the MSST of 13.63 kt, so the Bristol Bay red king crab stock is not currently overfished. The total catch was 7.71 kt which is well below the OFL of 10.66, so overfishing did not occur in 2010/11. The CPT recommended that for 2011/12 the ABC should be set below the maximum ABC because of uncertainties in the estimation of OFL, and the SSC recommended an ABC of 90% of the OFL. Table 3 below shows the status and catch specifications calculations for the last 4 years and the estimates of OFL and ABC and the forecast biomass for 2011/2012. The table shows clear evidence that in recent years the stock has not been overfished and that overfishing has not occurred.

Table 3.
Status and catch specifications (kt) of Bristol Bay red king crab

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2007/08	20.32	37.69	9.24	9.30	10.54		
2008/09	17.06	39.83	9.24	9.22	10.48	10.98	
2009/10	15.56	40.37	7.26	7.27	8.31	10.23	
2010/11	13.63	32.64	6.73	6.76	7.71	10.66	
2011/12		29.76[D]				8.80	7.92

*Model forecast based on the 2011 assessment under the assumption that the 2011/12 catch equals to the OFL. This value will be updated during the September 2012 assessment when the 2012 survey data and the 2011/12 catch data become available.

For the St Matthew blue king crab stock, the CPT recommends that it is assigned to tier 4, with the scalar gamma fixed at 1 for calculating F_{OFL}. The Bmsy proxy was estimated for the period 1989/90 to 2009/10 as this was after the period of very high exploitation rates in the early 1980s and covered the period of stock re-building. The three stage catch survey analysis (CSA) assessment model developed for this fishery is presented in the appendix to the SAFE report, but is awaiting approval, and so in the interim, a survey-based assessment has been used for this year. Bmsy proxy is estimated as 3.04 kt. Mature male biomass in 2010/11 was estimated as 6.70 kt which equates to 220% of Bmsy proxy. MMB is very much higher than MSST of 1.52kt, so the St Matthew blue king crab stock is not considered to be overfished. The total male catch in 2010/11 was 0.64 kt which is below the OFL of 1.04 kt, so overfishing did not occur in 2010/11. There is considerable uncertainty in the estimate of natural mortality which is a key component of assessments of tier 4 stocks, and in the survey data which may be an underestimate of abundance. In the light of these uncertainties, the CPT recommended that the maximum ABC should not be used, but a 10% buffer giving an ABC of 3.4kt for 2011/12. Table 4 below shows the status and catch specifications calculations for the last 4 years and the estimates of OFL and ABC and the forecast biomass for 2011/2012. The stock was declared rebuilt in 2009, and the table shows clear evidence that since the fishery re-opened, the stock has not been overfished and that overfishing has not occurred.

Table 4.

Historical status and catch specifications (kt) of St. Matthew blue king crab

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2007/08		4.39	closed	closed	0.16		
2008/09	1.81	4.87	closed	closed	0.09	0.74 [retained]	
2009/10	1.52	5.79	0.53	0.20	0.25	0.78	
2010/2011	1.52	6.7	0.73	0.57	0.64	1.04	
2011/2012		7.17*				1.7	1.5

* Forecast based on survey data available in the 2011 assessment under the assumption that the 2010/11 catch is equal to the OFL. This value will be updated during the September 2012 assessment when the 2012 survey data and the 2011/12 catch data become available

For the Eastern Bering Sea snow crab stock, the CPT recommends that it is assigned to tier 3, and that the proxy for Bmsy ($B_{35\%}$) should be the mature male biomass based on the average recruitment from 1979 to 2011. The assessment authors evaluated 13 alternative model scenarios. The assessment has been improved this year through new approaches to defining variable M, reformulation of survey selectivity for the BSFRF survey data and the availability of new growth data. The $B_{35\%}$ for 2010/11 was estimated at 147.5 kt. Mature male biomass (MMB) was estimated at 196.6 kt which is 133% of $B_{35\%}$. MMB is significantly higher than the MSST of 73.7 kt, so the Eastern Bering Sea snow crab stock is not currently overfished. The total catch in 2010/11 was 26.7 kt, which is well below the OFL of 44.4 kt, so overfishing did not occur in 2010/11. The CPT considered many options for calculating an ABC less than the maximum ABC which takes into account uncertainty in the assessment, but was unable to recommend a specific ABC. Following its review of the assessment, the SSC recommended a 10% buffer for the ABC. Table 4 below shows the status and catch specifications calculations for the last 4 years and the estimates of OFL and ABC and the forecast biomass for 2011/2012. All model scenarios indicated that the stock is above the $B_{35\%}$, so the stock is rebuilt, and Table 4 shows clear evidence that in recent years the stock has not been overfished and that overfishing has not occurred.

Table 5.

Historical status and catch specifications for snow crab (kt).

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2007/08	72.1	98.9	28.6	28.6	35.0		
2008/09	74.1	109.3	26.6	26.5	31.5	35.1	
2009/10	66.6	127.7	21.8	21.8	23.9	33.1	
2010/11	73.7	196.6	24.6	24.7	26.7	44.4	
2011/12		133.8*				73.5	66.1

*Model forecast based on the 2011 assessment under the assumption that the 2011/12 catch equals to the OFL. This value will be updated durin the September 2012 assessment when the 2012 survey data and the 2011/12 catch data become available.

Overall there is strong evidence from the assessments that for the last few years the level of fishing permitted for all three crab stocks has been commensurate with the current state of the fishery resources.

http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	Evidence
6.1.4	**Management actions are agreed to in the eventuality that data sources and analyses indicate that these reference points have been exceeded.**

The harvest rate is decreased when stock biomass is moving from upper to limit reference point and is reduced to zero when the stock reaches the limit reference point (1/2 MSY). At that point, a rebuilding plan is implemented.
If overfishing has occurred or the stock is overfished, the Magnuson-Stevens Act (MSA) requires the NPFMC to immediately end overfishing and rebuild stocks. The MSA also requires that Fishery Management Plans (FMPs) incorporate accountability measures to prevent the ACL from being exceeded and to correct any excesses in ACLs if they do occur. Accountability measures could include seasonal, area and gear allocations, closed areas, bycatch limits, in-season fishery closures, gear restrictions, limited entry, catch shares and observer and vessel monitoring requirements. All such measures are designed to allow close monitoring of catch levels from all sources, to react to specific bycatch problems and to provide a database for evaluating potential consequences of future management actions.

Under the BSAI crab FMP, specific accountability measures that have been used to prevent the ACL being exceeded include individual fishing quotas (IFQs) and measures to ensure IFQs are not exceeded, measures to minimize bycatch in the directed crab fisheries and monitoring and catch accounting measures. In addition, the ACL and TAC have been reduced if the ACL was exceeded in the previous fishing year.

Whilst all three crab fisheries are currently not overfished, that has not always been the case. The St Matthew blue king crab fishery was declared overfished and closed in

	1999 because the stock biomass estimate had fallen below the MSST. A re-building plan which included a harvest strategy, bycatch control measures and habitat protection measures was put in place, and the fishery was declared re-built in 2009, and was therefore re-opened for the 2009/10 fishing season. Similarly, the Eastern Bering Sea snow crab stock was declared overfished in 1999 because the total mature biomass estimate dropped below the MSST, and a re-building plan was implemented in 2000. This included the implementation of a harvest strategy, gear modifications to reduce bycatch of female and sub-legal male crabs in the directed fishery and protection of essential habitat for snow crabs. Recent assessments all show that the stock has been re-built. http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html	
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
6.1.5	**In implementing the precautionary approach, the fisheries management organizations in Alaska take into account, *inter alia*, uncertainties relating to the size and productivity of the stocks, reference points, stock condition in relation to such reference points, levels and distribution of fishing mortality and the impact of fishing activities, including discards, on non target and associated or dependant species as well as environmental and socio-economic conditions.** The management system for BSAI crabs takes a wide range of factors into account. The tier system for stock determination status accommodates varying levels of uncertainty of information relating to crab population ecology and fishing history, and incorporates new scientific information providing a mechanism for continually improving the status determination criteria as more information becomes available. The management decision rules are based on target and limit reference points and the exploitation rate is adjusted in relation to stock condition. Bycatch levels in both the directed and non-directed fisheries are continually monitored and form part of the assessment. Ultimately, decisions by the SSC on OFL and ABC for each crab stock may take into account scientific uncertainties, socio-economic factors and other ecological considerations. Ecosystem considerations are provided in the Ecosystem SAFE. The potential impact of crab fishing gear on other species and their habitat is monitored. Environmental Impact Statements (EISs) are required under the National Environmental Policy Act (NEPA) if major federal actions are likely to significantly affect the quality of the human environment. An EIS for the BSAI crab fisheries was prepared in 2004 to provide decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative management/rationalization programs. The EIS considered impacts on safety, harvester efficiency, processing efficiency, and the distribution of benefits between the harvesting and processing sectors, consumers, captains and crew, and affected coastal communities. http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE	

	2011.pdf http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf http://access.afsc.noaa.gov/reem/ecoweb/Eco2011.pdf http://www.epa.gov/compliance/basics/nepa.html http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/default.htm	

7. Management actions and measures for the conservation of stock and the aquatic environment shall be based on the Precautionary Approach. Where information is deficient a suitable method using risk assessment shall be adopted to take into account uncertainty. ***FAO CCRF 7.5.1/7.5.4/7.5.5*** ***FAO ECO 29.6/32***						
Confidence Ratings	**Low**	**0 out of 3**	**Medium**	**0 out of 3**	**High**	**3 out of 3**

Clause:

7.1 The precautionary approach shall be applied widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment.

FAO Eco 29.6

7.1.1 The absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures.

FAO CCRF 7.5.1

Eco 29.6/32

Evidence adequacy rating:

☑**High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
7.1	**The precautionary approach is applied widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment.** Article VIII, Section 4 of the State of Alaska's Constitution is titled Sustained Yield and dictates that: *"Fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial users."* The principle of sustained yield management is a basic tenet of conservation: the annual harvest of a biological resource should not exceed the annual regeneration of that resource. Maximum sustained yield is the largest harvest that can be maintained year after year. State law defines maximum sustained yield as "the achievement and maintenance in perpetuity of a high level annual or regular periodic output of the various renewable resources of the state land consistent with multiple use" (AS

	38.04.910). The qualifying phrase "subject to preferences among beneficial uses" signals recognition by the delegates that not all the demands made upon resources can be satisfied, and that prudent resource management based on modern conservation principles necessarily involves prioritizing competing uses. http://w3.legis.state.ak.us/docs/pdf/citizens_guide.pdf In addition to this, the MSA dictates the development of FMPs for all the federally managed/overseen fisheries. In the BSAI Crab FMP, the OFL, corresponding to the MSY is not the target for catches, rather the upper limit. Catches are in line with the TAC and well below the OFL to take into account the risks involved when calculating MSY. The FAO Guidelines for the Precautionary Approach (PA) (FAO 1995) advocate a comprehensive management process that includes data collection, monitoring, research, enforcement, and review. Prior identification of desirable (target) and undesirable (limit) outcomes must be carried out and measures are required that will avoid undesirable outcomes with high probability and correct them promptly should they occur. The Guidelines suggest that this be achieved through decision rules that specify in advance what action should be taken when specified deviations from operational targets are observed (i.e. harvest control rules). Furthermore, the Guidelines suggest that a management plan should not be accepted until it has been shown to perform effectively in terms of its ability to avoid undesirable outcomes (for example through simulation trials). Lastly, the absence of adequate scientific information should not be used as a reason for postponing or failing to take measures to conserve target species, associated or dependent species as well as non-target species and their environment (FAO. 1995). Precautionary approach to fisheries. Part 1: Guidelines on the precautionary approach to capture fisheries and species introductions. FAO Fisheries Technical Paper 350/1 [online]. Available from http://www.fao.org/DOCREP/003/W3592E/W3592E00.HTM. All the above parameters illustrating the FAO PA definition have been illustrated fully in the previous sections of the assessment. Status determination criteria for crab stocks are annually calculated using a five-tier system that accommodates varying levels of uncertainty of information. The five-tier system incorporates new scientific information and provides a mechanism to continually improve the status determination criteria as new information becomes available. Under the five-tier system, overfishing and overfished criteria and acceptable biological catch (ABC) levels are annually formulated. The annual catch limit (ACL) for each stock equals the ABC for that stock. Each crab stock is annually assessed to determine its status and whether (1) overfishing is occurring or the rate or level of fishing mortality for the stock is approaching overfishing, (2) the stock is overfished or the stock is approaching an overfished condition, and (3) the catch has exceeded the ACL. ***Overfished*** is determined by comparing annual biomass estimates to the established MSST. For stocks where MSST (or proxies) are defined, if the biomass drops below the MSST (or proxy thereof) then the stock is considered to be overfished. ***Overfishing*** is defined as any amount of catch in excess of the overfishing level (OFL). The OFL is calculated by applying the FOFL control rule annually estimated using the tier system to abundance estimates.	

The NPFMC treats OFL (MSY) as a upper limit rather than a target. This system is intrinsically precautionary in nature and the practical results can be seen by comparing catches against OFL determinations for 3 crab stocks under assessment.

Historical status and catch specifications for snow crab (kt).

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2007/08	72.1	98.9	28.6	28.6	35.0		
2008/09	74.1	109.3	26.6	26.5	31.5	35.1	
2009/10	66.6	127.7	21.8	21.8	23.9	33.1	
2010/11	73.7	196.6	24.6	24.7	26.7	44.4	
2011/12		133.8*				73.5	66.15

*Model forecast based on the 2011 assessment under the assumption that the 2011/12 catch equals to the OFL. This value will be updated during the September 2012 assessment when the 2012 survey data and the 2011/12 catch data become available.

Status and catch specifications (kt) of Bristol Bay red king crab

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2007/08	20.32	37.69	9.24	9.30	10.54		
2008/09	17.06	39.83	9.24	9.22	10.48	10.98	
2009/10	15.56	40.37	7.26	7.27	8.31	10.23	
2010/11	13.63	32.64	6.73	6.76	7.71	10.66	
2011/12		29.76[D]				8.80	7.92

*Model forecast based on the 2011 assessment under the assumption that the 2011/12 catch equals to the OFL. This value will be updated during the September 2012 assessment when the 2012 survey data and the 2011/12 catch data become available.

Historical status and catch specifications (kt) of St. Matthew blue king crab

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2007/08		4.39	closed	closed	0.16		
2008/09	1.81	4.87	closed	closed	0.09	0.74 [retained]	
2009/10	1.52	5.79	0.53	0.20	0.25	0.78	
2010/2011	1.52	6.7	0.73	0.57	0.64	1.04	
2011/2012		7.17*				1.7	1.5

* Forecast based on survey data available in the 2011 assessment under the assumption that the 2010/11 catch is equal to the OFL. This value will be updated during the September 2012 assessment when the 2012 survey data and the 2011/12 catch data become available.

http://w3.legis.state.ak.us/docs/pdf/citizens_guide.pdf
http://www.fao.org/DOCREP/003/W3592E/W3592E00.HTM
http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html
http://www.fakr.noaa.gov/npfmc/resources-publications/safe-reports.html
http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

Evidence adequacy rating:

☑**High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
7.1.1	**The absence of adequate scientific information is not used as a reason for postponing or failing to take conservation and management measures.** Absence of adequate scientific information and therefore uncertainties is not used as a reason for postponing or failing to take conservation and management measures. The three crab stocks part of this assessment are managed under a tier system rule based on stock knowledge. Status determination criteria for crab stocks are annually calculated using a five-tier system that accommodates varying levels of uncertainty of information. The five-tier system incorporates new scientific information and provides a mechanism to continually improve the status determination criteria as new information becomes available. The lower the tier, the <u>less</u> conservative the determination of OFL/ABC and ACL are. This is because more conservative determinations are at the higher tier levels. Under the five-tier system, overfishing and overfished criteria and acceptable biological catch (ABC) levels are annually formulated. The annual catch limit (ACL) for each stock equals the ABC for that stock. Each crab stock is annually assessed to determine its status and whether (1) overfishing is occurring or the rate or level of fishing mortality for the stock is approaching overfishing, (2) the stock is overfished or the stock is approaching an overfished condition, and (3) the catch has exceeded the ACL. The difference between OFL and ABC takes into account uncertainties considering both biological (stock assessment) and socio-economic parameters. This is one of a number of components described in this document that provides a precautionary approach within the FMP management program. When adequate scientific information appears to be lacking, crab management is always precautionary. Such insufficient information leads to research priorities to find information necessary to improve management. The following are examples of such activities: For snow crab, one example of management activities for improving information collection on the stock is provided. Following the fishery biomass decline declaration for EBS snow crab in 1999, the U. S. Congress appropriated funds to the state of Alaska to develop a cooperative research program to restore the fishery. These funds, appropriated under the title Bering Sea Snow Crab Fishery Restoration Research, were applied by the state to four research investigations whose goals were integral to assessing the consequences of management practices on stock health, achieving stock recovery, and formulating fishery conservation and management measures that conform to the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) and the Sustainable Fisheries Act (SFA). The research investigation described in the article “Reproductive Dynamics and Life History of Snow Crab in the Eastern Bering Sea” was designed and implemented as a collaborative effort between the NMFS’ AFSC and the ADFG, Region IV, to increase knowledge of the stock and improve the relative management measures.

http://www.afsc.noaa.gov/Quarterly/jfm04/jfm04featurelead.htm
http://www.afsc.noaa.gov/Quarterly/jfm04/jfm04feature.pdf

Additionally, the North Pacific Research Board (NPRB) awarded US$ 250,000 in 2007 to Katherine Swiney of RACE Shellfish, and Ginny Eckert, Ph.D. and Gordon Kruse, Ph.D. of the University of Alaska, Fairbanks a four year grant to conduct concurrent laboratory experiments and field collections of Bristol Bay red king crab (BBRKC) and eastern Bering Sea snow crab (EBSSC) to achieve three project objectives which are important for improving assessment of reproductive potential and understanding population dynamics for these two stocks. The objectives are to: (1) assess reductions in fecundity during brooding and occurrence of unfertilized or non-viable eggs (2) assess egg quality by female size and reproductive history and (3) assess larval fitness by female size, reproductive history, and egg quality.

The incorporation of reproductive potential in the development of biological reference points is a pressing fishery management need for Bering Sea crab stocks. A review by the Center for Independent Experts (CIE) determined that a quantitative understanding of the contribution of female crabs of differing life histories are needed to replace the current, crude measure of reproductive output based on total female biomass. (http://www.afsc.noaa.gov/kodiak/shellfish/research.htm**).**

The latest progress report for this research is dated July 2011 and is available at http://doc.nprb.org/web/07_prjs/714%20prog%20rpt%20jul%202011.pdf.

For both Red and Blue king crab, The Alaska King Crab Research, Rehabilitation and Biology (AKCRRAB) Program is an Alaska Sea Grant partnership with regional fishermen's groups, coastal communities, NOAA Fisheries, the Alutiiq Pride Shellfish Hatchery and Chugach Regional Resources Commission, and the University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, to conduct a research program aimed at hatching and rearing wild red and blue king crabs in a large-scale hatchery setting. This coalition of state, federal, and stakeholder groups views the effort as important to the region's long-term economic development and sustainability. The project aims to understand the large-scale culturing needs of wild red and blue king crab stocks, and to perfect strategies for hatching and rearing king crab to a stage where they can be released into the wild and contribute to reversing low wild stock abundance in Alaska. Acquiring this knowledge base will aid policymakers in making informed decisions about whether to one day pursue active rehabilitation of depressed wild king crab stocks through hatchery enhancement.
http://seagrant.uaf.edu/research/projects/initiatives/king_crab/general/

More generally, a key component of the annual assessments and subsequent SAFE reports for the BSAI crab fisheries is the identification of components of the assessment where there are gaps in evidence and which require research to fill those gaps. Assessments of each of the three crab fisheries highlight priorities for future research and the assessment authors will respond to requests from a hierarchy of peer-reviewers through the CPT, SSC and external reviews (e.g. CIE) to conduct either re-analysis of data currently available or new research to generate additional data and/or information.

Clause: **7.2** **For new and exploratory fisheries, procedures shall be in place for promptly applying precautionary management measures, including catch or effort limits.** **7.2.1** **Provisions shall be made for the gradual development of new or exploratory fisheries while information is being collected on the impact of these fisheries, allowing an assessment of the impact of such fisheries on the long-term sustainability of the stocks.** **7.2.2** **Information collection and precautionary management provisions shall be established and initiated early on to allow impact assessment.** ***FAO CCRF 7.5.4*** **7.2.3** **Contingency plans shall be agreed in advance for the appropriate management response to serious threats to the resource as a result of overfishing or adverse environmental changes or other phenomena adversely affecting the fishery resource. Measures may be temporary and shall be based on best scientific evidence available.** ***FAO CCRF 7.5.5***	
Evidence adequacy rating: ☐ **High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
7.2	**Not Applicable.** The three fisheries here under assessment are not new and exploratory fisheries but well developed fisheries.
Evidence adequacy rating: ☐**High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
7.2.1	**Not Applicable.** The three fisheries here under assessment are not new and exploratory fisheries but well developed fisheries.
Evidence adequacy rating: ☐ **High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
7.2.2	**Not Applicable.** The three fisheries here under assessment are not new and exploratory fisheries but well developed fisheries.

Evidence adequacy rating: ☑**High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
7.2.3	**Contingency plans are agreed in advance for the appropriate management response to serious threats to the resource as a result of overfishing or adverse environmental changes or other phenomena adversely affecting the fishery resource.** NMFS will determine whether a stock is in an overfished condition by comparing annual biomass estimates to the established MSST, defined as ½ BMSY. For stocks where MSST (or proxies) are defined, if the biomass drops below the MSST (or proxy thereof) then the stock is considered to be overfished. MSSTs or proxies are set for stocks in Tiers 1-4. For Tier 5 stocks, it is not possible to set an MSST because there are no reliable estimates of biomass. If overfishing occurred or the stock is overfished, section 304(e)(3)(A) of the Magnuson-Stevens Act, as amended, requires the Council to immediately end overfishing and rebuild affected stocks. For Tiers 1 through 4, once a stock is assigned to a tier, the determination of stock status level is based on recent survey data and assessment models, as available. The stock status level determines the equation used in calculating the FOFL. Three levels of stock status are specified and denoted by “a,” “b,” and “c”. The FMSY control rule reduces the FOFL as biomass declines by stock status level. At stock status level “a,” current stock biomass exceeds the BMSY. For stocks in status level “b,” current biomass is less than BMSY but greater than a level specified as the “critical biomass threshold” (β). In stock status level “c,” the ratio of current biomass to BMSY (or a proxy for BMSY) is below β. At stock status level “c,” directed fishing is prohibited and an FOFL at or below FMSY would be determined for all other sources of fishing mortality in the development of the rebuilding plan. The Council will develop a rebuilding plan once a stock level falls below the MSST. Both the EBS snow crab and St Matthew Blue King crab fisheries have been through a rebuilding plan and have now been reopened for fishing. The annual NMFS eastern Bering Sea bottom-trawl survey provides an assessment of the status of the crab stocks, and ADFG triennial pot surveys in St Matthew provide additional information on the Blue King crab stock (found at very shallow depths not accessible by NMFS trawl surveys). The St Matthew Blue King crab fishery was declared overfished and closed in 1999 when the stock size estimate was below the MSST. In November of 2000, Amendment 15 to the FMP was approved to implement a rebuilding plan for the St. Matthew Island blue king crab stock. The rebuilding plan included a harvest strategy established in regulation by the Alaska Board of Fisheries and an area closure to control bycatch as well as gear modifications. In 2008/09 and 2009/10, the MMB was above *B*MSY for two years and was declared rebuilt in 2009. In spite of the different methodologies employed, as well as the latest prosecution of another SMBKC fishery, results from the 2011 assessment are in keeping with those from the 2010 assessment, which likewise indicated increasing stock biomass well above BMSY and moderate to strong recruitment. However, with stock biomass potentially near historical highs and evidence of reduced recruitment, reason exists to anticipate an end to the positive trends of the last few years.

In 2000, due to the decline in abundance of EBS snow crab and the declaration of the stock as overfished, the harvest rate for calculation of the GHL was reduced to 20% of male crab over 101 mm. After 2000, a rebuilding strategy was developed based on simulations by Zheng (2002). The currency for estimating BMSY changed during the 10 year rebuilding period. Using the current definitions for estimating BMSY, and the Model results for any scenario presented in the 2011 Crab SAFE report (models 1 through 10), the snow crab stock was above BMSY for the last three years (2008/09, 2009/10 and 2010/11). The total mature observed survey biomass in 2011 was 447,400 t which is also above the Bmsy (418,150 t) in place under the rebuilding plan implemented in 2000. The increase in total mature biomass was mainly due to a large increase in female mature biomass in 2011.

http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf

http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf

D. Management Measures

8. **Management shall adopt and implement effective measures including; harvest control rules and technical measures applicable to sustainable utilization of the fishery and based upon verifiable evidence and advice from available scientific and objective, traditional sources.** *FAO CCRF 7.1.1/7.1.2/7.1.6/7.4.1/7.6.1/7.6.9/12.3* *FAO Eco 29.2/29.4/30*						
Confidence Ratings	**Low**	**0 out of 10**	**Medium**	**0 out of 10**	**High**	**10 out of 10**

Clause:

8.1 Conservation and management measures shall be designed to ensure the long-term sustainability of fishery resources at levels which promote the objective of optimum utilization, and be based on verifiable and objective scientific and/or traditional sources. In the evaluation of alternative conservation and management measures, their cost-effectiveness and social impact shall be considered.

FAO CCRF 7.1.1 Others 7.4.1/7.6.7

Eco 29.2/29.4

8.1.1 **States shall prohibit dynamiting, poisoning and other comparable destructive fishing practices.**

FAO CCRF 8.4.2

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	Evidence	
8.1	**Conservation and management measures are designed to ensure the long-term sustainability of fishery resources at levels which promote the objective of optimum utilization, and are based on verifiable and objective scientific and/or traditional sources. In the evaluation of alternative conservation and management measures, their cost-effectiveness and social impact is considered.** The NPFMC's fishery management plan (FMP) for BSAI crab stocks outlines the stock status definitions, the criteria used to determine stock status using a five-tier system and the step-by-step framework under which the NPFMC sets final overfishing levels (OFLs) and acceptable biological catches (ABCs). The MSA requires that the Science and Statistical Committee (SSC) of the NPFMC determines the scientific benchmarks while the Council itself recommends quotas based on these benchmarks. This	

separation of responsibilities is a key step forward in the goal of eliminating overfishing and enhancing recovery of overfished stocks.

The OFL is the catch level above which overfishing is occurring, and the harvest control rules aim to prevent overfishing by establishing a maximum fishing mortality threshold and using this threshold value to determine annual catch limits. The ABC is the level of annual catch that accounts for scientific uncertainty in the estimate of OFL and other uncertainties. The ABC is set below the OFL. The ACL is the level of catch that serves as the basis for invoking accountability measures, and for crab stocks the ACL is set at the ABC. The TAC is the annual catch target for the fishery which is set at or below the ACL and may take into account uncertainty in the management process and socio-economic factors, or other biological concerns that may affect the reproductive potential of the stock but that are not reflected in the OFL itself.

The status determination criteria for crab stocks are calculated on an annual basis using a five-tier system that accommodates varying levels of uncertainty of information, and incorporates new scientific information providing a mechanism for continually improving the status determination criteria as more information becomes available. Under the system overfishing and overfished criteria and ABC (= ACL) levels are formulated. For crab stocks, the overfishing level equals MSY and is derived through the annual assessment process. Each crab stock is assessed annually to determine its status and if catch estimates exceed the OFL, then overfishing is occurring. If annual biomass estimates are below MSST (defined as 0.5 Bmsy) then the stock is overfished. If overfishing has occurred or the stock is overfished, the Magnuson-Stevens Act (MSA) requires NPFMC to immediately end overfishing and rebuild stocks. The MSA also requires that the FMP includes accountability measures to prevent ACLs from being exceeded and to correct overages if they do occur (see section 6.1 and 6.1.4 for further details).

The National Environmental Policy Act (NEPA) requires preparation of EISs for major Federal actions significantly affecting the quality of the human environment. NEPA is a comprehensive process to provide checks and balances against changes to the environment that may impact ecosystems and the natural processes, as well as the socio-economic sphere of fisheries. An EIS for the BSAI crab fisheries was prepared in 2004 to provide decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative management/rationalization programs. The EIS considered impacts on safety, harvester efficiency, processing efficiency, and the distribution of benefits between the harvesting and processing sectors, consumers, captains and crew, and affected coastal communities towards a rationalization program for the crab fleet (excluding Norton Sound).

http://www.epa.gov/compliance/basics/nepa.html

http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/default.htm

Evidence adequacy rating:

☑ High **☐ Medium** **☐ Low**

Clause:	Evidence
8.1.1	**Dynamiting, poisoning and other comparable destructive fishing practices are prohibited in Alaska.** The Federal Bering Sea/Aleutian Islands Fishery Management Plan authorizes the use of pot gear (and ring nets, although not used) to harvest the crab resources. Trawls and tangle nets are specifically prohibited because of the high mortality rates which they inflict on non legal crab. Title 5 of Fish and Game, Chapter 34 and 35 of the Alaska Administrative Code (5 AAC 34 and 35) specify "lawful gear" (i.e. size, dimension, internal structure etc...) for king and tanner crab respectively (http://www.touchngo.com/lglcntr/akstats/aac/title05.htm).

Clause:

8.2 States shall seek to identify domestic parties having a legitimate interest in the use and management of the fishery.

8.2.1 Arrangements shall be made to consult these parties and gain their collaboration.

FAO CCRF 7.1.2 Others 7.1.6

Evidence adequacy rating:

☑ High **☐ Medium** **☐ Low**

Clause:	Evidence
8.2	**Domestic parties having a legitimate interest in the use and management of the fishery are identified.** The Crab Rationalization Program allocates BSAI crab resources among harvesters, processors, and coastal communities who have been involved with and/or were dependent upon these fisheries. The North Pacific Fishery Management Council developed the Program over a 6-year period to accommodate the specific dynamics and needs of the BSAI crab fisheries. The Program was implemented in 2005 builds on the Council's experiences with the halibut and sablefish Individual Fishing Quota (IFQ) program and the American Fisheries Act (AFA) cooperative program for Bering Sea pollock. The Program is a limited access system that balances the interests of several groups who depend on these fisheries. The Program addresses conservation and management issues associated with the previous derby fishery, reduces bycatch

and associated discard mortality, and increases the safety of crab fishermen by ending the race for fish.

Share allocations to harvesters and processors, together with incentives to participate in fishery cooperatives, increases efficiencies, provides economic stability, and facilitates compensated reduction of excess capacities in the harvesting and processing sectors. Community interests are protected by Community Development Quota (CDQ) allocations and regional landing and processing requirements, as well as by several community protection measures.

These community protection measures are primarily limits on the amount of PQS and IPQ that can be used outside of communities with historic reliance on the crab fisheries, which means that more than 3% of a crab fishery was processed there. There are nine Eligible Crab Communities (ECCs): Adak, Akutan, Unalaska/Dutch Harbor, False Pass, King Cove, Kodiak, Port Moller, Saint George, and Saint Paul. The two main protection measures are:

1)-Right of First Refusal (ROFR), and

2)-QS Purchase

Before NMFS issues any PQS, an ECC may establish a contract with that PQS holder which guarantees the ECC first rights to any PQS proposed for sale for use outside that community. Some requirements exist for IPQ as well. ROFR does not apply to Adak. Each ECC can purchase QS and lease the IFQ to community residents. Communities would need to submit an annual report to NMFS if they purchase QS.

Crab Rationalization program components include quota share allocation, processor quota share allocation, IFQ and individual processing quota (IPQ) issuance, quota transfers, use caps, crab harvesting cooperatives, protections for Gulf of Alaska groundfish fisheries, arbitration system, monitoring, economic data collection, and cost recovery fee collection.

(http://www.fakr.noaa.gov/sustainablefisheries/crab/rat/progfaq.htm#wicr).

The Community Development Quota (CDQ) Program began in December of 1992 with the goal of promoting fisheries related economic development in economically distressed western Alaska native villages. The program is a federal fisheries program that involves eligible communities who have formed six regional organizations, referred to as CDQ groups. There are 65 communities within a fifty-mile radius of the Bering Sea coastline who participate in the program. The CDQ program allocated a portion of the Bering Sea and Aleutian Island harvest amounts to CDQ groups, including pollock, halibut, Pacific cod, crab and bycatch species. The CDQ program was granted perpetuity status during the 1996 reauthorization of the Magnuson-Stevens Act. The program was modelled after the Alaska Native Claims Settlement Act (ANCSA) (http://www.fakr.noaa.gov/cdq/).

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
8.2.1	**Arrangements are made to consult these parties and gain their collaboration.** The Crab rationalization program has experienced extensive public review. NMFS has issued QS to qualified LLP holder or crew member applicants who submitted an application BEFORE the application deadline. Applications were accepted from April 4, 2005, until 5:00 p.m. Alaska local time on June 3, 2005. The deadline to apply for QS has passed, all applications received after the deadline are deemed untimely and will not be eligible for QS. QS may now be received only by transfer from another QS holder. The BOF and the NPFMC are openly public processes. Any individual or group can submit proposals for discussion of management and research for crab fisheries in Alaska. The BOF meets in communities throughout coastal Alaska, while the NPFMC meets in communities in Alaska as well as in Washington and Oregon to provide public opportunities. Written comments are accepted when it is not possible to attend in person. http://www.fakr.noaa.gov/npfmc/ http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main	

Clause:

8.3 **Fleet capacity operating in the fishery shall be measured and states shall maintain, in accordance with recognized international standards and practices, statistical data, updated at regular intervals, on all fishing operations and a record of all authorizations to fish allowed by them.**

FAO CCRF 8.1.2, 8.1.3

8.3.1 **Mechanisms shall be established where excess capacity exists to reduce capacity to levels commensurate with sustainable use of the resource. Such mechanisms shall include monitoring the capacity of fishing fleets.**

FAO CCRF 7.1.8, 7.6.3

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	Evidence	
8.3	**Fleet capacity operating in the fishery is measured and there are maintained, in accordance with recognized international standards and practices, statistical data, updated at regular intervals, on all fishing operations and a record of all authorizations to fish allowed by them.** The crab fisheries in the Bering Sea are limited entry rationalized fisheries. Capacity of these fisheries has been reduced since 2002. Fleet consolidation accompanying rationalization was substantial. In both the Bristol Bay red king crab and Bering Sea snow crab fisheries, the annual average post-rationalization fleet was roughly one-third of the size of the pre-rationalization fleet. While virtually all participating Alaska communities lost vessels, the remaining vessel ownership has tended to aggregate in fewer and larger communities. As explained in the previous clause above, applications to participate in the rationalized BSAI crab fisheries were accepted from April 4, 2005, until 5:00 p.m. Alaska local time on June 3, 2005. Quota Shares (QS) may now be received only by transfer from another QS holder. http://www.fakr.noaa.gov/npfmc/PDFdocuments/catch_shares/Crab/SIAexS_911.pdf The capacity of the crab fleet is fixed since 2006 and continuously monitored by RAM and CFEC. The NMFS's Restricted Access Management Program (RAM) is responsible for managing Alaska Region permit programs, including those that limit access to the Federally-managed fisheries of the North Pacific. RAM responsibilities include: providing program information to the public, determining eligibility and issuing permits, processing transfers, collecting landing fees and related activities. The Restricted Access Management (RAM) Program has prepared lists of License Limitation Program (LLP) groundfish and crab licenses. LLP licenses are initially issued to persons, based on the activities of original qualifying vessels. The Alaska Commercial Fisheries Entry Commission (CFEC) helps to conserve and maintain the economic health of Alaska's commercial fisheries by limiting the number of participating fishers. CFEC issues permits and vessel licenses to qualified individuals in both limited and unlimited fisheries, and provides due process hearings and appeals as and when needed. The RAM division as well as the CFEC maintain on their websites, all the fishermen records for which fishing permits are issued. http://www.fakr.noaa.gov/ram/ http://www.cfec.state.ak.us/	

Evidence adequacy rating:

☑ **High**	☐ **Medium**	☐ **Low**

Clause:	Evidence	
8.3.1	Please see evidence provided above in 8.3.	

Clause:

8.4 States and relevant groups from the fishing industry shall encourage the development and implementation of technologies and operational methods that reduce waste and discards of the target species. These measures shall be applied appropriately.

***FAO CCRF* 8.4.5**

8.4.1 Technical measures shall be taken into account, where appropriate, in relation to:

- **fish size**
- **mesh size or gear**
- **discards**
- **closed seasons**
- **closed areas**
- **areas reserved for particular (e.g. artisanal) fisheries**
- **protection of juveniles or spawners**

8.4.2 Suitable arrangements shall be in place to measure performance and to promote, to the extent practicable, the development and use of selective, environmentally safe and cost-effective gear, methods and techniques. Less consistent methods, practices and gears shall be phased out accordingly.

FAO CCRF 7.6.9, 7.6.4, 8.5.2

8.4.3 Fishing gear shall be marked in accordance with national legislation in order that the owner of the gear can be identified. Gear marking requirements shall take into account uniform and internationally recognizable gear marking systems.

FAO CCRF 8.2.4

Evidence adequacy rating:		
☑ **High**	☐ **Medium**	☐ **Low**

Clause:	Evidence
8.4	**States and relevant groups from the fishing industry encourage the development and implementation of technologies and operational methods that reduce waste and discards of the target species.** **Escape mechanisms for females and undersized males** *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 BSAI area (specified in Section 8.1.1 of Crab FMP). 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 BSAI *C. bairdi*, *C. opilio*, and 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 pots catching and holding ability in case the pot is lost. A slower paced fishery allows for longer soak times and more time for the gear to sort undersized or female crab from the harvest. Crabbers are constructing pots with larger web on the panels to allow for female and juvenile crab to exit the pot before the gear is hauled back by the vessel. This results in significantly less by-catch of the non-targeted animals and a higher catch rate of legal sized crab. Also, fewer pots being used in the crab fisheries results in less impact on the marine habitat. The yearly marine habitat footprint of the directed crab fisheries is now less than ½ square mile for the entire Bering Sea and Aleutian Islands. http://alaskaberingseacrabbers.org/environment.html http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf For escape of non-target crabs, a minimum size of 9" stretched mesh on one third of one vertical panel is required for pots used in the Bristol Bay Red king crab fishery. http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section825.htm Pots used to take *Chionoecetes opilio* Tanner crab must have at least eight escape rings with an inside diameter measure of no less than four inches placed within one mesh measurement from the bottom of the pot, with four escape rings on each of two sides of a four-sided pot, or if the pot has no escape rings as specified in this paragraph, one-half of one side of a four-sided pot must have a side panel composed of not less than five and one-quarter inch stretched mesh webbing to permit escapement of undersize *C. opilio* Tanner crab. (http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter035/section525.htm).

	In the Saint Matthew Island Section, each king crab pot must have eight escape rings with an inside diameter measure of 5.8 inches placed within one mesh measurement from the bottom of the pot, with four escape rings on two sides of a four-sided pot, or if the pot has no escape rings as specified in this paragraph, then one-half of one side of a four-sided pot must have a side panel composed of net less than eight-inch stretched mesh webbing. http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section925.htm Other gear restrictions for the 3 fisheries 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. http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf Upon retrieval of crab pots, a wide range of sorting and discard techniques are currently used by the crab fleets but the basic elements of the process are essentially the same on all vessels. After the pot has been retrieved and secured in the launcher, crab are dumped either into totes (plastic boxes) or onto a sorting table. As the male crab of marketable size are separated from the rest of the catch and placed into circulating water tanks, the crab to be discarded are returned to the sea in a variety of methods, ranging from being tossed overboard, dragged in totes and dumped into an outflow shoot, or placed directly into an outflow ramp of various designs. Some vessels such as the F/V *Arctic Sea* use a highly automated system where crab are dumped directly onto a conveyor belt table running the width of the vessel. Legal sized crab are sorted from the catch while the remainder of the catch is rapidly returned to the sea with minimal or no handling. The F/V *Arctic Hunter* uses a hydraulically operated sorting table which slides back from the pot launcher to the center of the boat. The discarded catch slides downhill through an aluminium flume to exit at the water level. http://doc.nprb.org/web/09_prjs/917_Final%20report%20June%20_2_.pdf A report to the Alaskan governor in 2008 by the Coalition for Safe and Sustainable Crab Fisheries (BSAI Crab Program) described the use of such chutes and its adoption by the entire fleet in an effort to reduce crab mortality. http://www.wafro.com/imageuploads/file175.pdf Season length and the pace of the fisheries influences handling mortality. With longer fishing seasons (brought forward by rationalization of the BSAI crab fisheries), the pace of the fisheries slows down allowing fishermen to improve fishing methods, such as gear operation and sorting on deck. Also, with more time, fishermen are able to improve handling methods and reduce the mortality of crabs brought on deck. http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/final/Chapter1.pdf http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034.htm Additional operational flexibility is being evaluated under NPRB project 917, evaluating handling mortality in the snow crab fishery. The final component of this study, field observations on the effects of cold weather on handling mortality, is been conducted during this winter's 2012 fishery. http://project.nprb.org/view.jsp?id=830b2825-1af7-4912-aced-0b3f90719056	

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
8.4.1	**Technical measures are taken into account, where appropriate, in relation to fish size, mesh size or gear, discards, closed seasons, closed areas, areas reserved for particular (e.g. artisanal) fisheries, and for protection of juveniles or spawners.** Male red king crab six and one-half inches or greater in width of shell may be taken or possessed. http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section820.htm In the Saint Matthew Island Section, only male blue and golden king crab five and one-half inches or greater in width of shell may be taken or possessed. http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section920.htm Male Tanner crab of the species *Chionoecetes opilio* 3.1 inches (78 mm) or greater in width of shell may be taken or possessed. In the Bering Sea District, Tanner crab size limits are as follows: (1) male *C. bairdi* Tanner crab, or hybrid Tanner crab conforming to the identification criteria described at 5 AAC 35.521(a) , must be 5 1/2 inches or greater in width of shell; (2) male *C. opilio* Tanner crab, or hybrid Tanner crab conforming to the identification criteria described at 5 AAC 35.521(b) , must be 3.1 inches or greater in width of shell. http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter035/section520.htm Undersized males and females must be promptly discarded from crab vessels to decrease handling mortality rates. **Alaska Administrative Code (AAC) specification about gear requirements relating to crab size.** **5 AAC 35.050. Lawful gear for Tanner crab** Unless otherwise specified in this chapter, (1) Tanner crab may be taken only with Tanner crab pots and ring nets; Tanner crab taken by other means must be returned to the water without further harm; (2) a Tanner crab pot is a pot that is no more than 10 feet long by 10 feet wide by 42 inches high with rigid tunnel eye openings that individually are less than five inches (13 cm) in one dimension with tunnel eye opening perimeters that individually are more than 36 inches (91.4 cm) or a pot that is no more than 10 feet long by 10 feet wide by

42 inches high and that tapers inward from its base to a top that consists of one horizontal opening of any size;

(3) Tanner crab pots with tunnel eye openings on the vertical plane of the pot that are used to take Tanner crab during the closed king crab season in any area may not have tunnel eye openings more than five inches (13 cm) in height.

History: In effect before 1982; am 7/25/82, Register 83; am 6/30/83, Register 86; am 7/14/85, Register 95; am 7/12/86, Register 99; am 7/23/88, Register 107; am 9/19/90, Register 115; am 1/11/92, Register 121; em am 12/29/92 - 4/27/93, Register 125; am 7/23/94, Register 131; em am 10/20/95 - 2/16/96, Register 136; am 9/29/96, Register 139; am 3/11/2001, Register 157; am 8/24/2002, Register 163. Authority: AS 16.05.251

http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter035/section050.htm

5 AAC 34.050. Lawful gear for king crab

Unless otherwise specified in this chapter,

(1) king crab may be taken only with king crab pots; king crab taken by other means must be returned to the water without further harm;

(2) a king crab pot is a pot that is no more than 10 feet long by 10 feet wide by 42 inches high with rigid tunnel eye openings that individually are no less than five inches (13 cm) in any one dimension with tunnel eye opening perimeters that individually are more than 36 inches (91.4 cm) or a pot that is no more than 10 feet long by 10 feet wide by 42 inches high and that tapers inward from its base to a top consisting of one horizontal opening of any size;

(3) during the open season for king crab, all shellfish pots, other than those described as Dungeness crab, Tanner crab, or shrimp pots, must conform to the specifications in (2) of this section.

History: In effect before 1982; am 7/25/82, Register 83; am 6/30/83, Register 86; am 6/30/84, Register 90; am 7/14/85, Register 95; am 7/12/86, Register 99; em am 9/30/87 - 1/27/88, Register 104; am 7/23/88, Register 107; em am 9/15/89 - 1/12/90, Register 112; am 9/19/90, Register 115; am 5/2/92, Register 122; em am 8/21/92 - 12/18/92, Register 123; am 6/24/93, Register 126; am 7/23/94, Register 131; am 11/6/96, Register 140. Authority: AS 16.05.251

Other operational measures and regulations relating to avoidance of ghost fishing, aimed at improving escape of undersize male and female crab, and decrease of handling mortality on board of fishing vessels are described in clause 8.4.

Seasons restrictions are detailed in State regulations for all crab species.

5 AAC 34.810. Fishing seasons for Registration Area T (Bristol Bay Red king crab)
http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section810.htm

5 AAC 35.510. Fishing seasons for Registration Area J (EBS snow crab)
http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter035/section510.htm

5 AAC 34.910. Fishing seasons for Registration Area Q (blue king crab St. Matthew)
http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section910.htm

Fishing Seasons

The Federal BSAI Crab FMB describes fishing season requirements. 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 aggregations 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. 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 softshell condition, if they are held for long time periods, if holding tanks are contaminated with fresh or warm water, or if crabs are handled too often. 2. To produce the best possible product quality. 3. To minimize fishing during severe weather conditions. 4. To minimize the cost of industry operations. 5. To coordinate the king and Tanner crab fisheries with other fisheries that are making demands on the same harvesting, processing, and transportation systems. Seasons can be timed relative to one another to spread fishing effort, prevent gear saturation, and allow maximum participation in the fisheries by all elements of the crab fleets, 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. Important commercial and subsistence king crab fishery takes place in Norton Sound. This fishery was restricted to small boats in 1993 and designated a super exclusive fishery in 1994. The BSAI Crab 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, Pribilof, or St. Matthew, during that registration year. The Norton Sound fishery is the only superexclusive registration area authorized by the FMP. Community Development Quotas (CDQs) that had a Guideline Harvest Level set by the State of Alaska for all BSAI Crab fisheries were issued for 3.5% in 1998; 5% in 1999; and 7.5% in 2000. The CDQ percentage is to date been increased to 10%. http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf Also there are groundfish closure areas, or trawl protection areas, to minimize the impact of groundfish harvests on crab resource. See: http://www.fakr.noaa.gov/npfmc/conservation-issues/habitat-protections.html	

Evidence adequacy rating:

☑ High **☐ Medium** **☐ Low**

Clause:	Evidence
8.4.2	**Suitable arrangements are in place to measure performance and to promote, to the extent practicable, the development and use of selective, environmentally safe and cost-effective gear, methods and techniques. Less consistent methods, practices and gears are phased out accordingly.** As discussed above in the above clauses of this section, the promotion (through regulation), to the extent practicable, development and use of selective, environmentally safe and cost-effective gear, methods and techniques is one of the key requirements for the BSAI crab fisheries. The gear utilized and the effects on target and non target catch as well as other issues relating to decreasing handling mortality have been researched and conservation sensitive modifications to gear have evolved since the 1990s (see below) and have been included, where appropriate into regulation. Such studies include, to name but a few, the following: Bradley Gene Stevens, Jan A. Haaga, William E. Donaldson, AFSC. 1993 Underwater observations on behavior of king crabs escaping from crab pots. Alaska Fisheries Science Center, National Marine Fisheries Service, U.S. Dept. of Commerce, 14 p. **Alaska Fishery Research Bulletin articles (http://www.adfg.alaska.gov/index.cfm?adfg=afrb.shellfish)** **Handling Increases Mortality of Softshell Dungeness Crabs Returned to the Sea** Gordon H. Kruse, David Hicks, and Margaret C. Murphy - Vol. 1(1). 1994 **Results of a Questionnaire on Research and Management Priorities for Commercial Crab Species in Alaska** Margaret C. Murphy, William E. Donaldson, and Jie Zheng - Vol. 1(1) 1994 **Tanner Crab Survival in Closed Pots** Al Kimker - Vol. 1(2). 1994 **Compensatory Feeding Capacity of 2 Brachyuran Crabs, Tanner and Dungeness, After Starvation Periods Like Those Encountered in Pots** J. M. Paul, A. J. Paul, and Al Kimker - Vol. 1(2). 1994 **An Annotated Bibliography of Capture and Handling Effects on Crabs and Lobsters** Margaret C. Murphy and Gordon H. Kruse - Vol. 2(1). 1995 **Experimental Effects of Soak Time on Catch of Legal-Sized and Nonlegal Red King Crabs by Commercial King Crab Pots**

Douglas Pengilly and Donn Tracy - Vol. 5(2). 1998

Capture Efficiency and Size Selectivity of Two Types of Pots for Red King Crabs in the Bering Sea
Shijie Zhou and Gordon H. Kruse - Vol. 6(2). 2000

Zhou, S., and G.H. Kruse. 2000. Modifications of cod pots to reduce Tanner crab bycatch. North American Journal of Fisheries Management 20: 897-907.

Zhou, S. and **T. C. Shirley**. 1995. Effects of handling on feeding, activity and survival of red king crabs. J. Shellfish Research 14(1): 173-177.

Zhou, S. and **T. C. Shirley**. 1997. Behavioral responses of red king crab to crab pots. Fisheries Research 30: 177-189.

Zhou, S. and **T. C. Shirley**. 1997. Performance of two red king crab pot designs. Can. J. Fisheries & Aquatic Sciences 54: 1858-1864.

Warrenchuk, J. J. and T. C. Shirley. 2002. Effects of windchill on the snow crab (*Chionoecetes opilio*). Pages 81-96 *in* A.J. Paul et al. editors. Crabs in cold water regions: biology, management, and economics. University of Alaska, Sea Grant College Program. Fairbanks.

Warrenchuk, J.J. and **T.C. Shirley**. 2002. Estimates of mortality of snow crab, *Chionoectes opilio*, discarded during the Bering Sea fishery in 1998. Alaska Fisheries Research Bulletin 9(1):44-52.

van Tamelen, P. 2005. Estimating handling mortality due to air exposure: Development and application of thermal models for the Bering Sea snow crab fishery. Trans. Am. Fish. Soc. 134:411-429.

Stoner, A. W. 2009. Prediction of discard mortality for Alaskan crabs after exposure to freezing temperatures, based on a reflex impairment index. Fish. Bull. 107:451-463.

Elizabeth Chilton, Dan Urban, Earl Krygier, Allan Stoner. 2011. Reduction of bycatch mortality for non-target crab species in the commercial snow crab (*Chionoecetes opilio*) fishery. NPRB Project 917 Final Report.

Rose, C. S., Hammond, C., Stoner, A., Munk, E., and Gauvin, J. *in press*. Quantification of unobserved mortality rates of snow, Tanner and red king crabs *(Chionoecetes opilio*, *C. bairdi and Paralithodes camtschaticus*) after encounters with trawls on the seafloor. Fish. Bull.

In addition the BOF and Council process continuously discuss and review regulation primarily related to conservation of the crab stocks, including issues related to use of selective, environmentally safe and cost-effective gear, methods and techniques. Less consistent methods, practices and gears are phased out accordingly.

	Also, section 4.0 of the BSAI Crab FMP addresses the requirement in EFH regulations (50 CFR 600.815(a)(2)(i)) that each FMP must contain an evaluation of the potential adverse effects of all regulated fishing activities on EFH. This evaluation must 1) describe each fishing activity, 2) review and discuss all available relevant information, and 3) provide conclusions regarding whether and how each fishing activity adversely affects EFH. Relevant information includes the intensity, extent, and frequency of any adverse effect on EFH; the type of habitat within EFH that may be affected adversely; and the habitat functions that may be disturbed. In addition, the evaluation should 1) consider the cumulative effects of multiple fishing activities on EFH, 2) list and describe the benefits of any past management actions that minimize potential adverse effects on EFH, 3) give special attention to adverse effects on habitat areas of particular concern (HAPCs) and identify any EFH that is particularly vulnerable to fishing activities for possible designation as HAPCs, 4) consider the establishment of research closure areas or other measures to evaluate the impacts of fishing activities on EFH, 5) and use the best scientific information available, as well as other appropriate information sources. This evaluation assesses whether fishing adversely affects EFH in a manner that is more than minimal and not temporary in nature (50 CFR 600.815(a)(2)(ii)). This standard determines whether Councils are required to act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable. http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf	
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
8.4.3	**State regulations impose marking requirements on pot gear used in the rationalized crab fisheries**. **Title 5 Alaska Administrative Code 34.051. King crab gear marking requirements** (a) At least one buoy on each king crab pot or ring net must be legibly marked with the permanent ADFG vessel license plate number of the king crab vessel operating the gear. The buoy must bear only the number of the vessel used in operating the gear. The number shall be painted on the top one-third of the buoy in numerals at least four inches high, one-half inch wide, and in a color contrasting to that of the buoy. The buoy markings must be visible on the buoy above the water surface when the buoy is attached to the crab pot. (b) In registration areas where a king crab pot limit is in effect, each king crab pot must have one identification tag issued by the department placed on the main buoy or on the trailer buoy if more than one buoy is attached to the pot. (c) Identification tags are issued before each fishing season, are uniquely numbered for	

	each registration year, and will be issued at the time of vessel registration for that vessel only. The vessel owner, or the owner's agent, shall apply for identification tags at a department office designated to issue the tags. Replacement of tags lost during the season is permitted if the vessel operator submits a sworn statement or affidavit describing how the tags were lost and listing the numbers of the lost tags. Tags shall be renewed annually before each fishing season. **History: Eff. 9/1/96, Register 139; am 11/6/96, Register 140** **Authority:** AS 16.05.251 AS 16.05.632 http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section051.htm **Title 5 Alaska Administrative Code 35.051. Tanner crab gear marking requirements** At least one buoy on each Tanner crab pot or ring net must be legibly marked with the permanent ADFG vessel license plate number of the Tanner crab vessel operating the gear. The buoy must bear only the number of the vessel used in operating the gear. The number shall be painted on the top one-third of the buoy in numerals at least four inches high and one-half inch wide, in a color contrasting to that of the buoy. The buoy markings must be visible on the buoy above the water surface when the buoy is attached to the crab pot. **History: Eff. 9/29/96, Register 139** **Authority:** AS 16.05.251 AS 16.05.632 http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter035/section051.htm	

9. There shall be defined management measures designed to maintain stocks at levels capable of producing maximum sustainable levels. *FAO CCRF 7.1.8/7.6.3/7.6.6/8.4.5/8.4.6/8.5.1/8.5.3/8.5.4/8.11.1/12.10* *FAO Eco 29.2bis*						
Confidence Ratings	**Low**	**0 out of 9**	**Medium**	**0 out of 9**	**High**	**9 out of 9**

Clause:

9.1 Measures shall be introduced to identify and protect depleted resources and those resources threatened with depletion, and to facilitate the sustained recovery of such stocks. Also, efforts shall be made to ensure that resources and habitats critical to the wellbeing of such resources which have been adversely affected by fishing or other human activities are restored.

FAO CCRF 7.6.10

Eco 30

Evidence adequacy rating:

☑ High **☐ Medium** **☐ Low**

Clause:	**Evidence**
9.1	**Measures are introduced to identify and protect depleted resources and those resources threatened with depletion, and to facilitate the sustained recovery of such stocks. Also, efforts are made to ensure that resources and habitats critical to the wellbeing of such resources which have been adversely affected by fishing or other human activities are restored.** As specified in the BSAI crab FMP, there are clearly defined management measures designed to maintain the crab stocks at levels capable of producing maximum sustainable levels. These include harvest strategy and harvest control rule, stock status definitions, criteria used to determine stock status using a five-tier system and the step-by-step framework under which the NPFMC sets final overfishing levels (OFLs) and acceptable biological catches (ABCs). The state of the three crab resources under assessment in this report is monitored through the use of a complex system that yearly determines overfishing levels, allowable biological catches and annual catch limits. A stock reaching overfished conditions is placed under a rebuilding plan. The St Matthew Blue King crab fishery was declared overfished and closed in 1999 when the stock size estimate was below the MSST. In November of 2000, Amendment 15 to the FMP was approved to implement a rebuilding plan for the St. Matthew Island blue king crab stock. In 2008/09 and 2009/10, the MMB was above *B*MSY for two years and was declared rebuilt in 2009.

In 2000, the decline in abundance of EBS snow crab caused the declaration of the stock as overfished. After 2000, a rebuilding strategy was developed based on simulations by Zheng (2002). The currency for estimating BMSY changed during the 10 year rebuilding period. Using the current definitions for estimating BMSY, and the Model results for any scenario presented in the 2011 Crab SAFE report (models 1 through 10), the snow crab stock was above BMSY for the last three years (2008/09, 2009/10 and 2010/11). The total mature observed survey biomass in 2011 was 447,400 t which is also above the Bmsy (418,150 t) in place under the rebuilding plan implemented in 2000.

In terms of restoring resources and habitats critical to the wellbeing of crab resources which have been adversely affected by fishing or other human activities, the first thing to establish is whether essential fish habitats need restored.

The MSA includes provisions concerning the identification and conservation of Essential Fish Habitat (EFH). The MSA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The NMFS and the NPFMC (as well as all the other regional Fishery Management Councils) must describe and identify EFH in FMPs, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other actions to encourage the conservation and enhancement of EFH. Federal agencies that authorize, fund, or undertake actions that may adversely affect EFH must consult with NMFS, and NMFS must provide conservation recommendations to federal and state agencies regarding actions that would adversely affect EFH.

Evaluation of Effects on EFH of BSAI Crab Species

Red King Crab

Issue	**Evaluation**
Spawning/breeding	S (Substantial effect)
Feeding	U (Unknown effect)
Growth to maturity	MT (Minimal, temporary, or no effect)

Summary of Effects - There is an area of overlap between current female red king crab distribution and areas where trawling occurs in the southern Bristol Bay. Southern Bristol Bay is an important spawning ground for red king crab and heavy trawling there could greatly impact the crab spawning success. Trawling in deeper waters also somewhat overlaps the migration route to mating areas. There are essentially no fishing effects in areas important to juvenile red king crab. All known juvenile rearing areas are currently protected by trawl closure areas. Most of the distribution of red king crab was to the north and east of the high fishing effects areas during the past 15 years. However, a high density of mature female crab were found in the heavy trawling area during 2008-2009, and it appears that mature female crab moved back to the historical important spawning ground in the southern Bristol Bay. **Given the current overlap, trawling intensity in the southern Bristol Bay, and the importance of the spawning ground there, professional judgement indicates that trawling fisheries have currently adversely affected the EFH of red king crab.** This heavy trawling could impact the stock recovery and jeopardize the ability of the stock to produce MSY over the long term. Beyond trawling in the southern Bristol Bay, other fishing may have minimum impacts on red king crab EFH.

In this regard, a staff discussion paper is been developed by the Council and the NMFS in March 2012. Here, options for Council action include:

•Revise the effects of EFH evaluations.
•No management action, but encourage further research in this area to better understand adult, juvenile and larval distribution and habitat usage.
•Extend or establish trawl closure areas in the affected area as EFH conservation measures.
•Extend the range of the red king crab savings area to protect more of the stock.
•Apply a seasonal closure to protect the adult female red king crab from March to May during molting and mating.
•Close area southwest of Amak Island.
•Designate a HAPC priority for areas important for red king crab egg hatching, and consider designating this area as a HAPC.

This specific item is scheduled for discussion on the Council session post October meeting.

http://www.fakr.noaa.gov/npfmc/PDFdocuments/conservation_issues/EFH/EFHDiscPaper411.pdf

Blue King Crab

Issue	Evaluation
Spawning/breeding	MT (Minimal, temporary, or no effect)
Feeding	U (Unknown effect)
Growth to maturity	U (Unknown effect)

Summary of Effects: Fishing activity effects are unknown or are considered to have overall minimal and temporary effects on the EFH for blue king crab, although the Pribilof Islands stock is below MSST and the St. Matthew stock of blue king crabs has just recovered to BMSY. It is unknown if habitat loss or degradation by fishing activities had any role in the decline of these stocks. For the Pribilof Islands blue king crab, any fishing activities thought to have adverse consequences on habitat have previously been mitigated by establishment of the Pribilof Islands trawl closure area. For St. Matthew blue king crab, there has never been a groundfish bottom trawl fishery in the area. Given the current very small overlap and fishing intensity in areas with blue king crab of all life stages, professional judgement indicates that fisheries do not currently adversely affect the EFH of blue king crab.

Snow Crab

Issue	Evaluation
Spawning/breeding	U (Unknown effect)
Feeding	MT (Minimal, temporary, or no effect)
Growth to maturity	MT (Minimal, temporary, or no effect)

Summary of Effects - Fishing activities are considered to have overall minimal and temporary effects on the EFH for snow crabs. The current distribution of snow crab does not overlap the high trawl effects area to any extent. Juvenile snow crab

	distribution occurs on mud substrate and does not overlap areas of high trawling effects. Fishing effects on snow crab habitat and the subsequent impacts on snow crab feeding are expected to be minimal. http://www.fakr.noaa.gov/habitat/efh/review/appx3.pdf http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf

Clause:

9.2 When deciding on use, conservation and management of the resource, due recognition shall be given, where relevant, in accordance with national laws and regulations, to the traditional practices, needs and interests of indigenous people and local fishing communities which are highly dependent on these resources for their livelihood.

FAO CCRF 7.6.6

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
9.2	**When deciding on use, conservation and management of the resource, due recognition is given, where relevant, in accordance with national laws and regulations, to the traditional practices, needs and interests of indigenous people and local fishing communities which are highly dependent on these resources for their livelihood.** The three BSAI crab fisheries hereby under assessment are well developed commercial fisheries. The needs of rural coastal communities have been taken into account through the Community Development Quota (CDQ). The Western Alaska CDQ Program allocates a percentage of all Bering Sea and Aleutian Islands quotas for groundfish, prohibited species, halibut, and crab to eligible communities. The purpose of the CDQ Program is to (i) to provide eligible western Alaska villages with the opportunity to participate and invest in fisheries in the Bering Sea and Aleutian Islands Management Area; (ii) to support economic development in western Alaska; (iii) to alleviate poverty and provide economic and social benefits for residents of western Alaska; and (iv) to achieve sustainable and diversified local economies in western Alaska. Those communities receive 10% of the total TAC for each of the crab species. http://www.fakr.noaa.gov/cdq/default.htm **Bristol Bay Red King Crab Subsistence Fishery** Provisions are made in Title 5 of the Alaska Administrative Code for subsistence fisheries on red king crab in four general areas: Yakutat [5 AAC 02.108]; Kodiak [5 AAC

	02.420]; Alaska Peninsula-Aleutian Islands [5 AAC 02.520]; and the Bering Sea [5 AAC 02.620]. Bag limits and seasons are generally more liberal and gear requirements less restrictive than for personal use or sport fisheries. Unlike personal use fishery catch, which may be shared only with immediate family members, subsistence fishery catch may be shared with all members of the community. **Personal Use Fishery** There are red king crab personal use fisheries around the state of Alaska. Each region around the state has their own set of regulations in terms of seasons and bag limits for the personal-use fishery. Some areas require permits for personal use red king crab such as the Juneau area district 11-A personal use red king crab fishery. The personal use red king crab fishery is designed to provide harvest opportunities for Alaska residents and their immediate family members. http://www.adfg.alaska.gov/index.cfm?adfg=redkingcrab.main There are no subsistence or personal use Bering Sea snow crab or St. Matthew Island blue king crab in the area under assessment.	

Clause: **9.3** **States and relevant groups from the fishing industry shall encourage the development and implementation of technologies and operational methods that reduce discards of the target and non-target species catch. The use of fishing gear and practices that lead to the discarding of catch shall be discouraged and the use of fishing gear and practices that increase survival rates of escaping fish shall be promoted.** ***FAO CCRF 8.4.5***		
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
9.3	**The development and implementation of technologies and operational methods that reduce discards of the target and non-target species catch is encouraged. The use of fishing gear and practices that lead to the discarding of catch is discouraged and the use of fishing gear and practices that increase survival rates of escaping fish is promoted.** **Escape mechanisms for females and undersized males** 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 BSAI area (specified in Section 8.1.1 of Crab FMP). 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 BSAI *C. bairdi*, *C. opilio*, and 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 pots catching and holding ability in case the pot is lost. A slower paced fishery allows for longer soak times and more time for the gear to sort undersized or female crab from the harvest. Crabbers are constructing pots with larger web on the panels to allow for female and juvenile crab to exit the pot before the gear is hauled back by the vessel. This results in significantly less by-catch of the non-targeted animals and a higher catch rate of legal sized crab. Also, fewer pots being used in the crab fisheries results in less impact on the marine habitat. Physical damage to the habitat by pot gear depends on habitat type. Sand and soft sediments where the majority of EBS crab pot fishing occurs are less likely to be impacted, whereas coral, sponge, and gorgonian habitats are more likely to be damaged by commercial crab pots in the AI GKC fishery (Quandt 1999, NMFS 2004). The total portion of the EBS impacted by commercial pot fishing may be less than 1% of the shelf area (NMFS 2004). The report concludes that BSAI crab fisheries have an insignificant effect on benthic habitat. (http://alaskaberingseacrabbers.org/environment.html) For escape of non-target crabs, a minimum size of 9" stretched mesh on one third of one vertical panel is required for pots used in the Bristol Bay Red king crab fishery. http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section825.htm Pots used to take *Chionoecetes opilio* Tanner crab must have at least eight escape rings with an inside diameter measure of no less than four inches placed within one mesh measurement from the bottom of the pot, with four escape rings on each of two sides of a four-sided pot, or if the pot has no escape rings as specified in this paragraph, one-half of one side of a four-sided pot must have a side panel composed of not less than five and one-quarter inch stretched mesh webbing to permit escapement of undersize *C. opilio* Tanner crab. (http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter035/section525.htm). In the Saint Matthew Island Section, each king crab pot must have eight escape rings with an inside diameter measure of 5.8 inches placed within one mesh measurement from the bottom of the pot, with four escape rings on two sides of a four-sided pot, or if the pot has no escape rings as specified in this paragraph, then one-half of one side of a four-sided pot must have a side panel composed of net less than eight-inch stretched mesh webbing. http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section925.htm Other gear restrictions for then 3 fisheries 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. http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf Upon retrieval of crab pots, a wide range of sorting and discard techniques are currently used by the crab fleet but the basic elements of the process are essentially the same on all vessels. After the pot has been retrieved and secured in the launcher, crab are dumped either into totes (plastic boxes) or onto a sorting table. As the male crab of marketable size are separated from the rest of the catch and placed into	

	circulating water tanks, the crab to be discarded are returned to the sea in a variety of methods, ranging from being tossed overboard, dragged in totes and dumped into an outflow chute, or placed directly into an outflow ramp of various designs (a report to the Alaskan governor in 2008 by the Coalition for Safe and Sustainable Crab Fisheries (BSAI Crab Program) described the use of such chutes and its adoption by the entire fleet in an effort to reduce crab mortality. http://www.wafro.com/imageuploads/file175.pdf. Some vessels such as the F/V *Arctic Sea* use a highly automated system where crab are dumped directly onto a conveyor belt table running the width of the vessel. Legal sized crab are sorted from the catch while the remainder of the catch is rapidly returned to the sea with minimal or no handling. The F/V *Arctic Hunter* uses a hydraulically operated sorting table which slides back from the pot launcher to the center of the boat. The discarded catch slides downhill through an aluminium flume to exit at the water level. http://doc.nprb.org/web/09_prjs/917_Final%20report%20June%20_2_.pdf Season length and the pace of the fisheries influences handling mortality. With longer fishing seasons (brought forward by rationalization of the BSAI crab fisheries), the pace of the fisheries slows down allowing fishermen to improve fishing methods, such as gear operation and sorting on deck. Also, with more time, fishermen are able to improve handling methods and reduce the mortality of crabs brought on deck. http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/final/Chapter1.pdf	

Clause: **9.4** **Technologies, materials and operational methods shall be applied to minimize the loss of fishing gear and the ghost fishing effects of lost or abandoned fishing gear.** ***FAO CCRF 8.4.6, 8.4.1***		
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
9.4	**Technologies, materials and operational methods are applied to minimize the loss of fishing gear and the ghost fishing effects of lost or abandoned fishing gear.** After rationalization of the Crab fisheries in the BSAI, vessel numbers have decreased and there has been a slower paced fishery, with decreased rates of lost fishing gear and allowing for longer soak times and more time for the gear to work sorting undersized and females crab from the harvest. Crabbers are constructing pots with larger web on the panels to allow for female and juvenile crab to exit the pot before the gear is hauled back by the vessel. Also, fewer pots being used in the crab fisheries results in less impact on the marine habitat.	

The yearly marine habitat footprint of the directed crab fishery is now less than ½ square mile for the entire Bering Sea and Aleutian Islands (The CPT calculated these numbers numerous times by multiplying the total number of crab pots, by the number of times they were estimated to be deployed in a fishery, and then multiplying by the bottom area of each pot) (http://alaskaberingseacrabbers.org/environment.html)

Alaska Administrative Code. 5 AAC 39.145. Escape mechanism for shellfish and bottom-fish pots (relating to ghost fishing).

Pot gear must include an escape mechanism in accordance with the following provisions:

(1) A sidewall, which may include the tunnel, of all shellfish and bottomfish pots must contain an opening equal to or exceeding 18 inches in length, except that in shrimp pots the opening must be a minimum of six inches in length. The opening must be laced, sewn, or secured together by a single length of untreated, 100 percent cotton twine, no larger than 30 thread.

The cotton twine may be knotted at each end only. The opening must be within six inches of the bottom of the pot and must be parallel with it. The cotton twine may not be tied or looped around the web bars. Dungeness crab pots may have the pot lid tie-down straps secured to the pot at one end by a single loop of untreated, 100 percent cotton twine no larger than 60 thread, as a substitute for the above requirement; the pot lid must be secured so that, when the twine degrades, the lid will no longer be securely closed.

(2) All king crab, Tanner crab, shrimp, miscellaneous shellfish and bottomfish pots may, instead of complying with (1) of this section, satisfy the following: a sidewall, which may include the tunnel, must contain an opening at least 18 inches in length, except that shrimp pots must contain an opening at least six inches in length. The opening must be laced, sewn, or secured together by a single length of treated or untreated twine, no larger than 36 thread.

A galvanic timed release (GTR) device, designed to release in no more than 30 days in salt water, must be integral to the length of twine so that, when the device releases, the twine will no longer secure or obstruct the opening of the pot. The twine may be knotted only at each end and at the attachment points on the galvanic timed release device. The opening must be within six inches of the bottom of the pot and must be parallel with it. The twine may not be tied or looped around the web bars.

(3) in an area open to commercial, personal use, sport, or subsistence fishing with pot gear, including a pot storage area, a registered commercial fishing vessel or a vessel used for personal use, sport, or subsistence fishing may not have on board the vessel or in the water, in fishing or stored condition, any bottomfish or shellfish pot gear that does not have an opening or rigging as specified in (1) or (2) of this section.

History: In effect before 1984; am 6/30/84, Register 90; am 9/19/90, Register 115; am 4/30/91, Register 118; am 6/24/93, Register 126, am 7/15/93, Register 127; am 7/23/94, Register 131; am 5/19/2001, Register 158; am 8/24/2002, Register 163; am

	7/31/2003, Register 167 **Authority:** AS 16.05.251 http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter039/section145.htm Also note evidence in clause 8.4 & 8.4.1

Clause:

9.5 There shall be a requirement that fishing gear, methods and practices where practicable, are sufficiently selective as to minimize waste, discards, and catch of non-target species - both fish and non-fish species and impacts on associated or dependent species.

FAO CCRF 7.6.9, 7.2.2

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
9.5	**There is a requirement that fishing gear, methods and practices where practicable, are sufficiently selective as to minimize waste, discards, and catch of non-target species - both fish and non-fish species and impacts on associated or dependent species.** The selectivity of pot gear in regards to bycatch of juvenile and female crab is regulated by requirement of escape rings, specific mesh panel webbings, sorting tables and chutes on board of vessels (to decrease handling mortality) as discussed in the immediate clauses above. Pot gear used to fish for crab in the BSAI appears to be relatively selective. The majority of bycatch species in each of the 3 fisheries under assessment are mostly crab. The Tables displayed below (from 2011 ADFG Observer Data Report available at http://www.adfg.alaska.gov/FedAidPDFs/FDS11-04.pdf) demonstrates that. See also 8.4 & 8.4.

Table 6. Total contents of 1950 pot lifts (numbers) sampled during the 2009/2010 Bristol Bay red king crab fishery.

Commercial crab species	Total catch	Other species	Total catch
red king crab		yellowfin sole	1,143
legal	43,593	starfish unident.	725
sublegal	49,023	jellyfish unident.	406
female	6,050	Pacific cod	241
Tanner crab		snail unident.	186
legal	2,162	sculpin unident.	158
sublegal	724	tunicate unident.	92
female	70	great sculpin	66
snow crab		Pacific halibut	50
legal	307	starry flounder	40
sublegal	3	hermit crab unident.	23
female	0	hairy triton (or Oregon triton)	20
hybrid *C. bairdi*		sponge unident.	18
legal	0	Pacific lyre crab	17
sublegal	4	sea cucumber unident.	16
female	0	basket star	14
blue king crab		flatfish unident.	6
legal	1	arrowtooth flounder	5
sublegal	0	sea anemone unident.	5
female	1	yellow Irish lord	5
hair crab		crab unident.	4
legal	16	snailfish unident.	4
sublegal	3	giant octopus	3
female	4	Alaska plaice	2
		mussel unident.	2
		rock sole unident.	2
		sand dollar unident.	2
		scallop unident.	2
		walleye pollock	2
		Coral unident.	1
		graceful decorator crab	1
		rockfish unident.	1
		sea urchin unident.	1
		sea whip unident.	1
		shrimp unident.	1
		skate unident.	1

Total 7. Contents of 1646 pot lifts (numbers) sampled during the 2009/2010 Bering Sea snow crab fishery.

Commercial crab species	Total catch	Other species	Total catch
snow crab		snail unident.	7,251
legal	555,668	Pacific cod	545
sublegal	3,184	Neptune snail unident.	140
female	1,288	hairy triton (or Oregon triton)	117
Tanner crab		basket star	79
legal	1,346	sea anemone unident.	73
sublegal	35,296	yellow Irish lord	45
female	1,170	hermit crab unident.	44
hybrid *C. bairdi*		Pacific halibut	37
legal	420	starfish unident.	34
sublegal	1,044	sculpin unident.	24
female	0	Pacific lyre crab	17
hybrid *C. opilio*		walleye pollock	11
legal	180	octopus unident.	9
sublegal	0	yellowfin sole	9
female	3	jellyfish unident.	7
Tanner crab unident.		skate unident.	7
legal	0	giant octopus	6
sublegal	2,857	arrowtooth flounder	3
female	0	brittle star unident.	3
		flathead sole	3
		sea urchin unident.	3
		Pacific ocean perch	2
		prowfish	2
		rockfish unident.	2
		Atka mackerel	1
		bigmouth sculpin	1
		Greenland halibut (or Greenland turbot)	1
		northern rockfish	1
		rock sole unident.	1
		sea cucumber unident.	1
		sea pen or sea whip unident.	1
		sea pen unident.	1
		searcher	1
		sea whip unident.	1

Table 8. Total contents of 989 pot lifts (numbers) sampled during the 2009/2010 St Matthew Island blue king crab fishery.

Commercial crab species	Total catch	Other species	Total catch
blue king crab		Pacific cod	530
legal	10,521	hermit crab unident.	241
sublegal	10,863	brittle star unident.	213
female	1,638	sculpin unident.	197
snow crab		great sculpin	145
legal	1,158	Pacific lyre crab	120
sublegal	311	circumboreal toad crab	101
female	138	Pacific halibut	82
Tanner crab		basket star	49
legal	0	starfish unident.	41
sublegal	6	yellowfin sole	28
female	1	snail unident.	24
hybrid *C. bairdi*		jellyfish unident.	11
legal	0	Greenland halibut (or Greenland turbot)	8
sublegal	2	skate unident.	5
female	1	octopus unident.	3
hybrid *C. opilio*		sponge unident.	3
legal	1	walleye pollock	3
sublegal	1	arrowtooth flounder	2
female	0	flatfish unident.	2
red king crab		sand dollar unident.	2
legal	1	yellow Irish lord	2
sublegal	1	Alaska plaice	1
female	0	bigmouth sculpin	1
		flathead sole	1
		giant octopus	1
		graceful decorator crab	1

Clause:
9.6 The intent of fishing selectivity and fishing impacts related regulations shall not be circumvented by technical devices and information on new developments and requirements shall be made available to all fishers. ***FAO CCRF 8.5.1***
Evidence adequacy rating: ☑**High** ☐ **Medium** ☐ **Low**

Clause:	Evidence
9.6	**The intent of fishing selectivity and fishing impacts related regulations is circumvented by technical devices and information on new developments and requirements is made available to all fishers.** No evidence is available to indicate that technical devices are negatively affecting or circumventing regulations aimed at defining requirements for fishing selectivity or to reduce fishing impacts. Because the fishery was rationalized in 2005, most enforcement of IFQ/IPQ violations, as well as size, sex and season violations occur at offloading. While this is true, there is still significant at-sea enforcement by the State Fish & Wildlife Troopers where they pull pots and check gear on the grounds with the E/V Stinson. ADFG perform pot and vessel holding tank inspections prior to each fishing season; sometimes the Alaska Wildlife Troopers will assist in this inspection process. Generally speaking, AWT personnel ensures state regulations, permits, gear and catch are in line with regulations. Also, the on-board crab observer program collects information which is presented to the AWT who can use it in the enforcement process. Information on new requirements is available at the ADFG, NPFMC and NMFS websites. For example, regulations pertaining to management of the King and Tanner crab fisheries in Alaska are available under Fish and Game, Chapter 34 and 35 of the Alaska Administrative Code. http://www.touchngo.com/lglcntr/akstats/aac/title05.htm http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034.htm http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter035.htm

Clause:		
9.7	**International cooperation shall be encouraged with respect to research programs for fishing gear selectivity and fishing methods and strategies, dissemination of the results of such research programs and the transfer of technology.** ***FAO CCRF 8.5.4***	
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
9.7	**International cooperation is encouraged with respect to research programs for fishing gear selectivity and fishing methods and strategies, dissemination of the results of such research programs and the transfer of technology.** The Alaska Sea Grant College Program has been sponsoring and coordinating the Lowell Wakefield Fisheries Symposium series since 1982, in partnership with the Alaska Department of Fish and Game, NOAA National Marine Fisheries Service, and the North Pacific Fishery Management Council. These meetings are a forum for information exchange in biology, management, economics, and processing of various fish species and complexes, as well as an opportunity for scientists from high-latitude countries to meet informally and discuss their work. The series is Internationally recognized for excellence and scope, and more than 1,000 scientists from 30 nations have come to Alaska to focus their expertise on key resource management problems. Symposia relative to crab have been sponsored several times and most recently in 2009. The marked decline of king and Tanner crabs in the Bering Sea during the early 1980s was the impetus for the International Symposium on King and Tanner Crabs. Scientists and fishery managers from Argentina, Japan, Canada, and the United States met in Anchorage, Alaska, in 1989. Fifty-three papers were included in the proceedings, including contributions from Soviet scientists. Topics include reproduction, feeding and growth, population structure and dynamics, mortality, and stock assessment and management. Subsequently, in 1995, there was a symposia built on knowledge brought together during four previous north latitude crab symposia, with recommendations for future crab research. Forty-eight papers were presented at the 1995 symposium in Anchorage, Alaska. Research was included from Argentina, Australia, Canada, Japan, Norway, Russia, and the United States. Long-term goals of the symposium were to better conserve the resource, strengthen the industry, and provide accessible healthful protein to the consumer. Furthermore, the proceedings of the symposium "Crabs in Cold Water Regions," held in January 2001 in Anchorage, Alaska, presented 53 papers on recent research advances. The book brought researchers and managers up to date on biology, distribution, life history, ecology, and recruitment of cold water crabs. Length-based modeling techniques were used to provide better insights into crab population	

	dynamics. Survey and fishery data spanned 20–30 years, thus advancing understanding of decade-long fluctuations of longer-lived species, and helping to uncover relationships with the ecosystem. More recently, the proceedings book based on the 25th Lowell Wakefield Fisheries Symposium in March 2009 held in Alaska had 27 peer-reviewed papers by international crab fishery researchers, on the mechanisms of human-caused and natural fluctuations of crab stocks and fisheries around the world. The papers contributed significantly to the body of knowledge on crab population dynamics, resiliency to fishing, climate effects, and the role of habitat for Alaska king crab, Dungeness crab, blue crab, and other crab stocks and fisheries (information is also exchanged during the Interagency Crab Research Meetings). http://seagrant.uaf.edu/conferences/wakefield/proceedings.html	

Clause:

9.8 States and relevant institutions involved in the fishery shall collaborate in developing standard methodologies for research into fishing gear selectivity, fishing methods and strategies, and on the behaviour of target and non target species in relation to such fishing gear as an aid for management decisions and with a view to minimizing non-utilized catches.

FAO CCRF 8.5.3, 12.10

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
9.8	**There is collaboration in developing standard methodologies for research into fishing gear selectivity, fishing methods and strategies, and on the behaviour of target and non target species in relation to such fishing gear as an aid for management decisions and with a view to minimizing non-utilized catches.** A variety of research has been carried out to study fishing gear selectivity, fishing methods and strategies as well as on the behaviour of target and non target species to such gear. Most of the authors in the articles illustrated below have been or are involved with Alaskan fisheries management organizations. Here below are some of the articles of research been made on the subject. Other articles result from national/International collaborative aspect of research. Bradley Gene Stevens, Jan A. Haaga, William E. Donaldson, AFSC. 1993 Underwater observations on behavior of king crabs escaping from crab pots. Alaska Fisheries Science Center, National Marine Fisheries Service, U.S. Dept. of Commerce, 14 p.	

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Gordon H. Kruse, David Hicks, and Margaret C. Murphy - Vol. 1(1). 1994

Results of a Questionnaire on Research and Management Priorities for Commercial Crab Species in Alaska
Margaret C. Murphy, William E. Donaldson, and Jie Zheng - Vol. 1(1) 1994

Tanner Crab Survival in Closed Pots
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Compensatory Feeding Capacity of 2 Brachyuran Crabs, Tanner and Dungeness, After Starvation Periods Like Those Encountered in Pots
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An Annotated Bibliography of Capture and Handling Effects on Crabs and Lobsters
Margaret C. Murphy and Gordon H. Kruse - Vol. 2(1). 1995
Experimental Effects of Soak Time on Catch of Legal-Sized and Nonlegal Red King Crabs by Commercial King Crab Pots
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Capture Efficiency and Size Selectivity of Two Types of Pots for Red King Crabs in the Bering Sea. Shijie Zhou and Gordon H. Kruse - Vol. 6(2). 2000

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Warrenchuk, J. J. and T. C. Shirley. 2002. Effects of windchill on the snow crab (*Chionoecetes opilio*). Pages 81-96 *in* A.J. Paul et al. editors. Crabs in cold water regions: biology, management, and economics. University of Alaska, Sea Grant College Program. Fairbanks.

van Tamelen, P. 2005. Estimating handling mortality due to air exposure: Development and application of thermal models for the Bering Sea snow crab fishery. Trans. Am. Fish. Soc. 134:411-429.

Stoner, A. W. 2009. Prediction of discard mortality for Alaskan crabs after exposure to freezing temperatures, based on a reflex impairment index. Fish. Bull. 107:451-463.

Elizabeth Chilton, Dan Urban, Earl Krygier, Allan Stoner. 2011. Reduction of bycatch mortality for non-target crab species in the commercial snow crab (*Chionoecetes opilio*) fishery. NPRB Project 917 Final Report.

Rose, C. S., Hammond, C., Stoner, A., Munk, E., and Gauvin, J. *in press*. Quantification of unobserved mortality rates of snow, Tanner and red king crabs *(Chionoecetes opilio*, *C. bairdi and Paralithodes camtschaticus*) after encounters with trawls on the seafloor. Fish. Bull.

Clause:

9.9 Policies shall be developed for increasing stock populations and enhancing fishing opportunities through the use of artificial structures, placed with due regard to the safety of navigation.

FAO CCRF 8.11.1

9.9.1 States shall ensure that, when selecting the materials to be used in the creation of artificial reefs as well as when selecting the geographical location of such artificial reefs, the provisions of relevant international conventions concerning the environment and safety of navigation are observed.

FAO CCRF 8.11.2

9.9.2 States shall, within the framework of coastal area management plan, establish management systems for artificial reefs and fish aggregation devices. Such management systems shall require approval for the construction and deployment of such reefs and devices and shall take into account the interests of fishers, including artisanal and subsistence fishers.

FAO CCRF 8.11.3

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause:	Evidence	
9.9	**Not Applicable**	
Evidence adequacy rating: ☐ High ☐ Medium ☐ Low		
Clause:	**Evidence**	
9.9.1	**Not Applicable**	
Evidence adequacy rating: ☑ High ☐ Medium ☐ Low		
Clause:	**Evidence**	
9.9.2	**Within the framework of coastal area management plan, there is an established management systems for artificial reefs and fish aggregation devices. Such management systems require approval for the construction and deployment of such reefs and devices and takes into account the interests of fishers, including artisanal and subsistence fishers.** Construction and deployment of reefs and enhancement devices requires previous consultation and evaluation, and approval by one or more of the following agencies: NOAA's National Marine Fisheries Center - Fisheries Restoration Center Alaska Department of Fish and Game – Restoration and Enhancement Alaska Department of Environmental Conservation - Alaska Clean Water Actions US Environmental Protection Agency – River Corridor and Wetland Restoration Coastal America – Regional Conservation Projects US Fish and Wildlife Service – Partners for Fish and Wildlife Program and Alaska Coastal Program Any project with potential for considerable impact on the natural environment will also be required to go through an environmental and socio-economic NEPA analysis. This is well explained under fundamental clause 2 of this report. Also, ADFG, NPFMC and NMFS manage fisheries in Alaska and within their public process they offer fisherman the opportunity to get involved and participate in the various decision making processes relevant to fisheries management.	

10. Fishing operations shall be carried out by fishers with appropriate standards of competence in accordance with international standards and guidelines and regulations. *FAO CCRF 8.1.7/8.1.10/8.2.4/8.4.5*						
Confidence Ratings	**Low**	**0 out of 3**	**Medium**	**0 out of 3**	**High**	**3 out of 3**

Clause: **10.1 States shall enhance through education and training programs the education and skills of fishers and, where appropriate, their professional qualifications. Such programs shall take into account agreed international standards and guidelines.** ***FAO CCRF 8.1.7, 8.4.1***	
Evidence adequacy rating: ☑**High** ☐ **Medium** ☐ **Low**	
Clause:	**Evidence**
10.1	**Alaska enhances through education and training programs the education and skills of fishers and, where appropriate, their professional qualifications. Such program takes into account agreed international standards and guidelines.** The North Pacific Fishing Vessel Owners association (NPFVO) provides a large and diverse training program that many of the professional crab crew members must pass. Training ranges from firefighting on a vessel, damage control, man-overboard, MARPOL, etc. The Sitka-based Alaska Marine Safety Education Association alone has trained more than 10,000 fishermen in marine safety and survival through a Coast Guard-required class on emergency drills http://www.npfvoa.org/ ; http://www.adn.com/2011/04/27/1832381/workplace-fatalities-fall-sharply.html#ixzz1Xt1ESQqh. The State of Alaska, Department of Labor & Workforce Development (ADLWD) includes AVTEC (formerly called Alaska Vocational Training & Education Center, now called Alaska's Institute of Technology). One of AVTEC's main divisions is the Alaska Maritime Training Center. The goal of the Alaska Maritime Training Center is to promote safe marine operations by effectively preparing captains and crew members for employment in the Alaskan maritime industry. The Alaska Maritime Training Center is a United States Coast Guard (USCG) approved training facility located in Seward, Alaska, and offers USCG/STCW-compliant maritime training. (STCW is the international Standards of Training,

Certification, & Watchkeeping.) In addition to the standard courses offered, customized training is available to meet the specific needs of maritime companies. Courses are delivered through the use of their world-class ship simulator, state-of-the-art computer-based navigational laboratory, and modern classrooms equipped with the latest instructional delivery technologies.

The Center's mission is to provide Alaskans with the skills and technical knowledge to enable them to be productive in Alaska's continually evolving maritime industry.

Supplemental to their on-campus classroom training, the Alaska Maritime Training Center has a partnership with the Maritime Learning System to provide mariners with online training for entry-level USCG Licenses, endorsements, and renewals.

The Center's course offerings include –

Video Tutorials –

* How to get your Merchant Mariner's Credential; * Which Course Do You Need?

U.S. Coast Guard Approved/STCW-Compliant Courses –

* Able Seaman; * Assistance Towing Operations; * Automatic Radar Plotting Aids (ARPA) Operations;

* Basic Safety Training - STCW'95; includes:

** First Aid & CPR; ** Personal Safety and Social Responsibility; ** Basic Fire Fighting; ** Personal Survival Techniques; Bridge Resource Management (BRM); Global Maritime Distress & Safety System (GMDSS);

* Master Not More Than 200 Tons Program; * Meteorology; * Operator of Uninspected Passenger Vessels (OUPV); * Proficiency in Survival Craft; * Qualified Member of Engine Department (QMED) Oiler; * Radar Observer (Unlimited), Original; * Radar Observer (Unlimited), Refresher; * Radar Observer (Unlimited), Recertification; * Rating Forming Part of a Navigational Watch; * Seafood Processor Orientation and Safety Course; * Shipboard Emergency Medicine.

* Tankship – Dangerous Liquids (P.I.C.); * Visual Communications/Flashing Lights; * Medical Care Provider

Additional AVTEC Maritime Courses

* FCC Marine Radio Operators Permit Examination

	The University of Alaska Sea Grant Marine Advisory Program (MAP) provides education and training in several other sectors, including – * better process control; * HACCP (Hazard Analysis / Critical Control Point); * sanitation control procedures; * marine refrigeration technology; * net mending; * icing & handling; * direct marketing; * financial management for fishermen; * maximizing fuel efficiency In addition, MAP conducts sessions of their Alaska Young Fishermen's Summit (AYFS). Each Summit is an intense, 3-day course in all aspects of Alaska fisheries, from fisheries management & regulation, to seafood markets & marketing. The target audience for these Summits is young Alaskans from coastal communities. The 2012 AYFS was held Feb. 13 and 14 in Juneau, AK. The two-day conference aimed at providing crucial training and networking opportunities for fishermen entering the business or wishing to take a leadership role in their industry. The event took advantage of the Juneau location by introducing participants to the legislative process, and introducing the fish caucus of the legislature to the issues and concerns of Alaska's emerging fishermen. Furthermore, MAP provides training and technical assistance to fishermen and seafood processors in Western Alaska. Following completion of a needs assessment in year one of the project, a number of training courses and workshops were developed in cooperation with local communities and CDQ groups. Additional education is provided by the Fishery Industrial Technology Center, in Kodiak, Alaska. ***sources of evidence –*** http://www.avtec.edu/AMTC.htm http://www.stcw.org/ http://seagrant.uaf.edu/map/ http://seagrant.uaf.edu/map/fishbiz/index.php http://www.sfos.uaf.edu/fitc/academicprograms/ http://www.npfvoa.org/ http://www.adn.com/2011/04/27/1832381/workplace-fatalities-fall-sharply.html#ixzz1Xt1ESQqh http://www.sfos.uaf.edu/pcc/projects/07/brown/ http://amsea.org/	

<table>
<tr><td colspan="3">Clause:

10.2 States, with the assistance of relevant international organizations, shall endeavour to ensure through education and training that all those engaged in fishing operations be given information on the most important provisions of this Code, as well as provisions of relevant international conventions and applicable environmental and other standards that are essential to ensure responsible fishing operations.

FAO CCRF 8.1.10</td></tr>
<tr><td colspan="3">Evidence adequacy rating:

☑High ☐ Medium ☐ Low</td></tr>
<tr><td>Clause:</td><td>Evidence</td><td></td></tr>
<tr><td>10.2</td><td>Alaska endeavours to ensure through education and training that all those engaged in fishing operations be given information on the most important provisions of the FAO Code of Conduct for Responsible Fisheries, as well as provisions of relevant international conventions and applicable environmental and other standards that are essential to ensure responsible fishing operations.

The University of Alaska Sea Grant Marine Advisory Program (MAP) provides education and training in several sectors, including fisheries management, in the forms of seminars and workshops. In addition, MAP conducts sessions of their Alaska Young Fishermen's Summit. Each Summit is an intense, 3-day course in all aspects of Alaska fisheries, from fisheries management & regulation (eg- MSA), to seafood markets & marketing. The target audience for these Summits is young Alaskans from coastal communities. While there is not much education and training which explicitly deals with the Code, the Alaska fishery management process itself is an excellent de facto educational process. Alaska's fisheries are extremely compliant with the Code, as demonstrated by the Alaska Seafood Marketing Institute's checklist. Therefore, anyone who seeks to understand Alaska's fisheries management process unavoidably winds up becoming very familiar with the Code.

http://seagrant.uaf.edu/map/
http://sustainability.alaskaseafood.org/fao</td><td></td></tr>
</table>

Clause:		
10.3	**States shall, as appropriate, maintain records of fishers which shall, whenever possible, contain information on their service and qualifications, including certificates of competency, in accordance with their national laws.** ***FAO CCRF 8.1.8***	
Evidence adequacy rating:		
☑**High**	☐ **Medium**	☐ **Low**

Clause:	Evidence	
10.3	**Alaska maintains records of fishers, and whenever possible, contain information on their service and qualifications, including certificates of competency, in accordance with national laws.** The Restricted Access Management Program (RAM) is responsible for managing Alaska Region permit programs, including those that limit access to the Federally-managed fisheries of the North Pacific. RAM responsibilities include: providing program information to the public, determining eligibility and issuing permits, processing transfers, collecting landing fees and related activities. The Restricted Access Management (RAM) Program has prepared lists of License Limitation Program (LLP) groundfish and crab licenses. LLP licenses are initially issued to persons, based on the activities of original qualifying vessels (see notes below): LLP Licenses Issued (as of year-end except for the current year), in ".csv" text format: Full list of crab LLP licenses are available online for 2012, 2011, 2010, 2009, 2008, 2007, 2006, 2005, 2004, 2003 and 2002. http://www.fakr.noaa.gov/ram/llp.htm#list The Alaska Commercial Fisheries Entry Commission (CFEC) helps to conserve and maintain the economic health of Alaska's commercial fisheries by limiting the number of participating fishers. CFEC issues permits and vessel licenses to qualified individuals in both limited and unlimited fisheries, and provides due process hearings and appeals as and when needed. The RAM division as well as the CFEC maintain on their websites, all the fishermen records for which fishing permits are issued (http://www.fakr.noaa.gov/ram/ , http://www.cfec.state.ak.us/). Fisherman need to have bots CFEC gear card and the RAM permit for IFQ.	

E. Implementation, Monitoring and Control

11.	**An effective legal and administrative framework shall be established and compliance ensured through effective mechanisms for monitoring, surveillance, control and enforcement for all fishing activities within the jurisdiction.** ***FAO CCRF 7.1.7/7.7.3/7.6.2/8.1.1/8.1.4/8.2.1*** ***FAO Eco 29.5***

Confidence Ratings	Low	0 out of 2	Medium	0 out of 2	High	2 out of 2

11.1.	**Effective mechanisms shall be established for fisheries monitoring, surveillance, control and enforcement measures including, where appropriate, observer programs, inspection schemes and vessel monitoring systems, to ensure compliance with the conservation and management measures for the fishery in question.** ***FAO CCRF 7.1.7 Others 7.7.3, 8.1.1*** ***Eco 29.5***

Evidence adequacy rating:

☑**High** ☐ **Medium** ☐ **Low**

Clause:	Evidence
11.1	**Effective mechanisms are established for fisheries monitoring, surveillance, control and enforcement measures including, where appropriate, observer programs, inspection schemes and vessel monitoring systems, to ensure compliance with the conservation and management measures for the fishery in question.** The NMFS Office of Law Enforcement with use of the United States Coast Guard's at-sea platforms is primarily responsible for enforcing crab regulations at sea, while the NMFS Office of Law Enforcement and the State of Alaska's Division of Wildlife Troopers (AWT) have that responsibility ashore. AWT spends about 90% of their effort doing dockside enforcement of offloaded crab (although The AWT vessel E/V Stinson also does at-sea enforcement, checking gear and catch for legal specification). In fiscal year 2010 there have been 27 vessel boarding and 3 full vessel audits in Dutch Harbour, 5 full vessel audits and 2 vessel boardings in Kodiak, 2 crab processor inspections in Kodiak and 4 in Dutch Harbour. Because the fishery was rationalized in 2005, most enforcement of IFQ/IPQ violations, as well as size, sex and season violations occur at the dock at time of offloading. AWT also perform pot and vessel holding tank inspections prior to each fishing season. Generally speaking, AWT personnel check state regulations, permits, gear and catch.

The inter-relationship between USCG, AWT and NMFS has been described as outstanding (pers. Communications, Lt. Will Ellis, Kodiak, AWT “C” Detachment Supervisor, January 18, 2011). Crab bycatch in groundfish fisheries is monitored under the Groundfish Observer Program.

Crab Observer Program

Since 1988 ADFG has required varying levels of observer coverage aboard vessels participating in the BAI crab fisheries. The ADFG Observer report for 2009/2010 summarizes commercial crab fisheries by crab observers deployed on floating-processor vessels, catcher-processor vessels, and catcher vessels and provides historical data for comparison. Primary data summaries include estimates of CPUE and information about size and shell condition of both captured and retained crabs. Further information include catch rates by soak time & depth, female reproductive condition, sampled pot lift locations, species composition of sampled pot lifts, total legal tally results.

Dockside inspections

Crab information is mainly collected through a dockside sampling program. Dockside samplers (port samplers), ADFG staff, provide an independent data source for assessing the accuracy of the CPUE estimates for retained legal crab. They will also call AWT if an inspection has spotted a violation. ADFG technicians and Wildlife Troopers also perform pot and vessel holding tank inspections prior to each fishing season.

Vessel Monitoring System

Any vessel used to harvest crab in the rationalized crab fisheries must have a functioning VMS transmitter on board. The VMS must be transmitting when the following three conditions are met:
1) the vessel is operating in any reporting area off Alaska; and,
2) the vessel has crab pots or crab pots hauling equipment, or a crab pot launcher onboard; and,
3) the vessel has (or is required to have) a Federal Crab Vessel Permit (FCVP).

Logbooks are also mandatory. These include:
1) The Daily Fishing Log (DFL), which must be maintained by the operator of a catcher vessel using pot gear to harvest CR crab from the BSAI; and,
2) The Daily Cumulative Production Log (DCPL), which must be maintained by the operator of a CV vessel using pot gear to harvest CR crab from the BSAI.

NMFS’OLE is able to detect through the VMS signal whether a boat is fishing or transiting in an area and through those data they base much of their enforcement decisions to act against a potential offences.

Fishery Management Measure Enforceability Matrix

	Surveillance – Aircraft/Ship/VMS	At-Sea Boarding	Dockside
Limiting Amount/ Percent Landed	No	No	Yes
Limiting Amount/ Percent Onboard	No	Limited	Yes
Prohibiting Retention	No	Yes	Yes
Requiring Retention	Limited	Yes	No
Size Restrictions	No	Yes	Yes
Closed Areas	Yes	Yes	No
Closed Seasons	Limited	Yes	Yes
Gear/Vessel Restrictions	Limited	Yes	Limited
Limited Access Privilege Programs	No	Limited	Yes
Recordkeeping/ Reporting	No	Limited	Yes
Permits	Limited	Yes	Yes

http://www.nmfs.noaa.gov/sfa/reg_svcs/Council%20stuff/CCC_May2010/Tab%2017/Law%20Enforcement%20Presentation.pdf

Clause:

11.2 Fishing vessels shall not be allowed to operate on the resource in question without specific authorization.

FAO CCRF 7.6.2 Other 8.1.2, 8.2.1

Evidence adequacy rating:

☑**High** ☐ **Medium** ☐ **Low**

Clause:	Evidence
11.2	**Fishing vessels are not allowed to operate on the resource in question without specific authorization.** Fishing vessels are not allowed to operate on the resource in question without specific authorization. All crab vessels participating in the BSAI rationalized crab fishery must obtain a Federal Crab Vessel Permit (FCVP). A copy of the permit must be on board any vessel of the fishery and must be available for inspection at any time by an authorized officer. As of January 1, 2000 a Federal LLP license is required for vessels participating in directed fishing for LLP groundfish species in the GOA or BSAI, or fishing in any BSAI LLP crab fisheries. A vessel must be named on an original LLP license that is onboard the vessel. Exceptions are explained below. The LLP is authorized in Federal regulations at 50 CFR 679.4(k), definitions relevant to the

	program are at 679.2, and prohibitions are at 679.7. The LLP license requirement is in addition to all other permits or licenses required by federal regulations. The LLP is a Federal program and LLP licenses are not required for participation in fisheries that occur in the waters of the State of Alaska. There are four exceptions to the LLP license requirement: 1) vessels that do not exceed 26 feet in Length Overall (LOA) in the GOA; 2) vessels that do not exceed 32 feet LOA in the BSAI; 3) vessels that do not exceed 60 feet LOA and that are using jig gear (but no more than 5 jig machines, one line per machine, and 15 hooks per line) are exempt from the LLP requirements in the BSAI; and, 4) certain vessels constructed for, and used exclusively in, Community Development Quota fisheries. All such vessels will possess a State of Alaska CFEC permit if they make a commercial landing. http://www.fakr.noaa.gov/ram/letters/fcvp_permit_yr10-11.pdf http://www.fakr.noaa.gov/ram/llp.htm#list	

Clause:

11.3 States involved in the fishery shall, in accordance with international law, within the framework of sub-regional or regional fisheries management organizations or arrangements, cooperate to establish systems for monitoring, control, surveillance and enforcement of applicable measures with respect to fishing operations and related activities in waters outside their national jurisdiction.

FAO CCRF 8.1.4

11.3.1 States which are members of or participants in sub-regional or regional fisheries management organizations or arrangements shall implement internationally agreed measures adopted in the framework of such organizations or arrangements and consistent with international law to deter the activities of vessels flying the flag of non-members or non-participants which engage in activities which undermine the effectiveness of conservation and management measures established by such organizations or arrangements.

FAO CCRF 7.7.5, 8.3.1

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
11.3	**Not Applicable.** The crab fisheries under assessment here are harvested exclusively within the Alaska EEZ only. Those fisheries are not part of any international agreement or part of a framework of sub-regional or regional fisheries management organizations or arrangements.	

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
11.3.1	**Not Applicable**. The crab fisheries under assessment here are harvested exclusively within the Alaska EEZ only. Those fisheries are not part of any international agreement or part of a framework of sub-regional or regional fisheries management organizations or arrangements.	

Clause:

11..4 Flag States shall ensure that no fishing vessels entitled to fly their flag fish on the high seas or in waters under the jurisdiction of other States unless such vessels have been issued with a Certificate of Registry and have been authorized to fish by the competent authorities. Such vessels shall carry on board the Certificate of Registry and their authorization to fish.

FAO CCRF 8.2.2

11.4.1 Fishing vessels authorized to fish on the high seas or in waters under the jurisdiction of a State other than the flag State, shall be marked in accordance with uniform and internationally recognizable vessel marking systems such as the FAO Standard Specifications and Guidelines for Marking and Identification of Fishing Vessels.

FAO CCRF 8.2.3

Evidence adequacy rating:

☐**High** ☐ **Medium** ☐ **Low**

Clause:	Evidence	
11.4	**Not Applicable.** The entire crab harvests are conducted in Alaskan waters by American vessels. No foreign fleet is allowed to fish in the Alaska's EEZ. All fishing vessels must be at least 75% U.S. ownership.	
Evidence adequacy rating:		
☐**High**	☐ **Medium**	☐ **Low**
Clause:	**Evidence**	
11.4.1	**Not Applicable.** The entire crab harvests are conducted in Alaskan waters by American vessels. No foreign fleet is allowed to fish in the Alaska's EEZ. All fishing vessels must be at least 75% U.S. ownership.	

12.	There shall be a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations. *FAO CCRF 7.7.2/8.2.7*				
Confidence Ratings	**Low**	**0 out of 2**	**Medium**	**0 out of 2**	**High**	**2 out of 2**

Clause:

12.1 National laws of adequate severity shall be in place that provide for effective sanctions.

12.1.1 Sanctions shall be in force that affects authorization to fish and/or to serve as masters or officers of a fishing vessel, in the event of non-compliance with conservation and management measures.

FAO CCRF 7.7.2/8.1.9/8.2.7

Evidence adequacy rating:

☑High **☐ Medium** **☐ Low**

Clause:	Evidence
12.1	**National laws of adequate severity are in place to provide for effective sanctions.** In Alaska waters, enforcement policy section 50CFR600.740 states – (a) The MSA provides four basic enforcement remedies for violations, in ascending order of severity, as follows: (1) Issuance of a citation (a type of warning), usually at the scene of the offense (see 15 CFR part 904, subpart E). (2) Assessment by the Administrator of a civil money penalty. (3) For certain violations, judicial forfeiture action against the vessel and its catch. (4) Criminal prosecution of the owner or operator for some offenses. It shall be the policy of NMFS to enforce vigorously and equitably the provisions of the MSA by utilizing that form or combination of authorized remedies best suited in a particular case to this end. (b) Processing a case under one remedial form usually means that other remedies are inappropriate in that case. However, further investigation or later review may indicate the case to be either more or less serious than initially considered, or may otherwise reveal that the penalty first pursued is inadequate to serve the purposes of the MSA. Under such circumstances, the Agency may pursue other remedies either in lieu of or in addition to the action originally taken. Forfeiture of the illegal catch does not fall within this general rule and is considered in most cases as only the initial step in remedying a violation by removing the ill-gotten gains of the offense.

(c) If a fishing vessel for which a permit has been issued under the MSA is used in the commission of an offense prohibited by section 307 of the MSA, NOAA may impose permit sanctions, whether or not civil or criminal action has been undertaken against the vessel or its owner or operator. In some cases, the MSA requires permit sanctions following the assessment of a civil penalty or the imposition of a criminal fine. In sum, the MSA treats sanctions against the fishing vessel permit to be the carrying out of a purpose separate from that accomplished by civil and criminal penalties against the vessel or its owner or operator. The State of Alaska also has a very aggressive marine fisheries compliance program with stiff penalties if a vessel is caught in non-compliance. For the crab fisheries here in question only the male Alaskan king crab meeting minimum size requirements can be kept and quota limits are strictly enforced. Any violator of these laws will receive hefty fines in the hundreds of thousands dollars. After rationalization of the crab fisheries, capacity reduced and fewer vessels have now the opportunity to fish longer. These crab fisheries are very profitable and the vast majority of fishermen fish by the book with an eye to keep the fishery viable and sustainable for years to come. Downstream (processors) checks to catch type and weight are routine and extensive. Observers collect data an all target and non target catches.

Magnuson-Stevens Act Schedule

Magnuson-Stevens Act Schedule	
VIOLATION	**OFFENSE LEVEL**
VIOLATIONS REGARDING GEAR	
Minor-Moderate Violations Examples: Violating area specific gear requirements, having non-complying gear onboard, or fishing with non-compliant gear; falsifying or failing to affix vessel markings; failing to comply with gear tag or marking requirements; dumping gear.	II - III
Moderate Violations Example: Fishing for Western Pacific bottomfish management unit species (MUS) using prohibited gear.	IV
VIOLATIONS REGARDING THE FACILITATION OF ENFORCEMENT, SCIENTIFIC MONITORS OR OBSERVERS	
Minor - Moderate Violations Examples: Failing to provide information, notification, accommodations, access, or reasonable assistance to either a NFMS-approved observer or a sea sampler conducting his or her duties aboard a vessel; submitting false or inaccurate data, statements, or reports; discarding, release, or transferring fish before bringing it aboard or making it available to an observer for sampling.	II-III

Magnuson-Stevens Penalty Matrix

	Level of Intent			
Harm to the Resource or Regulatory Program, Offense Level	A Unintentional	B Negligent	C Reckless	D Willful
I	Written warning-$1,000	Written warning-$1,500	Written warning-$2,000	Written warning-$2,500
II	Written warning-$2,000	$2,000-$5,000	$5,000-$10,000	$10,000-$15,000
III	$2,000-$5,000	$5,000-$10,000	$10,000-$15,000	$15,000-$25,000
IV	$5,000-$15,000	$15,000-$25,000	$25,000-$50,000 and permit sanction of 10-20 days*	$50,000-$80,000 and permit sanction of 20-60 days*
V	$15,000-$25,000	$25,000-$50,000 and permit sanction of 10-20 days*	$50,000- $80,000 and permit sanction of 20-60 days*	$60,000- $100,000 and permit sanction of 60-180 days*
VI	$25,000-$50,000	$50,000-$80,000 and permit sanction of 20-60 days*	$60,000-$100,000 and permit sanction of 60-180 days*	$100,000-statutory maximum and permit sanction of 1 year-permit revocation*

http://www.nmfs.noaa.gov/sfa/reg_svcs/Councils/ccc_2011/Tab%20L%20-%20Enforcement%20Issues/Enforcement%20Issues.pdf

The Marine Division of AWT and the State of Alaska Department of Law pursue a very aggressive enforcement policy. They attend the BOF and are integral into the process for formulation or legislation, analogous to the USCG attendance and input in the Council process. AWT has Statutory / Regulatory legislation pertaining to their Authority: AS 16 Fish & Game, 5AAC Fish & Game, 20 AAC Commercial Fishing, AS 11 Criminal, AS 46 Environment, AS 44 State Government, AS 02 Aeronautics, AS 18 Health & Safety. A State violation is a criminal violation (strict liability).

50CFR600.740 Enforcement policy http://www.law.cornell.edu/cfr/text/50/600/740

AWT: http://housemajority.org/coms/hres/27/AWT_Fisheries_Enforcement.pdf

http://www.alaskaseafood.org/sustainability/pdf/Sustainability%20White%20Paper.pdf

Evidence adequacy rating:

☑**High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
12.1.1	**Sanctions are in force that affects authorization to fish and/or to serve as masters or officers of a fishing vessel, in the event of non-compliance with conservation and management measures.**

Please see evidence in section 12.1 above and details provided in the "Policy for the Assessment of Civil Administrative Penalties and Permit Sanctions" issued by NOAA Office of the General Counsel – Enforcement and Litigation - March 16, 2011. This Policy provides guidance for the assessment of civil administrative penalties and permit sanctions under the statutes and regulations enforced by NOAA. The purpose of this Policy is to ensure that: (1) civil administrative penalties and permit sanctions are assessed in accordance with the laws that NOAA enforces in a fair and consistent manner; (2) penalties and permit sanctions are appropriate for the gravity of the violation; (3) penalties and permit sanctions are sufficient to deter both individual violators and the regulated community as a whole from committing violations; (4) economic incentives for noncompliance are eliminated; and (5) compliance is expeditiously achieved and maintained to protect natural resources. Under this Policy, NOAA expects to improve consistency at a national level, provide greater predictability for the regulated community and the public, improve transparency in enforcement, and more effectively protect natural resources.
For significant violations, the NOAA attorney may recommend charges under NOAA's civil administrative process (*see* 15 C.F.R. Part 904), through issuance of a Notice of Violation and Assessment of a penalty (NOVA), Notice of Permit Sanction (NOPS), Notice of Intent to Deny Permit (NIDP), or some combination thereof. Alternatively, the NOAA attorney may recommend that there is a violation of a criminal provision that is sufficiently significant to warrant referral to a U.S. Attorney's office for criminal prosecution.
http://www.noaanews.noaa.gov/stories2011/pdfs/Penalty%20Policy%20--%20FINAL.pdf

AWT

In January 1989, ADFG gene conservation lab analyzed 89 red king crab samples of unknown origin. These samples were from a boatload of crabs allegedly caught near Adak Island in the Aleutian Islands. Enforcement personnel and biologists from ADFG believed that the crabs were actually caught in Bristol Bay during an area closure. Lab data clearly showed that the crabs could not have come from Adak Island and that they probably originated from the Norton Sound/Bristol Bay stock. Based on these findings the vessel owner and the skipper agreed to pay the state $565,000 in penalties for fishing violations.

Here is an example of AWT action relative to a misdemeanor in a crab fishery:

On 7/2/11 at 1045 hours, Troopers in Juneau arrested James R. Seymour, age 35, of Petersburg for failing to appear for a 6/30 court appearance on a original charge of illegal storage of commercial crab gear. Seymour was remanded to the Lemon Creek Correctional Center with a $4000 bail.

http://www.alaskawaypoints.com/trooper-report?page=1

Clause:

12.2 Flag States shall take enforcement measures in respect of fishing vessels entitled to fly their flag which have been found by them to have contravened applicable conservation and management measures, including, where appropriate, making the contravention of such measures an offence under national legislation.

12.2.1 Sanctions applicable in respect of violations and illegal activities shall be adequate in severity to be effective in securing compliance and discouraging violations wherever they occur.

FAO CCRF 8.2.7

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
12.2	**Not applicable.** The entire crab harvests are conducted in Alaskan waters by American vessels. No foreign fleet is allowed to fish in the Alaska's EEZ. All fishing vessels must be at least 75% U.S. ownership.	

Evidence adequacy rating:

☐ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**	
12.2.1	**Not applicable.** The entire crab harvests are conducted in Alaskan waters by American vessels. No foreign fleet is allowed to fish in the Alaska's EEZ. All fishing vessels must be at least 75% U.S. ownership. Federal and State legislation for fisheries enforcement applies accordingly (see Clause 12.1 and 12.1.1).	

F. Serious Impacts of the Fishery on the Ecosystem

13.	**Considerations of fishery interactions and effects on the ecosystem shall be based on best available science, local knowledge where it can be objectively verified and using a risk based management approach for determining most probable adverse impacts. Adverse impacts on the fishery on the ecosystem shall be appropriately assessed and effectively addressed.** ***FAO CCRF 7.2.3/8.4.7/8.4.8/12.11*** ***Eco 29.3/31***					
Confidence Ratings	**Low**	**0 out of 13**	**Medium**	**0 out of 13**	**High**	**13 out of 13**

Clause:

13.1 States shall assess the impacts of environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks, and assess the relationship among the populations in the ecosystem.

FAO CCRF 7.2.3

13.1.1 Adverse environmental impacts on the resources from human activities are assessed and, where appropriate, corrected.

FAO CCRF 7.2.2

13.1.2 The most probable adverse impacts of the fishery on the ecosystem/environment shall be considered, taking into account available scientific information, and local knowledge.

Eco 31

13.1.3 In the absence of specific information on the ecosystem impacts of fishing for the unit of certification, generic evidence based on similar fishery situations can be used for fisheries with low risk of severe adverse impact. However, the greater the risk the more specific evidence is necessary to ascertain the adequacy of mitigation measures.

Eco 30.4, 31.4

13.1.4 Impacts that are likely to have serious consequences shall be addressed. This may take the form of an immediate management response or a further analysis of the identified risk.

Eco 29.3,29.4, 31

Evidence adequacy rating:		
☑ **High**	☐ **Medium**	☐ **Low**

Clause:	**Evidence**
13.1	**There is assessment of the impacts of environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks, and assess the relationship among the populations in the ecosystem.** **From Ecosystem Crab SAFE 2011** http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf **Introduction** The purpose of the Crab Ecosystem Considerations and Indicators (CECI) report is to consolidate ecosystem information specific to the crab stocks in the Bering Sea and Aleutian Islands (BSAI) Fishery Management Plan. The BSAI Fishery Management Plan covers 10 stocks of crab representing five species: red king crab (*Paralithodes camtschaticus*; RKC), blue king crab (*Paralithodes platypus*; BKC), golden king crab (*Lithodes aequispinus*; GKC), southern Tanner crab (*Chionoecetes bairdi*), and snow crab (*Chionoecetes opilio*). The CECI report will serve as an appendix to the BSAI King and Tanner Crab Stock Assessment and Fisheries Evaluation (SAFE) document. The objectives of this chapter are to assess the BSAI ecosystem trends, identify and provide annual updates of ecosystem status indicators and research priorities for BSAI crab stocks, and to update management status indicators. The format and organization of the CECI chapter are adapted from the Ecosystem Considerations Appendix to the BSAI and Gulf of Alaska Groundfish SAFE documents and the North Pacific Marine Science Organization (PICES) workshop on integrating ecological indicators of the North Pacific (Kruse et al. 2006). In order to avoid duplication of effort, sections in this document may occasionally refer to detailed reports from the Groundfish Ecosystem Considerations Appendix on topics specifically impacting crab ecology. Beamish and Mahnken (1999) addressed incorporating the dynamics of an ecosystem, i.e., multispecies interactions and environmental variations, into stock assessments and resource management by discussing the need to understand natural influences which regulate a species as well as the influence from humans. Ecosystem-based management in the BSAI crab fisheries involves accounting for other influences on the target species beyond directed fishing. To address these influences, the CECI is composed of three main sections. First, the **Ecosystem Assessment** portion of the document provides a historical overview of the physical and biological environment of the BSAI ecosystem utilized by crab species as well as aspects of crab life history such as survival, recruitment, growth, maturity and natural mortality which are known to be impacted by changes in the BSAI ecosystem.

The second section of the CECI, **Current Status of Ecosystem Indicators**, provides current information and updates on the status of the physical and biological components of the BSAI ecosystem. Physical components include pelagic and benthic habitat variables while biological components include prey availability and their abundance as well as distribution and abundance of competitors and predators. This section updates current research and identifies future research priorities for BSAI crab stocks with respect to ecosystem interactions.

The final section, the **Ecosystem-based Management Indicators**, provides trends which could indicate early warning signals of direct fishery effects on crab-oriented BSAI ecosystem components, warranting management intervention or providing evidence of the efficacy of previous management actions. Specific indicators include the magnitude of directed fishery effects on BSAI habitat and resulting management efforts, and spatial and temporal removals of the target catch affecting other biological predators. In this section, the authors review potential fishery effects on crab biology such as changes in age and size at maturity, and reproduction.

http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf

FATE research. NOAA also supports the Fisheries And The Environment (FATE) program to ensure the sustainable use of US fishery resources under a changing climate. The focus of FATE is on the development, evaluation, and distribution of leading ecological and performance indicators. In 2005, a study on fish and crab larvae as indicators of climate change was carried out.
http://fate.nmfs.noaa.gov/

PICES Special Publication 1: Marine Ecosystems of the North Pacific.
The North Pacific ecosystem status report is a contribution by the North Pacific Marine Science Organization (PICES) to identify, describe, and integrate observations of change in the North Pacific Ocean that are occurring now, and have occurred during the past several years; it will remain a work-in-progress. Publication 1 represents the first attempt to describe, in a systematic and integrated fashion, the state of the North Pacific Ocean. This first step describes the present state of the marine ecosystems of the North Pacific Ocean (status), in the context of their recent past (last five years) and longer variability (trends); it summaries regional assessments into a broad basin-wide synthesis; identifies critical factors that cause changes in these ecosystems; and it identifies key questions and critical data gaps that inhibit understanding of these marine ecosystems
http://www.pices.int/publications/special_publications/NPESR/2005/npesr_2005.aspx

The North Pacific Research Board (NPRB) was created by Congress in 1997 to conduct research activities on or relating to the fisheries or marine ecosystems in the North Pacific Ocean, Bering Sea, and Arctic Ocean with a priority on cooperative research efforts designed to address pressing fishery management or marine ecosystem information needs. While the NPRB has invested millions of dollars on obtaining this objective, they have also developed a special project that seek to understand the integrated ecosystems of the BSAI.

For the Bering Sea, a large multiyear ecosystem project is winding towards completion. It consists of two large projects that will be integrated. One funded by the National

	Science Foundation (NSF's BEST program is the Bering Ecosystem STudy, a multi-year study (2007-2010)). The other funded by NPRB (BSIERP, is the Bering Sea Integrated Ecosystem Research Program (2008-2012)). The overlapping goals of these projects led to a partnership that brings together some $52 million worth of ecosystem research over six years, including important contributions by NOAA and the US Fish & Wildlife Service. From 2007 to 2012, NPRB, NSF, and project partners are combining talented scientists and resources for three years of field research on the eastern Bering Sea Shelf, followed by two more years for analysis and reporting. http://bsierp.nprb.org/focal/index.html Impacts of a Warming Arctic - by Arctic Climate Impact Assessment, pp. 144. ISBN 0521617782. Cambridge, UK: Cambridge University Press, December 2004. While this project focuses on the Arctic, significant information about the Bering Sea and the GOA are incorporated into this climate review document. It noted that the Arctic is now experiencing some of the most rapid and severe climate change on earth. Over the next 100 years, climate change is expected to accelerate, contributing to major physical, ecological, social, and economic changes, many of which have already begun. Changes in arctic climate will also affect the rest of the world through increased global warming and rising sea levels. http://www.acia.uaf.edu Lastly, the Council has and will continue to consider habitat protection measures, they are particularly tasked with the assessment of Essential Fish Habitat as it pertains to managed species such as BSAI crab species. http://www.fakr.noaa.gov/npfmc/conservation-issues/habitat-protections.html	
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
13.1.1	**Adverse environmental impacts on the resources from human activities are assessed and, where appropriate, corrected.** The largest impact resulting from human activities on the BSAI crab resources, and more specifically, on the 3 stocks here under consideration is fishing. Directed crab fishing as well as crab bycatch in other fisheries such as the groundfish fisheries is assessed yearly and corrected appropriately through yearly stock assessment activities, and through the formulation of overfishing levels, allowable biological catch and allowable catch limits. These are all document in the yearly crab SAFE report compiled by ADFG, NMFS and NMPFMC scientists. Also effects on EFH caused by fishing activities such as trawling are routinely assessed and corrected (where possible). The last EFH review (2010) identified impacts of trawling on EFH habitat of red King Crab in Bristol Bay. These are being considered accordingly by the NPFMC. Summary of Effects - There is an area of overlap between current female red king crab distribution and areas where trawling occurs in the southern Bristol Bay. Southern Bristol Bay is an important spawning ground for red king crab and heavy trawling there could greatly impact the crab spawning success. Trawling in deeper waters also	

	somewhat overlaps the migration route to mating areas. There are essentially no fishing effects in areas important to juvenile red king crab. All known juvenile rearing areas are currently protected by trawl closure areas. Most of the distribution of red king crab was to the north and east of the high fishing effects areas during the past 15 years. However, a high density of mature female crab were found in the heavy trawling area during 2008-2009, and it appears that mature female crab moved back to the historical important spawning ground in the southern Bristol Bay. **Given the current overlap, trawling intensity in the southern Bristol Bay, and the importance of the spawning ground there, professional judgement indicates that trawling fisheries have currently adversely affected the EFH of red king crab.** This heavy trawling could impact the stock recovery and jeopardize the ability of the stock to produce MSY over the long term. Beyond trawling in the southern Bristol Bay, other fishing may have minimum impacts on red king crab EFH. In this regard, a staff discussion paper is been developed by the Council and the NMFS in March 2012. Here, options for Council action include: •Revise the effects of EFH evaluations. •No management action, but encourage further research in this area to better understand adult, juvenile and larval distribution and habitat usage. •Extend or establish trawl closure areas in the affected area as EFH conservation measures. •Extend the range of the red king crab savings area to protect more of the stock. •Apply a seasonal closure to protect the adult female red king crab from March to May during molting and mating. •Close area southwest of Amak Island. •Designate a HAPC priority for areas important for red king crab egg hatching, and consider designating this area as a HAPC. This specific item is scheduled for discussion on the Council session post October 2012 meeting. http://www.fakr.noaa.gov/npfmc/PDFdocuments/conservation_issues/EFH/EFHDiscPaper411.pdf NEPA – The Council's analytical review documents that evaluate proposed changes to the conservation and management of groundfish and shellfish stocks for which they are responsible, are NEPA compliant documents. This means that adverse environmental impacts to the resource from human activities are assessed and, where appropriate, corrected. These documents are widely distributed and made available so that the public at large and other natural resource, management or development agencies will have an opportunity to testify or comment on possible impacts to their sphere of influence. In like manner, when other resource, development or management agencies that receive federal funds wish to implement new activities or develop new regulations that may impact fisheries under the auspicious of the Council, they must also develop NEPA documents which show their project's plan conform to existing Council FMPs and seek comments from the Council on ways that their proposed activities may impact the Council. http://www.eli.org/seminars/event.cfm?eventid=445 (NEPA at 40: How a Visionary Statute Confronts 21st Century Environmental Impacts -- Co-sponsored by: The	

	Environmental Law Institute, The George Washington University Law School and The Council on Environmental Quality). A review of the beneficial effects of NEPA on developing regulations is discussed and provides insight on the NEPA analysis to provide public and state and federal agency reviews to proposed processes that can impact the public and its businesses. Specifically, NEPA requires federal agencies to prepare Environmental Assessments or Environmental Impact Statements prior to making decisions. The President's Council on Environmental Quality, referred to as CEQ, which was established along with NEPA, has adopted regulations and other guidance that provide general procedures for federal agencies to follow when preparing these documents. Moreover, each federal agency has adopted its own detailed NEPA procedures, and the federal courts, after more than 30 years of litigation, have played a major role in shaping NEPA's interpretation and implementation. http://www.solano.com/pdf/N20_TOC.pdf (The NEPA Book) or http://www.solano.com/old_site_02/oldsite/bookinfo_nepa.htm	
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
13.1.2	**The most probable adverse impacts of the fishery on the ecosystem/environment are considered, taking into account available scientific information, and local knowledge.** EXCERPT FROM ECOSYSTEM CONSIDERATION INDICATORS FOR BERING SEA AND ALEUTIAN ISLANDS KING AND TANNER CRAB SPECIES by E.A. Chilton, K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy; NOAA NMFS'AFSC, 2011. **Ecosystem-based Management Indicators** This section of the CECI provides early signals of direct human effects on BSAI crab ecosystem components via directed fishery affects on the ecosystem and summarizes current management actions such as: management efforts in response to directed fishery effects on BSAI habitat, and spatial and temporal removals of the target catch affecting other biological predators. In this section, the potential fishery effects on crab life history stages such as removal of legal sized males, age at maturity and reproduction are reviewed. **Fishery-Specific Impacts on the Physical Environment** *Effects of Crab Fishing Gear on Seafloor Habitat* In the BSAI crab fisheries Final Environmental Impact Statement (EIS), the impact of pot gear on benthic EBS species is discussed (NMFS 2004). Benthic species examined included fish, gastropods, coral, echinoderms (sea stars and sea urchins), non-target	

crab, and invertebrates (sponges, octopuses, anemones, tunicates, bryozoans, and hydroids). It is likely that habitat is affected during both setting and retrieval of pots, but little research has been done. Physical damage to the habitat by pot gear depends on habitat type. Sand and soft sediments where the majority of EBS crab pot fishing occurs are less likely to be impacted, whereas coral, sponge, and gorgonian habitats are more likely to be damaged by commercial crab pots in the AI GKC fishery (Quandt 1999, NMFS 2004). The total portion of the EBS impacted by commercial pot fishing may be less than 1% of the shelf area (NMFS 2004). The report concludes that BSAI crab fisheries have an insignificant effect on benthic habitat.

Management Enacted Efforts

Habitat protection areas, prohibited species caps (PSC) and crab bycatch limits are in place to protect important benthic habitat for crab and other resources and reduce crab bycatch in the trawl and fixed gear fisheries. Beginning in 1995, the Pribilof Islands Conservation Area was closed to all trawling and dredging year-round to protect BKC habitat (NPFMC 1994). 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. The Red King Crab Savings Subarea is a portion of the Red King Crab Savings Area between 56° 00′ and 56° 10′ N lat. Within this Subarea, non-pelagic trawl gear may be used if GHLs were established for a Bristol Bay RKC fishery the previous year. The RKC bycatch limit is established by NMFS after consultation with the Council and the limit does not exceed an amount equivalent to 25 percent of the RKC PSC allowance (Federal Register 679.21 Prohibited Species Bycatch Management). To protect juvenile RKC and critical rearing habitat (stalked ascidians and other living substrate), another year-round closure to all trawling was implemented in 1996 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 (NPFMC 2008, Fig. 14).

The Bering Sea Habitat Conservation Area, Northern Bering Sea Research Area, Nunivak Island, Etolin Strait, and Kuskokwim Bay Habitat Conservation Area, St. Lawrence Island Habitat Conservation Area, and St. Matthew Island Habitat Conservation Area were closed to non-pelagic gear in 2008. These areas include BKC habitat, locations that have not been fished with non-pelagic gear, nearshore bottom habitat that support subsistence marine resources and a research area (Federal Register Vol. 73, No 144, July 25, 2008, Rules and Regulations). A scientific research plan is currently being developed for the Northern Bering Sea Research Area and will be reviewed by the North Pacific Fishery Management Council in 2011. The major objectives of the plan are to study the effects of bottom trawling on benthic species and habitat with the goal of providing information to assist in the development of future protection measures for crab and other species as well as subsistence needs of western Alaska communities. PSC limits are in place for RKC, Tanner and snow crab. If PSC limits are reached in predetermined bottom trawl fisheries executed in specific areas, those fisheries are closed. Snow crab taken within the “Snow Crab Bycatch Limitation Zone” (COBLZ) 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 is prohibited from fishing within the COBLZ. A recent review of the PSC limits for commercial crab species in groundfish fisheries is detailed in *Crab*

Bycatch in the Bering Sea/Aleutian Island Fisheries (NPFMC 2010). Annual crab bycatch limits (CBLs) are specified for RKC, Tanner and snow crab in the scallop fishery in the Bering Sea, Registration Area Q, and are calculated as a percentage of the most recent abundance estimate of RKC, Tanner and snow crab in Registration Area Q.

Effects of groundfish Fishing Gear on Seafloor Habitat
McConnaughey et al. (2000) examined the impact of trawl gear on the EBS seafloor by comparing an area closed to trawling adjacent to an area that has experienced intensive fishing for yellowfin sole. There were significantly detectable differences in macrofaunal populations between the two areas, with greater diversity and niche breadth of sedentary macrofauna in the unfished area. The biomass of stalked, attached and encrusted epifaunal organisms (sponges, anemones, soft corals, and tunicates) was greater in the unfished area. These organisms provide substrate complexity and are vulnerable to bottom trawl gear. A larger number of marine snail and bivalve shells also added to the complexity of the substrate in the unfished area. Overall, the complexity of the benthic substrate as well as the epifaunal diversity is affected by bottom trawl gear and reduces the heterogeneity of the benthic communities (McConnaughey et al. 2000). Recent research by Rose et al. (2010) examined the adaption of rubber cookie discs and different lengths of bottom trawl bridle cables to improve fishing efficiency of flatfish as well as reduce the impact of these bottom trawls to the seafloor.
The CPT presented a discussion paper to the NPFMC in March 2011 evaluating the effects of groundfish fishing on essential fish habitat for RKC. The discussion paper highlighted the interaction between trawl fishing and ovigerous female RKC in the southwest area of Bristol Bay, an area with potentially higher survival rates for larval and juvenile RKC. The NPFMC requested further analysis on the effectiveness of the RKC Savings Area and the Nearshore Bristol Bay Trawl Closure with respect to the impact of fishing gear on seafloor habitat.

Fishery-Specific Impacts on Biological Environment

Directed Fishery Contribution to Competitor and Predator Mortality
The EBS crab fisheries catch a small amount of other species as bycatch. A limited number of groundfish, such as Pacific cod, Pacific halibut, yellowfin sole, and sculpin (*Myoxocephalus* spp.), are caught in the directed pot fishery (Barnard and Burt 2007; Barnard and Burt 2008; Gaeuman 2010). The invertebrate component of bycatch includes echinoderms (stars and sea urchin), snails, non-FMP crab (hermit crabs and lyre crabs), and other invertebrates (sponges, octopus, anemone, and jellyfish). Typically, low levels of bycatch of these species do not impact their abundance (NMFS 2004). Mortality to fish and non-target invertebrates from ghost fishing of lost crab and groundfish pots in the EBS has not been evaluated. The term ghost fishing describes continued fishing by lost or derelict gear. Crab caught in lost pots may die of starvation; however, the impact of ghost fishing on crab stocks remains unknown. To reduce starvation mortality in lost pots, crab pots have been required to be fitted with degradable escape mechanisms such as cotton thread or twine since 1977. Pots without escape mechanisms could continue to catch and kill crab for many years. High and Worlund (1979) estimated an effective fishing life of 15 years for king crab pots. The ADFG requires the use of a biodegradable twine panel in each crab pot intended to disable ghost fishing in lost pots after approximately 30 days. Recent work indicates that even biodegradable twine may remain intact for up to 89 days in lost pots (Barnard 2008), or 3 times the length of time (30 days) found to cause irreversible

	starvation in crab (Paul et al. 1994). Testimony from crabbers and pot manufacturers indicate that all pots currently fished in Bering Sea crab fisheries contain escape mechanisms (NPFMC 2007). NMFS conducted Endangered Species Act (ESA) Section 7 Consultations-Biological Assessments on the impact of the Bering Sea and Aleutian Island FMP crab fisheries on marine mammals (NMFS 2000) and on seabirds (NMFS 2002). As noted in the Endangered Species Act EIS report, crab fisheries do not adversely affect ESA listed species, destroy or modify their habitat, or comprise a measurable portion of their diet (NMFS 2004). Although the possibility of strikes of listed seabirds with crab fishing vessels does exist (NMFS 2000), NMFS concluded that available evidence is not sufficient to suggest that these interactions occur in today's fisheries or limit the recovery of seabirds. Of non-listed marine mammals, bearded seals (*Erignathus barbatus*) are the only marine mammal potentially impacted by crab fisheries insofar as crab are a measurable portion of their diet (Lowry et al. 1980; NMFS 2004). For non-listed seabirds, the Alaska Groundfish Fisheries Final Programmatic SEIS (NMFS 2004) provides life history, population biology and foraging ecology for marine birds. The SEIS concluded that crab stocks under the NPFMC fishery management plan (NPFMC 1998) have very limited interaction with non-listed seabirds. *Directed Fishery Contribution to Discards and Offal Production* The EIS for the BSAI crab fisheries summarizes some of the effects of discards and offal production (NMFS 2004). Returning discards, process waste, and the contents of used bait containers to the sea provides energy to scavenging birds and animals that may not otherwise have access to those energy resources. The total offal and discard production as a percentage of the unused detritus already going to the bottom has not been estimated. *Groundfish and Scallop Fisheries By-Catch of Commercial Crab* RKC, Tanner and snow crab, regardless of sex or size, are considered prohibited species in the groundfish and scallop fisheries with an estimated handling mortality of 50% in fixed gear, 80% in trawl gear and 40% dredge gear fisheries. Bottom trawl fisheries in specific areas are closed when PSC limits of RKC, Tanner and snow crab are reached Bycatch data of commercial crab species caught in the groundfish fisheries is provided by NMFS, Alaska Regional Office from 1991 through 2010 and incorporated into the individual species stock assessments when appropriate to their tier level. The scallop fishery in the Bering Sea (Registration Area Q,) is executed from July 1st through the end of February and closes if harvest guidelines or CBLs are reached. Since 1993, 100% observer coverage has been required on all vessels participating in the scallop fishery. Scallop observers collect biological data from the targeted catch as well as bycatch species. The Bering Sea fishery within Area Q targets scallop beds in 90 to 106 m of water in a small area (13 nmi^2) north of Unimak Island (Rosenkranz 2010). Scallop fishery closures in Area Q resulting from CBLs have decreased in recent years mainly due to lower crab abundances in the EBS (Barnhart and Rosenkranz 2003, Table 2). Fishery-Specific Impacts on Crab Biology *Directed Fishery Effects of the Target Catch Relative to Predators* The spatial and temporal removal of the target catch, legal-sized male crab, is dependent on the size of the vessel quota, weather conditions, advancing ice edge, processor demand, and Community Development Quotas (CDQ) deliveries distributed	

between St. Paul Island and Dutch Harbor, Alaska. Historically, Bristol Bay RKC is fished from late October through early December, and EBS Tanner and snow crab January through April. The St. Matthew Island BKC fishery opened in November of 2009 after a ten year rebuilding plan, although this fishery was historically executed in September and October just prior to the red king fishery. The Norton Sound RKC and Aleutian Islands GKC fisheries are conducted in the summer and fall.
There are few species identified as predators of legal-sized male crab and specific information is limited due to the difficulty of identifying prey items to the species level with only partial carapace or dactyl pieces. Based on food habits data collected in the summer months during the annual EBS bottom trawl survey, Pacific cod, Pacific halibut and skates are the primary predators of large or legal size crab although legal-sized crab are a minimal component of these predators diets.

Directed Fishery Effects on Target Crab, Age-At-Maturity and Reproduction
In the BSAI, minimum size limits for male crab are established based upon the estimated average size-at maturity with the intent of allowing males to mate at least once before becoming harvestable. Females are not harvested and fishing seasons are timed to protect the crab when they are molting and mating (NPFMC 2008). It is possible that male-only fisheries with minimum size limits reduce the abundance of large crab; however this has not been examined for Bering Sea crab stocks. In Glacier Bay National Park and Preserve, located at the northern end of the southeastern Alaska panhandle, the number and size of legal-sized male Dungeness crab increased significantly after the closer of the park to commercial fishing. Females and sub-legal males were not targeted by the commercial fishery and these crab did not increase in size or abundance following the closure of the fishery (Taggart et al. 2004). Commercial fishing in Glacier Bay National Park and Preserve appeared to have altered the size structure of male Dungeness crab which may also be occurring within EBS crab stocks.
Over time, size-at-maturity may be reduced due to fishing-induced mating selection in male-only fisheries (Zheng 2008). A significant decline in size at 50% maturity of male Bristol Bay Tanner crab may be the result of genetic responses to the fishery. Fast-growing males may not have an opportunity to mate prior to being harvested in the fishery, whereas slow-growing males may undergo their terminal molt to maturity before reaching the legal size limit and therefore mate (Zheng 2008). Recent analysis of the economic and biological impact of reducing the legal size of Tanner crab in the EBS concluded that a reduction would result in decreased handling mortality in the directed fishery of the terminally molted, sublegal males due to the increased CPUE from the smaller legal males but handling mortality would not be reduced in other fisheries (Bechtol et al. 2010). A reduction in legal-sized Tanner crab may also reduce potential risk of genetic effects from removing only the larger males (Zheng and Pengilly 2010). A reduction in the abundance of large males may result in the mating of less fecund males, reduced female mate choice and an increased chance of sperm limitation (Smith and Jamieson 1991; Sato et al. 2005a; Sato et al. 2006; Sato and Goshima 2006; Sainte-Marie et al. 2008). Male size and mating frequency affects reproductive success of many crab species. In general, larger males are more successful at mating (production of a fertilized egg clutch) and can successfully mate with multiple females (Paul and Paul 1990; Paul and Paul 1997; Sato et al. 2005b; Sato and Goshima 2006). Based upon manipulation population studies of a smaller lithodid crab species, *Hapalogaster dentate,* a decrease in male size and sex ratio would result in sperm limitation (Sato and Goshima 2006). Laboratory research and field studies in eastern Hokkaido, Japan suggested that sperm limitation could occur in fished populations of *Paralithodes brevipes* (Sato et al. 2005b). Large male snow crab from

	heavily harvested stocks in the Gulf of St. Lawrence, Canada have small amounts of spermatophores in their vas deferens which is in contrast to higher levels observed in lightly or not fished stocks (Conan and Comeau 1986; Sainte-Marie et al. 1995). In heavily exploited snow crab stocks, a high percent of males may be harvested upon reaching morphometric maturity resulting in an inability of mature males to accumulate a sufficient number of spermatophores necessary to successfully mate (Conan and Comeau 1986; Sainte-Marie et al. 1995). In the EBS, female snow crab sperm reserves increase with female size and appear to generally be lower than other snow crab stocks (Slater et al. 2010). Limited sperm reserve data from EBS snow and Tanner crab suggest that in 2005 less than one half of primiparous females sampled had sufficient sperm reserves to fertilize a full second clutch of eggs (Gravel and Pengilly 2007). Alternately, in northern California, nearly all molting female Dungeness crab mate regardless of size despite intense fishing on males (Hankin et al. 1997). The short and long term effects of removing large male crab from a population are not well understood and may vary by species and population. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
13.1.3	As detailed above in 13.1.2, sufficient information is available to determine the ecosystem impacts of the BSAI crab fisheries. Actions by the relevant, NPFMC, NMFS and ADFG, are taken accordingly.

Evidence adequacy rating:

☑ **High** ☐ **Medium** ☐ **Low**

Clause:	**Evidence**
13.1.4	**Impacts that are likely to have serious consequences are addressed. This may take the form of an immediate management response or a further analysis of the identified risk.** The three stocks are not being overfished or are in overfished conditions as under the specifications and definitions of overfished and overfishing conditions of the BSAI Crab FMP. There is no catch of endangered, threatened or protected species and bycatch of other species is largely limited to other crab species, all of which are accounted for within the yearly crab SAFE reports. Also habitat considerations and effects of fishing gear on sea floor and related biogenic structure are considered minimal and non permanent. Issues relating to bottom trawling in parts of Bristol Bay are however considered to have serious effects on parts of Bristol Bay red king crab EFH. This is now been reviewed by scientists and considered for action through the NPFMC process.

	The crab fisheries in question use largely pollock, cod and herring fish as bait. Herring are managed by ADFG throughout Alaska. Pacific cod and pollock are managed by the NPFMC in federal waters and by ADFG in state waters.

Clause:

13.2 Appropriate measures shall be applied to minimize:

- **Catch, waste and discards of non-target species (both fish and non-fish species).**
- **Impacts on associated, dependent or endangered species**.

FAO CCRF 7.6.9

Eco 31.1

13.2.1 Non target catches, including discards, of stocks other than the "stock under consideration" shall be monitored and shall not threaten these non-target stocks with serious risk of extinction; if serious risks of extinction arise, effective remedial action shall be taken.

Eco 31.1

Evidence adequacy rating:

☑ High **☐ Medium** **☐ Low**

Clause:	Evidence
13.2	**Appropriate measures are applied to minimize: catch, waste and discards of non-target species (both fish and non-fish species) and impacts on associated, dependent or endangered species**. The majority of bycatch species in each of the 3 fisheries under assessment are mostly crab. A limited number of groundfish, such as Pacific cod, Pacific halibut, yellowfin sole, and sculpin (*Myoxocephalus* spp.), are caught in the directed pot fishery (Barnard and Burt 2007; Barnard and Burt 2008; Gaeuman 2010). The invertebrate component of bycatch includes echinoderms (sea stars and sea urchins), snails, non-FMP crab (hermit crabs and lyre crabs), and other invertebrates (sponges, octopus, anemone, and jellyfish). Typically, low levels of bycatch of these species do not impact their abundance (NMFS 2004). Mortality to fish and non-target invertebrates from ghost fishing of lost crab and groundfish pots in the EBS has not been evaluated. The Tables displayed in the 2011 ADFG Observer Data Report available at http://www.adfg.alaska.gov/FedAidPDFs/FDS11-04.pdf shows bycatch species and numbers. The tables are available in Clause 9.5 of this report. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf

Evidence adequacy rating:		
☑ **High**	☐ **Medium**	☐ **Low**

Clause:	**Evidence**
13.2.1	**Non target catches, including discards, of stocks other than the "stock under consideration" are monitored and do not not threaten these non-target stocks with serious risk of extinction; if serious risks of extinction arise, effective remedial action are taken.** Non target catches, including discards, of stocks other than the "stock under consideration" are monitored and do not threaten these non-target stocks with serious risk of extinction. Pot gear used to fish for crab in the BSAI appears to be relatively selective. The majority of bycatch species in each of the 3 fisheries under assessment are mostly crab. The Tables displayed in clause 9.5 (from 2011 ADFG Observer Data Report available at http://www.adfg.alaska.gov/FedAidPDFs/FDS11-04.pdf) demonstrates that. See also clauses 4.1., 8.4, 8.4.2 and 13.2

Clause:

13.3 The role of the "stock under consideration" in the food-web shall be considered, and if it is a key prey species in the ecosystem, management measures shall be in place to avoid severe adverse impacts on dependent predators.

Eco 31.2

Evidence adequacy rating:		
☑ **High**	☐ **Medium**	☐ **Low**

Clause:	**Evidence**
13.3	**The role of the "stock under consideration" in the food-web is considered.** There are few species identified as predators of legal-sized male crab and specific information is limited due to the difficulty of identifying prey items to the species level with only partial carapace or dactyl pieces. Based on food habits data collected in the summer months during the annual EBS bottom trawl survey, Pacific cod (biomass increasing), Pacific halibut (biomass increasing) and skates (not considered overfished or suffering overfishing) are the primary predators of large or legal size crab although legal sized crab are a minimal component of these predators diets. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf

Clause:		
13.4	**Pollution, waste, catch by lost or abandoned gear are minimized, through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost effective fishing gear and techniques.** ***FAO CCRF 7.2.2*** **13.4.1 States shall introduce and enforce laws and regulations based on the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating there to (MARPOL 73/78).** ***FAO CCRF 8.7.1***	
Evidence adequacy rating:		
☑ **High**	☐ **Medium**	☐ **Low**
Clause:	**Evidence**	
13.4	**Pollution, waste, catch by lost or abandoned gear are minimized, through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost effective fishing gear and techniques.** Please see clause 9.3. Waste and catch by lost or abandoned gear are minimized through the use of escape rings and specific mesh webbing requirements. Also ghost fishing is regulated by compulsory use of biodegradable twines and/or galvanic releases aimed at disabling pot fishing within 30 days. The rationalized crab fishery of the BSAI is now more effective than before rationalization (2005) in loosing less pots and with more time at hand and increased soak times, current practices are believed more selective than before 2005. The Environmental Protection Agency (EPA) and Alaska Department of Environmental Conservation (ADEC) Regulations are in place that required used gear to be landed in ports for disposal. Other types of pollution (oil, chemicals, waste, harmful substances and garbage) are controlled under MARPOL and implemented under US Coast Guard, EPA or ADEC regulations. Their regulations are in many cases more stringent and broader in nature. All of these agencies have regulations that require individuals or industry to comply with their standards and expeditiously report any infractions to those regulations. http://www.imo.org/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-(marpol) http://www.uscg.mil/top/missions/marineenvironmentalprotection.asp http://www.epa.gov/lawsregs/topics/water.html#oceans http://dec.alaska.gov/spar/	

Evidence adequacy rating:		
☑ **High**	☐ **Medium**	☐ **Low**

Clause:	**Evidence**	
13.4.1	**There are enforced laws and regulations based on the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating there to (MARPOL 73/78).** The information supplied above in Clause 13.4 describes the various state and federal agencies who implement regulations that meet or surpass the MARPOL regulations. In many cases, the state and federal regulations implement the MARPOL regulations. Members of the Alaska fishing industry sit on the MARPOL advisory committee. Same Source of Evidence as in 13.4 above.	

Clause:

13.5 **There shall be knowledge of the essential habitats for the "stock under consideration" and potential fishery impacts on them. Impacts on essential habitats and on habitats that are highly vulnerable to damage by the fishing gear involved shall be avoided, minimized or mitigated. In assessing fishery impacts, the full spatial range of the relevant habitat shall be considered, not just that part of the spatial range that is potentially affected by fishing.**

Eco 31.3

13.5.1 **Assessment and scientific evaluation shall be carried out on the implications of habitat disturbance impact on the fisheries and ecosystems prior to the introduction on a commercial scale of new fishing gear, methods and operations. Accordingly, the effects of such introductions shall be monitored.**

FAO CCRF 8.4.7 Other 12.11

Evidence adequacy rating:		
☑ **High**	☐ **Medium**	☐ **Low**

Clause:	**Evidence**	
13.5	**There is knowledge of the essential habitats for the "stock under consideration" and potential fishery impacts on them. Impacts on essential habitats and on habitats that are highly vulnerable to damage by the fishing gear involved are avoided, minimized or mitigated. In assessing fishery impacts, the full spatial range of the relevant habitat is considered, not just that part of the spatial range that is potentially affected by fishing.**	

	Section 4.0 of the BSAI Crab FMP addresses the requirement in EFH regulations (50 CFR 600.815(a)(2)(i)) that each FMP must contain an evaluation of the potential adverse effects of all regulated fishing activities on EFH. This evaluation must 1) describe each fishing activity, 2) review and discuss all available relevant information, and 3) provide conclusions regarding whether and how each fishing activity adversely affects EFH. Relevant information includes the intensity, extent, and frequency of any adverse effect on EFH; the type of habitat within EFH that may be affected adversely; and the habitat functions that may be disturbed. In addition, the evaluation should 1) consider the cumulative effects of multiple fishing activities on EFH, 2) list and describe the benefits of any past management actions that minimize potential adverse effects on EFH, 3) give special attention to adverse effects on habitat areas of particular concern (HAPCs) and identify any EFH that is particularly vulnerable to fishing activities for possible designation as HAPCs, 4) consider the establishment of research closure areas or other measures to evaluate the impacts of fishing activities on EFH, 5) and use the best scientific information available, as well as other appropriate information sources. This evaluation assesses whether fishing adversely affects EFH in a manner that is more than minimal and not temporary in nature (50 CFR 600.815(a)(2)(ii)). This standard determines whether Councils are required to act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable. The last EFH review (2010) identified impacts of trawling on EFH habitat of red King Crab in Bristol Bay. These are being considered accordingly by the NPFMC. Summary of Effects - There is an area of overlap between current female red king crab distribution and areas where trawling occurs in the southern Bristol Bay. Southern Bristol Bay is an important spawning ground for red king crab and heavy trawling there could greatly impact the crab spawning success. Trawling in deeper waters also somewhat overlaps the migration route to mating areas. There are essentially no fishing effects in areas important to juvenile red king crab. All known juvenile rearing areas are currently protected by trawl closure areas. Most of the distribution of red king crab was to the north and east of the high fishing effects areas during the past 15 years. However, a high density of mature female crab were found in the heavy trawling area during 2008-2009, and it appears that mature female crab moved back to the historical important spawning ground in the southern Bristol Bay. **Given the current overlap, trawling intensity in the southern Bristol Bay, and the importance of the spawning ground there, professional judgement indicates that trawling fisheries have currently adversely affected the EFH of red king crab.** This heavy trawling could impact the stock recovery and jeopardize the ability of the stock to produce MSY over the long term. Beyond trawling in the southern Bristol Bay, other fishing may have minimum impacts on red king crab EFH. In this regard, a staff discussion paper is been developed by the Council and the NMFS in March 2012. Here, options for Council action include: •Revise the effects of EFH evaluations. •No management action, but encourage further research in this area to better understand adult, juvenile and larval distribution and habitat usage. •Extend or establish trawl closure areas in the affected area as EFH conservation measures. •Extend the range of the red king crab savings area to protect more of the stock. •Apply a seasonal closure to protect the adult female red king crab from March to May	

	during molting and mating. •Close area southwest of Amak Island. •Designate a HAPC priority for areas important for red king crab egg hatching, and consider designating this area as a HAPC. This specific item is scheduled for discussion on the Council session post October 2012 meeting http://www.fakr.noaa.gov/npfmc/PDFdocuments/conservation_issues/EFH/EFHDiscPaper411.pdf	
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
13.5.1	**Assessment and scientific evaluation are carried out on the implications of habitat disturbance impact on the fisheries and ecosystems prior to the introduction on a commercial scale of new fishing gear, methods and operations.** The implication of habitat disturbance impact on fisheries and the ecosystem would be carried out under the NEPA processes. Pot gear is the only and a long established gear used to catch king and Tanner crab in the BSAI fisheries. No other gear is allowed. Tangle nets and trawl gear were used to harvest crab prior to the 1970s. They are no longer a lawful gear due to their indiscriminate (sex & size) harvest of crab.	

Clause: **13.6** **Research shall be promoted on the environmental and social impacts of fishing gear and, in particular, on the impact of such gear on biodiversity and coastal fishing communities.** ***FAO CCRF 8.4.8, 7.6.4***		
Evidence adequacy rating: ☑ **High** ☐ **Medium** ☐ **Low**		
Clause:	**Evidence**	
13.6	**Research is promoted on the environmental and social impacts of fishing gear and, in particular, on the impact of such gear on biodiversity and coastal fishing communities.** The Council, the SSC, the AP and the NPRB all annually produce a list of research priorities that focus on timely and important management concerns. This list helps NMFS, NPRB and other research funding agencies focus their tight research funds to resolve topical fishery management issues. In addition, the Council and NPRB seek	

	Individual, community, NGO and fishing industry regulatory or policy proposals and research proposals. This broad group of potential requesters of research or regulatory proposers assures the Council that proposals will include those who are concerned that industrial fisheries such as crab may cause ecosystem or environmental concerns. Because rural coastal Alaskan communities are often concerned with potential impacts from industrial fisheries, they often go to the Council and BOF with their concern over potential or perceived social impacts. The NEPA assessment analysis, fully described in Section 2, will fully evaluate any proposed changes to existing FMP rules and policies as to their impact on biodiversity and coastal fishing communities. The analysis does this because that is how NEPA works. MSA also assures that any proposed change will evaluate biodiversity and coastal fishing communities because of the EFH requirements of MSA and because National Standard 8 requires the Councils to minimize adverse economic impacts on coastal fishing communities. Additionally, the NPFMC's management objectives require that proposed changes promote sustainable fisheries and communities and increase Alaska Native Consultation. Lastly, as noted in an earlier Clause (8.2) NMFS has developed the Economic and Social Sciences Research Program within their REFM division; it provides economic and socio-cultural information that assists NMFS in meeting its stewardship programs. Since coastal community members are important affected stakeholders, the AFSC's Economic and Social Sciences Research (ESSR) Program has been preparing the implementation of the Alaska Community Survey, an annual voluntary data collection program initially focused on Alaska communities for feasibility reasons, in order to improve the socio-economic data available for consideration in North Pacific fisheries management. http://www.nmfs.noaa.gov/sfa/magact http://www.afsc.noaa.gov/REFM/Socioeconomics/Default.php http://www.fakr.noaa.gov/npfmc/PDFdocuments/fmp/CrabFMPOct11.pdf	

Fundamental clause 14. Where fisheries enhancement is utilized, environmental assessment and monitoring shall consider genetic diversity and ecosystem integrity. Not Applicable.

8. External Peer Review

Peer Reviewer A review

Summary and Recommendation

The three stocks being considered for certification meet the FAO definition of responsible fisheries management which requires that stocks under consideration are not overfished, are maintained at a level which promotes the objective of optimal utilization and maintains its availability for present and future generations, taking into account that longer term changes in productivity can occur due to natural variability and/or impacts other than fishing. The management program in place stipulates that if biomass drops below target levels, measures will be taken to ensure restoration within reasonable timeframes of the stocks to sustaining levels.

I found that the information presented in the background sections of the report proved sufficient to support a broad understanding of the general history, development and main management entities and management systems in use by the fishery. It provided the reader with sufficient background information to enable the evidence provided in later sections to be placed in sufficient context for interpretation. In my opinion, the evidence based rationales and summaries, presented for each clause of the Conformance Criteria, were consistent with the proposed confidence rating. There were no findings of non-conformance with any clauses and I found no clauses where I believed that non-conformance was warranted.

The assessment team who compiled the assessment review were obviously competent professionals who possessed a good grasp of the BSAI crab fisheries under review. I encourage the Certification committee to award Certification to the BSAI crab fisheries for these Red and Blue king crab and the *Opilio* crab fisheries.

Full Summary of comments

SECTION	
A	**Fisheries Management System**
1. There must be a structured and legally mandated management system based upon and respecting International, National and local fishery laws and considering other coastal resource users, for the responsible utilization of the stock under consideration and conservation of the marine environment.	
This section provides a very comprehensive review of the management system in place to manage the three stocks being considered for certification. There are a few minor additions and corrections that I would suggest. **Clause 1.1 – the 1989 FMP was developed jointly with the BOF, ADFG, NPFMC, CPT and the public/stakeholders. The BOF rejected the first draft and the plan was not adopted until the state agreed on what it considered to be the proper state/federal balance to management.** **– ADFG is clearly a strong participant in crab research, both at headquarters (HQ), Dutch Harbor and Kodiak, where a dedicated staff of approximately 30 individuals participate in management and research (e.g. most of the exploitation models used by the CPT were developed by HQ staff). The state annually spends $2 million, derived from state general fund and test fish funds, on Bering Sea crab research and management. It also receives approximately $800,000 in federal crab rationalization fees and some fees for Bering Sea crab research from Congress. This should be reflected in Clause 1.1.** **Clause 1.2.1 clearly states that the current best available science is that EBS SC are a distinct population even though there is some larval drift across the US/Russian boundary and into the northern boundary area outside of the normal NMFS survey tracks. Additionally, there is no adjacent fishing across the border on the Russian side; so that any BS SC larval drift across the border does not result in a transboundary fishery.** **Clause 1.2.4 – add: "The state/federal management system has a long history of taking into account previous management measures and improving enforcement. Many years of public testimony through the NEPA process has slowly improved the management: moving from open access, to license limitation, to the IFQ/IPQ system. This is evidenced in the archival records of the NPFMC and the BOF."** **Clause 1.3 should reflect the participation of the State of Alaska and the NPFMC in the US/Russian ICC. Where scientists and policymakers discussed transboundary issues and concerns with each other.** **Clause 1.4 – while the harvest of BS crab occurs only off Alaska, more than 75% of the participants come from neighbouring states (Oregon and Washington). For this reason, the crab FMP required, and the BOF developed, the only out of state advisory committee to the BOF. It is called the Pacific Northwest Crab Industry Advisory Committee (PNCIAC). Not Relevant here (states is implied as other countries).** **Clause 1.6 – as noted in clause 1.1 above: "ADFG is clearly a strong participant in crab research, both at HQ, Dutch Harbor and Kodiak, where a dedicated staff of approximately 30 individuals participate in management and research (e.g. most of the exploitation models used to manage crab were developed by HQ staff). The state annually spends $2**	

	million for BSAI crab management and research, derived from state general fund and test fish funds. It also receives approximately $800,000 in federal crab rationalization fees and some fees for Bering Sea crab research from Congress." This should be incorporated into Clause 1.6 so that more accurately reflects the state participation in financing research and management. **Clause 1.7 – add at the bottom of the first paragraph: "The annual crab SAFE assessment process evaluates crab stocks and current regulations by the CPT, SSC, the public and the NPFMC. Any need for program modification recognized during this annual review process can result in a proposed amendment to the FMP been brought forward by the CPT, SSC, the public or the Council."** **Clause 1.9 – add to the bottom of the second paragraph: "While there are currently no high seas harvest of crab considered under this assessment, the Compliance Agreement is important if climate change ever alters stock distribution such that high seas harvests become a concern."** **The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly, apart for the comment relating to 1.4 where states is implied as countries.**
2.	Management organizations must participate in coastal area management related institutional frameworks, decision-making processes and activities relevant to the fishery resource and its users in support of sustainable and integrated use of living marine resources and the avoidance of conflict among users.
	This section provides an excellent review of the policies and practices that the joint state/federal management regime uses to provide sound scientific and procedural decision-making that includes stakeholders at all stages of the management process. **Clause 2.1 – insert prior to the second last sentence in paragraph 2 the following:"Any proposed changes to the existing management regime by government, industry, or the public must go through a rigorous regulatory review process. During this process…" (continues on with this sentence starting with department scientists and biologists prepare).** **Clause 2.1.1 – add at the end of the first paragraph of the section on "the BOF process": "This process ensures that the local communities customary uses and practices are considered."** **– End of second paragraph add: "see clause 1.4 noting the addition of PNCIAC."** **– Add to the end of the first sentence of "the NPFMC process": "… which assures that the rights of coastal communities and their historic access to the fishery is included in the decision process."** **– Under the paragraph on CDQ seven lines down is a phrase that says "including Pollock, halibut, Pacific cod, crab and by catch species." This should read "halibut, groundfish (Pollock, Pacific cod, flatfish and rockfish), crab and bycatch species."** **– The end of this CDQ paragraph notes that "the CDQ program was created with three primary differences:"; the document only notes two differences. A possible third difference might be: "Restricted to communities adjacent to the Bering sea."** **Clause 2.3 – suggest sentences three and four read: "The groundfish fisheries in the Bering**

Sea operate under either the federal LLP program or the rationalized Pollock and flatfish programs. Additionally, several areas are closed to the groundfish fleet to protect crab habitat. Further, waters around traditional… etc.,"

Clause 2.5 – revise first sentence of second paragraph to read: "The primary job of the NPFMC and the BOF is to manage the resources sustainably and to determine the allocation of resources to different users."
– Modify the third line of the seventh paragraph to read: "Status of the fisheries in the BSAI can be found <u>in the Economic SAFE</u>. These reports are published nearly…"

Clause 2.6 – at the end of the second paragraph note that the NPRB joined with NSF and their BASIS program to augment the special funding of BSIERP to nearly $52 million. The NPRB also funded individual projects to support management and conservation of Council related fisheries. Each grant of the NPRB includes a requirement that a portion of the funds be directed to community education and outreach.
– In the fifth line of the paragraph on ADEC add a period after "water quality" and add a sentence that reads: "This agency monitors and enforces the discharges associated with fish and shellfish processing."
– Under the paragraph "ADFG" note that the agency collects physical and chemical data during their St. Matthew's pot survey using data loggers placed on the survey pots. Data includes temperature, depth, salinity and conductivity.

Clause 2.7 – add after the first sentence: "timely consultation is facilitated through various international agreements."

Clause 2.8 – The State/Federal Action Plan was between NMFS and ADFG. It set out procedures for the two agencies to work together on crab management. The 1997 Joint Protocol was between the NPFMC and the BOF setting up an annual Joint Board/Council meeting on coordinating state/federal issues. The September 1999 addendum to the Joint Protocol and State/Federal Action Plan designated a subgroup of the Board and Council to their joint protocol committee and specified staffing issues.
– Start a new paragraph six line down on second paragraph when you talk about ANILCA; this is a different subject.

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.

3. Management objectives must be implemented through management rules and actions formulated in a plan or other framework.

This section provides an excellent description of how the crab FMP defines management objectives that are incorporated into BS crab management.

Clause 3.1 – toward the end of this clause add a notation to "see Clause 1.1".

Clause 3.2.1 - after (IFQ) add "for sablefish and Pacific halibut". In line 6, add "in 2005" after "The Bering Sea crab fishery followed suit"

Clause 3.2.3 – Add a clause in the second line of the first paragraph after: "there is little to no subsistence take" that reads "and small artisanal vessels seldom fished."
– And add to the end of the one sentence second paragraph: "Those who had participated

prior to rationalization, and met qualifying criteria, received some quota share at the time of program implementation."

Clause 3.2.4 – add a sentence at the end that reads: "Many groundfish fisheries have closed areas or restricted harvest to protect crab and their habitat."

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.

B	**Science and Stock Assessment Activities**

4. There must be effective fishery data (dependent and independent) collection and analysis systems for stock management purposes.

This section adequately describes the extensive state and federal data collection process, including information from onboard crab observers in the directed fishery and the levels of crab bycatch in the groundfish fisheries as recorded by their onboard groundfish observers.

Clause 4.1 – At the bottom of paragraph 2, under Bristol Bay red King crab, redraft the last sentence to read: "Catches declined significantly in the 1980s due to a well documented regime shift that resulted in warming ocean conditions. Crab stocks have stayed at low levels relative to historic catch levels up to the present day."
– At a sentence at the end of the third paragraph under Eastern Bering seasonal crab: "New research, including cold water handling mortality assessment during the 2012 fishery, may modify this mortality rate for BS SC pot bycatch in the future."

Clause 4.1.2 – Add a sentence to the first paragraph after "verified in real-time" that reads: "This data is clearly timely, since it is used to close or modify the fishery in-season."

Clause 4.2 – Add a sentence to the end of the last paragraph: "These concerns are associated with the harvest of halibut and groundfish, rather than the industrial crab fleet."

Clause 4.3.1 – Start this clause with: "See clauses 2.5, 2.6, and 4.3 which describe how data is collected and maintained."

Clause 4.4 – You may want to note that the University Seafood Technical Center in Kodiak has had numerous development programs to utilize fish and shellfish. Also, Alaska Fisheries Development Foundation (AFDF) has a long history related to promoting and developing fish and fish species as food. (see www.afdf.org)

Clause 4.10 – Delete the second sentence and last sentence which deal with "developing countries"; not an issue with this clause. Add the following at the end of the last sentence: "Therefore, these three fisheries do not qualify as 'previously unfished or very lightly fished'. For the past 40 years, the U.S. Congress, through the NMFS, has rendered technical and financial support for research, and conservation and management."

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.

5. There must be regular stock assessment activities appropriate for the fishery resource, its range, the species biology and the ecosystem and undertaken in accordance with acknowledged scientific standards to support optimum utilization of fishery resources.
This section adequately describes the joint state and federal research activities that resulted in stock assessment for the three species of Bering Sea crab. **Clause 5.1 – First paragraph: note that the fisheries are jointly managed and that BOF and ADFG participate with the Council and the NMFS under the FMP. In front of the last paragraph note that: "Both ADFG & NMFS maintain research facilities, where professional staff are provided educational and advancement opportunities."** **Clause 5.1.1 – First line should also note that the fisheries are jointly managed by the NPFMC & the BOF.** **– In the 5th paragraph note that the Center for Independent Experts is a review panel of national and international experts.** **Clause 5.3 – End of second paragraph: note that Canadians scientists were invited to discuss snow crab management at the annual Inner Agency Research Meeting and that international scientists also attended and contributed their expertise at various Lowell Wakefield symposiums.** **The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.**

C	The Precautionary Approach

6. The current state of the stock must be defined in relation to reference points or relevant proxies or verifiable substitutes allowing for effective management objectives and target. Remedial actions must be available and taken where reference point or other suitable proxies are approached or exceeded.
There is a significant amount of information within the Council and BOF process that describes state/federal precautionary management. The drafters of this section have done an excellent job in detailing the information required for certification. I have no comments; they have completed their job admirably.
7. Management actions and measures for the conservation of stock and the aquatic environment must be based on the Precautionary Approach. Where information is deficient, a suitable method using risk assessment must be adopted to take into account uncertainty.
This section describes how the various management measures and actions that assure conservation of the resource are based on the precautionary approach and account for uncertainty. The drafters again completed a rigorous review that describes the available information by which this is accomplished. Other than a few editorial comments, the section addresses the task. **Clause 7.1.1 – In paragraph 2, 6 lines down, it states that "The lower the tier a given crab stock is managed under, the <u>more</u> conservative the determination of OFL/ABC and ACL are." This was a simple drafting error, I'm sure the drafter meant to say that the lower the tier, the <u>less</u> conservative the determination of OFL/ABC and ACL are. This is because more conservative determinations are at the higher tier levels.**

– Add a new short paragraph after paragraph 2 and before paragraph 3. "When adequate scientific information appears to be lacking, crab management is always precautionary. Findings of insufficient information will lead to research priorities that determine such information necessary to improve management. The following are examples of such activities: "

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.

D	Management Measures

8. Management must adopt and implement effective measures including; harvest control rules and technical measures applicable to sustainable utilization of the fishery, and based upon verifiable evidence and advice from available scientific and objective, traditional sources.

Again, this section reflects the high standards that the drafters held themselves to in the certification process. Other than a few minor editorial notations, Section 8 more than adequately describes management measures to assure sustainability of this resource.

Clause 8.1 – End of 3rd paragraph: the drafter notes that we should "see section 6.1.4 for further details" I would also include all of section 6, or at least section 6.1.

Clause 8.2 – Rewrite the end of the first sentence in the six paragraph on CDQ's to read: "… Economic development in economically distressed Western Alaskan native villages." This was the original Council justification in the motions.

Clause 8.3 – Second sentence of the first paragraph should note that capacity of the fisheries were originally restricted based on qualifying participation during the years 1988-1998 where qualifying individuals received an LLP in 2002. This resulted in significant consolidation. Further substantial consolidation in capacity resulted with the crab rationalization program in 2005. (delete next sentence and continue on with) "In both the Bristol Bay…"

Clause 8.4 – first paragraph: for consistency, here and other places, use BSAI instead of BS/AI.

- **You might add at the end of this clause a notation that additional operational flexibility is being evaluated under NPRB project 917, evaluating handling mortality in the snow crab fishery. The final component of this study, field observations on the effects of cold weather on handling mortality, is been conducted during this winter's 2012 fishery.**

http://project.nprb.org/view.jsp?id=830b2825-1af7-4912-aced-0b3f90719056

Clause 8.4.1 – Add a small section to the end of this clause that notes there are groundfish closure areas, or trawl protection areas, to minimize the impact of groundfish harvests on crab resource. See:
http://www.fakr.noaa.gov/npfmc/conservation-issues/habitat-protections.html

Clause 8.4.2 – Add a clause in the last line to the first paragraph that reads: "… mortality have been researched and conservation sensitive modifications to gear have evolved since the 1990s (see citations below). These have been included …"

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.

9. There must be defined management measures, designed to maintain stocks at levels capable of producing maximum sustainable levels.

Certification authors have again more than adequately addressed the issues of this section, describing management measures needed to maintain stocks at levels that produce maximum sustainable yields. I have proposed some minor clarifications and additions to supplement this already adequate documentation.

Clause 9.3 – in the first paragraph, last sentence, add the words "of the directed fishery" after the word "footprint". (Repeat this clarification in clause 9.4 first paragraph)

Clause 9.4 – end of clause, "see also clause 8.4 and 8.4.1"

Clause 9.5 – end of clause "see also clause 8.4 and 8.4.2"

Clause 9.6 – paragraph 2 states that: (1) "most enforcement of IFQ/IPQ violations, as well as size, sex and season violations occur at offloading." While this is true, there is still significant at-sea enforcement by the State Fish & Wildlife Troopers where they pull pots and check gear on the grounds with the E/V Stinson. (2) "Alaska wildlife troopers perform pot and vessel hold inspections prior to each fishing season." While they may assist once in awhile, most all of the pot and vessel hold inspections are performed by ADFG staff in Dutch Harbor and other ports adjacent to the Bering Sea. Also, information that is important to enforcing regulations results from the onboard crab observer program, after the observers information is turned over to Alaska wildlife troopers.

Clause 9.7 – end of clause should note that the annual interagency crab meetings also provide national and international cooperation on research and management issues.

Clause 9.9 – prior to the first sentence add: "While there are no artificial structures been placed in BS AI crab habitat, two GOA research structures have been developed (see following Clause 9.9.1)"

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.

10. Fishing operations must be carried out by fishers with appropriate standards of competence in accordance with international standards and guidelines and regulations.

Section 10 adequately describes the various state and federal educational opportunities available for fishers to be trained in safety, professional competence, and understanding the regulatory regime under which they work. I have no comments on the individual clauses.

E	**Implementation, Monitoring and Control**

11. An effective legal and administrative framework must be established and compliance ensured, through effective mechanisms for monitoring, surveillance, control and enforcement for all fishing activities within the jurisdiction.

Section 11 adequately describes the legal and administrative frameworks that assure compliance of the management regulations through the effective means of monitoring, surveillance and enforcement.

Clause 11.1 - paragraph 1 states that: (1) "most enforcement of IFQ/IPQ violations, as well as size, sex and season violations occur at offloading." While this is true, there is still significant at-sea enforcement by the State Fish & Wildlife Troopers where they pull pots and check gear on the grounds with the E/V Stinson. (2) "Alaska wildlife troopers perform pot and vessel hold inspections prior to each fishing season." As noted in Clause 9.6, while troopers may once in awhile help, most all of the pot and vessel hold inspections are performed by ADFG staff in Dutch Harbor and other ports adjacent to the Bering Sea.
Also, information that is important to enforcing regulations results from the onboard crab observer program, after the observers information is turned over to Alaska wildlife troopers.

Clause 11.2 – add to the end of the Clause an additional point: "Additionally, all vessels that land Bering Sea crab shall possess a State of Alaska CFEC permit if they make a commercial landing.

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly

12. There must be a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations.

Section 12 adequately describes the framework for sanctions for violations and illegal activities, noting that the severity of the legal actions support compliance and discourage violations. The Council process includes a presentation by the enforcement committees at each Council meeting that notify the Council and the members of the public of ongoing legal actions against violators of the council's fishing regulations. During these presentations the fishing community is noticed of the enforcement action and the severity of the legal remedy. This constant public reminder of enforcement and legal actions serves as a strong deterrent to those in the fishing community who might consider ignoring the laws. I had no additional comments to the individual clauses in this section.

F	**Serious Impacts of the Fishery on the Ecosystem**

13. Considerations of fishery interactions and effects on the ecosystem must be based on best available science, local knowledge where it can be objectively verified and using a risk based management approach for determining most probable adverse impacts. Adverse impacts on the fishery on the ecosystem must be appropriately assessed and effectively addressed.

Section 13 provides a very extensive, well-written and comprehensive evaluation of the council's consideration of the fishery interactions and effects on the ecosystem. I have only two minor comments.

Clause 13.2.1 – because this clause notes that non-target catches, including discards, "shall be monitored", I would add information this clause with information about the observer coverage described in the earlier sections of this assessment report.

Clause 13.5.1 – While this clause requires the assessment and scientific evaluation of the impacts on habitat, the fisheries and the ecosystem prior to the introduction of commercial scale fishing

gear, I believe this is the clause where you should note the exclusion of two fishing gears originally used by foreign fishers and early U.S. crab resource explorers. Tangle nets and trawl gear were used to harvest crab prior to the 1970s. Neither gear is now lawful due to the scientific assessment of their indiscriminate (sex, size and species) harvest and quality issues associated with trawl caught crab. **The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.**

Peer Reviewer B review

Summary and Recommendation

The evidence presented in Section 7 of this report clearly supports high confidence ratings for all 13 fundamental clauses of the Conformance Criteria and each of the three units of assessment merits certification under the FAO-Based RFM Certification Program.

For the most part, high confidence ratings for sub-clauses are well supported by the evidence, however, there are shortcomings, detailed below, in a fair number that the assessment team will be able to address fairly readily. Given that survey biomass estimates are treated as absolute values, more details on catchability values and how they were derived should be provided. A source of confusion and some concern relates to many sub-clauses dealing with issues involving other "States". In some cases it is clear that this means other countries, in others it seems to mean other adjacent States of the Union (US), of which there are none for Alaska. Whether States consistently means other countries should be made clear up front. In some instances, the evidence presented does not address the issue, in others the issue is not really applicable. Nonetheless, much of the information is well worth providing in the context of the big picture. All of these should be re-visited and a determination made regarding applicability of the issue and whether the evidence presented actually addresses it. If the issue is not applicable, a simply statement to that effect along with a brief explanation and no confidence rating should suffice.

Full Summary of comments

SECTION	
A	**Fisheries Management System**

5. There must be a structured and legally mandated management system based upon and respecting International, National and local fishery laws and considering other coastal resource users, for the responsible utilization of the stock under consideration and conservation of the marine environment.

The discreteness of each of the three units of assessment needs clarification. It was pointed out in the Background section that each crab “stock” under consideration should be shown in relation to overall species distribution along with management unit boundaries in relation to those for fisheries on the same species in adjacent areas. Present whatever evidence there is for biological unity, but no one has to be convinced that these represent discrete stocks as such. Statements in the Background regarding red king crab stocks are pretty definitive and one should be cautious in that regard unless the evidence is convincing. It would be fair enough to indicate they are treated as stocks for management purposes, which may the case here, but it seems more likely they are localized populations or stock components than individual stocks.

There is no mention of the genetics research presented here for red king crab in the Background to support the stock separation presented there. There is mention in the Background of some genetics research on blue king crab, but here it states that it has only been completed for red king crab – referring to different studies no doubt, but whatever is available should be presented here.

Including Figs. 6, 22 and 33 from the NMFS survey, rather than just referring to them, might be helpful here.

1.2.1 The evidence presented doesn’t really address the issue raised.
1.2.2 This is a superficial consideration of the issue and, as pointed out in 1.2 above, some clear evidence by way of illustration of the crab populations (stock components) under assessment in relation to overall distribution and adjacent fisheries is needed.
1.2.3 Is the groundfish bycatch mortality assumed to be 80% for each of the three species? State what the crab discard mortality is and whether it’s the same for each species.
1.3 and 1.3.1 The evidence presented does not address the issues raised in these sub-clauses. However, it appears the issues are not relevant or applicable. An explanation for why these are not applicable should suffice in which case no confidence rating should be necessary.
1.4, 1.4.1 and 1.4.2 The wording of these sub-clauses appears to pertain to different countries as opposed to neighbouring US States, of which Alaska has none. Either way, the issues are not really applicable.
1.5. The issue seems to pertain to different countries and probably not applicable.
1.6 and 1.6.1. The information is worth presenting, but these issues pertain to multi-State fisheries and appear not to be applicable (1.6 about financing is applicable, 1.6.1. is agreed as not applicable).
1.8. A High rating is intended and warranted, but not indicated.
1.9. The issue is not applicable.

While a High confidence rating for fundamental clause 1 overall is well supported, the concerns identified need to be addressed.

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.

2 Management organizations must participate in coastal area management related institutional frameworks, decision-making processes and activities relevant to the fishery resource and its users in support of sustainable and integrated use of living marine resources and the avoidance of conflict among users.

Insert comments here.

2.7. In this sub-clause, States seems to pertain to different countries, but this is not clear. However, one would expect the issue to be dealing with adverse transboundary environmental effects associated with fishing, not some other industry.

A High confidence rating for fundamental clause 2 is well supported.

The assessment team has evaluated all the comments put forward. States is intended as Countries. The clause was re-evaluated and deemed not applicable as none of the three stocks under assessment are shared, straddling or transboundary resources.

3 Management objectives must be implemented through management rules and actions formulated in a plan or other framework.

Insert comments here.

A High confidence rating for fundamental clause 3 is well supported.

B	**Science and Stock Assessment Activities**

4 There must be effective fishery data (dependent and independent) collection and analysis systems for stock management purposes.

Insert comments here.

4.1.1. There should be a more detailed description of the NMFS trawl survey provided here. Eg, is a liner used in the cod end, mesh size, size of rollers in ground gear, etc? A map illustrating the broad coverage and distribution of the fixed stations would be very helpful. There should be more detailed consideration of assumptions (or estimates?) regarding catchability for the different size components for which biomass estimates are generated for each of the three species. Catchability is mentioned very briefly in the snow crab portion of 3.4 in the Background where further comments are made. Given that biomass estimates are treated as absolute values, catchability values and how they were derived should be provided. There should also be a description of biomass estimation procedures in terms of how it is derived for each of the three localized units of assessment from this very broad-scale survey.

4.7, 4.9, 4.10 and 4.11. These sub-clauses appear not to be applicable. Note misspelling in sub-clause 4.9 itself – anti should be and.

Despite the foregoing, a High confidence rating for fundamental clause 4 is well supported.

The assessment team has evaluated all the comments put forward and has revised/added the information in the text accordingly.

5. There must be regular stock assessment activities appropriate for the fishery resource, its range, the species biology and the ecosystem and undertaken in accordance with acknowledged scientific standards to support optimum utilization of fishery resources.

Insert comments here.

A High confidence rating for fundamental clause 5 is well supported.

C	The Precautionary Approach

6. The current state of the stock must be defined in relation to reference points or relevant proxies or verifiable substitutes allowing for effective management objectives and target. Remedial actions must be available and taken where reference point or other suitable proxies are approached or exceeded.

Insert comments here.

6.1, 6.1.1 and 6.1.2. In conventional precautionary approach (PA) terminology, the word limit is used to identify the lower reference point. It would avoid some confusion to not keep stating that MSY is treated as a limit. The target (or upper) reference point is generally something substantially less than an estimated MSY and the limit (or lower) reference point is quite substantially lower. The maximum harvest rate is allowed only above the target and must be reduced below and essentially eliminated at the limit. It would be helpful if the approach in Alaskan crab fisheries could be stated more clearly with respect to this general, conventional understanding.

This clarification has been made.

Reference points are generally based on spawning stock biomass. There should be some fairly brief, straightforward explanation/rationalization for using mature male biomass. Females are not harvested and their retention is prohibited, there appears to be no statement to that effect until fundamental clause 8 is considered. There should be some consideration of what is known about female natural mortality rates, fluctuations in their abundance and the nature of the spawning stock-recruitment relationship for each of the three species.

Assessment Team. 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 optimum yield. 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 but 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 the BSAI crab 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.

Has there been any concern about potential consequences, in terms of reduced genetic diversity, associated with the fishery targeting large males and allowing too much mating by males that mature at small sizes? Any comment that could be made in that regard? More details about the mature male biomass MMB should be provided. What size range is included? Again, there appears to be no mention of a minimum legal size in the fishery until fundamental clause 8 is considered. Is any of this MMB smaller than minimum legal size? Do any males mature at sizes smaller than the MMB range?

Assessment Team. *Directed Fishery Effects on Target Crab, Age-At-Maturity and Reproduction*

In the BSAI, minimum size limits for male crab are established based upon the estimated average size-at maturity with the intent of allowing males to mate at least once before becoming harvestable. Females are not harvested and fishing seasons are timed to protect the crab when they are molting and mating (NPFMC 2008). It is possible that male-only fisheries with minimum size limits reduce the abundance of large crab; however this has not been examined for Bering Sea crab stocks. In Glacier Bay National Park and Preserve, located at the northern end of the southeastern Alaska panhandle, the number and size of legal-sized male Dungeness crab increased significantly after the closer of the park to commercial fishing. Females and sub-legal males were not targeted by the commercial fishery and these crab did not increase in size or abundance following the closure of the fishery (Taggart et al. 2004). Commercial fishing in Glacier Bay National Park and Preserve appeared to have altered the size structure of male Dungeness crab which may also be occurring within EBS crab stocks.

Over time, size-at-maturity may be reduced due to fishing-induced mating selection in male-only fisheries (Zheng 2008). A significant decline in size at 50% maturity of male Bristol Bay Tanner crab may be the result of genetic responses to the fishery. Fast-growing males may not have an opportunity to mate prior to being harvested in the fishery, whereas slow-growing males may undergo their terminal molt to maturity before reaching the legal size limit and therefore mate (Zheng 2008). Recent analysis of the economic and biological impact of reducing the legal size of Tanner crab in the EBS concluded that a reduction would result in decreased handling mortality in the directed fishery of the terminally molted, sublegal males due to the increased CPUE from the smaller legal males but handling mortality would not be reduced in other fisheries (Bechtol et al. 2010). A reduction in legal-sized Tanner crab may also reduce potential risk of genetic effects from removing only the larger males (Zheng and Pengilly 2010). A reduction in the abundance of large males may result in the mating of less fecund males, reduced female mate choice and an increased chance of sperm limitation (Smith and Jamieson 1991; Sato et al. 2005a; Sato et al. 2006; Sato and Goshima 2006; Sainte-Marie et al. 2008). Male size and mating frequency affects reproductive success of many crab species. In general, larger males are more successful at mating (production of a fertilized egg clutch) and can successfully mate with multiple females (Paul and Paul 1990; Paul and Paul 1997; Sato et al. 2005b; Sato and Goshima 2006). Based upon manipulation population studies of a smaller lithodid crab species, *Hapalogaster dentate,* a decrease in male size and sex ratio would result in sperm limitation (Sato and Goshima 2006). Laboratory research and field studies in eastern Hokkaido, Japan suggested that sperm limitation could occur in fished populations of *Paralithodes brevipes* (Sato et al. 2005b). Large male snow crab from heavily harvested stocks in the Gulf of St. Lawrence, Canada have small amounts of spermatophores in their vas deferens which is in contrast to higher levels observed in lightly or not fished stocks (Conan and Comeau 1986; Sainte-Marie et al. 1995). In heavily exploited snow crab stocks, a high percent of males may be harvested upon reaching morphometric maturity resulting in an inability of mature males to accumulate a sufficient number of spermatophores necessary to successfully mate (Conan and Comeau 1986; Sainte-Marie et al. 1995). In the EBS, female snow crab sperm reserves increase with female size and appear to generally be lower than other snow crab stocks (Slater et al. 2010). Limited sperm reserve data from EBS snow and Tanner crab suggest that in 2005 less than one half of primiparous females sampled had sufficient sperm reserves to fertilize a full second clutch of eggs (Gravel and Pengilly 2007). Alternately, in northern California, nearly all molting female Dungeness crab mate regardless of size despite intense fishing on males (Hankin et al. 1997). The short and long term effects of removing large male crab from a population are not well understood and may vary by species and population.

http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf

A High confidence rating for fundamental clause 6 is well supported.

7. Management actions and measures for the conservation of stock and the aquatic environment must be based on the Precautionary Approach. Where information is deficient, a suitable method using risk assessment must be adopted to take into account uncertainty.

Insert comments here.

7.1. The wording of this sub-clause has to do with broader, general application of the PA to aquatic resources and the aquatic environment. This issue isn't being addressed here.

7.2, 7.2.1 and 7.2.2. The wording of these sub-clauses clearly indicate they have to do with new and exploratory fisheries and are really not applicable.

While a High confidence rating for fundamental clause 7 is generally supported, some evidence regarding broad application of the PA to the aquatic environment should be included.

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.

D	Management Measures

8. Management must adopt and implement effective measures including; harvest control rules and technical measures applicable to sustainable utilization of the fishery, and based upon verifiable evidence and advice from available scientific and objective, traditional sources.

Insert comments here.

A High confidence rating for fundamental clause 8 is well supported. Note that the High for evidence adequacy rating has not been ticked for any of the sub-clauses.

9. There must be defined management measures, designed to maintain stocks at levels capable of producing maximum sustainable levels.	
Insert comments here. 9.3. Some minor editing required in 5th and 6th paragraphs. 9.8. The issue identified in this sub-clause has clearly been addressed, but a sentence or two mentioning the extent of the collaborative (international/national?) aspect of all the research, as wording alludes to, might be included. 9.9. The evidence has to do with general habitat protection/restoration. Wording of the sub-clause has to do with use of artificial reefs for enhancement and their placement with regard to navigation. The issue identified is not really applicable. 9.9.1. The evidence describes local artificial-reef initiatives that have nothing to do with the crab populations under consideration. The issue identified in the wording of the sub-clause has to do with selection of materials for and location of artificial reefs and observing international conventions, etc. It is not really applicable. A High confidence rating for fundamental clause 9 is well supported. Note that the High evidence adequacy rating is not ticked for any of the sub-clauses. **The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.**	
10. Fishing operations must be carried out by fishers with appropriate standards of competence in accordance with international standards and guidelines and regulations.	
Insert comments here. A High confidence rating for fundamental clause 10 is well supported.	
E	**Implementation, Monitoring and Control**
11. An effective legal and administrative framework must be established and compliance ensured, through effective mechanisms for monitoring, surveillance, control and enforcement for all fishing activities within the jurisdiction.	
Insert comments here. 11.3 and 11.3.1. The issues identified here are not applicable. 11.4 and 11.4.1. The issues identified are not applicable. A High confidence rating for fundamental clause 11 is well supported. **The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.**	

12. There must be a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations.

Insert comments here.

12.2 and 12.2.1. The wording of these two sub-clauses is only very subtly different from 12.1 and 12.1.1 and probably do not reflect the issues intended – the intent presumably deals with countries policing its vessels that fish in waters outside its jurisdiction. The evidence presented probably adequately addresses the intended issue, but it is not applicable.

A High confidence rating for fundamental clause 12 is well supported.

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.

F	Serious Impacts of the Fishery on the Ecosystem

13. Considerations of fishery interactions and effects on the ecosystem must be based on best available science, local knowledge where it can be objectively verified and using a risk based management approach for determining most probable adverse impacts. Adverse impacts on the fishery on the ecosystem must be appropriately assessed and effectively addressed.

Insert comments here.

13.2. The evidence just gives a brief summary of bycatch. A summary of the measures to minimize bycatch, as alluded to, should be included along with reference to the sub-clause where the details are provided.
13.2.1. Reference to 13.2 does not provide the evidence required to adequately address the issue. Cite others where the issue identified is treated in some detail.

A High confidence rating for fundamental clause 13 is well supported. Note that the High evidence adequacy rating is not ticked for any of the sub-clauses.

The assessment team has evaluated all the comments put forward and has revised the information in the text accordingly.

9. Non-Conformances and Corrective Actions

Non conformances are categorized as minor, major and critical non conformances. Where the Assessment Team concludes that the available evidence does not meet the 'high' confidence rating for a specific clause of the Conformance Criteria, and on further clarification with fishery management organizations, the outcome remains unchanged; a non conformance may be raised against that particular clause.

Based on the high quality of information and reports available and through the course of consultation and witnessing the various management processes, the assessment team was highly confident of the responsible fisheries management that is demonstrated by the Alaska BSAI king and snow crab commercial fisheries in accordance with the FAO-Based RFM conformance criteria.

Items for future surveillance action

Two items are noted for future surveillance review.

Clauses 9.1, 13.1.1, 13.1.4, 13.5.	The last EFH review (2010) identified impacts of trawling on EFH habitat of red King Crab in Bristol Bay. These are being considered accordingly by the NPFMC. Summary of Effects - There is an area of overlap between current female red king crab distribution and areas where trawling occurs in the southern Bristol Bay. Southern Bristol Bay is an important spawning ground for red king crab and heavy trawling there could greatly impact the crab spawning success. Trawling in deeper waters also somewhat overlaps the migration route to mating areas. There are essentially no fishing effects in areas important to juvenile red king crab. All known juvenile rearing areas are currently protected by trawl closure areas. Most of the distribution of red king crab was to the north and east of the high fishing effects areas during the past 15 years. However, a high density of mature female crab were found in the heavy trawling area during 2008-2009, and it appears that mature female crab moved back to the historical important spawning ground in the southern Bristol Bay. **Given the current overlap, trawling intensity in the southern Bristol Bay, and the importance of the spawning ground there, professional judgement indicates that trawling fisheries have currently adversely affected the EFH of red king crab.** This heavy trawling could impact the stock recovery and jeopardize the ability of the stock to produce MSY over the long term. Beyond trawling in the southern Bristol Bay, other fishing may have minimum impacts on red king crab EFH. In this regard, a staff discussion paper is been developed by the Council and the NMFS in March 2012. Here, options for Council action include: •Revise the effects of EFH evaluations. •No management action, but encourage further research in this area to better understand adult, juvenile and larval distribution and habitat usage. •Extend or establish trawl closure areas in the affected area as EFH conservation measures.

	•Extend the range of the red king crab savings area to protect more of the stock. •Apply a seasonal closure to protect the adult female red king crab from March to May during molting and mating. •Close area southwest of Amak Island. •Designate a HAPC priority for areas important for red king crab egg hatching, and consider designating this area as a HAPC. This specific item is scheduled for discussion on the Council session post October 2012 meeting and will be reviewed accordingly by the assessment team. http://www.fakr.noaa.gov/npfmc/PDFdocuments/conservation_issues/EFH/EFH DiscPaper411.pdf
Clause 13.1.2	Directed Fishery Effects on Target Crab, Age-At-Maturity and Reproduction In the BSAI, minimum size limits for male crab are established based upon the estimated average size-at maturity with the intent of allowing males to mate at least once before becoming harvestable. Females are not harvested and fishing seasons are timed to protect the crab when they are molting and mating (NPFMC 2008). It is possible that male-only fisheries with minimum size limits reduce the abundance of large crab; however this has not been examined for Bering Sea crab stocks. The short and long term effects of removing large male crab from a population are not well understood and may vary by species and population according to available evidence. The assessment team will verify next year if new information has been made available to improve understanding of this delicate subject. http://www.fakr.noaa.gov/npfmc/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf

10. Recommendation and Determination

The Assessment Team recommend that the management system of the applicant fishery, the U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries [Bristol Bay Red King Crab *(Paralithodes camtschaticus)*, Eastern Bering Sea Snow Crab *(Chionoecetes opilio)* and St. Matthew Island Blue King Crab (*Paralithodes platypus)*] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) and subject to a federal [National Marine Fisheries Service (NMFS)/North Pacific Fishery Management Council (NPFMC)] and state [Alaska Department of Fish and Game (ADFG) & Board of Fisheries (BOF)] joint management regime, is certified against the FAO-Based Responsible Fisheries Management Certification Program.

Certification Committee Determination

The appointed members of the Global Trust Certification Committee met on the **16th April 2012**. After a detailed discussion, the Committee determined that the management system of the applicant U.S. Alaska King and Snow Crab Bering Sea commercial fisheries [Bristol Bay Red King Crab *(Paralithodes camtschaticus)*, Eastern Bering Sea Snow Crab *(Chionoecetes opilio)* and St. Matthew Island Blue King Crab (*Paralithodes platypus)*] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) and subject to a federal [National Marine Fisheries Service (NMFS)/North Pacific Fishery Management Council (NPFMC)] and state [Alaska Department of Fish and Game (ADFG) & Board of Fisheries (BOF)] joint management regime, is certified against the FAO-Based Responsible Fisheries Management Certification Program.

11. References

Full citation	Url
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Appendix 1

Alaska crab Assessors

Based on the Technical expertise required to carry out the above fishery assessment, Global Trust Certification Ltd. confirmed the Assessment Team members for this fishery as follows.

Dr. Thomas C. Shirley

Dr. Thomas C. Shirley is a noted authority on high latitude crabs. He is a Professor Emeritus at the University of Alaska Fairbanks, where he was a Professor of Marine Biology for 23 years (1982-2005). He was the Endowed Chair of Biodiversity and Conservation Science at the Harte Research Institute from 2005 to 2011, and is currently Professor of Marine Biology at Texas A&M University-Corpus Christi. Dr. Shirley received his Ph.D. from Louisiana State University and his M.S. and B.S. degrees from Texas A&I University. In addition to his many other publications, Dr. Shirley has authored or co-authored more than 90 peer-reviewed publications, symposium proceedings and technical reports on crabs, including two books, on crab biology, ecology and management. Most of these publications were on red, blue and golden king crabs, Tanner and snow crabs, and Dungeness crabs in Alaska. Dr. Shirley served on the Crab Plan Team of the North Pacific Fisheries Management Council from 1985 to 2005, and reviewed the management plan for king crabs in Southeast Alaska for the Alaska Department of Fish and Game in 2006. Dr. Shirley has received many awards and honorifics, served on national and international panels, and chaired many symposia and workshops on crab biology. Many of his former graduate students now serve in management roles in state and federal agencies or in academic positions in Alaska and throughout the world. Dr. Shirley remains actively involved in research on high latitude and deep-water crab biology and management.

Herman Savikko

Herman Savikko worked for the Alaska Department of Fish and Game for 30 years. Mr. Savikko was involved in the development and reporting of management strategies for finfish/shellfish fisheries throughout the State for more than 21 years. This included participation in the Board of Fisheries process where seasons, harvest limits, pot limits, and other regulations were established. Mr. Savikko tracked development and implementation of the BSAI crab vessel buy-back program. As the State/Federal Marine Fisheries Coordinator on the Commissioner of Fish and Game's team, he was involved in the development and implementation of the federal Crab Rationalization (Voluntary 3-Pie Cooperative) program in the Bering Sea/Aleutian Islands, participating as a team member in initiating the design of program dynamics like quota shares, fishery cooperatives, A, B and C share determinations, community protection measures, regionalization requirements, and other conditions of the fishery. He was also a voting member of the North Pacific Fishery Management Council's Crab Plan Team for nine years, assisting in the production of SAFE documents and working on recommendations of TACs, ACLs, and OFLs.

Dr. Julian Addison

Julian Addison has over 25 years experience of stock assessment and provision of management advice on shellfish fisheries. After completing a PhD on population ecology and modelling at Imperial College, London he moved to the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) in Lowestoft, England which is the UK Government's marine science agency for environment, fisheries and aquaculture science. Until December 2010 when he left CEFAS to become an independent consultant, he was Senior Shellfish Advisor to Government policy makers, providing advice on the status, sustainable management and development of wild shellfish stocks in England and Wales, a role which involved working closely with marine managers, legislators and stakeholders, Government Statutory Nature Conservation Organisations and environmental NGOs. Alongside his advisory role, he conducted extensive scientific research on crustacean biology and population dynamics working primarily on edible crabs, spider crabs, lobsters, Nephrops and shrimps, but also worked on projects involving a wide range of mollusc species and on the inshore trawl, net and line fisheries. He has also worked as a visiting scientist at Department of Fisheries and Oceans in Halifax, Nova Scotia and at the National Marine Fisheries Service in Woods Hole, Massachusetts where he undertook collaborative research on crabs and lobsters and experienced shellfish management approaches in North America. He has worked extensively with ICES and was Chair of the Working Group on the Biology and Life History of Crabs, a member of the Working Group on Crangon Fisheries and Life History and a member of the Steering Group on Ecosystems Function. Recent work includes peer reviews of MSC assessments of lobster and coldwater prawn fisheries in North America and Europe, and a review of the stock assessment model for blue crabs in Chesapeake Bay, USA.

Vito Ciccia Romito

Vito holds a BSc in Ecology and an MSc in Tropical Coastal Management (Newcastle University, United Kingdom). His BSc studies focused on bycatch, discards, benthic impact of commercial fishing gear and relative technical solutions, after which he spent a year in Tanzania as a Marine Research officer at Mafia Island Marine Park carrying out biodiversity assessments and monitoring studies of coral reef, mangrove and seagrass ecosystems. Subsequently, for his MSc, he focused on fisheries assessment techniques, ecological dynamics of overexploited tropical marine ecosystems, and evaluation of low trophic aquaculture as a support to artisanal reef fisheries. Since 2010, he has been fully involved through Global Trust with the FAO-based RFM Assessment and Certification program covering the Alaska commercial salmon, halibut, sablefish, pollock, king and snow crab fisheries and the Icelandic cod, haddock, seithe and redfish fisheries.

Dave Garforth (Lead Assessor)

Dave Garforth, BSC, HDip. (Applied Science), MSC has been involved in fisheries and aquatic resources for over 20 years. Currently, managing Global Trust FAO based Fishery Certification Program, with experience in the application of ISO/IEC Guide 65 based seafood certification systems and a professional background in numerous fishery assessments. Previous professional background includes; Development Officer in the Irish Sea Fisheries Board, supply chain and trade experience at Pan European Fish Auctions, the control and enforcement of fisheries regulations as a UK Fishery Officer. Dave is also a lead, third party IRCA approved auditor.

Appendix 2

Based on the Technical expertise required to carry out the above fishery assessment, Global Trust Certification Ltd. confirmed the External Peer Reviewers members for this fishery as follows.

Dr. Jerry Ennis

Following undergraduate and graduate degrees at Memorial University of Newfoundland in the 1960s, Dr. Ennis completed a Ph.D. in marine biology at University of Liverpool in the early 1970s. He retired in 2005 following a 37-year research career with the Science Branch of the Department of Fisheries and Oceans. His extensively published work (40 in the primary, peer reviewed literature) has focused primarily on lobster fishery and population biology and on various aspects of larval, juvenile and adult lobster behaviour and ecology, as well as snow crab biology in Newfoundland waters. Throughout his career, Dr. Ennis was heavily involved in the review and formulation of scientific advice for management of shellfish in Atlantic Canada as well as the advisory/consultative part of managing the Newfoundland lobster fishery. In retirement, published several articles aimed at presenting fishery science primarily to harvesters but to other interested parties as well, and participated in four MSC certification projects as reviewer or assessor.

Earl Krygier

Earl E. Krygier gained a BSc in Science, an MSc from the Department of Fisheries and Wildlife, and completed a Ph.D Doctoral Thesis (on the role of nursery areas for juvenile English sole off Oregon) at the Oregon State University. From 1989 to 2008 he worked for ADFG's Commercial Fisheries Division as Extended Jurisdiction Program Manager with primary responsibility on state policy coordination of state, national and international marine fishery matters (research, conservation and management, and policy development), provided support for ADFG's Commissioner in carrying out his NPFMC's responsibilities and acting as the Commissioner's alternate (1989-1997). Earl represented ADFG at the IPHC for 19 years, and he was state representative at the Donut Hole and the U.S./Russian ICC meetings. He sat as alternate for the Commissioner on the North Pacific Research Board (NPRB); represented ADFG on Alaska's CDQ Allocation Team; advised department staff, the Alaska BoF members, the Alaska Legislature and other state officials on NPFMC activities; and proposed management plans, long-range policies and regulatory implications, or inter-jurisdictional issues arising from Council actions. He coordinated ADFG's staff activities at the NPFMC and recommended policies and strategies to the director, commissioner and other state officials in regards to extended jurisdictional fisheries.

From 2008 to present times he is the Owner/Manager of KEE Biological Consultants and served as the Marine Conservation Alliance Foundation's (MCAF) Cooperative Research Coordinator, implementing MCAF's marine research activities in Alaska in cooperation with state or federal agencies, academia, the seafood industry and other interested parties.

Appendix 3

Summary of the Certification of Alaska crab fisheries

Alaska Bering Sea King and Snow crab commercial fisheries are awarded certification to the FAO Based Responsible Fisheries Management Program.

Certification Determination

On the 16th April 2012 a positive Certification determination was awarded for the *fishery management of the U.S. Alaska Bering Sea King and Snow crab commercial fisheries,* against the FAO-based Responsible Fisheries Management (RFM) Certification Program (Conformance Criteria version 1.2)[1]. The assessment was performed at the request of the Alaska Seafood Marketing Institute (ASMI). This document provides a concise summary of the assessment information and certification decision.

The Full Assessment and Certification Report will be made available for download on request at Global Trust and ASMI's websites after the 25th May 2012: www.GTCERT.com and http://sustainability.alaskaseafood.org/crab-certification

The Units of Certification are the:

- Alaska Bering Sea Bristol Bay Red King crab *(Paralithodes camtschaticus*) fishery fished by pot gear.
- Alaska Bering Sea St. Matthew Blue King crab (*Paralithodes platypus)* fishery fished by pot gear.
- Eastern Bering sea Snow crab *(Chionoecetes opilio)* fishery fished by pot gear.

All the units of certification are within Alaska jurisdiction (200 nautical miles EEZ) and subjected to a federal [National Marine Fisheries Service (NMFS)/North Pacific Fishery Management Council (NPFMC)] and state [Alaska Department of Fish and Game (ADFG) & Board of Fisheries (BOF)] Joint management regime.

The resulting certification communication for the Alaska Bering Sea King and Snow crab commercial fisheries is: ***'Certified Responsible Fisheries Management'*.**

Following the 12 month assessment process, a Global Trust Certification Committee, composed of fishery, certification and accreditation experts, unanimously agreed with the Assessment Team's findings that the applicant Alaska Bering Sea King and Snow crab commercial fisheries are responsibly managed. The assessment and certification considered the effectiveness of management organizations, the robustness of fishery management plans and practices based on objective science and the outcomes of the management decisions and processes for these fisheries.

Background to the FAO Based Responsible Fisheries Management (RFM) Certification

This Certification delivers high confidence that reliable management systems are in place to properly assess and respond to any current and evolving issues and allow the fishery to continue on the path

[1] Version 1.2 (Sept 2011), as derived by the United Nations Food and Agriculture Organization (FAO) Code of Conduct for Responsible Fisheries (1995), the FAO Guidelines for the Eco-Labeling of Fish and Fishery Products from Marine Capture Fisheries (2005) as amended/extended in 2009, and the FAO Fisheries Circular No. 917 by John. F. Caddy (1996).

of responsible management. These management systems are certified as consistent with those recommended by the FAO Code of Conduct for Responsible Fisheries (1995) and FAO Guidelines for the Eco-Labeling of Fish and Fishery Products from Marine Capture Fisheries (2005) and amended/extended in 2009.

This Certification demonstrates responsible management for the sustainable use of the fisheries and is a realistic and tangible communication for this standard and process. The Global Trust Certification lasts for five years and it involves annual surveillance assessments of the fishery. This Certification means that the Alaska Bering Sea King and Snow crab commercial fisheries have met the criteria for certification of responsibly managed fisheries at the point in time of the assessment. Annual surveillance assessments and a full re-assessment every 5 years will be used to verify that fishery management continues to perform responsibly.

The Alaska Bering Sea King and Snow crab commercial fisheries achieved high conformity against all clauses of the FAO-Based RFM Conformance Criteria. The separate peer review evaluations also supported a positive decision for certification. The information considered during the assessment has been collated and recorded. The assessment findings have been documented in a 250 page Full Assessment and Certification Report.

The assessment was conducted by Global Trust Certification according to the International Standards Organization (ISO) Guide 65:1996 procedures for FAO-based Responsible Fisheries Management Certification. ISO Guide 65 is the international general requirements for bodies operating product and process certification systems. The ISO Guide 65 assessment, certification and decision process is governed by the accreditation bodies of the International Accreditation Forum (IAF). Global Trust Certification is accredited by the Irish National Accreditation Board (INAB) who is a member of the IAF.

Details of the Assessment

ASMI, on behalf of Alaska Bering Sea King and Snow crab commercial fisheries, submitted an application to Global Trust Certification for a formal assessment of the these fisheries to the requirements of the FAO-Based Responsible Fisheries Management (RFM) Certification Program.

After the initial site visits and validation assessments an expert Assessment Team was formed to undertake the full assessment. The Assessment Team was composed of independent assessors (Table 1) with expert competency in fishery science and management of commercial crab fisheries.

The Assessment Team's report was peer-reviewed by two additional independent experts (Table 2) before submission to a formal Global Trust Certification Committee (Table 3) for an independent certification decision.

The level of conformance of each fishery was scored against each clause of the FAO Based Conformance Criteria (version 1.2). Conformance ratings were assigned through consensus scoring by the assessment team, based on objective evidence derived and measured from each fishery and verified through on site meetings and consultations.

A. The Fisheries Management System

Fundamental 1

There shall be a structured and legally mandated management system based upon and respecting International, National and local fishery laws, for the responsible utilization of the stock under consideration and conservation of the marine environment.

No. Supporting clauses	17	Non conformances
Supporting clauses used	9	
Supporting clauses N/A	6	
Level of conformity	HIGH	Zero

Summarized evidence:

There is a structured, legally mandated management system based upon and respecting International, National and local fishery laws:

Alaska's Bering Sea and Aleutian Islands (BSAI) crab are managed under the Fishery Management Plan (FMP) for Commercial King and Tanner Crab approved by the United States Secretary of Commerce on June 2, 1989. The NPFMC is the regional council established by the Magnuson-Stevens Fishery Management and Conservation Act (MSFMCA or MSA) to oversee management of the Alaska's fisheries. MSA is the primary layer of governance for Bering Sea crab fisheries. While the NPFMC has responsibility for crab management in the BSAI, the BSAI crab FMP establishes a State/Federal cooperative management regime that defers crab management to the State of Alaska, specifically the department of Fish and Game (ADFG), with partial Federal oversight. The National Marine Fisheries Service (NMFS) Alaska Regional Office is responsible for the management, conservation, and protection of living marine resources within the Alaska EEZ (3-200 nm). The NMFS Alaska Fisheries Science Center (AFSC) in Seattle and the Kodiak Fisheries Research Center (KFRC) generate the scientific information and analysis necessary for the conservation, management, and utilization of the region's crab resources. The NMFS research is used by the NPFMC's Crab Plan Team (CPT) to recommend a Total Allowable Catch (TAC) in each fishery. ADFG uses their recommendations along with the best scientific data available at the time to establish catch limits for each of its crab fisheries in the Bering Sea. All fisheries activities and decisions are subject to conditions established by the MSA as well as actions taken by the Alaska Board of Fisheries (BOF) for all management Category 2 and 3 measures (e.g. size, season, sex, reporting requirements etc...) under the FMP. The BOF and the NPFMC's management arrangements and decision-making processes for the fishery are publically available and can be described as organized in a transparent manner. The Crab Rationalization program, first implemented in 1995, was subject to 18-month, two-year, and five-year program reviews. Refinements continue to occur as the program matures. The NMFS Office of Law Enforcement (OLE) with use of the United States Coast Guard's (USCG) at-sea platforms is primarily responsible for enforcing crab regulations at sea, while the NMFS OLE and the State of Alaska's Division of Wildlife Troopers (AWT) have that responsibility ashore.

The stocks under consideration are well defined:

These are well described and understood by the various science and management entities involved. The Bristol Bay Red King Crab *(Paralithodes camtschaticus)*, Eastern Bering Sea Snow Crab *(Chionoecetes opilio)* and St. Matthew Island Blue King Crab (*Paralithodes platypus)* stocks not considered common, shared, trans-boundary, straddling, highly migratory fish stocks or high seas fish stocks exploited by two or more States and bound by international agreements. The ADFG defines a succinct area under their regulation 5 AAC34.800 Description of Registration Area T, for the single stock Bristol Bay red king crab fishery. The St. Matthew Island blue king crab fishery is defined by specific district boundaries encompassing the fishable population's location, under 5 AAC 34.905 (C)(2) Description of Registration Area Q districts, Saint Matthew Island Section. The district area boundaries for Eastern Bering Sea *C. opilio* snow crab are defined under 5 AAC 35.505 (e)(1) and

(B)(2) Description of Registration Area J districts.

All sources of mortality and removals are considered by the management system and directed crab fisheries removals are well documented through the eLandings system. Crab bycatch in the groundfish bottom trawl fisheries is accounted for by the groundfish observer program, and crab bycatch caps are in place to limit take.

A. The Fisheries Management System

Fundamental 2

Management organizations shall participate in coastal area management institutional frameworks, decision-making processes and activities related to the fishery and its users, in support of sustainable and integrated resource use, and conflict avoidance.

No. Supporting clauses	16	Non conformances
Supporting clauses used	15	
Supporting clauses N/A	1	
Level of conformity	HIGH	Zero

Summarized evidence:

Participation in Institutional frameworks, decision making processes and activities:
The NMFS and the NPFMC participate in coastal area management-related institutional frameworks through the federal National Environmental Policy Act (NEPA) processes. This occurs whenever resources under their management may be affected by other developments and each time they create, renew or amend regulations. The fishery management agencies have processes, committees and groups that allow potential coastal zone developments and issues to be brought to formal review and engagement such as the NPFMC meetings or the BOF meetings. From witnessing the processes, interviews with representatives of these organizations, The Council and the BOF actively encourage stakeholder participation, and all their deliberations are conducted in open, public sessions. Decisions are transparently documented on the various websites of these organizations in a timely manner.

Fishery resource allocation and conflict avoidance:
The primary job of the NPFMC and the BOF is allocation of resources to different users. There is a clear and tangible separation of biological decisions from allocation of fishery opportunities. Rationalization of the fishery has been a long-term objective. Allocation and effort is appropriate to the available resource and promotes responsible fishing practice.

With a Congressionally approved approach creating Processor Quota Shares and Individual Fishing Quotas for rationalized crab fisheries in the BSAI in 2005, the numbers of buyers and sellers were capped, seasons were protracted and vessels were able to join cooperatives that resulted in fewer vessels deploying less gear on the grounds. The economic conditions under which fishing industries operate promote responsible fisheries, and these circumstances are actively reviewed and demonstrated in the analysis by NMFS. ADFG also track ex-vessel value of the fisheries they manage, and produce Annual Management Reports that support the analysis. Decisions are based on both biological and socio-economic information collected and analyzed by NPFMC, NMFS and ADFG staff economists that participate in the economic, social and cultural evaluation and review process of fishery management proposals. Allocation also considers subsistence and community development initiatives. The Community Development Quota (CDQ) Program is a federal fisheries program that involves 65 communities within a fifty-mile radius of the Bering Sea coastline who participate in the BSAI crab fisheries and are allocated 10% of the harvest privileges for the crab species.

A. The Fisheries Management System

Fundamental 3

Management objectives shall be implemented through management rules and actions formulated in a plan or other framework.

No. Supporting clauses	6	Non conformances
Supporting clauses used	6	
Supporting clauses N/A	0	
Level of conformity	HIGH	Zero

Summarized evidence:

Long-term fisheries management objectives are clearly defined:

Long-term fisheries management objectives are outlined in the BSAI Crab FMP. State regulations for the king and snow/(& Tanner crab) fisheries are listed under the Alaska Administrative Code, Title 5, Chapter 34 and 35. The MSA, as amended, sets out ten national standards for fishery conservation and management (16 U.S.C. § 1851) to which all fishery management plans must be consistent.

In this respect, the BSAI king and Tanner crab FMP lists the following 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: To protect, conserve, and enhance adequate quantities of essential fish habitat (EFH) to support king and Tanner crab populations and maintain a healthy ecosystem; 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 all interested parties; 7) Research and Management Objective: Provide fisheries research, data collection, and analysis to ensure a sound information base for management decisions.

Conservation of aquatic habitats and biodiversity are integral parts of the NPFMC's management process. These concerns and decisions are summarized in the Ecosystems Considerations chapter of the Council's annual Stock Assessment and Fishery Evaluation (SAFE) and report. The annual Ecosystem SAFE reports outline the relative ecosystem considerations for the BSAI crab fisheries. Furthermore, Essential Fish Habitats (EFH) identification and protection constitute a key objective for the management system as outlined in the BSAI crab FMP. Many groundfish fisheries have closed areas or restricted harvest prescriptions to protect crab and their habitat. The pot gear deployed is demonstrated to be relatively selective, with ADFG mandated escape mechanisms for juvenile crabs and females, and biodegradable pot components to reduce ghost fishing from lost pots. Pots loss has decreased considerably since rationalization (and season extension) of the BSAI crab fisheries.

B. Science and Stock Assessment Activities

Fundamental 4

There shall be effective fishery data (dependent and independent) collection and analysis systems for stock management purposes.

No. Supporting clauses	14	Non conformances
Supporting clauses used	9	
Supporting clauses N/A	5	
Level of conformity	HIGH	Zero

Summarized evidence:

Data collection, aggregation and use

The collection, aggregation and use of data in stock assessments for the BSAI crab fisheries are undertaken through collaboration between primarily the NPFMC, the NMFS and ADFG. Data collection, analysis and stock assessment of the BSAI crab fisheries respect the NPFMC's BSAI crab FMP requirements. NMFS and ADFG collect fishery dependant data and undertake fishery-independent surveys for all BSAI crab fisheries providing the basis for the assessment of the crab stocks and their impact on the ecosystem. The NMFS annual trawl surveys of the eastern Bering Sea provide indices of relative abundance and biomass for all three fisheries. Full details of the datasets for the three fisheries and their time series can be found in the annual Stock Assessment and Fishery Evaluation (SAFE) reports.

Bristol Bay red king crab (BBRKC) and Eastern Bering Sea snow crab (EBSSC) bycatch data are collected by ADFG and NMFS, and fisheries-independent data from the NMFS annual trawl surveys of the eastern Bering Sea and two recent Bering Sea Fisheries Research Foundation (BSFRF) surveys. St Matthew blue king crab (SMBKC) fisheries data are collected by ADFG, bycatch data by ADFG and NMFS, and fisheries-independent data from the NMFS annual trawl surveys of the eastern Bering Sea and the triennial ADFG pot survey. ADFG runs and deploys ADFG observers on vessel participating in the BSAI crab fisheries as an important component of data collection and fishery management. Observers are deployed on all catcher-processor vessels in the crab fisheries, on randomly selected catcher vessels in the BBRKC and EBSSC fisheries, and in all vessels fishing for SMBKC. Observed pot lifts in 2009/10 represented 1.6%, 1.2% and 9.2% of the total pot lifts in the fishery for the BBRKC, EBSSC and SMBKC fisheries respectively. All three fisheries have effective fishery data collection systems in place and surveys providing fishery-independent estimates of stock biomass and there are sufficiently long time series of both fishery-dependent and fishery-independent data. In addition to fishery data, annual SAFE reports provide information on ecosystem indicators which may have an impact on BSAI crab stocks.

The socio-economic data requirements as set in the BSAI crab FMP include: 1) the value of crab harvested, 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. The Economic and Social Sciences Research Program within NMFS's REFM division provides economic and socio-cultural information that assists NMFS in meeting its stewardship programs.

B. Science and Stock Assessment Activities

Fundamental 5

There shall be regular stock assessment activities appropriate for the fishery, its range, the species biology and the ecosystem, undertaken in accordance with acknowledged scientific standards to support its optimum utilization.

No. Supporting clauses	11	Non conformances
Supporting clauses used	10	
Supporting clauses N/A	1	
Level of conformity	HIGH	Zero

Summarized evidence:

Stock assessment activities:

The NMFS undertakes shellfish stock assessments through the annual Eastern Bering Sea trawl survey which provides the primary input to the shellfish assessments. NMFS shellfish assessment programs are coordinated between the ASFC's Kodiak Laboratory and the NOAA/NMFS AFSC in Seattle, Washington. The AFSC is split into a number of Divisions which contribute to research and stock assessment of shellfish. The Resource Assessment and Conservation Engineering (RACE) Division comprises scientists from a wide range of disciplines whose function is to conduct quantitative fishery surveys and related ecological and oceanographic research to describe the distribution and abundance of commercially important fish and crab stocks in the region, and to investigate ways to reduce bycatch, bycatch mortality and the effects of fishing on habitat. Information derived from both regular surveys and associated research are analysed by AFSC stock assessment scientists and supplied to fishery management agencies and to the commercial fishing industry. The Resource Ecology and Fisheries Management (REFM) Division conducts research and data collection to support an ecosystem approach to management of fish and crab resources. More than twenty-five groundfish and crab stock assessments are developed annually and used to set catch quotas. In addition, economic and ecosystem assessments are provided to the Council on an annual basis. The Fisheries Monitoring and Analysis Division (FMA) monitors groundfish fishing activities and conducts research associated with sampling commercial fishery catches and estimation of catch and bycatch mortality, and analysis of fishery-dependent data.

For the BBRKC fishery, a length-based analysis (LBA) model combines multiple sources of survey, catch and bycatch data using a maximum likelihood approach to estimate abundance, recruitment and catchabilities, catches and bycatch of the commercial pot fisheries and groundfish trawl fisheries. For the SMBKC fishery a three-stage catch-survey analysis (CSA) assesses the male component of the stock incorporating data from commercial catches from the directed fishery and its observer program, the annual EBS trawl survey, triennial pot surveys and bycatch data from the groundfish trawl fishery. This assessment model is in development and has not yet been approved by the Crab Plan Team, so for 2011 a survey-based assessment was used. For the EBSSC fishery the stock assessment uses a size and sex-structured model which is fitted to time series of total catch data from the directed fishery and bycatch data from the trawl fishery, size frequency data from the catch in the pot fishery and the bycatch in both the pot and trawl fisheries, and abundance data from the NMFS trawl survey and two recent BSFRF surveys. The assessment provides a range of alternative model scenarios, but all model scenarios indicate that the stock is rebuilt.
Ecosystem SAFE documents are provided yearly to the NPFMC. An ongoing goal is to produce an ecosystem assessment utilizing a blend of data analysis and modelling to clearly communicate the current status and possible future directions of ecosystems. A NEPA Environmental Impact Assessment for the BSAI crab fisheries was prepared in 2004 to provide decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative management/rationalization programs, including the rationalization selected by the Council.

C. The Precautionary Approach

Fundamental 6

The current state of the stock shall be defined in relation to reference points or relevant proxies or verifiable substitutes allowing for effective management objectives and target. Remedial actions shall be available and taken where reference point or other suitable proxies are approached or exceeded.

No. Supporting clauses	5	Non conformances
Supporting clauses used	5	
Supporting clauses N/A	0	
Level of conformity	HIGH	Zero

Summarized evidence:

Status determination criteria for crab stocks, reference points and relative biomass:

The status determination criteria for crab stocks are calculated on an annual basis using a five-tier system that accommodates varying levels of uncertainty of information, and incorporates new scientific information providing a mechanism for continually improving the status determination criteria as more information becomes available. For tier 3 stocks, the target reference point is $B_{35\%}$ (when spawning biomass is reduced to 35% of the unfished condition), a proxy for Bmsy, or biomass at Maximum Sustainable Yield (MSY). Stock status of BSAI crabs are determined by two metrics. Firstly, the stock is considered to be overfished if the stock size is estimated to be below the minimum stock size threshold (MSST) or limit reference point (1/2 MSY). Secondly, overfishing is considered to have occurred if the exploitation level, or fishing mortality, exceeds the fishing mortality at the overfishing level (F_{OFL}), or more intuitively if the total catch exceeds the OFL level (equivalent to MSY).

Reference points are considered appropriate and precautionary for stock harvest practices.

Stock	Reference Point (RP)	Biomass at RP	Biomass at present	Percentage of Reference Point
BBRKC	$B_{35\%}$	27.3 kt	32.64 kt	119%
SMBKC	Bmsy proxy	3.04 kt	6.70 kt	220%
EBSSC	$B_{35\%}$	147.5 kt	196.6 kt	133%

The five tier system was evaluated by a review team appointed by the Committee for Independent Experts (CIE) in 2006, whose report provided important input to the final version of the system now in operation. A full management strategy evaluation (MSE) to assess the robustness of the current Eastern Bering Sea snow crab model has been funded by North Pacific Research Board (NPRB) for the period 2008-2011. There is strong evidence from the assessments that since rationalization, the level of fishing permitted for all three crab stocks has been commensurate with the current state of the fishery resources and never exceeded the overfishing level.

C. The Precautionary Approach

Fundamental 7

Management actions and measures for the conservation of stock and the aquatic environment shall be based on the Precautionary Approach. Where information is deficient a suitable method using risk assessment shall be adopted to take into account uncertainty.

No. Supporting clauses	7	Non conformances
Supporting clauses used	3	
Supporting clauses N/A	4	
Level of conformity	HIGH	Zero

Summarized evidence:

The FAO Guidelines for the Precautionary Approach (PA) are satisfied:

The precautionary approach is applied widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment. The MSA, as amended, sets out ten national standards for fishery conservation and management. The BSAI Crab FMP is consistent with MSA requirements in applying the Precautionary Approach to fisheries. The FAO Guidelines for the Precautionary Approach (PA) (FAO 1995) advocate a comprehensive management process that includes data collection, monitoring, research, enforcement, and review, prior identification of desirable (target) and undesirable (limit) outcomes, and measures in place to avoid and correct undesirable outcomes, the action to be taken when specified deviations from operational targets are observed and an effective management plan. Lastly, the FAO guidelines advocate that the absence of adequate scientific information should not be used as a reason for postponing or failing to take measures to conserve target species, associated or dependent species as well as non-target species and their environment. The overall management for the BBRKC, EBSSC and SMBKC comprises all the elements as specified above in the FAO guidelines for the PA.

Absence of adequate scientific information is not used as a reason for postponing or failing to take conservation and management measures. The three crab stocks part of this assessment are managed under a tier system rule based on stock knowledge. Status determination criteria for crab stocks are annually calculated using a five-tier system that accommodates varying levels of uncertainty of information. The five-tier system incorporates new scientific information and provides a mechanism to continually improve the status determination criteria as new information becomes available. The lower the tier, the less conservative the determination of OFL/ABC and ACL are. This is because more conservative determinations are at the higher tier levels (where less stock information is available). This system is intrinsically precautionary in nature and the results involve catches always lower than the overfishing level. Also, a key component of the annual assessments and subsequent SAFE reports for the BSAI crab fisheries is the identification of components of the assessment where there are gaps in evidence which require further research and/or improvements.

D. Management Measures

Fundamental 8

Management shall adopt and implement effective measures including; harvest control rules and technical measures applicable to sustainable utilization of the fishery and based upon verifiable evidence and advice from available scientific and objective, traditional sources.

No. Supporting clauses	10	Non conformances
Supporting clauses used	10	
Supporting clauses N/A	0	
Level of conformity	HIGH	Zero

Summarized evidence:

Management measures:

The NPFMC's FMP for BSAI crab stocks outlines the harvest strategy and harvest control rule, the stock status definitions, the criteria used to determine stock status using a five-tier system and the step-by-step framework under which the NPFMC sets final overfishing levels (OFLs) and acceptable biological catches (ABCs). The BSAI Crab FMP Plan authorizes the use of pot gear (and ring nets, although not used) to harvest the crab resources. Trawls and tangle nets are specifically prohibited because of the high mortality rates which they inflict on non legal crab. Title 5 of Fish and Game, Chapter 34 and 35 of the Alaska Administrative Code (5 AAC 34 and 35) lists all state requirements for the BSAI crab fisheries.

Crab rationalization:

The Crab rationalization program has experienced extensive public review. It allocates BSAI crab resources among harvesters, processors, and coastal communities who have been involved with and/or were dependent upon these fisheries. The NPFMC developed the Program over a 6-year period to accommodate the specific dynamics and needs of the BSAI crab fisheries. The Program, implemented in 2005, builds on the Council's experiences with the halibut and sablefish Individual Fishing Quota (IFQ) program and the American Fisheries Act (AFA) cooperative program for Bering Sea pollock. The Program is a limited access system that balances the interests of several groups who depend on these fisheries. It addresses conservation and management issues associated with the previous derby fishery, reduces bycatch and associated discard mortality, and increases the safety of crab fishermen by ending the race for fish. Share allocations to harvesters and processors, together with incentives to participate in fishery cooperatives, increases efficiencies, provides economic stability, and facilitates compensated reduction of excess capacities in the harvesting and processing sectors. Community interests are protected by CDQ allocations and regional landing and processing requirements, as well as by several community protection measures.

The BSAI crab FMP defers design specifications required for commercial crab pots and ring nets to the State. Escape mechanisms may be incorporated or mesh size adjusted to allow female and sublegal male crab to escape. Crabbers are constructing pots with larger web on the panels to allow for female and juvenile crab to exit the pot before the gear is hauled back. The yearly marine habitat footprint has been assessed and its impact considered very small for the entire BSAI directed crab fisheries. Regulation imposes that undersized males and females must be promptly discarded from crab vessels to decrease handling mortality rates. Discarded crabs are returned to the sea in a variety of methods including direct release and/or with the use of chutes and ramps.

The Federal BSAI Crab FMB describes fishing season requirements, those are aimed to protect king and snow/Tanner crabs during the molting and mating portions of their life cycle. Also, groundfish closure areas, or trawl protection areas, are in place to minimize the impact of groundfish harvests on crab resource. In addition, Section 4.0 of the BSAI Crab FMP addresses the requirement in EFH regulations (50 CFR 600.815(a)(2)(i)) that each FMP must contain an evaluation of the potential adverse effects of all regulated fishing activities on EFH. This evaluation assesses whether fishing adversely affects EFH in a manner that is more than minimal and not temporary in nature (50 CFR 600.815(a)(2)(ii)). This standard determines whether Councils are required to act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable.

D. Management Measures

Fundamental 9

There shall be defined management measures designed to maintain stocks at levels capable of producing maximum sustainable levels.

No. Supporting clauses	**11**	**Non conformances**
Supporting clauses used	**9**	
Supporting clauses N/A	**2**	
Level of conformity	**HIGH**	**Zero**
Items noted for Surveillance	Essential Fish Habitat interactions with groundfish trawling. This specific item is scheduled next for discussion on the Council session post the October 2012 meeting. This will be subject to review by the assessment team.	

Summarized evidence:

Management measures to maintain the crab stocks at maximum sustainable levels:

As specified in the BSAI crab FMP, there is clearly defined harvest strategy that consists of a set of defined management measures designed to maintain the crab stocks at levels capable of producing maximum sustainable levels. These include harvest control rule, stock status definitions, criteria used to determine stock status using a five-tier system and the step-by-step framework under which the NPFMC sets final overfishing levels (OFLs) and acceptable biological catches (ABCs). The St Matthew Blue King crab fishery was declared overfished and closed in 1999 when the stock size estimate was below the MSST (limit reference point). In November of 2000, Amendment 15 to the FMP was approved to implement a rebuilding plan for the St. Matthew Island blue king crab stock. In 2008/09 and 2009/10, the MMB was above Bmsy for two years and was declared rebuilt in 2009. In 2000, the decline in abundance of EBS snow crab caused the declaration of the stock as overfished. After 2000, a rebuilding strategy was developed based on simulations by Zheng (2002). The currency for estimating BMSY changed during the 10 year rebuilding period. Using the current definitions for estimating BMSY, and the model results for any scenario presented in the 2011 Crab SAFE report, the snow crab stock was above BMSY for the last three years (2008/09, 2009/10 and 2010/11). The total mature observed survey biomass in 2011 was 447,400 t which is also above the Bmsy (418,150 t) in place under the rebuilding plan implemented in 2000.

Essential Fish Habitats (EFH) to maintain stocks capable of producing MSY:

The MSA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH are necessary to maintain stocks capable of producing maximum sustainable yields. The NMFS and the NPFMC must describe and identify EFH in FMPs, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other actions to encourage the conservation and enhancement of EFH. At present, there is an area of overlap between current female red king crab distribution and areas where trawling occurs in the southern Bristol Bay. A high density of mature female crab were found in the heavy trawling area during 2008-2009, and it appears that mature female crab moved back to the historical important spawning ground in the southern Bristol Bay. Given the current overlap, trawling intensity in the southern Bristol Bay, and the importance of the spawning ground there, professional judgement indicates heavy trawling could impact the stock recovery and jeopardize the ability of the stock to produce MSY over the long term. In this regard, a staff discussion paper is been developed by the Council and the NMFS in March 2012. Seven options for Council action have been proposed including establishment/extension of trawl closures, seasonal closures or designation of habitat areas of particular concern (HAPC). This specific item is scheduled next for discussion on the Council session post the October 2012 meeting. This will be subject to review by the assessment team.

D. Management Measures

Fundamental 10

Fishing operations shall be carried out by fishers with appropriate standards of competence in accordance with international standards and guidelines and regulations.

No. Supporting clauses	3	Non conformances
Supporting clauses used	3	
Supporting clauses N/A	0	
Level of conformity	HIGH	Zero

Summarized evidence:

Training opportunities and facilities:

The North Pacific Fishing Vessel Owners association (NPFVO) provides a large and diverse training program that many of the professional crew members must pass. Training ranges from firefighting on a vessel, damage control, man- overboard, MARPOL, etc., and The Sitka-based Alaska Marine Safety Education Association alone has trained more than 10,000 fishermen in marine safety and survival through a Coast Guard-required class on emergency drills. The State of Alaska, Department of Labor & Workforce Development (ADLWD) includes AVTEC (formerly called Alaska Vocational Training & Education Center, now called Alaska's Institute of Technology). One of AVTEC's main divisions is the Alaska Maritime Training Center. The goal of the Alaska Maritime Training Center is to promote safe marine operations by effectively preparing captains and crew members for employment in the Alaskan maritime industry. The Alaska Maritime Training Center is a United States Coast Guard (USCG) approved training facility located in Seward, Alaska, and offers USCG/STCW-compliant maritime training (STCW is the international Standards of Training, Certification, & Watchkeeping). In addition to the standard courses offered, customized training is available to meet the specific needs of maritime companies

Also, the University of Alaska Sea Grant Marine Advisory Program (MAP) provides education and training in several sectors, including fisheries management, in the forms of seminars and workshops. MAP also conducts sessions of their Alaska Young Fishermen's Summit. Each Summit is an intense course in all aspects of Alaska fisheries, from fisheries management & regulation (e.g. MSA), to seafood markets & marketing. The 2012 AYFS was held February 13th and 14th in Juneau, AK. The two-day conference aimed at providing crucial training and networking opportunities for fishermen entering the business or wishing to take a leadership role in their industry. The event took advantage of the Juneau location by introducing participants to the legislative process, and introducing the fish caucus of the legislature to the issues and concerns of Alaska's emerging fishermen. In addition to this, MAP provides training and technical assistance to fishermen and seafood processors in Western Alaska. A number of training courses and workshops were developed in cooperation with local communities and CDQ groups. Additional education is provided by the Fishery Industrial Technology Center, in Kodiak, Alaska.

E. Implementation, Monitoring and Control

Fundamental 11

An effective legal and administrative framework shall be established and compliance ensured through effective mechanisms for monitoring, surveillance, control and enforcement for all fishing activities within the jurisdiction.

No. Supporting clauses	6	Non conformances
Supporting clauses used	2	
Supporting clauses N/A	4	
Level of conformity	HIGH	Zero

Summarized evidence:

Enforcement agencies:

The NMFS Office of Law Enforcement with use of the United States Coast Guard's at-sea platforms is primarily responsible for enforcing crab regulations at sea, while the NMFS Office of Law Enforcement and the State of Alaska's Division of Wildlife Troopers (AWT) have that responsibility ashore. AWT spends about 90% of their effort conducting dockside enforcement of offloaded crab (although the AWT vessel E/V Stinson conducts at-sea enforcement, checking gear and catch for legal specification). Wildlife Troopers also perform pot and vessel holding tank inspections prior to each fishing season. More generally, AWT personnel check state regulations, permits, gear and catch.

Fishing permit requirements:

Fishing vessels are not allowed to operate on the crab resources without specific authorization. All vessels participating in the BSAI rationalized crab fishery must obtain a Federal Crab Vessel Permit (FCVP). A copy of the permit must be on board any vessel of the fishery and must be available for inspection at any time by an authorized officer. As of January 1, 2000 a Federal License Limitation Program (LLP) license is required for vessels participating in directed fishing for LLP groundfish species in the GOA or BSAI, or fishing in any BSAI LLP crab fisheries. A vessel must be named on an original LLP license that is onboard the vessel. The LLP is authorized in Federal regulations at 50 CFR 679.4(k), definitions relevant to the program are at 679.2, and prohibitions are at 679.7. All such vessels will also possess a State of Alaska Commercial Fisheries Entry Commission (CFEC) permit if they make a commercial landing. The entire crab harvests are conducted in Alaskan waters by American vessels. No foreign fleet is allowed to fish in the Alaska's EEZ. All fishing vessels must be at least 75% U.S. ownership. Because the fishery was rationalized in 2005, most enforcement of IFQ/IPQ violations, as well as size, sex and season violations occur at offloading.

E. Implementation, Monitoring and Control

Fundamental 12

There shall be a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations.

No. Supporting clauses	4	Non conformances
Supporting clauses used	2	
Supporting clauses N/A	2	
Level of conformity	HIGH	Zero

Summarized evidence:

Enforcement policies and regulations, state and federal:

In Alaska waters, enforcement policy section 50CFR600.740 states: (a) The MSA provides four basic enforcement remedies for violations, in ascending order of severity, as follows: (1) Issuance of a citation (a type of warning), usually at the scene of the offense (see 15 CFR part 904, subpart E). (2) Assessment by the Administrator of a civil money penalty. (3) For certain violations, judicial forfeiture action against the vessel and its catch. (4) Criminal prosecution of the owner or operator for some offenses. The MSA treats sanctions against the fishing vessel permit to be the carried out of a purpose separate from that accomplished by civil and criminal penalties against the vessel or its owner or operator. The “Policy for the Assessment of Civil Administrative Penalties and Permit Sanctions” issued by NOAA Office of the General Counsel – Enforcement and Litigation on March 16, 2011, provides guidance for the assessment of civil administrative penalties and permit sanctions under the statutes and regulations enforced by NOAA. The purpose of this Policy is to ensure that: (1) civil administrative penalties and permit sanctions are assessed in accordance with the laws that NOAA enforces in a fair and consistent manner; (2) penalties and permit sanctions are appropriate for the gravity of the violation; (3) penalties and permit sanctions are sufficient to deter both individual violators and the regulated community as a whole from committing violations; (4) economic incentives for noncompliance are eliminated; and (5) compliance is expeditiously achieved and maintained to protect natural resources.

The Marine Division of AWT and the State of Alaska Department of Law pursue a very aggressive enforcement policy. They attend the BOF and are integral into the process for regulation formulation and legislation, analogous to the USCG attendance and input in the Council process. AWT has Statutory / Regulatory legislation pertaining to their Authority: AS 16 Fish & Game, 5AAC Fish & Game, 20 AAC Commercial Fishing, AS 11 Criminal, AS 46 Environment, AS 44 State Government, AS 02 Aeronautics, AS 18 Health & Safety. A State violation is a criminal violation (strict liability).

F. Serious Impacts of the Fishery on the Ecosystem

Fundamental 13

Considerations of fishery interactions and effects on the ecosystem shall be based on best available science, local knowledge where it can be objectively verified and using a risk based management approach for determining most probable adverse impacts. Adverse impacts on the fishery on the ecosystem shall be appropriately assessed and effectively addressed.

No. Supporting clauses	13	Non conformances
Supporting clauses used	13	
Supporting clauses N/A	0	
Level of conformity	HIGH	Zero
Items noted for Surveillance	Essential Fish Habitat interactions with groundfish trawling. This specific item is scheduled next for discussion on the Council session post the October 2012 meeting. This will be subject to review by the assessment team.	

Summarized evidence:

Ecosystem reports and studies:

The purpose of the Crab Ecosystem Considerations and Indicators (CECI) report is to consolidate ecosystem information specific to the crab stocks in the BSAI FMP. The CECI serves as an appendix to the yearly BSAI King and Tanner crab SAFE report. The CECI report is composed of the Ecosystem Assessment chapter, the Current Status of Ecosystem Indicators chapter, and the Ecosystem-based Management Indicators chapter. Several programs are in place to study the BSAI Ecosystem and its living resources. The Fisheries And The Environment (FATE) program's focus of FATE is on the development, evaluation, and distribution of leading ecological and performance indicators.

The North Pacific Research Board (NPRB) was created by Congress in 1997 to conduct research activities on or relating to the fisheries or marine ecosystems in the North Pacific Ocean, Bering Sea, and Arctic Ocean with a priority on cooperative research efforts designed to address pressing fishery management or marine ecosystem information needs. For the Bering Sea, a large multiyear ecosystem project is winding towards completion. It consists of two large projects that will be integrated, the Bering Ecosystem Study (2007-2010) and the Bering Sea Integrated Ecosystem Research Program (2008-2012).

2010 Essential Fish Habitats review, and pot gear impacts:

The last EFH review (2010) identified impacts of trawling on EFH habitat of red King Crab in Southern Bay. This is being considered by the NPFMC and is an active item for discussion past the October 2012 Council Session. In the BSAI crab fisheries Final Environmental Impact Statement (EIS), the impact of pot gear on benthic Eastern Bering Sea species is discussed. Benthic species examined included fish, gastropods, coral, echinoderms (sea stars and sea urchins), non-target crab, and invertebrates (sponges, octopuses, anemones, tunicates, bryozoans, and hydroids). The total portion of the EBS impacted by commercial pot fishing may be less than 1% of the shelf area and the report concludes that BSAI crab fisheries have an insignificant effect on benthic habitat. Habitat protection areas, prohibited species caps (PSC) and crab bycatch limits are in place to protect important benthic habitat for crab and other resources and reduce crab bycatch in the trawl and fixed gear fisheries. If PSC limits are reached in predetermined bottom trawl fisheries executed in specific areas, those fisheries are closed.

Bycatch and ETP species

The EBS crab fisheries catch a small amount of other species as bycatch. A limited number of groundfish, such as Pacific cod, Pacific halibut, yellowfin sole, and sculpin are caught in the directed pot fishery. The invertebrate component of bycatch includes echinoderms (stars and sea urchin), snails, non-FMP crab (hermit crabs and lyre crabs), and other invertebrates (sponges, octopus, anemone, and jellyfish). Typically, low levels of bycatch of these species do not impact their abundance. As noted in the Endangered Species Act EIS report, crab fisheries do not adversely affect ESA listed species, destroy or modify their habitat, or comprise a measurable portion of their diet.

Based on food habits data collected in the summer months during the annual EBS bottom trawl survey, Pacific cod, Pacific halibut and skates are the primary predators of large or legal size crab although legal-sized crab are a minimal component of these predators diets. It is possible that male-only fisheries with minimum size limits reduce the abundance of large crab; however this has not been examined for Bering Sea crab stocks. The short and long term effects of removing large male crab from a population are not well understood and may vary by species and population as outlined in various scientific studies. Such studies are ongoing.

Further Information

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Table 1: Global Trust Assessment Team Members

Assessor	Role	Assessor	Role
Dave Garforth, Global Trust Certification Ltd. Quayside Business Park Dundalk, Co. Louth Ireland	Lead Assessor	**Vito Ciccia Romito,** Global Trust Certification Ltd. Quayside Business Park Dundalk, Co. Louth Ireland	Assessor
Mr. Herman Savikko, Alaska, USA.	Assessor	**Dr. Julian Addison,** Cavaillon, France.	Assessor
Prof. Thomas Shirley. Texas, USA.	Assessor		

http://sustainability.alaskaseafood.org/crab-certification

Table 2: Peer Reviewers

Dr. Jerry Ennis	Earl Krygier
Following undergraduate and graduate degrees at Memorial University of Newfoundland in the 1960s, Dr. Ennis completed a Ph.D. in marine biology at University of Liverpool in the early 1970s. He retired in 2005 following a 37-year research career with the Science Branch of the Department of Fisheries and Oceans. His extensively published work (40 in the primary, peer reviewed literature) has focused primarily on lobster fishery and population biology and on various aspects of larval, juvenile and adult lobster behaviour and ecology, as well as snow crab biology in Newfoundland waters. Throughout his career, Dr. Ennis was heavily involved in the review and formulation of scientific advice for management of shellfish in Atlantic Canada as well as the advisory/consultative part of managing the Newfoundland lobster fishery. In retirement, published several articles aimed at presenting fishery science primarily to harvesters but to other interested parties as well, and participated in four MSC certification projects as reviewer or assessor.	Earl E. Krygier gained a BSc in Science, an MSc from the Department of Fisheries and Wildlife, and completed a Ph.D Doctoral Thesis (on the role of nursery areas for juvenile English sole off Oregon) at the Oregon State University. From 1989 to 2008 he worked for ADFG's Commercial Fisheries Division as Extended Jurisdiction Program Manager with primary responsibility on state policy coordination of state, national and international marine fishery matters (research, conservation and management, and policy development), provided support for ADFG's Commissioner in carrying out his NPFMC's responsibilities and acting as the Commissioner's alternate (1989-1997). He sat as alternate for the Commissioner on the North Pacific Research Board (NPRB); represented ADFG on Alaska's CDQ Allocation Team; advised department staff, the Alaska BoF members, the Alaska Legislature and other state officials on NPFMC activities; and proposed management plans, long-range policies and regulatory implications, or inter-jurisdictional issues arising from Council actions. From 2008 to present times he is the Owner/Manager of KEE Biological Consultants and served as the Marine Conservation Alliance Foundation's (MCAF) Cooperative Research Coordinator.

Table 3: Certification Committee Members

Bill Paterson, **Legal / Technical /Certification and Accreditation Expert** Global Trust Certification Ltd.	
Ciaran Kelly **Fishery Management Expert** Marine Institute. Ireland	**Clare Murray** **Fishery Scientist** Global Trust Certification Ltd.
Also in Attendance	
Vito Ciccia Romito: Fishery Scientist Global Trust Certification Ltd. (Fishery Presentation to Certification Committee only)	
Dave Garforth: Fisheries and Certification Expert Global Trust Certification Ltd. (Fishery Presentation to Certification Committee only)	