



ALASKA RESPONSIBLE FISHERIES MANAGEMENT CERTIFICATION

Full Assessment and Certification Report

For The

U.S. Alaska Bering Sea and Aleutian Islands King, Tanner and Snow Crab Commercial Fisheries (200 mile EEZ)

Facilitated By the

Bering Sea Crab Client Group LLC

Assessors: Dr. Ivan Mateo, Lead Assessor
Dr. Gerald P. Ennis, Assessor
Dr. Wesley W. Toller, Assessor

Report Code: AK/CRA/002/2017
Date: 7th December 2017

Global Trust Certification Ltd.

3rd Floor, Block 3,
Quayside Business Park,
Mill Street,
Dundalk,
Co. Louth,
Ireland.
T: +353 42 932 0912
F: +353 42 938 6864
www.GTCert.com



Foreword

The Alaska Responsible Fisheries Management (RFM) Standard Version 1.3 is composed of Conformance Criteria and is based on the 1995 FAO Code of Conduct for Responsible Fisheries and the FAO Guidelines for the Eco-labelling of Fish and Fishery Products from Marine Capture Fisheries adopted in 2005 and amended/extended in 2009. The Standard also includes full reference to the 2011 FAO Guidelines for the Eco-labelling of Fish and Fishery Products from Inland Fisheries which in turn are now supported by a suite of guidelines and support documents published by the UN FAO. Further information on the Alaska RFM program may be found on <http://www.alaskaseafood.org/rfm-certification/certified-fisheries/>

Table of Contents

Foreword	1
Table of Contents	2
List of Figures	6
List of Tables	7
Acronyms	8
i. Summary and Recommendations	9
ii. Schedule of Key Assessment Activities	9
iii. Assessment Team Details	10
1. Introduction	11
Recommendations of the Assessment Team	12
2. Fishery Applicant Details	13
3. Background to the Fishery	14
3.1 Species Biology	14
3.2 Fishery Location and Method	21
3.3 Fishery Management History and Organization	29
3.4 Stock Assessment Activities	32
3.5 Historic Biomass and Removals in the Fishery	42
3.6 Economic Value of the Fishery	52
4. Proposed Units of Assessment	58
5. Consultation Meetings	59
On-Site Assessment and Consultation Meetings	59
6. Assessment Outcome Summary	63
E. Implementation Monitoring and Control	65
F. Serious Impacts of the Fishery on the Ecosystem	65
Conformity Statement	67
7. Fishery Assessment Evidence	68
Section A: The Fisheries Management System	68
7.1 Fundamental Clause 1	68
Supporting Clause 1.1	68
Supporting Clause 1.2	71
Supporting Clause 1.2.1	78
Supporting Clause 1.3	79
Supporting Clause 1.3.1	80
Supporting Clause 1.4	81
Supporting Clause 1.4.1	82
Supporting Clause 1.5	83
Supporting Clause 1.6	84
Supporting Clause 1.6.1	87
Supporting Clause 1.7	88
Supporting Clause 1.8	90
Supporting Clause 1.9	91

7.2 Fundamental Clause 2 93

- Supporting Clause 2.1 93
- Supporting Clause 2.1.1 97
- Supporting Clause 2.1.2 99
- Supporting Clause 2.2 100
- Supporting Clause 2.3 102
- Supporting Clause 2.4 105
- Supporting Clause 2.5 107
- Supporting Clause 2.6 110
- Supporting Clause 2.7 114
- Supporting Clause 2.8 116

7.3 Fundamental Clause 3 120

Supporting Clause 3.1 120

- Supporting Clause 3.2 123
- Supporting Clause 3.2.1 123
- Supporting Clause 3.2.2 125
- Supporting Clause 3.2.3 127
- Supporting Clause 3.2.4 128
- Supporting Clause 3.2.5 130
- Supporting Clause 3.2.6 132

Section B: Science and Stock Assessment Activities 134

7.4 Fundamental Clause 4 134

- Supporting Clause 4.1 134
- Supporting Clause 4.1.1 136
- Supporting Clause 4.1.2 137
- Supporting Clause 4.2 138
- Supporting Clause 4.3 139
- Supporting Clause 4.4 141
- Supporting Clause 4.5 142
- Supporting Clause 4.6 144
- Supporting Clause 4.7 145
- Supporting Clause 4.8 146
- Supporting Clause 4.9 147
- Supporting Clause 4.10 148
- Supporting Clause 4.11 149

7.5 Fundamental Clause 5 150

- Supporting Clause 5.1 150
- Supporting Clause 5.1.1 152
- Supporting Clause 5.1.2 153
- Supporting Clause 5.2 155
- Supporting Clause 5.3 157
- Supporting Clause 5.4 158
- Supporting Clause 5.5 159

Section C: The Precautionary Approach 160

7.6 Fundamental Clause 6 160

- Supporting Clause 6.1 160
- Supporting Clause 6.2 166
- Supporting Clause 6.3 168
- Supporting Clause 6.4 177

7.7 Fundamental Clause 7 178
 Supporting Clause 7.1 178
 Supporting Clause 7.1.1 180
 Supporting Clause 7.1.2 181
 Supporting Clause 7.2 182
 Supporting Clause 7.3 183
Section D: Management Measures 185
7.8 Fundamental Clause 8 185
 Supporting Clause 8.1 185
 Supporting Clause 8.1.1 187
 Supporting Clause 8.1.2 188
 Supporting Clause 8.1.3 189
 Supporting Clause 8.2 190
 Supporting Clause 8.3 191
 Supporting Clause 8.4 193
 Supporting Clause 8.5 194
 Supporting Clause 8.6 196
 Supporting Clause 8.7 198
 Supporting Clause 8.8 200
 Supporting Clause 8.9 202
 Supporting Clause 8.10 204
 Supporting Clause 8.11 205
 Supporting Clause 8.12 206
 Supporting Clause 8.13 207
 Supporting Clause 8.14 208
7.9 Fundamental Clause 9 209
 Supporting Clause 9.1 209
 Supporting Clause 9.2 211
 Supporting Clause 9.3 212
Section E: Implementation, Monitoring and Control..... 213
7.10 Fundamental Clause 10 213
 Supporting Clause 10.1 213
 Supporting Clause 10.2 220
 Supporting Clause 10.3 221
 Supporting Clause 10.3.1 222
 Supporting Clause 10.4 223
 Supporting Clause 10.4.1 224
7.11 Fundamental Clause 11 225
 Supporting Clause 11.1 225
 Supporting Clause 11.2 227
 Supporting Clause 11.3 229
Section F: Serious Impacts of the Fishery on the Ecosystem..... 230
7.12 Fundamental Clause 12 230
 Supporting Clause 12.1 230
 Supporting Clause 12.2 236
 Supporting Clause 12.3 239
 Supporting Clause 12.4 249
 Supporting Clause 12.5 251

Supporting Clause 12.5.1 254

Supporting Clause 12.6 256

Supporting Clause 12.7 264

Supporting Clause 12.8 267

Supporting Clause 12.9 269

Supporting Clause 12.10 275

Supporting Clause 12.11 277

Supporting Clause 12.12 281

Supporting Clause 12.13 284

Supporting Clause 12.14 291

Supporting Clause 12.15 294

Fundamental Clause 13..... 296

Supporting Clause 13.1 296

Supporting Clause 13.1.1 298

Supporting Clause 13.2 299

Supporting Clause 13.2.1 300

Supporting Clause 13.3 301

Supporting Clause 13.4 302

Supporting Clause 13.5 303

Supporting Clause 13.5.1 304

Supporting Clause 13.5.2 305

Supporting Clause 13.5.3 306

Supporting Clause 13.6 307

Supporting Clause 13.7 308

Supporting Clause 13.8 309

Supporting Clause 13.9 310

Supporting Clause 13.10 311

Supporting Clause 13.11 312

Supporting Clause 13.12 313

Supporting Clause 13.13 314

Supporting Clause 13.14 315

8. External Peer Review..... 316

Summary and Recommendation Peer Reviewer 1..... 316

8.1.1. Full Summary of Comments – Peer Reviewer 1 316

Summary and Recommendation Peer Reviewer 2..... 322

8.2.1. Full Summary of Comments – Peer Reviewer 2 322

9. Non-Conformances and Corrective Actions 332

9.1 Non Conformances..... 333

9.2 Corrective Actions 333

9.3 Status of non-conformances 347

10. Recommendation and Determination 348

11. References 349

Appendix 1 – Assessment Team 358

Appendix 2 359

Appendix 3 361

List of Figures

Figure 1 Golden King crab distribution in Alaska waters. 14

Figure 2 Tanner and snow crab distributions in Alaska waters..... 16

Figure 3 Red king crab distribution in Alaska waters. 18

Figure 4 Blue king crab distribution in Alaska waters. 20

Figure 5 The Bering Sea and Aleutian Islands (BSAI) management area. 22

Figure 6 Distribution of red king crab stocks in Alaska waters (after Seeb et al. 1989)..... 23

Figure 7 Aleutian Islands Management Area O and its subdivisions. 26

Figure 8 Single-buoy pot fishing method. 28

Figure 9 Annual cycle of management decision making for BSAI king and Tanner crab stocks (from BSAI crab FMP; NPFMC 2011). 31

Figure 10 Fishery management organizational chart for BSAI king and Tanner crab fisheries.**32**

Figure 11 National Marine Fisheries Service eastern Bering Sea bottom trawl survey boundary from 1975 to present indicating four major stanzas in total coverage. 33

Figure 12 National Marine Fisheries Service eastern Bering Sea standard bottom trawl area surveyed by the FV Alaska Knight and the FV Vesteraalen from 31 May to 26 July 2016. 34

Figure 13 Retained catch during the directed fishery, estimated bycatch mortality during all crab fisheries, and estimated bycatch mortality during all groundfish fisheries of Aleutian Islands golden king crab, 1985/86–2015/16. Note: CF = confidential. 43

Figure 14 Trends in GKC mature male biomass (model scenarios (Sc) 1 to 12 and 1d fits) in the EAG, 1960/61–2015/16. Mature male crab size is ≥ 121 mm CL. 44

Figure 15 Trends in GKC mature male biomass (model scenarios 1 to 12 and 1d fits) in the WAG, 1960/61–2015/16. Mature male crab size is ≥ 121 mm CL. 45

Figure 16 Retained catch (males $t \times 10^3$) in the directed fisheries (US pot fishery [green bars], Russian tangle net fishery [red bars], and Japanese tangle net fisheries [blue bars]) for Tanner crab since 1965/66. 46

Figure 17 Trends in survey biomass for mature male and female Tanner crab, and in abundance for legal..... 47

Figure 18 Model fits to the observed mature biomass at time of trawl survey for EBS snow crab. 48

Figure 19 Retained catch and bycatch mortality biomass (t) for Bristol Bay red king crab from 1953 to 2015. Handling mortality rates were assumed to be 0.2 for the directed pot fishery 0.25 for the Tanner crab fishery and 0.8 for the trawl fisheries. 49

Figure 20 Comparison of area-swept estimates of total survey biomass and 2016 model predictions for Bristol Bay red king crab. The error bars are ± 2 standard deviations..... 50

Figure 21 Comparisons of area-swept estimates of total male survey biomass (t) for SMBKC and model predictions for the 2015 model and each of the GMACS model scenarios in 2016. The error bars are ± 2 standard deviations. 52

Figure 22 Bristol Bay red king crab general, Community Development Quota (CDQ), and Individual Fishing Quota (IFQ) fishery ex-vessel value and vessel effort, 1980–2015/16 (from Leon et al. 2017)..... 54

Figure 23 Saint Matthew Island Section blue king crab commercial fishery effort and ex-vessel value, 1981–2015/16 (from Leon et al. 2017). 55

Figure 24 Eastern Bering Sea snow crab effort (number of vessels) and ex-vessel value (millions of dollars), 1979/80 to 2015/16. Data from Leon et al. (2017). 56

Figure 25 Eastern Bering Sea tanner crab effort (number of vessels) and ex-vessel value (millions of dollars), 1974/75 to 2015/16. Data from Leon et al. (2017). Gaps indicate fishery closures. 57

Figure 26 Status of 7 Bering Sea crab stocks in relation to status determination criteria (BMSY, MSST, overfishing). Note that information is insufficient to assess Tier 5 stocks according to these criteria (WAIRKC, AIGKC, PIGKC). 172

Figure 27 Magnuson Stevens Penalty Matrix..... 228

Figure 28 Year-round groundfish closures in the U.S. Exclusive Economic Zone (EEZ) of Alaska, excluding most Stellar sea lion closures (from Olson in Zador 2015) 285
Figure 29 The distribution of probability of presence for coral in the Aleutian Islands is shown below, with the areas closed to mobile fishing gear shaded in grey. (Credit: CN Rooper, NOAA: from DSCRTP 2016)..... 287

List of Tables

Table 1. Fishery Applicant Details. 13
Table 2. Proposed units of assessment and certification for the US Alaska King, Tanner and Snowcrab Bering Sea and Aleutian Islands Commercial fishery. 58
Table 3 Summary of Meetings, BSAI King, Tanner and Snow Crab Fishery site visits, Jan 20-29 2017. 59
Table 4 Stocks of king and Tanner crab in the BS/AI area (from Crab FMP 101 October 2011)..... 75
Table 5 Status and catch specifications of Aleutian Islands golden king crab..... 169
Table 6 Historical status and catch specifications for Eastern Bering Sea Tanner crab (thousand t). Shaded ... 172
Table 7 Historical status and catch specifications for snow crab (thousand t). Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch. 173
Table 8 Historical status and catch specifications for Bristol Bay red king crab (thousand t). Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch..... 174
Table 9 Historical status and catch specifications for Saint Matthew blue king crab (thousand t). Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch..... 175
Table 10 USCG CFVS Boardings and Violations BSAI Crab Fisheries (FY 2011-2016) 214
Table 11 Causes for Violations 215
Table 12 Dockside Boardings and violations from calendar year 2016 216
Table 13 IFQ Crab Boarding’s 2012-2016..... 218
Table 14 Effects of Tanner crab fishery on ecosystem (from Stockhausen 2016) 236
Table 15 Observer data from Gaeumon (2014) for Bristol Bay red king crab..... 257
Table 16 Observer data from Gaeumon (2013) for St. Matthew Island blue king crab..... 258
Table 17 Observer data from Gaeumon (2014) for EBS snow crab 259
Table 18 Observer data from Gaeumon (2014) for Bering Sea Tanner crab east of 166° W long..... 260
Table 19 Observer data from Gaeumon (2014) for Aleutian Islands golden king crab east of 174° W long 261
Table 20 Observer data from Gaeumon (2014) for Aleutian Islands golden king crab west of 174° W long 262

Acronyms

ABC	Allowable Biological Catch
ACA	Adak Community Allocation
ADFG	Alaska Department of Fish and Game
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center
ASMI	Alaska Seafood Marketing Institute
BOF	Board of Fisheries
BSAI	Bering Sea and Aleutian Islands
CCRF	Code of Conduct for Responsible Fisheries
CDQ	Community Development Quota
CFEC	Commercial Fisheries Entry Commission
CPT	Crab Plan Team
CPUE	Catch per Unit Effort
EBS	Eastern Bering Sea
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
IRFA	Initial Regulatory Flexibility Analysis
IRIU	Improved Retention/Improved Utilization
LLP	License Limitation Program
MSFCMA	Magnuson-Stevens Fisheries Management and Conservation 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
OY	Optimum Yield
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
SSL	Steller Sea Lion
TAC	Total Allowable Catch
USCG	U.S. Coast Guard

i. Summary and Recommendations

This document is the Reassessment Report (ref AK/CRA/002./2017) for the U.S. Alaska Bering Sea and Aleutian Islands King, and Snow crab commercial fisheries following Certification against the Alaska RFM Program, awarded on April 16th 2012.

The certification covers the U.S. Alaska Bering Sea and Aleutian Islands King, Tanner, and Snow crab commercial fisheries [Bristol Bay Red King crab (*Paralithodes camtschaticus*), St. Matthew Island Blue King crab (*Paralithodes platypus*), Eastern Bering Sea Tanner Crab (*Chionoecetes bairdi*), Aleutian Islands Golden King Crab (*Lithodes aequispinus*), and Eastern Bering Sea Snow crab (*Chionoecetes opilio*)] 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.

The reassessment was conducted according to the Global Trust procedures for Alaska RFM Certification using the Alaska RFM Standard to Version 1.3 Standard. The reassessment was conducted by a team of Global Trust appointed Assessors comprising of two members of Global Trust’s internal staff and two externally contracted fishery expert. Details of the assessment team are provided in [Appendix 1](#).

The main Key outcomes have been summarized in Section 5 “[Assessment Outcome Summary](#)”. During this reassessment two minor non-conformances were found on sub-clauses 6.3 and 12.13. A corrective action plan has been provided by the client for the minor non-conformances on 6.3 and 12.13.

Finally the Assessment Team recommends that the management system of the applicant fishery, the U.S. Alaska Bering Sea and Aleutian Islands King, Tanner, and Snow crab commercial fisheries [Bristol Bay Red King crab (*Paralithodes camtschaticus*), St. Matthew Island Blue King crab (*Paralithodes platypus*), Eastern Bering Sea Tanner Crab (*Chionoecetes bairdi*), Aleutian Islands Golden King Crab (*Lithodes aequispinus*), and Eastern Bering Sea Snow crab (*Chionoecetes opilio*)] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ), should be awarded continuing certification and initial certification (continuing certification in the case of BB RKC, SMI BKC and EBS SC; initial certification in the case of AI GKC and EBS TC) to the AK Responsible Fisheries Management Certification Program.

ii. Schedule of Key Assessment Activities

Assessment Activities	Date(s)
Appointment of Reassessment Team	December 16, 2016
On-site Witnessed Reassessment and Consultation Meetings	January 20-27 th 2017
Draft Reassessment Report	April 17, 2017
External Peer Review	October 1-31, 2017
Final Reassessment Report	November 1 2017
Certification Review/Decision	December 7 2017

iii. Assessment Team Details

Dr. Ivan Mateo, Lead Assessor

SAI Global/Global Trust Certification Ltd.
Providence, Rhode Island
United States of America
T: +1 401 486 8592
E: ivan.mateo@saiglobal.com

Dr. Gerald P. Ennis , Assessor 1

Independent fishery expert
St. Johns Newfoundland, Canada.
E: ennis.jerry@gmail.com

Dr. Wesley W. Toller, Assessor 2

Independent fishery expert
Seattle, United States
E: wesleytoller@gmail.com

Jean Ragg, Program Administration

SAI Global/Global Trust Certification Ltd.
Quayside Business Park, Mill Street
Dundalk, County Louth, Ireland
E: jean.ragg@saiglobal.com

1. Introduction

The U.S. Alaska Bering Sea and Aleutian Islands King and Snow crab commercial fisheries [Bristol Bay Red King crab (*Paralithodes camtschaticus*), St. Matthew Island Blue King crab (*Paralithodes platypus*), and Eastern Bering Sea Snow crab (*Chionoecetes opilio*)] fishery was reassessed against the requirements of the AK-RFM Certification Program. The request for reassessment was made by Bering Sea Crab Client Group LLC, and was conducted by Global Trust Certification Ltd. On this reassessment, there were two new fisheries assessed and added on the certificate: Eastern Bering Sea Tanner Crab (*Chionoecetes bairdi*), Aleutian Islands Golden King Crab (*Lithodes aequispinus*).

This reassessment report documents the reassessment procedure for the continuing certification of U.S. Alaska Bering Sea and Aleutian Islands King and Snow crab commercial fisheries as well as the new assessments for certification for Tanner Crab (*Chionoecetes bairdi*), and Aleutian Islands Golden King Crab (*Lithodes aequispinus*), to the Alaska RFM Certification Program. This is a voluntary program for Alaska fisheries and has been supported by ASMI who wish to provide an independent, third-party certification program that can be used to verify that Alaska fisheries are responsibly managed according to the FAO Code of Conduct for Responsible Fisheries.

The reassessment was conducted according to the Global Trust procedures for Alaska RFM Certification in accordance with EN45011/ISO/IEC Guide 65 accredited certification procedures. The reassessment is based on the criteria specified in the Alaska Responsible Fisheries Management (AKRFM) Standard Version 1.3. The Alaska RFM Standard is composed of conformance criteria based on the 1995 FAO Code of Conduct for Responsible Fisheries and the FAO Guidelines for the Eco-labelling of Fish and Fishery Products from Marine Capture Fisheries adopted in 2005 and amended/extended in 2009; hereafter generally referred to as the FAO Criteria. The Standard also includes full reference to the 2011 FAO Guidelines for the Eco-labelling of Fish and Fishery Products from Inland Fisheries which in turn are now supported by a suite of guidelines and support documents published by the UN FAO.

The reassessment is based on 6 major components of responsible management that are derived from the FAO Code of Conduct for Responsible Fisheries and Guidelines for the Eco-labelling 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 124 sub-clauses. Collectively, these form the Alaska RFM Conformance Criteria against which a fishery applying for certification is assessed.

The reassessment was comprised of reassessment planning, onsite audits and certification reporting, Peer Review and Certification Committee review. Five meetings/visits were held during the site visit made to the fishery. At various stages in the reassessment process, information pertaining to the step in the reassessment process has been posted on the Alaska Seafood website at the following address:

<http://www.alaskaseafood.org/rfm-certification/certified-fisheries-companies/certified-fisheries/>.

The Draft Report will also be available for comment by stakeholders who have registered interest with Global Trust during a 30 day period. (<http://www.GTCert.com>)

A summary of the consultation meetings is presented in section 5. Assessors were comprised of both external contracted fishery consultants and Global Trust internal staff ([Appendix 1](#)). Peer Reviewers were comprised of external contracted fisheries consultants ([Appendix 2](#)).

This report documents each step in the reassessment process and the recommendation to the Certification Committee of Global Trust who will preside over the certification decision according to the requirements of ISO/IEC Guide 65 accredited certification

Recommendations of the Assessment Team

The Assessment Team recommends that the management system of the applicant fishery, U.S. Alaska Bering Sea and Aleutian Islands King, Tanner, and Snow crab commercial fisheries [Bristol Bay Red King crab (*Paralithodes camtschaticus*), St. Matthew Island Blue King crab (*Paralithodes platypus*), Eastern Bering Sea Tanner Crab (*Chionoecetes bairdi*), Aleutian Islands Golden King Crab (*Lithodes aequispinus*), and Eastern Bering Sea Snow crab (*Chionoecetes opilio*)] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) 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

Table 1. Fishery Applicant Details.

Applicant Contact Information			
Organization/Company Name:	Bering Sea Crab Client Group LLC	Date: 4/27/17	
Correspondence Address:	23929 22ND Drive, SE, Bothell		
Street :			
City :	Seattle		
State:	Washington	Zip code	98199
Country:	USA		
Phone:	(425) 486 8173	E-mail Address:	sgoodman@nrccorp.com
Key Management Contact Information			
Full Name:	Goodman	Scott	
Position:	Executive Director		
Correspondence Address:	23929 22ND Drive, SE, Bothell		
Street :			
City :	Seattle	Zip code	98199
State:	Washington		
Country:	USA		
Phone:	(425) 486 8173	E-mail Address:	sgoodman@nrccorp.com

3. Background to the Fishery

3.1 Species Biology

Golden King Crab (*Lithodes aequispinus*)

Golden, or brown, king crab (GKC) occur from the Japan Sea to the northern Bering Sea, around the Aleutian Islands, on various sea mounts, and as far south as northern British Columbia (Figure 1). In the Bering Sea and Aleutian Islands, they are found at depths from 200 m to 1,000 m, generally on high relief, rocky habitat where strong currents and abundant epifauna are prevalent¹.

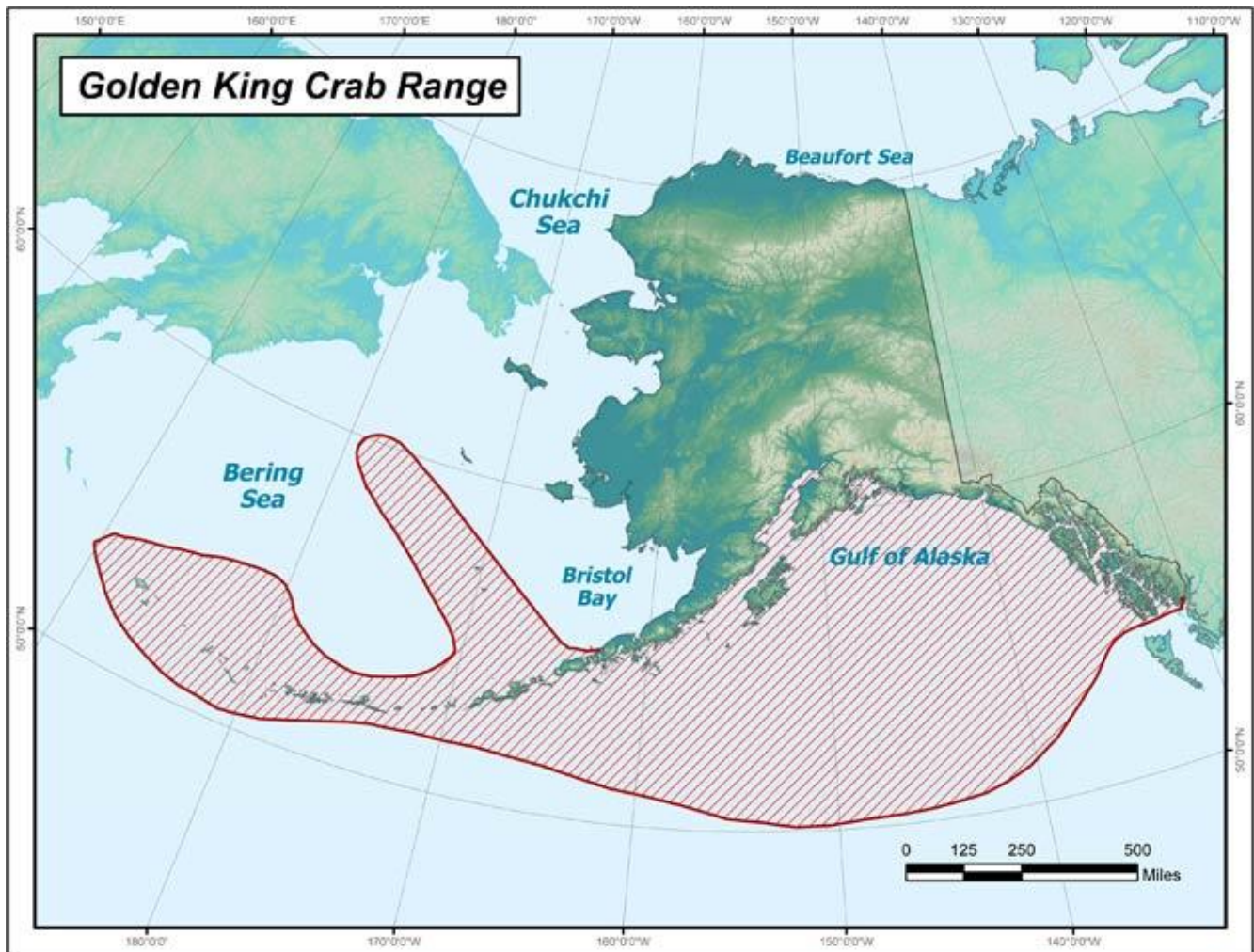


Figure 1 Golden King crab distribution in Alaska waters².

¹ http://www.afsc.noaa.gov/Education/factsheets/10_gkc_fs.pdf

² <http://www.adfg.alaska.gov/index.cfm?adfg=goldenkingcrab.rangemap>

Size at sexual maturity varies with latitude, with crabs in the northern areas maturing at smaller sizes. In the St. Matthew Island area, males and females attain 50% maturity at 92 mm and 98 mm carapace length, respectively while in the eastern Aleutian Islands these sizes are 130 mm and 111 mm. Mature GKC occur at all depths within their distribution. Males tend to congregate in somewhat shallower waters than females, and this segregation appears to be maintained throughout the year. Legal males are most abundant between 274 and 639 m, abundance of sub-legal males increases at depths >364 m and females are most abundant at intermediate depths between 274 and 364 m.

Females molt and mate year-round and brood their eggs for about 12 months. Spawning is asynchronous and aseasonal. Because larvae can develop without eating (lecithotrophic), eggs are larger with more yolk and fewer, typically between 10,000 and 30,000, than in other king crab species. The intermolt period for males averages > 1 year, at 139 mm carapace length only about 50% molt annually.

The diet of GKC is mostly unknown but is likely similar to other king crab species. As opportunistic omnivores, they likely eat bivalves, sea stars, polychaete worms, sand dollars, crabs and other crustaceans, sponges, and sea urchins.

Tanner Crab (*Chionoecetes bairdi*)

Chionoecetes bairdi is one of five species in the genus *Chionoecetes*. The common name “Tanner crab” for *C. bairdi* was recently modified to “southern Tanner crab”. Prior to this, the term “Tanner crab” had also been used to refer to other members of the genus, or the genus as a whole. Hereafter, the common name “Tanner crab” will be used in reference to “southern Tanner crab”³.

Tanner crabs are found in continental shelf waters of the north Pacific. In the east, their range extends as far south as Oregon and in the west as far south as Hokkaido, Japan. The northern extent of their range is in the Bering Sea, where they are found along the Kamchatka Peninsula to the west and in Bristol Bay to the east. In the eastern Bering Sea, the Tanner crab distribution may be limited by water temperature. *C. bairdi* is common in the southern half of Bristol Bay, around the Pribilof Islands, and along the shelf break, although males smaller than the industry-preferred size (>125 mm CW) and ovigerous and immature females of all sizes are distributed broadly from southern Bristol Bay northwest to St. Matthew Island. The southern range of the cold water congener the snow crab, *C. opilio*, in the EBS is near the Pribilof Islands. The distributions of snow and Tanner crab overlap on the shelf from approximately 56° to 60°N, and in this area, the two species hybridize (Figure 2).

Although the State of Alaska’s (SOA) harvest strategy and management controls for this stock are different east and west of 166° W, the unit stock of Tanner crab in the EBS appears to encompass both regions and comprises crab throughout the geographic range of the NMFS bottom trawl survey and for assessment, it is treated as a single unit.

³ http://www.afsc.noaa.gov/Education/factsheets/10_bairdi_fs.pdf

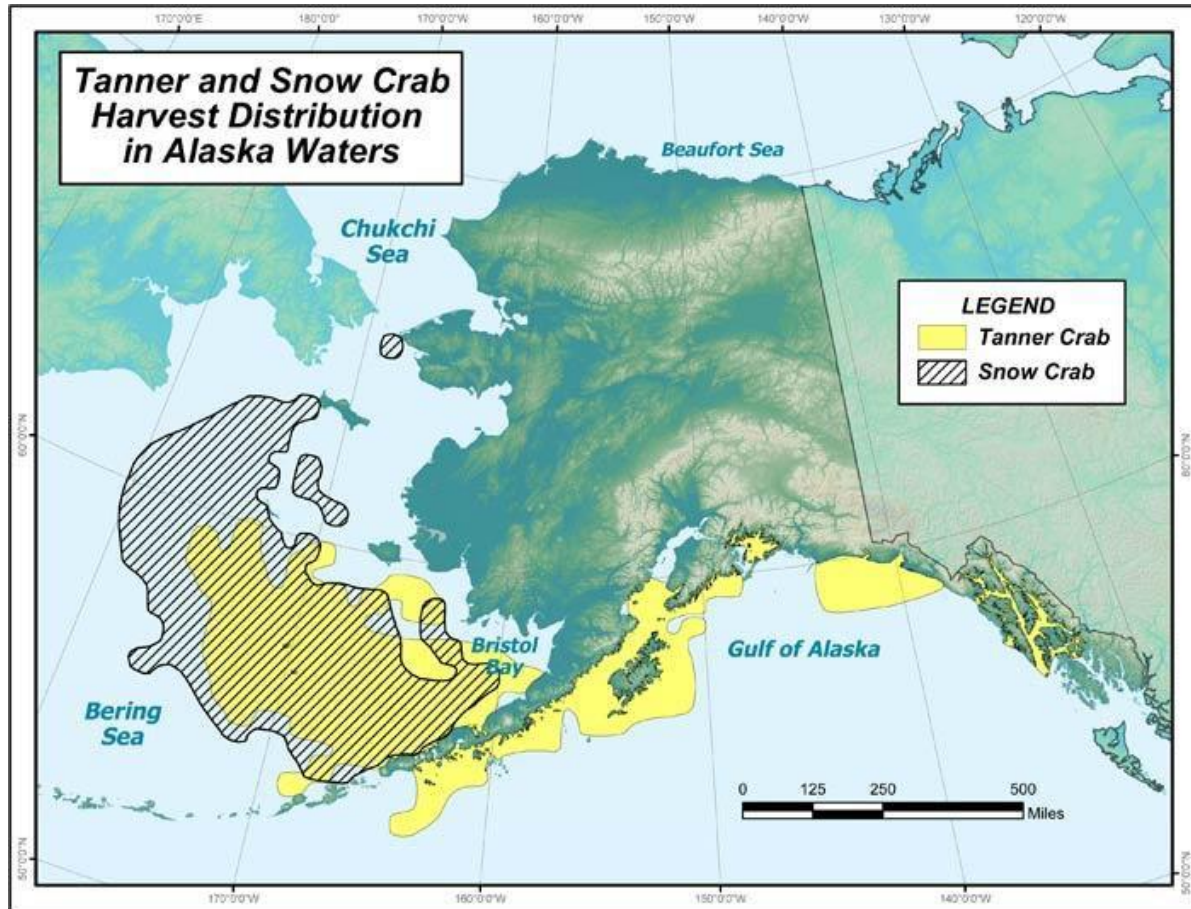


Figure 2 Tanner and snow crab distributions in Alaska waters⁴.

Crabs grow through molting. Newly-molted crab are soft-shelled and harden gradually. Growth in immature Tanner crab larger than 25 mm CW proceeds by a series of annual molts up to a final (terminal) molt to maturity. Females usually undergo their terminal molt from their last juvenile, or pubescent, instar while being grasped by a male. Subsequent mating takes place annually in a hard shell state after the female’s clutch of eggs has hatched. Fertile egg clutches can be produced in the absence of mating by using sperm stored in the spermathecae. Two or more consecutive egg fertilization events can follow a single copulation using stored sperm to self-fertilize the new clutch although egg viability decreases with time and age of the stored sperm.

In males, physiological maturity refers to the presence or absence of spermatophores in the gonads whereas morphometric maturity refers to the presence or absence of a large claw. During the terminal molt to morphometric maturity, there is a disproportionate increase in the size of the chelae in relation to the carapace. A consequence of the terminal molt in male Tanner crab is that a substantial portion of the population may never achieve legal size.

⁴ <http://www.adfg.alaska.gov/index.cfm?adfg=tannercrab.rangemap>

Differences have been observed between mating periods for pubescent and multiparous females in the Gulf of Alaska and Prince William Sound. There, pubescent molting and mating takes place over a protracted period from winter through early summer, whereas multiparous mating occurs over a relatively short period during mid-April to early June. Egg condition for multiparous females in the EBS observed between April and July also suggest that hatching of old and extrusion of new clutches began in April and ended in mid-June.

A variety of factors affect fecundity, female size being the most important. For females 75 to 124 mm CW fecundity ranges from 89 to 424 x 10³ eggs. Primiparous females are only about 70% as fecund as multiparous females of the same size. From data collected in the NMFS bottom trawl survey, size at 50% maturity for females (all shell classes combined) has been estimated at 68.8 mm CW and for males (all shell classes combined) at 91.9 mm CW.

Snow Crab (*Chionoecetes opilio*)

Snow crab are distributed on the continental shelf of the Bering Sea, Chukchi Sea, and in the western Atlantic Ocean as far south as Maine⁵. In the Bering Sea, snow crab are distributed widely over the shelf and are common at depths less than about 200 meters (Figure 2). In the Bering Sea, smaller crabs tend to occupy more inshore northern regions and mature crabs deeper areas to the south of the juveniles. The eastern Bering Sea population within U.S. waters is managed as a single stock, however, distribution of the population may extend into Russian waters to an unknown degree. Snow crab are found on soft bottoms at depths of 60-400 m where temperature remains below 5°C.

Maturity is attained at about 5-6 years. There is a large size disparity between the sexes. Maximum size is about 95 mm carapace width (CW) in females and 160 mm in males. Males and females undergo a terminal molt to maturity. In females this molt occurs while being grasped by a mature male and they mate for the first time while in soft shell condition – these females are referred to as primiparous. Subsequent mating of multiparous females takes place annually in a hard shell state after the female's clutch of old eggs has hatched. Fertile egg clutches can be produced in the absence of mating by using sperm stored in the spermathecae. Two or more consecutive egg fertilization events can follow a single copulation using stored sperm to self-fertilize the new clutch, although egg viability decreases with time and age of the stored sperm.

In males, physiological maturity refers to the presence or absence of spermatophores in the gonads whereas morphometric maturity refers to the presence or absence of a large claw. During the terminal molt to morphometric maturity, there is a disproportionate increase in the size of the chelae in relation to the carapace. Morphometrically mature males readily copulate, however, morphometrically immature, or juvenile, males that have not undergone terminal molt can have fully formed spermatophores in their vas deferens and can mate with both primiparous and multiparous females. A consequence of the terminal molt in males is that a substantial portion of the population may never achieve legal size.

Snow crab mate in late winter to early spring. Females carry between 6000 and 140,000 eggs. Hatching occurs during April to June in the year following mating. Hatching usually coincides with peak of the spring plankton bloom, resulting in high availability of food for the larvae. The free-swimming larvae molt and grow through several distinct stages over a 2-month period before settlement.

⁵ http://www.afsc.noaa.gov/Education/factsheets/10_opilio_fs.pdf

Snow crab diet changes with 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.

Red King Crab (*Paralithodes camtschaticus*)

Red king crab inhabit intertidal waters to depths >200 m of the North Pacific Ocean from British Columbia to the Bering Sea, and south to Hokkaido, Japan, and are found in several areas of the Aleutian Islands, eastern Bering Sea, and the Gulf of Alaska⁶ (Figure 3).

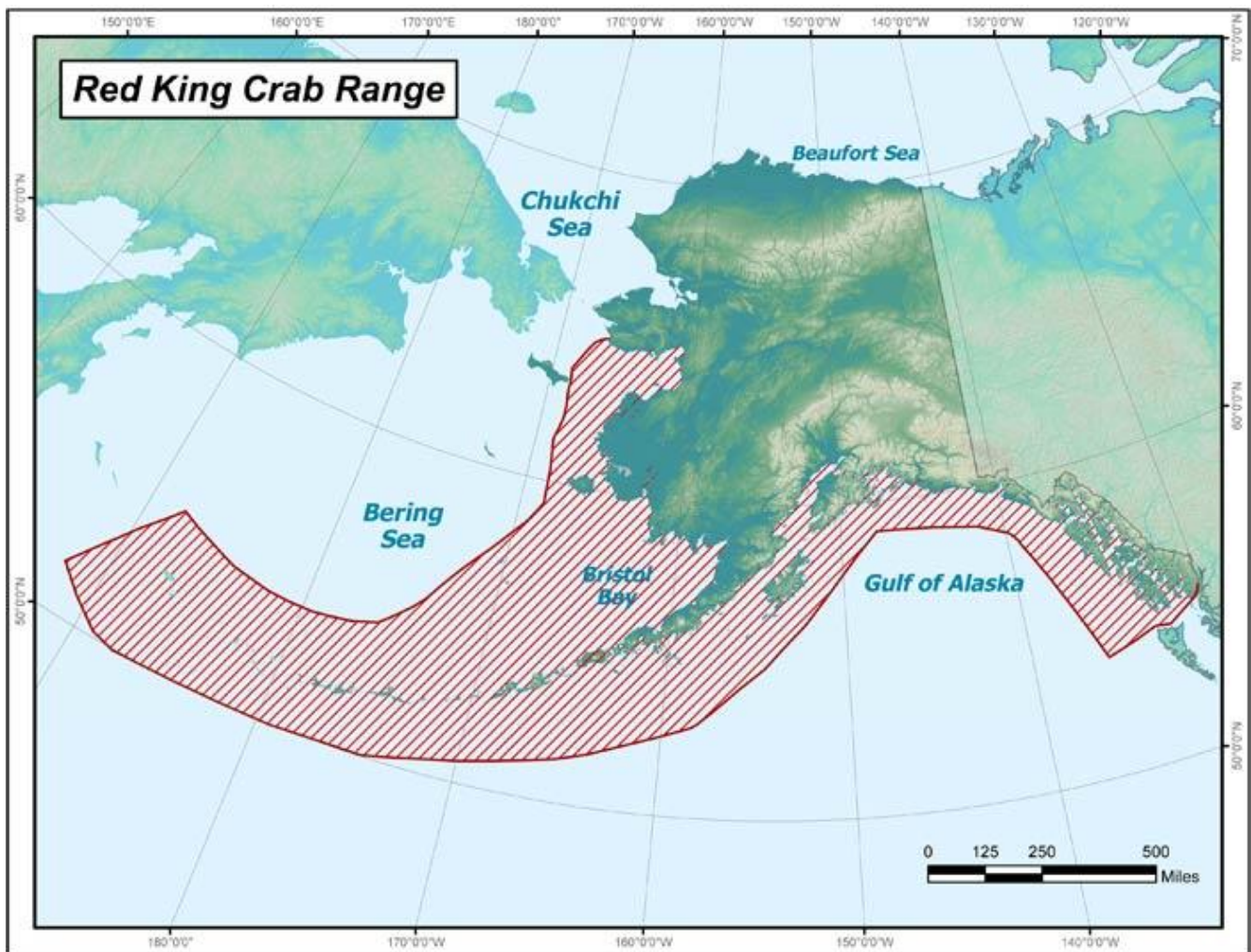


Figure 3 Red king crab distribution in Alaska waters⁷.

⁶ http://www.afsc.noaa.gov/Education/factsheets/10_rkc_fs.pdf

⁷ <http://www.adfg.alaska.gov/index.cfm?adfg=redkingcrab.rangemap>

Red king crabs are a species of large crab that appear dark red or burgundy in colour⁸. They are closely related to the blue king crab (*Paralithodes platypus*) and the golden (brown) king crab (*Lithodes aequispinus*). Juveniles molt multiple times per year until age 3 or 4, thereafter, molting continues annually in females for life and in males until attaining functional maturity, after which molt frequency declines. Male red king crabs can grow to very large sizes with carapace lengths up to 11 inches and a five foot leg span. Both sexes reach sexual maturity at 5–12 years of age, may live >20 years and attain maximum sizes of 227 carapace length (CL) in males and 195 mm CL in females. Adult females must molt in order to mate but males do not.

Primiparous females mate a few weeks earlier in the spring than multiparous females. The eggs are extruded and carried externally for about 11 months and hatched during April-June the following year. Fecundity ranges from several tens of thousands to a few hundreds of thousands depending on female size.

Adults undertake shallow to deep annual migrations. They move to shallow water in late winter and by spring the hatching of old eggs occurs. Adult females and some adult males molt and mate before moving back to deeper water to feed and where they tend to segregate. In the Kodiak area, adult males have been known to migrate up to 100 miles round-trip annually, moving at times as fast as a mile per day.

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 while adults prey on 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.

Blue King Crab (*Paralithodes platypus*)

Blue king crab range throughout the North Pacific Ocean from Hokkaido, Japan to southeastern Alaska⁹. Their distribution is discontinuous (Figure 4). 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.

⁸ <http://www.adfg.alaska.gov/index.cfm?adfg=redkingcrab.main>

⁹ <http://www.adfg.alaska.gov/index.cfm?adfg=bluekingcrab.main>

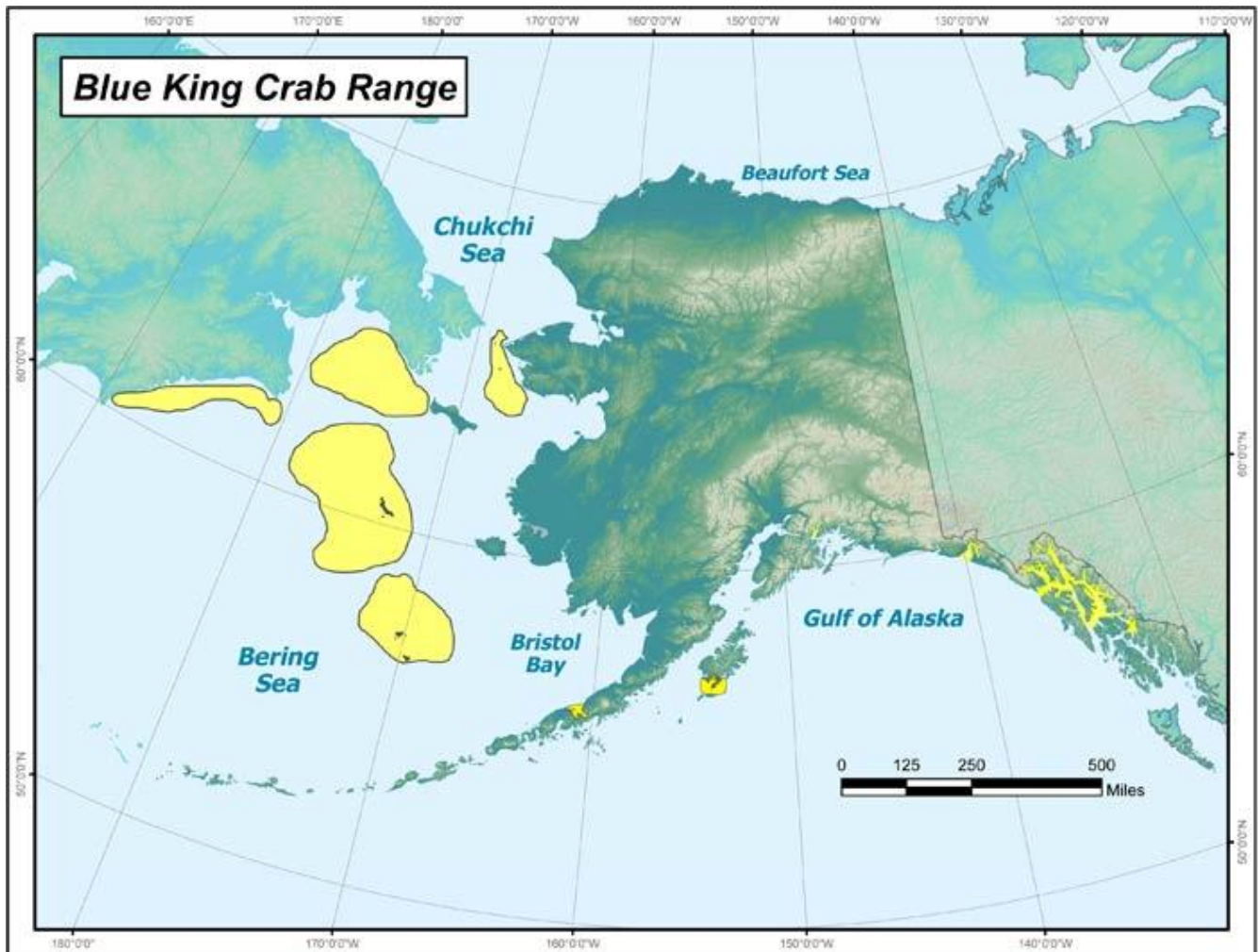


Figure 4 Blue king crab distribution in Alaska waters¹⁰.

Like the red king crab, the blue king crab is considered a shallow water species by comparison with other lithodids such as golden king crab, *Lithodes aequispinus*, and the scarlet king crab, *Lithodes couesi*¹¹. Adults undergo an annual deep to shallow water migration. They move to shallow water in late winter and, after hatching of old eggs in spring, the females and some males molt and mate before moving back to deeper water where they feed and tend to segregate by sex. Adult males are found at an average depth of 70 m.

Unlike red king crab, juvenile blue king crab do not form pods, but instead rely on cryptic coloration for protection from predators and require suitable habitat such as cobble and shell hash. They molt frequently as juveniles, growing a few millimeters in size with each molt. They reach sexual maturity at 5-6 years of age. In the St. Matthews Island population, spermatophores are present in the vas deferens of 50% of males at sizes of 40-49 mm CL and in 100% of the males \geq 100 mm CL. Although spermatophore presence indicates physiological sexual maturity, it may not be an indicator of functional sexual maturity. For management

¹⁰ <http://www.adfg.alaska.gov/index.cfm?adfg=bluekingcrab.rangemap>

¹¹ http://www.afsc.noaa.gov/Education/factsheets/10_bkc_fs.pdf

purposes, 105 mm CL is used to define the lower bound of functionally maturity in males. The reproductive cycle appears to be annual for the first two reproductive cycles and biennial thereafter. Longevity is unknown but estimates indicate this species may live, 20 to 30 years.

Females release an average of 110,000 larvae over a 29-day period in late March through mid-April. The larval period lasts for 2.5 to 4 months and, following metamorphosis, settlement occurs during July through early September.

Food eaten by king crabs varies by species, size, and depth inhabited. They are omnivorous and their diet includes worms, clams, mussels, snails, brittle stars, sea stars, sea urchins, sand dollars, barnacles, crabs, other crustaceans, fish parts, sponges, and algae. They are preyed upon by a wide variety of organisms including Pacific cod, sculpins, halibut, yellowfin sole, octopuses, other king crabs, and sea otters.

The foregoing summaries of species biology have been adapted from several sources, primarily the stock assessment documents included in SAFE 2016 and the factsheets found at the links provided.

3.2 Fishery Location and Method

Management Area

The Fishery Management Plan (FMP) for BSAI king and Tanner crabs (NPFMC 2011) 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 Bering Sea and Aleutian Islands area (BSAI), 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. Each of the five stocks under assessment here is managed under the FMP for BSAI king and Tanner crabs.

The BSAI area is defined in the FMP 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). The 1988 agreement between the two parties shifted the boundary westward from the convention line of 1867. Boundaries of the BSAI management area are shown in Figure 5 below.

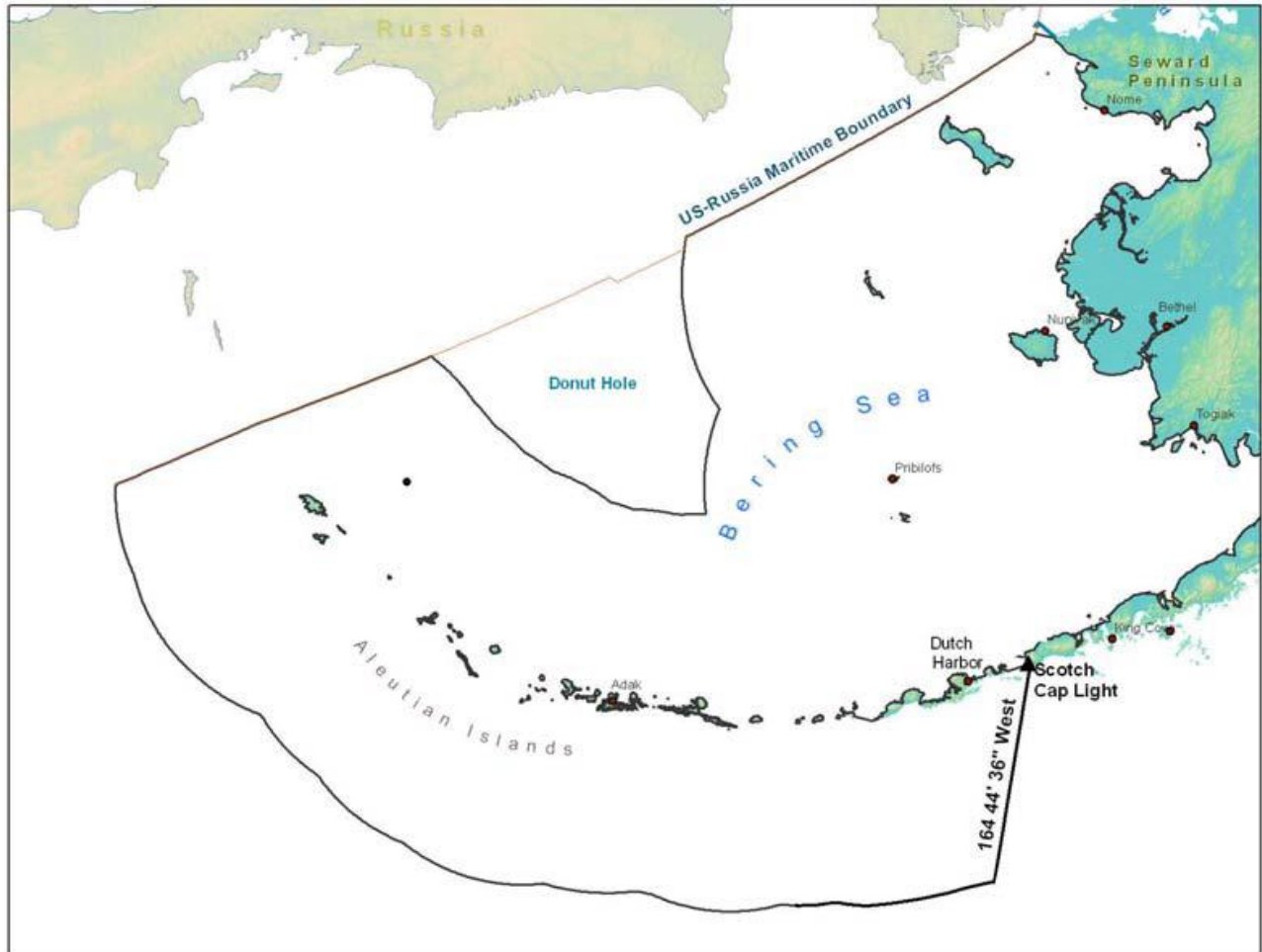


Figure 5 The Bering Sea and Aleutian Islands (BSAI) management area.

Stock Structure – Bristol Bay Red King Crab

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° 36’ N lat.), east of 168° 00’ W long., and south of the latitude of Cape Newenham (58° 39’ N lat.) (ADF&G

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 6).

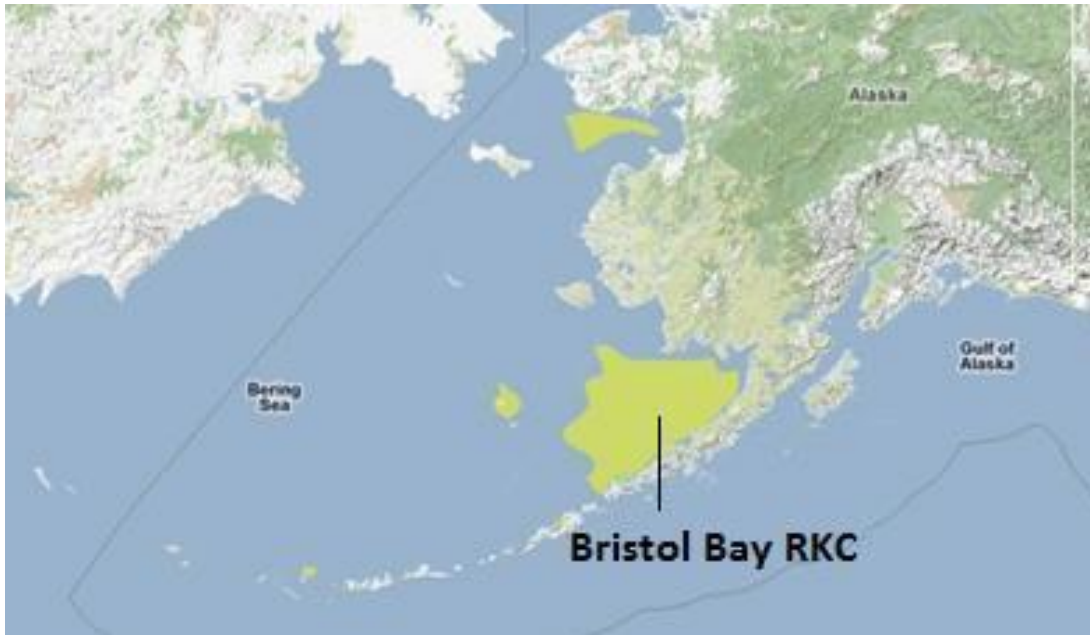


Figure 6 Distribution of red king crab stocks in Alaska waters (after Seeb et al. 1989).

More recently, 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. Grant et al. (2014) recently reviewed the phylogeography and population genetics of red king crab, providing a synopsis of our current understanding of population structure of this species in the North Pacific.

Stock Structure – St. Matthew Blue King Crab

Two discrete stocks of blue king crab are actively managed in the BSAI region: the Pribilof Islands and St. Matthew Island stocks. Other smaller populations of blue king crab are found in the vicinity of St. Lawrence Island and Nunivak Island, as well as isolated populations in the Gulf of Alaska. Blue king crab stocks are managed separately to accommodate different life histories and fishery characteristics (Crab FMP 2011).

According to the 2016 Crab SAFE report, the Alaska Department of Fish and Game (ADF&G) Gene Conservation Laboratory division has detected regional population differences between blue king crab collected from St. Matthew Island and the Pribilof Islands. NMFS tag-return data from studies on blue king crab in the Pribilof Islands and St. Matthew Island support the idea that legal-sized males do not migrate between the two areas (Otto and Cummiskey 1990). St. Matthew Island blue king crab 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.

Stock Structure – EBS Snow Crab

As noted at initial assessment (GTC 2012), currently there is little known about *C. opilio* genetic population structure within the Pacific/Arctic range of the species. The Eastern Bering Sea stock is managed as a single unstructured (random-mating) population. The goal of current 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.

Research conducted by the ADFG's Gene Conservation Lab found low levels of geographic differentiation 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 et al. 1998).

Parada et al. 2010 used biophysical modelling to develop a new hypothesis for the spatial dynamics of the Bering sea snow crab population: 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. Results from simulations 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 (i.e. southern- and westernmost areas of the Bering Sea) out of the geographic region of interest.

Stock Structure – EBS Tanner Crab

The 2011 Crab FMP (2011) identifies a single stock of Tanner crab, *C. bairdi*, managed within the eastern Bering Sea. According to the 2016 Crab SAFE report, Tanner crabs in the EBS are considered to be a separate stock distinct from Tanner crabs in the eastern and western Aleutian Islands. Somerton (1981b) suggests that clinal differences in some biological characteristics may exist across the range of the unit stock. These conclusions may be limited since terminal molt at maturity in this species was not recognized at the time of that analysis, nor was stock movement with ontogeny considered. Biological characteristics estimated based on comparisons of length frequency distributions across the range of the stock, or on modal length analysis over time may be confounded as a result.

Although the State of Alaska's (SOA) harvest strategy and management controls for this stock are different east and west of 166° W, the unit stock of Tanner crab in the EBS appears to encompass both regions and comprises crab throughout the geographic range of the NMFS bottom trawl survey. Evidence is lacking that the EBS shelf is home to two distinct, non-intermixing, non-interbreeding stocks that should be assessed and managed separately.

Stock Structure – Aleutian Islands Golden King Crab

Several discrete stocks of golden king crab are thought to exist in the BSAI region. Until 1996, the Aleutian Islands GKC stock was separated into two management areas, Adak and Dutch Harbor. The entire area is now managed as one area; Dutch Harbor Area O. Based on historic landing data, two golden crab stocks have been identified and are managed as the Sequam and Adak stocks separated at 174° W longitude (Crab FMP 2011). They are also referred to as eastern Aleutian golden (EAG) and western Aleutian golden (WAG) stocks.

The 2016 Crab SAFE report considers in some detail the evidence for golden king crab stock structure. Given the expansiveness of the Aleutian Islands Area and the existence of deep (>1,000 m) canyons between some islands, at least some weak structuring of the stock within the area would be expected. Data for making inferences on stock structure of golden king crab within the Aleutian Islands are largely limited to the geographic distribution of commercial fishery catch and effort. Catch data by statistical area from fish tickets and catch data by location from pots sampled by observers suggest that habitat for legal-sized males may be continuous throughout the waters adjacent to the islands in the Aleutian chain. However, regions of low fishery catch suggest that availability of suitable habitat, in which golden king crab are present at only low densities, may vary longitudinally. Catch has been low in the fishery in the area between 174° W longitude and 176° W longitude (the Adak Island area) in comparison to adjacent areas, a pattern that is consistent with low CPUE for golden king crab between 174° W longitude and 176° W longitude during the 2002, 2004, 2006, 2010, and 2012 NMFS Aleutian Islands bottom trawl surveys (von Szalay et al. 2011).

In addition to longitudinal variation in GKC density, there is also a gap in fishery catch and effort between the Petrel Bank-Petrel Spur area and the Bowers Bank area; both of those areas, which are separated by Bowers Canyon, have reported effort and catch. Recoveries during commercial fisheries of golden king crab tagged during ADF&G surveys (Blau and Pengilly 1994; Blau et al. 1998; Watson and Gish 2002; Watson 2004, 2007) provided no evidence of substantial movements by crab in the size classes that were tagged (males and females ≥ 90 -mm carapace length [CL]). Maximum straight-line distance between release and recovery location of 90 golden king crab released prior to the 1991/92 fishery and recovered through the 1992/93 fishery was 61.2 km (Blau and Pengilly 1994). Of the 4,567 recoveries reported through 12 April 2016 for the male and female golden king crab tagged and released between 170.5° W longitude and 171.5° W longitude during the 1991, 1997, 2000, 2003, and 2006 ADF&G Aleutian Island golden king pot surveys, none of the 3,807 with recovery locations specified by latitude and longitude were recovered west of 173° W longitude and only fifteen were recovered west of 172° W longitude (V. Vanek, ADF&G, Kodiak, pers. comm.). Similarly, of 139 recoveries in which only the statistical area of recovery was reported, none were recovered in statistical areas west of 173° W longitude and only one was in a statistical area west of 172° W longitude.

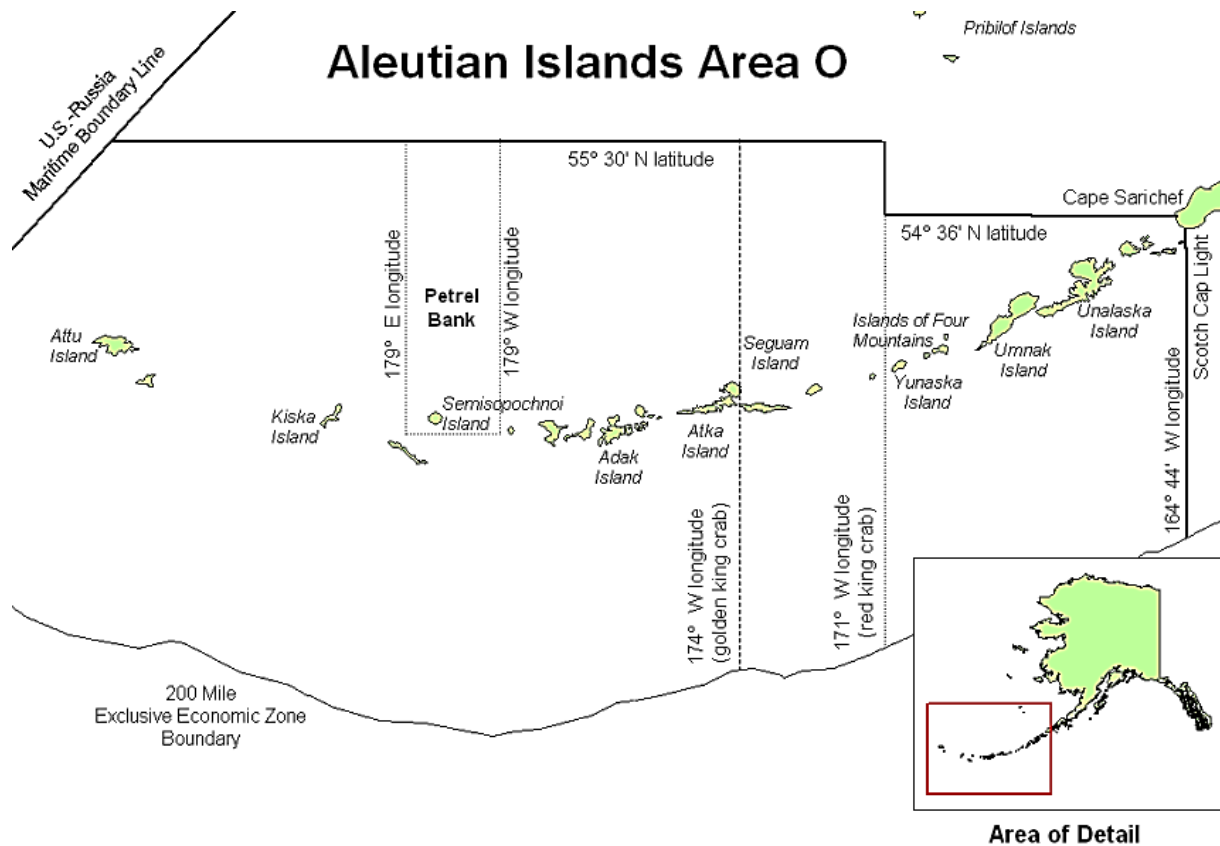


Figure 7 Aleutian Islands Management Area O and its subdivisions.

Fishing Method

The five king and Tanner crab stocks under consideration here are harvested using twine or wire meshed steel pots (traps). The Federal BSAI Crab FMP 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 respectively¹². Mesh sizes are specified to allow escapement of sublegal-sized crabs and females. The pots must have escape rings located on the sides of the pots to aid in the escape of smaller crabs.

In addition, regulation 5 AAC 39.145 *Escape Mechanism for Shellfish and Bottomfish Pots*¹³ was put in place to limit the potential for ghost fishing and the needless death of crabs and other animals. This regulation stipulates, in part, that crab pots must contain an appropriately located opening at least 18 in long that is then “laced, sewn, or secured together by a single length of untreated, 100 percent cotton twine, no larger than 30 thread,” which may be knotted only at the ends. If a pot becomes lost, the length of cotton twine will eventually decay through a process of biodegradation, permitting captured animals to escape. The regulation also allows for an alternative mechanism using a galvanic timed-release (GTR) device designed to release within 30 days (Gaeuman 2011).

¹² <http://www.touchngo.com/Iglcntr/akstats/aac/title05.htm>

¹³ <http://www.touchngo.com/Iglcntr/akstats/aac/title05/chapter039/section145.htm>

Pots are baited with herring or other fresh bait such as Pacific cod. 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.

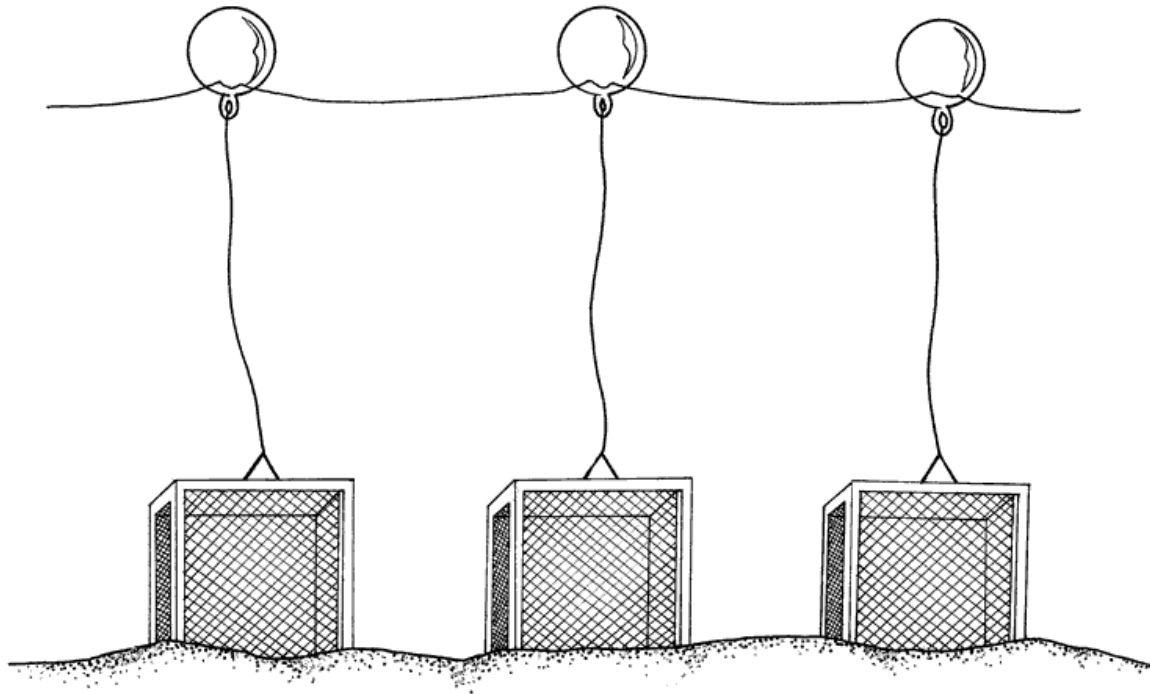
Pot soak time is variable and depends on a number of factors including the fishery and species targeted. Typically pots are soaked for one or more days however in the Aleutian Islands GKC fishery soak times may exceed 20 days. Once aboard, a pot is opened and the catch is sorted. Females, and undersized males are discarded alive down inclined ramps over the side and legal-sized males are retained in aerated seawater tanks (live-holds). The inclined ramps prevent the crabs from receiving damage that would have occurred if the crabs had fallen and impacted 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. In some situations, pots may be stored at sea in designated areas in an inactivated (i.e. non-fishing) state with all doors fully open and with all bait containers removed (e.g. 5 AAC 34.627¹⁴). Typically, catcher vessels deliver crab live to shore stations where they are cooked and then either canned or sold as fresh or frozen product. A lesser number of catcher-processor vessels also operate in the BSAI crab fisheries.

Single-Buoy Pots and Longline Pots

Four of the five fisheries under assessment here utilize a pot fishing method whereby a line extends from each pot to a surface buoy that marks its location (Figure 8). This single-buoyed pot arrangement is used exclusively in the Bristol Bay Red King crab fishery, St. Matthew Island blue king crab fishery, EBS Tanner crab fishery, and EBS snow crab fishery.

¹⁴ <http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section627.htm>



© Alaska Seafood 2008

Figure 8 Single-buoy pot fishing method.

In the Aleutian Islands golden king crab fishery, pots are set attached to a longline (i.e. longline pot method). Golden king crabs inhabit depths greater than where other commercially exploited king crabs are typically found (Blau et al. 1996). In addition, strong currents are typical of the Aleutian Islands region (J. Hilsinger, pers. comm.) The depths and steep bottom topography in the inter-island passes inhabited by golden king crabs necessitates the use of longlined rather than single pot gear. The longline pot fishing method facilitates pot retrieval in high current areas and may reduce pot loss (NMFS 2004).

Use of longline pot gear for AIGKC is set forth in the Alaska Administrative Code 5 AAC 34.625 *Lawful gear for Registration Area O*¹⁵: (b) Pots used to take golden king crab (2) may be operated only from a shellfish longline; a buoy is not required for each pot, but each end of the longline must be marked by a cluster of four buoys; one buoy in the cluster must be marked in accordance with 5 AAC 34.051 and have the initials "SL" to identify it as a shellfish longline; for purposes of this subsection "a shellfish longline" is a stationary, buoyed, and anchored line with at least 10 shellfish pots attached.

In the AIGKC fishery, vessel set 400 to 1,800 pots (700 pots each on average). Pots used in this fishery are constructed with a steel bar frame and covered with nylon mesh netting. A variety of pots sizes is used, largely depending on vessel size and area fished. Pots range from 5 feet by 5 feet by 32 inches high to 6 feet by 7 feet by 34 inches high. Pots are set in string of 20 to 80 pots, each pot connected to the other by 80 to 100 fathoms of floating polypropylene line. Therefore, a single string may be 2 to 5 miles long. The ends of each string are marked with four buoys. Pots are baited with chopped herring or other bait placed in hanging bait bag in the center of the pot. The average soak time to allow maximum fishing is 10 to 23 days. Three to four pots may hang in the catenary as the gear is hauled up, with the vessel positioned directly above the pot that is next to leave the bottom.

¹⁵ <http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section625.htm>

3.3 Fishery Management History and Organization

NPFMC

The North Pacific Fishery Management Council (NPFMC) is one of eight regional councils established by the Magnuson-Stevens 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 key feature of the Council is expertise provided by Plan Teams. The primary function of the Crab Plan Team (CPT) 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 CPT is composed of scientists from ADF&G (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.

NMFS

The NOAA National Marine Fisheries Service (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 ADF&G 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 with 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.

ADF&G

The Alaska Department of Fish and Game (ADF&G) has responsibility for developing the information upon which to base State fishing regulations, with continued assistance from NMFS. In carrying out this responsibility, ADF&G 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 ADF&G, or his designee, after consultation with the NMFS Regional Administrator, or his designee, may open or close seasons or areas by means of emergency orders (EO) authorized under State regulations.

An annual area management report to the Alaska Board of Fisheries (BOF) 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 ADF&G, 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.

The annual cycle of management decision making for king and Tanner crab stocks and its interaction with fisheries and resources assessments is shown in Figure 9 below. Regulatory proposals are addressed every three years by the BOF. An overview of fishery management is shown in the organizational chart below (Figure 10).

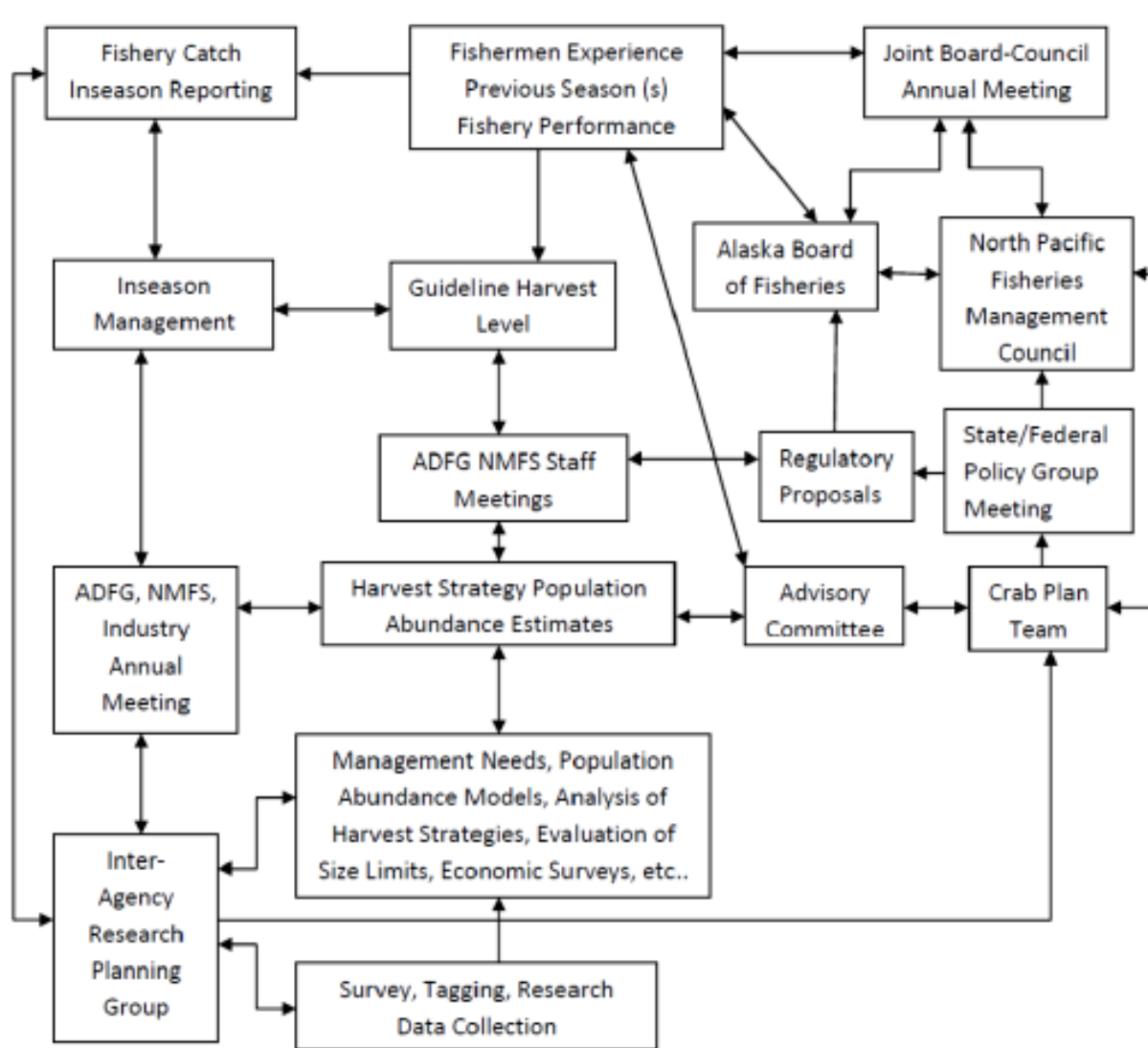


Figure 9 Annual cycle of management decision making for BSAI king and Tanner crab stocks (from BSAI crab FMP; NPFMC 2011).

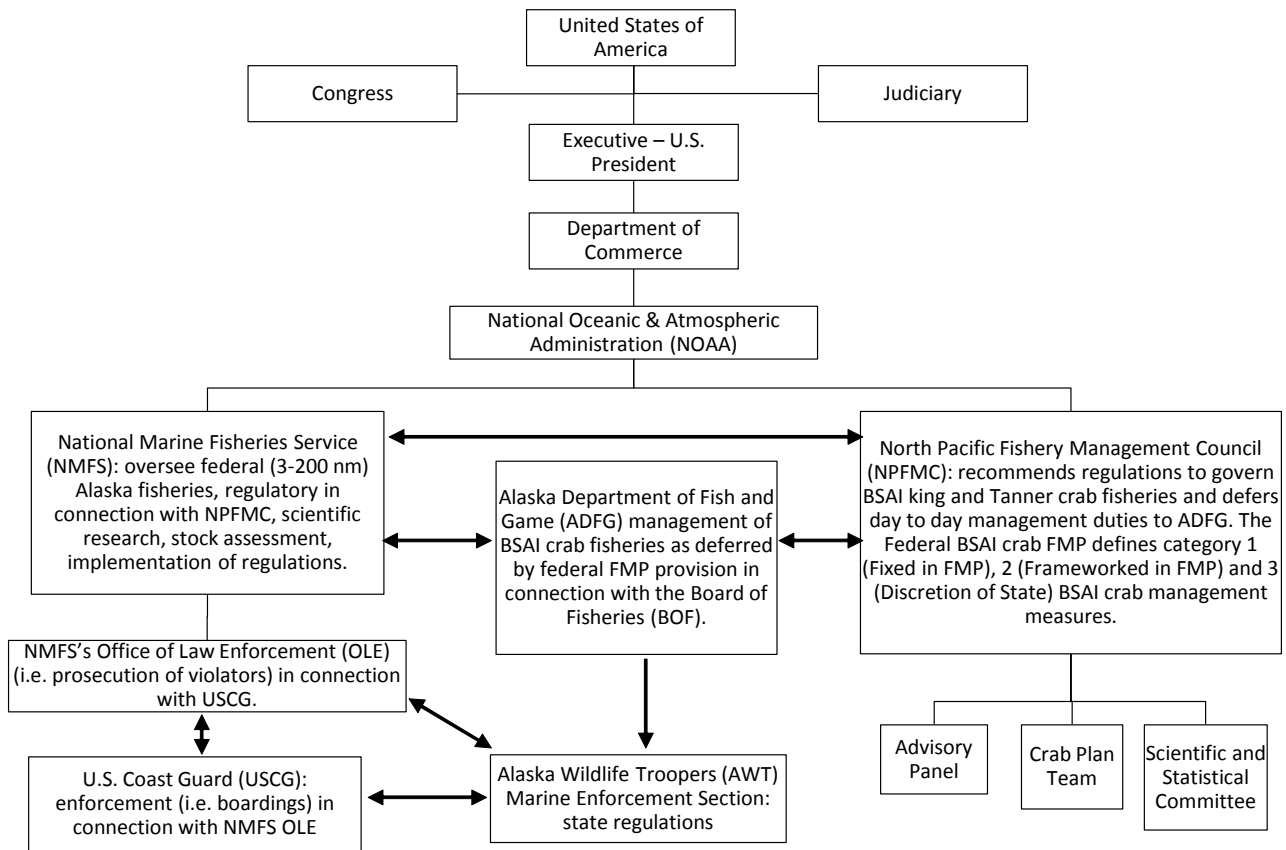


Figure 10 Fishery management organizational chart for BSAI king and Tanner crab fisheries.

3.4 Stock Assessment Activities

Fishery Independent Surveys

NMFS has conducted an annual fishery-independent bottom trawl survey of the eastern Bering Sea since 1975. The purpose of this survey is to collect data on the distribution and abundance of crab, groundfish, and other benthic resources in the region. In 2016, 375 standard stations were sampled on the eastern Bering Sea shelf. This survey provides key fishery-independent indices of abundance/biomass, size/sex composition and shell condition used in assessments of four of the five BSAI stocks under consideration. The AI Golden King crab stock is not covered in this survey. ADFG conducted pot surveys in a limited area of the EAG (east of 174° W longitude) AI Golden King crab distribution in 1997, 2000, 2003 and 2006. This survey was too limited in geographic scope and too infrequent to provide a reliable index of AI GKC abundance. Recently, attempts have been made to initiate a consistent time series of pot surveys with increased spatial coverage. This is a cooperative effort by the Aleutian Islands King Crab Foundation (an industry group) and ADFG. The EAG was surveyed in 2015 and 2016 during the eastern Aleutian Islands fishery but the survey planned for the WAG in 2016 did not go ahead. As yet, a reliable, fishery-independent survey index has not been available for the AI Golden King crab assessment. ADFG also conducts a triennial pot survey of the Bristol Bay red king crab which is also an important component of the data sets used in its stock assessment.

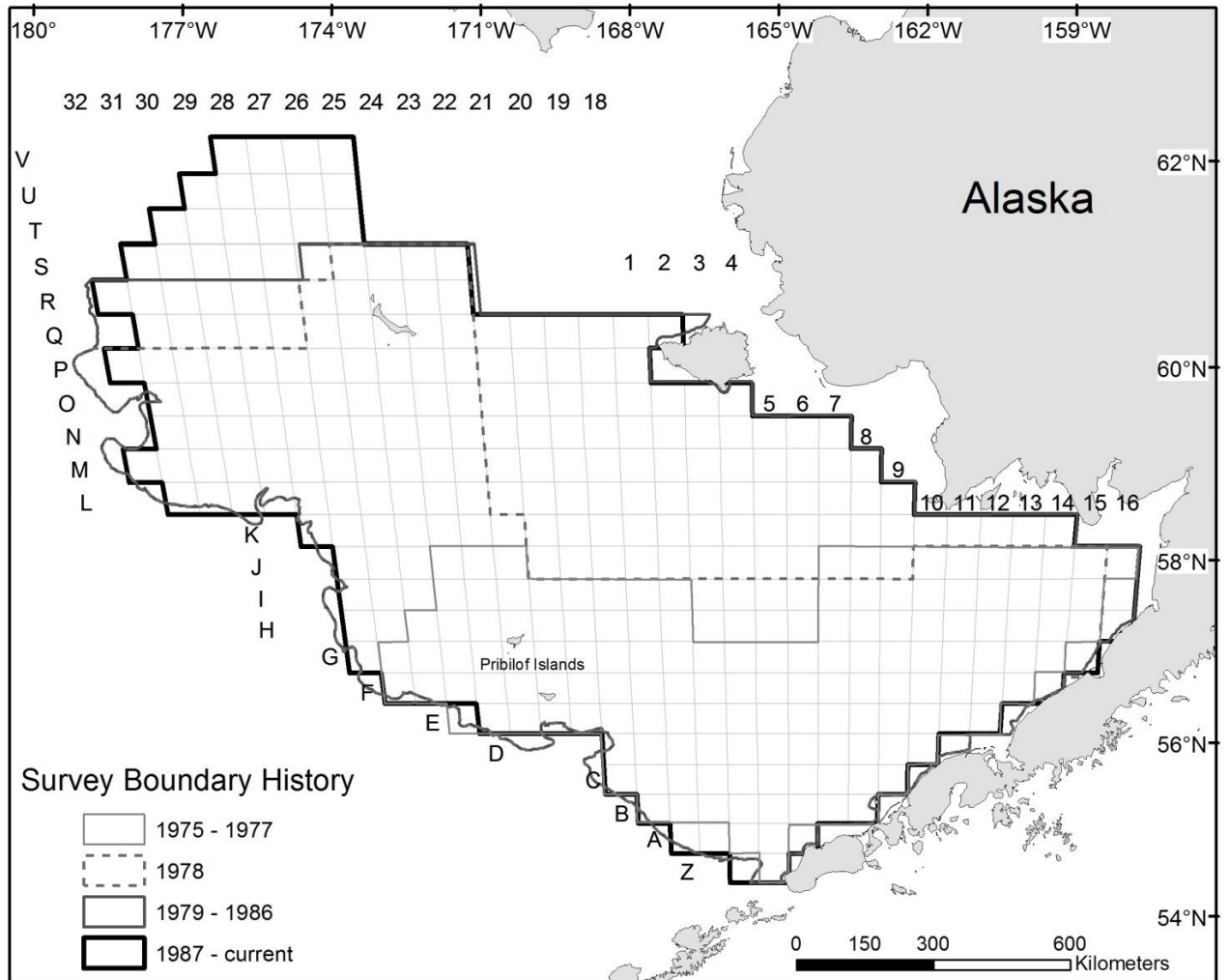


Figure 11 National Marine Fisheries Service eastern Bering Sea bottom trawl survey boundary from 1975 to present indicating four major stanzas in total coverage.

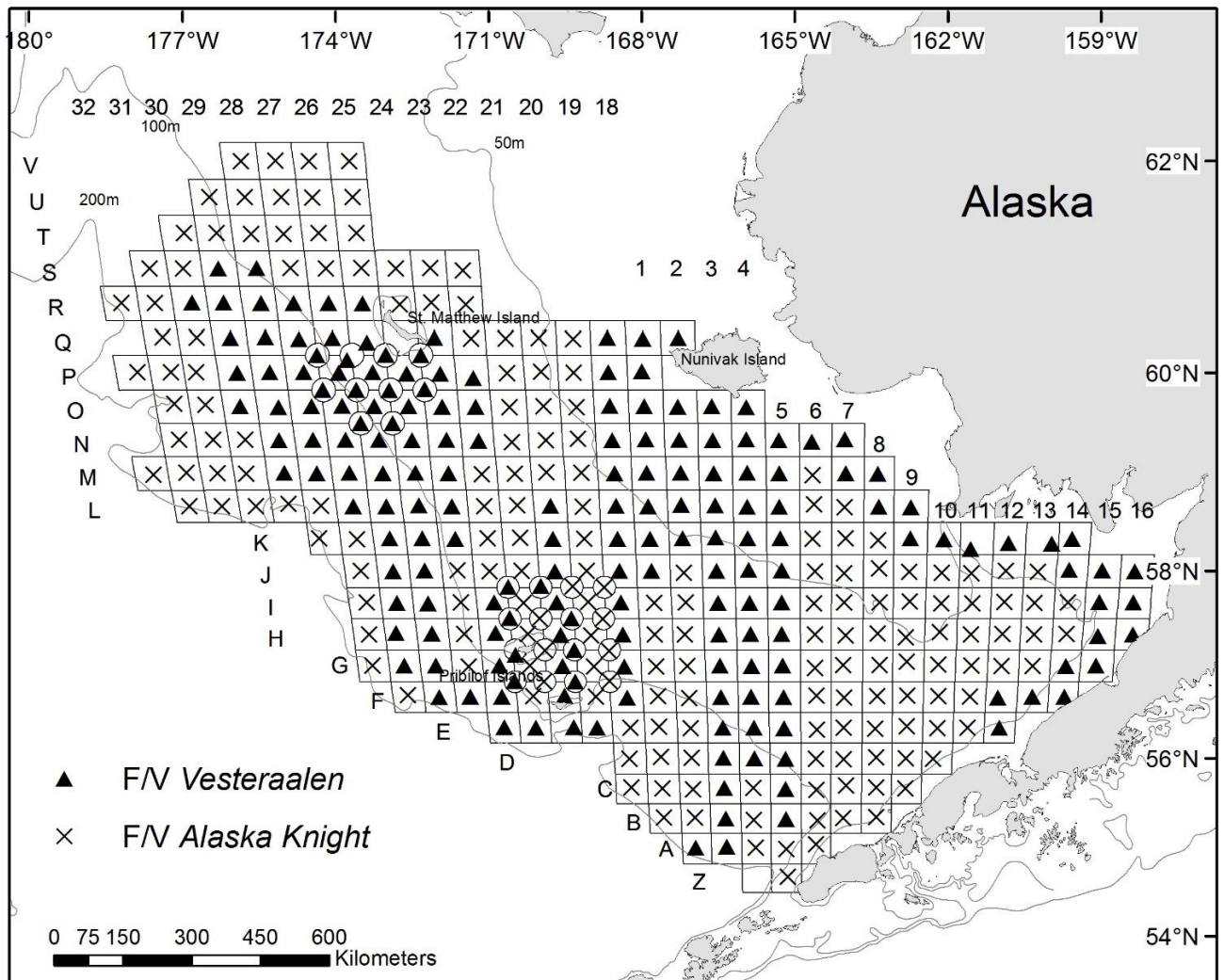


Figure 12 National Marine Fisheries Service eastern Bering Sea standard bottom trawl area surveyed by the FV Alaska Knight and the FV Vesteraalen from 31 May to 26 July 2016.

Details of survey design/methods, crab biological sampling and results for the 2016 survey for each crab species are provided in Daly et al. (2016).

Aleutian Islands Golden King Crab Fishery

PSA Workshop

An assessment validation of the Aleutian Islands Golden King crab fishery was conducted to fulfil part of the assessment and certification requirements for the FAO based Responsible Fisheries Management (RFM) Certification Program (Global Trust, 2013). Its purpose was to assess feasibility of the management system for full assessment and identify whether significant challenges would likely occur in full assessment. Based on available information at the time (site visits conducted during March, 2013), the assessment concluded that only a low level of confidence could be assigned to Fundamental Clauses 5 (Stock assessment activities appropriate for the fishery) and 6 (Current state of stock in relation to reference points). The assessment team recommended that the stock not be presented for full assessment until further information is available to support more certainty in the outcome of evaluations against these two clauses. Note that the clause organization followed in the foregoing assessment was in accordance with Version 1.2 of the RFM.

The Alaska RFM Certification Program's Data Deficient Framework (DDF)¹⁶ is an addendum to Version 1.3 of the RFM Scoring Guidance designed for use by Assessment Teams in cases of data deficient fisheries in Alaska that have been scoped out as such, as described above in the case of the Aleutian Islands Golden King crab fishery. The DDF entails the assessment of three key clauses of the RFM Standard using a modified but equivalent framework through the use of a risk assessment tool, the Productivity Susceptibility Analysis (PSA), as modified by Patrick et al. (2009) and previously used to demonstrate the utility of the vulnerability evaluation, on 166 U.S. fish stocks (within 6 fisheries) that had varying degrees of productivity, susceptibility, and data quality. The PSA evaluates an array of productivity and susceptibility attributes for a stock, from which index scores for productivity and susceptibility are computed and graphically displayed. The resulting vulnerability (to overfishing) score (1 = low and 3 = high) is used as a proxy score for the three selected (key) clauses that require specific data and information about 1) the stock under consideration, 2) associated bycatch species (including retained and discarded catch), and 3) Endangered, Threatened and Protected (ETP) Species. Retained bycatch includes those species which are retained but are not necessarily species of primary target, abundance or value. Among all, the main directive for the assessment of status of the stock under consideration using the DDF is a very conservative harvest, in line with the precautionary approach. All other clauses in Version 1.3 of the Standard are scored using the default system and information derived from the DDF can be used, if appropriate and as required, for various clauses in the RFM Standard.

In accordance with DDF requirements, a workshop was convened and lead by Vito Romito, Responsible Sourcing Standards Ltd., on behalf of ASMI, in September 2016 to conduct a PSA for the Aleutian Islands Golden King crab fishery, specifically for sub-clause 6.3 of Version 1.3, the one being followed in this full assessment. The output from the PSA workshop that was provided to this assessment team is provided in Appendix 3. Our critique of the workshop, based on review and evaluation prior to and during the site visit meetings in January, 2017, follows in *italics*.

A major shortcoming of the Golden King crab PSA workshop for this assessment team was the lack of a comprehensive report to adequately summarize workshop discussion and properly explain the analysis and interpretation of results. The team obtained some clarification on certain points by email exchange with the workshop leader prior to the site visits but, additional issues and concerns with the PSA arose over the course of further review and extensive discussions. These are detailed below.

¹⁶<http://www.alaskaseafood.org/wp-content/uploads/2016/01/Data-Deficient-Fishery-Framework-Addendum-to-Scoring-Guidance-Final-1.pdf>

- 1) *The data quality threshold values: good (High) <2.0; moderate (Medium) 2.0 - 3.5; poor (Low) >3.5 (from Patrick et al. 2010), were not provided with the DQ scoring scheme provided, nor was it explained how the DQ scores obtained for P and S attributes separately were combined to derive the overall DQ score.*
- 2) *Derivation of the vulnerability score was not explained. The two-dimensional nature of the PSA leads directly to the calculation of an overall vulnerability score (v) of a species, defined as the Euclidean distance of productivity and susceptibility scores using*

$$v = \sqrt{(p - 3)^2 + (s - 1)^2}$$

This equation puts the P scoring (high score = low risk) on the same footing as the S scoring (low score = low risk).

- 3) *While Patrick et al. (2010) considered the PSA capable of differentiating vulnerability of stocks along a gradient of P and S indices, fixed thresholds separating low-, moderate-, and high-vulnerability species were not proposed. Nevertheless, the graph provided (Appendix 3) delineates zones of risk. The origin of risk zones identified in the graph was not provided and workshop text confusingly equates $v = 1.8$ with a precautionary limit (yellow curve in the graph). The DDF Guidance document identifies California Ocean Science Trust¹⁷ as the source for the PSA graph it includes from which cut off vulnerability scores were developed to match the four RFM conformance/non-conformance categories as follows: < 2.5 = full conformance, 2.5 to 2.75 = minor non-conformance, 2.75 to 3 = major non-conformance, >3 = critical non-conformance. This graphic clearly puts a score of 2.5 high in the transition zone between low and medium risk into the lower portion of the medium zone. Note too that DDF follows OST in reversing the scale on the x-axis (Productivity) to avoid confusion related to the graphic oddity of having the high P score (3) at the origin. In Patrick et al. (2010), vulnerability scores were plotted (Fig. 3 in their paper) for a subset of 50 stocks for which status (overfished/overfishing) could be determined - many of these fell between 2 and 2.5. The veracity of equating scores up to 2.5 to "full conformance" is suspect.*
- 4) *The meaning of the "1" in the dot representing the vulnerability score in the workshop graph was not provided; we have assumed it is the score derived from this PSA (0.91) rounded up to 1.*
- 5) *The PSA report does not identify workshop participants, making it difficult to evaluate the breadth of opinion represented by the attendees.*
- 6) *Although not shown in the workshop tables (Appendix 3), a weight of 4 was used for all attributes in the workshop PSA. Patrick et al. (2010) state that weights in the PSA can be adjusted within a scale of 0-4, with a default = 2, to customize the application to each fishery. It is unclear why the default weighting of 2 was not used. Further, given the population growth attribute description provided (left column of table), it seems peculiar that a uniform weight of 4 was used. It effectively means the analysis did not include weighting.*
- 7) *Patrick et al. (2010) assigned a weighting of zero (0) to some attributes, which caused them to be removed from the analysis, because the attribute had no relation to the fishery and its stocks. The*

¹⁷<http://www.oceansciencetrust.org/wp-content/uploads/2015/09/PSA-test-on-CA-Fisheries-Report-April2014.pdf>

workshop output did not follow this approach for attributes whose relation to AI golden king crab was highly questionable, such as the thresholds given for Maximum size (Lmax).

- 8) *Patrick et al. (2010) modified attribute scoring thresholds used in previous publications to better suit the distribution of life history characteristics observed in U.S. fish stocks. They went to considerable statistical length to evaluate a range of scoring categories to identify attribute scoring thresholds that produced significantly different bins of their data. Clearly, PSA is not a one-size-fits-all exercise. The team considers that the workshop PSA was carried out without any consideration of Golden King crab in the context of its position at the upper end of a broad spectrum of crustaceans instead of at the lower end of a comparable spectrum of fish.*
- 9) *Following consideration of the concerns outlined above, the team decided to explore how rescoring the PSA for Golden King crab, using resources available from NMFS¹⁸ and using values that we felt were more appropriate to P and S attributes and DQ, would impact upon the calculation of P, S and v scores and data quality rankings. We modified scoring as follows:*

Productivity

Population growth: from 1.5 to 1 – Based on crustacean equivalency.

Maximum size: from 3 to 1 but with a weight of 0.

Mean trophic level: 3 to 1 – SeaLifeBase¹⁹ gives a trophic level of 3.54 for this species.

Susceptibility

SSB: from 1 to 2 – use the more conservative value rather than average of the two.

Seasonal migrations: from 1 to 2 – the conclusion from the evidence matches the intermediate attribute description.

Schooling behaviors: from 1 to 2 – ditto.

Data Quality

von Bertalanffy Growth Coefficient (k): from 3 to 4

Estimated Natural Mortality: from 1 to 2

Recruitment Pattern: from 1 to 2

Geographic Concentration: from 1 to 4

Fishery Impact to EFH: from 1 to 2

In addition, the overall weighting was changed from 4 to the default 2 for all attributes with the exception of Lmax (set to zero).

The foregoing resulted in changes as follows:

P score decreased from 2.2 to 1.78 and associated DQ score increased from 2.15 to 2.6

S score increased from 1.3 to 1.6 and associated DQ score increased from 1.3 to 1.8

v score increased from 0.91 to 1.35 and averaged DQ score increased from 1.7 to 2.2 which downgraded DQ from high to medium.

Although our changes yielded less optimistic results for the Golden King crab PSA, they did not push the vulnerability score into non-conformance territory. The results should, however, serve to emphasize the need to exercise great caution with interpretation of PSA results in general, especially given our contention that the non-conformance bar seems to be set very high.

¹⁸ http://www.nmfs.noaa.gov/sfa/laws_policies/national_standards/psa.html

¹⁹ <http://www.sealifebase.org/Ecology/FishEcologySummary.php?StockCode=28766&GenusName=Lithodes&SpeciesName=aequispinus>

References For Above PSA Critique

Global Trust, 2013. FAO-Based RFM Certification Validation Report for US Alaska Golden King Crab Commercial Fishery. Report Code: AK/AIGK/001/2013.

Patrick, W.S., P. Spencer, O. Ormseth, J. Cope, J. Field, D. Kobayashi, T. Gedamke, E. Cortés, K. Bigelow, W. Overholtz, J. Link, and P. Lawson. 2009. Use of productivity and susceptibility indices to determine stock vulnerability, with example applications to six U.S. fisheries. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-101, 90p.

Patrick, W.S., P. Spencer, J. Link, J. Cope, J. Field, D. Kobayashi, P. Lawson, T. Gedamke, E. Cortés, O. Ormseth, K. Bigelow, and W. Overholtz. 2010. Using productivity and susceptibility indices to assess the vulnerability of United States fish stocks to overfishing. Fishery Bulletin 108: 305-322. Available at: http://www.nmfs.noaa.gov/sfa/laws_policies/national_standards/psa.html

The BSAI crab stocks are managed under a tier system rule based on stock knowledge. Status determination criteria are calculated using a five-tier system that accommodates varying levels of uncertainty of information. The system incorporates new scientific information and provides a mechanism to continually improve the status determination criteria as new information becomes available. The higher the stock tier status, the greater the uncertainty and the more conservative the determination of OFL and ABC.

The Aleutian Islands golden king crab has been assessed as a Tier 5 stock: there are no reliable estimates of biomass and only historical catch data are available. The OFL is 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.

In the 2016 cycle it was assessed as a single stock, and the assessment concluded that overfishing did not occur in 2015/16 because the 2015/16 estimated total catch did not exceed the Tier 5 OFL established for 2015/16 (5,690 t). The 2015/16 estimated total catch did not exceed the ABC established for 2015/16 (4,260 t). The OFL and ABC values for 2016/17 were the status quo, Alternative 1 recommended values.

There is no direct evidence of separate golden king crab stock structure in the Aleutian Islands between areas west and east of 174° W longitude. However, given the expansiveness of the Aleutian Islands Area and the existence of deep (>1,000 m) canyons between some islands, at least some weak structuring of the stock within the area would be expected. Data for making inferences on stock structure of golden king crab within the Aleutian Islands are largely limited to the geographic distribution of commercial fishery catch and effort, which suggests that habitat for legal-sized males may be continuous throughout the waters adjacent to the islands in the Aleutian chain. However, regions of low fishery catch suggest that availability of suitable habitat, in which golden king crab are present at only low densities, may vary longitudinally.

Since 1996, the Alaska Department of Fish and Game (ADFG) has divided management of the Aleutian Islands golden king crab fishery at 174° W longitude. Hereafter, the east of 174° W longitude stock segment is referred to as EAG and the west of 174° W longitude stock segment is referred to as WAG.

Development of a population dynamics model as a basis for annual stock assessment of AIGKC has been ongoing for many years. It is a male-only, length-based model that combines a variety of catch, catch composition and catch discard data from commercial crab and groundfish (trawl and pot) fisheries, standardized observer legal size catch-per-unit-effort (CPUE) as indices of abundance, and tag recaptures by release-recapture lengths to estimate stock assessment parameters, primarily trends in mature male biomass and total fishing mortality.

The model has been subjected to rigorous internal and external peer review throughout its development. Significant concerns have been raised regarding the use of CPUE as an indicator of abundance and the use of mean recruitment for 1996-2015 to tune the model instead of using the period covering the full catch history (from the early 1980s). Nevertheless, the CPT decided at its September (2016) meeting to approve the current version of the AIGKC assessment model for setting OFLs and ABCs for the EAG and WAG separately during the 2017 stock assessment cycle. This decision was endorsed by the SSC at its October (2016) meeting.

Goals at the January (2017) CPT meeting were to evaluate the model runs requested by the CPT and the SSC, to consider the appropriate tier level for the AIGKC assessment, and to propose a set of model runs for evaluation and potential adoption at a CPT meeting in May (2017). In January, the CPT recommended that AIGKC be placed in Tier 3. If the SSC agrees with this recommendation in February (2017), there would be no need to develop OFL/ABC tables for Tier 4 in the May assessment document.

The preliminary base model results considered by the CPT in January are reasonably consistent with the perception that the AIGKC fishery has been stable and the stock has been relatively lightly and sustainably exploited in recent years. In the EAG base model, the estimated fishing mortality has been below F35% since 2000, and stock is estimated to be above the BMSY reference point and increasing. The picture is more complex for the WAG base model. Fishing mortalities were below F35% from 2005 to around 2012, and then increased to above F35% in the last few years. Stock biomass has hovered around the BMSY reference point since 1990, but recently declined below it. It should be noted that these results are from preliminary models and final models used in May (2017) could change.

In January, the CPT recommended that the following base model be brought forward for evaluation in May:

1. The observer CPUE time series should start in 1995.
2. Add the retained catch CPUE index for 1985-1998 (fish ticket data).
3. Model two time periods for selectivity (pre- and post-rationalization).
4. Do Francis reweighting for the length-composition data.
5. Estimate a single natural mortality value using a combined EAG/WAG model and do a likelihood on natural mortality. Then use the estimated value of natural mortality as a fixed value in separate EAG and WAG assessments for OFL and ABC projections and further model sensitivity analyses
6. Obtain mean recruitment to initialize the model using only recruitment estimates that are informed by data (i.e., recruit CVs less than sigma R)
7. Calculate BMSY reference point based on average recruitment from 1986-2016 (whole time series).

In January, the CPT also recommended that the following alternative scenarios be brought forward for evaluation in May:

- Scenario that drops the retained catch CPUE index.
- Scenario that includes the observer CPUE index from 1991-1994.
- Scenario with three selectivity periods rather than two.
- Scenarios with low and high bracketing values for natural mortality to demonstrate model sensitivity.
- Scenarios that use alternative time periods to estimate mean recruitment for the BMSY reference point
- Scenario that compares a maturity ogive vs knife edge maturity.

At time of writing this report (February 2017), it is anticipated that the foregoing will provide the basis for management decision making for the 2017/18 season which starts in August.

Eastern Bering Sea Tanner Crab

The Tanner crab stock assessment model is a stage/size-based population dynamics model that incorporates sex (male, female), shell condition (new shell, old shell), and maturity (immature, mature) as different categories into which the overall stock is divided on a size-specific basis. Crab enter the modeled population as recruits following an assumed size distribution. An equal sex ratio is assumed at recruitment, and all recruits begin as immature, new shell crab. Within a model year, new shell, immature recruits are added to the population numbers-at-sex/shell condition/maturity state/size remaining on July 1 from the previous year. These are then projected forward to February 15 ($\delta t = 0.625$ yr) and reduced for the interim effects of natural mortality. Subsequently, the various fisheries that either target Tanner crab or catch them as bycatch are prosecuted as pulse fisheries (i.e., instantaneously). Catch by sex/shell condition/maturity state/size in the directed Tanner crab, snow crab, BBRKC, and groundfish fisheries is calculated based on fishery-specific stage/size-based selectivity curves and fully-selected fishing mortalities and removed from the population. The numbers of surviving immature, new shell crab that will molt to maturity are then calculated based on sex/size-specific probabilities of maturing, and growth (via molt) is calculated for all surviving new shell crab. Crab that were new shell, mature crab become old shell, mature crab (i.e., they don't molt) and old shell crab remain old shell. Population numbers are then adjusted for the effects of maturation, growth, and change in shell condition. Finally, population numbers are reduced for the effects of natural mortality operating from February 15 to July 1 ($\delta t = 0.375$ yr) to calculate the population numbers (prior to recruitment) on July 1. Model parameters are estimated using a maximum likelihood approach, with Bayesian-like priors on some parameters and penalties for smoothness and regularity on others. Data components entering the likelihood include fits to mature survey biomass, survey size compositions, retained catch, retained catch size compositions, bycatch mortality in the bycatch fisheries, and bycatch size compositions in the bycatch fisheries. Model refinement is an ongoing process with alternative configurations/scenarios evaluated during each annual stock assessment (SAFE 2016).

The OFL for this stock is based on the Tier 3 control rule. Its application requires a set of years for defining RMSY, the mean recruitment corresponding to *BMSY* under prevailing environmental conditions. The recommended time period for defining RMSY is 1982 – 2016 as used in previous OFL determination. Based on the estimated biomass at 15 February 2017, the stock is at Tier 3 level a. The *FMSY* proxy (*F*35%) is 0.58 yr^{-1} , and the 2015/16 FOFL is 0.58 yr^{-1} under the Tier 3 level a OFL control rule, which results in a total male and female OFL of 25,610 t. A 20% buffer to account for model uncertainty and stock productivity uncertainty applied to the OFL sets ABC at 20,490 t.

Eastern Bering Sea Snow Crab

The snow crab population dynamics model is an integrated size-structured model which tracks the number of crab of each sex, shell condition, and maturity state. A terminal molt is included in which crab move from an immature to a mature state, after which no further molting occurs. The mid-points of 5 mm size bins tracked ranges from 27.5 to 132.5 mm CW. The model is fitted to abundance data from the NMFS trawl survey, total catch /bycatch from the directed fishery, bycatch from the groundfish trawl fishery along with size frequencies by maturity status for each.

Parameters estimated in the 2016 assessment included those associated with the population processes recruitment, growth, natural mortality, fishing mortality, selectivity (fishery and survey), catchability, and maturity. Molting probability, weight at length, discard mortality, bycatch mortality, and parameters associated with the variance in growth and proportion of recruitment allocated to size bin were estimated outside of the model or specified. Samples were drawn from the posterior distributions of estimated parameters and derived

quantities used in management (e.g. MMB and OFL) via MCMC. This involved conducting 2,000,000 cycles of the MCMC algorithm, implementing a 5% burn-in period, and saving every 500th draw. Chains were then thinned until diagnostic statistics demonstrated a lack of evidence of non-convergence.

During annual assessments, various model scenarios are evaluated based on their fit to the data, the credibility of the estimated population processes, and the strength of the influence of the assumptions of the model on the outcomes of the assessment. Details are provided in SAFE 2016.

The EBS snow crab is a Tier 3 stock so the OFL is determined by the FOFL control rule using F35% as the proxy for FMSY. The proxy for *BMSY* (*B35%*) is the mature male biomass at mating (151,800 t) based on average recruitment over 1978 to present. Consequently, the minimum stock size threshold (MSST) is 75,800 t. The standard buffer for Tier 3 stocks (10%) to account for uncertainties sets the 2016/17 ABC at 21,300 t.

Bristol Bay Red King Crab

The red king crab stock assessment model is a sex- and size-structured population dynamics model incorporating data from the NMFS eastern Bering Sea trawl survey, the Bering Sea Fisheries Research Foundation (BSFRF) trawl survey, landings of commercial catch, at-sea observers, and dockside samplers. It uses a maximum likelihood approach to estimate abundance, recruitment, selectivities, catches, and bycatch of the commercial pot fisheries and groundfish trawl fisheries. Abundances by carapace length and shell condition in any one year are modeled to result from abundances in the previous year minus catch and handling and natural mortalities, plus recruitment, and additions to or losses from each length class due to growth. The minimum carapace length for both males and females is set at 65 mm, and crab abundance is modeled with a length-class interval of 5 mm. The last length class includes all crab ≥ 160 mm CL for males and ≥ 140 mm CL for females.

Three alternative models were evaluated in the 2016 assessment. In the model recommended by the CPT, annual stock abundance was estimated for male and female crabs ≥ 65 -mm carapace length from 1975 to the time of the 2016 survey and mature male (males ≥ 120 mm CL) biomass was projected to 15 February 2017.

Bristol Bay red king crab is a Tier 3 stock. The estimated *B35%* is 25,800 t. MMB projected for 2016/17 is 24,000 t, 93% of *B35%*. Consequently, the stock is in Tier 3b in 2016/17. The recommended OFL for 2016/17 is 6,640 t. A 10% buffer from the OFL sets the ABC at 5,970 t. MMB for 2015/16 was estimated to be 27,680 t and above MSST (12,890 t), hence the stock was not overfished in 2015/16. The total catch in 2015/16 (5,340 t) was less than the 2015/16 OFL (6,730 t), hence overfishing did not occur in 2015/16. The stock at 2016/17 time of mating is projected to be above the MSST and 93% of *B35%*, hence the stock is not projected to be in overfished condition in 2016/17.

St. Matthew Island Blue King Crab

The 2016 assessment model makes use of the modeling framework GMACS. It is based upon the 3-stage length-based model used previously. There are several differences, a major one being that natural and fishing mortality are continuous within 5 discrete seasons (using the "correct" catch equation rather than being applied as a pulse). Season length in GMACS is controlled by changing the proportion of natural mortality that is applied during each season. The GMACS model is used to assess the male crab ≥ 90 mm CL. The three size categories are: 90–104 mm CL; 105–119 mm CL; and ≥ 120 mm CL. Males ≥ 105 are used as a proxy to identify mature males, and males ≥ 120 mm CL are used as a proxy to identify legal males. The aim when developing this model was to first provide a fit to the data that best matched the 2015 model. The model incorporates the available time series data from commercial catch, annual trawl survey, triennial pot survey, bycatch in the groundfish trawl and fixed-gear

fisheries and observer catch composition data. A detailed description of the GMACS model and its implementation can be found in SAFE 2016.

Six model configurations were evaluated in the 2016 assessment. The CPT recommended use of GMACS base scenario for stock status determination. The stock is in Tier 4. This model uses the full assessment period (1978/79-2015/16) to define the proxy for *BMSY* in terms of average estimated *MMB_{mat}*. The projected *MMB* estimated for 2016/17 is 2,230 t and the *FMSY* proxy is the natural mortality rate (0.18^{-1} year) and FOFL is 0.09, resulting in a mature male biomass OFL of 140 t. The *MMB/BMSY* ratio is 0.61. A 20% buffer on the OFL results in an ABC of 110 t.

3.5 Historic Biomass and Removals in the Fishery

Aleutian Islands Golden King Crab

The fishery has been prosecuted as a directed fishery since 1981/82 and has been opened every year since then. Retained catch peaked in 1986/87 at 6,696 t, but the retained catch dropped sharply after 1989/90 to an average of 3,145 t for the period 1990/91–1995/96. A guideline harvest level (GHL) was introduced into management for the first time in 1996/97. A GHL of 2,676 t was established in 1996/97 and subsequently reduced to 2,585 t beginning in 1998/99. The GHL (or, since 2005/06, the TAC) remained at 2,585 t through 2007/08, but was increased to 2,715 t for 2008/09–2011/12 and increased to 2,853 t for 2012/13–2015/16. The TAC for 2016/17 was reduced to 2,515 t, which reflects a 25% reduction for the area west of 174° W longitude. In addition to the retained catch that is allotted as TAC, there was retained catch in a cost recovery fishery towards a \$300,000 goal in 2013/14 and 2014/15 and towards a \$500,000 goal in 2015/16 and 2016/17. Total retained catch in 2015/16 is confidential because only 2 vessels participated in the western Aleutian Islands fishery. However, portions of the catch that can be reported include 1,498 t from the eastern Aleutian Islands fishery and 92 t from the cost recovery fishery.

Discarded catch occurs mainly during the directed fishery. Although low levels of discarded catch can occur during other crab fisheries, there have been no such fisheries prosecuted since 2004/05. Estimates of the bycatch mortality during crab fisheries decreased during 1995/96–2005/06, both in absolute value and relative to the retained catch weight, and stabilized during 2005/06–2014/15. Estimated bycatch mortality during crab fisheries in 2015/16 is confidential because only 2 vessels participated in the western Aleutian Islands fishery. However, bycatch mortality that can be reported includes 166 t from both the eastern Aleutian Islands and cost recovery fisheries.

Discarded catch also occurs during fixed-gear and trawl groundfish fisheries, but is small relative to discards during the directed fishery and the groundfish fisheries are a minor contributor to total fishery mortality; estimated bycatch mortality during groundfish fisheries in 2015/16 was 30 t.

Estimated total fishery mortality during 1995/96–2015/16 has ranged from 2,242 t to 3,157 t.

Catch per pot lift (CPUE) of retained legal males decreased from the 1980s into the mid-1990s, but increased steadily after 1994/95 and increased markedly at the initiation of the Crab Rationalization program in 2005/06. The fishery has been managed separately east and west of 174° W longitude since 1996/97 and, although CPUE for the two areas showed similar trends through 2010/11, during 2011/12–2014/15 CPUE trends have diverged (increasing east of 174° W longitude and decreasing west of 174° W longitude).

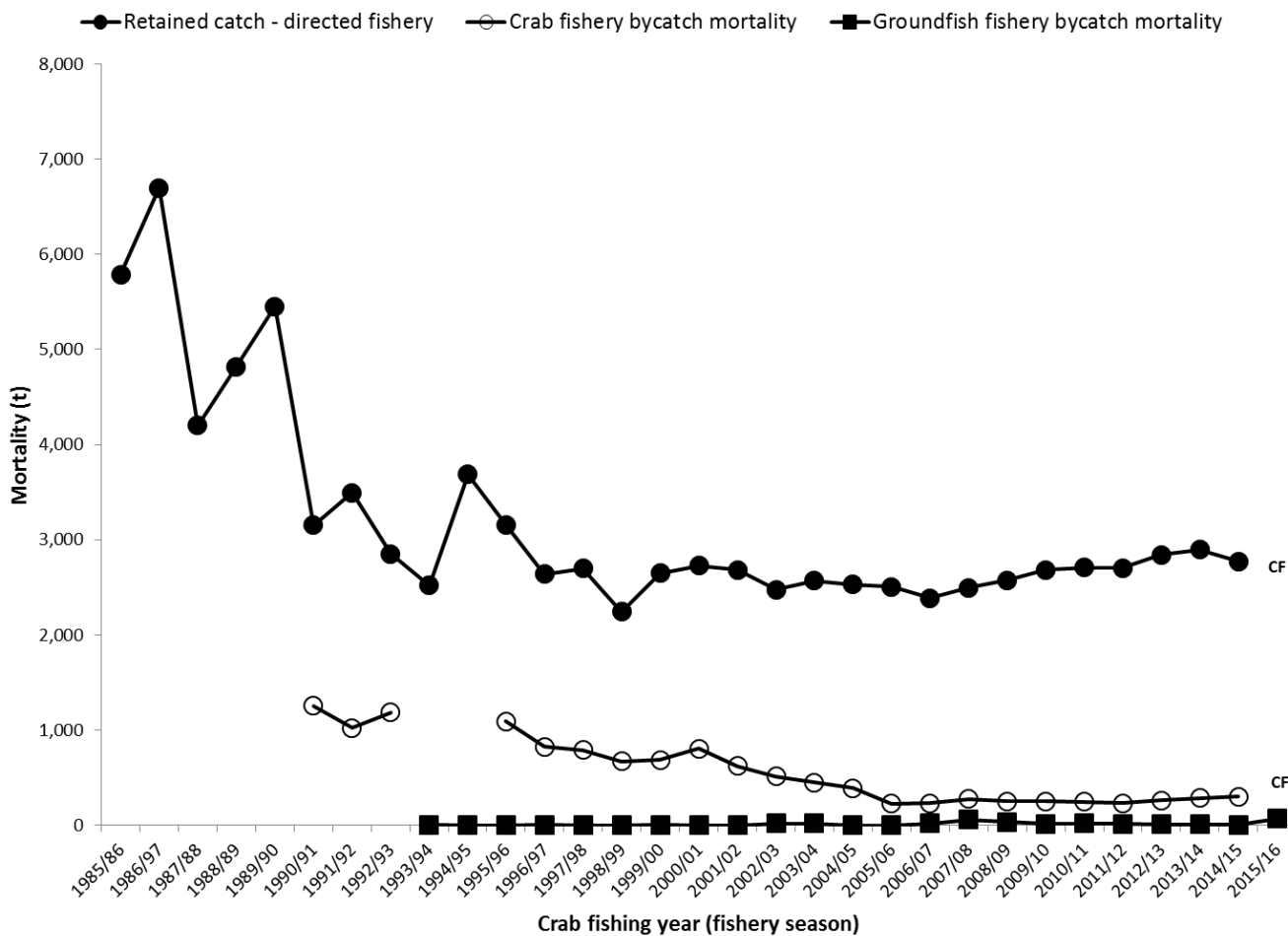


Figure 13 Retained catch during the directed fishery, estimated bycatch mortality during all crab fisheries, and estimated bycatch mortality during all groundfish fisheries of Aleutian Islands golden king crab, 1985/86–2015/16. Note: CF = confidential.

Trends in GKC mature male biomass from 1960/61 for the EAG and WAG, from the latest version of the assessment model presented to the CPT in January, 2017, are shown in Figure 14 and Figure 15.

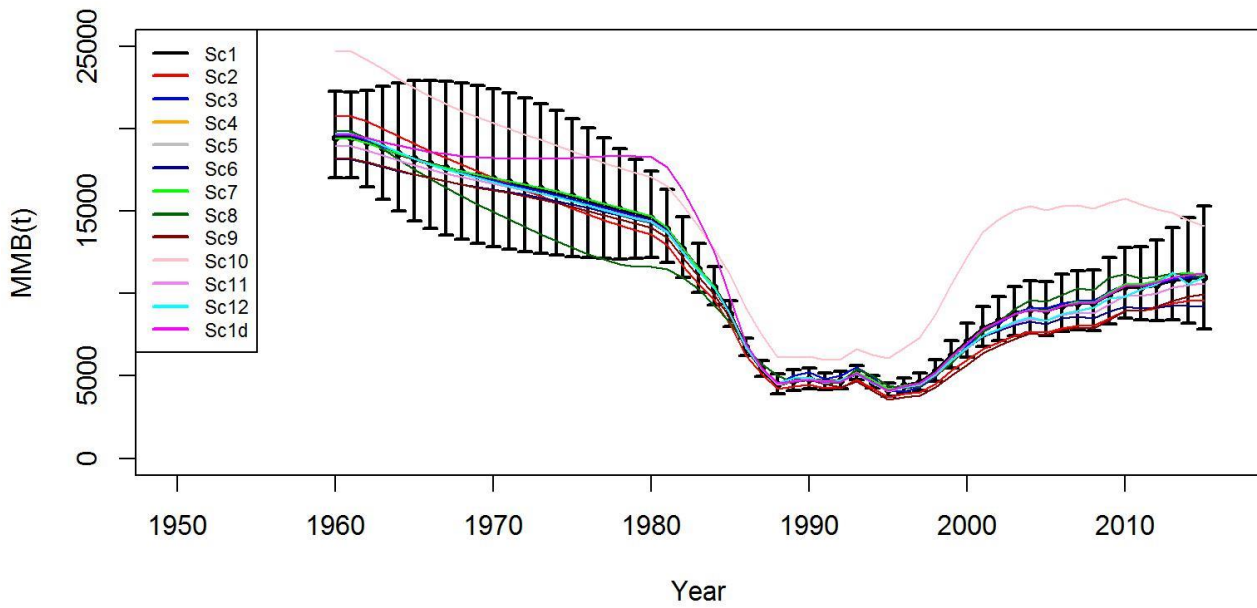


Figure 14 Trends in GKC mature male biomass (model scenarios (Sc) 1 to 12 and 1d fits) in the EAG, 1960/61–2015/16. Mature male crab size is ≥ 121 mm CL.

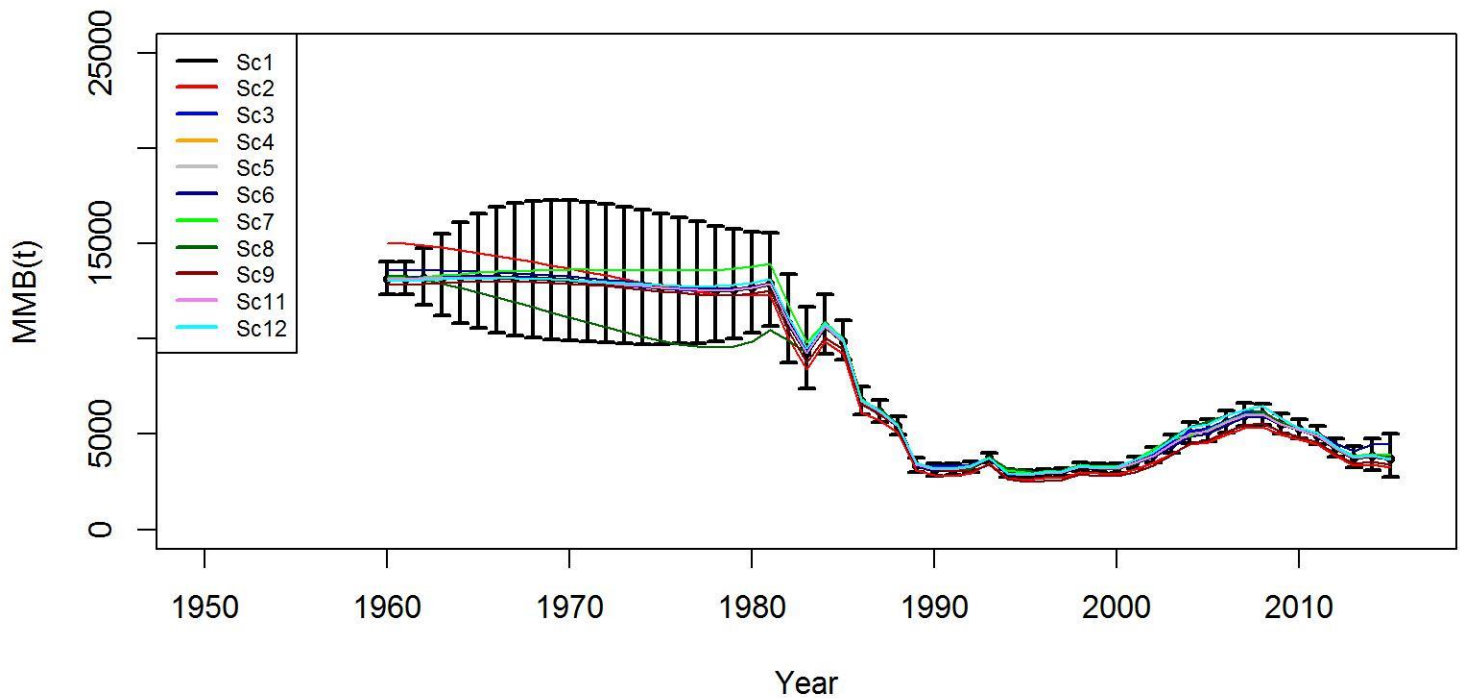


Figure 15 Trends in GKC mature male biomass (model scenarios 1 to 12 and 1d fits) in the WAG, 1960/61–2015/16. Mature male crab size is ≥ 121 mm CL.

Eastern Bering Sea Tanner Crab

Landings of Tanner crab in the Japanese fishery (1965-1978) peaked at 19,950 t and in the Russian fishery (1965-1971) landings peaked at 7,080 t. Both the Japanese and Russian Tanner crab fisheries were displaced by the domestic fishery by the late-1970s and foreign fishing for Tanner crab ended in 1980.

The domestic Tanner crab pot fishery developed rapidly in the mid-1970s (Figure 16). US landings were first reported for Tanner crab in 1968 at 460 t taken incidentally to the EBS red king crab fishery. Tanner crab was targeted thereafter by the domestic fleet and landings rose sharply in the early 1970s, reaching a high of 30,210 t in 1977/78. Landings fell sharply after the peak and fishing was closed in 1985/86 and 1986/87 due to depressed stock status. In 1987/88, the fishery reopened and landings rose again in the late-1980s to a second peak in 1990/91 at 18,190 t, and then fell sharply through the mid-1990s. The Tanner crab fishery was closed between 1996/97 and 2004/05 as a result of conservation concerns regarding depressed stock status. It reopened in 2005/06 and averaged 770 t retained catch between 2005/06-2009/10. For the 2010/11-2012/13 seasons, the State of Alaska closed directed commercial fishing for Tanner crab due to estimated female stock being below thresholds adopted in the state harvest strategy. However, these thresholds were met in fall 2013 and the directed fishery was opened in 2013/14 with TACs set at 746 t for the area west of 166° W and 664 t for the area east of 166° W with combined retained catch of 1,248 t. The combined retained catch was 6,160 t in 2014/2015 and 8,910 t in 2015/16, the largest since 1992/93.

As of the 2016 stock assessment, based on the estimated biomass at 15 February 2017, the stock is at Tier 3 level a. The control rule resulted in an OFL of 25,610 t. A 20% buffer recommended by the CPT set the ABC at 20,490 t for 2016/17. However, in accordance with State harvest strategy **5 AAC 35.508**, the 2016 mature

female survey biomass was below the threshold and the directed Tanner crab fishery was closed for the 2016/17 season.

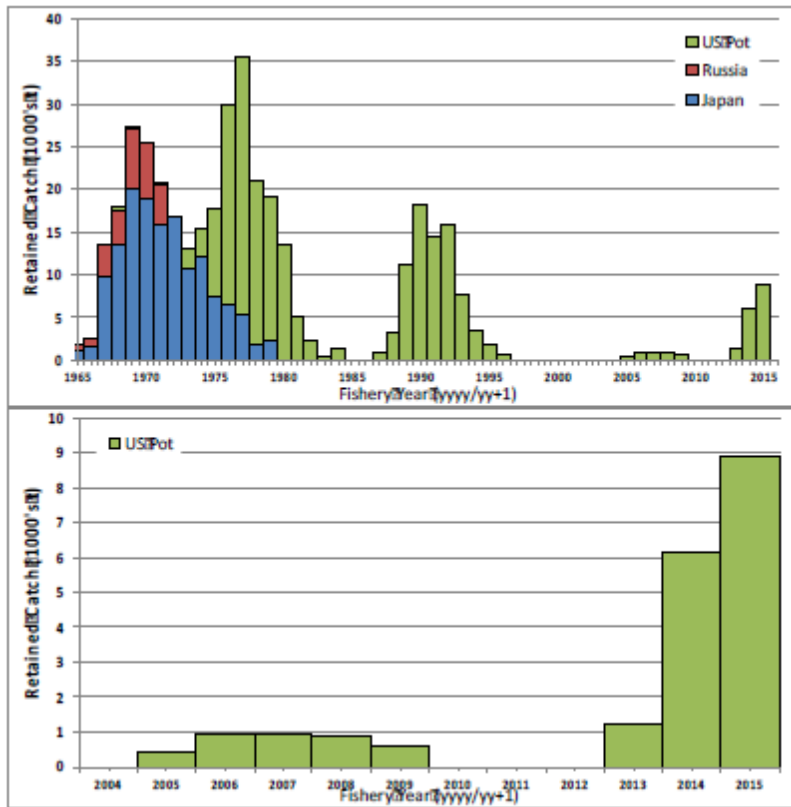


Figure 16 Retained catch (males t x 103) in the directed fisheries (US pot fishery [green bars], Russian tangle net fishery [red bars], and Japanese tangle net fisheries [blue bars]) for Tanner crab since 1965/66.

Time series trends from the NMFS EBS bottom trawl survey suggest the Tanner crab stock in the EBS has undergone decadal-scale fluctuations (Figure 17). Estimated biomass of mature crab in the survey started at its maximum (281,000 t) in 1975, decreased rapidly to a low (14,000 t) in 1986, and rebounded quickly to a smaller peak (134,000 t) in 1991. After 1991, mature survey biomass decreased again, reaching a minimum of 10,500 t in 1998. Recovery following this decline was slow and mature biomass did not peak again until 2008 (67,000 t), after which it has fluctuated more rapidly—immediately decreasing the following year by almost 50% and reaching a minimum in 2012 (36,000 t), followed by an increase of almost 50% in 2013 and reaching a peak in 2014 (82,000 t). The most recent trend (2014-2016) has been a declining one. Trends in the male and female components of mature survey biomass, as well as legal male abundance, have primarily been in synchrony with one another.

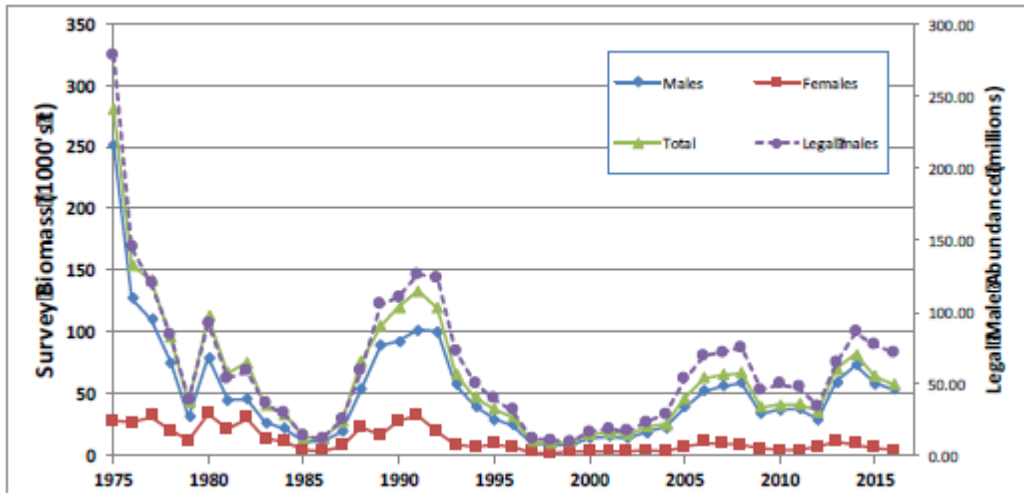


Figure 17 Trends in survey biomass for mature male and female Tanner crab, and in abundance for legal males, based on the NMFS EBS bottom trawl survey.

Eastern Bering Sea Snow Crab

Snow crab were harvested in the Bering Sea by the Japanese from the 1960s until 1980 when foreign fishing was prohibited. Thereafter, retained catches increased from low levels in the early 1980s to a high of 143,020 t in 1991. Retained catch declined to 88,090 t in 1998 and in 1999, the stock was declared overfished, at which time retained catches dropped to levels similar to the early 1980s. Retained catches have slowly increased since 1999 as the stock rebuilt, although retained catch during 2015 was low (18,420 t).

Since 1992, discards from the directed pot fishery estimated from observer data has ranged from 11% to 64% (average 33%) of the retained catch of male crab. The highest estimated discard mortality was 17,060 t (16%), which occurred during 1993. Female discard catch is very low and not a significant source of mortality. Discard of snow crab in groundfish fisheries is significant but much less than in the directed fishery.

Observed survey mature male biomass decreased from 167,100 t in 2011 to 97,500 t in 2013, increased to 163,500 t in 2014, then fell to 80,000 t in 2015 and 63,200 t in 2016 (Figure 18). The 2016 model estimates of mature male biomass showed trends similar to survey biomass during 2011–2016. The model estimates a 3-year trend of increasing recruitment starting in 2014, with very high values for 2016. This is supported by the associated survey size compositions, particularly for males.

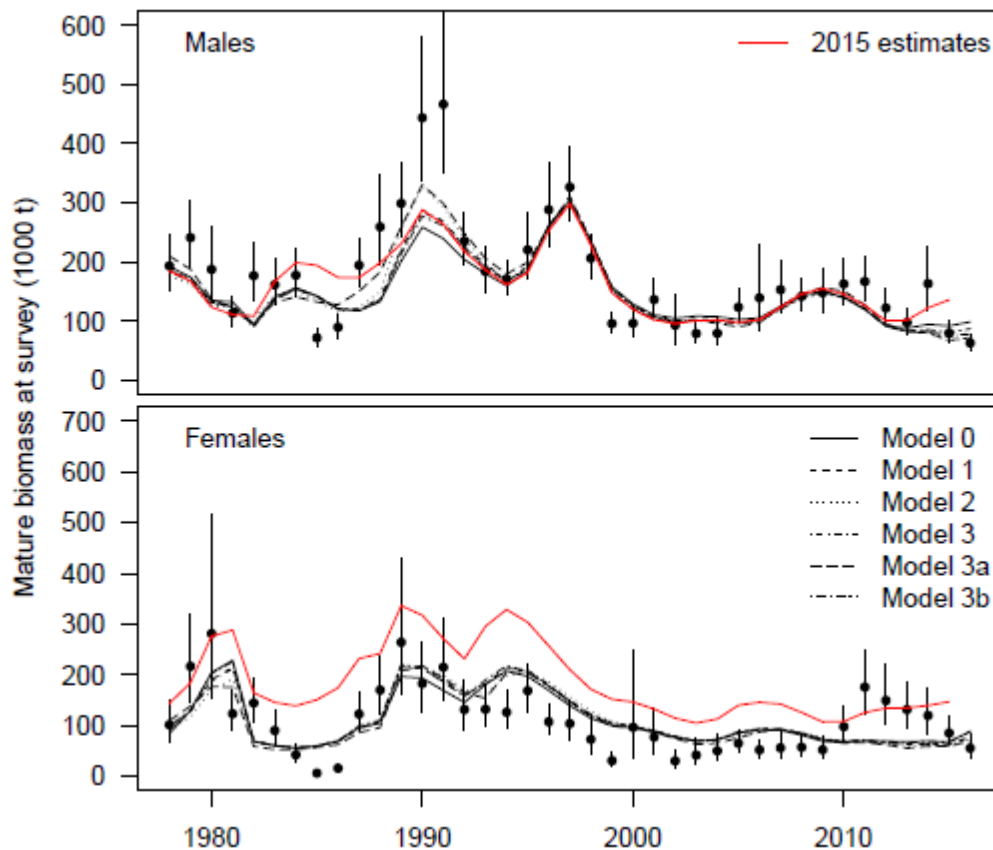


Figure 18 Model fits to the observed mature biomass at time of trawl survey for EBS snow crab.

Bristol Bay Red King Crab

The Japanese fleet started the Bristol Bay red king crab fishery in the early 1930s, stopped fishing from 1940 to 1952, and resumed the fishery from 1953 until 1974. The Russian fleet fished the stock from 1959 to 1971. U.S. trawlers started fishing in 1947, but the effort and catch declined in the 1950s. The U.S. fishery began to expand in the late 1960s and peaked in 1980 with a catch of 58,943 t (Figure 19). The catch declined dramatically in the early 1980s and has remained at low levels during the last two decades. After the early 1980s stock collapse, the fishery took place during a short period in the fall with the catch quota based on the stock assessment conducted the previous summer. Beginning with the 2005/2006 season, new regulations associated with fishery rationalization resulted in an increase in the duration of the fishing season (October 15 to January 15). Since 2000, retained catch has ranged between 3,866 and 9,304 t and was 4,614 t in 2015. Total catch, which includes an estimate of bycatch mortality biomass, was 5,336 t in 2015.

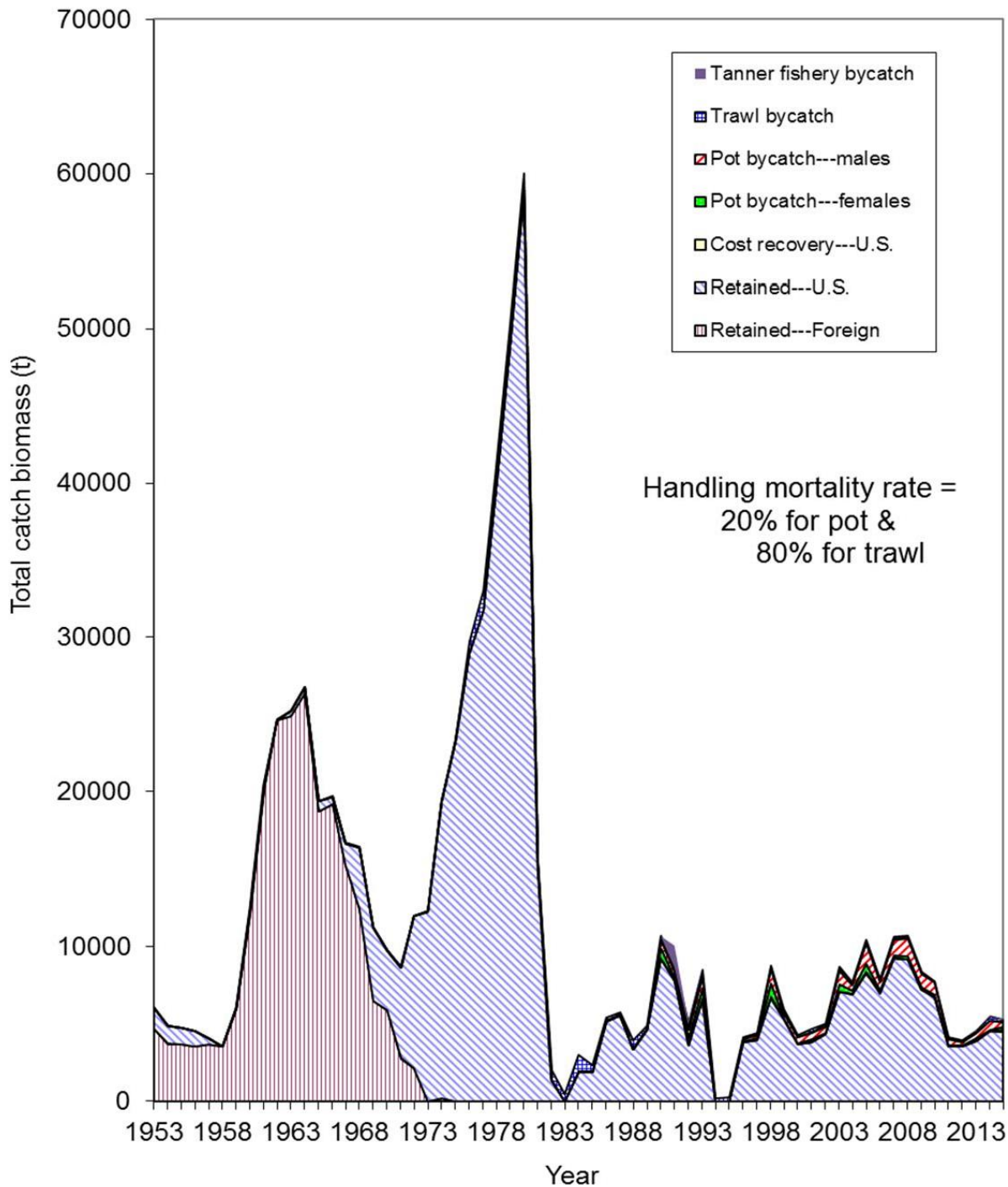


Figure 19 Retained catch and bycatch mortality biomass (t) for Bristol Bay red king crab from 1953 to 2015. Handling mortality rates were assumed to be 0.2 for the directed pot fishery 0.25 for the Tanner crab fishery and 0.8 for the trawl fisheries.

Model estimates of total survey biomass increased from 252,300 t in 1975 to 300,200 t in 1977, fell to 34,900 t in 1985, generally increased to 91,700 t in 2007, and subsequently declined to 65,700 t in 2016 (Figure 20). Estimated recruitment was high during the 1970s and early 1980s and has been generally low since 1985. The

near-term outlook for this stock is a continued gradual declining trend. Recruitment has been poor (less than the mean from 1984-2016) since 2006. The 2011 survey produced a high catch of juvenile males and females <65 mm CL in one survey tow but that catch did not track into the 2012-2016 surveys. The survey area-swept estimates for abundance and biomass in 2015-2016 were more consistent with previous surveys, in comparison to 2014, when the estimates were anomalously high.

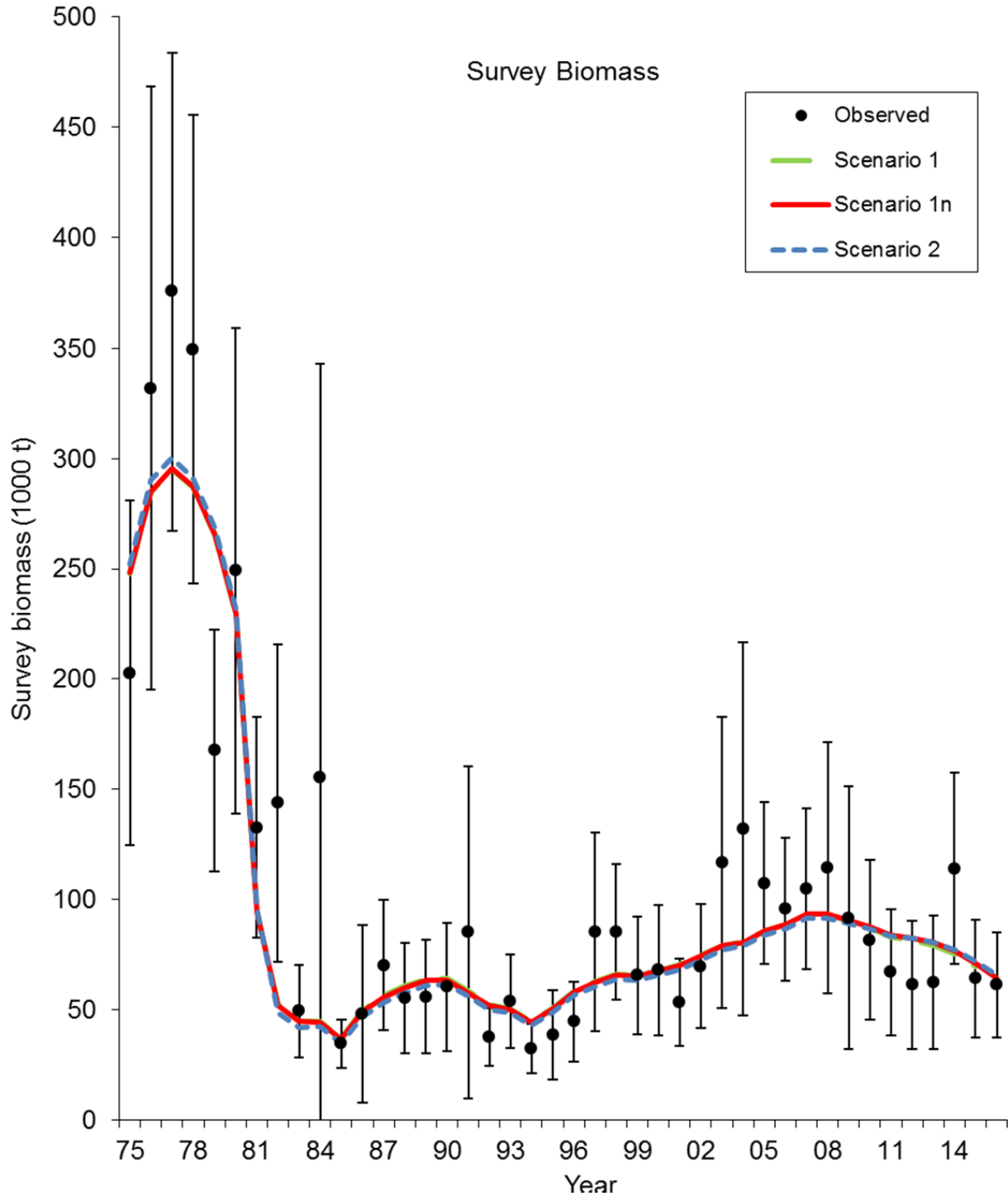


Figure 20 Comparison of area-swept estimates of total survey biomass and 2016 model predictions for Bristol Bay red king crab. The error bars are +/- 2 standard deviations.

St. Matthew Island Blue King Crab

The fishery was prosecuted as a directed fishery from 1977 to 1998. Landings peaked in 1983/84 at 4,288 t. From 1986/87 to 1990/91, landings were fairly stable averaging 568 t annually. Landings increased to an average of 1,496 t during the 1991/92 to 1998/99 seasons until the fishery was declared overfished and closed in 1999 when the stock size estimate was below the MSST. In 2000, Amendment 15 to the FMP was approved to implement a rebuilding plan for the stock. The rebuilding plan included a harvest strategy established in regulation by the Alaska Board of Fisheries, an area closure to control bycatch, and gear modifications. In 2008/09 and 2009/10, the MMB was estimated to be above *BMSY* for two years and the stock was declared rebuilt in 2009.

The fishery re-opened in 2009/10 with a TAC of 529 t and retained catch of 209 t. In 2010/11 the TAC was 726 t and retained catch 573 t. The 2011/12 retained catch of 853 t represented 80% of the 1,152 t TAC. In 2012/13, 99% (733 t) of a reduced TAC (740 t) was landed, though catch rate, at about 10 crab per pot, was little changed from what it had been during the previous three years. The directed fishery was closed in 2013/14 due to declining trawl survey estimates of abundance and concerns about the health of the stock. It resumed in 2014/15 with a TAC of 300 t, but fishery performance was relatively poor with a retained catch of 140 t. The TAC in 2015/16 was 190 t and retained catch 50 t. The recommended ABC for 2016/17 is 110 t.

Bycatch of non-retained blue king crab has been observed in the St. Matthew blue king crab fishery, the eastern Bering Sea snow crab fishery, and trawl and fixed-gear groundfish fisheries. Based on limited observer data, bycatch of sublegal male and female crabs in the directed blue king crab fishery off St. Matthew Island was relatively high when the fishery was prosecuted in the 1990s, and total bycatch (in terms of number of crabs captured) was often twice as high or higher than total catch of legal crabs.

Following a period of low numbers (below 30% of the 1978-2016 mean) after the stock was declared overfished in 1999, trawl-survey indices of abundance and biomass generally increased to well above average from 2007-2012 (Figure 21). In 2013 the survey biomass estimate was low (~40% of the mean value) but was followed by average biomass estimates in 2014 and 2015. The 2016 survey biomass estimate was 3,500 t. This represents about 60% of the long term mean with the most recent 3-year average at 87% of the mean value. This indicates a general decline in biomass compared to the recent peak survey estimate of nearly twice the average. The assessment model estimates dampen the interannual variability observed in the survey biomass and suggest that the stock (in survey biomass units) is presently at about 45% of the long term model-predicted survey biomass average. The trend from these values suggest a slight decline.

Because little information about the abundance of small crab is available for this stock, recruitment has been assessed in terms of the number of male crab within the 90-104 mm carapace length (CL) size class in each year. The 2013 trawl-survey area-swept estimate of 0.335 million males in this size class marked a three-year decline and was the lowest since 2005. That decline did not continue as the 2014 survey estimate was 0.723 million. Survey recruitment was 0.992 million in 2015, but the majority of this survey estimate is from one tow with a great deal of uncertainty. In 2016, survey recruitment declined to 0.535 million.

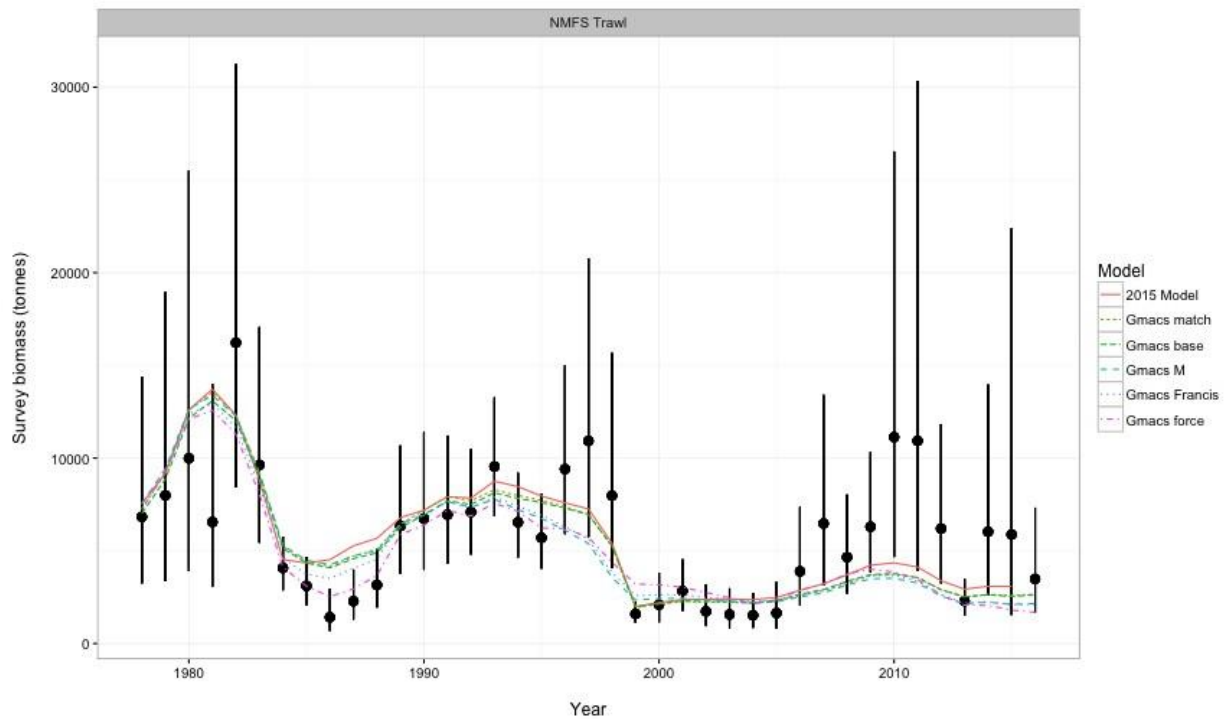


Figure 21 Comparisons of area-swept estimates of total male survey biomass (t) for SMBKC and model predictions for the 2015 model and each of the GMACS model scenarios in 2016. The error bars are +/- 2 standard deviations.

3.6 Economic Value of the Fishery

The Crab Economic SAFE (e.g. Garber-Yonts and Lee 2016) provides statistical information about economic activity in commercial crab fisheries managed under the Council’s Federal FMP for Bering Sea/Aleutian Islands King and Tanner Crabs (BSAI Crab FMP). Substantial additional detail is available for those active fisheries managed under the Crab Rationalization (CR) Program. The Crab Economic SAFE report is produced as part of the annual Stock Assessment and Fishery Evaluation (SAFE), provided as a reference source for information on status and trends in social and economic dimensions of fisheries managed under the FMP, to support evaluation of management and regulatory decision making.

Across all fisheries managed under the FMP, total volume of commercial ex-vessel landings in 2014 was 81 million pounds, with an estimated gross ex-vessel revenue value of \$246 million. Total finished pounds reported by processors in 2014 across all FMP crab species and product forms was 53.2 million pounds, with an estimated first wholesale value of \$331 million (F.O.B Alaska). Of the 10 crab stocks managed under the FMP, six were open to targeted fishing during 2014, prosecuted by an active fleet of approximately 108 vessels, and landed and processed at 17 processing facilities throughout the region. In the rationalized fisheries that currently represent some 99 percent of the volume of these landings, there were an estimated 1197 fishing crew positions across 76 active vessels in 2014, with labor share earnings totaling \$31.8 million paid to deck crew members and \$14.4 million to captains. Processing these landings for the first wholesale market is estimated to have accounted for some 843 thousand hours of line labor in 2014, generating \$9 million in wages.

As an indicator of the relative economic importance of Alaska crab fisheries to the state and U.S. economies, the 81 million pounds (36.6 thousand metric tons) of commercial catch of king and tanner crab in domestic waters off Alaska (including catch in the gulf of Alaska and other fisheries not managed under the FMP) during 2014

represented 0.85 percent of the total volume of U.S. commercial seafood landings, but accounted for 4.1 percent of total ex-vessel value; with respect to Alaska alone, these fisheries account for 1.41 percent of total catch volume and 12 percent of total ex-vessel value produced in the State's commercial fisheries.

Crab rationalization had a number of important economic consequences. One 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. In addition to a substantial reduction in the number of active vessels, consolidation in the crab-harvesting sector following rationalization in 2005/06 resulted in longer seasons. Correspondingly, the number of crew positions was reduced and working conditions changed, resulting in longer periods of active work in the fisheries for a smaller number of remaining crab crew participants. Another 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 purpose of the EDR is 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 (see Garber-Yonts & Lee 2016).

Bristol Bay Red King Crab

An historical account of the Bristol Bay red king crab fishery is given in Leon et al. (2017). Implementation of the CR program resulted in a sharp decrease in vessel participation in the BBRKC fishery. Vessel effort declined from an average of 243 vessels per year in the 5 years prior to CR to 89 vessels in 2005/06 season. Participation decreased to 65 vessels in the 2010/11 season and has stabilized to an average of 63 vessels since then. Season length has substantially increased since the beginning of CR, from seasons lasting 3 to 5 days in the 5 years prior to CR, to a regulatory 93-day season during CR. Since CR, the majority of the harvest occurs by mid-November; however, fishing effort has occurred until the season closure in mid-January. Vessels averaged 28 fishing days over the past 3 seasons. In all years since CR, harvest has been within 0.5% of the TAC. Information on effort and ex-vessel value of the BBRKC fishery is summarized in the figure below.

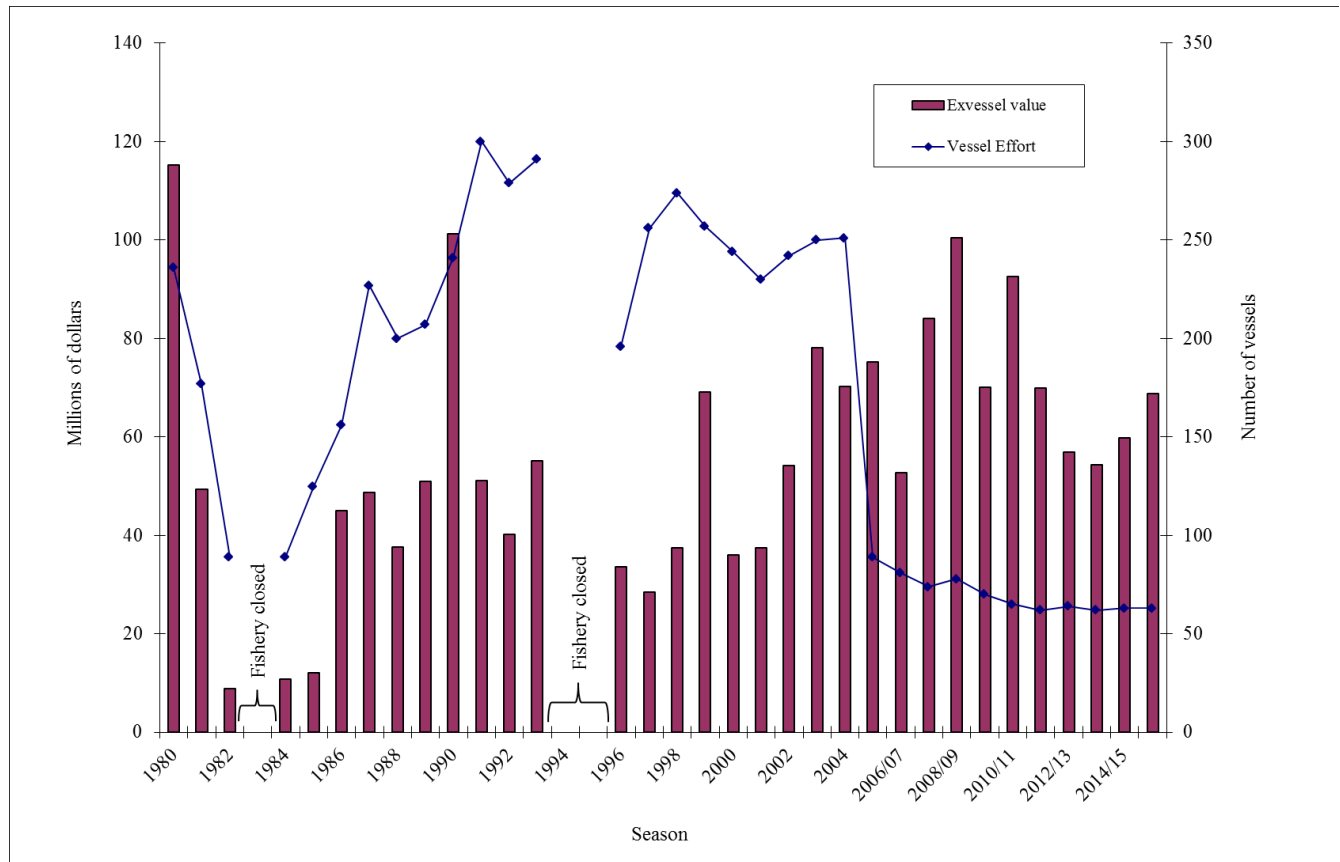


Figure 22 Bristol Bay red king crab general, Community Development Quota (CDQ), and Individual Fishing Quota (IFQ) fishery ex-vessel value and vessel effort, 1980–2015/16 (from Leon et al. 2017).

St Matthew Island Blue King Crab

Leon et al. (2017) give an historical overview of the St. Matthew Island blue king crab fishery. Catch and effort in the SMBKC fishery peaked in 1983 when 164 vessels harvested 9.5 million pounds. In subsequent seasons, catches remained below 4.7 million pounds. From 1999 to 2008/09, the fishery remained closed because regulatory abundance thresholds were not met. The SMBKC fishery re-opened in 2009/10 under the CR program. Since CR, far fewer vessels have participated in the fishery – approximately 3-7 vessels. The fishery closed again in 2013/14 in response to low population abundance observed in the NMFS trawl survey. A summary of effort and ex-vessel value of the SMBKC fishery is shown in Figure 23 below.

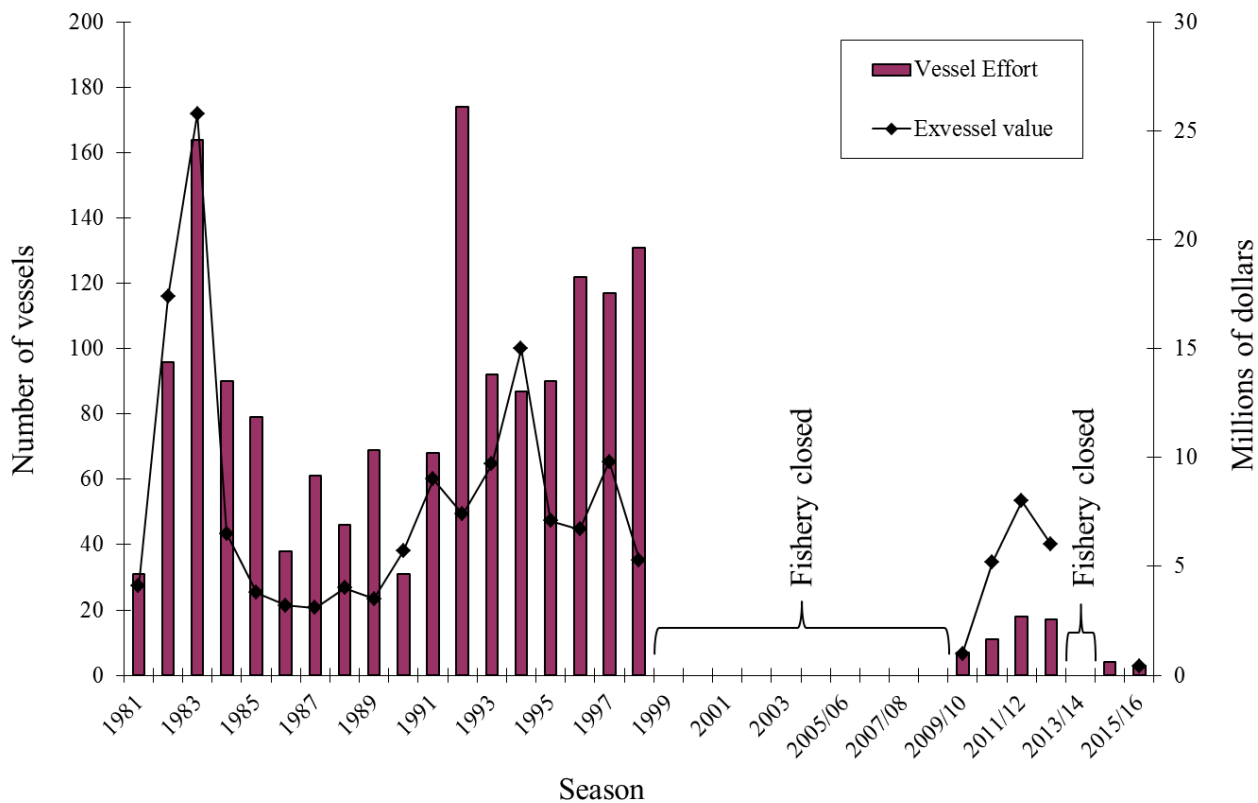


Figure 23 Saint Matthew Island Section blue king crab commercial fishery effort and ex-vessel value, 1981–2015/16 (from Leon et al. 2017).

Eastern Bering Sea Snow Crab

An historical account of the Eastern Bering Sea snow crab fishery is given in Leon et al. (2017). Snow crab harvest reached an all-time high of 328.6 million pounds during the 1991 season. Participation as well as ex-vessel value of harvest peaked in the 1994 season, with 273 vessels and an ex-vessel value of \$210.15 million. Vessel participation has reduced since rationalization, fluctuating from a low of 69 vessels in 2006/07 and 2009/10, to a high of 78 vessels in 2005/06 and 2007/08. A summary of effort and ex-vessel value of the fishery is shown in the Figure 24

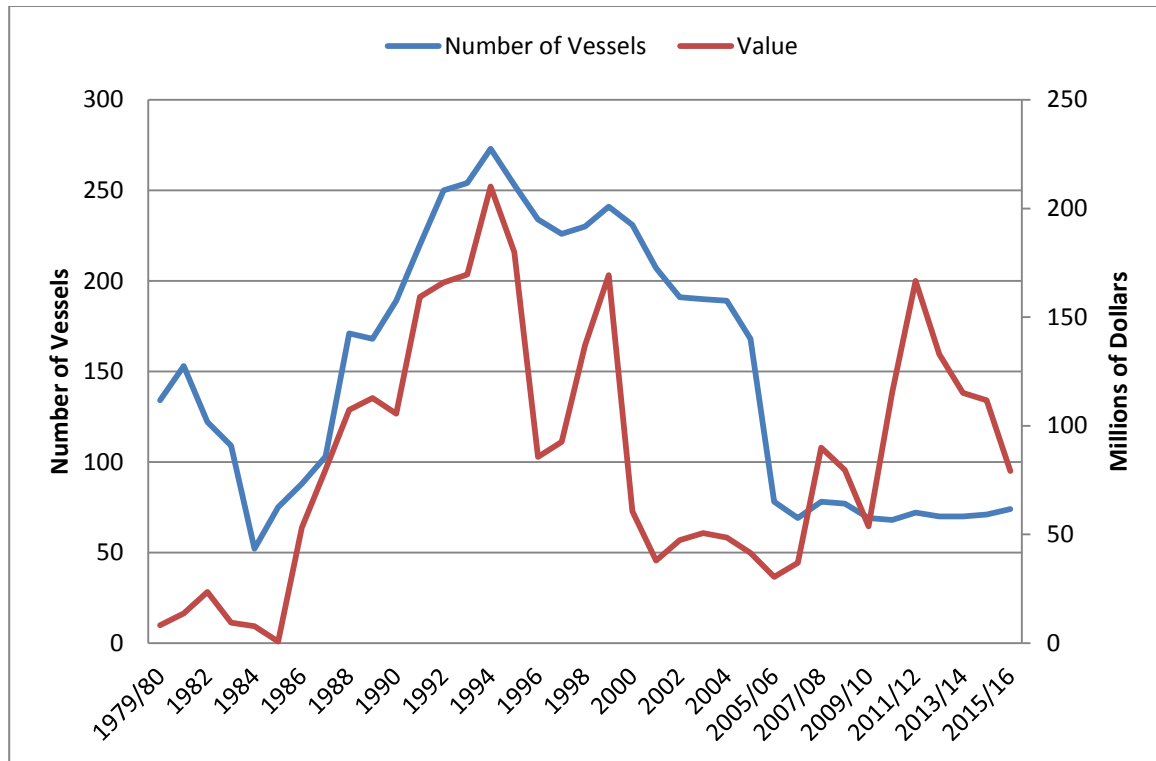


Figure 24 Eastern Bering Sea snow crab effort (number of vessels) and ex-vessel value (millions of dollars), 1979/80 to 2015/16. Data from Leon et al. (2017).

Eastern Bering Sea Tanner Crab

Leon et al. (2017) give an historical account of the Eastern Bering Sea tanner crab fishery. A summary of effort and ex-vessel value of the fishery is shown in the Figure 25

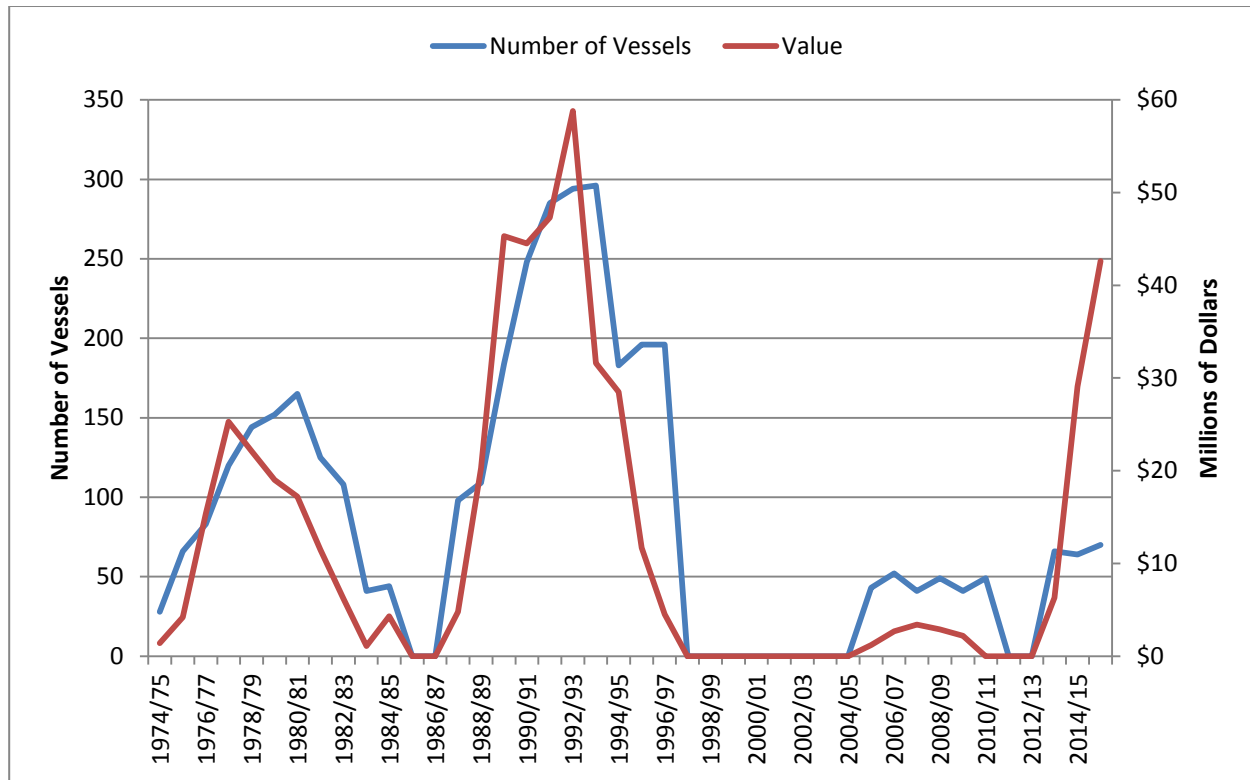


Figure 25 Eastern Bering Sea tanner crab effort (number of vessels) and ex-vessel value (millions of dollars), 1974/75 to 2015/16. Data from Leon et al. (2017). Gaps indicate fishery closures.

Aleutian Islands Golden King Crab

Leon et al. (2017) give an historical account of the Aleutian Islands golden king crab fishery. The report includes season-by-season information on total landings, vessel number, average size of crab harvested, and the ex-vessel value of landings since the directed fishery began in the 1981/82 season in the Adak area. Peak participation in the fishery occurred in the 1983/84 season, with over 100 vessels recording landings. Since CR, the number of participating vessels has been much lower, with approximately 3-8 vessels in the IFQ fishery East of 174° W (EAG) and approximately 2-3 vessels in the fishery West of 174° W (see Table 1-4 in Leon et al. 2017).

Garber-Yonts and Lee (2016) reported vessel number and ex-vessel value for the most recent five-year period for the AI Golden king crab fishery (EAG and WAG fisheries were combined) as follows: in 2011 five vessels participated in the fishery and the ex-vessel value of harvest was \$29.4 million; in 2012 six vessels participated in the fishery and the ex-vessel value of harvest was \$24.02 million; in 2013 six vessels participated in the fishery and the ex-vessel value of harvest was \$24.79 million; in 2014 five vessels participated in the fishery and the ex-vessel value of harvest was \$24.89 million; in 2015 five vessels participated in the fishery and the ex-vessel value of harvest was \$25.12 million.

4. Proposed Units of Assessment

The following are the proposed units of assessment and certification for US Alaska King, Tanner and Snowcrab Bering Sea and Aleutian Islands Commercial fishery.

Table 2. Proposed units of assessment and certification for the US Alaska King, Tanner and Snowcrab Bering Sea and Aleutian Islands Commercial fishery.

Unit of Certification			
U.S. ALASKA KING, TANNER AND SNOW CRAB BERING SEA and ALEUTIAN ISLANDS COMMERCIAL FISHERIES			
Fish Species (Common & Scientific Name)	Geographical Location of Fishery	Gear Type	Principal Management Authority
Red King crab (Paralithodes camtschaticus)	Bristol Bay	Trap Gear (e.g pot)	North Pacific Fishery Management Council (NPFMC or 'Council') National Marine Fisheries Service (NMFS, or 'NOAA Fisheries'), Alaska Region
Snow crab (Chionoecetes opilio)	Eastern Bering Sea	Trap Gear (e.g pot)	
Blue King crab (Paralithodes platypus)	St. Matthew Island	Trap Gear (e.g pot)	Alaska Department of Fish and Game (ADFG)
Golden King Crab (Lithodes aequispinus)	Aleutian Island	Trap Gear (e.g pot)	Alaska Board of Fisheries
Tanner Crab (Chionoecetes bairdi)	Eastern Bering Sea	Trap Gear (e.g pot)	

5. Consultation Meetings

On-Site Assessment and Consultation Meetings

Table 3 Summary of Meetings, BSAI King, Tanner and Snow Crab Fishery site visits, Jan 20-29 2017.

Date	Organization and Location	Representative	Main Topics of Discussion
January 20 th 2017	Bering Sea Crab Client Group LLC, Seattle, Washington Alaska Bering Sea Crabbers, Seattle Washington	Scott Goodman Ruth Christiansen (ABSCA) Ivan Mateo (GTC) Jerry Ennis (GTC) Wesley Toller (GTC)	<ul style="list-style-type: none"> • Changes or significant updates in law, regulations or commercial fisheries operations affecting the BSAI crab fisheries in 2015/16. • 2015/16 catches for the 3 fisheries. • issues with illegal catches in the BSAI or on the Russian side • changes to bycatch avoidance mechanisms, technical (e.g. escape rings, large mesh size, cod fingers) and operational methods • Ongoing projects of the Alaska Bering Sea Crabbers association. • Changes to management measures relative to legal size, minimum mesh size, protection of juveniles and females • General trends in stock status for these stocks. • Handling of sublegal and female crabs. Return at sea of females and juvenile crab, handling and methods. • Gear loss and ghost fishing, • Gear conflicts with other users, overlapping fishing areas with other crab or groundfish fisheries • Area closures • Fishing threats to Essential Fish Habitats from other fleets. • Provenience of bait for these fisheries • Crab economic data collection and use. 2015 updates
January 20 th 2017	NOAA Alaska Fisheries Science Center, Seattle, Washington	Benjamin J. Turnock, (EBS snow crab stock assessment scientist), Ann Hollowed, (Senior Scientist), Martin Dorn, (Research Fisheries Biologist) Ivan Mateo (GTC) Jerry Ennis (GTC)	<ul style="list-style-type: none"> • Changes or significant updates in law, regulations or commercial fisheries operations • Changes to the IFQ system for crab • Changes to the FMP for BSAI crab • Bycatch avoidance mechanisms, technical (e.g. escape rings, pot fingers) and operational methods. • Levels of transfers of licences/turnover • CDQ in 2015/2016 within limits • Fishing Capacity Reduction Programs

Date	Organization and Location	Representative	Main Topics of Discussion
		Wes Toller (GTC)	<ul style="list-style-type: none"> • Dealloss within the IFQ system • Assessment of climatic or oceanic effects that may be influencing the status/trend • Endangered species interactions • Rationalization of quota by non-fishers
January 20th 2017	North Pacific Fisheries Management Council	Diana Stram FMP coordinator Conference Call Ivan Mateo (GTC) Jerry Ennis (GTC) Wes Toller (GTC)	<ul style="list-style-type: none"> • Changes or significant updates in law, regulations or commercial fisheries operations • Changes to the IFQ system for crab • Changes to the FMP for BSAI crab • Bycatch avoidance mechanisms, technical (e.g. escape rings, pot fingers) and operational methods. • Levels of transfers of licences/turnover • CDQ in 2015/2016 within limits • Fishing Capacity Reduction Programs • Dealloss within the IFQ system • Assessment of climatic or oceanic effects that may be influencing the status/trend • Endangered species interactions • Rationalization of quota by non-fishers
January 23th 2017	Aleutian Pribiloff Islands Community Development Center Anchorage AK	John Hillsinger, Consultant Ivan Mateo (GTC) Jerry Ennis (GTC) Wes Toller (GTC)	<ul style="list-style-type: none"> • AIGKC DDF PSA evaluation
January 24th 2017	NOAA AK Regional Office Juneau	Gretchen Harrington, NEPA Coordinator, Keeley Kent, Fishery Management Specialist Ivan Mateo (GTC) Jerry Ennis (GTC) Wes Toller (GTC)	<ul style="list-style-type: none"> • Changes or significant updates in law, regulations or commercial fisheries operations • Changes to the IFQ system for crab • Changes to the FMP for BSAI crab • Bycatch avoidance mechanisms, technical (e.g. escape rings, pot fingers) and operational methods. • Levels of transfers of licences/turnover • CDQ in 2015/2016 within limits • Fishing Capacity Reduction Programs • Dealloss within the IFQ system • Assessment of climatic or oceanic effects that may be influencing the status/trend • Endangered species interactions • Rationalization of quota by non-fishers

Date	Organization and Location	Representative	Main Topics of Discussion
January 24 th 2017	Alaska Dept. of Fish and Game (ADF&G), Juneau, Alaska	Jie Zheng, (BBRKC stock assessment scientist) Forrest Bowers, (Deputy Director) Siddeek Shareef (AIGKC stock assessment scientist) Ivan Mateo (GTC) Jerry Ennis (GTC) Wes Toller (GTC)	<ul style="list-style-type: none"> • • Changes or significant updates in law, regulations or commercial fisheries operations affecting these species • Bycatch avoidance mechanisms, technical (e.g. escape rings, pot fingers) and operational methods. • Gear loss and ghost fishing, extent, issues. • Measures to spatially and temporally protect breeding populations. • Deadloss • ADFG crab observer coverage and data collection; observer coverage rate in 2014/2015 • Observed/potential significant detrimental impacts on species used as bait in BSAI crab fisheries • Issues with gear conflict between BSAI fishery and other fisheries • Assessment of climatic or oceanic effects that may be influencing the status/trend • Endangered species interactions • Changes in the footprint of the fishery • Enhancement opportunities
January 25 th 2017	US CoastGuard Juneau, Alaska	Ms. Courtney Sergeant, Lieutenant Commander Ivan Mateo (GTC) Jerry Ennis (GTC) Wes Toller (GTC)	<ul style="list-style-type: none"> • Discussion Enforcement activities from 2012 till 2016.
January 26 th 2017	Alaska Dept. of Fish and Game (ADF&G), Kodiak, Alaska	Mark Stichert, (Kodiak Fish and Game Coordinator), Miranda Westphal, (Fisheries Biologist III), Vicky Vaneck, (Fisheries Biologist I), Laura Slater, (Fisheries Biologist I) Ivan Mateo (GTC) Jerry Ennis (GTC) Wes Toller (GTC)	<ul style="list-style-type: none"> • Changes or significant updates in law, regulations or commercial fisheries operations affecting these species • Bycatch avoidance mechanisms, technical (e.g. escape rings, pot fingers) and operational methods. • Gear loss and ghost fishing, extent, issues. • Measures to spatially and temporally protect breeding populations. • Deadloss • ADFG crab observer coverage and data collection; observer coverage rate in 2014/2015 • Observed/potential significant detrimental impacts on species used as bait in BSAI crab fisheries • Issues with gear conflict between BSAI fishery and other fisheries • Assessment of climatic or oceanic effects that may be influencing the status/trend

Date	Organization and Location	Representative	Main Topics of Discussion
			<ul style="list-style-type: none"> • Endangered species interactions • Changes in the footprint of the fishery • Enhancement opportunities
January 26 th 2017	NOAA Alaska Fisheries Science Center, Kodiak, Alaska	Bob Foy, Fisheries Biologist Ivan Mateo (GTC) Jerry Ennis (GTC) Wes Toller (GTC)	<ul style="list-style-type: none"> • Assessment of climatic or oceanic effects that may be influencing the status/trend • New research programs to elucidate biology or ecology of crabs under assessment • Research on shell aging for crab species. Updates • Studies focused on research gaps identified in the 2013 Crab SAFE (e.g. natural mortality estimation, ontogenetic migration, males and females mating efficiency and dynamics, female biennial spawning) • Research on contribution of female crabs of differing life histories to reproductive output. Updates • Fishing threats to EBS habitats from other fleets • Ecological importance of stock in relation to food web dynamics (e.g. key prey or predator species). • Ecosystem changes attributed to the commercial fishery • Significant changes in levels of crab prey or predators species/abundance • Identification of ecosystem indicators used in relation to the dynamics of these fisheries
January 27 th 2017	Best Western Inn Kodiak Kodiak AK	Linda Kozak Fishery Representative Ivan Mateo (GTC) Jerry Ennis (GTC) Wes Toller (GTC)	<ul style="list-style-type: none"> • AIGKC DDF PSA evaluation
February 7 th 2017	Alaska Dept. of Fish and Game (ADF&G), Juneau, Alaska	Chris Siddon, (Marine Fisheries Scientist) <i>Conference call</i> Ivan Mateo (GTC) Jerry Ennis (GTC) Wes Toller (GTC)	<ul style="list-style-type: none"> • AIGKC DDF PSA evaluation • Distribution of AIGKC fishing effort • Outcome indicators for sensitive AI habitats

6. Assessment Outcome Summary

A. The Fisheries Management System

Alaska's BSAI crab stocks are managed under the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs (FMP). The crab FMP was developed under a negotiated agreement between the State of Alaska and the federal government. The result was a state/federal fishery management plan (FMP) which incorporated concerns of the NPFMC, NMFS and MSA requirements on the federal side and ADFG, the BOF and Alaska statutes on the state side. This balance resulted in true Joint Management where the needs of both Alaska residents and those from other states were met. The crab FMP has three categories of regulations which reflect the state and federal emphasis. Once the state and federal agencies and the BOF and NPFMC arrived at consensus and put the Joint management document to public review, it was submitted to the Secretary of Commerce who accepted joint management for the BSAI crab fisheries.

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. 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 various 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.

B. Data Collection, Stock Assessment and Scientific Advice

The collection, aggregation and use of data in stock assessments for the BSAI crab fisheries are undertaken through collaboration between 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 dependent 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 four of the five fisheries under consideration. Full details of the datasets for the five fisheries and their time series can be found in the annual Stock Assessment and Fishery Evaluation (SAFE) reports

The NMFS undertakes shellfish stock assessments through the annual Eastern Bering Sea trawl survey which provides the primary input to the shellfish assessments. Information derived from both regular surveys and associated research are analyzed by AFSC stock assessment scientists and supplied to fishery management agencies and to the commercial fishing industry. In addition, economic and ecosystem assessments are provided to the Council on an annual basis. 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. 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. For the AIGKC fishery, the stock assessment uses a length-based model that combines a variety of catch, catch composition and catch discard data from commercial crab and groundfish (trawl and pot) fisheries and standardized observer legal size catch-per-unit-effort (CPUE) as indices of abundance. For the EBSTC fishery, the stock assessment model is a stage/size-based population dynamics model that incorporates sex (male, female), shell condition (new shell, old shell), and maturity (immature, mature) as different categories into which the overall stock is divided on a size-specific basis. 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 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 example, for tier 3 stocks, the target reference point is B35% (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 (FOFL), or more intuitively if the total catch exceeds the OFL level (equivalent to MSY).

C. Management Objectives for the Stock

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. Conservation of aquatic habitats and biodiversity are integral parts of the NPFMC's management process. These concerns and decisions are summarized annually in the AFSC Ecosystems Considerations report and the ecosystem sections of each annual Stock Assessment and Fishery Evaluation (SAFE) report. Furthermore, Essential Fish Habitat (EFH) identification and protection constitute a key objective for the management system as outlined in the BSAI crab FMP.

D. Precautionary Approach

The overall management for the BBRKC, EBSSC, SMBKC, AIGKC and EBSTC comprises all the elements as specified in the FAO guidelines for the precautionary approach. FAO Guidelines for the Precautionary Approach (PA) (FAO 1995) advocate a comprehensive management process that includes data collection, monitoring, research, enforcement, and review. Absence of adequate scientific information is not used as a reason for postponing or failing to take conservation and management measures. The five crab stocks under consideration 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, due to a greater level of information being known about the stock. Higher tier stocks are managed more conservatively due to gaps in the information about the stock. This system is intrinsically precautionary in nature and the results involve catches always lower than the overfishing level. The annual assessments and subsequent SAFE reports for the BSAI crab fisheries allow for the identification of areas where there are gaps in the knowledge of the stock which require further research and/or improvements.

E. Implementation Monitoring and Control

There is a division of effort and emphasis in the at-sea enforcement between the USCG and the AWT. Under joint management there are both state and federal laws to enforce, and both state and federal agents actively conduct at-sea enforcement. The USCG is responsible for enforcing the main federal vessel regulations: this includes safety at sea, drug enforcement, vessel compliance with ESA and EFH requirements and assuring compliance of federal permits, observer coverage, licenses and VMS in the crab fisheries. AWT have vessels that conduct at-sea compliance with gear regulations, capable of hauling and confiscating crab pots, sample crab harvests at sea, assure sex and size requirements are met and assure that the vessels have all required state and federal licenses. Additionally AWT, along with ADFG area biologists and technicians, conduct vessel inspections dockside, conducting hold inspections and observing offloads of harvested crab for compliance. The entire crab harvests are conducted in Alaskan waters by American vessels. No foreign fleet is allowed to fish in the Alaska's EEZ. Because the fishery was rationalized in 2005, most enforcement of IFQ/IPQ violations, as well as size, sex and season violations occur at offloading.

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 2011 Policy for the Assessment of Civil Administrative Penalties and Permit Sanctions issued by NOAA Office of the General Counsel – Enforcement and Litigation, provides guidance for the assessment of civil administrative penalties and permit sanctions under the statutes and regulations enforced by NOAA. 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

F. Serious Impacts of the Fishery on the Ecosystem

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 last EFH review (2010) identified impacts of groundfish trawling on EFH habitat of red king Crab in Southern Bristol Bay as a potential problem area. The NPFMC is addressing the issue. In the BSAI crab fisheries Final Environmental Impact Statement (EIS), the impact of pot gear on benthic Eastern Bering Sea species is discussed. 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 to reduce crab bycatch in the trawl and fixed gear groundfish fisheries. If PSC limits are reached in bottom trawl fisheries executed in specific areas, those fisheries are closed. 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, snails, non-FMP crab, and other invertebrates. 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. 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.

Conformity Statement

The Assessment Team recommend that the management system of the applicant fishery, U.S. Alaska Bering Sea and Aleutian Islands King, Tanner, and Snow crab commercial fisheries [Bristol Bay Red King crab (*Paralithodes camtschaticus*), St. Matthew Island Blue King crab (*Paralithodes platypus*), Eastern Bering Sea Tanner Crab (*Chionoecetes bairdi*), Aleutian Islands Golden King Crab (*Lithodes aequispinus*), and Eastern Bering Sea Snow crab (*Chionoecetes opilio*)] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) 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

7. Fishery Assessment Evidence

Section A: The Fisheries Management System

7.1 Fundamental Clause 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 (1995) 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 (2009) 28

FAO Eco (2011) 35, 37.3

No. Supporting clauses/sub-clauses	13
Supporting clauses applicable	6
Supporting clauses not applicable	7
Non Conformances	0

Supporting Clause 1.1

There shall be an effective legal and administrative framework established at local and national level appropriate for fishery resource conservation and management. The management system and the fishery operate in compliance with the requirements of local, national and international laws and regulations, including the requirements of any regional fisheries management agreement.

FAO CCRF (1995) 7.7.1

FAO Eco (2009) 28

FAO Eco (2011) 35

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>

Summary Evidence:

There is an effective legal and administrative framework established at the local and national level appropriate for fishery resource conservation and management. The management system and the fishery operate in compliance with applicable law including the MSA.

Evidence:

Alaska’s Bering Sea and Aleutian Islands (BSAI) crab fisheries 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 (CPT), submitted to the National Marine Fisheries Service (NMFS) for public review and comment, with the final product being sent to the Secretary of Commerce for approval (see Crab FMP; NPFMC 2011).

The NPFMC is one of eight regional fishery management 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 legal instrument governing BSAI crab fisheries. The Act 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 limited Federal oversight.

The legal and administrative framework for management of BSAI crab fisheries is further supported by the NMFS. Regional NMFS facilities including Alaska Fisheries Science Center (AFSC) in Seattle and the Kodiak Fisheries Research Center (KFRC) generate scientific information and analyses necessary for the conservation, management, and utilization of the region's crab resources²⁰. The KFRC has the primary facility for the Alaska Fisheries Science Center's RACE Shellfish Assessment Program.

The BSAI King and Tanner Crab FMP is a “framework” plan, designed to allow for long-term management of the fishery without needing frequent amendments (BSAI Crab FMP; NPFMC 2011). 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 FMPs are written and amended subject to MSA. Category 2 and 3 management measures are subject to Alaska State statutes and regulations²¹.

The development process for the BSAI King and Tanner Crab FMP illustrates the effectiveness of the administrative framework at local and national levels. The 1989 FMP was developed jointly with the BOF, Alaska Department of Fish and Game (ADF&G), 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. ADF&G continues to play a central role in the BSAI crab administrative framework. The Department operates crab research programs at headquarters (HQ), Dutch Harbor, and Kodiak, with approximately 30 individuals participating in management and research activities. For example, most of the exploitation models used by the CPT were developed by ADF&G scientific staff.

The legal framework is implemented at local and national levels. 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) share 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.

References:	<p>Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV</p> <p>NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p.</p>
--------------------	--

²⁰ see: <http://www.afsc.noaa.gov/> and <http://www.afsc.noaa.gov/Kodiak/default.htm>

²¹ <http://www.adfg.alaska.gov/index.cfm?adfg=fishregulations.commercial>

	http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf
Non-Conformance Number (if relevant)	NA

Supporting Clause 1.2

Management measures shall consider 1) the whole stock biological unit (i.e. structure and composition contributing to its resilience) over its entire area of distribution 2) the area through which the species migrates during its life cycle and 3) other biological characteristics of the stock.

FAO ECO (2009) 30.3

FAO ECO (2011) 37.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

For each of the five crab stocks under assessment, management measures consider the whole stock biological unit over its entire area of distribution, the area through which the species migrates during its life cycle, and other biological characteristics of the stock.

Evidence:

1. Consideration of whole stock biological unit over its entire area of distribution

The Council and NMFS produce annually a Stock Assessment & Fishery Evaluation (SAFE) report covering all crab stocks within the BSAI King and Tanner Crab Fishery Management Plan (FMP). Both state and federal assessment biologists meet at the NPFMC Plan Team meetings and share assessment information and harvest strategies to assure conservation management over the entire stock distribution.

Appendix D of the Crab FMP (2011) provides a synopsis of the biological and environmental characteristics of crab resources, including descriptions of the management area and BSAI crab stocks. FMP descriptions of stock biological units for each of the crabs under assessment are presented in the following sections.

1.1 Area of Stock Distribution - Red King Crab

Three discrete stocks of red king crab are actively managed in the BSAI region: Bristol Bay, Norton Sound, and Adak stocks (Figure 6). Other populations of red king crab are found in the Pribilof Islands area, St. Matthew, and St Lawrence Island area, but are managed in conjunction with blue king crab fisheries. Red king crab stocks are managed separately to accommodate different life histories and fishery characteristics (Crab FMP, 2011).

According to the 2016 Crab SAFE report, 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 (Alaska Department of Fish and Game (ADF&G) 2012). The Bristol Bay area includes all waters north of the latitude of Cape Sarichef (54°36' N lat.), east of 168°00' W long., and south of the latitude of Cape Newenham (58°39' N lat.) and the fishery for RKC in this area is managed separately from fisheries for RKC outside of this area; i.e., the red king crab in the Bristol Bay area are assumed to be a separate stock from red king crab outside of this area.

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.

1.2 Area of Stock Distribution - St Matthews Blue King Crab

Two discrete stocks of blue king crab are actively managed in the BSAI region: the Pribilof Islands and St. Matthew Island stocks (Figure 4). Other smaller populations of blue king crab are found in the vicinity of St. Lawrence Island and Nunivak Island, as well as isolated populations in the Gulf of Alaska. Blue king crab stocks are managed separately to accommodate different life histories and fishery characteristics (Crab FMP 2011).

According to the 2016 Crab SAFE report, the Alaska Department of Fish and Game (ADF&G) Gene Conservation Laboratory division has detected regional population differences between blue king crab collected from St. Matthew Island and the Pribilof Islands. NMFS tag-return data from studies on blue king crab in the Pribilof Islands and St. Matthew Island support the idea that legal-sized males do not migrate between the two areas (Otto and Cummiskey 1990). St. Matthew Island blue king crab tend to be smaller than their Pribilof conspecifics, and the two stocks are managed separately.

1.3 Area of Stock Distribution - Aleutian Islands Golden King Crab

Several discrete stocks of golden king crab are thought to exist in the BSAI region. Until 1996, the Aleutian Islands stock was separated into two management areas, Adak and Dutch Harbor (Figure 7). The entire area is now managed as one area; Dutch Harbor Area O. Based on historic landing data, two golden crab stocks have been identified and are managed as the Sequam and Adak stocks separated at 174° W longitude (Crab FMP 2011).

The 2016 Crab SAFE report considers in some detail the evidence for golden king crab stock structure. Given the expansiveness of the Aleutian Islands Area and the existence of deep (>1,000 m) canyons between some islands, at least some weak structuring of the stock within the area would be expected. Data for making inferences on stock structure of golden king crab within the Aleutian Islands are largely limited to the geographic distribution of commercial fishery catch and effort. Catch data by statistical area from fish tickets and catch data by location from pots sampled by observers suggest that habitat for legal-sized males may be continuous throughout the waters adjacent to the islands in the Aleutian chain. However, regions of low fishery catch suggest that availability of suitable habitat, in which golden king crab are present at only low densities, may vary longitudinally. Catch has been low in the fishery in the area between 174° W longitude and 176° W longitude (the Adak Island area) in comparison to adjacent areas, a pattern that is consistent with low CPUE for golden king crab between 174° W longitude and 176° W longitude during the 2002, 2004, 2006, 2010, and 2012 NMFS Aleutian Islands bottom trawl surveys (von Szalay et al. 2011). In addition to longitudinal variation in density, there is also a gap in fishery catch and effort between the Petrel Bank-Petrel Spur area and the Bowers Bank area; both of those areas, which are separated by Bowers Canyon, have reported effort and catch. Recoveries during commercial fisheries of golden king crab tagged during ADF&G surveys (Blau and Pengilly 1994; Blau et al. 1998; Watson and Gish 2002; Watson 2004, 2007) provided no evidence of substantial movements by crab in the size classes that were tagged (males and females ≥ 90 -mm carapace length [CL]). Maximum straightline distance between release and recovery location of 90 golden king crab released prior to the 1991/92 fishery and recovered through the 1992/93 fishery was 61.2 km (Blau and

Pengilly 1994). Of the 4,567 recoveries reported through 12 April 2016 for the male and female golden king crab tagged and released between 170.5° W longitude and 171.5° W longitude during the 1991, 1997, 2000, 2003, and 2006 ADF&G Aleutian Island golden king pot surveys, none of the 3,807 with recovery locations specified by latitude and longitude were recovered west of 173° W longitude and only fifteen were recovered west of 172° W longitude (V. Vanek, ADF&G, Kodiak, pers. comm.). Similarly, of 139 recoveries in which only the statistical area of recovery was reported, none were recovered in statistical areas west of 173° W longitude and only one was in a statistical area west of 172° W longitude.

Snow crab are thought to be one stock throughout its range in the BSAI area (Figure 2). However, management the area is divided into two subdistricts, and NMFS estimates abundance and sets GHl by subdistrict (Crab FMP 2011).

According to the 2016 Crab SAFE report, Snow crab (*Chionoecetes opilio*) are distributed on the continental shelf of the Bering Sea, Chukchi Sea, and in the western Atlantic Ocean as far south as Maine. In the Bering Sea, snow crab are distributed widely over the shelf and are common at depths less than about 200 meters. Smaller crabs tend to occupy more inshore northern regions and mature crabs deeper areas to the south of the juveniles (Zheng et al. 2001). 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.

As noted at initial assessment (GTC 2012), currently there is little known about *C. opilio* genetic population structure within the Pacific/Arctic range of the species. 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.

Research conducted by the ADFG's Gene Conservation Lab found low levels of geographic differentiation 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 et al. 1998).

Parada et al. 2010 used biophysical modelling to develop a new hypothesis for the spatial dynamics of the Bering sea snow crab population: 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. Results from simulations 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 (i) 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 (i.e. southern- and westernmost areas of the Bering Sea) out of the geographic region of interest.

1.5 Area of Stock Distribution - EBS Tanner Crab

The 2011 Crab FMP (2011) identifies a single stock of Tanner crab: *C. bairdi* are managed for the eastern Bering Sea (Figure 2). According to the 2016 Crab SAFE report, Tanner crabs in the EBS are considered to be a separate stock distinct from Tanner crabs in the eastern and western Aleutian Islands. Somerton (1981b) suggests that clinal differences in some biological characteristics may exist across the range of the unit stock. These conclusions may be limited since terminal molt at maturity in this species was not recognized at the time of that analysis, nor was stock movement with ontogeny considered. Biological characteristics estimated based on comparisons of length frequency distributions across the range of the stock, or on modal length analysis over time may be confounded as a result.

Although the State of Alaska's (SOA) harvest strategy and management controls for this stock are different east and west of 166° W, the unit stock of Tanner crab in the EBS appears to encompass both regions and comprises crab throughout the geographic range of the NMFS bottom trawl survey. Evidence is lacking that the EBS shelf is home to two distinct, non-intermixing, non-interbreeding stocks that should be assessed and managed separately.

2. Consideration of area through which species migrates during its life cycle

Management measures fully consider the area through which species migrate during its life cycle for each of the five stocks under assessment. Life cycles of FMP crab species were reviewed comprehensively in the NFMS final Environmental Impact Statement (EIS) for the Bering Sea and Aleutian Islands King and Tanner Crab Fisheries (NMFS 2004). The EIS considered physical and biological aspects of the following life history stages: embryonic stages; larval stages; transitional (glaucothoe) stage; juvenile stages, and adult stages. The area through which species migrates during its life cycle was further examined for each crab species during the process to identify and describe essential fish habitat (EFH) in the EIS (NMFS 2004) and Fishery Management Plan (FMP; NPFMC 2011) for the BSAI King and Tanner Crab Fisheries.

Information about life cycles are considered explicitly within annual stock survey and assessment procedures (e.g. see Crab SAFE 2016) and thus are integrated into TAC setting approaches and formulation of regulations which define fishery boundaries and seasons.

3. Consideration of other Biological Characteristics of the stock

Management measures also consider other biological characteristics of all stocks which are managed under the BSAI Crab FMP. Relevant biological characteristics are considered during annual updates of stock assessments. For example, the 2016 Crab SAFE report explicitly considers other biological characteristics of the EBS snow crab stock such as growth, life history characteristics, natural mortality rates, weight at length, sexual maturity of male and females, molting probability, mating ratio and reproductive success, size and age. These biological characteristics are considered within existing stock survey and assessment procedures, TAC setting approaches, and existing regulations defining fishery boundaries and seasons.

Summary of Identified King and Tanner Crab Stocks in the BSAI Area

The BSAI King and Tanner Crab Fishery Management Plan (Crab FMP 2011) identified 17 separate stocks of king and Tanner crab that are managed in the BS/AI area (Table E.4). In most cases, these stocks are geographically separable on the basis of distribution and differing biological characteristics and interchange with adjacent groups is limited to oceanographic transport of planktonic larvae. In some cases, however, stocks are merely defined by existing regulatory boundaries either for statistical purposes or because pertinent information is lacking.

Table 4 Stocks of king and Tanner crab in the BS/AI area (from Crab FMP 101 October 2011)

Aleutian Islands golden king crab	Probably separated from Bering Sea stocks by an area of sparse king crab abundance north of Unimak Pass. There may be various distinct biological groups in the area (see Otto and Cummiskey 1985, Somerton and Otto 1986).
Aleutian Islands red king crab	One or several distinct groups that are geographically separated by deep water trenches in passes between islands and from Bering Sea stocks by an area of sparse king crab abundance north of Unimak Pass.
Bristol Bay red king crab	A distinct biological group (see Otto et al. 1989). Blue and golden king crab also occur here in low abundance but are not separately managed.
Pribilof District blue king crab	A distinct biological and geographic group (see Otto and Cummiskey 1990, Somerton and MacIntosh 1983a, 1983b).
Pribilof District red king crab	A distinct biological and geographic group.
Pribilof District golden king crab	Probably two biological groups (Pribilof and Zhemchug Canyons) that are not entirely geographically distinct from each other or from golden king crab found in Bristol Bay or the Northern District (see Otto and Cummiskey 1985, Somerton and Otto 1986).
St. Matthew Section blue king crab	A distinct biological and geographic group (see Otto and Cummiskey 1990, Somerton and MacIntosh 1983a, 1983b).
Northern District golden king crab	A group that has unique biological characteristics but may not be geographically distinct (see Otto and Cummiskey 1985, Somerton and Otto 1986).
Norton Sound Section red king crab	A distinct biological and geographic group (see Powell et al. 1983, Otto et al. 1989).
Bering Sea District <i>C. bairdi</i>	Probably distinct from group(s) in Aleutian Islands. Probably consists of two groups (east and west) that differ biologically (see Somerton 1981).
Bering Sea District <i>C. opilio</i>	Considered as distinct because species is almost absent from Aleutians. Gradations in biological characteristics over their geographical range.

References:

Blau, S.F., and D. Pengilly (1994) Findings from the 1991 Aleutian Islands golden king crab survey in the Dutch Harbor and Adak management areas including analysis of recovered tagged crabs. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K94-35, Kodiak. <http://www.sf.adfg.state.ak.us/fedaidpdfs/RIR.4K.1994.35.pdf>

Blau, S.F., L.J. Watson, and I. Vining (1998) The 1997 Aleutian Islands golden king crab survey. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K98-30, Kodiak. <http://www.adfg.alaska.gov/FedAidPDFs/RIR.4K.1998.30.pdf>

Grant, W. S., D. A. Zelenina , and N. S. Mogue (2014) Chapter 3. Phylogeography of Red King Crab - Implications for Management and Stock Enhancement. In: King Crabs of the World: Biology and Fisheries Management. Bradley G. Stevens (Ed.) CRC Press 2014, Pages 47–72, ISBN: 978-1-4398-5541-6. <http://www.crcnetbase.com/doi/abs/10.1201/b16664-4>

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.

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://fishbull.noaa.gov/963/merkouris.pdf>

NMFS (2004) Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p.

<https://alaskafisheries.noaa.gov/sites/default/files/analyses/crabeis0804-chapters.pdf>

NPFMC (2016) Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. 2016 Final Crab SAFE, North Pacific Fishery Management Council, September 2016. 899 p.

https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf

NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p.

<http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf>

Otto, R.S., and P.A. Cummiskey (1985) Observations on the reproductive biology of golden king crab (*Lithodes aequispina*) in the Bering Sea and Aleutian Islands. Proceedings of the International King Crab Symposium. University of Alaska Sea Grant Report No. 85-12, pp 123-135.

Otto, R.S., R. MacIntosh, and P. Cummiskey (1990) Fecundity and other reproductive parameters of female red king crab (*Paralithodes camtschatica*) in Bristol Bay and Norton Sound, Alaska. In: B. Melteff (ed.) Proceedings of the International Symposium on King and Tanner crabs. Lowell Wakefield Fisheries Symposium Series, Alaska Sea Grant College Program Report No. 90-04. pp. 65-90.

Otto, R.S. and P.A. Cummiskey (1990) Growth of adult male blue king crab (*Paralithodes platypus*). In: B. Melteff (ed.) Proceedings of the International Symposium on King and Tanner crabs. Lowell Wakefield Fisheries Symposium Series, Alaska Sea Grant College Program Report No. 90-04. pp. 245-257.

Parada, C., Armstrong, D.A., Ernst, B., Hinckley, S., and Orensanz JML (2010) Spatial dynamics of snow crab (*Chionoecetes opilio*) in the eastern Bering Sea: putting together the pieces of the puzzle. Bull Mar Sci, 2010, vol. 86: 413-37

<http://www.pmel.noaa.gov/foci/publications/2010/paraR709.pdf>

Powell, G.C., R. Peterson and L. Schwarz (1983) The red king crab, *Paralithodes camtschatica* (Tilesius) in Norton Sound, Alaska: History of biological research and resource utilization through 1982. Division of Commercial Fisheries, Alaska Department of Fish and Game, Juneau, Alaska. Informational Leaflet No. 222, 104p.

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

Somerton, D.A. (1981) Regional Variation in the size of maturity of two species of Tanner crab (*Chionoecetes bairdi* and *C. opilio*) in the eastern Bering Sea, and its use in defining management subareas. *Can. J. Fish. Aquat. Sci.* Vol. 38, pp 163-174.

<http://www.nrcresearchpress.com/doi/abs/10.1139/f81-022#.WL2KCH-tCtE>

Somerton, D.A. and R.S. Otto (1986) Distribution and reproductive biology of the golden king crab, *Lithodes aequispina*, in the eastern Bering Sea. *Fish. Bull.* 84(3), pp 571-584.

<http://fishbull.noaa.gov/843/somerton.pdf>

Somerton, D.A. and R.A. MacIntosh (1983a) The size at sexual maturity of blue king crab, *Paralithodes platypus*, in Alaska. *Fish. Bull.* 81(3), pp 621-623.

Somerton, D.A. and R.A. MacIntosh (1983b) Weight-size relationships for three populations in Alaska of the blue king crab, *Paralithodes platypus*, (Brandt, 1850) (Decapoda, Lithodidae). *Crustaceana* 45:169-175.

https://www.jstor.org/stable/20103865?seq=1#page_scan_tab_contents

Von Szalay, P.G., C.N. Roper, N.W. Raring, and M.H. Martin (2011) Data report: 2010 Aleutian Islands bottom trawl survey. U.S. Dep. Commerce., NOAA Technical Memorandum NMFS-AFSC-215.

<https://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-215.pdf>

Watson, L.J. (2004) The 2003 triennial Aleutian Islands golden king crab survey and comparisons to the 1997 and 2000 surveys (revised October 17, 2005). Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K04-42, Kodiak. [Revised 10/17/2005].

Watson, L.J. (2007) The 2006 triennial Aleutian Islands golden king crab survey. Alaska Department of Fish and Game, Fishery Management Report No. 07-07, Anchorage.

<http://www.sf.adfg.state.ak.us/fedaidpdfs/fmr07-07.pdf>

Watson, L.J., and R.K. Gish (2002) The 2000 Aleutian Islands golden king crab survey and recoveries of tagged crabs in the 1997–1999 and 2000–2002 fishing seasons. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K02-6, Kodiak.

Zheng, J., G.H. Kruse, and D.R. Ackley (2001) Spatial distribution and recruitment patterns of snow crabs in the eastern Bering Sea. *Spatial Processes and management of marine populations.* Alaska sea grant college program. AK-SG-01-02, 2001.

<http://nsgd.gso.uri.edu/aku/akuw99004/AK-SG-01-02a.pdf>

Non-Conformance Number (if relevant)	NA
---	-----------

Supporting Clause 1.2.1

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

FAO CCRF (1995) 7.3.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Management takes account of previously agreed management measures that were established and applied in the same region.				
Evidence: The BSAI crab management system routinely takes into account all previously agreed upon management measures. Consideration of previous management arrangements occurs at State, Federal and Council levels. The NPFMC annually reviews current and historic management measures in BSAI crab fisheries in consideration of future modification. The Council agenda for each meeting is set in response to both current priority issues and possible future changes or events with the potential to impact the fisheries. All meetings are open to the public comment both prior to and during the meeting. Continual public input into the NPFMC process ensures that stakeholder’s issues of concern remain live and are adequately discussed and considered. The Council announces all meetings on the NPFMC website, utilizing a ‘Three Meeting Outlook’ (e.g. see issue current as of March 2017 ²²) to outline issues of concern that will likely be discussed at the following three NPFMC meetings. This approach allows stakeholders to prepare and submit comments in advance of meetings so that concerns about current, proposed or previous management arrangements may be discussed in the relevant forum. Adequate consideration of previous management measures is also evident, for example, in processes relating to Individual Fishing/Processor Quotas (IFQ/IPQ) over the years since program initiation. Changes to the IFQ/IPQ system, and the rules which govern it, were considered by NPFMC and NMFS whenever modifications (e.g. Community protection measures, crew protection measures, etc.) have been proposed. Many years of public testimony through the NEPA process also show a consistent trend towards improved 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 Alaska Board of Fisheries (BOF). ADF&G and the BOF routinely take into account all previously agreed management measures. At BOF meetings, all stakeholders are encouraged to propose changes to any regulation which deals with the fisheries under discussion. The state/federal management system has a long history of taking into account previous management measures and improving enforcement.				
References:				
Non-Conformance Number (if relevant)			NA	

²² <http://www.npfmc.org/wp-content/PDFdocuments/meetings/threemeetingoutlook.pdf>

Supporting Clause 1.3

Where trans-boundary, shared, straddling or highly migratory fish stocks and high seas fish stocks are exploited by two or more States (neighboring or not), 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 and its environment.

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: The five crab stocks under assessment are not considered trans-boundary, shared, straddling, highly migratory, or high seas fish stocks. As such, this clause is <u>not applicable</u> .				
Evidence: This clause is <u>not applicable</u> to the crab stocks under assessment. The five crab stocks under assessment (BB Red King Crab, SMI Blue King Crab, AI Golden King Crab, EBS snow crab, and EBS tanner crab) are not considered trans-boundary, shared, straddling, highly migratory, or high seas fish stocks (see discussion of BSAI crab stock structure under clause 1.2).				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 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 (1995) 7.1.3, 7.1.4, 7.1.5, 7.3.2, 10.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>
Summary Evidence: The five crab stocks under assessment are not considered shared, straddling, high seas or highly migratory stocks. As such, this clause is <u>not applicable</u> .			
Evidence: See clause 1.3			
References:			
Non-Conformance Number (if relevant)			NA

Supporting Clause 1.4

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 (1995) 7.1.5

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>
Summary Evidence: The five stocks under assessment are not considered common or shared resources exploited by two or more States. As such, this clause is <u>not applicable</u> .			
Evidence: This clause is <u>not applicable</u> .			
References:			
Non-Conformance Number (if relevant)			NA

Supporting Clause 1.4.1

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 (1995) 7.3.5

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: The five stocks under assessment are not considered common or shared resources exploited by two or more States. As such, this clause is <u>not applicable</u> .				
Evidence: This clause is <u>not applicable</u> .				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 1.5

The Applicant fishery’s management system shall actively foster international cooperation and coordination on fishery matters with regard to:

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

FAO CCRF (1995) 7.3.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: The five stocks under assessment are not considered shared, straddling, high seas or highly migratory stocks, nor are they considered common shared resources exploited by two or more States. As such, this clause is <u>not applicable</u> .				
Evidence: This clause is <u>not applicable</u> .				
References:				
Non-Conformance Number (if relevant)				NA

Supporting 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 (1995) 7.7.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

There are established means by which fisheries management activities, organisations and arrangements are financed. Where appropriate, arrangements aim to recover the costs of fisheries conservation, management and research.

Evidence:

Specific costs incurred during management, research and enforcement of BSAI crab fisheries 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. ADF&G provides the Crab Observer Oversight Task Force (COOTF) with an annual financial report summarizing test fish expenditures on BSAI crab fishery observer program (ADF&G 2016).

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).

Observer Program

Provisions for financing the crab observer program are set out in Alaska Statute (5 AAC 39.645.c Shellfish onboard observer program). Program costs are paid for through federal funds and/or test fishing (cost-recovery). Observer coverage costs are paid either entirely by the vessel (100% coverage), through test-fishing, and/or federal funds.

NOAA budget²³

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 98 percent of the total Fiscal Year (FY) 2016 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

NOAA's National Marine Fisheries Service (NMFS) serves the Nation through a science-based approach to the conservation and management of living marine resources and the promotion of sustainable fisheries and healthy coastal and marine ecosystems. NMFS manages 469 fish stocks within the U.S. Exclusive Economic Zone (EEZ) as well as invertebrates, sea turtles, marine mammals, and other marine and coastal species, and their habitats for commercial, recreational, and subsistence purposes. The President's FY 2016 Budget requested \$990.1 million for NMFS (across all appropriations).

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 2016. 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

²³ <http://www.osec.doc.gov/bmi/budget/FY16BIB/EntireDocument-WebVersionWithCharts.pdf>

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 administering 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.

The **Marine Mammal Unusual Mortality Event Fund** provides funds to support investigations and responses to unusual marine mammal mortality events.

References: ADF&G (2016) Alaska Department of Fish & Game (ADF&G) Bering Sea and Aleutian Islands (BSAI) crab observer program annual test fish report. Report to Crab Observer Oversight Task Force (COOTF). June 21, 2016. 19 p.
https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/bering_aleutian/fy16_adfgrepo_rttoCOOTF.pdf

Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. <https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV>

DOC (2016) The Department of Commerce Budget In Brief, Fiscal Year 2016. Penny Pritzker, Secretary. 160 p.
<http://www.osec.doc.gov/bmi/budget/FY16BIB/EntireDocument-WebVersionWithCharts.pdf>

NOAA Fisheries (2016) Crab Rationalization Program Cost Recover for Fishing Year 2015/2016. Sustainable Fisheries Division, NOAA Fisheries, 9 p.
https://alaskafisheries.noaa.gov/sites/default/files/reports/fleetreport_fees2015_2016.pdf

Non-Conformance Number (if relevant)	NA
---	-----------

Supporting Clause 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 (1995) 7.8.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>
Summary Evidence:			
The BSAI king and Tanner Crab fisheries are conducted exclusively within the U.S. EEZ of Alaska. Only U.S. flagged vessels are permitted to access the fishery. There is no possibility of the use of flags of convenience. As such this clause is <u>not applicable</u> .			
Evidence:			
This clause is <u>not applicable</u> .			
References:			
Non-Conformance Number (if relevant)			NA

Supporting 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 (1995) 7.6.8

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>

Summary Evidence:

Procedures are in place within the management system to ensure continuous review of the efficacy of conservation and management measures. A mechanism exists to revise or abolish current management measures in light of new information.

Evidence:

A mechanism exists to revise or abolish current management measures in light of new information. Under the Magnuson-Stevens Act (MSA), Regional Fishery Management Councils are required to²⁴: 1852(f)(3) “conduct public hearings, at appropriate times and in appropriate locations in the geographical area concerned, so as to allow all interested persons an opportunity to be heard in the development of fishery management plans and amendments to such plans...” and 1852(f)(5) to “review on a continuing basis, and revise as appropriate, the assessments and specifications made pursuant to section 1853(a)(3) and (4) of this title with respect to the optimum yield...”

The NPFMC has procedures in place to ensure continuous review of the efficacy of conservation and management measures (NPFMC 2012). The Council annually reviews previous, current, and possible future conservation and management measures. The NPFMC sets its agenda for each meeting in response to both current priority issues and possible future changes/events with the potential to impact BSAI crab fisheries²⁵ with all meetings being open to public comment. The continual public input into the NPFMC process effectively provides public scrutiny of the NPFMC’s activities with issues being discussed continuously as long as they remain of importance to the stakeholder. Where areas are of concern are identified, revisions to conservation and management measures are proposed and debated at NPFMC meetings with resulting recommendations going to the respective agencies for approval. Upon approval, the revised regulations are implemented and enforced by the appropriate agencies. For example, the annual crab SAFE assessment process evaluates crab stocks and current regulations by the Crab Plan Team (CPT), Scientific and Statistical Committee (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 brought forward by the CPT, SSC, the public or the Council.

Similar to NPFMC, Alaska’s Board of Fisheries (BOF) has transparent management arrangements and decision-making processes. Conservation management measures are kept under continuous review. The Board (and ADFG) provides a great deal of information on their websites, including agenda of meetings, discussion papers, news items, and records of decisions²⁶. The BOF actively encourages stakeholder participation, and BOF deliberations are conducted in open, public session. Anyone may submit regulatory proposals, and all such proposals are given due consideration by the BOF. The Board of Fisheries has the authority to adopt

²⁴ <https://www.law.cornell.edu/uscode/text/16/1852>

²⁵ <http://www.npfmc.org/council-meeting-archive/>

²⁶ <http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main>

regulations described in AS 16.05.251 including: establishing open and closed seasons and areas for taking fish; setting quotas, bag limits, harvest levels and limitations for taking fish; and establishing the methods and means for the taking of fish. BOF review and revision of conservation and management efforts is evidenced by, for example, its publication of revised Commercial Fisheries Regulations for King and Tanner Crab Fisheries (ADF&G 2015).

References:

Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. <https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV>

NPFMC (2012) Statement of Organization, Practices, and Procedures of the North Pacific Fisheries Management Council. Draft, 23 March 2012. 31 p. <https://www.npfmc.org/wp-content/PDFdocuments/membership/SOPPs412.pdf>

ADF&G (2015) 2015-2017 Commercial Fisheries Regulations for King and Tanner Crab Fisheries. Alaska Department of Fish and Game, 169 p. <http://www.adfg.alaska.gov/index.cfm?adfg=fishregulations.commercial>

Non-Conformance Number (if relevant)

NA

Supporting 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 (1995) 7.1.9

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Management arrangements and decision making are organized in a transparent manner for the fishery.				
Evidence: NPFMC and BOF processes are organized in a highly transparent manner in terms of both management arrangements and decision-making processes as previously described under supporting clause 1.7. NPFMC: Council meetings are advertised in advance and the public is welcome to attend. Rules of procedure dictate transparency in Council matters, including requirements for advance preparation and public noticing of meeting agendas (NPFMC 2012). The NPFMC sets its agenda for each meeting in response to both current priority issues and possible future changes/events with the potential to impact BSAI crab fisheries. The Council (and NMFS) provides a great deal of information on their websites, including meeting agendas, discussion papers, and records of decisions ²⁷ . The Council actively encourages stakeholder participation, and all Council deliberations are conducted in open, public session. As previously discussed, the Three Meeting Outlook outlines issues likely to be of concern and therefore be discussed at the following three NPFMC meetings affording stakeholders the opportunity to prepare and submit comments for discussion in advance of meetings. BOF: Similar to NPFMC, Alaska’s Board of Fisheries (BOF) management arrangements and decision-making processes for the fishery are organized in a very transparent manner. The Board (and ADFG) provides a great deal of information on their websites, including agenda of meetings, discussion papers, news items, and records of decisions ²⁸ . The BOF actively encourages stakeholder participation, and BOF deliberations are conducted in open, public session. Anyone may submit regulatory proposals, and all such proposals are given due consideration by the BOF.				
References:	NPFMC (2012) Statement of Organization, Practices, and Procedures of the North Pacific Fisheries Management Council. Draft, 23 March 2012. 31 p. https://www.npfmc.org/wp-content/PDFdocuments/membership/SOPPs412.pdf			
Non-Conformance Number (if relevant)			NA	

²⁷ <http://www.npfmc.org/council-meeting-archive/>

²⁸ <http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main>

Supporting 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 (1995) 8.2.6

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence:				
<p>The crab fisheries under assessment are managed under the BSAI King and Tanner Crab Fisheries Management Plan (FMP) which are prosecuted exclusively within waters of the U.S. EEZ and State of Alaska. These fisheries do not occur on the high seas. As such this clause is <u>not applicable</u>.</p>				
Evidence:				
<p>This clause is currently <u>not applicable</u> to the five crab fisheries under assessment.</p> <p>At present there are no high seas harvests of the five crab stocks considered under this assessment. However, as was noted in the initial assessment of BSAI King and Snow Crab fisheries (GTC 2012), if stock distributions were to change in the future (e.g. in response to climate change) such that high seas harvests were to occur, then it would be applicable to assess fishery compliance with the Agreement. Of relevance to this hypothetical scenario:</p> <p style="padding-left: 40px;">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 1993²⁹. 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.</p>				
References:	<p>GTC (2012) FAO-Based Responsible Fisheries Management Certification: Full Assessment and Certification Report For The U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries. Global Trust Certification. http://www.alaskaseafood.org/wp-content/uploads/2016/03/FAO-RFM-AK_BSAI-King-and-Snow-Crab-Full-Assessment-and-Certification-Report_Public-Release_28_May_2012.pdf</p> <p>FAO Compliance Agreement (1993) AGREEMENT TO PROMOTE COMPLIANCE WITH INTERNATIONAL CONSERVATION AND MANAGEMENT MEASURES BY FISHING VESSELS ON THE HIGH SEAS. FAO, Rome. http://www.fao.org/fileadmin/user_upload/legal/docs/012t-e.pdf</p>			

²⁹ <http://www.fao.org/docrep/008/a0098e/a0098e04.htm>

Non-Conformance Number (if relevant)	NA

7.2 Fundamental Clause 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 (1995) 10.1.1/10.1.2/10.1.4/10.2.1/10.2.2/10.2.4

No. Supporting clauses/sub-clauses	10
Supporting clauses applicable	10
Supporting clauses not applicable	0
Non Conformances	0

Supporting 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 1) the fragility of coastal ecosystems and finite nature of their natural resources; 2) allowing for determination of the possible uses of coastal resources and govern access to them, 3) taking into account the rights and needs of coastal communities and their customary practices to the extent compatible with sustainable development. In setting policies for the management of coastal areas, 4) States shall take due account of the risks and uncertainties involved.

FAO CCRF (1995) 10.1.1, 10.1.3, 10.2.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence:				
<p>There is in place an appropriate policy, legal and institutional framework to achieve sustainable and integrated use of living marine resources. The system takes into account the fragility of coastal ecosystems and the finite nature of natural resources, and it considers the rights, needs and customary practices of coastal communities. The system allows for determination of possible uses of coastal resources and governs access to them. Policies for coastal zone management take due account of the risks and uncertainties involved.</p>				
Evidence:				
<p>Management of coastal resources within the Alaskan EEZ is governed by a framework of policies, regulations, statutes and laws which aim to achieve sustainable and integrated use of living marine resources. Multiple State and federal agencies are involved in coastal zone decision-making processes and activities of relevance to the BSAI crab fishery resource and its users. The system takes into account the fragility of coastal ecosystems, the finite nature of their natural resources and the needs of coastal communities. Further, it supports sustainable and integrated use of living marine resources and avoids conflict among users.</p> <p>BSAI crab fisheries are managed by the State (ADF&G) with Federal oversight by the NMFS and NPFMC³⁰. As Federal agencies, NMFS and NPFMC participate in coastal area management-related institutional frameworks through the federal National Environmental Policy Act (NEPA) process³¹. NEPA documents are required to be</p>				

³⁰ <http://www.npfmc.org/>

³¹ <https://www.epa.gov/nepa/national-environmental-policy-act-review-process>

produced each time regulations are renewed or amended meaning all proposed regulations include NEPA considerations. The NEPA process requires information to be made publically available and provides a robust opportunity for public involvement and ensures decisions are made in collaboration with fishery managers, fishermen, fishing organizations and fishing communities.

In addition to NMFS and NPFMC, a number of other State and Federal entities participate in coastal zone processes to ensure sustainable and integrated use of living marine resources. Some of the most important entities - together with a brief description of their role in managing coastal resources within the EEZ of Alaska - are presented below.

Alaskan Department of Environmental Conservation (ADEC)³²

ADEC implements statutes and regulations affecting air, land and water quality and is the lead state agency charged with implementing the federal Clean Water Act.

Alaska Department of Fish and Game (ADFG)³³

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's Endangered Species program.

Alaskan Department of Natural Resources (ADNR)³⁴

ADNR manages all state-owned land, water, and natural resources (except for fish and game), and uses the state Endangered Species Program to preserve the habitats of species threatened with extinction.

ADNR Office of Project Management and Permitting (OPMP)³⁵

The OPMP coordinates the review of larger scale projects in the state such as transportation, oil and gas, mining, federal grants, ANILCA coordination (ANILCA = Alaska National Interest Lands Conservation Act), and land use planning.

U.S. Fish and Wildlife Service (USFWS)³⁶

The USFWS fulfills functions including enforcement of federal wildlife laws, protection of endangered species, restoration of nationally significant fisheries and conservation and restoration of wildlife habitat. Additionally, the USFWS distributes monies collected through the Sport Fish and Restoration Program to State fish and wildlife agencies for fishery projects, boating access and aquatic education.

Bureau of Ocean Energy Management (BOEM)³⁷

The BOEM is responsible for managing environmentally and economically responsible development and provide safety and oversight of the offshore oil and gas leases. The activities of BOEM overlap extensively with those of ADNR, ADFG and ADEC given the potential impacts of such activities on marine resources.

Alaska Coastal Management Program (ACMP)

During the initial RFM assessment of BSAI crab fisheries, assessors noted the role of Alaska's Coastal

³² <http://dec.alaska.gov/>

³³ <http://www.adfg.alaska.gov/>

³⁴ <http://dnr.alaska.gov/>

³⁵ <http://dnr.alaska.gov/commis/opmp/>

³⁶ http://www.fws.gov/help/about_us.html

³⁷ http://www.boem.gov/uploadedFiles/Proposed_OCS_Oil_Gas_Lease_Program_2012-2017.pdf

Management Program (ACMP) in the framework for State management of coastal resources (see GTC 2012). The ACMP expired in 2011 and a ballot initiative to renew the program was not approved by Alaskan voters in 2012³⁸.

In effect, non-renewal of ACMP served to formalize and better define the State's role in decision making processes. Alaska has institutional and legal frameworks that determine the possible uses of coastal resources, govern access to them and take into account the rights of coastal fishing communities and their customary practices when doing so. The management framework explicitly recognizes and accounts for the rights of people dependent on marine fishing through NPFMC process, the Western Alaska Community Development Quota (CDQ) Program, allowances for subsistence fisheries in Alaskan waters and consultation with tribes and Native corporations. Ultimately, the assessment team considers the collectivity of NEPA processes and existing remits of State and Federal agencies to be demonstrably capable of planning and managing coastal developments in a transparent, organized and sustainable way.

NPFMC processes

The Council system mandated under the MSA (of which the NPFMC is part) was designed so that fisheries management decisions were made at the regional level allowing input from affected stakeholders. NPFMC meetings are open and public testimony is taken ensuring that the rights of coastal communities and their historic access to the fishery are considered in the decision making process.

The Western Alaska Community Development Quota (CDQ) Program³⁹

The Western Alaskan Community Development Quota (CDQ) Program is a federal fisheries program, authorized and governed by the MSA as amended in 2006 (MSA Section 305(i)(1)), which aims to promote fisheries related economic development in western Alaska. The Program involves 65 eligible communities within a fifty-mile radius of the Bering Sea coastline split into six regional organizations, referred to as CDQ groups. The Program allocates a portion of the 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 aims of the Program include:

1. Providing eligible villages with the opportunity to participate and invest in BSAI fisheries
2. Supporting economic development in western Alaska
3. Alleviating poverty and provide economic and social benefits for residents of western Alaska
4. Achieving sustainable and diversified local economies in western Alaska.

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).

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

³⁸ <http://www.alaskajournal.com/business-and-finance/2012-08-31/coastal-management-initiative-fails-heavy-margin>

³⁹ <https://alaskafisheries.noaa.gov/fisheries/cdq>

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.

Adak Community Allocation (ACA)

In 2005, in conjunction with the CR program, the BOF adopted regulation for an ACA Western Aleutian Islands golden king crab fishery. The program was established to benefit the community of Adak, who created a group called the Adak Community Development Corporation (ACDC). ACDC is a non-profit entity that represents the community of Adak and has a board of directors elected by the residents of Adak. The ACA crab allocation is not a CDQ fishery as Adak is not a CDQ community. The group must submit a comprehensive plan to DCED on the intended use of the ACA funds derived from harvesting the ACA golden king crab. The funds are intended for fisheries related purposes and other projects to benefit the community of Adak.

The ACA allocation is set at 10% of the TAC of western Aleutian Islands (west of 174° W long) golden king crab fishery. The fishery opened for the first time in August 2005 with an allocation of 270,000 pounds.

Consultation with tribes and Native corporations⁴⁰

In Alaska, NOAA's National Marine Fisheries Service (NMFS) consults with tribes and Native corporations about Federal actions that may affect tribal governments and their members. In fact the Alaska National Interest Lands Conservation Act (ANILCA⁴¹) which conveyed large sections of federal land to settle Alaska native lands claims specifically directs federal agencies to consult and coordinate with the State of Alaska. Executive Order 13175 sets the framework for regular and meaningful consultation and collaboration with Alaska Native representatives in the development of policies, legislation, regulations, and programs.

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 proceedings as well as through ANILCA and the Department of Natural Resources (DNR) Office of Project Management and Permitting (OPMP).

References:

GTC (2012) FAO-Based Responsible Fisheries Management Certification: Full Assessment and Certification Report For The U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries. Global Trust Certification.
http://www.alaskaseafood.org/wp-content/uploads/2016/03/FAO-RFM-AK_BSAI-King-and-Snow-Crab-Full-Assessment-and-Certification-Report_Public-Release_28_May_2012.pdf

Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. <https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV>

Non-Conformance Number (if relevant)

NA

⁴⁰ <https://alaskafisheries.noaa.gov/tribal-consultations>

⁴¹ <http://dnr.alaska.gov/commis/opmp/anilca/>

Supporting Clause 2.1.1

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

FAO CCRF (1995) 10.4.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

There are mechanisms for cooperation and coordination between U.S. and Canadian national authorities for the planning, development, conservation and management of coastal areas.

Evidence:

In discussing questions of coastal management in relation to the eastern North Pacific region (i.e. the area encompassing the Bering Sea and Aleutian Islands), the two relevant nations are the United States and Canada. The U.S. and Canada have one of the world’s oldest and most effective environmental partnerships necessitated by the extensive shared border and diverse ecosystems which require close cooperation among many U.S. states, Canadian provinces, U.S. Tribes, First Nations, and local and federal governments. The two federal governments have implemented over 40 international agreements to facilitate environmental management in the border area with in excess of 100 additional such agreements at the state level between U.S. states and Canadian provinces⁴².

Since 1994, Canada, Mexico and the United States have collaborated in protecting North America's environment through the North American Agreement on Environmental Cooperation (NAAEC), enacted at the same time as the North American Free Trade Agreement (NAFTA), to ensure that economic growth in the region would be accompanied by effective cooperation and continuous improvement in the environmental protection provided by each country. The NAAEC established a tri-national intergovernmental organization, the Commission for Environmental Cooperation (CEC)⁴³, to facilitate international collaboration on the protection, conservation, and enhancement of North America’s environment.

The CEC comprises a Council, a Secretariat and a Joint Public Advisory Committee (JPAC) and receives financial support from all three governments concerned. The Council is the governing body of the Commission and is made up of cabinet-level or equivalent representatives of each country, the Secretariat provides technical, administrative and operational support to the Council and JPAC consisting of five citizens from each country advises the Council on any matter within the scope of the NAAEC.

The mission of the CEC is to; *“facilitate collaboration and public participation to foster conservation, protection and enhancement of the North American environment for the benefit of present and future generations, in the context of increasing economic, trade, and social links among Canada, Mexico, and the United States”*.

The CEC is mandated to address some of North America’s most pressing environmental priorities through its cooperative work program and other initiatives. Examples of past and current CEC projects related to the marine environment include; *“Marine Protected Areas: Strengthening Management Effectiveness and*

⁴² <https://www.epa.gov/international-cooperation/epa-collaboration-canada>

⁴³ <http://www.cec.org/about-us/about-cec>

<i>Supporting Coastal Community Resilience”, “Engaging Communities to Conserve Marine Biodiversity through NAMPAN” and “Conserving Marine Species and Spaces of Common Concern”</i> ^{44,45,46} .	
References:	
Non-Conformance Number (if relevant)	NA

⁴⁴ <http://www.cec.org/our-work/projects/marine-protected-areas-strengthening-management-effectiveness-and-supporting-coastal-community-resilience>

⁴⁵ <http://www.cec.org/our-work/projects/engaging-communities-conserve-marine-biodiversity-through-nampan>

⁴⁶ <http://www.cec.org/our-work/projects/conserving-marine-species-and-spaces-common-concern>

Supporting Clause 2.1.2

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 (1995) 10.4.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Management authorities have appropriate technical capacities and financial resources to represent the fisheries sector in coastal management processes.				
Evidence: Federal and State management authorities have appropriate technical capacities to represent the fisheries sector in coastal management processes. NPFMC, NMFS and ADF&G employ internationally recognized scientists, seasoned fishery managers and policy makers. In most cases, these staff persons devote their entire careers to the agency they work for and the resource they are trying to manage. This clearly demonstrates a technical capacity to effectively represent their sector in the context of wider coastal management processes. Authorities also have sufficient financial resources to ensure representation of the fishery sector in coastal management processes (please see clause 1.6 for a discussion about financial resources).				
References:				
Non-Conformance Number (if relevant)				NA

Supporting 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. The public shall also 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 (1995) 10.1.2, 10.2.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>

Summary Evidence:

Representatives of the fisheries sector, including fishing communities and the wider public, are consulted in the decision making processes involved in coastal area management planning and development. The public is kept aware of the need to protect coastal resources and the importance of affected groups participating in management processes.

Evidence:

NMFS and NPFMC as federal agencies participate in coastal area management-related institutional frameworks through the federal National Environmental Policy Act (NEPA) process⁴⁷. NEPA processes provide robust and inclusive opportunities for public involvement in the decision making process (CEQ 2007). Representatives of the fisheries sector are actively consulted on, and engaged in, decisions involving coastal area management planning and development. Fishery managers, fishermen, fishing organizations and fishing communities are engaged through publicly advertised and scheduled meetings. Assessing the social and cultural value of coastal resources is stated as an explicit part of the decision making process for allocation and use of resources.

The NPFMC and NMFS both have processes in place to facilitate public engagement and ensure the concerns of coastal communities are heard. NPFMC conducts open meetings with both oral and written public testimony being taken and NMFS consults with tribes and Native corporations regarding Federal actions that may affect tribal governments and their members. The facilitation of public input ensures that the NPFMC and NMFS are kept abreast of issues of concern to coastal communities and that these are then given due consideration in the Council’s engagement with NEPA processes. Similarly, the Alaska Board of Fisheries (BoF) operates according to transparent processes, including holding open meetings, publishing meeting schedules, agendas and minutes, and soliciting public input. These BoF processes foster public engagement and thereby ensure that the Board is aware of the concerns of coastal communities regarding proposed management actions.

Many of the State and Federal management entities involved in coastal management planning and development (see clause 2.1 for a list of agencies) have outreach programs to ensure the public is kept aware of the need to protect coastal resources and the importance of participation by affected groups in coastal zone management/decision-making processes. For example, NPFMC, NMFS and ADF&G 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.

⁴⁷ <https://www.epa.gov/nepa/what-national-environmental-policy-act>

References:	CEQ (2007) A Citizen’s Guide to the NEPA. Having Your Voice Heard. Council on Environmental Quality, Executive Office of the President. December 2007. 45 p. https://ceq.doe.gov/get-involved/citizens_guide_to_nepa.html
Non-Conformance Number (if relevant)	NA

Supporting Clause 2.3

Fisheries practices that avoid conflict among fishers and other users of the coastal area (e.g. aquaculture, tourism, energy) shall be adopted and fishing shall be regulated in such a way as to avoid risk of conflict among fishers using different vessels, gear and fishing methods. 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 coastal users.

FAO CCRF (1995) 7.6.5, 10.1.4, 10.15

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Fisheries practices that avoid conflict among fishers and other coastal user groups (e.g. aquaculture, tourism, energy) are in place. Fishing is regulated to avoid risk of conflict among fishers using different vessels, gear and fishing methods. Procedures and mechanisms exist at State and Federal levels to settle conflicts which may arise within or between the fisheries sector and other coastal users.

Evidence:

Conflict Avoidance

The management system with its open and transparent structures and processes and participatory nature resolves the majority of disputes internally. NPFMC meetings provide fora for resolution of potential conflicts with users being afforded the opportunity to testify in person or in writing. In addition, stakeholders may review and submit written comments to the NMFS on proposed rules published in the Federal Register. The NPFMC works closely with ADFG and the BOF to coordinate fishery management programs in State and Federal waters of Alaska to address fish habitat concerns, catch limits, allocation issues and other management issues.

The NPFMC and the Alaska BOF have also created a joint protocol for development of "local area management plans," or LAMPs, for fisheries at ports where allocation or gear conflicts are present⁴⁸. The Board of Fisheries solicits LAMP proposals and evaluates them for adherence to the protocol before forwarding them to the NPFMC for action. A variety of measures, including moratoriums, harvest caps, and/or exclusion zones for all fisheries, can possibly be implemented as part of a LAMP to address near shore depletion or resolve other user conflicts.

In many cases the NEPA process expressly takes into account all resources and users of those 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. For example, conflicts between fishermen and other coastal users (e.g. aquaculture, tourism, energy) are usually discussed and resolved at the NEPA Process level.

For BSAI crab fisheries, NPFMC has established a "Gear Conflict" management objective within the Crab FMP (NPFMC 2011) to ensure that management measures minimize gear conflicts among fisheries. Within BSAI

⁴⁸ http://www.adfg.alaska.gov/static-sf/Region2/ground_fish/PDFs/Guidelines.pdf

crab fisheries, the risk of gear conflict has been greatly reduced by crab rationalization. Conflict is now less frequent because the fishery operates under an IFQ/IPQ system. The switch to the IFQ Program, with individual apportionments of the available quota and greatly extended fishing seasons, has consolidated the fishery and led to a reduction in gear conflict between fishers.

NPFMC processes also consider and seek to avoid or reduce conflicts that may arise between the BSAI crab fisheries and other fisheries operating in the region. 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 that protects the interest of coastal communities (see clause 2.1).

In addition, at the State level ADF&G and the BOF offer a public forum for stakeholder involvement and conflict avoidance. Stakeholders are afforded the opportunity to testify in person or in writing which reduces potential for conflict. For example, the role of BOF in IFQ allocation is seen as one important mechanism of conflict avoidance. "By taking on the task of resolving fishery disputes, the Board takes the politically-charged issue of allocation away from the fishery managers and politicians. While this system is not without its flaws, it dramatically increased the credibility of the management program by effectively separating decisions regarding allocation from those related to conservation. The separation of allocation and conservation decisions is critical for achieving sustainable fisheries in the state and elsewhere in the Northwest." (Ulmer 2000).

Conflict Resolution

Procedures and mechanisms to resolve conflicts exist at both State and Federal levels. At the Federal level, administrative appeals are handled by NOAA National Appeals Office (NAO). The Office adjudicates appeals of persons affected by initial administrative determinations, including those related to implementation of the Magnuson-Stevens Fishery Conservation and Management Act. The appeals may include hearings. During hearings an administrative appeals officer accepts testimony, and receives evidence into the record. NAO also may respond to motions and other requests related to the administrative appeals process. The Office ensures due process is afforded to all participants in the appeals process, and ensures sound and consistent jurisprudence in the appeals process. NAO determines the regulatory issues to be resolved, evaluates the evidence, and prepares written appellate decisions. Determinations are published on the website of the Alaska Region Administrative Appeals (the Alaska Office of Administrative Appeals is now part of NAO)⁴⁹. The Office is responsible for drafting, publishing and applying procedural regulations consistent with due process requirements (see procedures in NOAA NAO 2014).

At the State level, conflict are resolved through the BOF process, and through programs established by the Alaska Department of Natural Resources and ANILCA. A Joint Board Petition Policy (5 AAC 96.625) provides a mechanism for an interested person to petition the BOF for the adoption, amendment, or repeal of a regulation⁵⁰. However the petition process is utilized infrequently. The public has come to rely on the regularly scheduled participatory process as the basis for changing fish and game regulations.

⁴⁹ <https://alaskafisheries.noaa.gov/appeals/search>

⁵⁰ https://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2015-2016/august_teleconference/petition_policy_96_625.pdf

Additionally, Chapters 9 and 10 of the BSAI king and Tanner crab fishery management plan (NFMFC 2011) contain procedures for challenge of State laws or regulations regarding management of these fisheries alleged to be inconsistent with the Magnuson-Stevens Act, the FMP, or any other applicable Federal law.

The foregoing dispute resolution mechanisms have proven to be effective at dealing with most issues avoiding the necessity for disputes to escalate to the stage of legal action. However, in cases where administrative processes have not resulted in the resolution of disputes, parties can and do resolve the disputes in the federal court system.

References:	<p>NOAA NAO (2014) National Appeals Office Rules of Procedure. 15 CFR Part 906 [Docket No. 101019524–3999–02] RIN 0648–BA36, Federal Register Vol. 79, No. 25, February 6, 2014, Rules and Regulations. https://www.gpo.gov/fdsys/pkg/FR-2014-02-06/pdf/2014-02565.pdf</p> <p>Ulmer (2000) The Elements of Alaska’s Sustainable Fisheries. F. Ulmer in: Sustainable Fisheries Management: Pacific Salmon, E. Knudsen et al Editors, Lewis Publishers, 2000, p. 65.</p> <p>NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p. http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf</p>
--------------------	---

Non-Conformance Number (if relevant)	NA
---	-----------

Supporting 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 (1995) 7.1.10

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Management entities have processes in place to effectively disseminate information relating to conservation and management measures. Managers explain to resource users the purpose behind conservation measures in order to facilitate their application and thus gain increased support in their implementation.

Evidence:

Management entities have processes in place to effectively disseminate information relating to conservation and management measures, and related laws and regulations. Resource users and other interested individuals may access information relating to the BSAI crab fishery through various agency resources. The NPFMC, NMFS and ADF&G have websites where users can access comprehensive up to date information on management and conservation measures. Management organizations also maintain official profiles on various social media platforms from which they can both disseminate information and interact directly with stakeholders^{51,52,53}. Management agencies release regular information bulletins⁵⁴, news releases⁵⁵ and newsletters⁵⁶ informing the public of goings-on in Alaskan fisheries. ADF&G regularly publishes and distributes booklets summarizing current regulations (e.g. Commercial Fisheries Regulations for King and Tanner Crab Fisheries; ADF&G 2015) which are also made available online. Management agencies also have dedicated outreach sections that, in addition to attending public events, produce educational resources aimed at providing science-based materials and activities for students and teachers interested in exploring the science behind marine resource management and conservation^{57,58}.

In addition to the abovementioned management agency outreach platforms, information about conservation measures is also disseminated using a variety of other mechanisms. National Public Radio (NPR) is one of the main sources of information for Alaska fisherman (<http://www.npr.org/>): fishery reports are passed out through NPR, keeping fishermen informed of new developments as they are implemented. Local radio stations, 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

⁵¹ <https://twitter.com/NOAAFisheriesAK>

⁵² <https://www.facebook.com/NOAAFisheriesAK/?ref=hl>

⁵³ <https://www.facebook.com/alaskafishandgame>

⁵⁴ <https://alaskafisheries.noaa.gov/infobulletins/search/>

⁵⁵ <https://alaskafisheries.noaa.gov/news-releases/search/>

⁵⁶ <https://www.npfmc.org/npfmc-newsletters/>

⁵⁷ <http://www.afsc.noaa.gov/Education/default.htm>

⁵⁸ http://www.nmfs.noaa.gov/educators_students/education.html

and proposals, Industry and USCG information (<http://www.marineconservationalliance.org/>). NPR and MCA are widely used by industry and the communities.

Management organizations strive to explain the basis for and purpose of management and conservation measures to users of the resource in order to facilitate their application and thus gain increased support in the implementation of such measures. As described previously (see clause 1.8, 2.1 and 2.2), NPFMC and BOF conduct the majority of their business in open fora with stakeholders being afforded the opportunity to both make submissions and comment orally either in person or electronically. The basis for management recommendations is outlined in the supporting documents uploaded to the respective publically accessible web platforms in advance of meetings with sufficient time being given for stakeholders to digest the information and comment accordingly. In this way NPFMC and BOF meetings provide fora for resolution of potential issues between resource users and managers in advance of these issues becoming full blown conflicts thereby facilitating stakeholder “buy in” and possibly increasing support for proposed management measures within the community.

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 wide 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 Office of Protected Resources Outreach and Education Plan (NOAA OPR 2005) 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. Planned 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.

References:	NOAA OPR (2005) NOAA Fisheries Service Protected Resources Outreach and Education Strategic Plan, FY2005 – 2006. 27 p. http://www.nmfs.noaa.gov/pr/pdfs/education/strategic_plan.pdf ADF&G (2015) 2015-2017 Commercial Fisheries Regulations for King and Tanner Crab Fisheries. Alaska Department of Fish and Game, 169 p. http://www.adfg.alaska.gov/index.cfm?adfg=fishregulations.commercial
--------------------	--

Non-Conformance Number (if relevant)	NA
---	-----------

Supporting 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.

FAO CCRF (1995) 10.2.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Management organizations assess the economic, social and cultural value of coastal resources in order to assist decision-making on their allocation and use.

Evidence:

Assessment of the economic, social and cultural value of Alaskan fisheries is an integral part of the decision-making process for management of coastal resources. The primary job of the NPFMC and the BOF is to manage fisheries resources sustainably and to determine the allocation of resources to different users in accordance with provisions of the Magnuson Stephens Act (MSA). 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. In order for the Council and Board to fulfil MSA policy objectives, they use biological, economic and socio-cultural information collected and analyzed by NMFS and ADF&G.

Alaska Fisheries Science Center (AFSC) runs the Economic and Social Sciences Research (ESSR) Program in Alaska⁵⁹. The aim of the Program is to provide economic and sociocultural information to assist NMFS in meeting its stewardship responsibilities with activities being conducted in support of this mission including:

- collecting economic and sociocultural data relevant for the conservation and management of living marine resources
- developing models to use that data both to monitor changes in economic and sociocultural indicators and to estimate the economic and sociocultural impacts of alternative management measures
- preparing reports and publications
- participating on NPFMC, NMFS, and inter-agency working groups
- preparing and reviewing research proposals and programs
- preparing analyses of proposed management measures
- assisting Alaska Regional Office and NPFMC staff in preparing regulatory analyses
- providing data summaries

Many of the activities of the Program are conducted in collaboration with other Federal and State agencies and universities. Current research topics being addressed include regional economic impact models, behavioral models of fishing operations, indicators of economic performance, and the non-market valuation of living marine resources.

In 2005, AFSC compiled baseline socioeconomic information about 136 Alaska communities most involved in commercial fisheries compiling information from the US Census, ADF&G, CFEC, NMFS Restricted Access Management Division, Alaska Department of Community and Economic Development, and various community

⁵⁹ <http://www.afsc.noaa.gov/REFM/Socioeconomics/Default.php>

groups, websites, and archives in the process. In 2011 an exercise whereby the scope of the original evaluations was expanded led to updated profiles being produced for a total of 196 communities (Himes-Cornell et al. 2013). The new profiles add a significant amount of new information to help provide a better understanding of each community’s reliance on fishing. Introductory materials cover purpose, methods, and an overview of the profiled communities in the larger context of the state of Alaska and North Pacific fisheries. The community profiles comprise additional information including, but not limited to, annual population fluctuation, fisheries-related infrastructure, community finances, natural resources, educational opportunities, fisheries revenue, shore-based processing plant narratives, landings and permits by species, and subsistence and recreational fishing participation, as well as information collected from communities in the Alaska Community Survey, which was implemented during summer 2011, and the Processor Profiles Survey, which was implemented in Fall 2011. Comprehensive community profiles, concise snapshots and searchable maps of communities involved in commercial, recreational and subsistence fishing may be found on the AFSC website^{60,61}.

Additional information about the value of coastal resources comes from the Alaska Fisheries Information Network (AKFIN). AKFIN was established in 1997 in response to an increased need for detailed, organized fishery information to aid decision-making by managers with the aims of consolidating, managing and dispensing information related to commercial fishing in Alaska⁶². The AKFIN maintains an analytic database of both State and Federal historic, commercial Alaska fisheries data relevant to the needs of fisheries analysts and economists and provides that data in a usable format.

Assessment results are presented annually in Economic Stock Assessment and Fishery Evaluation (Economic SAFE) reports together with comprehensive information on stock assessments and updates on ecosystem status and trend (Ecosystem SAFE)⁶³. For example, the BSAI Crab Economic Status Report summarizes available economic information about the commercial crab fisheries managed under the FMP for BSAI King and Tanner Crab, with particular attention to the subset of fisheries included in the Crab Rationalization program. The report includes information on: production, sales, revenue, and price indices in the harvesting and processing sectors; income, employment, and demographics of labor in harvesting and processing sectors; capital and operating expenditures in the fishery; quota share lease and sale market activity; changes in distribution of quota holdings; productivity in the harvesting sector; U.S. imports and exports of king and Tanner crab; price forecasts; performance metrics for catch share programs; and information regarding data collection and ongoing economic and social science research related to the BSAI crab fisheries and related communities.

References:	<p>Garber-Yonts, B., and J. Lee., (2016) 2015 Stock Assessment and Fishery Evaluation Report for King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions: Economic Status of the BSAI Crab Fisheries, 2015. https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CrabEconSAFE2015.pdf</p> <p>Himes-Cornell, A., K. Hoelting, C. Maguire, L. Munger-Little, J. Lee, J. Fisk, R. Felthoven, C. Geller, and P. (2013) Community profiles for North Pacific fisheries - Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-259, Volume 1, 70 p.</p>
--------------------	---

⁶⁰ <http://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/CPU.php>

⁶¹ <http://www.afsc.noaa.gov/maps/ESSR/commercial/default.htm>

⁶² <http://www.akfin.org/about-akfin>

⁶³ <http://www.afsc.noaa.gov/REFM/Docs/2015/economic.pdf>

	<p>https://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-259/VOLUME%201.pdf</p> <p>Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV</p>
<p>Non-Conformance Number (if relevant)</p>	<p>NA</p>

Supporting Clause 2.6

States shall cooperate at the sub-regional level in order to improve coastal area management, and in accordance with capacities, measures shall be taken to establish or promote systems for research and monitoring of the coastal environment, in order to improve coastal area management, and promote multidisciplinary research in support and improvement of coastal area management using physical, chemical, biological, economic, social, legal and institutional aspects.

FAO CCRF (1995) 10.2.4, 10.2.5, 10.3.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

State and Federal agencies coordinate ongoing research and monitoring programs for the coastal environment. There are well-established multidisciplinary research programs to assess physical, chemical, biological, economic and social aspects of the coastal area which contribute to improved management.

Evidence:

State and Federal agencies coordinate ongoing research and monitoring programs for the coastal environment. A number of different entities are involved in coastal zone research and monitoring including: NPFMC, NMFS, ADF&G, U.S. Fish and Wildlife Service (USFWS), North Pacific Research Board (NPRB), PMEL as well as institutions of higher learning such as the University of Alaska Institute of Marine Science (IMS). The role of each of these entities is discussed further below.

Economic and social-cultural aspects are routinely assessed by the NPFMC, NMFS and ADF&G either during the NEPA review of plan amendments or during their on-going studies and evaluations (e.g. see Himes-Cornell et al. 2013 for recent socio-economic profiles of 196 Alaska communities as described under clause 2.5). Other State and federal entities that cooperate at the sub-regional level via NEPA processes in order to improve coastal area management include: Alaska Department of Environmental Conservation (ADEC); Alaska Department of Natural Resources (ADNR); DNR Office of Project Management and Permitting (OPMP); U.S. Fish and Wildlife Service (USFWS); and Bureau of Ocean Energy Management (BOEM). Brief descriptions of the roles of each as they relate to coastal area management may be found in supporting evidence for Clause 2.1.

EMA

The AFSC’s “Ecosystem Monitoring and Assessment Program” (EMA) aims to improve and reduce uncertainty in stock assessment models of commercial fish and shellfish species through the collection of observations of survey catch and oceanography. Its oceanographic observations include temperature, conductivity, salinity, density, 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 performs 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 region⁶⁴.

HCD

NOAA Fisheries' Habitat Conservation Division (HCD) works to avoid, minimize, or offset adverse anthropogenic effects 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 including commercial fishing. HCD focuses on activities in habitats used by federally managed fish species in marine, estuarine, and freshwater areas⁶⁵.

PMEL

NMFS's Pacific Marine Environmental Lab (PMEL) regularly collect oceanographic and environmental data important to understanding the changing habitat of crab and other marine species in Alaskan waters⁶⁶.

NPRB

The North Pacific Research board (NPRB) funds major research projects in the Gulf of Alaska⁶⁷ and the Bering Sea⁶⁸ aimed at examining physical and biological mechanisms that determine the survival of juvenile groundfishes in the GOA and understanding the impacts of climate change and dynamic sea ice cover on the eastern BS ecosystem respectively. For Oceanography, NPRB has provided millions of dollars in funding for numerous studies describing baseline oceanographic parameters and supported environmental buoy arrays. 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.

IMS

The IMS is the oldest and largest unit of the UAF's School of Fisheries and Ocean Science and is the home for research in oceanography and marine biology, including graduate student research for M.S. and Ph.D. degrees. IMS researchers conduct studies in the world's oceans, with particular emphasis on arctic and Pacific subarctic waters, including collaborative, multidisciplinary ecosystem studies of the waters around Alaska. IMS also conducts studies that form part of larger national and international cooperative programs⁶⁹. Externally funded research averages close to \$20M annually over the past decade, and currently exceeds \$43M in FY17 with the fully operational *R/V Sikuliaq*. IMS faculty and research staff provides expertise in marine biology, biological oceanography, physical, chemical and geological oceanography. Major areas of research are focused around:

⁶⁴ https://www.afsc.noaa.gov/ABL/EMA/EMA_Oceanography.php

⁶⁵ <https://alaskafisheries.noaa.gov/habitat>

⁶⁶ <http://www.pmel.noaa.gov>

⁶⁷ <http://www.nprb.org/gulf-of-alaska-project/about-the-project/>

⁶⁸ <http://www.nprb.org/bering-sea-project/about-the-project/>

⁶⁹ <http://www.uaf.edu/sfos/research/institute-of-marine-scienc/research-overview/>

- ecosystem structure and dynamics
- effects of climate change
- oceanographic and ecosystem factors affecting Alaskan fisheries
- applied research problems facing the U.S. Arctic offshore oil and gas industry

ADF&G Habitat Division

ADF&G Habitat Division⁷⁰ conducts research on coastal and marine environments throughout Alaska in an effort to document and mitigate human-related impacts, changes in habitat & species abundance. The agency also collects physical and chemical data, including temperature, depth, salinity and conductivity during their St. Matthew's pot survey using data loggers placed on the survey pots.

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 processing⁷¹. 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 environment⁷².

USCG

The Coast Guard enforces fisheries laws at sea including regulations to aid the recovery of marine protected species and their associated habitats⁷³.

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 fisheries⁷⁴.

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 format⁷⁵.

⁷⁰ <http://www.adfg.alaska.gov/index.cfm?adfg=habitatresearch.main>

⁷¹ <http://dec.alaska.gov/water/>

⁷² <http://dec.alaska.gov/spar/>

⁷³ <http://www.uscg.mil/hq/cg5/cg531/LMR.asp>

⁷⁴ <https://alaskafisheries.noaa.gov/fisheries/llp>

⁷⁵ <http://www.akfin.org/about/about-akfin/>

<p>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 processes⁷⁶.</p> <p>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 responsibilities⁷⁷.</p>	
References:	
Non-Conformance Number (if relevant)	NA

⁷⁶ <http://dnr.alaska.gov/commis/opmp/nilca/>

⁷⁷ <http://dnr.alaska.gov/commis/opmp/>

Supporting Clause 2.7

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 (1995) 8.11.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

State and federal management authorities have established a framework for management of artificial reefs and fish aggregation devices in the coastal waters of Alaska. These management systems require approval for the construction and deployment of such reefs and devices. Management takes into account the interests of fishers, including artisanal and subsistence fishers.

Evidence:

State and federal management authorities have established a framework for management of artificial reefs and fish aggregation devices in the coastal waters of Alaska. These management systems require approval for the construction and deployment of such reefs and devices. Management takes into account the interests of fishers, including artisanal and subsistence fishers.

The Department of Commerce, under the auspices of the National Oceanic and Atmospheric Administration (NOAA), developed the National Artificial Reef Plan in order to guide understanding of the many facets of artificial reef development and use, including the roles of Federal, State, and local governments. Required under the National Fishing Enhancement Act of 1984, NOAA most recently updated the Plan in 2007 (in coordination with Atlantic, Gulf, and Pacific States Marine Fisheries Commissions, as well as interested State and Federal agencies).

The National Artificial Reef Plan (NOAA 1985 as amended) provides guidance on various aspects of artificial reef use, including types of construction materials, and planning, siting, designing, and managing of artificial reefs for the benefit of aquatic life. The Plan is intended to respond to the information needs of a wide variety of users, including reef regulators, fishery and environmental managers, prospective donors of reef material, government officials, and the general public by facilitating effective artificial reef programs and performance monitoring. The Plan emphasizes the use of the most recent and best information available, establishes standard terminology to improve communication between parties interested in reefs, and assists in developing more uniform permitting procedures and clear guidance on materials acceptable for construction of marine artificial reefs. The U.S. Army Corps of Engineers is responsible for permitting the placement of decommissioned platforms as artificial reefs under section 10 of the Rivers and Harbors Act of 1899. The Plan also encourages the States to develop plans for artificial reefs in State waters and to participate in the planning for reefs in nearby Federal waters.

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 Center⁷⁸

⁷⁸ <http://www.habitat.noaa.gov/restoration/index.html>

- Alaska Department of Fish and Game – Restoration and Enhancement⁷⁹
- Alaska Department of Environmental Conservation - Alaska Clean Water Actions⁸⁰
- US Environmental Protection Agency – Wetlands Protection and Restoration⁸¹
- Coastal America Foundation⁸²
- US Fish and Wildlife Service – Partners for Fish and Wildlife Program⁸³ and
- US Fish and Wildlife Service – Alaska Coastal Program⁸⁴

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 (see discussion of NEPA processes under clause 2.2). 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.

As noted under clause 8.14 and 12.15, no habitat modifications are undertaken for the purpose of enhancement of BSAI King and Tanner Crab stocks, and the use of artificial structures is neither practical nor appropriate for the crab species under consideration. As such, the fishery management framework is shown to fulfil clause 2.7 but the issue does not apply directly to the units under assessment.

References:	NOAA (1985) National Artificial Reef Plan (as amended): Guidelines for Siting, Construction, Development and Assessment of Artificial Reefs http://www.nmfs.noaa.gov/sfa/management/recreational/documents/narp_cover_3.pdf
--------------------	--

Non-Conformance Number (if relevant)	NA
---	-----------

⁷⁹ <http://www.adfg.alaska.gov/index.cfm?adfg=habitatrestoration.main>

⁸⁰ http://dec.alaska.gov/water/acwa/acwa_index.htm

⁸¹ <https://www.epa.gov/wetlands>

⁸² <http://www.coastalamericafoundation.org/>

⁸³ <https://www.fws.gov/partners/>

⁸⁴ <https://www.fws.gov/coastal/contactR7.html>

Supporting Clause 2.8

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 (1995) 10.3.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

If an incident were to occur with potential for adverse environmental effects (e.g. oil spill, escape of an invasive species), there are management systems and action plans in place for response and containment. Additionally, there are systems to ensure the early sharing of information with the relevant Canadian authorities should such events have the potential for spill-over impacts on Canadian waters.

Evidence:

Oil and Hazardous Substances

The International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) is an international maritime convention establishing measures for dealing with marine oil pollution incidents nationally and in co-operation with other countries⁸⁵. The OPRC Convention was drafted within the framework of the International Maritime Organization (IMO) before being adopted in 1990, entering into force in 1995 and having a Protocol relating to hazardous and noxious substances added in 2000. As of April 2016, there are 109 state parties to the convention including those countries most likely to be impacted by a marine pollution incident in Alaskan waters the U.S., Canada and Russia.

States that are party to the Convention undertake, individually or jointly, to take all appropriate measures to prepare for and respond to oil pollution incidents. Parties are additionally required to co-operate and provide advisory services, technical support and equipment for the purpose of responding to an oil pollution incident upon the request of any Party affected or likely to be affected by such incident. In short this means that under the Convention, the U.S. can both call upon other signatory states to provide assistance in the event of a marine pollution incident within U.S. waters, and be called upon to provide reciprocal assistance should a similar event occur in another signatory state.

The Convention includes a requirement to report without delay any event, or indeed any observed event, involving a discharge, probable discharge or the presence of oil at sea to either the nearest coastal State, in the case of a ship, or to the coastal State to whose jurisdiction the unit is subject, in the case of an offshore unit. Similarly persons having charge of sea ports and oil handling facilities are required to report without delay any event involving a discharge or probable discharge of oil or the presence of oil to the competent national authority.

While international marine pollution contingency plans for the Canada-U.S contiguous waters have been in place since the early 1970s the provisions of OPRC necessitated further revisions to the Canada-United States

⁸⁵<http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/Default.aspx>

Joint Marine Pollution Contingency Plan (JCP)⁸⁶. The U.S. and Canadian Coast Guards are the custodians of the plan which is intended to outline and define roles and responsibilities in the event of a marine pollution incident and provide non-binding guidance to the respective Coast Guards, as well as other appropriate authorities, in coordinating preparedness and response operations.

The Alaska Department of Environmental Conservation's Division of Spill Prevention and Response (SPAR) is responsible for protecting Alaska's land, waters, and air from oil and hazardous substance spills by preventing, responding to and ensuring the clean-up of unauthorized discharges of oil and hazardous substances⁸⁷. SPAR has developed the Prevention and Emergency Response Program (PERP) whose mission is to protect public safety, public health and the environment by preventing and mitigating the effects of oil and hazardous substance releases and ensuring their clean up through government planning and rapid response⁸⁸. During a spill response, PERP staff carry out a variety of key tasks, depending on the size and nature of the incident including;

- Identifying the spiller or "responsible party"
- Determining the volume spilled and recovered
- Tracking the movement of the spill
- Coordinating with all local, state and federal interests using the Incident Command System (ICS) outlined in the State of Alaska Disaster Response Plan⁸⁹ and the Alaska Incident Management System Guide (AIMS) For Oil and Hazardous Substance Response⁹⁰

The Oil and Hazardous Substance Release Prevention and Response Fund, which is based on a per-barrel surcharge on crude oil production, was created in 1986 to provide funds for the safe handling and clean-up of oil and hazardous substances. State clean-up costs are recovered from the spiller, who is ultimately responsible for these costs. SPAR may also seek federal reimbursement from the national Oil Spill Liability Trust Fund for costs incurred in oil spill response activities.

The Pacific States/British Columbia Oil Spill Task Force is an organization comprised of representatives from state and provincial environmental agencies in the Pacific coastal area resulting from a memorandum signed by the governors of the U.S. states of Alaska, Washington, Oregon, and California, and the premier of the Canadian Province of British Columbia in 1989; Hawaii joined the Task Force in 2001 further broadening its regional scope. The task force was initially created in response to the need for cross-border coordination and cooperation in the wake of two major spill events, namely the oil barge *Nestucca* (December 1988) and *Exxon Valdez* (March 1989).

The Task Force's mission is to improve prevention, preparation, and response to oil spills on a state and provincial level. It achieves this by collecting and sharing data on oil spills, coordinating oil spill prevention projects, and promoting regulatory safeguards.

⁸⁶ <http://www.dfo-mpo.gc.ca/Library/343409.pdf>

⁸⁷ <http://dec.alaska.gov/spar/index.htm>

⁸⁸ <http://dec.alaska.gov/spar/PPR/docs/perp.pdf>

⁸⁹ https://dec.alaska.gov/spar/ppr/plans/adecc_disaster.pdf

⁹⁰ [http://dec.alaska.gov/spar/PPR/docs/AIMS_Guide-Complete\(Nov02\).pdf](http://dec.alaska.gov/spar/PPR/docs/AIMS_Guide-Complete(Nov02).pdf)

Marine Non-native/Invasive Species Management

There are numerous State and Federal agencies concerned with the management of biological threats with the potential to have adverse transboundary environmental effects on coastal areas including ADFG, the Aquatic Nuisance Species (ANS) Task Force and the National Invasive Species Council (NISC).

The National Invasive Species Council (NISC) was created by Executive Order in 1999 and provides high-level interdepartmental coordination of federal invasive species actions as well as working with other federal and non-federal groups to address invasive species issues at the national level⁹¹.

The ANS Task Force is an interagency committee established under the Nonindigenous Aquatic Nuisance Prevention and Control Act 1990 (NANPPCA) that is currently made up of 13 Federal Agencies⁹². The Task Force, co-chaired by the USFWS and NOAA, is charged with coordinating, developing and implementing a program to prevent the introduction and dispersal of ANS in U.S. waters, to monitor, control and research such species, and to disseminate information regarding ANS. This program is outlined in the Task Force Strategic Plan which undertakes to fulfil the provisions of the NANPPCA in addressing aquatic invasive species issues (ANS Task Force 2012). In 2002, ADFG prepared a management plan to address the threat posed by invasive species to the aquatic ecosystems in Alaska; *“The Alaska Aquatic Nuisance Species Management Plan”* (ADF&G 2012) that was approved by the federal Aquatic Nuisance Species (ANS) Task Force. Both the Task Force Strategic and the Alaska Aquatic Nuisance Species Management Plans espouse the importance of communication and education in the prevention of nuisance species.

Aquaculture/Mariculture Management

U.S. federal and state permits require containment management systems at all marine sites and enforce these measures through regular inspections and audits. With respect to aquaculture activities in the marine environment, advanced containment systems and improved management practices have dramatically reduced escapes from U.S. fish farms in the last 10 years⁹³ and this trend is likely to continue as equipment and husbandry techniques continue to evolve.

ADFG’s Mariculture Program permits and regulates aquatic farming in a manner that ensures the protection of the state’s fish, game, and aquatic plant resources⁹⁴. In Alaska, the mariculture industry primarily produces oysters, clams, and mussels. Among its core activities the Mariculture Program ensures that aquatic farming does not significantly alter an established fishery resource and is compatible with fish and wildlife resources and their habitat.

Note: In the initial RFM assessment of BSAI Crab, it was determined that clause 2.7 of RFMv1.1 (analogous to clause 2.9 in RFMv1.3) was not applicable because the stocks under assessment are not transboundary and are managed entirely within the Alaska EEZ (see GTC 2012). However the re-assessment team has taken the view that clause 2.9 is applicable to BSAI crab management because we take a broader interpretation of the word “activities” which is inferred to represent both fishing and non-fishing activities that may occur in the coastal zone.

References:	ANS Task Force (2012) Aquatic Nuisance Species Task Force Strategic Plan (2013 – 2017). Aquatic Nuisance Species Task Force (ANSTF). May 3, 2012. 29 p. https://www.anstaskforce.gov/Documents/ANSTF%20Strategic%20Plan%202013-2017.pdf
--------------------	--

⁹¹ <https://www.doi.gov/invasivespecies/>

⁹² <http://www.anstaskforce.gov/default.php>

⁹³ http://www.nmfs.noaa.gov/aquaculture/faqs/faq_aq_environment.html#8what

⁹⁴ <http://www.adfg.alaska.gov/index.cfm?adfg=fishingaquaticfarming.programinfo>

	<p>ADF&G (2012) The Alaska Aquatic Nuisance Species Management Plan. Alaska Department of Fish and Game. Juneau, Alaska. October 2002, RIR 5J02-10, 116 p. http://www.adfg.alaska.gov/FedAidpdfs/RIR.5J.2002.10.pdf</p> <p>GTC (2012) FAO-Based Responsible Fisheries Management Certification: Full Assessment and Certification Report For The U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries. Global Trust Certification. http://www.alaskaseafood.org/wp-content/uploads/2016/03/FAO-RFM-AK_BSAI-King-and-Snow-Crab-Full-Assessment-and-Certification-Report_Public-Release_28_May_2012.pdf</p>
<p>Non-Conformance Number (if relevant)</p>	<p>NA</p>

7.3 Fundamental Clause 3

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

FAO CCRF (1995) 7.3.3/7.2.2
 FAO ECO (2009) 28.1, 28.2
 FAO ECO (2011) 35.1, 35.2

No. Supporting clauses/sub-clauses	7
Supporting clauses applicable	7
Supporting clauses not applicable	0
Non Conformances	0

Supporting Clause 3.1

Long term management objectives shall be translated into a plan or other management document (taking into account uncertainty and imprecision) and be subscribed to by all interested parties.

FAO CCRF (1995) 7.3.3
 FAO ECO (2009) 28.1
 FAO ECO (2011) 35.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input checked="" type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>

Summary Evidence:

Long term management objectives are translated into a plan that is subscribed to by all interested parties.

Evidence:

Long-term objectives for the fishery are outlined in the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs (NPFMC 2011). FMP objectives are dictated by, and consistent with, the Magnuson-Stevens Act (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 Crab FMP provide adequate evidence to demonstrate the existence of long-term objectives clearly stated in a management plan.

NMFS conducts biological research⁹⁵ that is used by the NPFMC's Crab Plan Team to recommend a Total Allowable Catch (TAC) in each fishery. ADF&G 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 and Aleutian Islands.

⁹⁵ <https://alaskafisheries.noaa.gov/fisheries/crab>

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, 5 AAC 35.517 Bering Sea *C. opilio* Tanner crab harvest strategy, and 5 AAC 35.508 Bering Sea *C. bairdi* Tanner crab harvest strategy. Annual Management Reports may be found on the department’s web site (e.g. Zheng and Pengilly 2011).

Management decisions are made by the Council and BOF, and implemented and enforced by AWT, NMFS-OLE and USCG (see discussion of enforcement under clause 10). Both NPFMC and ADF&G make Council and Board deliberation and associated records publicly available on their websites (e.g. Crab SAFE (NPFMC 2016); ADF&G Annual Management Report for Shellfish Fisheries (Leon et al. 2017)). The decision-making processes of both agencies are extremely transparent and inclusive of all stakeholders^{96,97}, thereby ensuring that the plan is subscribed to by all interested parties.

References:	<p>Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV</p> <p>NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p. http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf</p> <p>NPFMC (2016) Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. 2016 Final Crab SAFE, North Pacific Fishery Management Council, September 2016. 899 p. https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf</p> <p>Leon, J. M., J. Shaishnikoff, E. Nichols, and M. Westphal. (2017) Annual management report for shellfish fisheries of the Bering Sea–Aleutian Islands Management Area, 2015/16. Alaska Department of Fish and Game, Fishery Management Report No. 17-10, Anchorage. http://www.adfg.alaska.gov/index.cfm?adfg=fishingCommercial.main</p> <p>Zheng, J. and D. Pengilly. (2011) Overview of Proposed Harvest Strategy and Minimum Size Limits for Bering Sea District Tanner Crab. Alaska Department of Fish and Game, Special Publication No. 11-02, Anchorage. http://www.adfg.alaska.gov/fedaidpdfs/sp11-02.pdf</p>
--------------------	---

Non-Conformance Number (if relevant)	NA
---	-----------

⁹⁶ <https://www.npfmc.org/how-do-i-get-involved/>

⁹⁷ <http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main>

Supporting Clause 3.2

Management measures shall provide inter alia that:

Supporting Clause 3.2.1

Excess fishing capacity shall be avoided and exploitation of the stocks remains economically viable.

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Conservation and management measures ensure that excess fishing capacity is avoided and exploitation of the stocks remains economically viable.				
Evidence: 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 ⁹⁸ . 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 ⁹⁹ . By capping the numbers of buyers and sellers, and providing greatly protracted seasons, participants were able to join cooperatives that resulted in fewer vessels deploying less gear on the grounds (reviewed in Fina 2011). The pot gear deployed is selective, with ADF&G 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 (2001 and 2002 seasons); the GHL for Bering Sea C. opilio was exceeded in four out of five years (2000, 2002, 2003, and 2004 seasons); and the GHL for Aleutian Islands golden king crab was exceeded in two out of five years (2000/01 and 2001/02 seasons; NPFMC 2007). Since the implementation of the crab rationalization program, observed harvest levels have been at or below total allowable catch (TAC) set for each of these fisheries.				
References:	Fina, M. (2011) Evolution of Catch Share Management: Lessons from Catch Share Management in the North Pacific. Fisheries 36(4): 164-177. April 2011. http://www.npfmc.org/wp-content/PDFdocuments/catch_shares/Fina_CatchShare_411.pdf NPFMC (2007) 2007 Crab SAFE. Stock Assessment and Fishery Evaluation Report			

⁹⁸ <https://alaskafisheries.noaa.gov/fisheries/ifq>

⁹⁹ <https://alaskafisheries.noaa.gov/fisheries/crab>

	for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands Regions. https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CRABSAFE07.pdf
Non-Conformance Number (if relevant)	NA

Supporting Clause 3.2.2

The economic conditions under which fishing industries operate shall promote responsible fisheries.

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: The economic conditions under which fishing industries operate promote responsible fisheries.				
Evidence: The economic conditions under which the fishing industries operate promote responsible fisheries, as demonstrated in economic analyses by NMFS and NPFMC. Assessments of the economic conditions of BSAI crab fisheries are performed on a regular and typically annual basis. NMFS prepares a number of status reports ¹⁰⁰ including the annual Economic SAFE Report (e.g. Garber-Yonts and Lee 2016). ADF&G also tracks ex-vessel value of the fisheries they manage, and produces Annual Management Reports (e.g. Leon et al 2017). These comprehensive reports are available online or as hard copy. NMFS and NPFMC publish the results from ongoing programs for data collection, monitoring and evaluating economic conditions of BSAI crab fisheries (also see references given under clauses 4.5 and 8.1.3). The operation of these data programs has been independently reviewed by the Center for Independent Experts (Anderson 2011). In addition, some of the main outputs from these socio-economic monitoring programs are published in academic journals as peer-reviewed studies (e.g. Abbott et al. 2010). There is strong evidence that conservation and management measures have improved the economic conditions under which the BSAI crab fishing industry operates. 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 ex-vessel. That season there were also seven vessels that participated in the St. Matthew fishery, landing a catch valued at approximately one million dollars ex-vessel. In the 2009/10 snow crab fishery, sixty-nine vessels harvested 43.2 million pounds worth of crab, with an ex-vessel value of \$48.27 million.				
References:	Abbott, J.K., Garber-Yonts, B., and Wilen, J.E. (2010) Employment and Remuneration Effects of IFQs in the Bering Sea/Aleutian Islands Crab Fisheries. <i>Marine Resource Economics</i> , 25:333-354. Anderson, C.M. (2011) Bering Sea/Aleutian Island Crab Economic Data Report. Center for Independent Experts Review Meeting, August 23-25, 2011. Panel Chair's Summary Report, November 2011.			

¹⁰⁰ <https://alaskafisheries.noaa.gov/fisheries-data-reports>

	<p>https://www.afsc.noaa.gov/refm/Socioeconomics/PDFs/CIE%20review%20reports/2011_11%20Anderson%20BSAI%20economic%20data%20collection%20meeting%20report.pdf</p> <p>Leon, J. M., J. Shaishnikoff, E. Nichols, and M. Westphal. (2017) Annual management report for shellfish fisheries of the Bering Sea–Aleutian Islands Management Area, 2015/16. Alaska Department of Fish and Game, Fishery Management Report No. 17-10, Anchorage. http://www.adfg.alaska.gov/index.cfm?adfg=fishingCommercial.main</p> <p>Garber-Yonts, B., and J. Lee., (2016) 2015 Stock Assessment and Fishery Evaluation Report for King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions: Economic Status of the BSAI Crab Fisheries, 2015. https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CrabEconSAFE2015.pdf</p>	
<p>Non-Conformance Number (if relevant)</p>	<p>NA</p>	

Supporting Clause 3.2.3

The interests of fishers, including those engaged in subsistence, small-scale and artisanal fisheries shall be taken into account.

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: The interests of all fishers are taken into account, including those engaged in subsistence, small-scale and artisanal fisheries.				
Evidence: The interests of all fishermen are taken into account through the participatory processes of the NPFMC, NMFS and BOFC as previously described. The BSAI crab FMP explicitly considers the interests of small scale subsistence harvesters under the plan’s economic and social objective (NPFMC 2011). However, as BSAI crab fisheries are industrialized fisheries that tend to occur far offshore, there is little to no subsistence take and small or artisanal vessels are seldom fished. Rather, the interests of Alaska Natives in the region are taken into account by the Community Development Quota (CDQ) program, or in the case of the western Aleutian Islands, the Adak Community Allocation (ACA) 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. The ACA program allocates shares of western Aleutian Islands golden king crab resources (west of 174° W long.) to the Adak Community Development Corporation (see description of ACA under clause 2.1). As the BSAI crab fisheries operate 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 crab rationalization, and met qualifying criteria, received some quota share at the time of program implementation.				
References:	NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p. http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf			
Non-Conformance Number (if relevant)				NA

Supporting Clause 3.2.4

Biodiversity of aquatic habitats and ecosystems shall be conserved and endangered species shall be protected. Where relevant, there shall be pertinent objectives, and as necessary, management measures.

FAO CCRF (1995) 7.2.2

FAO ECO (2009) 28.2

FAO ECO (2011) 35.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

There are explicit objectives and management measures to ensure that biodiversity of aquatic habitats and ecosystems is conserved and endangered species are protected.

Evidence:

The Magnuson-Stevens Act (MSA) provides the overarching legislative framework to ensure that the benthic biodiversity of aquatic habitats shall be conserved. Similarly, the Endangered Species Act (ESA) provides the overarching legislative framework to ensure that endangered species are protected (also see references cited under evidence for clause 12.5.1).

Conservation of the biodiversity of aquatic habitats and ecosystems is an integral part of NPFMC’s management process. At the habitat level, NPFMC sets out sets out seven management objectives in the BSAI king and Tanner crab fishery management plan (crab FMP) - one of which is an explicit habitat objective (NPFMC 2011). See clause 3.5 for further discussion of objectives for protecting aquatic habitats.

At the ecosystem level, NPFMC has adopted an Ecosystem-Based Fishery Management (EBFM) approach¹⁰¹ that recognizes the importance of conserving biodiversity. The first of four stated goals in the Council’s EBFM approach seeks to “Maintain biodiversity consistent with natural evolutionary and ecological processes, including dynamic change and variability” (Zador 2015). See clause 3.6 for further discussion of objectives for protecting aquatic ecosystems.

Should concerns arise about BSAI crab fisheries impacting on the biodiversity of aquatic habitats and ecosystems, NPFMC will summarise the issue(s) in the Ecosystems Considerations chapter of the Council’s annual SAFE report (Ecosystem SAFE; Chilton et al. 2011). Additionally, the status of habitats and ecosystems within the broader framework of Alaska’s ecosystems¹⁰² is reviewed annually (Zador et al. 2015).

The Council and NMFS have a long history of enacting management measures to conserve the biodiversity of aquatic habitats and ecosystems. Such conservation measures include, for example: broad time/area closures; bottom trawl restrictions; gear modifications (biodegradable panels, salmon/halibut excluder devices, seabird deterrents, elevated trawl sweeps); and bycatch limits on non-FMP species (salmon, halibut, herring, crab, forage fish)¹⁰³. See clause 12.9 for further discussion of measures to conserve aquatic habitats and clause 12.15 for further discussion of ecosystem outcome indicators.

¹⁰¹ <https://www.npfmc.org/ecosystem-vision-statement/>

¹⁰² <https://access.afsc.noaa.gov/reem/ecoweb/>

¹⁰³ <https://www.npfmc.org/wp-content/PDFdocuments/membership/EcosystemCommittee/EBFMstatus.pdf>

The Council and NMFS have a strong record of restricting fishing operations in order to protect endangered and threatened species of marine mammals and birds. In general, the BSAI crab fisheries under consideration here have little or no impact upon endangered and threatened species of marine mammals or birds. See clause 12.5.1 for further discussion of measures to protect endangered species.

References:	<p>ESA (1977) ENDANGERED SPECIES ACT OF 1973 As Amended through the 108th Congress. https://www.fws.gov/endangered/esa-library/pdf/ESAall.pdf</p> <p>Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV</p> <p>NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p. http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf</p> <p>Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011. http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf</p> <p>Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p. https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf</p>
--------------------	--

Non-Conformance Number (if relevant)	NA
---	-----------

Supporting Clause 3.2.5

There shall be management objectives seeking to avoid, minimize or mitigate impacts of the unit of certification on essential habitats for the stock under consideration and on habitats that are highly vulnerable to damage by the fishing gear of the unit of certification.

FAO ECO (2011) 41.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

There are management objectives seeking to avoid, minimize or mitigate impacts of the unit of certification on essential habitats for the stock under consideration and on habitats that are highly vulnerable to damage by the fishing gear of the unit of certification.

Evidence:

The NPFMC has established explicit management objectives seeking to avoid, minimize or mitigate impacts of BSAI crab fisheries (and other fisheries as well) on essential habitats. For example, a habitat objective is stated clearly in Section 7.2.4 of the BSAI crab FMP (NPFMC 2011):

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.

The Magnuson-Stevens Act (MSA) mandates that the Council ensure that any impacts to EFH are not more than minimal and not more than temporary in nature. The MSA defines EFH as; “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity”. NMFS and the NPFMC must describe and identify EFH in fishery management plans (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. The Council may also engage in EFH consultations depending on the nature of the activity¹⁰⁴.

The EFH Environmental Impact Statement (EFH EIS) completed in 2005 (NMFS 2005) and the Final EIS for BSAI crab fisheries (NMFS 2004) addressed many of the concerns surrounding impacts to EFH. EFH regulations (50 CFR 610.815(a)(2)(1) state that each Fishery Management Plan must contain an evaluation of the potential adverse effects of all regulated fishing activities on EFH. As part of this process, a fishery effects model was developed. The Long-term Effect Index (LEI) created an estimate of the proportional reduction in a habitat feature, relative to an unfished state, if a fishery were continued at current intensity and distribution to equilibrium (effects neither increase nor decrease if continued longer). For example, the LEI model found that none of the fishing activity in the Aleutian Islands is adversely affecting EFH in a manner that is more than minimal and not temporary in nature (NMFS 2005).

Habitat Areas of Particular Concern (HAPCs) are specific sites within EFH that are of particular ecological importance to the long-term sustainability of managed species, are of a rare type, or are especially susceptible

¹⁰⁴https://www.npfmc.org/wp-content/PDFdocuments/conservation_issues/EFH/EFHconsultationmotion412.pdf

to degradation or development. HAPCs are meant to provide for greater focus of conservation and management efforts and may require additional protection from adverse effects. In order to protect HAPCs, certain habitat protection areas and habitat conservation zones have been designated. A habitat protection area is an area of special, rare habitat features where fishing activities that may adversely affect the habitat are restricted. A habitat conservation zone is a subset of a habitat conservation area which additional restrictions are imposed on fishing beyond those established for the conservation area, in order to protect specific habitat features. Habitat protection areas and habitat conservation zones currently in place in Alaskan waters can be seen on the NPFMC website¹⁰⁵.

The Council has a history of taking management action to avoid, minimize or mitigate impacts to HAPCs and other vulnerable habitats. For example, as part of a suite of precautionary measures enacted in 2006, the Council implemented the Aleutians Islands Habitat Conservation Area in 2006, which froze the footprint of the bottom trawl fishery and closed approximately 60% of the fishable depths in the AI to bottom trawling. Several coral garden sites, Bowers Ridge, and seamounts were also protected from various gear types (see Aleutian Islands FEP; NPFMC 2007).

References:	<p>Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV</p> <p>NPFMC (2007) Aleutian Islands Fishery Ecosystem Plan. Prepared by: K. Aydin, S. Barbeaux, F. Bowers, V. Byrd, D. Evans, S. Gaichas, C. Ladd, S. Lowe, J. Olson, J. Sepez, P. Spencer, F. Wiese. For North Pacific Fishery Management Council. December 2007. 198 p. https://www.npfmc.org/aleutian-islands-fishery-ecosystem-plan/</p> <p>NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p. http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf</p> <p>NMFS (2004) Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p. https://alaskafisheries.noaa.gov/sites/default/files/analyses/crabeis0804-chapters.pdf</p> <p>NMFS (2005) Final EIS for Essential Fish Habitat Identification and Conservation in Alaska - April 2005. https://alaskafisheries.noaa.gov/habitat/efh-eis2005</p>
--------------------	---

Non-Conformance Number (if relevant)	NA
---	-----------

¹⁰⁵ <http://www.npfmc.org/habitat-protections/>

Supporting Clause 3.2.6

There shall be management objectives that seek to minimize adverse impacts of the unit of certification, including any enhancement activities, on the structure, processes and function of aquatic ecosystems that are likely to be irreversible or very slowly reversible.

FAO ECO (2011) 36.9

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Council EBFM objectives seek to minimize adverse impacts of the unit of certification on the structure, processes and function of aquatic ecosystems that are likely to be irreversible or very slowly reversible.

Evidence:

The NPFMC has utilized an informal Ecosystem-Based Fishery Management (EBFM) approach for many years¹⁰⁶. The Council formalized their EBFM approach when they adopted an ecosystem “vision and strategy”¹⁰⁷ as Council policy in February 2014:

Value Statement

The Gulf of Alaska, Bering Sea, and Aleutian Islands are some of the most biologically productive and unique marine ecosystems in the world, supporting globally significant populations of marine mammals, seabirds, fish, and shellfish. This region produces over half the nation’s seafood and supports robust fishing communities, recreational fisheries, and a subsistence way of life. The Arctic ecosystem is a dynamic environment that is experiencing an unprecedented rate of loss of sea ice and other effects of climate change, resulting in elevated levels of risk and uncertainty. The North Pacific Fishery Management Council has an important stewardship responsibility for these resources, their productivity, and their sustainability for future generations.

Vision Statement

The Council envisions sustainable fisheries that provide benefits for harvesters, processors, recreational and subsistence users, and fishing communities, which (1) are maintained by healthy, productive, biodiverse, resilient marine ecosystems that support a range of services; (2) support robust populations of marine species at all trophic levels, including marine mammals and seabirds; and (3) are managed using a precautionary, transparent, and inclusive process that allows for analyses of tradeoffs, accounts for changing conditions, and mitigates threats.

Implementation Strategy

The Council intends that fishery management explicitly take into account environmental variability and uncertainty, changes and trends in climate and oceanographic conditions, fluctuations in productivity for managed species and associated ecosystem components, such as habitats and non-managed species, and relationships between marine species. Implementation will be responsive to changes in the ecosystem and our understanding of

¹⁰⁶ <https://www.npfmc.org/wp-content/PDFdocuments/membership/EcosystemCommittee/EBFMstatus.pdf>

¹⁰⁷ <https://www.npfmc.org/ecosystem-vision-statement/>

those dynamics, incorporate the best available science (including local and traditional knowledge), and engage scientists, managers, and the public.

The vision statement shall be given effect through all of the Council’s work, including long-term planning initiatives, fishery management actions, and science planning to support ecosystem-based fishery management.

NPFMC processes ensure that there is monitoring of potential impacts of BSAI crab fisheries (as well as other fisheries) on aquatic ecosystems, as summarized in the Ecosystems Considerations chapter of the Council’s annual SAFE report (Ecosystem SAFE; Chilton et al. 2011). A Fishery Ecosystem Plan has been prepared for the Aleutian Islands (NPFMC 2007) and a draft FEP is in preparation for the Bering Sea (NPFMC 2015). Additionally, the status of habitats and ecosystems are monitored within the broader framework of Alaska’s ecosystems¹⁰⁸ and results are reviewed annually (Zador et al. 2015). Existing programs provide adequate monitoring for potential adverse impacts of fisheries on the structure, processes and function of aquatic ecosystems. These systems give confidence that if irreversible or very slowly irreversible impacts were present at the ecosystem level, they would be detected and addressed through timely management response.

Note: BSAI king and Tanner crab fisheries are not enhanced fisheries (see clause 13.1). Therefore enhancement considerations are not applicable under clause 3.2.6.

References:	<p>Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011. http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf</p> <p>Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p. https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf</p> <p>NPFMC (2007) Aleutian Islands Fishery Ecosystem Plan. Prepared by: K. Aydin, S. Barbeaux, F. Bowers, V. Byrd, D. Evans, S. Gaichas, C. Ladd, S. Lowe, J. Olson, J. Sepez, P. Spencer, F. Wiese. For North Pacific Fishery Management Council. December 2007. 198 p. https://www.npfmc.org/aleutian-islands-fishery-ecosystem-plan/</p> <p>NPFMC (2015) Development of a Bering Sea Fishery Ecosystem Plan. Discussion Paper – November 2015. C-7 BS FEP, December 2015. 31 p. https://www.npfmc.org/bsfep/</p>
--------------------	--

Non-Conformance Number (if relevant)	NA
---	-----------

¹⁰⁸ <https://access.afsc.noaa.gov/reem/ecoweb/>

Section B: Science and Stock Assessment Activities

7.4 Fundamental Clause 4

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

FAO CCRF (1995) 7.1.9/7.4.4/7.4.5/7.4.6/8.4.3/12.4

FAO ECO (2009) 29.1-29.3

FAO Eco (2011) 36.1, 36.3-36.5, 37.4

No. Supporting clauses/sub-clauses	13
Supporting clauses applicable	7
Supporting clauses not applicable	6
Non Conformances	0

Supporting Clause 4.1

All fishery removals and mortality of the target stock(s) shall be considered by management. Specifically, reliable and accurate data required for assessing the status of fishery/ies and ecosystems - including data on retained catch, bycatch, discards and waste shall be collected. Data can include relevant traditional, fisher or community knowledge, provided their validity can objectively be verified. These data shall be 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.

FAO CCRF (1995) 7.3.1, 7.4.6, 7.4.7, 12.4

FAO Eco (2009) 29.1-29.3

FAO Eco (2011) 36.1, 36.3, 36.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

All fishery removals and mortality of the target stocks is considered by management. ADFG undertakes a comprehensive, annual monitoring program to collect data on retained catch, bycatch/discards in all BSAI directed crab fisheries as well as crab bycatch/discards in all groundfish fisheries.

Evidence:

ADFG undertakes a comprehensive, annual monitoring program to collect data for all Bering Sea and Aleutian Islands (BSAI) crab fisheries¹⁰⁹.

Retained catch and estimated bycatch from the directed fishery as well as the Community Development Quota (CDQ) fishery and the ADFG cost-recovery harvest and fishing effort (pot lifts) are recorded on the ADFG eLandings system (previously reported on paper 'fish tickets'). In the directed fisheries, on-board observers record total catch, bycatch, discards, effort, size frequencies and shell condition, and sampling of

¹⁰⁹<http://www.adfg.alaska.gov/FedAidPDFs/FDS14-49.pdf>

retained catches is carried out by shore-based observers. The data are used in stock assessment and in-season projection of fishery performance. They also provide an independent estimate of fishery CPUE for comparison with estimates based on eLandings, daily fishing logs and interviews with vessel captains. Data on crab bycatch in the trawl and fixed gear groundfish fisheries are obtained by the NMFS observer program. Estimates of discarded catch include different assumed handling mortality rates for pot and trawl bycatches. Collectively, these monitoring and observer programs provide the basis for reliable estimation of total removals from all crab stocks annually for assessment and management purposes.

References:

Non-Conformance Number (if relevant)

NA

Supporting Clause 4.1.1

Timely, complete 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 (e.g. adoption of scientific advice) shall be promoted. Results of analysis shall be distributed accordingly as a contribution to fisheries conservation, management and development.

FAO CCRF (1995) 7.4.4, 12.3, 12.13

FAO Eco (2009) 29.1, 29.3

FAO Eco (2011) 36.3, 36.5

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Complete and reliable statistics are compiled on catch and fishing effort and subjected to rigorous statistical analysis in each annual stock assessment. Research results have been used as a basis for the setting of management objectives, reference points and performance criteria, as well as for annual adjustment of allowable catch levels.

Evidence:

Landings data for all BSAI crab fisheries, in the form of retained catch numbers and biomass, and fishing effort, in terms of pot lifts, are recorded on the ADFG eLandings system and are available to NMFS, ADFG, NPFMC and other agencies for their scientific, management and enforcement purposes. The data are verified in real time and can be used to close or modify a fishery in-season when necessary.

Lengthy time series of annual catch and effort data are available for all BSAI crab fisheries. The datasets are updated and utilized, along with other fishery and fishery-independent data, in the annual assessment of each stock/fishery conducted by a team of scientists familiar with and aware of potential inconsistencies in the data or their use in population estimation methods. Stock assessment reports note any deficiencies in data and identify any gaps which need to be filled by new research. Each stock assessment includes rigorous peer review by the Crab Plan Team and by the Scientific and Statistical Committee (SSC) of NPFMC¹¹⁰. In addition, periodic reviews are conducted by specially organised workshops with independent scientists and by the Center for Independent Experts (CIE)¹¹¹.

All details of the various datasets used in the assessment of each stock along with results and recommendations from the process are documented in the annual SAFE report. It informs the management decision-making process for the next fishing season. These annual assessments have provided the basis for the setting of management objectives, reference points and performance criteria and ensure adequate linkages between applied research and fisheries management.

¹¹⁰ http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf

¹¹¹ <http://www.ciereviews.org>

References:	
Non-Conformance Number (if relevant)	NA

Supporting Clause 4.1.2

In the absence of specific information on the “stock under consideration”, generic evidence based on similar stocks can be used for fisheries with low risk to that “stock under consideration”. However, the greater the risk of overfishing, the more specific evidence is necessary to ascertain the sustainability of intensive fisheries.

FAO Eco (2009) 30.4
FAO ECO (2011) 37.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence:				
Specific information is available for all BSAI crab stocks. This supporting clause is not applicable.				
References:				
Non-Conformance Number (if relevant)				NA

Supporting 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 (1995) 8.4.3
 FAO Eco (2009) 29.2bis

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

A scheme of at-sea and dock-side observers is established to collect accurate data for research and support compliance with applicable fishery management measures.

Evidence:

ADFG undertakes a comprehensive, annual monitoring program to collect data for all Bering Sea and Aleutian Islands (BSAI) crab fisheries. ADFG may deploy observers on any vessel participating in these fisheries. Since 1988, varying levels of observer coverage have been required. In accordance with the provisions of 5 AAC 39.645, during the 2013/14 season observers were deployed on all floating-processor and catcher-processor vessels, and on randomly selected catcher vessels participating in the Bristol Bay red king crab, Bering Sea snow crab and Bering Sea Tanner crab fisheries. In the Aleutian Islands golden king crab (AIGKC) fisheries, all catcher vessels were required to carry an observer during harvest of at least 50% of their total harvested weight in each 3-month trimester of the 9-month season. Dockside samplers were responsible for sampling retained catch delivered by vessels with no onboard observer. On-board observers are an important component of data collection and fishery management. They monitor fishing position, depth and soak time of the gear, as well as sample total and retained catch for size/sex composition and shell condition. They also document total catch, bycatch and effort¹¹²

During the 2013/14 season, sampling levels (number and % of pot lifts) for the fisheries under consideration were:

Bristol Bay Red King Crab	- 657 (1.4%)
Bering Sea Snow Crab	- 2,664 (1.2%)
Bering Sea Tanner Crab (E of 166° W)	- 267 (1.6%)
Bering Sea Tanner Crab (W of 166° W)	- 309 (1.3%)
Aleutian Islands Golden King Crab (E of 174° W)	- 499 (2.4%)
Aleutian Islands Golden King Crab (W of 174° W)	- 1,223 (3.0%)
St. Matthew Island Blue King Crab	- 2,841 (7.7%) (2012/13 season, fishery closed in 2013/14.

Similar information on crab bycatch in trawl and fixed gear groundfish fisheries is obtained by the NMFS observer program¹¹³.

¹¹² <http://www.adfg.alaska.gov/FedAidPDFs/FDS14-49.pdf>

¹¹³ http://www.afsc.noaa.gov/FMA/Manual_pages/MANUAL_pdfs/manual2015.pdf

References:	Crab Observer Training and Deployment Manual. September 2014. ADF&G Shellfish Observer Program. Dutch Harbor, unpublished. Shellfish Dockside Sampling Manual. September 2014. ADF&G Dockside Sampling Program. Dutch Harbor, unpublished.		
Non-Conformance Number (if relevant)	NA		

Supporting Clause 4.3

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 (1995) 7.4.6/7.4.7

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:
 Policies and procedures are prescribed at the federal and state levels to protect the confidentiality of data submitted to and collected by employees and contractors. Only authorized users have access to confidential data to perform an official duty.

NOAA administrative order 216-100 prescribes policies and procedures for protecting the confidentiality of data submitted to and collected by NOAA/NMFS¹¹⁴. Confidential data are those identifiable with a person. Before release to the public, data must be aggregated to protect individual identities. For fisheries data, this requires at least 3 entities contributing to any level of aggregated data. 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, 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 contractors collecting data with Federal authority.

Alaska Statute 16.05.815 also prohibits ADFG from releasing certain information that it receives from fishermen, fish buyers, and processors to ensure that detailed information on individual business activities will be held confidential and to provide an incentive for the public to furnish the department with good data. Records and reports requiring confidentiality include catch reports (fish tickets) and fishermen’s log books,

¹¹⁴http://www.st.nmfs.noaa.gov/st1/recreational/documents/Intercept_Appendices/Appendix%20M%20031408%20NOAA%20administrative%20order%20216-100.pdf

annual reports filed with the department by buyers, processors, and exporters, and data collected by onboard observers and port samplers¹¹⁵.

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 unauthorized disclosure.

Related information can be found in the evidence provided for supporting clauses 4.1, 4.1.1, 4.1.2, and 4.2.

References:

Non-Conformance Number (if relevant)

NA

¹¹⁵ <http://www.adfg.alaska.gov/FedAidPDFs/SP12-14.pdf>

Supporting Clause 4.4

States shall stimulate the research required to support national policies related to fish as food.

FAO CCRF (1995) 12.7

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: There is strong promotion of research into all aspects of seafood use by federal and state agencies and industry organizations that support national policies related to fish as food.				
Evidence: 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 ¹¹⁶ . 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 ¹¹⁷ as a component of the University of Alaska. The Fishery Industrial 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. The University Seafood Technical Center in Kodiak has had numerous development programs to utilize fish and shellfish. Also, the Alaska Fisheries Development Foundation (AFDF) ¹¹⁸ has a long history related to promoting and developing fish and fish species as food.				
References:				
Non-Conformance Number (if relevant)				NA

¹¹⁶<http://www.alaskaseafood.org>

¹¹⁷<http://www.sfos.uaf/fitc/>

¹¹⁸<http://afdf.org>

Supporting Clause 4.5

States shall ensure that a sufficient knowledge of the economic, social, marketing and institutional aspects of fisheries is collected through data gathering, analysis and research and that comparable data are generated for ongoing monitoring, analysis and policy formulation.

FAO CCRF (1995) 7.4.5, 12.9

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Extensive knowledge of the economic, social, marketing and institutional aspects of the BSAI crab fisheries has been acquired through dedicated research. Annual collection and analysis of relevant data provide the basis for ongoing monitoring, analysis and policy formulation related to these aspects of the fisheries.

Evidence:

The MSA’s National Standard 8 mandates that conservation and management measures shall, consistent with the conservation requirements of the 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 economic and social objective of the BSAI crab FMP¹¹⁹ intends to ensure that benefits derived from these fisheries are maximized over time through selection of management measures that examine: 1) The value of crab harvested 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 considers 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 these economic and social benefits.

Social and economic impacts of the BSAI crab fisheries on coastal communities are extremely high. Subsistence harvests must ensure that 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.

The Economic and Social Sciences Research Program within NMFS’s REFM¹²⁰ provides economic and socio-cultural information that assists NMFS in meeting its stewardship programs¹²¹. 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 implemented the Alaska Community

¹¹⁹<http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html>

¹²⁰<http://www.afsc.noaa.gov/REFM/Socioeconomics/Default.php>

¹²¹http://www.afsc.noaa.gov/REFM/Socioeconomics/SAFE/crab_safe/Crab_Economic_SAFE_2014.pdf

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. Also see supporting clause 3.2.2 for further discussion of the economic conditions under which the fishing industry operates.

The Community Development Quota (CDQ) program 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 oversight¹²². Allocations of crabs to the CDQ program are 10% of the guideline harvest level (GHL) for each species.

The Alaska Board of Fisheries and the NPFMC are open public processes¹²³. 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.

NPFM 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.

The Alaska Fisheries Information Network (AKFIN)¹²⁴ 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 a database of both state and federal historic, commercial fisheries data relevant to the needs of fisheries analysts and economists.

References:

Non-Conformance Number (if relevant)

NA

¹²²<http://www.alaskafisheries.noaa.gov/fisheries/cdq>

¹²³<http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main>

¹²⁴<http://www.akfin.org/about-akfin>

Supporting 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 (1995) 12.12

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence:				
<p>Traditional fisheries knowledge is obtained through ongoing opportunity for public/community input to the fisheries management process to ensure its application to sustainable fisheries conservation, management and development.</p>				
Evidence:				
<p>The BSAI crab fisheries are fully developed industrialized fisheries using modern technology in the capture process. They are prosecuted solely by the domestic US fleet.</p> <p>The Community Development Quota (CDQ)¹²⁵ program allocates a percentage of all BSAI crab quotas to eligible western Alaskan communities in order to provide an opportunity for those communities to participate, 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 are 10% of the guideline harvest level (GHL) for each species. Also see description of the Adak Community Allocation (ACA) under supporting clause 2.1.</p> <p>The Alaska Board of Fisheries and the NPFMC are open public processes¹²⁶. 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.</p> <p>NPFMC 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 into current fishery management regimes where appropriate. They also actively work to increase Alaska Native participation and consultation in fishery management through community workshops.</p>				
References:				
Non-Conformance Number (if relevant)				NA

¹²⁵ <http://www.alaskafisheries.noaa.gov/fisheries/cdq>

¹²⁶ <http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main>

Supporting 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 (1995) 12.14

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence:				
All the scientific stock assessment research is conducted within the Alaska EEZ. This supporting clause is not applicable.				
References:				
Non-Conformance Number (if relevant)				NA

Supporting 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 such research results with other regions.

FAO CCRF (1995) 12.15, 12.16

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence:				
All the scientific stock assessment research is conducted within the Alaska EEZ. This supporting clause is not applicable.				
References:				
Non-Conformance Number (if relevant)				NA

Supporting 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 and provision of research facilities, in order for them to participate effectively in the conservation, management and sustainable use of living aquatic resources.

FAO CCRF (1995) 12.18

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
Summary Evidence:			
Evidence:			
Developing countries do not participate in the BSAI crab fisheries. This supporting clause is not applicable.			
References:			
Non-Conformance Number (if relevant)			NA

Supporting 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 (1995) 12.19

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence:				
The BSAI crab fisheries are fully developed industrialised fisheries. This supporting clause is not applicable.				
References:				
Non-Conformance Number (if relevant)				NA

Supporting 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 (1995) 12.20

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence:				
Developing countries do not participate in the BSAI crab fisheries. This supporting clause is not applicable.				
References:				
Non-Conformance Number (if relevant)				NA

7.5 Fundamental Clause 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 (1995) 7.2.1/12.2/12.3/12.5/12.6/12.7/12.17

FAO Eco (2009) 29-29.3, 31

FAO Eco (2011) 42

No. Supporting clauses/sub-clauses	7
Supporting clauses applicable	7
Supporting clauses not applicable	0
Non Conformances	0

Supporting Clause 5.1

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

FAO CCRF (1995) 12.2/12.6

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: A well organized institutional framework is in place that conducts the research required for fishery management purposes.				
Evidence: The BSAI crab fisheries are jointly managed by the NPFMC and the BOF under the Fishery Management Plan (FMP) ¹²⁷ . A requirement of the FMP is the production of an annual stock assessment and fishery evaluation (SAFE) report. For each stock/fishery, the SAFE report provides a detailed description of the data and methodology used in the stock assessment, any changes in approaches, 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. In addition to the stock assessment, the SAFE report contains a chapter which assesses 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 these fisheries ^{128 129} .				

¹²⁷<http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html>

¹²⁸http://www.afsc.noaa.gov/REFM/Socioeconomics/SAFE/crab_safe/Crab_Economic_SAFE_2014.pdf

¹²⁹<http://www.afsc.noaa.gov/REFM/Socioeconomics/Default.php>

Extensive peer review is an integral part of the stock assessment process detailed in the SAFE reports, ensuring a robust scientific analysis of fishery status.

The annual assessments of individual stocks are conducted by ADFG and NMFS scientists. The assessments are then peer reviewed by the full CPT. Members of the CPT are employed by several agencies and are recognized experts in stock assessment and crab fisheries biology. The CPT provides comments and suggestions for improved methodology to the assessment authors who formally respond to all comments or suggestions. The CPT then makes recommendations on overfishing level (OFL) determinations, acceptable biological catch (ABC), stock status specifications and any other related issues to the Scientific and Statistics Committee (SSC) of the NPFMC. The SSC also provides comments and suggestions on the assessment which will be addressed in future SAFE reports. The SSC makes the final recommendation on OFL and ABC to the NPFMC. ADFG sets total allowable catch (TAC) levels in line with the Council’s ABC recommendations.

In addition to the peer review process that is integral to each annual assessment, BSAI crab stock assessment methodologies are also reviewed as considered necessary by way of specially convened NPFMC workshops that provide a more comprehensive review of special stock assessment methodology issues than would occur during the annual assessment cycle. The third in a series of such workshops was held in 2013 to review assessment models¹³⁰. Reference to any such review germane to current assessment activity for a particular stock is included in the annual SAFE report¹³⁰.

References:

Non-Conformance Number (if relevant)

NA

¹³⁰ http://www.afsc.noaa.gov/REFM/stocks/Plan_Team/crab/2013February2013workshop_Final.pdf

Supporting Clause 5.1.1

With the use of less elaborate methods for stock assessment frequently used for small scale or low value capture fisheries resulting in greater uncertainty about the state of the stock under consideration, more precautionary approaches to managing fisheries on such resources shall be required, including where appropriate, lower level of utilization of resources. A record of good management performance may be considered as supporting evidence of the adequacy and the management system.

FAO Eco (2011) 42

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Stock status criteria used in the assessment of BSAI crab stocks ensure more precautionary approaches to managing fisheries when uncertainty is high.				
Evidence: None of the BSAI crab fisheries can be considered small scale or low value. Nevertheless, the assessment methodology and degree of reliability varies between stocks. Status determination criteria for these stocks are 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. Tier 5 (highest uncertainty) stocks have no reliable estimates of biomass and only historical catch data are available. For these, the OFL is set equal to the average catch from a time period determined to be representative of the production potential of the stock. The ABC control rule sets the maximum ABC at less than or equal to 90 percent of the OFL and the ACL equals the ABC. For Tier 5 stocks where only retained catch information is available, the OFL and ACL will be set for the retained catch portion only, with the corresponding limits applying to the retained catch only. For Tier 5 stocks where information on bycatch mortality is available, the OFL and ACL calculations could include discard losses, at which point the OFL and ACL would be applied to the retained catch plus the discard losses from directed and non-directed fisheries. The State of Alaska sets TACs within the ABC limit based on threshold values for various stock component indicators that are more conservative than the ABC. Additional related information is provided in the evidence for supporting clauses 6.1 and 6.3.				
References:	Review of TACs Bering Sea Crab: 2016/17 Season. ADF&G Presentation to BSAI Crab Industry, October 12, 2016.			
Non-Conformance Number (if relevant)				NA

Supporting Clause 5.1.2

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. 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. 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 (1995) 12.1/7.4.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence:				
Well established institutions with qualified staff are in place that conduct research into all aspects of fisheries. Results are made available as needed to ensure that the best scientific evidence is used for fisheries conservation, management and development.				
Evidence:				
<p>In federal waters, the BSAI crab fisheries are jointly managed by the North Pacific Fishery Management Council (NPFMC), the National Marine Fisheries Service Alaska Region, BOF and ADFG under the BSAI Fishery Management Plan (FMP). Day-to-day management decisions and enforcement are devolved to the State of Alaska through the ADFG. 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 consistent¹³¹.</p> <p>The research branch of the NMFS Alaska Region is the Alaska Fisheries Science Center (AFSC)¹³². 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. NMFS shellfish assessment programs are coordinated between the AFSC's Kodiak Laboratory and the NOAA/NMFS AFSC in Seattle, Washington.</p> <p>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) Division¹³³ 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 shellfish 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 analyzed by Division stock assessment scientists and supplied to fishery management agencies and to the commercial fishing industry.</p>				

¹³¹<http://www.nmfs.noaa.gov/sfa/magact/mag3.html#s301>

¹³²<http://www.afsc.noaa.gov/>

¹³³<http://www.afsc.noaa.gov/race/default.php>

Resource Ecology and Fisheries Management (REFM) Division¹³⁴ conducts research and data collection to support an ecosystem approach to management of fish and crab resources. 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 socio-cultural information on Alaskan communities and traditional ecological knowledge.

The Fisheries Monitoring and Analysis Division (FMA)¹³⁵ 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) Program¹³⁶ 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.

NMFS conducts an annual fishery-independent trawl survey of the eastern Bering Sea to determine the distribution and abundance of crab and groundfish resources. It provides fishery-independent indices of relative stock abundance/biomass, size/sex composition and shell condition for four of the five fisheries under consideration. The AI Golden King crab stock is not covered in this survey. ADFG conducted pot surveys in a limited area of the EAG (east of 174° W longitude) AI Golden King crab distribution in 1997, 2000, 2003 and 2006. This survey was too limited in geographic scope and too infrequent to provide a reliable index of AI GKC abundance. Recently, attempts have been made to initiate a consistent time series of pot surveys with increased spatial coverage. The EAG was survey in 2015 and 2016 but the survey planned for the WAG in 2016 did not go ahead. As yet, a reliable, fishery-independent survey index has not been available for the AI Golden King crab assessment.

Details of monitoring programs in place to collect crab fishery catch and effort data as well as at-sea and dockside observer programs to collect catch composition, bycatch and discard data from crab and groundfish fisheries are included in the evidence for supporting clauses 4.1, 4.1.1 and 4.2.

References:	
Non-Conformance Number (if relevant)	NA

¹³⁴<http://www.afsc.noaa.gov/refm/default.php>
¹³⁵<http://www.afsc.noaa.gov/fma/default.htm>
¹³⁶<http://www.afsc.noaa.gov/HEPR/default.php>

Supporting Clause 5.2

There shall be established research capacity necessary to assess and monitor 1) the effects of climate or environment change on fish stocks and aquatic ecosystems, 2) the state of the stock under State jurisdiction, and for 3) the impacts of ecosystem changes resulting from fishing pressure, pollution or habitat alteration.

FAO CCRF (1995) 12.5

FAO Eco (2009) 31

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>

Summary Evidence:

There is well established research capacity to assess and monitor the effects of climate or environment change on BSAI crab stocks and their ecosystem, the state of these stocks and the impacts of ecosystem changes resulting from human activity.

Evidence:

Resource Ecology and Fisheries Management (REFM) Division¹³⁷ 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 environmental changes. Crab stock assessments are conducted annually and used by the NPFMC to set catch quotas. Annual economic and ecosystem assessments are also conducted. These provide a basis for scientific evaluation of how fish stocks, ecosystem relationships and user groups might be affected by fishery management actions and climate.

Within the AFSC there is also an interdisciplinary program, The Habitat and Ecological Processes Research (HEPR) Program¹³⁸ 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.

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 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. The indicators 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 modeling to clearly communicate the current status and possible future directions of

¹³⁷ <http://www.afsc.noaa.gov/refm/default.php>

¹³⁸ <http://www.afsc.noaa.gov/HEPR/default.php>

ecosystems¹³⁹.

The annual BSAI Crab SAFE report summarizes the status of crab stocks. It also includes a section on ecosystem considerations which provides information on ecosystem indicators which may have an impact on 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.

In addition to the above general ecosystem considerations, monitoring of and research related to effects of pollution of the marine environment throughout Alaska is an ongoing priority for AFSC and various State agencies. Details of programs and specific studies can be found at¹⁴⁰ and links provided therein.

References:

Non-Conformance Number (if relevant)

NA

¹³⁹ <https://access.afsc.noaa.gov/reem/ecoweb>

¹⁴⁰ http://www.afsc.noaa.gov/ABL/Habitat/ablhab_contaminants.htm

Supporting 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 (1995) 12.7

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: There is extensive international collaboration/cooperation that encourages research to ensure optimum utilization of BSAI crab resources.				
Evidence: Research output on BSAI crab stocks is regularly published in the scientific literature and presented/discussed at relevant international conferences and symposia ¹⁴¹ . Scientists participate in meetings of different organizations involving attendees from various countries, including, for example, the North Pacific Marine Science Organization (PICES) ¹⁴² , which has members from the US, Russia, Japan and Canada, to exchange and discuss the latest results and advances stock assessment science and management of fishery resources.				
References:				
Non-Conformance Number (if relevant)				NA

¹⁴¹<http://www.pmel.noaa.gov/foci/publications>

¹⁴²<http://www.pices.int>

Supporting 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 (1995) 12.7, 12.17

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Although BSAI crabs are not trans-boundary stocks, collaborative research programs are in place to improve understanding of their biology, environment and status.				
Evidence: Although the BSAI crab are not trans-boundary stocks, the United States and Russia share many important stocks of living marine resources in the North Pacific Ocean and Bering Sea, lending importance to coordination of efforts of the two countries to conserve and manage those resources. On May 31, 1988 the United States and Russia signed the <u>“Agreement Between the Government of the United States of America and the Government of the Union of Soviet Socialist Republics on Mutual Fisheries Relations”</u> , establishing the <u>U.S.-Russia Intergovernmental Consultative Committee</u> ¹⁴³ . The main objective of the Agreement is to maintain a fisheries relationship that benefits both countries. The United States and Russia cooperate on scientific research, consul on fisheries matters beyond their EEZs and beyond the EEZ of any third party to ensure proper conservation and management, and cooperate to address Illegal, Unreported, and Unregulated (IUU) fishing activities. On April 29, 2013, the United States and Russia signed a <u>Joint Statement on Enhanced Fisheries Cooperation</u> , which reaffirms the 1988 Agreement while focusing future cooperation on combating IUU fishing, collaborating on science and management of Arctic fisheries, and advancing conservation efforts in the Ross Sea region of Antarctica.				
References:				
Non-Conformance Number (if relevant)			NA	

¹⁴³ http://www.nmfs.noaa.gov/ia/agreements/bilateral_arrangements/russia/us-russia.html

Supporting Clause 5.5

Data generated by research shall be analysed and the results of such analyses published in a way that ensures confidentiality is respected, where appropriate.

FAO CCRF (1995) 12.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence:				
<p>Policies and procedures are in place to ensure the confidentiality of data submitted to and collected by employees and contractors. Only authorized users have access to confidential data in the performance of an official duty and their analysis and publication is conducted to ensure that confidentiality is respected.</p>				
Evidence:				
<p>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 stocks¹⁴⁴.</p> <p>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)¹⁴⁵. 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 be at least 3 entities contributing to any level of aggregated data. 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, 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 contractors 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 unauthorized disclosure.</p>				
References:				
<p>Non-Conformance Number (if relevant) NA</p>				

¹⁴⁴http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf

¹⁴⁵http://www.st.nmfs.noaa.gov/st1/recreational/documents/Intercept_Appendices/Appendix%20M%20031408%20NOAA%20administrative%20order%20216-100.pdf

Section C: The Precautionary Approach

7.6 Fundamental Clause 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 targets. Remedial actions shall be available and taken where reference point or other suitable proxies are approached or exceeded.

FAO CCRF (1995) 7.5.3, 7.6.1
 FAO Eco (2009) 29.2-29.2bis, 29.6, 30-30.2
 FAO Eco (2011) 36.2, 36.3, 37, 37.1, 37.2

No. Supporting clauses/sub-clauses	4
Supporting clauses applicable	4
Supporting clauses not applicable	0
Non Conformances	1

Supporting Clause 6.1

States shall establish safe target reference point(s) for management.

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Safe target reference points have been established for management of BSAI crab fisheries.				
Evidence: The FMP ¹⁴⁶ contains the following 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 EBS 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 FMP. Guideline harvest level (GHL) means the preseason estimated level of allowable fish harvest which will				

¹⁴⁶<http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html>

not jeopardize the sustained yield of the fish stocks. A GHL may be expressed as a range of allowable harvests for a species or species group of crab for each registration area, district, sub district, or section.

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.

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

BMSY stock size is the biomass that results from fishing at constant FMSY and is the minimum standard for a rebuilding target when a rebuilding plan is required.

Maximum fishing mortality threshold (MFMT) is defined by the FOFL control rule, and is expressed as the fishing mortality rate.

Minimum stock size threshold (MSST) is one half the BMSY 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. For crab stocks, biomass for determining overfished status is estimated on February 15 of the current year and compared to the MSST established by the NPFMC in October of the previous year.

Overfishing is defined as any amount of catch in excess of the overfishing level (OFL). The OFL is calculated by applying abundance estimates to the FOFL control rule which is annually estimated according to the tier system.

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 ABC levels are annually formulated. The 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.

For crab stocks, the OFL equals the maximum sustainable yield (MSY) and is derived through the annual assessment process, under the framework of the tier system. Overfishing is determined by comparing the OFL with the catch estimates for that crab fishing year. For the previous crab fishing year, NMFS will determine whether overfishing occurred by comparing the previous year's OFL with the catch from the previous crab fishing year. For the previous crab fishing year, NMFS will also determine whether the ACL was exceeded by comparing the ACL with the catch estimates for that crab fishing year. Catch includes all fishery removals, including retained catch and discard losses, for those stocks where non-target fishery removal data are available. Discard losses are determined by multiplying the appropriate handling mortality rate by observer estimates of bycatch discards. For stocks where only retained catch information is available, the OFL and ACL will be set for and compared to the retained catch.

The NMFS will determine whether a stock is in an overfished condition 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. 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 NPFMC to immediately end overfishing and rebuild affected stocks.

The MSA requires that FMPs include accountability measures to prevent ACLs from being exceeded and to correct overages of the ACL if they do occur. Accountability measures to prevent TACs and GHs from being exceeded have been used under this FMP for the management of the BSAI crab fisheries and will continue to be used to prevent ACLs from being exceeded. These include: individual fishing quotas and the measures to ensure that individual fishing quotas are not exceeded, measures to minimize crab bycatch in directed crab fisheries, and monitoring and catch accounting measures. Accountability measures in the harvest specification process include downward adjustments to the ACL and TAC in the fishing year after an ACL has been exceeded.

Annually, the NPFMC, SSC, and CPT will review (1) the stock assessment documents, (2) the OFLs and ABCs, and TACs or GHs, (3) NMFS's determination of whether overfishing occurred in the previous crab fishing year, (4) NMFS's determination of whether any stocks are overfished and (5) NMFS's determination of whether catch exceeded the ACL in the previous crab fishing year.

Optimum yield is defined in the FMP. Information pertaining to economic, social and ecological factors relevant to the determination of optimum yield is provided in the FMP. For each crab fishery, the optimum yield range is 0 to < OFL catch. For crab stocks, the OFL is the annualized MSY and is derived through the annual assessment process, under the framework of the tier system. Recognizing the relatively volatile reproductive potential of crab stocks, the cooperative management structure of the FMP, and the past practice of restricting or even prohibiting directed harvests of some stocks out of ecological considerations, this optimum yield range is intended to facilitate the achievement of the biological, economic and social objectives of the FMP under a variety of future biological and ecological conditions. It enables the SOA to determine the appropriate TAC levels below the OFL to prevent overfishing or address other biological concerns that may affect the reproductive potential of a stock but that are not reflected in the OFL itself. Under the FMP, the SOA establishes TACs at levels that maximize harvests, and associated economic and social benefits, when biological and ecological conditions warrant doing so.

Five-Tier System

The OFL and ABC for each stock are annually estimated for the upcoming crab fishing year using the five tier System. First, a stock is assigned to one of the five tiers based on the availability of information for that stock and model parameter choices are made. Tier assignments and model parameter choices are recommended through the CPT process to the SSC. The SSC recommends tier assignments, stock assessment and model structure, and parameter choices, including whether information is "reliable," for the assessment authors to use for calculating the proposed OFLs and ABCs based on the five-tier system.

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 F_{OFL} at or below F_{MSY} 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.

For Tiers 1 through 3, the coefficient α is set at a default value of 0.1, and β set at a default value of 0.25, with the understanding that the SSC may recommend different values for a specific stock or stock complex as merited by the best available scientific information.

In Tier 4, a default value of natural mortality rate (M) or an M proxy, and a scalar, γ , are used in the calculation of the FOFL.

In Tier 5, the OFL is specified in terms of an average catch value over an historical time period, unless the SSC recommends an alternative value based on the best available scientific information. The assessment author prepares the stock assessment and calculates the proposed OFLs by applying the FOFL and using the most recent abundance estimates. The assessment authors calculate the proposed ABCs by applying the ABC control rule to the proposed OFL.

Stock assessment documents shall: use risk-neutral assumptions; specify how the probability distribution of the OFL used in the ABC control rule is calculated for each stock; and specify the factors influencing scientific uncertainty that are accounted for in calculation of the probability distribution of the OFL.

The CPT annually reviews stock assessment documents, the most recent abundance estimates, the proposed OFLs and ABCs, and complies the SAFE. The CPT then makes recommendations to the SSC on the OFLs, ABCs, and any other issues related to the crab stocks.

The SSC annually reviews the SAFE report, including the stock assessment documents, recommendations from the CPT, and the methods to address scientific uncertainty. In reviewing the SAFE, the CPT and the SSC shall evaluate and make recommendations, as necessary, on: the assumptions made for stock assessment models and estimation of OFLs; the specifications of the probability distribution of the OFL; the methods to appropriately quantify uncertainty in the ABC control rule; and the factors influencing scientific uncertainty that the SOA has accounted for and will account for on an annual basis in TAC setting. The SSC will then set the final OFLs and ABCs for the upcoming crab fishing year. The SSC may set an ABC lower than the result of the ABC control rule, but it must provide an explanation for setting the ABC less than the maximum ABC.

As an accountability measure, the total catch estimate used in the stock assessment will include any amount of harvest that may have exceeded the ACL in the previous fishing season. For stocks managed under Tiers 1 through 4, this would result in a lower maximum ABC in the subsequent year, all else being equal, because maximum ABC varies directly with biomass. For Tier 5 stocks, the information used to establish the ABC is insufficient to reliably estimate abundance or discern the existence or extent of biological consequences caused by an overage in the preceding year. Consequently, the subsequent year's maximum ABC will not automatically decrease. However, when the ACL for a Tier 5 stock has been exceeded, the SSC may decrease the ABC for the subsequent fishing season as an accountability measure.

For Tiers 1 through 3, reliable estimates of B , B_{MSY} , and F_{MSY} , or their respective proxy values, are available. Tiers 1 and 2 are for stocks with a reliable estimate of the spawner/recruit relationship, thereby enabling the estimation of the limit reference points B_{MSY} and F_{MSY} .

Tier 1 is for stocks with assessment models in which the probability density function (pdf) of F_{MSY} is estimated.

Tier 2 is for stocks with assessment models in which a reliable point estimate, but not the pdf, of F_{MSY} is made.

Tier 3 is for stocks where reliable estimates of the spawner/recruit relationship are not available, but proxies for F_{MSY} and B_{MSY} can be estimated.

For Tier 3 stocks, maturity and other essential life-history information are available to estimate proxy limit reference points. For Tier 3, a designation of the form " F_x " refers to the fishing mortality rate associated with an equilibrium level of fertilized egg production (or its proxy such as mature male biomass at mating) per recruit equal to X% of the equilibrium level in the absence of any fishing.

The OFL and ABC calculation accounts for all losses to the stock not attributable to natural mortality. The OFL and ACL are total catch limits comprised of three catch components: (1) non-directed fishery discard losses; (2) directed fishery discard losses; and (3) directed fishery retained catch. To determine the discard losses, the handling mortality rate is multiplied by bycatch discards in each fishery. Overfishing would occur if, in any year, the sum of all three catch components exceeds the OFL.

Tier 4 is for stocks where essential life-history, recruitment information, and understanding are insufficient to achieve Tier 3. Therefore, it is not possible to estimate the spawner-recruit relationship. However, there is sufficient information for simulation modeling that captures the essential population dynamics of the stock as well as the performance of the fisheries. The simulation modeling approach employed in the derivation of the annual OFLs captures the historical performance of the fisheries as seen in observer data from the early 1990s to present and thus borrows information from other stocks as necessary to estimate biological parameters such as γ .

In Tier 4, a default value of natural mortality rate (M) or an M proxy, and a scalar, γ , are used in the calculation of the F_{OFL} . Explicit to Tier 4 are reliable estimates of current survey biomass and the instantaneous M . The proxy B_{MSY} is the average biomass over a specified time period, with the understanding that the Council's Scientific and Statistical Committee may recommend a different value for a specific stock or stock complex as merited by the best available scientific information. A scalar, γ , is multiplied by M to estimate the F_{OFL} for stocks at status levels "a" and "b," and γ is allowed to be less than or greater than unity. Use of the scalar γ is intended to allow adjustments in the overfishing definitions to account for differences in biomass measures. A default value of γ is set at 1.0, with the understanding that the Council's Scientific and Statistical Committee may recommend a different value for a specific stock or stock complex as merited by the best available scientific information.

If the information necessary to determine total catch OFLs and ACLs is available for a Tier 4 stock, then the OFL and ACL will be total catch limits comprised of three catch components: (1) non-directed fishery discard losses; (2) directed fishery discard losses; and (3) directed fishery retained catch. If the information necessary to determine total catch OFLs and ACLs is not available for a Tier 4 stock, then the OFL and ACL are determined for retained catch. In the future, as information improves, data would be available for some stocks to allow the formulation and use of selectivity curves for the discard fisheries (directed and non-directed losses) as well as the directed fishery (retained catch) in the models. The resulting OFL and ACL from this approach, therefore, would be the total catch OFL and ACL.

Tier 5 stocks have no reliable estimates of biomass and only historical catch data are available. For Tier 5 stocks, the OFL is set equal to the average catch from a time period determined to be representative of the production potential of the stock, unless the Scientific and Statistical Committee recommends an alternative value based on the best available scientific information. The ABC control rule sets the maximum ABC at

less than or equal to 90 percent of the OFL and the ACL equals the ABC. For Tier 5 stocks where only retained catch information is available, the OFL and ACL will be set for the retained catch portion only, with the corresponding limits applying to the retained catch only. For Tier 5 stocks where information on bycatch mortality is available, the OFL and ACL calculations could include discard losses, at which point the OFL and ACL would be applied to the retained catch plus the discard losses from directed and non-directed fisheries.

The foregoing has been taken directly from SAFE 2016 and additional information can be found therein¹⁴⁷.

References:	
Non-Conformance Number (if relevant)	NA

¹⁴⁷ http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf

Supporting Clause 6.2

States shall establish safe limit reference point(s) for exploitation (i.e. consistent with avoiding recruitment overfishing or other impacts that are likely to be irreversible or very slowly reversible). When a limit reference point is approached, measures shall be taken to ensure that it will not be exceeded. For instance, if fishing mortality (or its proxy) is above the associated limit reference point, actions should be taken to decrease the fishing mortality (or its proxy) below that limit reference point.

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Safe limit reference points have been established for exploitation of BSAI crab stocks and measures are in place to ensure fishing mortality is decreased when a limit reference point is approached.

Evidence:

The biomass that is associated with MSY, B_{msy} , 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 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 $\frac{1}{2}$ MSY. The harvest rate in the directed fishery is decreased when stock biomass is moving from upper to limit reference point. At stock status level “c”, the ratio of current biomass to B_{MSY} (or a proxy for B_{MSY}) is below β (critical biomass threshold), directed fishing is prohibited and an FOFL at or below F_{MSY} would be determined for all other sources of fishing mortality in the development of a rebuilding plan. The Council will develop a rebuilding plan once a stock level falls below the MSST.

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 five 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 $0.5 \times B_{msy}$, 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 occur¹⁴⁸.

¹⁴⁸<http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html>

References:	
Non-Conformance Number (if relevant)	NA

Supporting Clause 6.3

Data and assessment procedures shall be installed measuring the position of the fishery in relation to the reference points. Accordingly, the stock under consideration shall not be overfished (i.e. above limit reference point or proxy) and the level of fishing permitted shall be commensurate with the current state of the fishery resources, maintaining its future availability, taking into account that long term changes in productivity can occur due to natural variability and/or impacts other than fishing.

FAO CCRF (1995) 7.5.3, 7.6.1

FAO Eco (2009) 29.2-29.2bis, 29.6, 30-30.2

FAO Eco (2011) 36.2, 36.3, 37, 37.1, 37.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input checked="" type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input checked="" type="checkbox"/>	None <input type="checkbox"/>

Summary Evidence:

Procedures are in place to measure the position of BSAI crab fisheries in relation to their reference points and measures are in place to ensure they are not overfished or being overfished and take into account long term changes in productivity or impacts other than fishing.

Evidence:

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 crab fisheries in relation to pre-defined reference points¹⁴⁹.

Aleutian Islands Golden King Crab

The AIGKC has been assessed as a Tier 5 stock: there are no reliable estimates of biomass and only historical catch data are available. The OFL is 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.

As alluded to in the description of optimum yield in 6.1 Evidence, BSAI crab resources are managed under a joint federal/state agreement that includes federal oversight but defers much of the management to the State of Alaska. To a very large extent, management is a continuation of long-standing practice that pre-dates the FMP and is modified as required over time but in conformity with the FMP. The FMP authorizes the State to set preseason TACs and GHs under State regulations taking into account a suite of economic, social, biological and ecological factors listed in section 8.2.2 of the FMP in developing harvest strategies for each fishery. The annual TACs are set at levels that maximize harvests and associated economic and social benefits when biological and ecological conditions warrant. TACs are set sufficiently below the ACL so that the sum of the catch and the State’s assessment of additional uncertainty do not exceed the ACL. The decision to open a fishery in any given year is based on a threshold value of mature male and/or female biomass estimated from the most recent survey as a percentage of long-term averages. Details of the calculation of threshold values varies among fisheries. A fishery may not be opened even though the formal federal assessment indicates that the stock is not overfished and that overfishing is not occurring. A thorough review of the TAC decision-making process for each fishery is presented to the BSAI crab industry prior to season opening each year (referenced

¹⁴⁹http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf

in Supporting Clauses 5.1.1 and 5.1.2). ADF&G may close a fishery with a GHL before or after the GHL is achieved based on current in-season information as detailed in section 8.2.3 of the FMP. TACs and GHGs for each fishery are reported in the annual Stock Assessment and Fishery Evaluation Report, along with the OFLs and ABC/ACLs.

In the 2016 cycle it was assessed as a single stock, and the assessment concluded that overfishing did not occur in 2015/16 because the 2015/16 estimated total catch (confidential) did not exceed the Tier 5 OFL established for 2015/16 (5.69-thousand t; 12.54-million lb). The 2015/16 estimated total catch did not exceed the ABC established for 2015/16 (4.26-thousand t; 9.40-million lb). The OFL and ABC values for 2016/17 were the status quo, Alternative 1 recommended values.

Table 5 Status and catch specifications of Aleutian Islands golden king crab

Management Performance Table (values in t)

Fishing Year	MSST	Biomass (MMB)	TAC ^a	Retained Catch	Total Catch	OFL	ABC
2012/13	N/A	N/A	2,853	2,843	3,115	5.69 ^c	5.12 ^c
2013/14	N/A	N/A	2,853	2,894 ^b	3,192	5.69 ^c	5.12 ^c
2014/15	N/A	N/A	2,853	2,771 ^b	3,079	5.69 ^c	4.26 ^c
2015/16	N/A	N/A	2,853	Conf. ^d	Conf. ^d	5.69 ^c	4.26 ^c
2016/17	N/A	N/A	2,515			5,689	4,267

- a. Total allowable catch, established in lb and converted to t.
- b. Includes retained catch towards cost-recovery fisheries.
- c. Established in thousands of t.
- d. Confidential under Sec. 16.05.815 (SOA statute). TAC not attained.

The annual TAC is set by state regulation, **5 AAC 34.612 (Harvest Levels for Golden King Crab in Registration Area O)**, as approved by the BOF in March 2012:

- (a) Until the Aleutian Islands golden king crab stock assessment model and a state regulatory harvest strategy are established, the harvest levels for the Registration Area O golden king crab fishery are as follows:
 - (1) east of 174° W long.: 3.31 million pounds; and
 - (2) west of 174° W long.: 2.98 million pounds;
- (b) The department may reduce the harvest levels based on the best scientific information available and considering the reliability of estimates and performance measures, sources of uncertainty as necessary to avoid overfishing, and any other factors necessary to be consistent with sustained yield principles.

Between 2012/13 and 2015/16, the two areas were managed with a constant annual guideline harvest level or total allowable (retained) catch well below the ABC. In 2012, the BOF increased the TAC levels to 1,501 t (3.310 million pounds) for EAG and 1,352 t (2.980 million pounds) for WAG beginning with the 2012/13 fishing year. As a result of declining catch rate and harvest in the WAG, ADF&G reduced the WAG TAC to 1,014 t (2.235 million pounds) for the 2016/17 fishery.

Development of a population dynamics model as a basis for annual stock assessment of AIGKC has been ongoing for many years. It is a male-only, length-based model that combines a variety of catch, catch composition and catch discard data from commercial crab and groundfish (trawl and pot) fisheries, standardized observer legal size catch-per-unit-effort (CPUE) as indices of abundance, and tag recaptures by release-recapture lengths to estimate stock assessment parameters, primarily trends in mature male biomass and total fishing mortality. Further details are provided in 7.4 (Clause 4).

The model has been subjected to rigorous internal and external peer review throughout its development. Significant concerns have been raised regarding the use of CPUE as an indicator of abundance and the use of mean recruitment for 1996-2015 to tune the model instead of using the period covering the full catch history (from the early 1980s). Nevertheless, the CPT decided at its September (2016) meeting to approve the current version of the AIGKC assessment model for setting OFLs and ABCs for the EAG and WAG separately during the 2017 stock assessment cycle. This decision was endorsed by the SSC at its October (2016) meeting.

Goals at the January (2017) CPT meeting were to evaluate the model runs requested by the CPT and the SSC, to consider the appropriate tier level for the AIGKC assessment, and to propose a set of model runs for evaluation and potential adoption at a CPT meeting in May (2017). In January, the CPT recommended that AIGKC be placed in Tier 3. If the SSC agrees with this recommendation in February (2017), there would be no need to develop OFL/ABC tables for Tier 4 in the May assessment document.

The preliminary base model results considered by the CPT in January are reasonably consistent with the perception that the AIGKC fishery has been stable and the stock has been relatively lightly and sustainably exploited in recent years. In the EAG base model, the estimated fishing mortality has been below F35% since 2000, and stock is estimated to be above the BMSY reference point and increasing. The picture is more complex for the WAG base model. Fishing mortalities were below F35% from 2005 to around 2012, and then increased to above F35% in the last few years. Stock biomass has hovered around the BMSY reference point since 1990, but recently declined below it. It should be noted that these results are from preliminary models and final models used in May (2017) could change.

In January, the CPT recommended that the following base model be brought forward for evaluation in May:

1. The observer CPUE time series should start in 1995.
2. Add the retained catch CPUE index for 1985-1998 (fish ticket data).
3. Model two time periods for selectivity (pre- and post-rationalization).
4. Do Francis reweighting for the length-composition data.
5. Estimate a single natural mortality value using a combined EAG/WAG model and do a likelihood on natural mortality. Then use the estimated value of natural mortality as a fixed value in separate EAG and WAG assessments for OFL and ABC projections and further model sensitivity analyses
6. Obtain mean recruitment to initialize the model using only recruitment estimates that are informed by data (i.e., recruit CVs less than sigma R)
7. Calculate BMSY reference point based on average recruitment from 1986-2016 (whole time series).

In January, the CPT also recommended that the following alternative scenarios be brought forward for evaluation in May:

- Scenario that drops the retained catch CPUE index.
- Scenario that includes the observer CPUE index from 1991-1994.
- Scenario with three selectivity periods rather than two.
- Scenarios with low and high bracketing values for natural mortality to demonstrate model sensitivity.

- Scenarios that use alternative time periods to estimate mean recruitment for the BMSY reference point
- Scenario that compares a maturity ogive vs knife edge maturity.

At time of writing this report (February 2017), it is anticipated that the foregoing will provide the basis for management decision making for the 2017/18 season which starts in August.

The validation report for the AIGKC fishery concluded, based on the absence of an accepted stock assessment model as well as target and limit reference points, that the evidence adequacy rating for Clauses 5 and 6 (Version 1.2 of the RFM) were low and recommended that the stock not be considered for full assessment until further information is available to support more certainty in the outcome of evaluations against these clauses.

The Alaska RFM Certification Program's Data Deficient Framework (DDF) is an addendum to Version 1.3 of the RFM Scoring Guidance designed for use by Assessment Teams in cases of data deficient fisheries in Alaska that have been scoped out as such. In accordance with DDF requirements, a workshop was convened and led by Vito Romito, Responsible Sourcing Standards Ltd., on behalf of ASMI, in September 2016 to conduct a PSA for the AIGKC fishery, specifically for sub-clause 6.3 of Version 1.3, the one being followed in this full assessment.

This assessment team undertook a thorough review of the workshop results it was provided prior to and during the site visits. Our critique is included in section 3.4 of Background to the Fishery. It identifies various shortcomings of the workshop as well as a number of attribute and data quality scores it considered to be inappropriate. We explored how rescoring these would impact overall results. Although our changes to scoring yielded less optimistic results, they did not push the vulnerability score into non-conformance territory. The PSA results, therefore, are in agreement with the CPT's conclusion at its January meeting that the preliminary base model results are consistent with the perception that the AIGKC fishery has been stable and the stock has been relatively lightly and sustainably exploited in recent years.

This assessment team considers it appropriate to provide a medium evidence rating for this supporting clause in the case of the AIGKC fishery at this time. The possibility of closing this non-conformance will be considered when the outcome of the full 2017 stock assessment process is available or at the time of the first annual audit for the fishery.

Eastern Bering Sea Tanner Crab

A single OFL is set for Tanner crab in the EBS. ADF&G sets separate TACs for directed fisheries east and west of 166° W longitude.

The mature male biomass was estimated to be below the Minimum Stock Size Threshold (0.5BMSY) in February 2010 (the assumed time of mating) based on trends in mature male biomass from the survey, and NMFS declared the stock overfished in September 2010. The directed fisheries were closed from 2010/11 through 2012/13 crab fishery years. NMFS determined the stock was not overfished in 2012 based on a new assessment model with a revised estimate of BMSY. The fishery was opened for the 2013/14 season with a TAC of 746.2 t for the area west of 166° W longitude and 663.6 t for the area east of 166° W longitude and for the 2014/15 season with TAC of 2,328.7 t for the west and 3,829.3 t for the east. Total retained catch in the 2014/15 season was 6,160 t and in 2015/16 it was 8,910 t, the largest taken in the fishery since 1992/93.

The estimated MMB at time of mating in 2015 is 73.93 thousand t and the projection for the 2016 time of

mating is 45.34 thousand t. Estimates of recruitment since 1999 have been generally low relative to the peaks estimated for the period prior to 1990 and estimates of recruitment in the last four years are below the 1982–2016 average. Based on the estimated biomass at 15 February 2017, the stock is at Tier 3 level a. The *FMSY* proxy (*F*35%) is 0.58 yr⁻¹, and the 2015/16 *FOFL* is 0.58 yr⁻¹ under the Tier 3 level a *OFL* Control Rule, which results in a total male and female *OFL* of 25.61 thousand t. The CPT recommended a 20% buffer to account for model uncertainty and stock productivity uncertainty be applied to the *OFL*, to set *ABC* = 20.49 thousand t. The 2016/17 *OFL* is estimated from an updated model. The 20% buffer is the same that the *SSC* recommended for determination of the 2015/16 *ABC*. Current stock status is illustrated in Figure 26

Table 6 Historical status and catch specifications for Eastern Bering Sea Tanner crab (thousand t). Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch

Year	MSST	Biomass (MMB)	TAC (East + West)	Retained Catch	Total Catch Mortality	OFL	ABC
2012/13	16.77	59.35	0	0	0.71	19.02	8.17
2013/14	16.98	72.70	1.41	1.26	2.78	25.35	17.82
2014/15	13.40	71.57	6.85	6.16	9.16	31.48	25.18
2015/16	12.82	73.93	8.92	8.91	11.38	27.19	21.75
2016/17		45.34				25.61	20.49

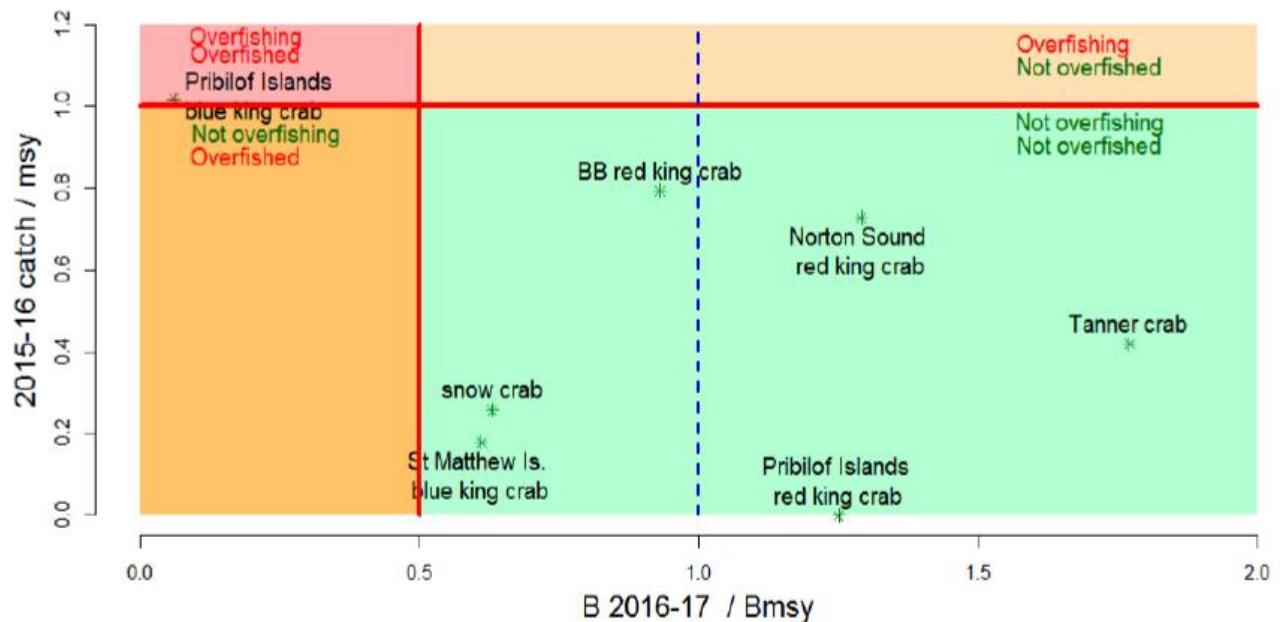


Figure 26 Status of 7 Bering Sea crab stocks in relation to status determination criteria (BMSY, MSST, overfishing). Note that information is insufficient to assess Tier 5 stocks according to these criteria (WAIRKC, AIGKC, PIGKC).

However, in accordance with State harvest strategy 5 AAC 35.508, the 2016 mature female survey biomass was below the threshold and the directed Tanner crab fishery was closed for the 2016/17 season.

However, in accordance with State harvest strategy 5 AAC 35.508, the 2016 mature female survey biomass was below the threshold and the directed Tanner crab fishery was closed for the 2016/17 season.

Eastern Bering Sea Snow Crab

Observed survey mature male biomass decreased from 167,100 t in 2011 to 97,500 t in 2013, increased to 163,500 t in 2014, then fell to 80,000 t in 2015 and 63,200 t in 2016. The 2016 model estimates of mature male biomass showed trends similar to survey biomass during 2011–2016, except that the model failed to match the 1-year spike in survey biomass observed in 2014. Observed survey mature female biomass rose quickly from 52,200 t in 2009 to 175,800 t in 2011, its highest value since 1991, then decreased steadily to 55,400 t in 2016. Although the model matches the observed mature female survey biomass fairly well in 2016, the model estimates do not follow the observed rise and fall that started in 2009; instead, they indicate that mature female biomass was fairly constant across the 2009-2016 time period. The model estimates a 3-year trend of increasing recruitment starting in 2014, with very high values for 2016 (> 6 million). This is supported by the associated NMFS EBS survey size compositions, particularly for males. The EBS snow crab is a Tier 3 stock so the OFL is determined by the FOFL control rule using F35% as the proxy for FMSY. The proxy for *BMSY* (*B35%*) is the mature male biomass at mating (151.8 thousand t) based on average recruitment over 1978 to present. Consequently, the minimum stock size threshold (MSST) is 75.8 thousand t. The CPT recommended using the standard buffer for Tier 3 stocks (10%) for setting the 2016/17 ABC due to model uncertainties and contradictions between model trends and survey and fishery observations. Current stock status is illustrated in Figure 26.

Table 7 *Historical status and catch specifications for snow crab (thousand t). Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch.*

Year	MSST	Biomass (MMB)	TAC	Retained catch	Total catch	OFL	ABC
2011/2012	77.3	165.2	40.3	40.5	42	73.5	66.2
2012/2013	77.1	170.1	30.1	30.1	32.4	67.8	61
2013/2014	71.5	126.5	24.5	24.5	27.7	78.1	69.3
2014/2015	73.2	129.3	30.8	30.8	34.3	69	62.1
2015/2016	73.2	123.5	18.4	18.4	21.4	61.5	55.4
2016/2017	75.8	91.6				23.7	21.3

In accordance with State harvest strategy **5 AAC 35.517**, the TAC determined for the 2016/17 season was 9,784 t.

Bristol Bay Red King Crab

Model estimates of total survey biomass increased from 252.3 thousand t in 1975 to 300.2 thousand t in 1977, fell to 34.9 thousand t in 1985, generally increased to 91.7 thousand t in 2007, and subsequently declined to

65.7 thousand t in 2016. Estimated recruitment was high during the 1970s and early 1980s and has been generally low since 1985. The near-term outlook for this stock is a continued gradual declining trend. Recruitment has been poor (less than the mean from 1984-2016) since 2006. The 2011 survey produced a high catch of juvenile males and females <65 mm CL in one survey tow but that catch did not track into the 2012–2016 surveys. The survey area-swept estimates for abundance and biomass in 2015-2016 were more consistent with previous surveys, in comparison to 2014, when the estimates were anomalously high.

Bristol Bay red king crab is in Tier 3. Average recruitment is based on model recruitment using the time period 1984 (corresponding to fertilization in 1977) to the last year of the assessment. The estimated B35% is 25.8 thousand t). MMB projected for 2016/17 is 24.0 thousand t, 93% of B35%. Consequently, the BBRKC stock is in Tier 3b in 2016/17.

The CPT recommended that the OFL for 2016/17 be set according to model scenario 2, for which the calculated OFL is 6.64 thousand t (14.63 million lb). The team recommended that a 10% buffer from the OFL be used to set the ABC at 5.97 thousand t (13.17 million lb).

MMB for 2015/16 was estimated to be 27.68 thousand t and above MSST (12.89 thousand t); hence the stock was not overfished in 2015/16. The total catch in 2015/16 (5.34 thousand t) was less than the 2015/16 OFL (6.73 thousand t); hence overfishing did not occur in 2015/16. The stock at 2016/17 time of mating is projected to be above the MSST and 93% of B35% (see above); hence the stock is not projected to be in overfished condition in 2016/17. Current stock status is illustrated in Figure 26.

Table 8 Historical status and catch specifications for Bristol Bay red king crab (thousand t). Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2012/13	13.19 ^A	29.05 ^A	3.56	3.62	3.90	7.96	7.17
2013/14	12.85 ^B	27.12 ^B	3.90	3.99	4.56	7.07	6.36
2014/15	13.03 ^C	27.25 ^C	4.49	4.54	5.44	6.82	6.14
2015/16	12.89 ^D	27.68 ^D	4.52	4.61	5.34	6.73	6.06
2016/17		24.00 ^D				6.64	5.97

In accordance with State harvest strategy **5 AAC 34.816**, the TAC determined for the 2016/17 season was 3,842 t.

St. Matthew Island Blue King Crab

Following a period of low numbers (below 30% of the 1978-2016 mean of 5,865 t) after the stock was declared overfished in 1999, trawl-survey indices of SMBKC stock abundance and biomass generally increased to well above average from 2007-2012. In 2013 the survey biomass estimate was low (~40% of the mean value) but was followed by average biomass estimates in 2014 and 2015 (with sampling CVs of 77% and 45%, respectively). The 2016 survey biomass estimate was 3,500 t (7.7 million lb with a CV of 39%). This value represents about 60% of the long term mean with the most recent 3-year average surveys at 87% of the mean value. This suggests a general decline in biomass compared to the recent peak survey estimate of nearly twice the average. The assessment model estimates dampen the interannual variability observed in the survey biomass and suggest that the stock (in survey biomass units) is presently at about 45% of the long term model-predicted survey biomass average. The trend from these

values suggest a slight decline.

Because little information about the abundance of small crab is available for this stock, recruitment has been assessed in terms of the number of male crab within the 90-104 mm carapace length (CL) size class in each year. The 2013 trawl-survey area-swept estimate of 0.335 million male SMBKC in this size class marked a three-year decline and was the lowest since 2005. That decline did not continue as the 2014 survey estimate was 0.723 million. Survey recruitment was 0.992 million in 2015, but the majority of this survey estimate is from one tow with a great deal of uncertainty. In 2016, survey recruitment declined to 0.535 million.

This stock is in Tier 4. The CPT recommended model (GMACS base scenario) uses the full assessment period (1978/79-2015/16) to define the proxy for *BMSY* in terms of average estimated *MMB_{mating}*. The projected *MMB* estimated for 2016/17 is 2,230 t (4.91 million lb) and the *FMSY* proxy is the natural mortality rate (0.18-1 year) and FOFL is 0.09, resulting in a mature male biomass OFL of 140 t (0.310 million lb). The *MMB/BMSY* ratio is 0.61. A 20% buffer on the OFL for the ABC, which was consistent with the approach used last year, gives an ABC based of 110 t (0.250 million lb). Current stock status is illustrated in Figure 26.

Table 9 Historical status and catch specifications for Saint Matthew blue king crab (thousand t). Shaded values are new estimates or projections based on the current assessment. Other table entries are based on historical assessments and are not updated except for total and retained catch

Year	MSST	Biomass (MMB _{mating})	TAC	Retained Catch	Total Catch	OFL	ABC
2012/13	1.80	2.85	0.74	0.73	0.82	1.02	0.92
2013/14	1.50	3.01	0	0	0.0003	0.56	0.45
2014/15	1.86	2.48	0.30	0.14	0.15	0.43	0.34
2015/16	1.84	2.11	0.19	0.05	0.05	0.28	0.22
2016/17		2.23				0.14	0.11

In accordance with State harvest strategy **5 AAC 34.917**, the stock is below the model threshold and the directed fishery for Blue King crab was closed for the 2016/17 season.

References:

C5 Crab Plan Team Report February 2017. Available at: <http://www.npfmc.org/fishery-management-plan-team/bsai-crab-plan-team/>

Siddeek, M.S.M., J. Zheng and D. Pengilly. Aleutian Islands Golden King Crab (*Lithodes aequispinus*) Model-Based Stock Assessment. Draft summary report for the January 2017 Crab Plan Team Discussion.

Starr, P. Comments on “Aleutian Islands Golden King Crab (*Lithodes aequispinus*) Model-Based Stock Assessment. Draft summary report for the January 2017 Crab Plan Team Discussion”.

Starr, P. Report to the Aleutian King Crab Research Foundation (AKCRF) on the NPFMC Crab Modelling workshop, 17–19 January 2017.

	<p>Martell, S. Comments on WAG Golden King Crab Model. Report for the January 2017 Crab Plan Team Discussion.</p> <p>Review of TACs Bering Sea Crab: 2016/17 Season. ADF&G Presentation to BSAI Crab Industry, October 12, 2016.</p>
<p>Non-Conformance Number (if relevant)</p>	<p>1</p>

Supporting Clause 6.4

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

FAO CCRF (1995) 7.5.3
 FAO Eco (2009) 29.6, 30.2
 FAO Eco (2011) 36.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Management actions have been agreed to for instances where a stock assessment indicates that its reference points have been exceeded.				
Evidence: 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 ¹⁵⁰ , 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.				
References:				
Non-Conformance Number (if relevant)	NA			

¹⁵⁰ <http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html>

7.7 Fundamental Clause 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 (1995) 7.5.1/7.5.4/7.5.5/12.3
 FAO ECO (2009) 29.6/32
 FAO Eco (2011) 36.7

No. Supporting clauses/sub-clauses	5
Supporting clauses applicable	4
Supporting clauses not applicable	1
Non Conformances	0

Supporting 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. This should take due account of stock enhancement procedures, where appropriate. Absence of scientific information shall not be used as a reason for postponing or failing to take conservation and management measures. Relevant uncertainties shall be taken into account through a suitable method of risk assessment, including those associated with the use of introduced or translocated species³.

FAO Eco (2009) 29.6
 FAO Eco (2011) 36.7

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>

Summary Evidence:

The precautionary approach is applied to conservation, management and exploitation of the BSAI crab resources in order to protect them and preserve their environment.

Evidence:

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” (AS38.04.910). 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 uses¹⁵¹.

In addition, the MSA dictates the development of FMPs for all the federally managed/overseen fisheries. The NPFMC treats OFL (MSY) as an upper limit rather than a target. Catches are in line with the TAC and well below the OFL to take into account the risks involved when calculating MSY.

The BSAI crab stocks are managed under a tier system rule based on stock knowledge. Status determination criteria are calculated using a five-tier system that accommodates varying levels of uncertainty of information. The system incorporates new scientific information and provides a mechanism to continually improve the status determination criteria as new information becomes available. The higher the stock tier status, the more conservative the determination of OFL and ABC. The difference between OFL and ABC takes into account uncertainties considering both biological and socio-economic parameters. The system is intrinsically precautionary.

The FAO Guidelines for the Precautionary Approach (PA) (FAO 1995)¹⁵² 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. Evidence provided for previous clauses demonstrates that these guidelines are met in the case of BSAI crab fisheries.

References:

Non-Conformance Number (if relevant)

NA

¹⁵¹http://w3.legis.state.ak.us/docs/pdf/citizens_guide.pdf

¹⁵²<http://www.fao.org/DOCREP/003/W3592E/W3592E00.HTM>.

Supporting Clause 7.1.1

In implementing the precautionary approach, States shall take into account, inter alia, of 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 dependent species as well as environmental and socio-economic conditions.

FAO CCRF (1995) 7.5.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence:				
<p>As implemented in management of BSAI crab fisheries, the precautionary approach takes into account 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 on non-target and associated or dependent species as well as environmental and socio-economic conditions.</p>				
Evidence:				
<p>The mission of the NMFS Alaska Fisheries Science Center (ASFC) 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.</p> <p>For each BSAI crab stock/fishery, the annual Crab SAFE report provides a detailed description of the data and methodology used in the stock assessment, any changes in approaches, 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 (See evidence for supporting clauses 5.1, 6.1, 6.2 and 6.3). Stock assessments and associated reference points take account of uncertainties relating to the size and productivity of each stock.</p> <p>Catch and fishing effort data are recorded by ADFG. ADFG on-board observers monitor fishing position, sample total and retained catch and document total catch, bycatch and effort and sampling of retained catches is carried out by shore-based observers. Data on crab bycatch in the trawl and fixed gear groundfish fisheries are obtained by the NMFS observer program. Collectively, these monitoring and observer programs provide the basis for reliable estimation of total removals from all crab stocks annually and are available to NMFS, ADFG, NPFMC and other agencies for their scientific, management and enforcement purposes (See evidence for supporting clauses 4.1, 4.1.1, 4.2).</p> <p>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 environmental changes. 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.</p> <p>Economic and ecosystem assessments are provided to the Council on an annual basis. These provide a basis for scientific evaluation of how fish stocks, ecosystem relationships and user groups might be affected by fishery management actions and climate (See evidence for supporting clauses 4.5, 5.1, 5.1.2 and 5.2).</p>				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 7.1.2

In the absence of adequate scientific information, appropriate research shall be initiated in a timely fashion.

FAO CCRF (1995) 7.5.1, 12.3

FAO Eco (2009) 29.6/32

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence:				
<p>The BSAI crab stocks are managed under a rule based on stock knowledge. Status determination criteria are calculated using a five-tier system that accommodates varying levels of uncertainty of information. The system incorporates new scientific information and provides a mechanism to continually improve the status determination criteria as new information becomes available.</p>				
Evidence:				
<p>The BSAI crab stocks are managed under a tier system rule based on stock knowledge. Status determination criteria are calculated using a five-tier system that accommodates varying levels of uncertainty of information. The system incorporates new scientific information and provides a mechanism to continually improve the status determination criteria as new information becomes available. The higher the stock tier status, the more conservative the determination of OFL/ABC and ACL. The difference between OFL and ABC takes into account uncertainties considering both biological and socio-economic parameters. This provides a precautionary approach within the FMP management program. When adequate scientific information appears to be lacking, crab management is always precautionary. Lack of information leads to research priorities to reduce uncertainty.</p> <p>A key component of annual stock assessments and subsequent SAFE reports is the identification of components of the assessment where there are gaps in knowledge and priorities for future research are highlighted. The assessment scientists respond to requests from peer reviewers to conduct re-analysis of data currently available or undertake to fill knowledge where feasible.</p>				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 7.2

In the case of new or exploratory fisheries, States shall adopt as soon as possible cautious conservation and management measures, including, inter alia, catch limits and effort limits. Such measures should remain in force until there are sufficient data to allow assessment of the impact of the fisheries on the long-term sustainability of the stocks, whereupon conservation and management measures based on that assessment should be implemented. The latter measures should, if appropriate, allow for the gradual development of the fisheries.

FAO CCRF (1995) 7.5.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence:				
BSAI crab fisheries are full developed. This supporting clause is not applicable.				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 7.3

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. Such measures may be temporary and shall be based on best scientific evidence available.

FAO CCRF (1995) 7.5.5

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Contingency plans have been agreed to for appropriate management response to serious threats to the BSAI crab resources as a result of overfishing or adverse environmental changes or other phenomena adversely affecting these resources based on the best scientific evidence available.

Evidence:

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. For crab stocks, biomass for determining overfished status is estimated on February 15 of the current year and compared to the MSST established by the NPFMC in October of the previous year.

Overfishing is defined as any amount of catch in excess of the overfishing level (OFL). The OFL is calculated by applying abundance estimates to the FOFL control rule which is annually estimated according to the tier system. 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 ABC levels are annually formulated. The 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.

For crab stocks, the OFL equals the maximum sustainable yield (MSY) and is derived through the annual assessment process, under the framework of the tier system. Overfishing is determined by comparing the OFL with the catch estimates for that crab fishing year. For the previous crab fishing year, NMFS will determine whether overfishing occurred by comparing the previous year’s OFL with the catch from the previous crab fishing year. For the previous crab fishing year, NMFS will also determine whether the ACL was exceeded by comparing the ACL with the catch estimates for that crab fishing year. Catch includes all fishery removals, including retained catch and discard losses, for those stocks where non-target fishery removal data are available. Discard losses are determined by multiplying the appropriate handling mortality rate by observer estimates of bycatch discards. For stocks where only retained catch information is available, the OFL and ACL will be set for and compared to the retained catch.

The NMFS will determine whether a stock is in an overfished condition 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. 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 NPFMC to immediately end overfishing and rebuild affected stocks. The MSA requires that FMPs include accountability measures to prevent ACLs from being exceeded and to correct overages of the ACL if they do occur. Accountability measures to prevent TACs and GHs from being exceeded have been used under this FMP for the management of the BSAI crab fisheries and will continue to be used to prevent ACLs from being exceeded.

Optimum yield is defined in the FMP. Information pertaining to economic, social and ecological factors relevant to the determination of optimum yield is provided in the FMP. For each crab fishery, the optimum yield range is 0 to < OFL catch. For crab stocks, the OFL is the annualized MSY and is derived through the annual assessment process, under the framework of the tier system. Recognizing the relatively volatile reproductive potential of crab stocks, the cooperative management structure of the FMP, and the past practice of restricting or even prohibiting directed harvests of some stocks out of ecological considerations, this optimum yield range is intended to facilitate the achievement of the biological, economic and social objectives of the FMP under a variety of future biological and ecological conditions. It enables the SOA to determine the appropriate TAC levels below the OFL to prevent overfishing or address other biological concerns that may affect the reproductive potential of a stock but that are not reflected in the OFL itself. Under the FMP, the SOA establishes TACs at levels that maximize harvests, and associated economic and social benefits, when biological and ecological conditions warrant doing so.

Additional related information can be found in the evidence for supporting clauses 6.1, 6.2 and 6.3.

References:

Non-Conformance Number (if relevant)

NA

Section D: Management Measures

7.8 Fundamental Clause 8

Management shall adopt and implement effective management measures designed to maintain stocks at levels capable of producing maximum sustainable yields, including harvest control rules and technical measures applicable to sustainable utilization of the fishery and be based upon verifiable evidence and advice from available scientific and objective, traditional sources.

FAO CCRF (1995) 7.1.1/7.1.2/7.1.6/7.4.1/7.6.1/7.6.9/12.3

FAO Eco (2009) 29.2/29.4/30

FAO Eco (2011) 36.2, 36.3

No. Supporting clauses/sub-clauses	17
Supporting clauses applicable	16
Supporting clauses not applicable	1
Non Conformances	0

Supporting 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, fisher or community sources.

FAO CCRF (1995) 7.1.1 Others 7.4.1/7.6.7

FAO Eco (2009) 29.2/29.4

FAO Eco (2011)36.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>

Summary Evidence:

Conservation and management measures are in place to ensure the long-term sustainability of BSAI crab resources at levels which promote optimum utilization that are based on verifiable and objective scientific and traditional, fisher and community sources.

Evidence:

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 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.

Optimum yield is defined in the FMP. Information pertaining to economic, social and ecological factors relevant to the determination of optimum yield is provided in the FMP. For each crab fishery, the optimum yield range is 0 to < OFL catch. For crab stocks, the OFL is the annualized MSY and is derived through the annual assessment process, under the framework of the tier system. Recognizing the relatively volatile reproductive potential of crab stocks, the cooperative management structure of the FMP, and the past practice of restricting or even prohibiting directed harvests of some stocks out of ecological considerations, this optimum yield range is intended to facilitate the achievement of the biological, economic and social objectives of the FMP under a variety of future biological and ecological conditions. It enables the SOA to determine the appropriate TAC levels below the OFL to prevent overfishing or address other biological concerns that may affect the reproductive potential of a stock but that are not reflected in the OFL itself. Under the FMP, the SOA establishes TACs at levels that maximize harvests, and associated economic and social benefits, when biological and ecological conditions warrant doing so.

Additional information related to the foregoing can be found in the evidence for supporting clauses 6.1, 6.2 and 6.3.

The National Environmental Policy Act (NEPA)¹⁵³ 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 fisheries¹⁵⁴ provides decision makers and the public with an evaluation of the environmental, social, and economic effects of alternative management/rationalization programs. The EIS considers 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.

References:	
Non-Conformance Number (if relevant)	NA

¹⁵³<http://www.epa.gov/compliance/basics/nepa.html>

¹⁵⁴<http://alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/default.htm>

Supporting Clause 8.1.1

Management targets are consistent with achieving maximum sustainable yield (MSY) (or a suitable proxy) on average, or a lesser fishing mortality if that is optimal in the circumstances of the fishery (e.g. multispecies fisheries) or to avoid severe adverse impacts on dependant predators.

FAO Eco (2009) 29.2

FAO Eco (2011) 36.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Management targets are consistent with achieving maximum sustainable yield (MSY) from the BSAI crab resources.				
Evidence: The NPFMC’s fishery management plan (FMP) for BSAI crab stocks outlines the stock status definitions, the criteria used to determine stock status and the step-by-step framework under which the NPFMC sets final overfishing levels (OFLs) and acceptable biological catches (ABCs). Optimum yield is defined in the FMP. Information pertaining to economic, social and ecological factors relevant to the determination of optimum yield is provided in the FMP. For each crab fishery, the optimum yield range is 0 to < OFL catch. For crab stocks, the OFL is the annualized MSY and is derived through the annual assessment process. Recognizing the relatively volatile reproductive potential of crab stocks, the cooperative management structure of the FMP, and the past practice of restricting or even prohibiting directed harvests of some stocks out of ecological considerations, this optimum yield range is intended to facilitate the achievement of the biological, economic and social objectives of the FMP under a variety of future biological and ecological conditions. Under the FMP, the SOA establishes TACs at levels that maximize harvests, and associated economic and social benefits, when biological and ecological conditions warrant doing so. Management targets are consistent with achieving optimum yield from these crab stocks with due consideration of potential ecological impacts. Additional information related to the foregoing can be found in the evidence for supporting clauses 6.1, 6.2 and 6.3. The potential for adverse impacts on dependant predators is discussed further in the evidence for supporting clause 12.14.				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 8.1.2

In the evaluation of alternative conservation and management measures, their cost-effectiveness and social impact shall be considered.

FAO CCRF (1995) 7.6.7

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: In the evaluation of alternative conservation and management measures for BSAI crab fisheries, their cost-effectiveness and social impact are considered.				
Evidence: 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 environmental changes. 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. Economic and ecosystem assessments are provided to the Council on an annual basis. These provide a basis for scientific evaluation of how fish stocks, ecosystem relationships and user groups might be affected by fishery management actions and climate. See evidence for supporting clause 8.1.3. Additional related information can be found in the evidence for supporting clause 7.1.1.				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 8.1.3

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 (1995) 7.4.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence:				
<p>Extensive studies have been conducted that provide an understanding of the costs, benefits and effects of alternative management options designed to rationalize fishing, in particular, those options relating to excess fishing capacity and excessive levels of fishing effort.</p>				
Evidence:				
<p>Resource Ecology and Fisheries Management (REFM) Division at the NMFS AFSC 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. Economic assessments are provided to the Council on an annual basis. These provide a basis for scientific evaluation of how user groups might be affected by fishery management actions.</p> <p>A separate annual SAFE report provides a comprehensive analysis of economic aspects of these fisheries. See evidence for supporting clause 5.1 and web links provided therein. A five-year review of the crab rationalization management program can be found at the web link provided.</p> <p>153http://www.afsc.noaa.gov/REFM/Socioeconomics/PDFs/5YearRev1210.pdf</p>				
References:				
Non-Conformance Number (if relevant)			NA	

Supporting Clause 8.2

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

FAO CCRF (1995) 8.4.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Dynamiting, poisoning and other comparable destructive fishing practices are prohibited in BSAI crab fisheries.				
Evidence: Dynamiting, poisoning and other comparable destructive fishing practices are prohibited in Alaska. The BSAI crab FMP authorizes the use of pot gear to harvest the crab resources. ¹⁵⁵				
References:				
Non-Conformance Number (if relevant)				NA

¹⁵⁵ <http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html>

Supporting Clause 8.3

States shall seek to identify domestic parties having a legitimate interest in the use and management of the fishery. 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. Arrangements shall be made to consult all the interested parties and gain their collaboration in achieving responsible fisheries.

FAO CCRF (1995) 7.1.2, 7.1.6, 7.6.6

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

All domestic parties with a legitimate interest in the use and management of BSAI crab fisheries have been identified and recognition is given to the traditional practices, needs and interests of indigenous people and local fishing communities. Arrangements are in place to consult all interested parties to gain their collaboration in achieving responsible fisheries.

Evidence:

The Crab Rationalization Program¹⁵⁶ 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 and 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, increase efficiencies, provide economic stability, and facilitate 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.

Community protection measures are primarily limits on the amount of Processor Quota Share (PQS) and Individual Processing Quota (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) Quota Share (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

¹⁵⁶<http://www.fakr.noaa.gov/sustainablefisheries/crab/rat/progfaq.htm#wicr>

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 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.

The Community Development Quota (CDQ) Program¹⁵⁷ began in 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.

The BOF¹⁵⁸ and the NPFMC¹⁵⁹ are open public processes which ensured extensive public review of the Crab Rationalization Program and the Community Development Quota Program. On an on-going basis, 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 proposals are accepted when it is not possible to attend in person.

References:	
Non-Conformance Number (if relevant)	NA

¹⁵⁷<http://www.fakr.noaa.gov/cdq/>

¹⁵⁸<http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main>

¹⁵⁹<http://www.fakr.noaa.gov/npfmc/>

Supporting Clause 8.4

Mechanisms shall be established where excess capacity exists, to reduce capacity to levels commensurate with sustainable use of the resource. Fleet capacity operating in the fishery shall be measured and monitored. 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 (1995) 7.1.8, 7.6.3, 8.1.2, 8.1.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Mechanisms are in place to reduce capacity to levels commensurate with sustainable use of the BSAI crab resources. Fleet capacity has been measured and is monitored. Statistics are updated regularly on all fishing operations and a record is maintained of all authorizations to fish these resources.				
Evidence: BSAI crab fisheries are limited entry rationalized fisheries. Fishing capacity has been reduced since 2002. Fleet consolidation accompanying rationalization was substantial and remaining vessel ownership has tended to aggregate in fewer and larger communities. The capacity of the crab fleet has been fixed since 2006 and continuously monitored by NMFS's Restricted Access Management Program (RAM) ¹⁶⁰ and the Alaska Commercial Fisheries Entry Commission (CFEC) ¹⁶¹ . 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. It 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 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. RAM and the CFEC maintain, on their websites, records of all fishing permits issued.				
References:				
Non-Conformance Number (if relevant)			NA	

¹⁶⁰<http://www.fakr.noaa.gov/ram/> <http://www.cfec.state.ak.us/>

¹⁶¹http://www.fakr.noaa.gov/npfmc/PDFdocuments/catch_shares/Crab/SIAexS_911.pdf

Supporting Clause 8.5

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

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

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Measures are in place in BSAI crab fisheries that restrict sizes that can be retained, require escape mechanisms to protect undersize and female crabs, establish closed seasons and closed areas and reserve areas for local, aboriginal fisheries.

Evidence:

The BSAI crab FMP¹⁶² authorizes the State to adjust size limits under State regulations. In establishing minimum size limits, the State can consider: 1) size at maturity, 2) protection of reproductive capability, 3) market and other economic considerations, 4) natural and discard mortality rates, 5) growth rates, and 6) yield per recruit. Typically, biological considerations are used to establish minimum legal size limits to ensure that conservation needs are served. Generally, preference for larger crabs based upon market and other economic considerations is achieved through processor/harvester agreements. The minimum commercial size limit has been determined for each area by using the size when 50 percent of the male population is sexually mature and adding the estimated dimensional growth of males up to a two-year period. This normally would give each male the opportunity to reproduce at least once before becoming vulnerable to the fishery.

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. While the FMP authorizes an experimental harvest and processing of 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. Undersized males and females must be promptly discarded from crab vessels to decrease handling mortality rates.

Fishing seasons are used to protect crabs during the molting and mating portions of their life cycle. Closed seasons have been set to maximize the reproductive potential of crab populations based on one or more of the following: 1) Protection of any breeding population of male crab that may form dense schools prior to and during annual migrations into shallow water breeding grounds. Such migrations have been described for red king crab and could possibly occur with other crabs. 2) Consideration of molting periods so that the shells have hardened enough to permit handling with minimal damage or mortality. 3) Protection of the

¹⁶²<http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html>

population during sensitive soft-shell periods. 4) Consideration of increasing product quality. 5) Minimization of bycatch.

The FMP specifically prohibits the use of trawls and tanglenet gear for catching crab because of the high mortality rates that could be inflicted on nonlegal crab. Pots and ring nets are the specified legal commercial gear in the BSAI crab fisheries. Multiple pots attached to a ground line are currently allowed in the golden king crab fishery. Various devices may be added to pots to minimize bycatch. Regulations specify escape mechanisms (escape rings or specified mesh panel webbings) to be incorporated in crab pots to allow female and sublegal male crab to escape and also require incorporation of biodegradable twine as an escape mechanism on all pots to terminate catching and holding ability of lost pots. The FMP authorizes use of pot limits to attain the conservation, economic and social objectives of the FMP when warranted.

Details of all regulations currently in place in each BSAI crab fishery can be found at the link provided below.¹⁶³

FMPs are required to describe and identify Essential Fish Habitat (EFH), minimize to the extent practicable adverse effects of fishing on EFH, and identify other actions to conserve and enhance EFH. The BSAI crab FMP describes crab EFH and includes information on habitat and biological requirements for each life history stage of these species. The EFH regulations provide guidance to identify habitat areas of particular concern (HAPCs). HAPCs are meant to provide greater focus to conservation and management efforts and may require additional protection from adverse effects. The **Aleutian Islands Habitat Conservation Area** and the **Aleutian Islands Coral Habitat Protection Areas** were established to protect EFH from fishing threats. In the former, use of non-pelagic trawl gear is prohibited year-round, except in designated areas and in the latter, use of bottom contact gear and anchoring by federally permitted fishing vessels is prohibited. Within EFH, the **Alaska Seamount Habitat Protection Areas**, where use of bottom contact gear and anchoring by a federally permitted fishing vessel is prohibited, and the **Bowers Ridge Habitat Conservation Zone**, where the use of mobile bottom contact gear is prohibited, have been established as HAPCs (see further discussion in the evidence section of supporting clause 12.9).

The FMP also recognizes state regulations that prohibit commercial fishing for king crab in waters within 10 miles of mean lower low water around St. Lawrence, King, and Little Diomed Islands as well as the state closure to protect the Norton Sound subsistence king crab fishery. The state may designate new closed water areas or expand or reduce existing state closed water areas in order to meet state subsistence requirements.

References:	
Non-Conformance Number (if relevant)	NA

¹⁶³<http://www.adfg.alaska.gov/index.cfm?adfg=regulations.main>

Supporting Clause 8.6

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 (1995) 8.2.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence:				
Gear used in BSAI crab fisheries has to be marked so the owner can be identified.				
<p>Alaska Administrative Code 34.051 requires king crab gear marking as follows: 1) 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. 2) 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. 3) 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.¹⁶⁴</p> <p>The above referenced requirements for the marking of king crab pot gear (as set forth in AA34.051) are not applicable to the Aleutian Islands golden king crab fishery. Use of longline pot gear for AIGKC is set forth in the Alaska Administrative Code 5 AAC 34.625 <i>Lawful gear for Registration Area O</i>¹⁶⁵: (b) Pots used to take golden king crab (2) may be operated only from a shellfish longline; a buoy is not required for each pot, but each end of the longline must be marked by a cluster of four buoys; one buoy in the cluster must be marked in accordance with 5 AAC 34.051 and have the initials "SL" to identify it as a shellfish longline; for purposes of this subsection "a shellfish longline" is a stationary, buoyed, and anchored line with at least 10 shellfish pots attached.</p> <p>Alaska Administrative Code 35.051 requires Tanner crab gear marking as follows: 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.¹⁶⁶</p>				

¹⁶⁴ <http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section051.htm>

¹⁶⁵ <http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter034/section625.htm>

¹⁶⁶ <http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter035/section051.htm>

References:	
Non-Conformance Number (if relevant)	NA

Supporting Clause 8.7

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

FAO CCRF (1995) 7.6.10

FAO Eco (2009) 30

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Measures are in place to identify and protect depleted resources and those resources threatened with depletion, and to facilitate their sustained recovery/restoration. Also, measures are in place to ensure that resources and habitats critical to the well-being of BSAI crab resources which have been adversely affected by fishing or other human activities are restored.

Evidence:

The NPFMC’s FMP for BSAI crab stocks¹⁶⁷ outlines the stock status definitions, the criteria used to determine stock status and the step-by-step framework under which the NPFMC sets final overfishing levels (OFLs) and acceptable biological catches (ABCs).

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. Under the system overfishing and overfished criteria and ABC 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 MSA requires NPFMC to immediately end overfishing and rebuild stocks. The MSA also requires that the FMP include accountability measures to prevent ACLs from being exceeded and to correct overages if they do occur. Clearly defined management measures, including harvest strategies and control rules, designed to maintain crab stocks at levels capable of producing maximum sustainable levels are included in the FMP. Measures require reducing fishing mortality if a stock is declining and closure of the directed fishery if depleted.

The National Environmental Policy Act (NEPA)¹⁶⁸ 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 provides decision makers and the public with an evaluation of the environmental, social, and economic effects of alternative management/rationalization programs.

¹⁶⁷<http://www.fakr.noaa.gov/npfmc/fishery-management-plans/crab.html>

¹⁶⁸<http://www.alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/default.htm>

The MSA includes provisions concerning the identification and conservation of Essential Fish Habitat (EFH)¹⁶⁹. 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 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 regarding actions that would adversely affect EFH. An annual review of existing and new EFH information is conducted by NMFS or the NPFMC and the information provided for review during the annual SAFE process. The NPFMC conducts a complete review of all the EFH components of the FMP once every 5 years and amends the FMP as appropriate. Additionally, the NPFMC may use the FMP amendment cycle every three years to solicit proposals for HAPCs and/or conservation and enhancement measures to minimize the potential adverse effects of fishing. EFH and HAPCs are discussed further in the evidence section of supporting clause 12.9.

References:	
--------------------	--

Non-Conformance Number (if relevant)	NA
---	-----------

¹⁶⁹<http://www.alaskafisheries.noaa.gov/habitat/efh-review>

Supporting Clause 8.8

States and relevant groups from the fishing industry shall measure performance and encourage the development, implementation and use of selective, environmentally safe and cost effective gear, technologies and techniques that sufficiently selective as to minimize catch, waste and discards of non-target species - both fish and non-fish species and impacts on associated or dependent species. 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. Inconsistent methods, practices and gears shall be phased out accordingly.

FAO CCRF (1995) 7.2.2, 7.6.4, 7.6.9, 8.4.5, 8.5.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: BSAI crab fisheries are required to use gear and technologies that research has demonstrated are environmentally safe, cost effective and sufficiently selective to minimize catch, waste and discards of non-target species as well as the use of gear and practices that increase survival rates of escaping fish.				
Evidence: Use of highly selective pots to minimize unwanted catch of target species as well as the bycatch of non-target species, along with development of handling practice to minimize mortality of discarded catch, have been key aspects of the management of BSAI crab fisheries for a long time. All aspects of gear performance and discard mortality have been extensively researched. Pots and ring nets are the specified legal commercial gear in these fisheries. Various devices may be added to pots to minimize bycatch of non-target crabs and other species. Regulations specify escape mechanisms (escape rings or specified mesh panel webbings) to be incorporated in crab pots to allow female and sublegal male crabs to escape and various devices may be added to pots to prevent capture of other species. Regulations also require incorporation of biodegradable twine as an escape mechanism on all pots to terminate catching and holding ability of lost pots. Crabbers are also constructing pots with larger web on the panels to allow for female and juvenile crabs to exit the pot before the gear is hauled back. This results in significantly less bycatch of non-targeted species and a higher catch rate of legal sized target crabs. After rationalization, vessel numbers decreased which resulted in a slower paced fishery with decreased rates of lost fishing gear and allowing for longer soak times that increase escapement of undersized and female crabs. Longer seasons resulting from rationalization and the slower pace of the fishing has allow for improved fishing and handling methods to reduce mortality of all catch components. 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, crabs are dumped into totes or onto a sorting table. As the male crabs 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. More sophisticated				

systems using automated conveyor belts and sorting tables that minimize handling and return discarded catch to the sea rapidly have also been introduced.^{170 171}

On-board observers in all fisheries record discards and estimates of total discard mortality are included in total fishery removals. This has provided considerable incentive to minimize unwanted catch to the fullest extent possible. Their reports demonstrate catches are dominated by legal crab of the target species, with much smaller amounts of other species.¹⁷²

The National Environmental Policy Act (NEPA)¹⁷³ requires preparation of EISs for major federal actions significantly affecting the quality of the human environment. The NEPA EIS process provides checks and balances against changes to the environment that may impact ecosystems and natural processes. An EIS for the BSAI crab fisheries provides decision makers and the public with an evaluation of the environmental impacts of fishing.

Additional related information can be found in supporting clauses 8.5, 8.7 and throughout clause 12.

References:

Non-Conformance Number (if relevant)

NA

¹⁷⁰<http://www.wafro.com/imageuploads/file175.pdf>

¹⁷¹http://www.doc.nprb.org/web/09_prjs/917_Final%20report%20June%2020_2_.pdf

¹⁷²<http://www.adfg.alaska.gov/FedAidPDFs/FDS13-54.pdf>

¹⁷³<http://www.alaskafisheries.noaa.gov/sustainablefisheries/crab/eis/final/Chapter1.pdf>

Supporting Clause 8.9

Technologies, materials and operational methods or measures including, to the extent practicable, the development and use of selective, environmentally safe and cost effective fishing gear and techniques shall be applied to minimize the loss of fishing gear, the ghost fishing effects of lost or abandoned fishing gear, pollution and waste.

FAO CCRF (1995) 7.2.2, 8.4.6, 8.4.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Selective, environmentally safe and cost effective fishing gear and techniques have been developed and applied in BSAI crab fisheries to minimize the loss of gear and the ghost fishing effects of lost or abandoned gear, pollution and waste.

Evidence:

After rationalization of the BSAI crab fisheries, vessel numbers decreased which resulted in a slower paced fishery with decreased rates of lost fishing gear and allowing for longer soak times and more time for escapement of undersized and female crab. 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.

Alaska Administrative Code 39.145 requires escape mechanisms related to ghost fishing for shellfish and bottom-fish pots as follows:

- 1) Pot gear must include a sidewall, which may include the tunnel, that contains 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.¹⁷⁴

A five-year review of the crab rationalization management program, which includes a consideration of lost pots and ghost fishing, can be found on the footnote referenced in evidence for supporting clause 8.1.3.

References:

Non-Conformance Number (if relevant)

NA

¹⁷⁴<http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter039/section145.htm>

Supporting Clause 8.10

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 (1995) 8.5.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
<p>Summary Evidence: The intent of fishing selectivity and fishing impacts related regulations are not circumvented by technical devices in BSAI crab fisheries and information on new developments and requirements are made available to all fishers.</p>			
<p>Evidence: ADFG perform pot and vessel holding tank inspections prior to each fishing season. At-sea enforcement of all regulations is conducted by State Fish & Wildlife Troopers and the ADFG on-board observer program collects information that can be used for enforcement. There is no evidence to indicate any use of devices to circumvent the intent of gear regulations. Information on new gear developments and any related regulatory requirements are readily available to harvesters through professional associations and the licensing system.</p>			
References:			
Non-Conformance Number (if relevant)	NA		

Supporting Clause 8.11

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 (1995) 8.4.7, 12.11

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Assessment and scientific evaluation is carried out on the implications of habitat disturbance impact on the BSAI crab fisheries and ecosystems prior to the introduction of new fishing gear, methods and operations and the effects of any such introductions are monitored.				
Evidence: Any commercial-scale introduction of any new fishing method would necessarily undergo extensive prior evaluation and ongoing monitoring as well as meet existing regulatory requirements as described in evidence for supporting clauses 8.5, 8.7, 8.8, 8.9, 12.2 and 12.3.				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 8.12

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 (1995) 8.5.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence:				
<p>There has been extensive international cooperation/collaboration with respect to research focused on fishing gear selectivity, fishing methods and strategies as well as the dissemination of results and transfer of technology from such research.</p>				
Evidence:				
<p>Alaska has a long history of direct involvement in promoting all aspects of fisheries research internationally. The Alaska Sea Grant College Program has been sponsoring and coordinating the Lowell Wakefield Fisheries Symposium series since 1982, in partnership with ADFG, NMFS, and the NPFMC. These symposia provide a forum for information exchange in biology, management, economics, and processing of various fish species as well as crab. The series is internationally recognized for excellence and scope. The theme of the upcoming <i>31st Wakefield Symposium</i> is "Impacts of a Changing Environment on the Dynamics of High-latitude Fish and Fisheries", a subject of vital importance to Alaskan crab fisheries and their management. Proceedings of all symposia in the series can be found at the link included below in references.¹⁷⁵</p> <p>There have been several other international symposia focused on northern latitude crab species and their fisheries held in Alaska. Collectively, they provide a forum for wide international cooperation in fisheries research and dissemination of results on all facets of fishing methods.</p> <p>See evidence for supporting clause 8.1.3.</p>				
References:				
Non-Conformance Number (if relevant)				NA

¹⁷⁵<http://seagrants.uaf.edu/conferences/wakefield/proceedings.html>

Supporting Clause 8.13

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 (1995) 8.5.3/12.10

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: There has been extensive collaboration on 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 in the case of BSAI crab fisheries.				
Evidence: The subject of fishing gear selectivity, fishing methods and strategies as well as the behavior of target and non-target species to such gear has been studied extensively in the case of Alaskan crab fisheries. A separate annual SAFE report provides a comprehensive analysis of economic aspects of these fisheries. See evidence for supporting clause 5.1 and web links provided therein. Such publication ensures wide collaboration and standardization with respect to associated methodologies. A five-year review of the crab rationalization management program can be found at the web link provided ¹⁷⁶ .				
References:				
Non-Conformance Number (if relevant)			NA	

¹⁷⁶ <http://www.afsc.noaa.gov/REFM/Socioeconomics/PDFs/5YearRev1210.pdf>

Supporting Clause 8.14

Policies shall be developed for increasing stock populations and enhancing fishing opportunities through the use of artificial structures. 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 the safety of navigation are observed.

FAO CCRF (1995) 8.11.1, 8.11.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence:				
<p>State and federal management authorities have established policies for the use of artificial reefs and fish aggregation devices in the coastal waters of Alaska. However, no habitat modifications are undertaken for the purpose of enhancement of BSAI crab stocks. There is no evidence to suggest they have benefitted from ecosystem enhancement through the use of artificial structures and such is neither practical nor appropriate for these crab species. As such, supporting clause 8.14 is <u>not applicable</u>.</p>				
References:				
Non-Conformance Number (if relevant)			NA	

7.9 Fundamental Clause 9

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

FAO CCRF (1995) 8.1.7/8.1.10/8.2.4/8.4.5

No. Supporting clauses/sub-clauses	3
Supporting clauses applicable	3
Supporting clauses not applicable	0
Non Conformances	0

Supporting Clause 9.1

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 (1995) 8.1.7/8.4.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>

Summary Evidence:

Advanced education and training programs are readily available and required by fishers to enhance their skills and professional qualifications.

Evidence:

The North Pacific Fishing Vessel Owners association (NPFVO) provides a large and diverse training program that many of the professional crab fishing vessel crew members must pass. Training ranges from firefighting on a vessel, damage control, man-overboard, MARPOL, etc.¹⁷⁷ 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 Alaska Department of Labor & Workforce Development includes AVTEC-Alaska’s Institute of Technology. One of its main divisions is the Alaska Maritime Training Center. Its goal 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 approved training facility that 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

¹⁷⁷<http://www.npfvoa.org>

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.¹⁷⁸

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 in a wide variety of subjects.

The University of Alaska Sea Grant Marine Advisory Program (MAP) also provides education and training in a number of subjects relevant to the fishing industry. MAP also conducts the Alaska Young Fishermen’s Summit. Each session is an intense, 3-day course in all aspects of Alaska fisheries targeting young Alaskans from coastal communities. In addition, MAP provides training and technical assistance to fishermen and seafood processors in Western Alaska through courses and workshops developed in cooperation with local communities and CDQ groups.¹⁷⁹

The Alaska Marine Safety Education Association (AMSEA) provides marine safety training for commercial fishermen, subsistence and recreational boaters throughout Alaska and across the United States. AMSEA’s Fishing Vessel Drill Conductor Trainings are accepted by the U.S. Coast Guard and meet the training requirements for fishermen onboard commercial fishing vessels.¹⁸⁰

Additional information can be found at the links provided below.

References:

Non-Conformance Number (if relevant)

NA

¹⁷⁸<http://www.avtec.edu>

¹⁷⁹<http://seagrant.uaf.edu/map/fishbiz/index.php>

¹⁸⁰<http://amsea.org>

Supporting Clause 9.2

States, with the assistance of relevant international organizations, shall endeavor to ensure through education and training that all those engaged in fishing operations be given information on the most important provisions of the FAO CCRF (1995), as well as provisions of relevant international conventions and applicable environmental and other standards that are essential to ensure responsible fishing operations.

FAO CCRF (1995) 8.1.10

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: All those engaged in BSAI crab fishing operations are provided information on the most important provisions of the FAO CCRF (1995), as well as provisions of relevant international conventions and applicable environmental and other standards that are essential to ensure responsible fishing operations, as part of required education and training.				
Evidence: Alaska’s fisheries are fully compliant with the FAO Code of Conduct for Responsible Fisheries. All engaged in fishing operations undergo required training, as per evidence provided in supporting clause 9.1, and would, as a matter of course, become familiar with the code and other standards associated with responsible fishing operations. Related information can be found at the link provided below in references. ¹⁸¹				
References:				
Non-Conformance Number (if relevant)				NA

¹⁸¹<http://sustainability.alaskaseafood.org/fao>

Supporting Clause 9.3

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 (1995) 8.1.8

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: Records of all BSAI crab fishers are maintained as part of licence and permit programs which contain information on their service and qualifications, including certificates of competency.				
Evidence: The Restricted Access Management Program (RAM) ¹⁸² 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 RAM maintains lists of License Limitation Program (LLP) groundfish and crab licenses that are available online. ¹⁸³ 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. ¹⁸⁴ The RAM and the CFEC maintain on their websites all the fishermen records for which fishing permits are issued. Fisherman need the CFEC gear card and the RAM permit for IFQ. Related information can be found at the links provided below in references.				
References:				
Non-Conformance Number (if relevant)				NA

¹⁸²<http://www.fakr.noaa.gov/ram>

¹⁸³<http://www.fakr.noaa.gov/ram/llp.htm#list>

¹⁸⁴<http://www.cfec.state.ak.us>

Section E: Implementation, Monitoring and Control

7.10 Fundamental Clause 10

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 (1995) 7.1.7/7.7.3/7.6.2/8.1.1/8.1.4/8.2.1

FAO ECO (2009) 29.5

FAO Eco (2011) 36.6

No. Supporting clauses/sub-clauses	6
Supporting clauses applicable	2
Supporting clauses not applicable	4
Non Conformances	0

Supporting Clause 10.1

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. This could include relevant traditional, fisher or community approaches, provided their performance could be objectively verified.

FAO CCRF (1995) 7.1.7 Others 7.7.3/8.1.1

FAO Eco (2009) 29.5

FAO Eco (2011) 36.6

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

There is a collaborative effort emphasizing the at-sea enforcement between the USCG and the AWT. Under joint management there are both state and federal laws to enforce, and both state and federal agents actively conduct at-sea enforcement. The USCG is responsible for enforcing the main federal vessel regulations: this includes safety at sea, drug enforcement, vessel compliance with ESA and EFH requirements and assuring compliance of federal permits, observer coverage, licenses and VMS in the crab fisheries. AWT have vessels that conduct at-sea compliance with gear regulations, capable of hauling and confiscating crab pots, sample crab harvests at sea, assure sex and size requirements are met and assure that the vessels have all required state and federal licenses. Additionally AWT, along with ADFG area biologists and technicians, conduct vessel inspections dockside, conducting hold inspections and observing offloads of harvested crab for compliance.

Evidence:

There is a collaborative effort emphasizing the at-sea enforcement between the USCG and the AWT. Under joint management there are both state and federal laws to enforce, and both state and federal agents actively conduct at-sea enforcement. The USCG is responsible for enforcing the main federal vessel regulations: this includes safety at sea, drug enforcement, vessel compliance with ESA and EFH requirements and assuring compliance of federal permits, observer coverage, licenses and VMS in the crab fisheries. AWT have vessels that conduct at-sea compliance with gear regulations, capable of hauling and confiscating crab pots, sample

crab harvests at sea, assure sex and size requirements are met and assure that the vessels have all required state and federal licenses. Additionally AWT, along with ADFG area biologists and technicians, conduct vessel inspections dockside, conducting hold inspections and observing offloads of harvested crab for compliance. The entire crab harvests are conducted in Alaskan waters by American vessels. No foreign fleet is allowed to fish in the Alaska’s EEZ. Because the fishery was rationalized in 2005, most enforcement of IFQ/IPQ violations, as well as size, sex and season violations occur at offloading.

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). The U.S. Coast Guard (USCG) and NMFS Office of Law Enforcement (OLE) enforce Alaska fisheries laws and regulations, especially 50CFR679.

USCG

The U.S. Coast Guard (USCG) is the lead federal maritime law enforcement agency for enforcing national and international law on the high-seas, outer continental shelf and inward from the U.S. Exclusive Economic Zone (EEZ) to inland waters. The USCG also patrols US waters to reduce foreign poaching, and inspects fishing vessels for compliance with safety requirements.

Here is a brief summary of enforcement activities by the US Coastguard*:

Table 10 USCG CFVS Boardings and Violations BSAI Crab Fisheries (FY 2011-2016)

	2011	2012	2013	2014	2015	2016
Bristol Bay Red King Crab Boardings	14	20	12	16	14	9
Violations	1	5	7	3	0	0
St. Mathew Blue King Crab Boardings	2	2	4	0	0	0
Violations	0	0	0	0	0	0
Tanner Crab, Bering Sea Snow Boardings	4	6	7	11	13	22
Violations	0	0	2	6	2	3
Tanner Crab, Bairdi Boardings	0	0	0	0	0	0
Violations	0	0	0	0	0	0
Aleutian Island Golden King Crab Boardings	0	1	3	0	4	3
Violations	0	0	0	0	0	1

Table 11 Causes for Violations

Year	Causes for violations
2011	Non-CG approved boarding ladder (1)(BBRKC)
2012	No Type IV PFD (2)(BBRKC) Logbook errors (2)(BBRKC) Failure to meet Observer coverage (1)(BBRKC)
2013	Logbook errors (4)(BBRKC) Prohibited species (2)(BBRKC) Observer violation (1)(BBRKC) Non-CG approved boarding ladder (2)(BSS)
2014	Failure to respond to LE assets on VHF-FM Ch.16 (1)(BBRKC) No lifering (1)(BBRKC) Unserviceable Type IV PFD (1)(BBRKC) CFVS violations (2)(BSS) Improper log keeping (1)(BSS) Failure to provide discard information to processor (1)(BSS) Expired inspection of firefighting system (1)(BSS) Failure to maintain catch log for required time period (1)(BSS)
2015	Lack of proper marking on liferings (1)(BSS) Unserviceable liferings (1)(BSS)
2016	Expired hydrostatic release for EPIRB (1)(BSS) Expired flares (1)(BSS) Certificate of Documentation not onboard (1)(BSS) Failure to monitor VHF-FM Ch. 16 (1)(GKC)

* Source: LCDR Corrie Sergent
Domestic Fisheries Section
Office of Response & Enforcement (DRE)
Coast Guard District Seventeen

NOAA OLE

NOAA Office of Law Enforcement Special Agents and Enforcement Officers perform a variety of tasks associated with the protection and conservation of the nation's living marine resources. In order to enforce these laws, OLE special agents and enforcement officers use OLE patrol vessels to board vessels fishing at sea, and conduct additional patrols on land, in the air and at sea in conjunction with other local, state and Federal agencies. OLE has responsibility for enforcement of the crab rationalization program. In addition, OLE's officers inspect and cross check at landings and processors records for reconciliation, and closely monitor Prohibited Species Catch in non-crab fisheries.

OLE Special Agents and Enforcement Officers conduct complex criminal and civil investigations, board vessels fishing at sea, inspect fish processing plants, review sales of wildlife products on the internet and conduct patrols on land, in the air and at sea. NOAA Agents and Officers can assess civil penalties directly to the violator in the form of Summary Settlements (SS) or can refer the case to NOAA's Office of General Counsel for Enforcement and Litigation (GCEL).

Brief Summary of NOAA OLE Enforcement Activities in 2016*

In general, compliance has been very good. On the federal side, the most common violations are exceeding an IFQ and there are only 1 or 2 each year. The amounts are minor and the fines have been the value of the overage. Other violations consist of late or incomplete submission of Economic Data Reports or exceeding the processing limits. In other words, most violations are technical or at least not directly tied to management of the resource.

The only federal violations that may directly impact the resource have been isolated instances of unreported crab. In the 10+ years of crab rationalization, there have been approximately 3 or 4 instances. One case involved crew taking home a dozen king crab to be mounted. Another case involved a crewman dumping crab deadloss overboard in the middle of the night; in that case, the receiving plant reported the violation immediately, and the crewman was fired before enforcement could respond. These examples illustrate the high level of compliance.

Below is a table of dockside boardings and violations from calendar year 2016. The "crab year" begins in August and ends in May so this table covers parts of two seasons.

Table 12 Dockside Boardings and violations from calendar year 2016

Date	Number of Boardings	Violations
JANUARY	3	None
FEBRUARY	1	None
MARCH	4	None
APRIL	5	None
MAY	1	None
JUNE	0	None
JULY	0	N/A
AUGUST	1	None
SEPTEMBER	0	N/A

OCTOBER	29	2 violations (logbook, opilio bycatch)
NOVEMBER	1	3 violations(1 captain's license, 2 crew licenses)
DECEMBER	Not available	N/A

These numbers do not include enforcement action such as Coast Guard aircraft patrols, the Alaska Trooper patrol vessel pulling pots to ensure legal configuration, or reviews of VMS or landings data.

* Source : Brent Pristas, Special Agent NOAA Fisheries Enforcement Kodiak, Alaska

AWT

The C Detachment of the Alaska Wildlife Troopers covers the Island of Kodiak, King Salmon, Dillingham, and the Aleutian Islands. Detachment headquarters is located in Kodiak and under the command by a Lieutenant, Sergeants in Dutch Harbor, King Salmon, and Kodiak assist with the overall supervision of this region. Posts within the region include: Dutch Harbor, Kodiak, Dillingham, King Salmon, Iliamna, and Cold Bay (Seasonal Posting)¹⁸⁵.

This detachment has enforcement responsibility for Commercial Fisheries in Salmon, Herring, Crab, and Ground fish. Overall, the AWT stated that the level of compliance is very high, and increasing, especially so after fishery rationalization (pers. comm., 24 May 2016, Lieutenant Jon Streifel, Deputy Commander, Alaska Wildlife Troopers, Southeast Alaska).

Description of AWT enforcement activities*

Enforcement focusses on dock side inspections of crab during offloads of product to processing facilities. In doing so, enforcement officers look for crab of the legal species, sex and size allowed by regulation and for the season being fished. Bycatch of crab and non-crab species is controlled by the tunnel dimensions of the pot which is required by regulation for the crab species being targeted. Bycatch of different crab species among targeted crab are reduced through the use of crab pots with specific tunnel eye opening dimensions where the crab crawl into the pots through. The size dimensions help keep other crab species from entering the pots due to the size of their carapaces. All crab is then sorted by the fishermen retaining the crab and any illegal or undersized crab and fish if caught, should be discarded alive at sea. Over many years of Enforcement’s inspection of crab pot gear on the fishing grounds, it is very uncommon to see by catch of non-crab species such as halibut or other finfish in an active fishing crab pot.

Enforcement inspects crab pot gear for Red, Tanner and Golden crab fisheries at sea and shore side to ensure compliance with established regulations. Enforcement looks for gear requirements such as escape mechanisms if the pot is lost, escape rings or mesh size for small immature crabs to filter out of the pots while they fish, legal Tunnel eye perimeter openings and identification markings on buoys of the vessel operating said gear. The Golden King Crab fishery operates using long lined pots and only five vessels actively fish this species. This gear can only be inspected on the fishing vessel’s operating the gear or shore side due to the way it is fished. With the extremely low number of active fishers in the Golden King Crab Fishery and the active engagement between vessel operators and State fishery managers, Enforcement receives or finds very few complaints of illegal fishing activity within the Golden King Crab fishery.

Overall, the general level of compliance in the crab fisheries of Bristol Bay, East Bering Sea and St. Mathew Island fisheries is moderate to high

¹⁸⁵ <http://dps.alaska.gov/AWT/detachments.aspx>

Table 13 IFQ Crab Boarding's 2012-2016

-
- **2012**
 - 112 Vessel Boardings
 - 9 Citations issued for the following offenses
 - Violation types – possession of illegal species Tanner crab/false statement on crew license/ possession of female Red King crab/fail to report personal use crab on fish ticket
 - **2013**
 - 71 Vessel Boardings
 - Violation Data for this year not attained
 - **2014**
 - 49 Vessel Boardings
 - 1 Citation issued for
 - Violation types –Possession of undersized Red king crab
 - **2015**
 - 63 Boardings
 - 17 State Citations issued
 - Violation type – Unlawful possession of Tanner Crab
 - **2016**
 - 13 Boardings
 - 3 State Citations issued
 - Undersized Golden King Crab/ Unlawful possession Tanner Crab
-

*Source: Lieutenant Jon Streifel
 Deputy Commander
 Alaska Wildlife Troopers
 Southwest Alaska
 Kodiak Post 99615

Crab Observer Program

Since 1988 ADFG has required varying levels of observer coverage aboard vessels participating in the BSAI crab fisheries. The ADFG Observer report for 2013/2014¹⁸⁶ 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.

¹⁸⁶ <http://www.sf.adfg.state.ak.us/FedAidPDFs/FDS14-49.pdf>

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 two conditions are met:

- the vessel is operating in any reporting area off Alaska; and,
- the vessel has crab pots or crab pots hauling equipment, or a crab pot launcher onboard;

References:

Non-Conformance Number (if relevant)

NA

Supporting Clause 10.2

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

FAO CCRF (1995) 7.6.2 Other 8.1.2, 8.2.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: All vessels harvesting BSAI crab must be authorized and permitted to fish, in accordance with federal regulations, 50CFR679. All crab vessels participating in the BSAI rationalized crab fishery must obtain a Federal Crab Vessel Permit (FCVP). 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				
Evidence: All vessels harvesting BSAI crab must be authorized and permitted to fish, in accordance with federal regulations, 50CFR679 ¹⁸⁷ . 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) ¹⁸⁸ . An annual FCVP is required for owners of any vessel used in the rationalized crab fisheries (CR crab, includes IFQ/IPQ fisheries; CDQ fisheries except Norton Sound king crab; and the golden king crab allocation to Adak). Operation Type endorsements are: SFP (Stationary Floating Processor); CPR (catcher-processor); and CAT (catcher vessel). This permit has requirements for VMS and logbook reporting. 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 ¹⁸⁹ . 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				
References:				
Non-Conformance Number (if relevant)				NA

¹⁸⁷ <https://alaskafisheries.noaa.gov/fisheries-679regs>

¹⁸⁸ https://alaskafisheries.noaa.gov/permits-licenses?field_fishery_pm_value=BSAI+Crab&=Apply

¹⁸⁹ https://alaskafisheries.noaa.gov/permits-licenses?field_fishery_pm_value=License+Limitation+Program+%28LLP%29#list

Supporting Clause 10.3

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 (1995) 8.1.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence: 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.				
References:				
Non-Conformance Number (if relevant)			NA	

Supporting Clause 10.3.1

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. In that respect, Port States shall also proceed, as necessary, to assist other States in achieving the objectives of the FAO CCRF (1995), and should make known to other States details of regulations and measures they have established for this purpose without discrimination for any vessel of any other State.

FAO CCRF (1995) 7.7.5/8.3.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence: 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.				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 10.4

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 (1995) 8.2.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence: 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.				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 10.4.1

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 (1995) 8.2.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence: 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.				
References:				
Non-Conformance Number (if relevant)				NA

7.11 Fundamental Clause 11

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

FAO CCRF (1995) 7.7.2/8.2.7

No. Supporting clauses/sub-clauses	3
Supporting clauses applicable	2
Supporting clauses not applicable	1
Non Conformances	0

Supporting Clause 11.1

National laws of adequate severity shall be in place that provide for effective sanctions.

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>

Summary Evidence:

The Magnuson-Stevens Act (MSA) provides four basic enforcement remedies for violations (50CFR600.740 Enforcement policy) as described in Evidence (below)

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. On March 16, 2011, NOAA issued a new Penalty Policy that provided guidance for the assessment of civil administrative penalties and permit sanctions under the statutes and regulations enforced by NOAA.

Evidence:

The Magnuson-Stevens Act (MSA) provides four basic enforcement remedies for violations (50CFR600.740 Enforcement policy)¹⁹⁰:

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.

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. On March 16, 2011, NOAA issued a new Penalty Policy that provided guidance for the assessment of civil administrative penalties and permit sanctions under the statutes and regulations enforced by NOAA.

¹⁹⁰ <https://www.law.cornell.edu/cfr/text/50/600.740>

In that Policy, the NOAA General Counsel’s Office committed to periodic review of the Penalty Policy to consider revisions or modifications as appropriate. The July 2014 revised version of the Penalty Policy is a result of that review. The purpose of the 2014 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.¹⁹¹

Under the new revised Policy, NOAA expects to continue to promote consistency at a national level, provide greater predictability for the regulated community and the public, maintain 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.

References:	
--------------------	--

Non-Conformance Number (if relevant)	NA
---	-----------

¹⁹¹ http://www.gc.noaa.gov/documents/Penalty%20Policy_FINAL_07012014_combo.pdf

Supporting Clause 11.2

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. Sanctions shall also 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 (1995) 7.7.2/8.1.9/8.2.7

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

The Magnuson-Stevens Act (50CFR600.740 Enforcement policy) provides four basic enforcement remedies for violations as described in Evidence (below). In some cases, the Magnuson-Stevens Act requires permit sanctions following the assessment of a civil penalty or the imposition of a criminal fine. The 2011 Policy for the Assessment of Civil Administrative Penalties and Permit Sanctions issued by NOAA Office of the General Counsel – Enforcement and Litigation, provides guidance for the assessment of civil administrative penalties and permit sanctions under the statutes and regulations enforced by NOAA.

Evidence:

The MSA provides four basic enforcement remedies for violations (50CFR600.740 Enforcement policy):

1. Issuance of a citation, 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.

In some cases, the MSA requires permit sanctions following the assessment of a civil penalty or the imposition of a criminal fine (Figure 27 **Magnuson Stevens Penalty Matrix**). In summary, 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.

NOAA’s OLE Agents and Officers can assess civil penalties directly to the violator in the form of Summary Settlements (SS) or can refer the case to NOAA's Office of General Counsel for Enforcement and Litigation (GCEL). GCEL can then assess a civil penalty in the form of a Notice of Permit Sanctions (NOPs) or Notice of Violation and Assessment (NOVAs), or they can refer the case to the U.S. Attorney's Office for criminal proceedings. For perpetual violators or those whose actions have severe impacts upon the resource criminal charges may range from severe monetary fines, boat seizures and/or imprisonment may be levied by the United States Attorney's Office.



Magnuson-Stevens Penalty Matrix

Harm to the Resource or Regulatory Program, Offense Level	Level of Intent			
	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*

Figure 27 Magnuson Stevens Penalty Matrix

There are very few repeat offenders. Sanctions include the possibility of temporary or permanent revocation of fishing privileges. Withdrawal or suspensions of authorizations to serve as masters or officers of a fishing vessel are also among the enforcement options. Within the USA EEZ, penalties can range up through forfeiture of the catch to forfeiture of the vessel, including financial penalties and prison sentences.

Finally, the cooperation of citizens and industry is cultivated through programs such as AWT's Fish & Wildlife Safeguard program, which encourages the reporting of violations, and "leverages" the range of enforcers

References:

Non-Conformance Number (if relevant)

NA

Supporting Clause 11.3

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.

FAO CCRF (1995) 8.2.7

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence:				
Evidence: 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.				
References:				
Non-Conformance Number (if relevant)				NA

Section F: Serious Impacts of the Fishery on the Ecosystem

7.12 Fundamental Clause 12

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 of the fishery on the ecosystem shall be appropriately assessed and effectively addressed.

FAO CCRF (1995) 7.2.3/8.4.7/8.4.8/12.11
 FAO ECO (2009) 29.3/31
 FAO Eco (2011) 41-41.4

No. Supporting clauses/sub-clauses	16
Supporting clauses applicable	16
Supporting clauses not applicable	0
Non Conformances	1

Supporting Clause 12.1

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 (1995) 7.2.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: There is an assessment of the impacts of environmental factors on target stocks and species belonging to the same ecosystem. Relationships among the populations in the ecosystem are assessed as well.				
Evidence: NPFMC and NMFS regularly assess the impacts of environmental factors on BSAI crab stocks (e.g. Crab SAFE; NPFMC 2016) and other species belonging to the same ecosystem (e.g. Groundfish SAFE ¹⁹²). Ecosystem assessments for BSAI crab fisheries are updated annually in the BSAI Crab SAFE. Additionally, the status of habitats and ecosystems are monitored within the broader framework of Alaska’s ecosystems ¹⁹³ and results are reviewed annually (Zador et al. 2015). Collectively, these ecosystem assessments consider target stocks, associated or dependent species, and the relationship among populations in the ecosystem. Related ecosystem research and monitoring initiatives are described in the section below as well.				
Ecosystem Crab SAFE				

¹⁹² <https://www.afsc.noaa.gov/REFM/stocks/assessments.htm>

¹⁹³ <https://access.afsc.noaa.gov/reem/ecoweb/>

The purpose and objectives of BSAI crab ecosystem assessment is elaborated in the Introduction to the Ecosystem Crab SAFE report (Chilton et al. 2011) as follows:

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.

The Ecosystem assessment portion of the Ecosystem Crab SAFE document considers how the physical and biological environment impacts on crab biology. Specifically, the authors reviewed environmental factors affecting recruitment, growth, maturity and natural mortality of king and Tanner crab.

NOAA

Scientists with the NOAA NMFS have conducted numerous studies and continue research on the impacts of acidification in the North Pacific Ocean upon crab (e.g. Long et al. 2013, 2016). A research plan has been developed by the Alaska Fisheries Science Center focusing on forecasting fish, shellfish and coral population responses to ocean acidification in the north Pacific Ocean and Bering Sea (Sigler et al. 2008).

FATE

NOAA also supports the Fisheries And The Environment (FATE) program¹⁹⁴ 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.

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 Ocean¹⁹⁵. 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 summarizes 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.

NPRB

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 needs¹⁹⁶. While the NPRB has invested millions of dollars on attaining this objective, they have also developed a special project 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

¹⁹⁴ <http://www.st.nmfs.noaa.gov/fate/>

¹⁹⁵ http://www.pices.int/publications/special_publications/NPESR/2005/npesr_2005.aspx

¹⁹⁶ <http://www.nprb.org/>

eastern Bering Sea Shelf, followed by two more years for analysis and reporting. Results from the project are being published in a series of special journal issues in Deep-Sea Research that are available on the NPRB website¹⁹⁷. Publications are aimed at sharing peer-reviewed project results across a broad audience and facilitating project integration and synthesis.

More recently, NPRB launched a Long-term Monitoring Program in 2013 with the goal of supporting new or existing time-series research that will enhance our ability to understand the current state of the marine ecosystem and predict ecosystem responses to changing ocean conditions. NPRB has committed an initial \$400,000 per year for five years to this effort (a total of \$2 million).

In addition, NPRB has initiated a comprehensive, ecosystem-level study (2010-2014) to examine the physical and biological mechanisms that determine survival of juvenile groundfishes in the Gulf of Alaska (2010-2014). A synthesis of program results was initiated in September 2015 and will continue through February 2018, building upon results of the field program to generate products with direct application to fisheries management.

ACIA

The Arctic Climate Impact Assessment (ACIA) is an international project of the Arctic Council and the International Arctic Science Committee (IASC) to evaluate and synthesize knowledge on climate variability, climate change, and increased ultraviolet radiation and their consequences¹⁹⁸. The results of the assessment were released at the ACIA International Scientific Symposium held in Reykjavik, Iceland in November 2004 (ACIA 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.

ACIA is itself a project of the Arctic Monitoring and Assessment Programme (AMAP) - an Arctic Council Working Group whose mission is to provide "reliable and sufficient information on the status of, and threats to, the Arctic environment, and providing scientific advice on actions to be taken in order to support Arctic governments in their efforts to take remedial and preventive actions relating to contaminants and adverse effects of climate change." AMAP's current work focusses on issues such as Arctic cryospheric change, Arctic Ocean acidification, and impacts of short-lived climate forcers (black carbon, tropospheric ozone and methane) on Arctic climate. The organization also includes socio-economic aspects in its assessment work, and to consider the integrated effects of multiple drivers of change. Relevant recent publications from AMAP include, among others, summary reports on ocean acidification (AMAP 2014) and mercury in the Arctic (AMAP 2011)

References:

NPFMC (2016) Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. 2016 Final Crab SAFE, North Pacific Fishery Management Council, September 2016. 899 p.
https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf

¹⁹⁷ <http://www.nprb.org/bering-sea-project/publications-reports/>

¹⁹⁸ <http://www.acia.uaf.edu>

ACIA (2004) Impacts of a Warming Arctic - by Arctic Climate Impact Assessment, pp. 144. ISBN 0521617782. Cambridge, UK: Cambridge University Press, December 2004.

<http://www.acia.uaf.edu/pages/scientific.html>

AMAP (2011) AMAP Assessment 2011: Mercury in the Arctic. AMAP, Oslo. 2011.

<http://www.amap.no/documents/doc/amap-assessment-2011-mercury-in-the-arctic/90>

AMAP (2014) Arctic Ocean Acidification 2013: An Overview. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. xi + 27 pp. ISBN 978-82-7971-083-7.

<http://www.amap.no/documents/doc/arctic-ocean-acidification-2013-an-overview/1061>

Beamish, R.J. and C. Mahnken. (1999) Taking the next step in fisheries management. Ecosystem approaches for fisheries management. Alaska Sea Grant College Program. AK-SG-99-01.

https://www.nwfsc.noaa.gov/assets/4/7954_09052014_130527_Beamish.and.Mahnken.1999.pdf

Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011.

http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf

Kruse, G.H., Livingston, P., Overland, J.E., Jamieson, G.S., McKinnell, S. and Perry, R.I. (eds.) (2006) Report of the PICES/NPRB Workshop on Integration of Ecological Indicators of the North Pacific with Emphasis on the Bering Sea. PICES Sci. Rep. No. 33, 109 pp.

https://www.pices.int/publications/scientific_reports/Report33/Rep_33.pdf

Long, W. C., K. M. Swiney, C. Harris, H. N. Page, and R. J. Foy. (2013) Effects of ocean acidification on juvenile red king crab (*Paralithodes camtschaticus*) and Tanner crab (*Chionoecetes bairdi*) growth, condition, calcification, and survival. PLoS ONE 8(4): e60959. doi:10.1371/journal.pone.0060959.

<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0060959>

Long, W.C., Van Sant, S.B., Swiney, K.M., R.J. Foy (2016) Decreased pH Changes Juvenile Blue King Crab Morphology and Decreases Growth and Survival. Alaska Marine Science Symposium, Anchorage, AK, Jan 2016 (2016 poster, .pdf, 1.16 MB) [Online](#).

Sigler, M. F., R. J. Foy, J. W. Short, M. Dalton, L. B. Eisner, T. P. Hurst, J. F. Morado, and R. P. Stone. (2008) Forecast fish, shellfish and coral population responses to ocean acidification in the north Pacific Ocean and Bering Sea: An ocean acidification research plan for the Alaska Fisheries Science Center. AFSC Processed Rep. 2008-07, 35 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 17109 Point Lena Loop Road, Juneau AK 99801

<https://www.afsc.noaa.gov/Publications/ProcRpt/PR2008-07.pdf>

Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p.

<https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf>

Non-Conformance Number (if relevant)	NA
---	-----------

Supporting Clause 12.2

Adverse environmental impacts on the resources from human activities shall be assessed and, where appropriate, corrected.

FAO CCRF (1995) 7.2.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>
			None <input checked="" type="checkbox"/>

Summary Evidence:

Adverse environmental impacts on BSAI crab resources from human activities are assessed and, where appropriate, corrected.

Evidence:

Adverse environmental impacts on BSAI crab resources from human activities are assessed. NPFMC and NMFS conduct regular assessments of crab ecosystems and habitats and investigate how environmental factors affect crab resources (e.g. Chilton et al. 2011, also see clause 12.3). Findings and conclusions are published in the Ecosystem section of the annual SAFE document (e.g. NPFMC 2016), annual Ecosystem Considerations documents (e.g. Zador 2015), and the various other research reports (e.g. Aydin et al. 2007, Marcello et al. 2012).

Currently, the best available science indicates that the largest impact resulting from human activities on BSAI crab resources, and more specifically, on the five stocks under consideration here, is fishing (an example from EBS Tanner crab is given in the table below). 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 (OFLs), acceptable biological catches (ABCs), annual catch limits (ACLs), and total allowable catches (TACs). These determinations and actions are all documented in the yearly crab SAFE report compiled by ADF&G, NMFS and NPFMC scientists (e.g. NPFMC 2016).

Table 14 Effects of Tanner crab fishery on ecosystem (from Stockhausen 2016)

Indicator	Observation	Interpretation	Evaluation
Fishery contribution to bycatch			
Prohibited species	salmon are unlikely to be trapped inside a pot when it is pulled, although halibut can be	unlikely to have substantial effects at the stock level	minimal to none
Forage (including herring, Atka mackerel, cod and pollock)	Forage fish are unlikely to be trapped inside a pot when it is pulled	unlikely to have substantial effects	minimal to none
HAPC biota	crab pots have a very small footprint on the bottom	unlikely to be having substantial effects post rationalization	minimal to none
Marine mammals and birds	crab pots are unlikely to attract birds given the depths at which they are fished	unlikely to have substantial effects	minimal to none
Sensitive non-target species	Non-targets are unlikely to be trapped in crab pot gear in substantial numbers	unlikely to have substantial effects	minimal to none
Fishery concentration in space and time	substantially reduced in time following rationalization of the fishery	unlikely to be having substantial effects	probably of little concern

Fishery effects on amount of large size target fish	Fishery selectively removes large males	May impact stock reproductive potential as large males can mate with a wider range of females	possible concern
Fishery contribution to discards and offal production	discarded crab suffer some mortality	May impact female spawning biomass and numbers recruiting to the fishery	possible concern
Fishery effects on age-at maturity and fecundity	None	unknown	possible concern

Where the potential for adverse environmental impacts on crab resources does arise, there is evidence that the Council considers and undertakes appropriate corrective measures. For example, effects on EFH caused by fishing activities such as trawling are routinely assessed and corrected (where possible). The last EFH review (NPFMC 2010) identified impacts of trawling on EFH habitat of red King Crab in Bristol Bay. These are being considered accordingly by the NPFMC (see clause 12.9). In addition, there is strong evidence that the Council and NMFS take measures to protect and conserve EFH and HAPCs through establishment of habitat protection areas and habitat conservation areas (also see clause 12.9).

More broadly, NEPA processes ensure that human activities with potential to impact BSAI crab resources are assessed and, where appropriate, corrected. 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. 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 resources under Council jurisdiction.

As discussed under clause 2.1, 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. Further details of the process can be found in The NEPA Book (Bass et al. 2001) and A Citizen’s Guide to NEPA (CEQ 2007).

References:	<p>Aydin, K., S. Gaichas, I. Ortiz, D. Kinzey, and N. Friday (2007) A comparison of the Bering Sea, Gulf of Alaska, and Aleutian Islands large marine ecosystems through food web modeling. NOAA Tech. Memo. NMFS-AFSC-178. 298 p. https://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-178.pdf</p> <p>Bass, R.E., A. I. Herson, and K. M. Bogdan (2001) The NEPA BOOK: A step-by-step guide on how to comply with the National Environmental Policy Act. 2001 (Second) Edition. Solano Press Books. ISBN 0-923956-67-0 http://www.solano.com/old_site_02/oldsite/bookinfo_nepa.htm</p>
--------------------	--

	<p>CEQ (2007) A Citizen’s Guide to the NEPA. Having Your Voice Heard. Council on Environmental Quality, Executive Office of the President. December 2007. 45 p. https://ceq.doe.gov/get-involved/citizens_guide_to_nepa.html</p> <p>Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011. http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf</p> <p>NPFMC (2010) Essential Fish Habitat (EFH) 5-year review for 2010: North Pacific Fishery Management Council, National Marine Fisheries Service Alaska Region. https://alaskafisheries.noaa.gov/sites/default/files/efh_5yr_review_sumrpt.pdf</p> <p>NPFMC (2016) Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. 2016 Final Crab SAFE, North Pacific Fishery Management Council, September 2016. 899 p. https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf</p> <p>Marcello, L.A., Mueter, F.J., Dawe, E.G., and Moriyasu, M. (2012) Effects of temperature and gadid predation on snow crab recruitment: comparisons between the Bering Sea and Atlantic Canada. Mar Ecol Prog Ser 469:249-261. http://www.int-res.com/articles/theme/m469p249.pdf</p> <p>Stockhausen, W.T. (2016) 2016 Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. Alaska Fisheries Science Center, 23 September 2016. In: NPFMC (2016) Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. 2016 Final Crab SAFE, North Pacific Fishery Management Council, September 2016. 899 p. https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf</p> <p>Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p. https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf</p>
<p>Non-Conformance Number (if relevant)</p>	<p>NA</p>

Supporting Clause 12.3

The most probable adverse impacts of the fishery on the ecosystem/environment shall be considered, taking into account available scientific information, and local knowledge. 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 shall be necessary to ascertain the adequacy of mitigation measures.

FAO Eco (2009) 30.4, 31, 31.4

FAO Eco (2011) 41.4

Evidence Rating :	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance :	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

The management system considers the most probable adverse impacts of BSAI crab fisheries on the ecosystem/environment, taking into account available scientific information and local knowledge. Where the risk of adverse impact of crab fisheries on the ecosystem or environment is greater, the Council seeks more specific evidence to support management action by, for example, identifying research priorities and coordinating research plans.

Evidence:

NPFMC, NMFS and ADF&G consider the most probable adverse impacts of BSAI crab fisheries. This information is updated annually in SAFE reports. Local knowledge about probable fishery impacts is incorporated into reviews/updates via the Council process, which is highly inclusive of input from stakeholders including fishermen and other members of coastal communities (see clause 1.7). However the Council relies heavily on the best available scientific information, as discussed below.

When there is potential for greater risk of adverse impact of crab fisheries on the ecosystem or environment, the Council seeks more specific evidence to support management action by identifying research priorities and coordinating on research plans. For example, Crab Ecosystem SAFE reports provide an opportunity to identify gaps in the data and future research priorities. The Crab Plan Team creates a list of crab specific research priorities on an annual basis that is forwarded to the North Pacific Fishery Management Council (NPFMC) for inclusion into a larger document. Several of these priorities have evolved into research projects funded by various entities including but not limited to AFSC and NMFS, the North Pacific Research Board (NPRB), the University of Alaska and other Universities (see clause 12.10). Crab specific research priorities are also developed at the annual December Interagency Crab Meeting held in Anchorage where a diverse number of research biologists from ADF&G, University of Alaska Fairbanks, University of Alaska Southeast, and AFSC present data from current projects and discuss potential collaborations (Webb and Woodby 2008). Currently, a number of crab ecosystem projects are being pursued which have developed from the research priorities discussed at these meetings.

As reported in the initial RFM assessment of Bering Sea king and snow crab (GTC 2012), Chilton et al. (2011) provide a good summary of available scientific information on the most probable adverse impacts of BSAI crab fisheries on the ecosystem/environment. The following sections are reproduced from Chilton et al. (2011) "Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species":

Ecosystem-based Management Indicators

This section of the CEI provides early signals of direct human effects on BSAI crab ecosystem components via directed fishery effects 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, we also review potential fishery effects on crab life history stages such as removal of legal sized males, age at maturity and reproduction.

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 (Fig. 15).

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 (Fig. 14), 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 (Fig. 14).

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 (see Management Enacted Efforts section).

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 nmi²) 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 (Table 1), 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 *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 suggest 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 successful 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 is not well understood and may vary by species and population.

References:

Barnard, D. R. (2008) Biodegradable twine report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 08-05, Anchorage.
<http://www.sf.adfg.state.ak.us/FedAidPDFs/fds08-05.pdf>

Barnard, D.R. and R. Burt (2007) Alaska Department of Fish and Game summary of the 2005/2006 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 07-02, Anchorage.
<http://www.adfg.alaska.gov/FedAidPDFs/fds07-02.pdf>

Barnard, D.R. and R. Burt (2008) Alaska Department of Fish and Game summary of the 2006/2007 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 08-17, Anchorage.
<http://www.adfg.alaska.gov/FedAidPDFs/fds08-17.pdf>

Bechtol, W.R., G. H. Kruse, J. Greenberg, and H. Geier (2010) Analysis of the Minimum Size Limit for Eastern Bering Sea Tanner Crab Fisheries: A Preliminary Report. North Pacific Fishery Management Council, Anchorage, AK.

Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011. http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf

Conan, G.Y. and M. Comeau (1986) Functional maturity and terminal molt of male snow crab, *chionoecetes opilio*. Canadian Journal of Fisheries and Aquatic Sciences 43:1710-1719. <http://www.nrcresearchpress.com/doi/abs/10.1139/f86-214#.WMhCS6LaviU>

Gaeuman, W. B. (2010) Summary of the 2008/2009 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 10-01, Anchorage. <http://www.adfg.alaska.gov/FedAidPDFs/FDS10-01.pdf>

Gravel, K. A., and D. Pengilly (2007) Investigations on reproductive potential of snow and Tanner crab females from the eastern Bering Sea in 2005. Alaska Department of Fish and Game, Fishery Data Series No. 07-23, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds07-23.pdf>

Hankin, D. G., T. H. Butler, P. W. Wild, and Q. L. Xue (1997) Does intense fishing on males impair mating success of female Dungeness crabs? Canadian Journal of Fisheries and Aquatic Sciences 54:655-669. <http://www.nrcresearchpress.com/toc/cjfas/54/3>

Lowry, L. F., K. H. Frost, and J. J. Burns (1980) Feeding of bearded seals in the Bering and Chukchi seas and trophic interaction with Pacific walrus. Arctic 33:330-342. <http://pubs.aina.ucalgary.ca/arctic/Arctic33-2-330.pdf>

McConnaughey, R. A., K.L. Mier, and C.B. Dew. 2000. An examination of chronic trawling effects on soft-bottom benthos of the eastern Bering Sea. ICES Journal of Marine Sciences 57(5):1377-1388. <https://academic.oup.com/icesjms/article/57/5/1377/660937/An-examination-of-chronic-trawling-effects-on-soft>

NMFS (2000) Endangered Species Act, Section 7 Consultations-Biological Assessments for Marine Mammal. National Marine Fisheries Service, Alaska Region. <https://alaskafisheries.noaa.gov/pr/biological-opinions/>

NMFS (2002) Endangered Species Act, Section 7 Consultations-Biological Assessments for Seabirds. National Marine Fisheries Service, Alaska Region. <https://alaskafisheries.noaa.gov/pr/biological-opinions/>

NMFS (2004) Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p. <https://alaskafisheries.noaa.gov/sites/default/files/analyses/crabeis0804-chapters.pdf>

NPFMC (1994) Environmental Assessment/Regulatory Impact Review for Amendment 21a to the Bering Sea/Aleutian Islands Groundfish Fishery Management Plan. North Pacific Fishery Management Council, Anchorage, AK. <https://www.npfmc.org/>

NPFMC (1995) Environmental Assessment/Regulatory Impact Review for Amendment 37 to the Bering Sea/Aleutian Islands Groundfish Fishery Management Plan. North Pacific Fishery Management Council, Anchorage, AK. <https://www.npfmc.org/>

NPFMC (2007) Environmental Assessment for Amendment 24. Overfishing definitions for Bering Sea and Aleutian Islands King and Tanner crab stocks. North Pacific Fishery Management Council, Anchorage, AK. <https://www.npfmc.org/>

NPFMC (2008) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, Anchorage, AK. <https://www.npfmc.org/>

NPFMC (2010) Crab bycatch in the Bering Sea/Aleutian Islands Fisheries. North Pacific Fishery Management Council, Anchorage, AK.
<http://www.npfmc.org/wp-content/PDFdocuments/bycatch/CrabBycatchPSC510.pdf>

Quandt, A. (1999) Assessment of fish trap damage on coral reefs around St. Thomas, USVI. Independent Project Report, UVI Spring 1999. p. 9.

Paul, J. M., and A. J. Paul (1990) Breeding success of sublegal size male red king crab *Paralithodes camtschatica* (Tilesius, 1815) (Decapoda, Lithodidae). Journal of Shellfish Research 9:29-32.

Paul, A. J., and J. M. Paul (1997) Breeding success of large male red king crab *Paralithodes camtschaticus* with multiparous mates. Journal of Shellfish Research 16:379-381.
<https://seagrant.uaf.edu/bookstore/pubs/RP/RP-98-02.html>

Paul, J.M., A.J. Paul, and A. Kimker (1994) Compensatory feeding capacity of 2 brachyuran crabs, Tanner and Dungeness, after starvation periods like those encountered in pots. Alaska Fishery Research Bulletin 1:184-187.
<http://www.sf.adfg.state.ak.us/fedaidpdfs/AFRB.01.2.184-187.pdf>

Rose, C.S., J.R. Gauvin, and C.F. Hammond (2010) Effective herding of flatfish by cables with minimal seafloor contact. Fishery Bulletin 108:136-144.
<http://aquaticcommons.org/8752/>

Rosenkranz, G.E. and M. Spafard (2010) Summary of observer data collected during the 2008/2009 Alaska weathervane scallop fishery. Alaska Department of Fish and Game, Fishery Data Series No. 10-97, Anchorage.

Sainte-Marie, B., T. Gosselin, J.M. Sevigny, and N. Urbani (2008) The snow crab mating system: Opportunity for natural and unnatural selection in a changing environment. Bulletin of Marine Science 83:131-161.

Sainte-Marie, B., S. Raymond, and J.C. Brethes (1995) Growth and maturation of the benthic stages of male snow crab, *Chionoecetes opilio* (Brachyura: Majidae). Canadian Journal of Fisheries and Aquatic Sciences 52:903-924.

http://www.nrcresearchpress.com/doi/abs/10.1139/f95-091#.WMg_qqLaviU

Sato, T., M. Ashidate, and S. Goshima (2005a) Negative effects of delayed mating on the reproductive success of female spiny king crab, *Paralithodes brevipes*. *Journal of Crustacean Biology* 25:105-109.

https://www.jstor.org/stable/1549932?seq=1#page_scan_tab_contents

Sato, T., M. Ashidate, S. Wada, and S. Goshima (2005b) Effects of male mating frequency and male size on ejaculate size and reproductive success of female spiny king crab *Paralithodes brevipes*. *Marine Ecology-Progress Series* 296:251-262.

<http://www.int-res.com/articles/meps2005/296/m296p251.pdf>

Sato, T., M. Ashidate, T. Jinbo, and S. Goshima (2006) Variation of sperm allocation with male size and recovery rate of sperm numbers in spiny king crab *Paralithodes brevipes*. *Marine Ecology-Progress Series* 312:189-199.

https://www.researchgate.net/publication/240809391_Variation_of_sperm_allocation_with_male_size_and_recovery_rate_of_sperm_numbers_in_spiny_king_crab_Paralithodes_brevipes

Sato, T., and S. Goshima (2006) Impacts of male-only fishing and sperm limitation in manipulated populations of an unfished crab, *Hapalogaster dentata*. *Marine Ecology-Progress Series* 313:193-204.

<http://www.int-res.com/articles/meps2006/313/m313p193.pdf>

Slater, L. M., K. A. MacTavish, and D. Pengilly (2010) Preliminary analysis of spermathecal load of primiparous snow crabs (*Chionoecetes opilio*) from the eastern Bering Sea, 2005-2008. In: G.H. Kruse, G.L. Eckert, R.J. Foy, R.N. Lipcius, B. Sainte-Marie, D.L. Stram, and D. Woodby (eds.), *Biology and management of exploited crab populations under climate change*. Alaska Sea Grant, University of Alaska Fairbanks. <https://seagrant.uaf.edu/bookstore/pubs/AK-SG-10-01.html>

Smith, B. D., and G. S. Jamieson. 1991. Possible consequences of intensive fishing for males on the mating opportunities of Dungeness crabs. *Transactions of the American Fisheries Society* 120:650-653.

[http://www.tandfonline.com/doi/abs/10.1577/1548-8659\(1991\)120%3C0650%3ANPCOIF%3E2.3.CO%3B2](http://www.tandfonline.com/doi/abs/10.1577/1548-8659(1991)120%3C0650%3ANPCOIF%3E2.3.CO%3B2)

Webb, J. and D. Woodby (2008) Long-term Alaska crab research priorities preliminary draft update, 2008. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 5J08-04, Juneau.

<http://www.sf.adfg.state.ak.us/FedAidPDFs/RIR.5J.2008.04.pdf>

Zheng, J. (2008) Temporal changes in size at maturity and their implications for fisheries management for eastern Bering Sea Tanner crab. *Journal of Northwest Atlantic Fishery Science* 41:137-149.

<http://journal.nafo.int/Volumes/Articles/ID/430/Temporal-Changes-in-Size-at-Maturity-and-Their-Implications-for-Fisheries-Management-for-Eastern-Bering-Sea-Tanner-Crab>

Zheng, J., and D. Pengilly (2011) Overview of proposed harvest strategy and minimum size limits for Bering Sea District Tanner crab. Alaska Department of Fish and Game, Special Publication No. 11-02, Anchorage.

<http://www.adfg.alaska.gov/fedaidpdfs/sp11-02.pdf>

Non-Conformance Number (if relevant)	NA
---	-----------

Supporting Clause 12.4

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. In this context, full recognition should be given to the special circumstances and requirements in developing countries and countries in transition, including financial and technical assistance, technology transfer, training and scientific cooperation.

FAO Eco (2009) 29.3, 29.4, 31

FAO Eco (2011) 41

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

The fishery management system addresses impacts that are likely to have serious consequences. Decisions regarding management responses always proceed from the best available scientific information. Management responses may be immediate (e.g. a Category 2 response taken by the State such as in-season adjustments) or they may be more protracted, following on further analysis of the identified risk (e.g. a Category 1 response such as a decision taken by the Council and NMFS to amend the Crab FMP).

Evidence:

The fishery management system addresses impacts that are likely to have serious consequences. NPFMC and NMFS conduct regular assessments of crab ecosystems and habitats and investigate how environmental factors affect crab resources (e.g. Chilton et al. 2011, also see clause 12.3). Findings and conclusions are published in the Ecosystem section of the annual SAFE document (e.g. NPFMC 2016), annual Ecosystem Considerations documents (e.g. Zador 2015), and the various other research reports.

As noted previously under clause 12.2, the impact which is most likely to be consequential to BSAI crab resources is fishing (reviewed in Chilton et al. 2011). The five stocks under consideration here are not being overfished nor are they in overfished conditions as under the specifications and definitions of overfished and overfishing conditions of the BSAI Crab FMP (NPFMC 2011, 2016). Directed crab fishing as well as crab bycatch in other fisheries such as the groundfish fisheries is assessed yearly and corrected appropriately through annual stock assessment activities, and through the formulation of overfishing levels (OFLs), acceptable biological catches (ABCs), annual catch limits (ACLs), and total allowable catches (TACs). These determinations and actions are all documented in the yearly crab SAFE report compiled by ADF&G, NMFS and NPFMC scientists (e.g. NPFMC 2016).

Notwithstanding the fishery-specific effects of a directed crab fishery on the target stock (as well as bycatch of crab in groundfish and scallop fisheries), there is little evidence to suggest that impacts from BSAI crab fisheries have serious consequences which are unmitigated. There is no catch of endangered, threatened or protected species and almost no indication of that BSAI crab fisheries interact with such ETP species (see clause 12.12). Bycatch of other species is minimal and comprised mainly of other crab species (see clause 12.11), 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 (NMFS 2004; see clause 12.13).

If, hypothetically, an impact were to arise that was likely to have serious consequences, management response could either take the form of 1) an immediate response or 2) further analysis of the identified risk. As described previously under clause 1.1, the BSAI King and Tanner Crab FMP is a “framework” plan, designed to allow for long-term management of the fishery without needing frequent amendments (NPFMC 2011). 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 FMPs are written and amended subject to MSA. Category 2 and 3 management measures are subject to Alaska State statutes and regulations¹⁹⁹. This arrangement provides a degree of flexibility. Management responses may be immediate, such as Category 2 responses by the State (e.g. in-season adjustments). Or management responses may involve further analysis of the identified risk(s), such as Category 1 responses by the Council and NMFS (e.g. a decision to amend the Crab FMP). By design, Category 1 response times are more protracted than Category 3 responses because Council processes involve scientific and stakeholder review. Regardless of whether actions are Categorized as 1, 2 or 3, however, decisions regarding the appropriate management response always proceed from review of the best available scientific information.

Note: the BSAI king and Tanner Crab fisheries are conducted exclusively within the U.S. EEZ of Alaska. As the crab fisheries under assessment are from the developed world, there is no reason to consider the stipulation in clause 12.4 which would recognize “special circumstances and requirements in developing countries and countries in transition.”

References:	<p>Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011. http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf</p> <p>Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV</p> <p>NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p. http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf</p> <p>NPFMC (2016) Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. 2016 Final Crab SAFE, North Pacific Fishery Management Council, September 2016. 899 p. https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf</p> <p>Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p. https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf</p>
--------------------	---

Non-Conformance Number (if relevant)	NA
---	-----------

¹⁹⁹ <http://www.adfg.alaska.gov/index.cfm?adfg=fishregulations.commercial>

Supporting Clause 12.5

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 (1995) 7.6.9
 FAO Eco (2009) 31.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

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

Evidence:

1. Measures to minimize catch, waste and discards of non-target species

The BSAI crab fisheries under consideration here have relatively low levels of catch of non-target species and are therefore often described as “clean” fisheries (C. Siddon, Marine Fisheries Scientist, ADF&G Division of Commercial Fisheries, pers. comm.). As noted under clause 12.6, the majority of non-target species taken in each of the five fisheries 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). The species composition of bycatch is discussed further under clause 12.6.

Appropriate conservation and management measures are applied to BSAI crab fisheries to minimize levels of catch, waste and discards of non-target species (crab, fish and non-fish species). Gear modifications are described in the Crab FMP (NPFMC 2011):

The FMP defers design specifications required for commercial crab pots and ring nets to the State. Pots and ring nets are the specified legal commercial gear for capturing crab in the BS/AI area (see Section 8.1.1). Multiple pots attached to a ground line are currently allowed by the State in the brown (golden) king crab fisheries. Various devices may be added to pots to prevent capture of other species; to minimize king crab bycatch, the State currently requires tunnel-eye heights to not exceed 3 inches in pots fishing for *C. bairdi* or *C. opilio* in the Bering Sea. Escape mechanisms may be incorporated or mesh size adjusted to allow female and sublegal male crab to escape; the State currently specifies escape rings or mesh panels in regulation for pots used in the BS/AI *C. bairdi*, *C. opilio*, and brown (golden) king crab fisheries, in the Bristol Bay king crab fishery, and in the Pribilof District king crab fishery. State regulations also currently require incorporation of biodegradable twine as an escape mechanism on all pots which will terminate a pot’s catching and holding ability in case the pot is lost.

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

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 ADF&G 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).

2. Measures to minimize impacts on associated, dependent or endangered species

As noted under clause 12.7, the crab stocks under consideration here are generally not viewed as key prey species. As such there is little evidence for adverse impacts of their removal upon associated or dependent species. Additionally, BSAI crab fisheries have very limited potential to impact upon endangered species (see clause 12.5.1 and 12.12). Therefore existing State and Federal measures to protect and recover endangered species, in accordance with provisions of the endangered species act and, as applicable, the marine mammal protection acts are appropriate for BSAI crab fisheries.

References:

Barnard, D. R. (2008) Biodegradable twine report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 08-05, Anchorage.
<http://www.sf.adfg.state.ak.us/FedAidPDFs/fds08-05.pdf>

Barnard, D.R. and R. Burt (2007) Alaska Department of Fish and Game summary of the 2005/2006 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 07-02, Anchorage.
<http://www.adfg.alaska.gov/FedAidPDFs/fds07-02.pdf>

Barnard, D.R. and R. Burt (2008) Alaska Department of Fish and Game summary of the 2006/2007 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 08-17, Anchorage.
<http://www.adfg.alaska.gov/FedAidPDFs/fds08-17.pdf>

Gaeuman, W. B. (2010) Summary of the 2008/2009 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 10-01, Anchorage.
<http://www.adfg.alaska.gov/FedAidPDFs/FDS10-01.pdf>

High, W. L., and D. D. Worlund (1979) Escape of king crab, *Paralithodes camtschatica*, from derelict pots. U.S. Dep. Commer., NOAA Tech. Rep. NMFS-SSRF-734, 11 p.

	<p>NMFS (2004) Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p. https://alaskafisheries.noaa.gov/sites/default/files/analyses/crabeis0804-chapters.pdf</p> <p>NPFMC (2007) Environmental Assessment for Amendment 24. Overfishing definitions for Bering Sea and Aleutian Islands King and Tanner crab stocks. North Pacific Fishery Management Council, Anchorage, AK. https://alaskafisheries.noaa.gov/sites/default/files/analyses/ktc24finalea0508.pdf</p> <p>Paul, J.M., A.J. Paul, and A. Kimker (1994) Compensatory feeding capacity of 2 brachyuran crabs, Tanner and Dungeness, after starvation periods like those encountered in pots. Alaska Fishery Research Bulletin 1:184-187. http://www.sf.adfg.state.ak.us/fedaidpdfs/AFRB.01.2.184-187.pdf</p>
<p>Non-Conformance Number (if relevant)</p>	<p>NA</p>

Supporting Clause 12.5.1

There shall be management objectives that seek to ensure that endangered species are protected from adverse impacts resulting from interactions with the unit of certification and any associated culture or enhancement activity, including recruitment overfishing or other impacts that are likely to be irreversible or very slowly reversible.

FAO ECO (2011) 41

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

There are explicit management objectives that seek to ensure that endangered species are protected from adverse impacts resulting from interactions with BSAI crab fisheries including recruitment overfishing or other impacts that are likely to be irreversible or very slowly reversible.

Evidence:

Management objectives exist which seek to ensure that endangered species are protected from adverse impacts resulting from interactions with BSAI crab fisheries. All U.S. fisheries management, including that of BSAI crab fisheries, must be consistent with the Magnuson-Stevens Act (MSA), the Marine Mammal Protection Act (MMPA)²⁰⁰, and the U.S. Endangered Species Act (ESA)²⁰¹. Each of these acts establishes management guidelines, objectives and legal protections for threatened and endangered species.

The purpose of the ESA²⁰² is to conserve threatened and endangered species and their ecosystems. There are more than 1,900 species listed under the ESA. A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is likely to become endangered in the future. The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) share responsibility for implementing the ESA. Within NOAA Fisheries, the Office of Protected Resources (OPR)²⁰³ has jurisdiction over 151 endangered and threatened marine species, from whales to sea turtles and salmon to Johnson’s sea grass.

The listing of a species as endangered makes it illegal to "take" (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to do these things) that species. Similar prohibitions usually extend to threatened species. Federal agencies may be allowed limited take of species through interagency consultations with NMFS or USFWS. Non-federal individuals, agencies, or organizations may have limited take through special permits with conservation plans. Effects to the listed species must be minimized and in some cases conservation efforts are required to offset the take. NMFS’ Office of Law Enforcement (OLE) works with the U.S. Coast Guard and other partners to enforce and prosecute ESA violations.

BSAI crab fisheries have only limited potential for interaction with endangered species of birds and marine mammals, and as such are generally not considered to have adverse impacts on endangered species. Chilton et al. (2011) summarize previous reviews of the subject:

²⁰⁰ <http://www.nmfs.noaa.gov/pr/laws/mmpa/>

²⁰¹ <https://www.fws.gov/endangered/laws-policies/>

²⁰² http://www.nmfs.noaa.gov/pr/pdfs/esa_factsheet.pdf

²⁰³ <http://www.nmfs.noaa.gov/pr/index.htm>

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.

Note: BSAI king and Tanner crab fisheries are not enhanced fisheries (see clause 13.1). Therefore considerations about “associated culture or enhancement activity” are not applicable.

References:

Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011.
http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf

NPFMC (1998) Fishery Management Plan for the Bering Sea/Aleutian Islands king and Tanner crabs. North Pacific Fishery Management Council, Anchorage, AK.
<https://www.npfmc.org/fishery-management-plan-team/bsai-crab-plan-team/>

NMFS (2000) Endangered Species Act, Section 7 Consultations-Biological Assessments for Marine Mammal. National Marine Fisheries Service, Alaska Region.
<https://alaskafisheries.noaa.gov/pr/biological-opinions/>

NMFS (2002) Endangered Species Act, Section 7 Consultations-Biological Assessments for Seabirds. National Marine Fisheries Service, Alaska Region.
<https://alaskafisheries.noaa.gov/pr/biological-opinions/>

NMFS (2004) Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p.
<https://alaskafisheries.noaa.gov/sites/default/files/analyses/crabeis0804-chapters.pdf>

Lowry, L. F., K. H. Frost, and J. J. Burns (1980) Feeding of bearded seals in the Bering and Chukchi seas and trophic interaction with Pacific walrus. Arctic 33:330-342.
<http://pubs.aina.ucalgary.ca/arctic/Arctic33-2-330.pdf>

Non-Conformance Number (if relevant)

NA

Supporting Clause 12.6

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, recruitment overfishing or other impacts that are likely to be irreversible or very slowly reversible; if such impacts arise, effective remedial action shall be taken.

FAO Eco (2009) 31.1

FAO Eco (2011) 41.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

An observer program is in place to monitor non-target catches, including discards, of stocks other than the stocks under consideration. Evidence indicates that BSAI crab fisheries considered here do not threaten non-target stocks with serious risk of extinction, recruitment overfishing or other impacts that are likely to be irreversible or very slowly reversible.

Evidence:

ADF&G has in place a mandatory observer program for BSAI crab fisheries (Schwenzfeier et al. 2012; also see clause 4.2). Non target catches, including discards, of stocks other than the “stock under consideration” are monitored. Each year ADF&G publishes a summary of the mandatory crab observer program database for the Bering Sea/Aleutian Islands commercial crab fisheries²⁰⁴. Representative bycatch data from the ADF&G summary reports are presented below for each of the crab fisheries under assessment.

²⁰⁴ Summaries available at: <http://www.adfg.alaska.gov/>

Table 15 Observer data from Gaeumon (2014) for Bristol Bay red king crab

Appendix C1.—Total contents of 657 pot lifts sampled during the 2013/14 Bristol Bay red king crab fishery.

Commercial crab species	Number	Other species	Number
Red King Crab		bigmouth sculpin	2
legal	17,538	Dover sole	1
sublegal	12,723	giant octopus	1
female	6,070	graceful decorator crab	2
Tanner Crab		great sculpin	29
legal	1,925	hermit crab unident.	6
sublegal	194	jellyfish unident.	334
female	62	mussel unident.	12
Snow Crab		Pacific cod	161
legal	9	Pacific halibut	27
sublegal	0	Pacific lyre crab	1
female	0	Pribilof whelk	1
Hair Crab		pygmy cancer crab	1
legal	86	rockfish unident.	1
sublegal	32	sculpin unident.	19
female	39	sea anemone unident.	13
		sea cucumber unident.	8
		snailfish unident.	1
		snail unident.	43
		sponge unident.	26
		starfish unident.	9
		tunicate unident.	13
		worm unident.	2
		yellowfin sole	251
		yellow Irish lord	3

Observer data from Gaeumon (2014) for Bristol Bay red king crab.

Appendix C9.—Total contents of 2,841 pot lifts sampled during the 2012/13 St. Matthew Island blue king crab fishery.

Commercial crab species	Number	Other species	Number	Other species	Number
Blue King Crab		Alaska plaice	1	Pacific lyre crab	7
legal	29,091	basket star	70	Pribilof neptune	135
sublegal	32,904	Bering flounder	1	sculpin unident.	315
female	12,827	bigmouth sculpin	34	sea anemone unident.	2
sex unknown	15	brittle star unident.	2	searcher	2
Snow Crab		circumboreal toad crab	1,381	sea urchin unident.	2
legal	749	flathead sole	6	skate unident.	10
sublegal	1,035	giant octopus	1	smooth lumpsucker	1
female	201	great sculpin	154	snailfish unident.	14
Tanner Crab		Greenland turbot	1	snail unident.	3,766
legal	11	hermit crab unident.	950	sponge unident.	2
sublegal	22	Hyas sp.	1	starfish unident.	180
female	5	hybrid C. opilio	0	tunicate unident.	2
Red King Crab		jellyfish unident.	64	walleye pollock	32
legal	2	Kamchatka flounder	1	yellowfin sole	51
sublegal	0	Pacific cod	1,115	yellow Irish lord	28
female	1	Pacific halibut	112		

Table 16 Observer data from Gaeumon (2013) for St. Matthew Island blue king crab

Appendix C5.—Total contents of 2,664 pot lifts sampled during the 2013/14 Bering Sea snow crab fishery.

Commercial crab species	Number	Other species	Number	Other species	Number
Snow crab		angled buccinum	1	sea anemone unident.	189
legal	860,855	arrowtooth flounder	2	sea urchin unident.	3
sublegal	10,898	Atka mackerel	1	sea whip unident.	3
female	11,389	basket star	148	sinuous whelk	6
sex unknown		bigmouth sculpin	1	skate unident.	6
Tanner Crab		Buccinum snail unident.	9	snail unident.	13,274
legal	32,582	circumboreal toad crab	1	spinyhead sculpin	1
sublegal	10,481	cockle unident.	1	sponge unident.	6
female	1,076	crab unident.	1	starfish unident.	17
sex unknown		flatfish unident.	1	walleye pollock	30
Tanner Crab unident.		flathead sole	1	worm unident.	2
male	1,169	giant octopus	43	yellowfin sole	6
female	2	great sculpin	3	yellow Irish lord	109
Hybrid Tanner Crab (legally <i>opilio</i> ^a)		Oregon triton	248		
legal	1,263	hermit crab unident.	123		
sublegal	0	jellyfish unident.	25		
female	37	ladder whelk	91		
Hybrid Tanner Crab (legally <i>bairdi</i> ^b)		lyre whelk	1		
legal	407	mussel unident.	2		
sublegal	57	Neptune snail unident.	27		
female	9	northern rockfish	1		
Red king Crab		octopus unident.	18		
legal	94	Pacific cod	682		
sublegal	0	Pacific halibut	77		
female	0	Pacific lyre crab	12		
Golden King Crab		Pribilof whelk	1038		
legal	0	prowfish	3		
sublegal	0	rex sole	1		
female	1	rockfish unident.	3		
		scale worm unident.	1		
		sculpin unident.	2		

^a Hybrid Tanner crab that are considered to be *C. opilio* by the criteria of 5 AAC 35.521.

^b Hybrid Tanner crab that are considered to be *C. bairdi* by the criteria of 5 AAC 35.521.

Table 17 Observer data from Gaeumon (2014) for EBS snow crab

Appendix C9.—Total contents of 267 pot lifts sampled during the 2013/14 Bering Sea Tanner crab fishery east of 166° W long.

Commercial crab species	Number	Other species	Number
Tanner Crab		Bering flounder	1
legal	13,108	brittle star unident.	4
sublegal	1,463	flathead sole	2
female	686	giant octopus	1
Red King Crab		graceful decorator crab	6
legal	142	great sculpin	6
sublegal	181	Oregon triton	11
female	1,100	hermit crab unident.	14
Snow Crab		jellyfish unident.	106
legal	164	Pacific cod	109
sublegal	9	Pacific halibut	3
female	0	Pacific lyre crab	10
Hybrid Tanner Crab		Pribilof whelk	4
(legally <i>bairdi</i> ^a)		sand dollar unident.	3
legal	7	scale worm unident.	1
sublegal	3	sea anemone unident.	1
female	0	sea cucumber unident.	1
Hybrid Tanner Crab		snail unident.	498
(legally <i>opilio</i> ^b)		sponge unident.	5
legal	1	starfish unident.	658
sublegal	0	yellowfin sole	84
female	0	yellow Irish lord	7
Hair Crab			
legal	9		
sublegal	0		
female	0		

^a Hybrid Tanner crab that are considered to be *C. bairdi* by the criteria of 5 AAC 35.521.

^b Hybrid Tanner crab that are considered to be *C. opilio* by the criteria of 5 AAC 35.521.

Table 18 Observer data from Gaeumon (2014) for Bering Sea Tanner crab east of 166° W long

Appendix C21.—Total pot lift contents for 499 pot lifts sampled during the 2013/14 Aleutian Islands golden king crab fishery east of 174° W long.

Commercial crab species	Number	Other species	Number	Other species	Number
Golden King Crab		Anthomastus sp.	3	Pacific cod	2
legal	17,923	arrowtooth flounder	2	Pacific halibut	16
sublegal	5,094	basket star	106	Pacific lyre crab	1
female	5,038	brittle star unident.	24	Pacific ocean perch	1
Scarlet King Crab		bryozoan unident.	30	Plexauridae unident.	2
legal	28	Calcigorgia sp.	3	Primnoidae Group I	64
sublegal	3	capelin	1	Primnoidae unident.	1
female	5	chiton unident.	2	red-tree coral	5
		Crypthelia sp.	5	sea anemone unident.	1
		Cup coral unident.	4	sea urchin unident.	9
		Cyclohelix sp.	9	shrimp unident.	1
		Distichopora sp.	3	skate unident.	2
		Errinopora sp.	6	snail unident.	23
		Fanellia sp.	3	soft coral unident.	3
		Flabellum sp.	3	sponge unident.	84
		flatfish unident.	3	starfish unident.	23
		hydroid unident.	18	stony coral unident.	1
		jellyfish unident.	2	Stylaster sp.	54
		Kamchatka coral	12		

Table 19 Observer data from Gaeumon (2014) for Aleutian Islands golden king crab east of 174° W long

Appendix C25.– Total pot lift contents for 1,223 pot lifts sampled during the 2013/14 Aleutian Islands golden king crab fishery west of 174° W long.

Commercial crab species	Number	Other species	Number	Other species	Number
Golden King Crab		Alaskagorgia aleutiana	2	Pacific halibut	8
legal	20,393	amphipod unident.	2	Pacific lyre crab	1
sublegal	9,528	Anthomastus sp.	20	Plexauridae unident.	55
female	8,165	Arthrogorgia sp.	35	Primnoidae Group I	226
Red King Crab		Atka mackerel	1	Primnoidae unident.	1
legal	11	bamboo coral	1	red-tree coral	11
sublegal	2	Bamboo coral unident.	1	rockfish unident.	6
female	1	basket star	159	sand dollar unident.	1
Scarlet King Crab		bigmouth sculpin	1	scaled crab	1
legal	9	bivalve unident.	1	scale worm unident.	9
sublegal	0	brittle star unident.	1,047	scallop unident.	7
female	0	bryozoan unident.	241	sculpin unident.	6
		Calcigorgia sp.	40	sea anemone unident.	12
		chiton unident.	21	sea cucumber unident.	2
		Clavularia sp.	19	sea lily unident.	14
		Coral unident.	2	sea whip unident.	1
		Crypthelia sp.	14	sea pen unident.	11
		Cup coral unident.	21	sea raspberry	2
		Cyclohelix sp.	20	sea spider unident.	15
		Distichopora sp.	43	sea urchin unident.	54
		Errinopora sp.	15	sea whip unident.	2
		Fanellia sp.	67	shortspine thornyhead	1
		flatfish unident.	4	shrimp unident.	4
		giant octopus	8	skate unident.	9
		Greenland turbot	4	snail unident.	44
		Oregon triton	13	soft coral unident.	14
		hermit crab unident.	2	sponge unident.	428
		hydroid unident.	365	starfish unident.	96
		invertebrate unident.	13	stony coral unident.	13
		jellyfish unident.	1	Stylaster sp.	190
		Kamchatka coral	10	tube worm unident.	27
		mussel unident.	4	tunicate unident.	11
		octopus unident.	4	worm unident.	140
		Pacific cod	1		

Table 20 Observer data from Gaeumon (2014) for Aleutian Islands golden king crab west of 174° W long

Pot gear used to fish for crab in the BSAI appears to be relatively selective. The majority of bycatch species in each of the five fisheries under assessment are mostly crab. 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; Gaeumon 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).

Available evidence from bycatch monitoring indicates that BSAI crab fisheries do not threaten non-target stocks with serious risk of extinction.

<p>References:</p>	<p>Barnard, D.R. and R. Burt (2007) Alaska Department of Fish and Game summary of the 2005/2006 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 07-02, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fds07-02.pdf</p> <p>Barnard, D.R. and R. Burt (2008) Alaska Department of Fish and Game summary of the 2006/2007 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 08-17, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fds08-17.pdf</p> <p>Gaeuman, W. B. (2010) Summary of the 2008/2009 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 10-01, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/FDS10-01.pdf</p> <p>Gaeuman, W. B. (2013) Summary of the 2012/2013 mandatory crab observer program database for the Bering Sea/Aleutian Islands commercial crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 13-54, Anchorage. http://www.adfg.alaska.gov/fedaidpdfs/fds13-54.pdf</p> <p>Gaeuman, W. B. (2014) Summary of the 2013/2014 mandatory crab observer program database for the Bering Sea/Aleutian Islands commercial crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 14-49, Anchorage. http://www.adfg.alaska.gov/fedaidpdfs/fds14-49.pdf</p> <p>NMFS (2004) Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p. https://alaskafisheries.noaa.gov/sites/default/files/analyses/crabeis0804-chapters.pdf</p> <p>Schwenzfeirer, M., M. Salmon, E. Evans, E. Henry, and L. Ward (2012) Annual report of the onboard observer program for the Bering Sea and Aleutian Islands crab fisheries, 2011/2011. Pages 195-251 [In] Fitch, H., M. Schwenzfeirer, B. Baechler, T. Hartill, M. Salmon, M. Deiman, E. Evans, E. Henry, L. Wald, J. Shaishnikoff, K. Herring, and J. Wilson (2012) Annual management report for the commercial and subsistence shellfish fisheries of the Aleutian Islands, Bering Sea and the Westward Region’s Shellfish Observer Program, 2010/11. Alaska Department of Fish and Game, Fishery Management Report No. 12-22, Anchorage. http://www.adfg.alaska.gov/fedaidpdfs/fmr12-22.pdf</p>
<p>Non-Conformance Number (if relevant)</p>	<p>NA</p>

Supporting Clause 12.7

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 objectives and measures shall be in place to avoid severe adverse impacts on dependent predators.

FAO Eco (2009) 31.2

FAO Eco (2011) 41.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

The role of BSAI crab stocks in the food web is adequately considered. King and Tanner crab stocks under assessment are not considered key prey species in BSAI ecosystems.

Evidence:

The role of BSAI crab stocks in the food web has been studied in detail. None of the five BSAI crab species within the unit of certification (red king crab, blue king crab, golden king crab, snow crab, Tanner crab) are typically considered ‘key’ prey species within their ecosystems. Relatively few species have been identified as predators of legal-sized male crab although specific information is limited due to the difficulty of identifying prey items to the species level with only partial carapace or dactyl pieces. For those predators that are known to prey upon the crab species under consideration here, there is no indication of a dependent trophic relation.

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. Pacific cod and large sculpins prey on adult king, Tanner and snow crab (NPFMC 2003, Aydin et al. 2007) but adult crab are relatively invulnerable to predation except after molting when they are in a soft shell state (Blau 1986, Livingston 1989, Loher et al. 1998).

According to Chilton et al. (2011), records of predation on golden and blue king crab are rare. The Resource Ecology and Ecosystem Modeling Program at AFSC collected stomachs on the EBS bottom trawl survey from over 100 species, yet BKC were found only in Pacific cod, walleye pollock and yellowfin sole stomachs. From 1981 to 2005, 5 Pacific cod, 27 walleye pollock and 8 yellowfin sole contained BKC prey from a total of 13,831 stomach samples with Pacific cod having the largest amount of BKC by weight (AFSC, REEM food habits database). One golden king crab was found in a white-blotched skate (*Bathyraja maculata*) stomach from the 612 samples collected from along the Kuril Islands and southeast Kamchatka during 1996 (Orlov 1998). Simenstad et al. (1977) assessed the AI marine food web in the vicinity of Amchitka Island and reported 6 instances of GKC and RKC in 69 halibut stomachs examined from inshore areas.

The Crab Ecosystem SAFE (Chilton et al. 2011) summarizes the contribution of directed BSAI crab fisheries to competitor and predator mortality of marine mammals, ESA listed species and seabirds:

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.

Available evidence indicates that BSAI crabs stocks are not key prey species whose removal adversely impacts on dependent predators. In additional, ongoing programs for monitoring of outcome indicators ensure that adverse impacts to dependent predators do not arise.

References:

Cilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011.

http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf

Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p.

<https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf>

Orlov (1998) The diets and feeding habits of some deep-water skates (Rajidae) in the Pacific waters off the Northern Kuril Islands and Southeastern Kamchatka. Alaska Fishery Research Bulletin. 5(1): 1-17.

<https://www.adfg.state.ak.us/static/home/library/PDFs/afrb/orlov5n1.pdf>

Simenstad, C.A., J.S. Isakson, and R.E. Nakatani. 1977. Marine fish communities of Amchitka Island, AK, pp. 451-492. In M. L. Merritt and R. G. Fuller (eds.), The Environment of Amchitka Island, Alaska. U.S. ERDA, TID-26712.

Aydin, K., S. Gaichas, I. Ortiz, D. Kinzey, and N. Friday. 2007. A comparison of the Bering Sea, Gulf of Alaska, and Aleutian Islands large marine ecosystems through food web modeling. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-178, 298p.

<https://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-178.pdf>

Blau, S.F. 1986. Recent declines of red king crab (*Paralithodes camtschatica*) populations and reproductive conditions around the Kodiak Archipelago, Alaska, pp 360-369. In G. S. Jamieson and N. Bourne (eds.), North Pacific Workshop on stock assessment and management of invertebrates. Canadian Special Publication of Fisheries and Aquatic Sciences 92.

Livingston, P.A. 1989. Interannual trends in Pacific cod, *Gadus macrocephalus*, predation on three commercially important crab species in the eastern Bering Sea. Fishery Bulletin 87: 807-827. <http://fishbull.noaa.gov/874/livingston.pdf>

Loher, T., P.S. Hill, G. Harrington, and E. Cassano. 1998. "Management of Bristol Bay red king crab: a critical intersections approach to fisheries management." Reviews in Fisheries Science 6(3):169-251.

	http://www.tandfonline.com/doi/abs/10.1080/10641269891314285	
Non-Conformance Number (if relevant)	NA	

Supporting Clause 12.8

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 thereto (MARPOL 73/78).

FAO CCRF (1995) 8.7.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Laws and regulations based on the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) are in place and enforced.

Evidence:

The "International Convention for the Prevention of Pollution From Ships" or MARPOL is one of the most important treaties regulating pollution from ships (MARPOL is short for Marine-Pollution). The current convention consists of the 1973 convention (year of signing) as modified in the 1978 protocol, hence it is referred to as MARPOL 73/78.

Six Annexes of the Convention cover the various sources of pollution from ships and provide an overarching framework for international objectives. Currently, the U.S. is signatory to Annexes I, II, III, V and VI. Annexes I, II, V and VI have been incorporated into U.S. law by the Act to Prevent Pollution from Ships (APPS) and implemented within 33 USC 1901 and 33 CFR 151²⁰⁵. The U.S. incorporates Annex III by the Hazardous Materials Transportation Act (HMTA) implemented within 46 USC 2101 and 49 CFR 171 -174 and 176. Although the U.S. has not ratified Annex IV, the U.S. has equivalent regulations for the treatment and discharge standards of shipboard sewage – the Federal Water Pollution Control Act (FWPCA) as amended by the Clean Water Act and implemented by 33 USC 1251 and 33 CFR 159²⁰⁶.

Under the provisions of the MARPOL Convention, the United States can take direct enforcement action under U.S. laws against foreign-flagged ships when pollution discharge incidents occur within U.S. jurisdiction. When incidents occur outside U.S. jurisdiction or jurisdiction cannot be determined, the United States refers cases to flag states, in accordance with MARPOL. These procedures require substantial coordination between the Coast Guard, the State Department, and other flag states, and the response rate from flag states has been poor. Different regulations apply to vessels, depending on the individual state.

The United States has long been aggressively enforcing compliance with the MARPOL (Grasso and Linsin 2011). Since the early 1990s, the effort has been directed at all types of registered and domestic tonnage – the full spectrum of waterborne commerce. Those entities and individuals prosecuted for MARPOL violations also span a wide spectrum of owners, operators, technical managers, masters, engineers, shoreside personnel and corporate officers.

Various state and federal agencies implement regulations that meet or surpass the MARPOL regulations, e.g. U.S. Coast Guard, U.S. EPA. Members of the Alaska fishing industry sit on the MARPOL advisory committee.

²⁰⁵ <https://www.law.cornell.edu/uscode/text/33/chapter-33>

²⁰⁶ <https://www.uscg.mil/hq/cgcvc/cvc/marpol.asp>

References:	Jeanne M. Grasso, J.M. and G. F. Linsin (2011) Current Trends in MARPOL Enforcement. MARPOL Enforcement in the United States. Maritime Professional. May, 2011. https://www.blankrome.com/index.cfm?contentID=37&itemID=2471	
Non-Conformance Number (if relevant)	NA	

Supporting Clause 12.9

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.

FAO Eco (2009) 31.3

FAO Eco (2011) 41.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

In accordance with requirements of the MSA, management agencies have knowledge of essential fish habitat (EFH) for the BSAI crab stocks under consideration. The potential for fishery impacts on EFH is assessed. Management systems ensure that fishery impacts on EFH and on habitats that are highly vulnerable to damage by the fishing gear are avoided, minimized or mitigated. In assessing fishery impacts, the full spatial range of the relevant habitat is considered.

Evidence:

EFH Provisions

Essential Fish Habitat (EFH) is defined in the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat: “waters” includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; “substrate” includes sediment, hard bottom structures underlying the waters, and associated biological communities; “necessary” means the habitat required to support a sustainable fishery and a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species’ full life cycle (see Crab FMP; NPFMC 2011). The MSA requires fishery management plans to describe and identify EFH, minimize to the extent practicable adverse effects of fishing on EFH, and identify other actions to conserve and enhance EFH (16 U.S.C. 1853(a)(7)). The NPFMC and NMFS identify and describe crab EFH in section the Fishery Management Plan for BSAI king and Tanner crab (NPFMC 2011).

Section 4.0 of the BSAI Crab FMP addresses MSA requirements in relation to the effects of fishing on EFH:

This section 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.

As noted in the initial RFM assessment of EBS king and snow crab (GTC 2012), the most recent EFH review process (2010) had identified concerns over trawl impacts to EFH for red king crab in southern Bristol Bay. The Council has followed up on this issue (see review in "Appendix 1: Summary of Council actions and motions on BBRKC since 2010" in: NPFMC 2017) as a separate matter from the forthcoming EFH review process which is described below.

HAPCs

The FMP for BSAI king and Tanner crab (NPFMC) contains detailed descriptions of EFH and habitat areas of particular concern (HAPCs). The crab FMP relates that:

The Council may designate specific sites as HAPCs and may develop management measures to protect habitat features within HAPCs. 50 CFR 600.815(a)(8) provides guidance to the Councils in identifying HAPCs. FMPs should identify specific types or areas of habitat within EFH as habitat areas of particular concern based on one or more of the following considerations:

- 1. the importance of the ecological function provided by the habitat;*
- 2. the extent to which the habitat is sensitive to human-induced environmental degradation;*
- 3. whether, and to what extent, development activities are, or will be, stressing the habitat type; or*
- 4. the rarity of the habitat type.*

Proposed HAPCs, identified on a map, must meet at least two of the four considerations established in 50 CFR 600.815(a)(8), and rarity of the habitat is a mandatory criterion. HAPCs may be developed to address identified problems for fishery management plans species, and they must meet clear, specific, adaptive management objectives.

The Council will initiate the HAPC process by setting priorities and issuing a request for HAPC proposals. Any member of the public may submit a HAPC proposal. HAPC proposals may be solicited every 5 years to coincide with the EFH 5-year review, or may be initiated at any time by the Council. The Council will establish a process to review the proposals. The Council may periodically review existing HAPCs for efficacy and considerations based on new scientific research.

The Council established the Aleutian Islands Habitat Conservation Area and the Aleutian Islands Coral Habitat Protection Areas to protect EFH from fishing threats. The Council also established two Habitat Areas of

Particular Concern (HAPCs) within crab EFH to protect those areas from fishing threats: the Alaska Seamount Protection Area and the Bowers Ridge Habitat Conservation Zone. Maps of these areas, as well as the coordinates, are provided in the crab FMP (NPFMC 2011). Descriptions are as follows:

Aleutian Islands Habitat Conservation Area

The use of non-pelagic trawl gear, as described in 50 CFR part 679, is prohibited year-round in the Aleutian Islands Habitat Conservation Area, except for the designated areas open to non-pelagic trawl gear fishing.

Aleutian Islands Coral Habitat Protection Areas

The use of bottom contact gear, as described in 50 CFR part 679, and anchoring by federally permitted fishing vessels is prohibited in Aleutian Islands Coral Habitat Protection Areas.

Alaska Seamount Habitat Protection Area

The use of bottom contact gear and anchoring by a federally permitted fishing vessel, as described in 50 CFR part 679, is prohibited in the Alaska Seamount Habitat Protection Area.

Bowers Ridge Habitat Conservation Zone

The use of mobile bottom contact gear, as described in 50 CFR part 679, is prohibited in the Bowers Ridge Habitat Conservation Zone.

The full spatial range of relevant habitats is considered in Council and NMFS processes for EFH assessment. For example, during the 2015 EFH 5-year Review the Council will evaluate EFH components in the six Council FMPs: Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI Groundfish); Groundfish of the Gulf of Alaska (GOA Groundfish); Bering Sea/Aleutian Islands King and Tanner Crab (BSAI Crab); Scallop Fishery off Alaska (Scallop); Salmon Fisheries in the EEZ off the Coast of Alaska (Salmon); and Fish Resources of the Arctic (Arctic). Thus, the Council has also established habitat conservation areas and habitat protection areas that extend beyond the geographic scope of the unit of certification (i.e. outside the Bering Sea and Aleutian Islands). Two examples are:

GOA Coral Habitat Protection Areas within GOA Coral HAPC

The GOA Coral Habitat Protection Areas are five specific areas within the larger GOA Coral HAPC. Maps of these areas, as well as their coordinates, are in Appendix A. The use of bottom contact gear and anchoring, as described in 50 CFR part 679, is prohibited in these areas.

GOA Slope Habitat Conservation Areas

The use of non-pelagic trawl gear in the GOA Slope Habitat Conservation Areas by any federally permitted fishing vessel, as described in 50 CFR part 679, is prohibited.

EFH Update and Review

The MSA (50 CFR 600.815 (a)(10)) requires that EFH information should be reported annually in the Stock Assessment Fishery Evaluation (SAFE) Reports. The SAFE reports for the Council's FMPs compile the most recent scientific assessment and research for groundfish, crab, and scallop managed species. This scientific information, and catch and survey data by species, are the current basis for EFH descriptions.

The Council and NMFS are further required by MSA (50 CFR 600.815 (a)(10)) to review the EFH components within each fishery management plan (FMP) every five years. The last EFH review was done in 2010 and another EFH review is currently underway. The approach that will be undertaken for the 2015 EFH 5-year review is outlined in NPFMC (2014). The objective of the review is to evaluate and synthesize new information

on habitat, determine whether changes to the FMPs are warranted, and present this evaluation in a summary report to the Council. The 2015 EFH 5-year Review is developing new analytical methods to describe EFH, updating the 2005 EFH Fishing Effects Model (see MacLean 2016), and investigating non-fishing effects on EFH. If the Council chooses to update its FMPs based on the report, for example to revise EFH descriptions or management measures, FMP amendments will subsequently be prepared, along with the appropriate analytical documents.

In 2010, NMFS published a Habitat Assessment Improvement Plan (HAIP; NMFS 2010), with the goal of better aligning stock assessment and habitat assessment. In order to further implement the HAIP, the 2015 EFH review will also prioritize stocks for habitat assessment.

Finally, the Council has synchronized the habitat areas of particular concern (HAPC) process with the EFH 5-year review. HAPCs are areas within EFH that may require additional protection from adverse effects. As identified in the Council's FMPs, HAPC proposals may be solicited every 5 years, in response to the Council identifying a habitat priority. It was the Council's intention to use the opportunity of the EFH review to fully vet habitat issues, and inform the HAPC designation process.

Ongoing EFH Research

There is a considerable amount of ongoing research effort aimed at improving understanding of EFH. AFSC, for example, recently summarized its EFH efforts during review and update of the NOAA EFH Research Plan (Sigler et al. 2012). Their review was based on the group's EFH research and stock assessment experience, the 2006 EFH research plan and four recent documents: 1) the NOAA Fisheries Habitat Assessment Improvement Plan, which identified approaches for improving habitat science (NMFS 2010); 2) the AFSC science plan, which identified habitat research priorities (AFSC 2010); 3) the North Pacific Fishery Management Council and NOAA Fisheries Alaska Region 5-year EFH review, which identified habitat research priorities and also summarized recent EFH research (NPFMC 2010); and 4) the proceedings of the 1st National Habitat Assessment Workshop (Blackhart 2010). As of 2009, 17 AFSC scientists within several different research programs were conducting EFH research (NMFS, 2010). During 2005-2009, NOAA Fisheries spent \$2.28 M on 49 EFH projects in Alaska (NPFMC 2010). Data from these and other projects were subsequently listed in a 2009 EFH inventory document for Alaska (McConnaughey et al. 2009). This research effort (number of habitat scientists, annual spending) has remained approximately level since then. In addition, during AFSC's review, the NOAA Fisheries Habitat Blueprint was advanced by NOAA Fisheries Assistant Administrator for Fisheries Eric Schwaab (Schwaab 2011).

NPFMC reviewed EFH in 2015 and found there had been a large advance in EFH information, in particular by substantially refining EFH maps for fish and crab species (Simpson et al. 2017). Refinements were obtained through an analysis to determine the environmental influences on species distributions and this information was used to improve EFH maps. These maps provide EFH Level 2 information (habitat-related densities) for the adult life stage for many FMP species and EFH Level 1 information (habitat distribution) for the juvenile life stages of some FMP species. These maps also provide a solid foundation for the next 5 years of EFH research. According to the most recent NPFMC review of EFH, during 2006-2016 NMFS had spent about \$5 M in total on 91 EFH projects in Alaska resulting in 74 scientific publications (NPFMC 2016).

More recently, NMFS has released a five-year plan for EFH research (Sigler et al. 2017). The new EFH research plan retains the original long-term goals that have guided EFH research in Alaska since 2005, namely: 1) characterize habitat utilization and productivity; 2) assess habitat sensitivity and recovery; 3) validate and improve fishing impacts model; 4) map the seafloor; and 5) assess coastal habitats facing development. However, the 2017 EFH plan recognizes two specific objectives that are to be achieved over the next 5 years: 1) Develop EFH Level 1 information (distribution) for life stages and areas where missing; and 2) Raise EFH

level from Level 1 or 2 (habitat-related densities) to Level 3 (habitat-related growth, reproduction, or survival rates).

References: AFSC (2010) NOAA Alaska Fisheries Science Center Science Plan. U.S. Dep. Commer., NOAA Alaska Fisheries Science Center. 20 p.
<https://www.afsc.noaa.gov/GeneralInfo/AFSCSciencePlanFINALJUNE12010.pdf>

Blackhart, K. (2010) Proceedings. 11th National Stock Assessment Workshop: Characterization of scientific uncertainty in assessments to improve determination of acceptable biological catches (ABCs); Joint Session of the National Stock and Habitat Assessment Workshops: Incorporating habitat information in stock assessments; and 1st National Habitat Assessment Workshop: Moving towards a national habitat science program. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-112. 153 p.
http://www.habitat.noaa.gov/pdf/NSAW_NHAW_Proceedings_final.pdf

GTC (2012) FAO-Based Responsible Fisheries Management Certification: Full Assessment and Certification Report For The U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries. Global Trust Certification.
http://www.alaskaseafood.org/wp-content/uploads/2016/03/FAO-RFM-AK_BSAI-King-and-Snow-Crab-Full-Assessment-and-Certification-Report_Public-Release_28_May_2012.pdf

McConnaughey, R. A., J. V. Olson, and M. F. Sigler (2009) Alaska Fisheries Science Center essential fish habitat data inventory. AFSC Processed Rep. 2009-01, 40 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. <https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV>

NPFMC (2010) Essential Fish Habitat (EFH) 5-year review for 2010: North Pacific Fishery Management Council, National Marine Fisheries Service Alaska Region.
https://alaskafisheries.noaa.gov/sites/default/files/efh_5yr_review_sumrpt.pdf

NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p.
<http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf>

NPFMC (2014) 2015 EFH 5-Year Review - Approach: Review and Revision of EFH Components within the Council's Fishery Management Plans, and Prioritization of Stocks for Habitat Assessment. D2 EFH 5 year Approach, April 2014. 6 p.
<https://www.npfmc.org/habitat-protections/essential-fish-habitat-efh/>

NPFMC (2017) Bristol Bay Red King Crab PSC discussion paper, January 2017. D1 BBRKC PSC Discussion Paper. February 2017, 21 p.
http://legistar2.granicus.com/npfmc/meetings/2017/1/951_A_North_Pacific_Council_17-01-30_Meeting_Agenda.pdf

NMFS (2004) Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p.

	<p>https://alaskafisheries.noaa.gov/sites/default/files/analyses/crabeis0804-chapters.pdf</p> <p>NMFS (2005) Final EIS for Essential Fish Habitat Identification and Conservation in Alaska - April 2005. https://alaskafisheries.noaa.gov/habitat/efh-eis2005</p> <p>NMFS (2010) Marine fisheries habitat assessment improvement plan. Report of the National Marine Fisheries Service Habitat Assessment Improvement Plan Team. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-108, 115 p. https://www.st.nmfs.noaa.gov/st4/documents/habitatAssessmentImprovementPlan_052110.PDF</p> <p>Schwaab, E. C. (2011) NOAA Fisheries Habitat Blueprint (Memo to NOAA Fisheries Leadership Council) 2 p. Silver Spring, MD. https://www.habitatblueprint.noaa.gov/</p> <p>Sigler, M. F., M. F. Cameron, M. P. Eagleton, C. H. Faunce, J. Heifetz, T. E. Helser, B. J. Laurel, M. R. Lindeberg, R. A. McConnaughey, C. H., Ryer, and T. K. Wilderbuer (2012) Alaska Essential Fish Habitat Research Plan: A research plan for the National Marine Fisheries Service's Alaska Fisheries Science Center and Alaska Regional Office. AFSC Processed Rep. 2012-06, 21 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 17109 Pt. Lena Loop Road, Juneau, AK 99801 http://www.afsc.noaa.gov/HEPR/docs/Sigler_et_al_2012_Alaska_Essential_Fish_Habitat_Research_Plan.pdf</p> <p>Sigler, M. F., M. P. Eagleton, T. E. Helser, J. V. Olson, J. L. Pirtle, C. N. Rooper, S. C. Simpson, and R. P. Stone (2017) Alaska Essential Fish Habitat Research Plan: A Research Plan for the National Marine Fisheries Service's Alaska Fisheries Science Center and Alaska Regional Office. AFSC Processed Rep.2015-05, 22 p. Alaska Fish. Sci. Cent., NOAA-NMFS. https://www.afsc.noaa.gov/Publications/ProcRpt/PR2017-05.pdf</p> <p>Simpson, S. C., Eagleton, M. P., Olson, J. V., Harrington, G. A., and Kelly, S.R. (2017) Final Essential Fish Habitat (EFH) 5-year Review, Summary Report: 2010 through 2015. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/AKR-15, 115p. ftp://ftp.library.noaa.gov/noaa_documents.lib/NMFS/TM_NMFS_AFKR/TM_NMFS_FAKR_15.pdf</p>	
<p>Non-Conformance Number (if relevant)</p>	<p>NA</p>	

Supporting Clause 12.10

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 (1995) 8.4.8/ 7.6.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

Management agencies actively promote research on the environmental and social impacts of fishing gear and, in particular, on the impact of such gear on biodiversity and coastal fishing communities.

Evidence:

The Council, AFSC and the NPRB all annually produce a list of research priorities^{207 208} 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. For BSAI crab fisheries, the Council has established an explicit “Research and Management Objective” in the crab FMP (NPFMC 2011) to provide fisheries research, data collection, and analysis to ensure a sound information base for management decisions. A number of different organizations are actively involved in relevant research on the environmental impacts of fishing gear on biodiversity, habitats and ecosystems, as previously described under clauses 3.2.4, 3.2.5 and 3.2.6, respectively.

With respect to promoting research on the social impacts of gear on coastal fishing communities, the Council and NMFS seek individual, community, NGO and fishing industry input on all regulatory or policy proposals and research proposals. By soliciting feedback on research and regulatory proposals from such a broad base of stakeholders, the Council is assured to include parties who many have concerns that industrial fisheries (such as BSAI king and Tanner crab) may have adverse environmental or social impacts. Because rural coastal Alaskan communities are frequently concerned about the activities of industrial fisheries, they often go directly to the Council and/or BOF with their concerns about potential or perceived social impacts. Also see clause 2.5 for further discussion of the assessment of social and cultural values of coastal resources.

NEPA processes (described under clause 2.1) also ensure that any proposed changes to existing FMP rules and policies are evaluated for impacts to coastal fishing communities. The Council sets out an economic and social management objective in the FMP for BSAI crab fisheries that seeks to maximize economic and social benefits to the nation over time (NPFMC 2011). Additionally, MSA National Standard 8 requires the Councils to minimize adverse economic impacts on coastal fishing communities (also see clause 2.1). If the potential for adverse social impacts from a proposal were unknown, appropriate research would have to be conducted before approvals could be issued.

Lastly, NOAA Fisheries has developed the Economic and Social Sciences Research (ESSR) Program²⁰⁹ within the Resource Ecology and Fisheries Management (REFM) division. The primary mission of ESSR is to provide economic and sociocultural information that will assist NMFS in meeting its stewardship responsibilities.

²⁰⁷ <https://www.npfmc.org/research-priorities/>

²⁰⁸ <https://www.afsc.noaa.gov/GeneralInfo/FINAL%20FY17%20AFSC%20AGM%20v3.pdf>

²⁰⁹ <http://www.afsc.noaa.gov/REFM/Socioeconomics/Default.php>

Among other things, ESSR conducts social science research such as: collecting economic and sociocultural data relevant for the conservation and management of living marine resources; and developing models to use that data both to monitor changes in economic and sociocultural indicators and to estimate the economic and sociocultural impacts of alternative management measures. Since coastal community members are important affected stakeholders, 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.

References:

Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended. <https://www.law.cornell.edu/uscode/text/16/chapter-38/subchapter-IV>

NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p. <http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf>

Non-Conformance Number (if relevant)

NA

Supporting Clause 12.11

There shall be outcome indicator(s) consistent with achieving management objectives for non-target stocks (i.e. avoiding overfishing and other impacts that are likely to be irreversible or very slowly reversible).

FAO ECO (2011) 41.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

There are outcome indicators for non-target stocks taken in the BSAI crab fisheries under assessment. These outcome indicators are consistent with achieving management objectives for non-target stocks (i.e. avoiding overfishing and other impacts that are likely to be irreversible or very slowly reversible).

Evidence:

There are outcome indicators for non-target stocks taken in the BSAI crab fisheries under assessment. These outcome indicators are consistent with achieving management objectives for non-target stocks (i.e. avoiding overfishing and other impacts that are likely to be irreversible or very slowly reversible).

Crab Bycatch (crab FMP species)

The largest component of bycatch in BSAI crab fisheries is crab (undersized, female, and non-target species; see clause 12.6). For those crab species falling within the scope of the BSAI king and Tanner crab FMP (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.; NPFMSC 2011), outcome indicators are explicitly incorporated into the Council’s five-tiered system for stock assessment. Non-target crab bycatch of FMP species in directed crab fisheries, as well as FMP 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 (OFLs), acceptable biological catches (ABCs), annual catch limits (ACLs), and total allowable catches (TACs). These determinations and actions are all documented in the yearly crab SAFE report compiled by ADF&G, NMFS and NPFMC scientists (e.g. NPFMC 2016). Annual trawl surveys (Daly et al. 2016) collect fishery-independent data on the distribution and abundance of crab, groundfish, and other benthic resources in the eastern Bering Sea. These data are used to estimate population abundances for the management of commercially important species in the region.

Finfish Bycatch

The ADF&G observer program collects data to monitor bycatch in BSAI crab fisheries (see clause 12.6). Fish including a number of crab predators, especially Pacific cod, halibut, yellowfin sole and sculpin account for the greatest proportion of estimated crab pot bycatch (NMFS 2004). These species are widely distributed and highly abundant representatives of the greater groundfish community. In the Final Environmental Impact Statement for BSAI crab fisheries, it was concluded that the effects on species caught as bycatch in the BSAI crab fisheries are insignificant (NMFS 2004).

Pacific cod is managed by NPFMC as a tier 3 stock in the Eastern Bering Sea (Thompson 2016), yellowfin sole is managed as a tier 1 stock in BSAI (Wilderbuer et al. 2016), and BSAI sculpin are managed by NPFMC as a species complex within tier 5 (Spies et al. 2016). As such, there are outcome indicators whose explicit aim is to avoid overfishing. Similarly, outcome indicators (reference points) exist for Pacific halibut, a species

managed by the International Pacific Halibut Commission (IPHC)²¹⁰. Halibut fisheries are closely monitored, heavily regulated, and the resource is currently considered to be healthy (IPHC 2016).

Invertebrate Bycatch (excluding crab FMP species)

Data on invertebrate bycatch are also collected in the ADF&G observer program (see clause 12.6). These data were reviewed by NFMS during preparation of the Final Environmental impact Statement for BSAI crab fisheries (2004). The following excerpt from the Final EIS discusses invertebrate bycatch:

Gastropods: Snails (including *Neptunea borealis*) were the second most common bycatch category after cod. An estimated 354,000 snails were taken as bycatch in BSAI crab fisheries in 2000. Various species of *Neptunea* were common occupants of recovered Bering Sea crab pots (B. Stevens, NOAA Fisheries Kodiak Lab, personal observation). This genus of snails is the most dominant in the middle and outer shelf areas of the southeast Bering Sea (Jewett and Feder 1981; as cited in NMFS 2001d, Section 3.6.1.1). There was historically a small, Japanese fishery for snails in the Bering Sea since 1971. A United States snail fishery began in 1992 and lasted less than a decade with a peak harvest in 1996 of 3.5 million pounds (lbs.) (worth over \$1 million U.S. dollars). Last commercial fishery for snails, with landings of 932,000 lbs., occurred in 1997 (ADF&G 2001).

Echinoderms: Within the BSAI almost 100,000 sea stars, 27,000 brittle stars, 7,000 basket stars and 4,000 sea urchins were estimated to be taken as bycatch during the 2000 BSAI crab fishing seasons. Sea stars were caught in all three crab fisheries but not identified to species. Those taken are most likely of the genera *Asterias*, *Pycnopodia* and/or *Gorgonocephalus*. In the southeast Bering Sea, king and snow crabs rank as the greatest component of total invertebrate epifaunal (animals that live on top of the sea floor) biomass. The sea star (*Asterias amurensis*) represents 12 percent of the biomass at bottom depths 40-100 m, replaced by basket stars (*Gorgonocephalus caryi*) representing 7 percent of total biomass at depths >100 m (Jewett and Feder 1981; as cited in NMFS 2003b). In northeastern Bering Sea, sea urchins and basket stars comprise 22 percent and 56 percent, respectively, of the invertebrate species at bottom depths >40 m (Jewett and Feder 1981; as cited in NMFS 2003b). Since these species represent such a large proportion of the benthic community, loss due to bycatch mortality in the crab fisheries would not be expected to effect their populations.

Non-FMP Crab: Other crab species caught as bycatch include, lyre crabs, hermit crabs and Korean hair crab (*Erimacrus isenbeckii*). Korean hair crab supported a very small dedicated commercial fishery north of the Pribilof Islands. The Korean hair crab bycatch in the Bering Sea amounted to the estimated catch from the 2000 Bering Sea hair crab fishery. This fishery was closed as of 2001 until there is evidence of hair crab recruitment. Information on distributions and abundances of lyre and hermit crab are lacking. Effects of crab pot bycatch are unknown at this time.

Other Invertebrates: Octopus (*Octopus dofleini*) were caught primarily in the Bering Sea snow crab fishery. Octopus are a crab predator and compete with crabs for prey. Since 1995, there has been a small fishery for octopus in the Bering Sea comprised of bycatch from various groundfish fisheries (ADF&G 2001). During 2000, there is still wastage of this resource; 40,000

²¹⁰ <http://www.iphc.int/about-iphc.html>

lbs. of octopus were discarded at sea compared to the 16,000 lbs. that were retained for fish meal and bait. The effect of octopus mortality due to crab pot bycatch is unknown.

Jellyfish and sea anemones would not be expected to sustain significant impacts from crab pot fishing. Biomass of jellyfish has increased tenfold in the Bering Sea in the past decade with greatest increase occurring over the mid-shelf domain, at 50-100 m depths (NMFS 2003b).

Sponge and corals are routinely hauled up with crab pots that fish deeper waters along the Aleutian Islands for golden king crab. An estimated 22,500 sponges were destroyed by crab pot fishing in 2000. It is assumed that these sessile organisms are not able to reattach to the substrate when returned to the water and thus will die. Destruction of sponge and corals may be crucial to some species of small benthic organisms including newly settled crabs as they provide valuable habitat structure and protection from predation. The ADF&G shellfish observer program has begun to collect coral bycatch data and species composition in the Aleutian Islands golden king crab fisheries to learn about amount caught as bycatch and the variety of coral species. ADF&G, in collaboration with NOAA Fisheries, is developing *A Field Guide to Alaskan Corals* (Wing and Barnard, in prep.) to enable data collection of corals caught in the golden king crab fishery. The extent of coral bycatch is presumed to be insignificant because the golden king crab fisheries occur in a small percentage of coral habitat.

Crab pot bycatch is deemed insignificant for any population of other benthic species routinely caught in the major eastern Bering Sea crab fisheries. Fishes including Pacific cod, yellowfin sole, Pacific halibut, sculpin, walleye pollock, other flatfish, and skates all have very high abundance relative to the level of estimated pot bycatch. Gastropods and echinoderms comprise a major portion of the total biomass of the eastern Bering Sea and small losses due to pot bycatch would have little significance. In some cases crab pot bycatch have become part of small dedicated fisheries as for snails, octopus, and Korean hair crab. Minor losses of other invertebrates are not estimable but assumed to be relatively insignificant. In addition, the minor amount of these species caught as bycatch does not result in declines in species diversity because it does not cause a decline in any species abundance. From this information, NOAA Fisheries concludes that status quo has an insignificant effect on the population levels of benthic species caught as bycatch.

References:

Daly, B. J., C. E. Armistead, and R. J. Foy. 2016. The 2016 eastern Bering Sea continental shelf bottom trawl survey: Results for commercial crab species. U.S. Dep. Commer., NOAA Tech. Memo. NMFS AFSC-327, 167 p. doi:10.7289/V5/TM-AFSC-327. <http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-327.pdf>

IPHC (2015) International Pacific Halibut Commission. Annual Report 2015. <http://www.iphc.int/publications/annual/ar2015.pdf>

NMFS (2004) Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p. <https://alaskafisheries.noaa.gov/sites/default/files/analyses/crabeis0804-chapters.pdf>

NPFMC (2011) Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p. <http://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf>

	<p>NPFMC (2016) Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. 2016 Final Crab SAFE, North Pacific Fishery Management Council, September 2016. 899 p. https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf</p> <p>Spies, I., Aydin, K., Dan Nichol, D., Palsson, W., Jerry Hoff, J., and T.T. TenBrink (2016) Chapter 19. Assessment of the sculpin stock complex in the Bering Sea and Aleutian Islands. NPFMC Bering Sea and Aleutian Islands SAFE. North Pacific Fishery Management Council. December, 2016. https://www.afsc.noaa.gov/REFM/Docs/2016/BSAIsculpin.pdf</p> <p>Thompson, G.G. (2016) Chapter 2: Assessment of the Pacific Cod Stock in the Eastern Bering Sea. NPFMC Bering Sea and Aleutian Islands SAFE. North Pacific Fishery Management Council. December, 2016. https://www.afsc.noaa.gov/REFM/Docs/2016/EBSpcod.pdf</p> <p>Wilderbuer, T.K., D.G. Nichol and J. Ianelli (2016) Chapter 4. Assessment of the yellowfin sole stock in the Bering Sea and Aleutian Islands. NPFMC Bering Sea and Aleutian Islands SAFE. North Pacific Fishery Management Council. December, 2016. https://www.afsc.noaa.gov/REFM/Docs/2016/BSAlyfin.pdf</p>
<p>Non-Conformance Number (if relevant)</p>	<p>NA</p>

Supporting Clause 12.12

There shall be outcome indicator(s) consistent with achieving management objectives that seek to ensure that endangered species are protected from adverse impacts resulting from interactions with the unit of certification and any associated culture or enhancement activity, including recruitment overfishing or other impacts that are likely to be irreversible or very slowly reversible.

FAO ECO (2011) 41

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

There are outcome indicators consistent with ensuring that endangered species are protected from adverse impacts resulting from interactions with BSAI crab fisheries (including recruitment overfishing or other impacts) that are likely to be irreversible or very slowly reversible.

Evidence:

As noted previously, there are clear objectives (see clause 12.5.1) that seek to ensure that endangered species are protected from adverse impacts resulting from interactions with BSAI crab fisheries, including impacts that are likely to be irreversible or very slowly reversible. These objectives are implemented through appropriate measures aimed at minimizing impacts on endangered species (see clause 12.5).

All U.S. fisheries management, including that of BSAI crab fisheries, must be consistent with the Magnuson-Stevens Act (MSA), the Marine Mammal Protection Act (MMPA)²¹¹, and the U.S. Endangered Species Act (ESA)²¹². Each of these acts establishes management guidelines, objectives and legal protections for threatened and endangered species. The purpose of the ESA²¹³ is to conserve threatened and endangered species and their ecosystems. A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is likely to become endangered in the future. The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) share responsibility for implementing the ESA. Within NOAA Fisheries, the Office of Protected Resources (OPR)²¹⁴ has jurisdiction over 151 endangered and threatened marine species, from whales to sea turtles and salmon to Johnson’s sea grass.

The MMPA was enacted on October 21, 1972. All marine mammals are protected under the MMPA. The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. NMFS is charged with protecting whales, dolphins, porpoises, seals, and sea lions. Walrus, manatees, otters, and polar bears are protected by the USF&WS.

The Marine Mammal Protection Act requires stock assessment reports to be reviewed annually for stocks designated as strategic, annually for stocks where there are significant new information available, and at least once every 3 years for all other stocks. Each stock assessment includes, when available, a description of the stock's geographic range, a minimum population estimate, current population trends, current and maximum

²¹¹ <http://www.nmfs.noaa.gov/pr/laws/mmpa/>

²¹² <https://www.fws.gov/endangered/laws-policies/>

²¹³ http://www.nmfs.noaa.gov/pr/pdfs/esa_factsheet.pdf

²¹⁴ <http://www.nmfs.noaa.gov/pr/index.htm>

net productivity rates, optimum sustainable population levels and allowable removal levels, and estimates of annual human-caused mortality and serious injury through interactions with commercial fisheries and subsistence hunters. The most recent (2015) Alaska Marine Mammal stock assessment was released in August 2015²¹⁵ and can be downloaded at <http://www.nmfs.noaa.gov/pr/sars/region.htm>.

As noted previously under clause 12.5.1, there is very limited potential for BSAI crab fisheries to have adverse impacts on endangered species or marine mammals. The Crab Ecosystem SAFE Report (Chilton et al. 2011) summarized the subject:

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.

The annual Ecosystems Considerations report (Zador 2015) elaborates on additional outcome indicators which are consistent with monitoring for adverse impacts upon endangered species. For marine mammals, ecosystem indicators include estimations of stock abundance and/or related parameters for Stellar sea lions, northern fur seals, harbour seals, arctic ice seals (bearded seal, ribbon seal, ringed seal, spotted seal) and bowhead whales. For seabirds, a variety of ecosystem indicators are in place. For example, the multivariate Seabird Indicators for the Eastern Bering Sea is an index derived from the first two principal components of a principal components analysis (PCA) that combines reproductive effort data (mean hatch date and reproductive success) from common murre, *Uria aalge*, thick-billed murre, *U. lomvia*, blacklegged kittiwake *Rissa tridactyla*, red-legged kittiwake, *R. brevirostris*, and red-faced cormorants, *Phalacrocorax urile*, breeding on the Pribilof Islands.

Ongoing programs that monitor outcome indicators help to ensure that adverse impacts to endangered species do not arise.

Note: BSAI King and Tanner Crab Fisheries are not enhanced fisheries (see clause 13.1). Therefore considerations about “associated culture or enhancement activity” are not applicable.

References:	Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011. http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chpaters/Ecosystem_CrabSAFE.pdf
--------------------	---

²¹⁵ <http://www.nmfs.noaa.gov/pr/sars/region.htm>

	<p>Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p. https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf</p> <p>Muto, M. M., V. T. Helker, R. P. Angliss, B. A. Allen, P. L. Boveng, J. M. Breiwick, M. F. Cameron, P. J. Clapham, S. P. Dahle, M. E., Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, R. C. Hobbs, Y. V., Ivashchenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbini (2016) Alaska marine mammal stock assessments, 2015. U.S. Dep. Commer., NOAA Tech. Memo. NMFS AFSC-323, 300 p. doi:10.7289/V5/TM-AFSC-323. http://www.nmfs.noaa.gov/pr/sars/pdf/alaska2015_final_corrected .pdf</p>
<p>Non-Conformance Number (if relevant)</p>	<p>NA</p>

Supporting Clause 12.13

There shall be outcome indicator(s) consistent with achieving management objectives for avoiding, minimizing or mitigating the impacts of the unit of certification on essential habitats for the “stock under consideration” and on habitats that are highly vulnerable to damage by the fishing gear of the unit of certification.

FAO ECO (2011) 41.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input checked="" type="checkbox"/>	High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input checked="" type="checkbox"/> None <input type="checkbox"/>
Summary Evidence:			
<p>The management system has established outcome indicators for avoiding, minimizing or mitigating impacts to essential fish habitat (EFH). BB red king crab, SM blue king crab, EBS snow crab, and EBS tanner crab fisheries are not typically prosecuted in areas with habitats that are highly vulnerable to damage by pots. Outcome indicators for these units of assessment are consistent with achieving management objectives. The AI golden king crab fishery takes place in deep water areas where coral and sponge habitats may be adversely impacted by bottom contact gear such as pots. For the AI GKC unit of certification, it was not shown that outcome indicators are in place that are consistent with avoiding, minimizing, or mitigating the impact on habitats that are highly vulnerable to damage by the fishing gear of the unit of certification (i.e. pots).</p>			
Evidence:			
<p>As noted previously under clause 12.9, management agencies have knowledge of essential fish habitat (EFH) for the BSAI crab stocks under consideration. The potential for BSAI crab fisheries to impact on EFH is regularly assessed and management measures are taken to ensure that fishery impacts on EFH and on habitats that are highly vulnerable to damage by the fishing gear are avoided, minimized or mitigated. Some of the most significant conservation and management measures implemented to date are spatial closures (temporary, seasonal or permanent) to some or all gear types. Examples include the Aleutian Islands Habitat Conservation Area, Aleutian Islands Coral Habitat Protection Areas, Alaska Seamount Habitat Protection Area, and Bowers Ridge Habitat Conservation Zone (Figure 32; also see clause 12.9). Although it is difficult to establish an exact figure for the total area of all closures, Olson (2015) suggests that almost 65% of the U.S. EEZ of Alaska is closed to bottom trawling if the Arctic FMP closure is included in the calculation (Figure 32). Chilton et al. (2011) discuss additional management actions to protect important benthic habitat for crab and other resources and to reduce crab bycatch in the trawl and fixed gear fishery through habitat protection areas, prohibited species caps (PSCs) and crab bycatch limits. The AIHCA closure effectively freezes the current footprint of trawling activities until scientists can determine the full scope of deep-sea coral habitat and fisheries resources in the region and provides a <i>de facto</i> sanctuary for those coral species residing in deep water (Stone 2014).</p>			

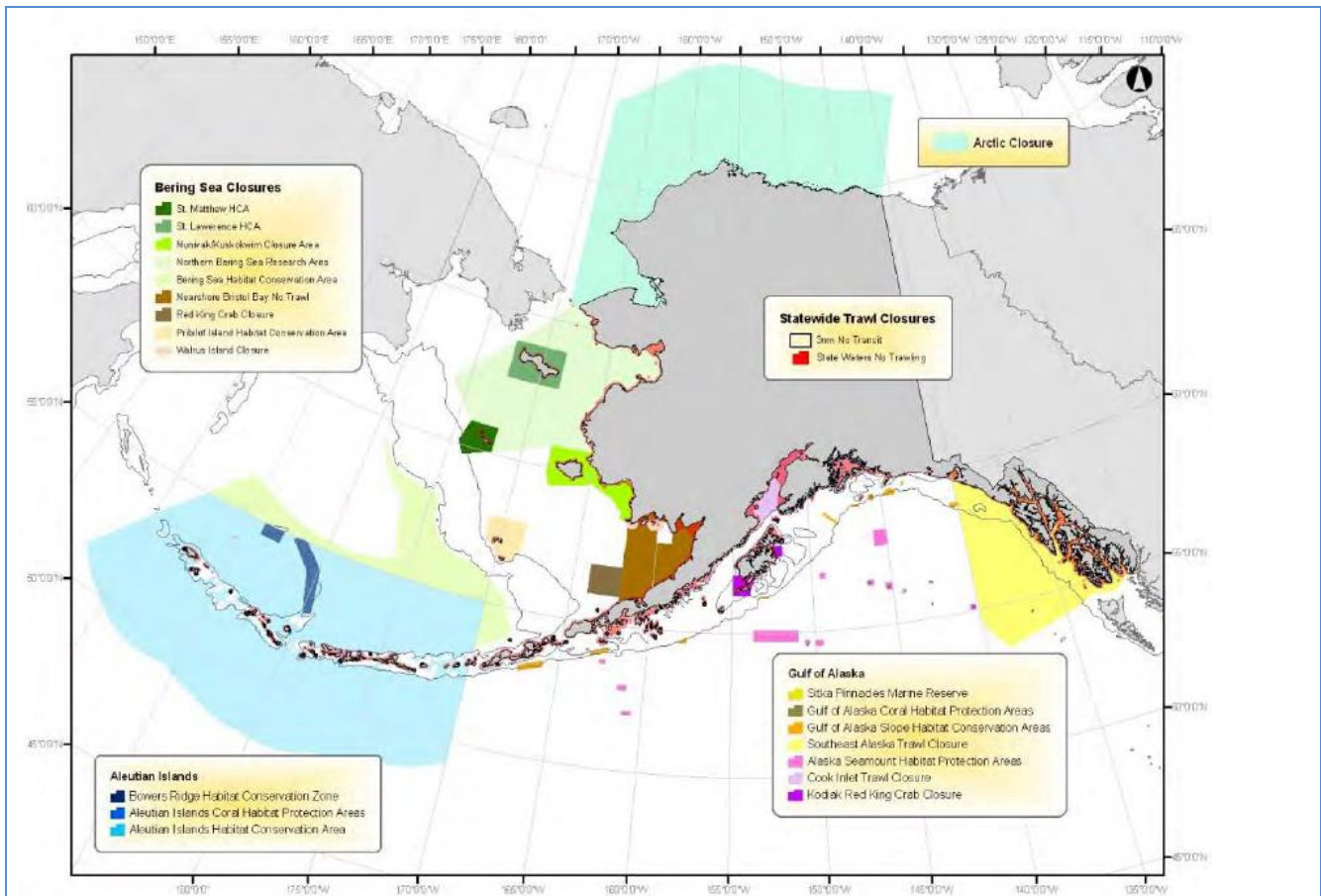


Figure 28 Year-round groundfish closures in the U.S. Exclusive Economic Zone (EEZ) of Alaska, excluding most Stellar sea lion closures (from Olson in Zador 2015)

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 (i.e. those areas where BB red king crab, SM blue king crab, EBS snow crab, and EBS tanner crab fisheries are typically prosecuted) 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 (Chilton et al. 2011). According to NMFS (2004), AI golden king crabs are taken in areas consisting of rough, uneven bottom at depths of 100-400 fathoms (600 to 2,400 feet). Fishery effort is concentrated on rocky substrata and pinnacles in the Aleutian Islands and at the entrances to passes between the islands. Such habitats are home to many sessile (attached) animals including gorgonian corals, anemones, sea stars, crinoids (a type of echinoderm), and sponges. These organisms supply shelter and food to small crabs, fish, and other organisms. Pot fishing in these areas probably has significant impacts on the hard-bottom fauna, but has not been studied.

The consensus view is that BSAI crab pot fisheries pose minimal risk of causing adverse impacts on EFH, HAPCs, and/or other sensitive or vulnerable habitats. NMFS (2004) summarized as follows:

Results of this analysis indicate that the BSAI crab fisheries impacts to benthic habitat had no measurable effects (NMFS 2004d). The effects of the BSAI crab fisheries were determined to be minimal and temporary because, combined, the crab fisheries have an extremely small footprint because they impact less than one percent of available habitat. Additionally, the

BSAI crab fisheries, except Aleutian Islands golden king crab and Aleutian Islands red king crab, impact habitat types (sand, silt, and mud) that have low recovery times. The Aleutian Islands golden king crab and Aleutian Islands red king crab fisheries occur on slope areas characterized by having rough bottom and living substrates that have a relatively long recovery time. However, because these fisheries impact such a small portion of the available habitat in the Aleutian Islands, it was concluded that these fisheries also have no measurable effects on benthic habitat. Thus, the effects of the fishery are concentrated in an extremely small proportion of total available benthic habitat and these effects are considered minimal and temporary. From this analysis, it is concluded that the BSAI crab fisheries have an insignificant effect on benthic habitat.

Recent Studies

As summarized in the Deep Sea Coral Research and Technology Program (DSCRTP) 2016 Report to Congress, parts of the Bering Sea slope, including Pribilof Canyon, were previously identified as coral areas with potential for fishing gear interaction. The Alaska Fishery Science Center has led predictive habitat modeling for corals in this area along with ground-truth surveys in partnership with the DSCRTP. The results indicate that while corals do occur on the Eastern Bering Sea slope and canyons, their abundance and density are much less than in many areas of the Aleutian Islands and the Gulf of Alaska. About one quarter of the coral habitat predicted for the eastern Bering Sea slope occurs in Pribilof Canyon (about 10% of the total slope area). The predicted coral habitat also extends westward to the adjacent slope, indicating that this coral habitat concentration may not be unique to Pribilof Canyon (see publications by Miller et al. 2012, Sigler et al. 2013, 2015, Goddard et al. 2016, and Rooper et al. 2016). The North Pacific Council reviewed the new information in 2015 and concluded that further management action was not warranted at this time.

The DSCRTP 2016 Report to Congress also describes the Aleutian Islands and Petrel Bank and Spur: The Aleutian Islands are home to some of the richest deep-sea coral habitats in the U.S. EEZ. The extensive AIHCA and smaller AICHPAs provide important protection to much coral habitat. However, surveys conducted by the DSCRTP and other newly analyzed information, along with predictive habitat modeling, suggest that certain areas, including many “coral garden” habitats, may currently remain open to bottom trawling. In addition, a number of relatively small areas within the Aleutian Islands have high levels of coral bycatch in commercial fisheries as reported by the Alaska Groundfish Observer Program.

With respect to the AIGKC fishery, the spatial distribution of pot fishing effort in relation to vulnerable habitats is unclear but may be extensive in some areas. Stone and Shotwell (2007) summarized:

“No studies have been undertaken to study the effects of pot fishing on seafloor habitat in Alaska. Single pot fisheries likely have a minimal effect on coral habitat since they generally occur in soft-sediment areas with minimal coral habitat and because a relatively small area of the seafloor is contacted with the gear (Table 2.3). Pot longlines used in the Aleutian Island golden king crab fishery, however, have the potential to cause extensive damage to coral habitat (Table 2.3) since the spatial distribution of fishing is extensive in some areas of high coral abundance (Figures 2.20A and 2.20B). Depending on how the gear is retrieved, the area of seafloor contacted may be relatively large and the forces on the seafloor may be substantial. The gear is retrieved in a manner to minimize drag on the seafloor due to the strength limitations of the longline; however, under certain conditions the gear can be dragged like a plough across the seafloor. This situation can occur in areas of steep bathymetry and when strong winds and currents dictate that fishing vessels retrieve gear while being forced away from it. At one site in the central Aleutian Islands where disturbance from this

gear was observed with the submersible Delta (Figure 2.21), the seafloor was scoured to bare substrate along 17 strips (Stone 2006). Aleutian Island coral gardens are at high risk to disturbance from this fishery.”

Predictive models of coral distribution (Woodby et al. 2009) or coral and sponge distribution (Rooper et al. 2014) have been developed for the Aleutian Islands. Results from Woodby et al. implied that there were "large swaths of seafloor with potential for supporting coral gardens" that fell outside of coral garden closures (no bottom contact gear), but were within the AIHCA (closed to bottom trawling). The predictive model of Rooper et al. suggests that current management (restrictions/closures in AIHCA and AICHPA) protects ~50% of the coral and sponge habitat in the Aleutian Islands at depths to 500 m. However no analysis is available to allow an estimation of the spatial overlap of the AIGKC fishery with vulnerable coral and sponge habitat (Figure 36).

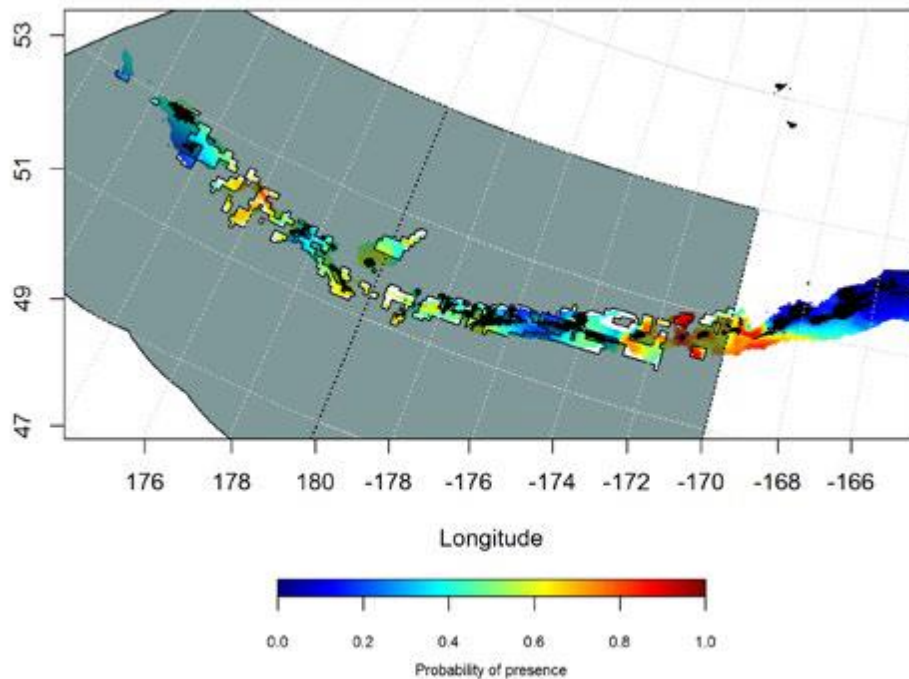


Figure 29 The distribution of probability of presence for coral in the Aleutian Islands is shown below, with the areas closed to mobile fishing gear shaded in grey. (Credit: CN Rooper, NOAA: from DSCRTP 2016)

Outcome Indicators

The management system has established management objectives that seek to avoid, minimize or mitigate impacts on EFH and on habitats that are highly vulnerable to damage by the fishing gear of the unit of certification (see clause 3.2.5). As discussed below, a wide array of ecosystem indicators is used to annually assess and monitor the ecosystems of the Bering Sea, Aleutian Islands, and Gulf of Alaska (Zador 2015; 2016; see clause 12.15) and a number of these indicators relate directly or indirectly to habitat outcomes. Outcome indicator(s) adequately reflect those management objectives for four of the units of certification (BB red king crab, SM blue king crab, EBS snow crab and EBS Tanner crab). For the AIGKC fishery, however, it was difficult to identify the required outcome indicators for habitats that are highly vulnerable to damage by pot fishing gear because information on the spatial distribution of fishing effort across habitats was lacking.

1) Habitat – Structural Epifauna, Aleutian Islands (from Rooper 2016). Groups considered to be structural epifauna, formerly known as HAPC biota, include seapens/seawhips, corals, anemones, and sponges. The biennial survey in the Aleutian Islands does not sample estimate the density of HAPC fauna well, but does seem to capture spatial trends in presence or absence. However, survey effort in rough or rocky areas where these groups are likely to be more abundant and survey effort is quite limited. The two major threats to populations of benthic invertebrates in the Aleutian Islands have been identified as fishing impacts and impacts of climate change. Both of these processes are occurring in the Aleutian Islands. Much of the benthic habitat in the Aleutians (~50% of the shelf and slope to depths of 500 m) has been protected from mobile fishing gear since 2006, however, no studies have been conducted to determine potential recovery or expansion of populations due to the closures.

2) Area Disturbed by Trawl Fishing Gear in the Eastern Bering Sea (Grieg and Zador 2015). Fishing gear can affect habitat used by a fish species for the processes of spawning, breeding, feeding, or growth to maturity. An estimate of the area of sea floor disturbed by trawl gear may provide an index of habitat disturbance. The area disturbed in the Eastern Bering Sea floor was calculated from observer trawl data each year from 1990-2014.

3) Time Trends in Non-Target Species Catch (Whitehouse et al. 2015). We monitor the catch of non-target species in groundfish fisheries in the Eastern Bering Sea (EBS), Gulf of Alaska (GOA) and Aleutian Islands (AI) ecosystems. The three categories of non-target species tracked are: 1. Scyphozoan jellyfish; 2. species associated with Habitat Areas of Particular Concern-HAPC species (seapens/whips, sponges, anemones, corals, tunicates); and 3. Assorted invertebrates (bivalves, brittle stars, hermit crabs, miscellaneous crabs, sea stars, marine worms, snails, sea urchins, sand dollars, sea cucumbers, and other miscellaneous invertebrates). Data derive from groundfish fisheries. As such, this indicator may have limited utility in relating habitat trends to crab pot fisheries.

4) Maintaining and Restoring Fish Habitats (Olson 2015). This indicator looks at areas closed to bottom trawling in the EBS/ AI and GOA. Many trawl closures have been implemented to protect benthic habitat or reduce bycatch of prohibited species (i.e., salmon, crab, herring, and halibut). Some of the trawl closures are year-round while others are seasonal. In general, year-round trawl closures have been implemented to protect vulnerable benthic habitat. Seasonal closures are used to reduce bycatch by closing areas where and when bycatch rates had historically been high. This indicator does not distinguish trawl closures from closures to other gear types (fixed gears, bottom contact gears) making it difficult to relate observed trends to crab pot fishing.

The aforementioned outcome indicators are informative about habitat status and trends for four of the crab fisheries under assessment: BB red king crab, SM blue king crab, EBS snow crab, and EBS Tanner crab. For the AI golden king crab unit of certification, however, it was not shown that outcome indicators are in place that are consistent with avoiding, minimizing, or mitigating the impact on habitats that are highly vulnerable to damage by pot fishing gear. For example, there are no spatial analyses available which would allow an estimation of current and historic overlap of AIGKC pot fishing effort with the distribution of vulnerable coral and sponge habitats in the Aleutian Islands. The AIGKC unit of certification is therefore assigned a medium confidence rating for clause 12.13.

References:	Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011.
--------------------	--

http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf

Goddard, P., R. Wilborn, C. Rooper, K. Williams, R. Towler, M. Sigler, and P. Malecha (2016) Results of the 2014 underwater camera survey of the eastern Bering Slope and Outer Shelf. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-313, 304 p. <http://dx.doi.org/10.7289/V5/TM-AFSC-313>:

<http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-313.pdf>

Grieg, A. and Zador, S (2015) Area Disturbed by Trawl Fishing Gear in the Eastern Bering Sea. In: Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p.

<https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf>

Miller R J, Hocevar J, Stone R, Federov D (2012) Structure-forming corals and sponges and their use as fish habitat in Bering Sea submarine canyons. PLoS ONE 7(3): e33885.

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0033885>

NMFS (2004) Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p.

<https://alaskafisheries.noaa.gov/sites/default/files/analyses/crabeis0804-chapters.pdf>

Olson, J. (2015) Maintaining and Restoring Fish Habitats: Areas Closed to Bottom Trawling in the EBS/ AI and GOA. Last updated: August 2015. In: Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p.

<https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf>

Rooper CN, Zimmermann M, Prescott MM, Hermann AJ (2014) Predictive models of coral and sponge distribution, abundance and diversity in bottom trawl surveys of the Aleutian Islands, Alaska. Mar Ecol Prog Ser 503:157-176.

<https://doi.org/10.3354/meps10710>

Rooper, C. (2016) Habitat. Structural Epifauna - Aleutian Islands. Pp.58-61 In: Zador, S., (Ed.) (2016) Ecosystem Considerations 2016: Status of the Aleutian Islands Marine Ecosystem. NPFMC November 14, 2016, 110 p.

<https://access.afsc.noaa.gov/reem/ecoweb/index.php?ID=31>

Rooper CN, Sigler M, Goddard P, Malecha PW, Towler R, Williams K, Wilborn R, Zimmermann M. (2016) Validation and improvement of species distribution models for structure forming invertebrates in the eastern Bering Sea with an independent survey. Mar. Ecol. Prog. Ser. 551:117-130

<http://www.int-res.com/abstracts/meps/v551/p117-130/>

Sigler, M.F., Rooper, C.N., Hoff G.R., Stone R.P., McConnaughey R.A., Wilderbuer T.K. 2013. Are Bering Sea canyons unique habitats within the eastern Bering Sea? Draft paper presented for Review by North Pacific Fishery Management Council. 157 p.

	<p>https://www.npfmc.org/wp-content/PDFdocuments/conservation_issues/BSHC/BeringSeaCanyons_a_513.pdf</p> <p>Sigler MF, Rooper CN, Hoff GR, Stone RP, McConnaughey RA, Wilderbuer TK (2015) Faunal features of submarine canyons on the eastern Bering Sea slope. Mar Ecol Prog Ser 526:21-40. http://www.int-res.com/abstracts/meps/v526/p21-40/</p> <p>Stone RP (2006) Coral habitat in the Aleutian Islands off Alaska: depth distribution, fine-scale species associations, and fisheries interactions. Coral Reefs 25: 229–238. http://link.springer.com/article/10.1007/s00338-006-0091-z</p> <p>Stone, R.P. (2014) The ecology of deep-sea coral and sponge habitats of the Central Aleutian Islands of Alaska. NOAA Professional Paper NMFS 16, 52 p. doi:10.7755/PP.16 http://spo.nmfs.noaa.gov/pp16.pdf</p> <p>Stone, R.P., and S. K. Shotwell (2007) State of Deep Coral Ecosystems in the Alaska Region: Gulf of Alaska, Bering Sea and the Aleutian Islands. pp. 65–108. In: S.E. Lumsden, T.F. Hourigan, A.W. Bruckner, and G. Dorr (eds.). The State of Deep Coral Ecosystems of the United States. NOAA Technical Memorandum CRCP-3. Silver Spring, MD. http://www.habitat.noaa.gov/pdf/pub_deep_coral_report_2007.pdf</p> <p>Whitehouse, A., Gaichas, S. and Zador, S. (2015) Time Trends in Non-Target Species Catch. In: Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p. https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf</p> <p>Woodby D, Carlile D, Hurlburt L (2009) Predictive modeling of coral distribution in the Central Aleutian Islands, USA. Mar Ecol Prog Ser 397: 227–240 http://www.int-res.com/abstracts/meps/v397/p227-240/</p> <p>Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p. https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf</p> <p>Zador, S., (Ed.) (2016) Ecosystem Considerations 2016. Status of the Aleutian Islands Marine Ecosystem. NPFMC November 14, 2016, 110 p. https://www.afsc.noaa.gov/REFM/Docs/2016/ecosysAI.pdf</p>
<p>Non-Conformance Number (if relevant)</p>	<p>2</p>

Supporting Clause 12.14

There shall be outcome indicator(s) consistent with achieving management objectives that seek to avoid severe adverse impacts on dependent predators resulting from the unit of certification fishing on a stock under consideration that is a key prey species.

FAO ECO (2011) 41.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

There are outcome indicators consistent with achieving avoidance of severe adverse impacts on dependent predators resulting from fishing on BSAI crab stocks. Available evidence does not indicate that the BSAI crab stocks under consideration represent key prey species for dependent predators.

Evidence:

None of the five BSAI crab species within the unit of certification (red king crab, blue king crab, golden king crab, snow crab, tanner crab) are typically considered ‘key’ prey species within their ecosystems. Relatively few species have been identified as predators of legal-sized male crab although specific information is limited due to the difficulty of identifying prey items to the species level with only partial carapace or dactyl pieces. For those predators that are known to prey upon the crab species under consideration here, there is no indication of dependency in this trophic relation.

Fish Predation

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. Pacific cod and large sculpins prey on adult king, Tanner and snow crab (NPFMC 2003, Aydin et al. 2007) but adult crab are relatively invulnerable to predation except after molting when they are in a soft shell state (Blau 1986, Livingston 1989, Loher et al. 1998).

According to Chilton et al. (2011), records of predation on golden and blue king crab are rare. The Resource Ecology and Ecosystem Modeling Program at AFSC collected stomachs on the EBS bottom trawl survey from over 100 species, yet BKC were found only in Pacific cod, walleye pollock and yellowfin sole stomachs. From 1981 to 2005, 5 Pacific cod, 27 walleye pollock and 8 yellowfin sole contained BKC prey from a total of 13,831 stomach samples with Pacific cod having the largest amount of BKC by weight (AFSC, REEM food habits database). One golden king crab was found in a white-blotched skate (*Bathyraja maculata*) stomach from the 612 samples collected from along the Kuril Islands and southeast Kamchatka during 1996 (Orlov 1998). Simenstad et al. (1977) assessed the AI marine food web in the vicinity of Amchitka Island and reported 6 instances of GKC and RKC in 69 halibut stomachs examined from inshore areas.

Marine Mammals and Seabirds

The Crab Ecosystem SAFE (2011) present outcome indicators which are consistent with achieving avoidance of severe adverse impacts to dependent predators. Fishery-specific impacts of BSAI crab fisheries in the context of the biological environment are described in the report section on ‘Directed Fishery Contribution to Competitor and Predator Mortality’:

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.

The Crab Ecosystem SAFE (2011) elaborates additional outcome indicators which are consistent with avoiding severe adverse impacts upon dependent predators. Further outcome indicators are described in Zador (2015), including ecosystem indicators for marine mammals and seabirds.

Available evidence indicates that BSAI crabs stocks are not key prey species whose removal adversely impacts on dependent predators. In additional, ongoing programs for monitoring of outcome indicators ensures that adverse impacts to dependent predators do not arise.

References:

Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011.
http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf

Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p.
<https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf>

Orlov (1998) The diets and feeding habits of some deep-water skates (Rajidae) in the Pacific waters off the Northern Kuril Islands and Southeastern Kamchatka. Alaska Fishery Research Bulletin. 5(1): 1-17.
<https://www.adfg.state.ak.us/static/home/library/PDFs/afrb/orlov5n1.pdf>

Simenstad, C.A., J.S. Isakson, and R.E. Nakatani. 1977. Marine fish communities of Amchitka Island, AK, pp. 451-492. In M. L. Merritt and R. G. Fuller (eds.), The Environment of Amchitka Island, Alaska. U.S. ERDA, TID-26712.

Aydin, K., S. Gaichas, I. Ortiz, D. Kinzey, and N. Friday. 2007. A comparison of the Bering Sea, Gulf of Alaska, and Aleutian Islands large marine ecosystems through food web modeling. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-178, 298p.
<https://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-178.pdf>

Blau, S.F. 1986. Recent declines of red king crab (*Paralithodes camtschatica*) populations and reproductive conditions around the Kodiak Archipelago, Alaska, pp 360-369. In G. S. Jamieson and N. Bourne (eds.), North Pacific Workshop on stock assessment and

	<p>management of invertebrates. Canadian Special Publication of Fisheries and Aquatic Sciences 92.</p> <p>Livingston, P.A. 1989. Interannual trends in Pacific cod, <i>Gadus macrocephalus</i>, predation on three commercially important crab species in the eastern Bering Sea. Fishery Bulletin 87: 807-827. http://fishbull.noaa.gov/874/livingston.pdf</p> <p>Loher, T., P.S. Hill, G. Harrington, and E. Cassano. 1998. "Management of Bristol Bay red king crab: a critical intersections approach to fisheries management." Reviews in Fisheries Science 6(3):169-251. http://www.tandfonline.com/doi/abs/10.1080/10641269891314285</p>
<p>Non-Conformance Number (if relevant)</p>	<p>NA</p>

Supporting Clause 12.15

There shall be outcome indicator(s) consistent with achieving management objectives that seek to minimize adverse impacts of the unit of certification, including any enhancement activities, on the structure, processes and function of aquatic ecosystems that are likely to be irreversible or very slowly reversible. Any modifications to the habitat for enhancing the stock under consideration must be reversible and not cause serious or irreversible harm to the natural ecosystem’s structure, processes and function.

FAO ECO (2011) 36.9, 41

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input checked="" type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>

Summary Evidence:

There are outcome indicators which are consistent with achieving management objectives of minimizing adverse impacts of the BSAI King and Tanner Crab fisheries on the structure, processes and function of aquatic ecosystems that are likely to be irreversible or very slowly reversible.

Evidence:

There are outcome indicators specific to the BSAI King and Tanner Crab fisheries which are used to assess impacts to aquatic ecosystems. These indicators are termed ‘Crab Ecosystem Considerations Indicators’ (CECI) and they are described in the CECI report by Chilton et al. (2011). The CECI report is composed of three main sections: Ecosystem Assessment, Current Status of Ecosystem Indicators (information on the physical and biological components of the BSAI ecosystem), and Ecosystem-based Management Indicators. The latter section 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.

Outcome indicators in the CECI report are consistent with achieving management objectives of identifying and minimizing adverse impacts of BSAI crab fisheries on aquatic ecosystems. For example:

Ecosystem-based Management Indicators

This section of the CECI provides early signals of direct human effects on BSAI crab ecosystem components via directed fishery effects 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.

In addition, managers utilize outcome indicators which are applied more broadly to the monitoring of the Alaska’s fisheries and marine ecosystems, as described in the NPFMC Ecosystems Considerations Report (Zador 2015). “The goal of the Ecosystem Considerations report is to provide stronger links between ecosystem research and fishery management and to spur new understanding of the connections between ecosystem components by bringing together the results of many diverse research reports into one document.” A wide array of indicators is utilized to assess physical and environmental trends, ecosystem trends, and fishing and fisheries trends. For example, the category of ‘Ecosystem-Based Management (Fishing-related) Indicators’ includes indicators for discards and non-target catch, fish habitats, sustainability, and humans as part of ecosystems.

Taken together, there is strong evidence that management utilizes outcome indicators consistent with achieving management objectives that seek to minimize adverse impacts of BSAI crab fisheries on the structure, processes and function of aquatic ecosystems that are likely to be irreversible or very slowly reversible.

Note: No habitat modifications are undertaken for the purpose of enhancement of the stocks under consideration. There is no evidence to suggest that BSAI King and Tanner Crab stocks have benefitted from ecosystem enhancement through the use of artificial structures. Thus, use of artificial structures is neither practical nor appropriate for the crab species under consideration. As such, issues relating to enhancement activities are not applicable to the unit of certification.

References:	<p>E.A. Chilton, K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy (2011) Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011. http://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf</p> <p>NMFS (2004) Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p. https://alaskafisheries.noaa.gov/sites/default/files/analyses/crabeis0804-chapters.pdf</p> <p>Quandt, A. (1999) Assessment of fish trap damage on coral reefs around St. Thomas, USVI. Independent Project Report, UVI Spring 1999. p. 9.</p> <p>Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p. https://www.afsc.noaa.gov/REFM/Docs/2015/ecosystem.pdf</p>
--------------------	---

Non-Conformance Number (if relevant)	NA
---	-----------

Fundamental Clause 13

Where fisheries enhancement is utilized, environmental assessment and monitoring shall consider genetic diversity and ecosystem integrity.

FAO CCRF (1995) 9.1.2/9.1.3/9.1.4/9.1.5/9.3.1/9.3.5
 FAO Eco (2011) 36.9,38, 39, 40, 41, 43

No. Supporting clauses/sub-clauses	19
Supporting clauses applicable	0
Supporting clauses not applicable	19
Non Conformances	0

Supporting Clause 13.1

State shall promote responsible development and management of aquaculture, including an advanced evaluation of the effects of aquaculture development on genetic diversity and ecosystem integrity, based on the best available scientific information (and/or traditional, fisher or community objective and verifiable knowledge). Significant uncertainty is to be expected in assessing possible adverse ecosystem impacts of fisheries, including culture and enhancement activities. This issue can be addressed by taking a risk assessment/risk management approach.

FAO CCRF (1995) 9.1.2
 FAO Eco (2011) 41

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>	High <input type="checkbox"/>	
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>

Summary Evidence:

BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated aquaculture developments. As such this clause is not applicable.

Evidence:

As early as 1991, the Alaska Department of Fish and Game (ADF&G) considered raising king crab in a hatchery environment for release into the wild. However shellfish hatchery research at the time was still in its infancy and not enough information was available to launch a successful crab restoration program. In the time since, there have been a number of important advances in king crab culturing techniques (R. Foy, personal comm.).

Unlike salmon enhancement, the goal of king crab cultivation is restorative. However initiation of a crab restoration program must first overcome several challenges, including the following issues recognized by ADF&G:

- 1) crab are long-lived and are not large enough to be fished until they are 7 to 9 years old;
- 2) no crab enhancement or restoration projects have yet been successful anywhere in the world;
- 3) there is no genetics policy for invertebrates;
- 4) the ADF&G Finfish Genetics Policy does not cover crab.

In 2007, the Alaska King Crab Research, Rehabilitation and Biology (AKCRRAB) Program was formed to research red and blue king crab restoration possibilities. The AKCRRAB program is a cooperative effort of Alaska Sea

Grant, the Alutiiq Pride Shellfish Hatchery, NOAA Fisheries, ADF&G, and the University of Alaska Fairbanks School of Fisheries and Ocean Sciences. The program is guided by a steering committee, while a team of scientists and scientific advisors guide research efforts. The role of ADF&G in AKCRRAB is advisory.

With respect to contemporary proposals for crab restoration work, most of ADF&G’s focus is on permitting and policy development, which seeks to minimize the risks cultivated crab released into the wild might pose to wild stocks. Factors ADF&G considers when evaluating development or permitting of hatchery operations include the following:

- Genetic risks, like inbreeding or hybridization
- Risks from disease
- Effects cultured releases might have on other species and their habitats
- What evaluation tools are necessary to assess projects
- Effects on other fisheries or user groups
- Public review
- Harvest management issues (all users — subsistence, personal use, sport fishing, commercial fishing; different harvest rates of wild and hatchery stock; allocation; stock recovery; mixed stock issues; and common property considerations).

At the time of this RFM assessment, ADF&G was still conducting additional research, developing relevant policies, and formulating permitting processes for crab restoration. ADF&G confirmed that no hatchery permits had been issued which would allow for the release of cultivated crab (exclusive of scientific investigations), and that no permit approvals were imminent (F. Bowers, pers. comm.). Therefore it can be concluded that the BSAI King and Tanner Crab Fisheries are not enhanced fisheries and that there are no associated aquaculture developments. As such this clause is not applicable.

References:	<p>http://www.adfg.alaska.gov/index.cfm?adfg=wildlifeneews.view_article&articles_id=544</p> <p>R. Foy, Director, Kodiak Laboratory, Alaska Fisheries Science Center, NOAA Fisheries, per. comm.</p> <p>F. R. Bowers, Deputy Director, Division of Commercial Fisheries, ADF&G pers. comm.</p>
--------------------	--

Non-Conformance Number (if relevant)	NA
---	-----------

Supporting Clause 13.1.1

In the case of enhanced fisheries, the fishery management system should take due regard of the natural production processes and be appropriate for the conservation of genetic diversity, biodiversity, protection of endangered species, maintenance of integrity of aquatic communities and ecosystems, minimising adverse impacts on ecosystem structure and function.

FAO CCRF (1995) 9.3.1
 FAO Eco (2011) 36.9, 41

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.2

State shall produce and regularly update aquaculture development strategies and plans, as required, to ensure that aquaculture development is ecologically sustainable and to allow the rational use of resources shared by aquaculture and other activities.

FAO CCRF (1995) 9.1.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated aquaculture developments. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.2.1

State shall ensure that the livelihoods of local communities, and their access to fishing grounds, are not negatively affected by aquaculture developments.

FAO CCRF (1995) 9.1.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input checked="" type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated aquaculture developments. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.3

Effective procedures specific to aquaculture of fisheries enhancement shall be established to undertake appropriate environmental assessment and monitoring with the aim of minimizing adverse ecological changes such as those caused by inputs from enhancement activities and related economic and social consequences.

FAO CCRF (1995) 9.1.5/9.2.5

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated aquaculture developments. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.4

With due regard to the assessment approach employed, stock assessment of fisheries that are enhanced through aquaculture inputs shall consider the separate contributions from aquaculture and natural production.

FAO Eco (2011) 43

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated aquaculture inputs. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.5

Any modification to the habitat for enhancing the stock under consideration is reversible and do not cause serious or irreversible harm to the natural ecosystem’s structure and function.

FAO Eco (2011) 41

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no habitat modifications associated with enhancement. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.5.1

Efforts shall be undertaken to minimize the harmful effects of introducing non-native species or genetically altered stocks used for aquaculture including culture based fisheries into waters.

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated introductions of non-native species or genetically altered stocks. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.5.2

Steps shall be taken to minimize adverse genetic disease and other effects of escaped farmed fish on wild stocks.
 FAO CCRF (1995) 9.3.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There is no associated escapement. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.5.3

Research shall be promoted to develop culture techniques for endangered species to protect, rehabilitate and enhance their stocks, taking into account the critical need to conserve genetic diversity of endangered species.

FAO CCRF (1995) 9.3.5

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.6

State shall protect transboundary aquatic ecosystems by supporting responsible aquaculture practices within their national jurisdiction and by cooperation in the promotion of sustainable aquaculture practices.

FAO CCRF (1995) 9.2.1

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated aquaculture practices. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.7

State shall, with due respect to their neighbouring States and in accordance with international law, ensure responsible choice of species, siting and management of aquaculture activities which could affect trans boundary aquatic ecosystems.

FAO CCRF (1995) 9.2.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated aquaculture activities. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.8

State shall consult with their neighbouring States, as appropriate, before introducing non-indigenous species into trans-boundary aquatic ecosystems.

FAO CCRF (1995) 9.2.3

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated aquaculture developments. There are no introductions of non-indigenous species. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.9

State shall establish appropriate mechanisms, such as databases and information networks to collect, share and disseminate data related to their aquaculture activities to facilitate cooperation on planning for aquaculture development at the national, sub-regional, regional and global level.

FAO CCRF (1995) 9.2.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated activities. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.10

State shall cooperate in the elaboration, adoption and implementation of international codes of practice and procedures for introductions and transfers of aquatic organisms.

FAO CCRF (1995) 9.3.2

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There are no associated transfers of aquatic organisms. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.11

States shall, in order to minimize risks of disease transfer and other adverse effects on wild and cultured stocks, encourage adoption and promote the use of appropriate practices/procedures in the selection and genetic improvement of broodstocks, the introduction of non-native species, and in the production, sale and transport of eggs, larvae, fry, broodstock or other live materials. States shall facilitate the preparation and implementation of appropriate national codes of practice and procedures to this effect.

FAO CCRF (1995) 9.3.3, 9.3.4

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.12

Enhanced fisheries may be supported in part by stocking of organisms produced in aquaculture facilities or removed from wild stocks other than the “stock under consideration”. Aquaculture production for stocking purposes should be managed and developed according to the above provisions, especially in relation to maintaining the integrity of the environment, the conservation of genetic diversity, disease control, and quality of stocking material.

FAO Eco (2011) 36.8, 40

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. There is no associated stocking of cultured or wild organisms. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.13

Regarding the enhanced components of the “stock under consideration”, provided that a natural reproductive stock component is maintained and fishery production is based primarily on natural biological production within the ecosystem of which the “stock under consideration” forms a part, enhanced fisheries shall meet the following criteria:

- the species shall be native to the fishery’s geographic area or introduced historically and have subsequently become established as part of the “natural” ecosystem;
- there shall be natural reproductive components of the “stock under consideration”;
- the growth during the post-release phase shall be based upon food supply from the natural environment and the production system shall operate without supplemental feeding.

FAO Eco (2011) 38

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

Supporting Clause 13.14

In the case of enhanced fisheries, “stock under consideration” may comprise naturally reproductive components and components maintained by stocking. In the context of avoiding significant negative impacts of enhancement activities on the natural reproductive components of “stock under consideration”:

- naturally reproductive components of enhanced stocks shall not be overfished;
- naturally reproductive components of enhanced stocks shall not be substantially displaced by stocked components. In particular, displacement shall not result in a reduction of the natural reproductive stock component below abundance-based target reference points (or their proxies) defined for the regulation of harvest.

FAO Eco (2011) 39

Evidence Rating:	Low <input type="checkbox"/>	Medium <input type="checkbox"/>		High <input type="checkbox"/>
Non-Conformance:	Critical <input type="checkbox"/>	Major <input type="checkbox"/>	Minor <input type="checkbox"/>	None <input type="checkbox"/>
Summary Evidence: BSAI King and Tanner Crab Fisheries are not enhanced fisheries. As such this clause is <u>not applicable</u> .				
Evidence: See clause 13.1				
References:				
Non-Conformance Number (if relevant)				NA

8. External Peer Review

Summary and Recommendation Peer Reviewer 1

Overall the assessment team was thorough and documented the evidence ratings and conformances of each supporting clause adequately. They provided comprehensive information that allowed me to evaluate the appropriateness of determining continuing and establishing certification. My responses below document my general and specific comments to each of the evaluation clauses. The assessment team provided a rigorous and sufficiently critical analysis of each of the sections of certification. Given the information provided to me in the report the appropriate conclusion has been reached: these are responsibly managed fisheries and I agree with the assessment team that the fisheries under consideration (US Alaska Bering Sea and Aleutian Islands King Crab, St. Matthew Island Blue King Crab, and Eastern Bering Sea Snow Crab should be awarded continuing certification. Similarly, the US Eastern Bering Sea Tanner Crab and Aleutian Islands Golden King Crab should be certified based on the performance criteria used in the assessment. The above named stocks (termed BSAI stock in the assessment document and below) conform to the Global Trust procedures for Alaska RFM certification using the Alaska RFM Standard.

The corrective action for the two minor non-conformances documented in the assessment report are acceptable and adequate. I have confidence that monitoring of the fishery and management system will be adequate to correct the minor non-conformances.

8.1.1. Full Summary of Comments – Peer Reviewer 1

Background Section	
Peer Review Comments: This section was thorough, well researched, and well communicated. Given the presented background of the BSAI stocks’ biology, fishery location and methods, stock structure, fishing methods, management history and organization, and stock assessment activity I was able to evaluate, with confidence, the performance criteria and supporting clauses that detailed the fishery management system, the data collection, stock assessment and scientific advice, management objectives for the stock, evidence of a precautionary approach, the implementation monitoring and control, and the determination of the fishery impacts on the ecosystem. No Response Required	
A.	The Fishery 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.
Peer Review Comments: The assessment team provided evidence and documentation of the structured and legally-mandated management systems that partner in the assessment, management, and enforcement of fishery	

A.	The Fishery Management System
<p>legislation. This level of management well satisfies the criteria that the management system is effective. The fishery management system for all stocks under consideration operate in a consistent way with the dictates of the Alaska Department of Fish and Game and for stocks in the EEZ, the Magnuson-Stevens Fishery Conservation and Management Act. The applicable supporting clauses document this compliance and there is a justified “high” evidence rating. Given the constraints the biological spatial distribution of the stock, management measures are adequate for the stocks in the entirety of their ranges. Management measures, primarily under the control of the NPFMC are evaluated and update management measures in a consistent way.</p> <p>No Response Required</p>	
2.	<p>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.</p>
<p>Peer Review Comments:</p> <p>The assessment team provided evidence and documentation of the various legally-mandated management systems that partner in the assessment, management, and enforcement of fishery legislation. This level of management satisfied the assessment criteria and addressed in the 10 supporting applicable clauses. The management system at the state and federal jurisdictional levels provide a sufficient management and legal framework for the regulation of the fishery and there is sufficient information to conclude that sufficient exchange of scientific information is performed to adequately manage the stock. The other considerations of transparency, efficacy of management, and integration of stakeholder input are all satisfied.</p> <p>No Response Required</p>	
3.	<p>Management objectives shall be implemented through management rules and actions formulated in a plan or other framework.</p>
<p>Peer Review Comments:</p> <p>Management objectives are robust and are codified in the fishery management plan (FMP) for the stock under consideration. The fishery management plan is supported by the input and scientific evidence from various academic, federal, and state (of Alaska) agencies as well as the fishing and stakeholder community.</p> <p>No Response Required</p>	

B.	Science and Stock Assessment Activities
4.	<p>There shall be effective fishery data (dependent and independent) collection and analysis systems for stock management purposes.</p>
<p>Peer Review Comments:</p> <p>I agree with the assessment team that sources of fishery removal are monitored and a variety of data reporting systems exist, and these data are publicly available. I agree with the documented assessment that there is high confidence that the catch and fishing effort well monitored and that these data are utilized in a rigorous quantitative assessment of the stock and fishery dynamics. Data</p>	

B.	Science and Stock Assessment Activities
<p>collection activities are consistent with international standards. Untargeted bycatch is quantified and addressed in the fishery management plan, as well as assessed quantitatively.</p> <p>No Response Required</p>	
5.	<p>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.</p>
<p>Peer Review Comments:</p> <p>A robust, scientifically-based stock assessments of some variety is undertaken using established methods. Such methods are used to describe the fishery and stock dynamics and also addresses the economics of the fishery and ecosystem considerations. The assessment is conducted by federal and state (of Alaska) employed scientists and knowledgeable stakeholders from agencies. Participants in the assessment bring significant research capacity and a history of performing stock assessments in the region. Thus, there is a high level of confidence that assessment activities are appropriate for the stocks under consideration. The region, its ecosystem, and the biology and dynamics of the stocks under consideration are well studied by university, state, and federal agency personnel. This information is used to support the decision-making process. The stock assessment activity is stringent.</p> <p>No Response Required</p>	

C.	The Precautionary Approach
6.	<p>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 targets. Remedial actions shall be available and taken where reference point or other suitable proxies are approached or exceeded.</p>
<p>Peer Review Comments:</p> <p>The stocks under consideration are under the mandate of the MSA and thus requires that conservation and fishery management measures prevent overfishing while achieving optimum yield. Under this management framework the NPFMC (North Pacific Fishery Management Council) mandates harvest rules consistent and sufficiently precautionary based on the assigned tier which reflects the uncertainty and availability of information. The tier system specifies appropriate and cautionary fishery reference points and is variable for each stock and thus proxies (informed by the history of exploitation and the best available science) are used. The high confidence of the supporting clauses speaks to the application of the tier system to determine stock and fishery status. The exception is the lack of an accepted and valid Aleutian Islands Golden King Crab (a tier five stock), which has been noted to have non-conformance because stock and fishery status are still outstanding – though it is expected that progress will have been made prior to the commencement of the 2017 fishing season. The data deficient framework is used to address this non-conformance as is the upcoming and continued attempt to assess this stock. I am satisfied with these efforts; indeed, the stock has been attempted to be modelled for many years. I have confidence that the review team will follow up on this non-conformance for AIGCK.</p>	

C.	The Precautionary Approach
No Response Required	
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.
<p>Peer Review Comments: For the stocks under consideration proxy reference points are used and the NPFMC has established reference points consistent with the precautionary approach. There is sufficient justification that a risk averse strategy is in place for the determination of whether stocks exceed fishery reference points. Such reference points are evaluated with an understanding of the process, measurement, and model uncertainty. No Response Required</p>	

D.	Management Measures
8.	Management shall adopt and implement effective management measures designed to maintain stocks at levels capable of producing maximum sustainable yields, including harvest control rules and technical measures applicable to sustainable utilization of the fishery and be based upon verifiable evidence and advice from available scientific and objective, traditional sources.
<p>Peer Review Comments: The multi-tier system established by the NPFMC in their evaluation of the stock, relative to fishery management points ensures sustainable utilization of the stock. The 16 relevant supporting clauses document consistency in implementing effective management – there is a history of fishery closure and recent rationalization of some of the BSAI fisheries as a result of scientific information consistent with catches being greater than are sustainable. No Response Required</p>	
9.	Fishing operations shall be carried out by fishers with appropriate standards of competence in accordance with international standards and guidelines and regulations.
<p>Peer Review Comments: The state of Alaska has an extensive safety and training programs available to fishers and entry is monitored and controlled. Entry of participants is regulated. No Response Required</p>	

E.	Implementation, Monitoring and Control
10.	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.

E. Implementation, Monitoring and Control	
Peer Review Comments: Monitoring and enforcement of the BSAI crab fishery is extensive and includes the evaluation of the impact of the fishery on habitats, protected and endangered resources and accounts, and accounting of discards. Similarly, gear restrictions are in place as are area closures zones in some habitats. There exists a suite of regulations that are consistent with international standards. No Response Required	
11.	There shall be a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations.
Peer Review Comments: There exist federal and state regulations that determine the penalties for non-conformance with fishery regulations including fines and prohibition from the fishery. The enforcement of regulations occurs at the state and federal levels. These are enforced effectively and are of adequate severity. No Response Required	
F. Serious Impacts of the Fishery on the Ecosystem	
12.	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 of the fishery on the ecosystem shall be appropriately assessed and effectively addressed.
Peer Review Comments: Management and assessment implicitly considers the potential of the fishery to adversely harm the ecosystem. A number of ecosystem-level investigations have been undertaken to understand the potential deleterious impacts of harvest of living marine resources from the ecosystem. This stock, like all living resources, play a role in the trophic dynamics of the system and are impacted by the ecosystem conditions. The primary deleterious impacts of BSAI crab harvest is traps interacting with the bottom, “ghost” fishing by traps, and bycatch. The assessment addresses these concerns and the impacts are evaluated based on available science. The minor non-conformance noted by the assessment team was documented because of the lack of outcome indicators to achieve the management objective of minimizing fishery impact on essential fish habitat – although I agree with the assessment team (which documents the most relevant studies) that the pot fisheries likely do have a small impact on the benthos (relative to mobile gear) it is a concern for the deep water Al golden crab. The corrective action for this non-conformance is reasonable and outlines the need, for the industry, to address this during subsequent surveillance and assessment. No Response Required	
13.	Where fisheries enhancement is utilized, environmental assessment and monitoring shall consider genetic diversity and ecosystem integrity.
Peer Review Comments: This fishery is not enhanced, no documentation needed and no supporting clauses applicable.	

F.	Serious Impacts of the Fishery on the Ecosystem
No Response Required	

Summary and Recommendation Peer Reviewer 2

The report is well written, very comprehensive and used relevant information to score the clauses and in presenting the evidence and scoring rationale. The evidence is laid out in detail in logical fashion to support the scoring decisions. Although it is quite lengthy, I do not see a requirement to shorten it, given that there are several crab species/fisheries involved. In a couple of places, some updated references could be added perhaps. Subject to addressing the concern expressed in the next paragraph for two of the stocks, I do not have any disagreements with the scoring of any clauses, and concur with the minor non-conformances identified in Supporting Clauses 6.3 and 12.13. The corrective action plan provided by the client also seems to be adequate in addressing the non-conformances, and should be acceptable. Again, subject to addressing the concern expressed in the next paragraph, I agree with the overall recommendation by the assessment team to award certification to the AK Responsible Fisheries Management Certification Program for the crab fisheries identified. The one main concern is that 2 of the 5 fisheries examined (St. Matthew Island BKC, and EBS tanner crab) were not opened in 2016-17, based on Alaskan State decisions as specified in 5 AAC 34.917 and 35.508 respectively. The assessment report states that the stocks are below the threshold established by the State’s management system, based on the current survey estimate of mature female biomass, which is the reason for the non-opening of these fisheries. It is not clear in the report how these thresholds have been established, or why they were necessary given the FMP in place. In the management framework in the FMP, which uses male biomass for the reference points and HCR, the stocks in question are clearly in the “not overfished/not overfishing zone”, as shown in Fig. 30, which is the basis for determining stock status relative to reference points in the stock assessment SAFE, and consequently in this report. However, I think it is important that this issue be addressed further in the report, particularly with respect to Fundamental Clause 6 on the Precautionary Approach, and considering that it is the initial certification assessment for Tanner crab.

Given that the outcome of the evaluation done for AIGKC under the Data Deficient Framework (DDF) seems to have now been overtaken by the evaluation of the new assessment model, I did not provide detailed comments on the DDF results presented in Appendix 3 of the report. I did review the elements and scoring, and have no major disagreements. The assessment team is to be commended for undertaking the DDF, including the workshop.

I have provided some comments and questions on the Background Section as well as on a number of individual supporting clauses in the following section. A few are of a minor editorial nature, while most are seeking clarification, updated or additional information, etc.

Team Response: The comments by peer reviewer 2 are addressed on the team response of the reviewer comments on the background section.

8.2.1. Full Summary of Comments – Peer Reviewer 2

Background Section
<p>Peer Review Comments:</p> <p>This section gives a thorough account of the biology, fisheries, management, etc. of the Alaskan crab fisheries under assessment. A more comprehensive description of the State harvest strategies, e.g. 5 AAC 35.508 as referenced on pg. 47 would be useful so as to better inform if/how it fits with the NPFMC Tier system/HCR and FMP, what the State strategies and thresholds are based on, etc. This is obviously a critical component in determining if fisheries proceed or not, as fisheries on two of the five units of certification were not opened in 2016/17 due to the State harvest strategies, even though they appear to be above the MSST values specified in the FMP. This could also be mentioned in the Assessment Outcome Summary in Section 6.</p> <p><Assessment Team responds to Peer Reviewer comments in line using different colored font></p>

Background Section

While the State harvest strategy is not a component of the “precautionary approach” per se, the following will be added as a 2nd paragraph in 6.3 Evidence to better explain the SOA role in the TAC decision-making process.

As alluded to in the description of optimum yield in 6.1 Evidence, BSAI crab resources are managed under a joint federal/state agreement that includes federal oversight but defers much of the management to the State of Alaska. To a very large extent, management is a continuation of long-standing practice that pre-dates the FMP and is modified as required over time but in conformity with the FMP. The FMP authorizes the State to set preseason TACs and GHIs under State regulations taking into account a suite of economic, social, biological and ecological factors listed in section 8.2.2 of the FMP in developing harvest strategies for each fishery. The annual TACs are set at levels that maximize harvests and associated economic and social benefits when biological and ecological conditions warrant. TACs are set sufficiently below the ACL so that the sum of the catch and the State’s assessment of additional uncertainty do not exceed the ACL. The decision to open a fishery in any given year is based on a threshold value of mature male and/or female biomass estimated from the most recent survey as a percentage of long-term averages. Details of the calculation of threshold values varies among fisheries. A fishery may not be opened even though the formal federal assessment indicates that the stock is not overfished and that overfishing is not occurring. A thorough review of the TAC decision-making process for each fishery is presented to the BSAI crab industry prior to season opening each year (referenced in Supporting Clauses 5.1.1 and 5.1.2). ADF&G may close a fishery with a GHI before or after the GHI is achieved based on current in-season information as detailed in section 8.2.3 of the FMP. TACs and GHIs for each fishery are reported in the annual Stock Assessment and Fishery Evaluation Report, along with the OFIs and ABC/ACLs.

A.	The Fishery 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.

Peer Review Comments:
 Clause 1.2. Figures 26-29 are repeats of Figs. in the Background Section – they can perhaps be removed and the earlier Figs referenced.

 The report was edited to reflect the reviewer’s suggestion. Figure 26, 27, 28 and 29 were deleted from the evidence section of clause 1.2 and the text was updated to refer to Figure 6 (BB RKC), Figure 4 (SM BKC), Figure 7 (AI GKC), and Figure 2 (EBS Tanner and Snow Crab) respectively, from the Background Section.

 Clause 1.3. This clause is not applicable, so perhaps Table 4 would be better placed in Clause 1.2?

A.	The Fishery Management System
<p>The report was revised to reflect the reviewer’s suggestion. Table 4 and its associated text were moved from the evidence section of clause 1.3 to the end of the evidence section for clause 1.2 and placed in a new subsection titled ‘Summary of Identified King and Tanner Crab Stocks in the BSAI Area.’</p> <p>Clause 1.6. Perhaps a sentence or 2 of detail on the industry funding/cost recovery going into the observer program would be useful here.</p> <p>The evidence section of clause 1.6 was updated to provide descriptive information about industry funding and cost recovery in relation to the observer program. A paragraph was inserted which reads: Provisions for financing the crab observer program are set out in Alaska Statute (5 AAC 39.645.c Shellfish onboard observer program). Program costs are paid for through federal funds and/or test fishing (cost-recovery). Observer coverage costs are paid either entirely by the vessel (100% coverage), through test-fishing, and/or federal funds.</p>	
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.
<p>Peer Review Comments: Clause 2.2. Should also refer to BOF processes re crab management.</p> <p>The evidence section of clause 2.2 was updated to address the reviewer’s comment. The second paragraph, which previously focussed on NMFS and NPFMC processes, was expanded to read as follows: “Similarly, the Alaska Board of Fisheries (BoF) operates according to transparent processes, including holding open meetings, publishing meeting schedules, agendas and minutes, and soliciting public input. These BoF processes foster public engagement and thereby ensure that the Board is aware of the concerns of coastal communities regarding proposed management actions.”</p>	
3.	Management objectives shall be implemented through management rules and actions formulated in a plan or other framework.
<p>Peer Review Comments: Clause 3.2.1. Which years does this statement apply to: “the GHL for Bering Sea C. opilio was exceeded in five out of six years” ?</p> <p>The evidence section of clause 3.2.1 was updated to address the reviewer’s concern. The sentence now specifies the seasons in which the GHL for C. opilio was exceeded as well as the seasons in which GHL was exceeded for Bristol Bay red king crab and Aleutian Islands golden king crab. The citation was also updated accordingly.</p> <p>Clause 3.2.2. Are there any independent or third-party studies on the economics of the BSAI crab fisheries?</p> <p>There are numerous studies on the economics of BSAI crab fisheries, including annual evaluations published as part of the SAFE document. Reader access to these reports was improved by providing additional web links and greater cross-referencing to other clauses in the report which cite socio-economic studies. A paragraph was added to the evidence section of clause 3.2.2 sas follows:</p>	

A.	The Fishery Management System
<p>“NMFS and NPFMC publish the results from ongoing programs for data collection, monitoring and evaluating economic conditions of BSAI crab fisheries (also see references given under clauses 4.5 and 8.1.3). The operation of these data programs has been independently reviewed by the Center for Independent Experts (Anderson 2011). In addition, some of the main outputs from these socio-economic monitoring programs are published in academic journals as peer-reviewed studies (e.g. Abbott et al. 2010).”</p> <p>Clause 3.2.4. Is the ESA and MMPA legislation worth mentioning here?</p> <p>The evidence section of clause 3.2.4 was updated to address the reviewer’s suggestion about referencing the MSA and ESA. A paragraph was inserted at the beginning of the section explaining:</p> <p>“The Magnuson-Stevens Act (MSA) provides the overarching legislative framework to ensure that the benthic biodiversity of aquatic habitats shall be conserved. Similarly, the Endangered Species Act (ESA) provides the overarching legislative framework to ensure that endangered species are protected (also see references cited under evidence for clause 12.5.1).”</p>	

B.	Science and Stock Assessment Activities
4.	There shall be effective fishery data (dependent and independent) collection and analysis systems for stock management purposes.
<p>Peer Review Comments:</p> <p>Clause 4.2. Is there a web link to any info on the ADFG Crab Observer material, noting that the manuals referenced are listed as unpublished. Are all crab fleets and fisheries covered by observers, e.g. are there any smaller vessels fishing crab which are exempt from observer coverage, as is the case with some groundfish vessels, or have lower coverage?</p> <p>This comment will be addressed by replacing the 1st paragraph of 4.2 Evidence with:</p> <p>ADFG undertakes a comprehensive, annual monitoring program to collect data for all Bering Sea and Aleutian Islands (BSAI) crab fisheries. ADFG may deploy observers on any vessel participating in these fisheries. Since 1988, varying levels of observer coverage have been required. In accordance with the provisions of 5 AAC 39.645, during the 2013/14 season observers were deployed on all floating-processor and catcher-processor vessels, and on randomly selected catcher vessels participating in the Bristol Bay red king crab, Bering Sea snow crab and Bering Sea Tanner crab fisheries. In the Aleutian Islands golden king crab (AIGKC) fisheries, all catcher vessels were required to carry an observer during harvest of at least 50% of their total harvested weight in each 3-month trimester of the 9-month season. Dockside samplers were responsible for sampling retained catch delivered by vessels with no onboard observer. On-board observers are an important component of data collection and fishery management. They monitor fishing position, depth and soak time of the gear, as well as sample total and retained catch for size/sex composition and shell condition. They also document total catch, bycatch and effort^{112, 113}.</p> <p>Also, delete the next to last paragraph/sentence. The two references included in the reference box are cited in web links provided.</p>	

B.	Science and Stock Assessment Activities
<p>Clause 4.3. Could also mention Alaskan state (ADFG) confidentiality provisions, e.g. the Commercial Fisheries Entry Commission and statute AS 16.05.815.</p> <p>This comment will be addressed by adding the following as a 2nd paragraph to 4.3 Evidence along with the web link provided:</p> <p>Alaska Statute 16.05.815 also prohibits ADFG from releasing certain information that it receives from fishermen, fish buyers, and processors to ensure that detailed information on individual business activities will be held confidential and to provide an incentive for the public to furnish the department with good data. Records and reports requiring confidentiality include catch reports (fish tickets) and fishermen’s log books, annual reports filed with the department by buyers, processors, and exporters, and data collected by onboard observers and port samplers¹¹⁶.</p> <p>¹¹⁶http://www.adfg.alaska.gov/FedAidPDFs/SP12-14.pdf</p>	
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.
<p>Peer Review Comments:</p> <p>Clause 5.1. When were the last CIE reviews for these crab stocks, and were recommendations from those reviews, if any were made, followed up on?</p> <p>A search at www.afsc.noaa.gov uncovered no CIE reviews specific to BSAI crab stock assessment methodology and the www.ciereviews.org website is currently non-functional. The last paragraph in 5.1 Evidence will be replaced with:</p> <p>In addition to the peer review process that is integral to each annual assessment, BSAI crab stock assessment methodologies are also reviewed as considered necessary by way of specially convened NPFMC workshops that provide a more comprehensive review of special stock assessment methodology issues than would occur during the annual assessment cycle. The third in a series of such workshops was held in 2013 to review assessment models¹³⁰. Reference to any such review germane to current assessment activity for a particular stock is included in the annual SAFE report.</p> <p>¹³⁰http://www.afsc.noaa.gov/REFM/stocks/Plan_Team/crab/2013February2013workshop_Final.pdf</p> <p>Also, the last sentence of 4.1.1 Evidence will be deleted along with the link to the CIE website.</p> <p>Clause 5.2. Would OSRI be relevant to mention for oil pollution studies re crab resources?</p> <p>This comment will be addressed by adding the following as a final paragraph to 5.2 Evidence:</p> <p>In addition to the above general ecosystem considerations, monitoring of and research related to effects of pollution of the marine environment throughout Alaska is an ongoing priority for AFSC and various State agencies. Details of programs and specific studies can be found at ¹³⁹ and links provided therein.</p> <p>¹³⁹http://www.afsc.noaa.gov/ABL/Habitat/ablhab_contaminants.htm</p>	

B.	Science and Stock Assessment Activities
<p>Clause 5.5. See comment on 4.3 re confidentiality of State records.</p> <p>This comment will be addressed as follows:</p> <p>The last sentence of 2nd paragraph of 5.5 Evidence will be separated and become a 4th paragraph and the paragraph in the response for 4.3 comment above will be inserted as 3rd paragraph of 5.5 Evidence.</p>	

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 targets. Remedial actions shall be available and taken where reference point or other suitable proxies are approached or exceeded.
<p>Peer Review Comments:</p> <p>Clause 6.1. There is a lot of detail in this clause including definitions of various terms, explanation of the tiered management structure, etc. I think this is OK here, even though the clause is looking for specific info on reference points (which is contained in the description). A reference to Table 6-1 is in the text – was it the intention to include that table here, or just reference it in the NPFMC FMP?</p> <p>The inclusion of reference to Table 6-1 (of the FMP) was un-intended. (see Table 6-1) will be deleted from paragraph/line 22 of 6.1 Evidence.</p> <p>I think it is also quite important to discuss the State harvest strategy(s) and threshold levels established, given that it appears that these values determine whether the crab fisheries are opened or not, (even though they do not seem to be a part of the FMP, or have I missed something there?). Do these thresholds have a biological basis, and how important are they relative to the reference points used in the FMP, and those used to determine stock status relative to overfishing?</p> <p>This comment is addressed above in Background Section.</p> <p>Clause 6.3. 2nd parag.: <i>The harvest rate ... is reduced to zero when the stock reaches the limit reference point. At that point, a rebuilding plan is implemented.</i> It should be made clear that the limit reference point MSST, or ½ Bmsy, triggers a rebuilding plan. If I am reading the NPFMC tier system/control rule correctly, the fishing mortality in the directed harvest is not set to zero until a biomass level denoted as β is reached, which is typically lower than ½ Bmsy.</p> <p>Here the reviewer is referring to the 2nd paragraph of 6.2, not 6.3. It is a condensed version of a paragraph of 6.1 which explains the control rules as the limit reference point is reached in more detail. The comment will be addressed by replacing the 2nd paragraph of 6.2 with the following:</p> <p>The (lower) limit reference point corresponds to ½ MSY. The harvest rate in the directed fishery is decreased when stock biomass is moving from upper to limit reference point. At stock status level “c”, the ratio of current biomass to BMSY (or a proxy for BMSY) is below β (critical biomass threshold), directed fishing is prohibited and an FOFL at or below FMSY would be determined for all other sources of fishing mortality in the</p>	

C.	The Precautionary Approach
<p>development of a rebuilding plan. The Council will develop a rebuilding plan once a stock level falls below the MSST.</p> <p>Editorial - Table header 4 says values are in 1000t, but some numbers in the table are in tons. Header was revised to: Table 4. Status and catch specifications (1000 t) of Aleutian Islands golden king crab.</p> <p>Clause 6.4. First paragraph: same comment as for clause 6.3 re when harvest rate = zero. Should also mention/discuss the Alaskan state threshold values used to determine if fishery goes ahead or not.</p> <p>This comment is addressed above in Background Section.</p>	
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.
<p>Peer Review Comments: Clauses 7.1.1 and 7.3 Should the State harvest strategy/threshold be mentioned in these clauses?</p> <p>Adding details of the State harvest strategy would be superfluous in these clauses. Reference to clauses 6.1, 6.2 and 6.3 is provided in both and, in 7.3, optimum yield, which incorporates the essence of the State harvest strategy at any rate, is explained.</p>	

D.	Management Measures
8.	Management shall adopt and implement effective management measures designed to maintain stocks at levels capable of producing maximum sustainable yields, including harvest control rules and technical measures applicable to sustainable utilization of the fishery and be based upon verifiable evidence and advice from available scientific and objective, traditional sources.
<p>Peer Review Comments: Clauses 8.1.2, 8.1.3. Evidence could probably include references to studies showing impact of rationalization on BSAI crab fisheries.</p> <p>The major economic impacts of rationalization occurred during the 2000s. Although it is an ongoing process, impacts over the recent past are relatively minor and incorporated in ongoing annual economic assessments. Nevertheless, the comment will be addressed by adding the following to the start of the 2nd paragraph of 8.1.2 Evidence: See evidence for supporting clause 8.1.3.</p> <p>And, the 2nd sentence of the 1st paragraph of 8.1.3 will be replaced with: A separate annual SAFE report provides a comprehensive analysis of economic aspects of these fisheries. See evidence for supporting clause 5.1 and web links provided therein.</p> <p>And the following will be added as a 2nd paragraph of 8.1.3:</p>	

D. Management Measures
<p>A five-year review of the crab rationalization management program can be found at the web link provided¹⁵³.</p> <p>¹⁵³http://www.afsc.noaa.gov/REFM/Socioeconomics/PDFs/5YearRev1210.pdf</p> <p>Clause 8.9. Any studies/data on ghost fishing, or any pot-recovery programs? NOAA publication may be useful https://marinedebris.noaa.gov/sites/default/files/publications-files/Ghostfishing_DFG.pdf</p> <p>This comment will be addressed by adding the following as a separate paragraph at the end of 8.9 Evidence:</p> <p>A five-year review of the crab rationalization management program, which includes a consideration of lost pots and ghost fishing, can be found at ¹⁵³ referenced in evidence for supporting clause 8.1.3.</p>
<p>9. Fishing operations shall be carried out by fishers with appropriate standards of competence in accordance with international standards and guidelines and regulations.</p>
<p>Peer Review Comments: No comments on this Clause</p>

E. Implementation, Monitoring and Control
<p>10. 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.</p>
<p>Peer Review Comments: No comments on this Clause</p>
<p>11. There shall be a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations.</p>
<p>Peer Review Comments: Clauses 11.1, 11.2. Editorial - Perhaps no need to have the 4 points from the MSA in the summarized evidence, as they are repeated immediately below in both clauses.</p> <p>The report was edited to reflect the reviewer’s suggestion.</p>

F. Serious Impacts of the Fishery on the Ecosystem
<p>12. 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 of the fishery on the ecosystem shall be appropriately assessed and effectively addressed.</p>
<p>Peer Review Comments: Clause 12.1. Are there any recent updates of ACIA 2004, NPRB beyond 2012?</p>

F. Serious Impacts of the Fishery on the Ecosystem

To address the reviewer's question about ACIA, the evidence section of clause 12.1 was updated with the following paragraph:

"ACIA is itself a project of the Arctic Monitoring and Assessment Programme (AMAP) - an Arctic Council Working Group whose mission is to provide ""reliable and sufficient information on the status of, and threats to, the Arctic environment, and providing scientific advice on actions to be taken in order to support Arctic governments in their efforts to take remedial and preventive actions relating to contaminants and adverse effects of climate change." AMAP's current work focusses on issues such as Arctic cryospheric change, Arctic Ocean acidification, and impacts of short-lived climate forcers (black carbon, tropospheric ozone and methane) on Arctic climate. The organization also includes socio-economic aspects in its assessment work, and to consider the integrated effects of multiple drivers of change. Relevant recent publications from AMAP include, among others, summary reports on ocean acidification (AMAP 2014) and mercury in the Arctic (AMAP 2011).

To address the reviewer's question about NPRB, the evidence section of clause 12.1 was updated with the following two paragraphs:

More recently, NPRB launched a Long-term Monitoring Program in 2013 with the goal of supporting new or existing time-series research that will enhance our ability to understand the current state of the marine ecosystem and predict ecosystem responses to changing ocean conditions. NPRB has committed an initial \$400,000 per year for five years to this effort (a total of \$2 million).

In addition, NPRB has initiated a comprehensive, ecosystem-level study (2010-2014) to examine the physical and biological mechanisms that determine survival of juvenile groundfishes in the Gulf of Alaska (2010-2014). A synthesis of program results was initiated in September 2015 and will continue through February 2018, building upon results of the field program to generate products with direct application to fisheries management.

Clause 12.9. Ongoing EFH Research appears to describe work ongoing around 2010. Is there a more recent update available?

The evidence section of clause 12.9 was expanded with additional information to address the reviewer's question. The following two paragraphs were included:

NPFMC reviewed EFH in 2015 and found there had been a large advance in EFH information, in particular by substantially refining EFH maps for fish and crab species (Simpson et al. 2017). Refinements were obtained through an analysis to determine the environmental influences on species distributions and this information was used to improve EFH maps. These maps provide EFH Level 2 information (habitat-related densities) for the adult life stage for many FMP species and EFH Level 1 information (habitat distribution) for the juvenile life stages of some FMP species. These maps also provide a solid foundation for the next 5 years of EFH research. According to the most recent NPFMC review of EFH, during 2006-2016 NMFS had spent about \$5 M in total on 91 EFH projects in Alaska resulting in 74 scientific publications (NPFMC 2016).

More recently, NFMS has released a five-year plan for EFH research (Sigler et al. 2017). The new EFH research plan retains the original long-term goals that have guided EFH research in Alaska since 2005, namely: 1) characterize habitat utilization and productivity; 2) assess habitat sensitivity and recovery; 3) validate and

F.	Serious Impacts of the Fishery on the Ecosystem
<p>improve fishing impacts model; 4) map the seafloor; and 5) assess coastal habitats facing development. However, the 2017 EFH plan recognizes two specific objectives that are to be achieved over the next 5 years: 1) Develop EFH Level 1 information (distribution) for life stages and areas where missing; and 2) Raise EFH level from Level 1 or 2 (habitat-related densities) to Level 3 (habitat-related growth, reproduction, or survival rates).</p> <p>Clause 12.13. I agree with the rationale and the minor non-conformance. Perhaps a sentence could be added in the last paragraph to focus on the exact nature of the non-conformance.</p> <p>To clarify the exact nature of the non-conformance, two sentences were added to the closing paragraph of the evidence section of Clause 12.13:</p> <p>“For example, there are no spatial analyses available which would allow an estimation of current and historic overlap of AIGKC pot fishing effort with the distribution of vulnerable coral and sponge habitats in the Aleutian Islands. The AIGKC unit of certification is therefore assigned a medium confidence rating for clause 12.13.”</p>	
13.	Where fisheries enhancement is utilized, environmental assessment and monitoring shall consider genetic diversity and ecosystem integrity.
<p>Peer Review Comments: Clause Non Applicable</p>	

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.

Low Confidence Rating (Critical Non-Conformance level)

Information/evidence is completely absent or contradictory to demonstrating compliance of an element of a fishery to the given requirements of a supporting clause. In these cases, a low confidence rating, equivalent to a critical non-conformance is assigned. Alternatively, any non-conformance assigned to any Section A to F, above the designated maximum permitted of 1 major non-conformance or 3 minor non-conformances will also result in the assignment of a critical non-conformance (at Section level). A critical non-conformance will essentially stop the assessment (not allowing for certification) unless the applicant is able to provide information/evidence that demonstrates a better state of the fishery than previously assessed. The Validation Report activities are designed to determine if critical non-conformances within the Applicant Management System are likely before proceeding with the assessment. Notwithstanding this, the option of assigning critical non-conformances remains available to the Assessment Team if there is merit for this decision to be taken.

Medium Confidence Rating (at Major Non-Conformance level)

Information/evidence is limited that demonstrates compliance of an element of the fishery to the given requirements of a supporting clause. In these cases a major improvement is needed to achieve high conformance and for a medium confidence rating at this level, a "major non-conformance" is assigned.

Medium Confidence Rating (at Minor Non-Conformance level)

Information/evidence is broadly available that demonstrates conformity to a clause although there are some gaps in information/performance that if available would clarify aspects of conformity and allow the Assessment Team to assign a higher level of confidence. In these cases a minor improvement is needed to achieve high conformance and for a medium confidence rating at this level, a "minor non-conformance" is assigned.

High Level of Confidence

Where the Assessment Team agrees that sufficient information/evidence is available to demonstrate conformance/performance to a given supporting clause, a high level of confidence is assigned. Sufficient evidence is that which allows, through expert opinion of the collective team, substantiation that a given element of a fishery, complies fully with the FAO-Based Responsible Fisheries Management Conformance Criteria.

9.1 Non Conformances

In the course of the reassessment of BSAI Crab Fishery the Assessment Team identified two areas (Clauses 6.3 and 12.13) that scored less than full conformance to the Alaska RFM Certification Standard Version 1.3. As a result, two **MINOR** non-conformances were issued:

Non-Conformance #1 (MINOR non-conformance: Clause 6.3)

Data and assessment procedures shall be installed measuring the position of the fishery in relation to the reference points. Accordingly, the stock under consideration shall not be overfished (i.e. above limit reference point or proxy) and the level of fishing permitted shall be commensurate with the current state of the fishery resources, maintaining its future availability, taking into account that long term changes in productivity can occur due to natural variability and/or impacts other than fishing.

Non-Conformance #2 (MINOR non-conformance: Clause 12.13)

With respect to the AI golden king crab unit of certification, the spatial distribution of pot fishing effort in relation to vulnerable habitats is unclear but may be extensive in some areas. Predictive models of coral and sponge distribution have been developed for the Aleutian Islands. However no spatial analysis is yet available which would allow an estimation of current and historic overlap of AIGKC pot fishing effort with the distribution of vulnerable coral and sponge habitats in the Aleutian Islands.

A corrective action plan from the client shall detail;

1. How Bering Sea Crab Client group intends to address these nonconformances, and
2. a set of specific timelines to allow for assessment during the next surveillance activities in 2018, 2019 and 2020 and the second full assessment audit in 2021, as relevant and if needed.

9.2 Corrective Actions

Letter from Bering Sea Crab Client Group in response to non-conformances #1 and 2.

Date: August 31, 2017

From: Bering Sea Crab Client Group (BSCCG)
Mr. Scott Goodman (Executive Director)
Bering Sea Fisheries Research Foundation (BSFRF)
4039 21st Avenue W, Suite 404
Seattle, WA 98199
(BSCCG is wholly owned subsidiary of BSFRF)

To: Mr. Bill Paterson (General Manager)
Global Trust Certification Ltd.
3rd Floor, Block 3
Quayside Business Park
Mill Street, Dundalk
Co. Louth, Ireland

RE: **Corrective Action Plan** – for two identified minor non-conformances in the Aleutian Islands Golden King Crab Unit of Assessment. Ref: fm13/AK/CRA/2017
(Conducted as part of U.S. Alaska Bering Sea and Aleutian Islands King, Tanner and Snow Crab Commercial Fisheries – Re and Full Assessments, 2017)

Dear Mr. Paterson,

In response to your letter dated 18 May, 2017 I am writing this **Corrective Action Plan** to address the non-conformance issues with the AIGKC fishery assessment. On behalf of the Bering Sea Crab Client Group (BSCCG) I have reviewed information available for both of the non-conformance issues identified, including materials referenced in the draft assessment (AK RFM BSAI CRAB Reassessment Form 11 Alaska RFM_Full Assessment), further information comparing current v. historical fishing effort in the AIGKC pot fishery, spatial regulatory closures of sensitive habitat on the fishing grounds, mechanisms that are in place to identify important habitat and develop protection measures, and new management decisions that have occurred recently. Portions of this information were not yet available at the time of the assessment reviews and your letter.

We acknowledge the substantial work done to review the AIGKC pot fishery as an ASMI RFM fishery unit of certification and we would seek to have both of the identified issues be closed as non-conformance issues in the near future either as a result of information presented here or as a result of actions taken as a part of this plan. The first issue identified (from supporting clause 6.3) in particular, we would recommend that it be closed out as a non-conformance after review of attached materials. The second issue identified (from supporting clause 12.13) is acknowledged as more complex but could be closed also, pending further review of information available in this action plan and in the near future.

Minor Non-Conformance #1 (Supporting Clause 6.3)

The summary information from the Assessment Team for this issue indicated “at the time of this writing, use of the latest version of the AIGKC assessment model for management decision making has not been formally accepted and implemented by the fishery management organizations.” As part of normal management and peer review processes for Alaskan crab stocks there is a substantial amount of time and several steps required as a given stock moves “upward” in a positive assessment scale toward more

accuracy and precision to inform management. As noted in the GT assessment, the NPFMC Crab Plan Team, Scientific and Statistical Committee and importantly, the State of Alaska Department of Fish and Game (ADF&G) all play roles in this process. Given the progress in other BSAI stocks, the AIGKC model is relatively late to move from Tier 5 to Tier 3, meet the requirements for model approval, and move into full implementation of results. Since the assessment team outcomes earlier this year however, the AIGKC model and assessment have completed full peer review approval and are formally accepted and implemented into appropriate parts of management.

We have included here for your review three attachments 1) reference pages from the NPFMC SSC meetings June 5-7, 2017, 2) letter from Dr. Robert Foy, Chair of the NPFMC CPT acknowledging final steps of approval and implementation, and 3) a letter from Dr. Benjamin Daly, ADF&G acknowledging the same. For your information and referenced by Dr. Daly in his letter, the next steps in implementation in addition to the model OFL serving as a maximum TAC setting threshold, the State of Alaska is developing a new harvest strategy for AIGKC to more flexibly handle fishery CPUE, survey information, and model outputs in consideration of TAC setting which importantly, is very similar to other BSAI Tier 3 crab stocks. In consideration of this progress and the documentation attached herein we would seek to have this minor non-conformance closed.

ATTACHMENTS

North Pacific Fishery Management Council

Dan Hull, Chairman
Chris Oliver, Executive Director



605 W. 4th Avenue, Suite 306
Anchorage, AK 99501-2252

Telephone (907) 271-2809

Fax (907) 271-2817

Visit our website: <http://www.npfmc.org>

SCIENTIFIC AND STATISTICAL COMMITTEE

Report to the NORTH PACIFIC FISHERY MANAGEMENT COUNCIL June 5th – 7th, 2017

The SSC met from June 5th through 7th at Centennial Hall, Juneau, AK.

Members present were:

Farron Wallace, Chair
NOAA Fisheries—AFSC

Sherri Dressel, Vice Chair
Alaska Dept. of Fish and Game

Milo Adkison
University of Alaska Fairbanks

Chris Anderson
University of Washington

Jennifer Burns
University of Alaska Anchorage

Robert Clark
Alaska Dept. of Fish and Game

Brad Harris
Alaska Pacific University

Anne Hollowed
NOAA Fisheries—AFSC

Gordon Kruse
University of Alaska Fairbanks

Dayv Lowry
Washington Dept. of Fish and Wildlife

Kate Reedy
Idaho State University Pocatello

Matt Reimer
University of Alaska Anchorage

Ian Stewart
Intl. Pacific Halibut Commission

B-1 Plan Team Nominations

The SSC reviewed the Plan Team nominations of Teresa A'mar and Nathaniel Nichols to the GOA Groundfish Plan Team, John Olson and Mike Byerly to the Scallop Plan Team, and Krista Milani to the Crab Plan Team. The SSC finds all of these nominees to be well qualified, with appropriate expertise that will assist the respective Plan Teams. The SSC recommends that the Council approve these nominations.

B-1 Social Science Planning Team (SSPT): Proposed Purpose and Organization

The SSC received a presentation from Sam Cunningham (NPFMC) on the Executive Director's Report on a Proposed Purpose and Organization of a Social Science Planning Team (SSPT). Public testimony was heard from Verner Wilson III (Bristol Bay Native Association) and Jon Warrenchuk (Oceana).

The proposal was developed in response to needs expressed by multiple groups. First, the SSC identified numerous gaps in social science data needed to meet statutory requirements for evaluating LAPP programs during recent reviews of Amendment 80, Bering Sea and Aleutian Islands (BSAI) crab rationalization, and the Halibut/Sablefish IFQ program. Second, the Human Dimensions Workshop hosted in July 2016 by AFSC identified value in having an advisory body dedicated to longer-term strategic planning for social science. Finally, Council staff, NMFS AKRO, and the AFSC social scientists also seek to coordinate their research programs to ensure responsive and broadly applicable social science products.

The proposed SSPT is designed to ensure the best available data and methods are applied in the scientific analyses that support Council decisions. Many of the persistent gaps in social science data span fisheries

Given ongoing concerns about the random effects model, the author and CPT recommended retaining PIGKC in Tier 5 and using the status quo procedures to calculate OFL with a 25% buffer for ABC, which is used for other Tier 5 stocks with similar levels of concern. The SSC agrees with this recommendation. In 2016, no vessels participated in this fishery and there was no reported bycatch in other fisheries. Thus, overfishing did not occur in 2016.

Western Aleutian Islands Red King Crab (WAIRKC)

The WAIRKC stock is managed using Tier 5 whereby total catch OFL is calculated using retained catch, non-directed crab discard mortality, and groundfish discard mortality averaged over 1995/96 – 2007/08. For the last few years, the ABC has been estimated with a 40% buffer below OFL to accommodate bycatch in groundfish fisheries and catch for cooperative surveys that operated as a test fishery. In 2016, the SSC expressed some concern about the size of the ABC, given the status of the stock and requested the author and CPT to review the buffer for next year's assessment. The cooperative survey in the Petrel area in 2016 revealed a very low CPUE of 0.11 crab per pot and no additional surveys have been planned. The SSC also appreciates the addition plots of size frequency data in Appendix 5. These appear to show some consistency in the annual progression of size modes, at least for a subset of years with sufficient observations.

As noted by the CPT, the assessment shows a high level of bycatch in groundfish fisheries in 2015/16 relative to previous years. Table 4 indicates that trawl fisheries are primarily responsible for this increase. The SSC broadens the CPT's request for additional information about the source of this bycatch to include fishery, specific area, season, sample sizes used for estimation, etc. The SSC also requests some evaluation to the extent possible about the potential that these removals represent a conservation concern to this crab stock. **Despite the new three-year assessment cycle for this stock, the SSC requests the CPT to review this issue in 2018.**

The author and CPT recommended calculation of OFL under Tier 5 using status quo methods. Given the depressed stock status and the lack of need to accommodate additional surveys, this year the CPT recommended increasing the buffer for ABC calculation to 75%, as had been used before accommodation was made for a test fishery. The SSC endorses these OFL and ABC recommendations. Overfishing did not occur during 2015/16 because the estimated total catch did not exceed the Tier 5 OFL.

Aleutian Islands Golden King Crab (AIGKC)

Through the 2016/17 fishing year, the AIGKC stock was managed using Tier 5 methods with data from ADF&G fish tickets, size-frequencies of landings, at-sea observations, and bycatch estimates from groundfish fisheries. A length-based stock assessment model has been developed that fits male-only population dynamics to data on catches and discards in the directed fishery, discards in the groundfish fishery, standardized indices of abundance based on observer data, fish ticket CPUE data, length-frequency data for the directed fishery (landing and total catch), and mark-recapture data. The CPT recommended, and the SSC approved, use of this model as a Tier 3 assessment for use in the 2017/18 specifications cycle. AIGKC is the only stock in the BSAI Crab Fishery Management Plan that is modeled with fishery-dependent catch and CPUE data without fishery-independent survey information.

In the current assessment, 11 model configurations were considered as summarized in Table T1 in the assessment chapter and as summarized below:

- Model 1 assumes that the proportion mature is a logistic function of length, was fitted to observer CPUE data for 1995/96 to 2015/16 and fish ticket data from 1985/86 to 1998/99, and fixed M for both the EAG and WAG to be 0.224yr^{-1} . B_{MST} reference points are based on average recruitment over 1987–2012.

SSC Minutes – June 2017

11 of 20

- Model 2 varied the assumptions of Model 1 by omitting the fish ticket data.
- Model 3 varied the assumptions of Model 1 by including additional observer CPUE data for 1991/92-1994/95.
- Model 4 varied the assumptions of Model 1 by considering three rather than two selectivity patterns.
- Model 5 varied the assumptions of Model 1 by assuming a lower value of M (0.189).
- Model 6 varied the assumptions of Model 1 by assuming a higher value of M (0.266).
- Model 7 is identical to Model 1, except B_{MSY} reference points are based on a longer time period (1982–2016) over which recruitment is averaged.
- Model 8 is identical to Model 1, except B_{MSY} reference points are based on a shorter time period (1996–2016) over which recruitment is averaged.
- Model 9 varied the assumptions of Model 1 by assuming knife-edged maturity at 111 mm CL.
- Model 10 varied the assumptions of Model 1 by assuming area-specific values for M .
- Model 11 involves knife-edged maturity at 111 mm CL and area-specific values for M .

The CPT felt that the maturity-at-length data appear unrealistic (e.g., the probabilities of being mature for large sizes are less than expected) and the logistic function does not fit well to the data for smaller animals. The SSC agrees. This logistic function was used for all models except Models 9 and 11. Thus, the CPT focused on Models 9 and 11, which are based on knife-edged maturity. The CPT also noted a weak retrospective pattern for Model 9 for the EAG (additional years of data lead to higher estimates of biomass), but not for the WAG. The CPT agreed with the assessment author's preferred model (Model 9). Model 9 was preferred to Model 11 because the evidence for area differences in M is weak. The SSC agrees with the choice of Model 9 for this year's assessment.

The SSC appreciates the efforts to investigate the spatial dynamics of the fishery data. Analysis of a subset 'core area' of spatial data indicated similar trends to those estimated for the standardized CPUE series using all of the data. However, this approach is not the same as predicting the CPUE in unfished areas; this type of spatial extrapolation has been the subject of considerable fisheries literature, and incomplete spatial analysis remains a fundamental problem in the interpretation of CPUE data.

The SSC requests that the assessment authors examine potential causes of the retrospective pattern for Model 9 for the EAG whereby additional years of data lead to higher estimates of biomass. The possibility that this feature is a function of population trend should be explored. AIGKC appear to be increasing in the EAG and more stable or declining in the WAG. To address the issues concerning model fits to maturity data, the CPT recommended that, for the next assessment, the maturity ogive should be estimated outside the model rather than inside the model along with other model parameters. The SSC feels that the veracity of the approach to estimate mature versus immature crab in this assessment needs to be evaluated.

As noted by the CPT, average recruitment used to set the 1960 recruitment and B_{MSY} were based on somewhat different time periods (1987-2012 and 1985-2015, respectively), contrary to the SSC's recommendation to use identical periods to calculate both quantities. Thus, the SSC supports the CPT's request that the authors base both the 1960 recruitment and B_{MSY} on the same set of years (1987-2012). The stock assessment author has already addressed this request.

Finally, the CPT noted that a single OFL and ABC need to be defined for AIGKC stock. However, separate models are available for each of the two areas, creating the need for a method to compute one OFL and ABC for the stock. The CPT considered two approaches:

1. Apply the OFL control rule by area and sum the OFLs by area.
2. Determine stock status for the stock by adding the estimates of current MMB and B_{MSY} by area. This stock status is then used to determine the ratio of F_{OFL} to $F_{35\%}$ by area, which is then used to

SSC Minutes – June 2017

12 of 20

calculate the OFLs by area, which are then added together to calculate an OFL for the entire stock.

The CPT preferred the second approach because it relies on a single stock status determination. Use of the first approach would cause the EAG area to be in Tier 3a and the WAG area to be in Tier 3b. The SSC agrees with the choice of the 2nd approach.

In summary, the SSC supports the CPT's recommendation to base the $B_{MSYproxy}$ for the Tier 3 harvest control rule on the average recruitment from 1987-2012, years for which recruitment is relatively precisely estimated. For ABC determination, the SSC recommends a 25% buffer (consistent with the assessment authors) rather than the 20% buffer recommended by the CPT. The CPT justified their recommendation for a 20% buffer based on the buffers used for other Tier 3 crab stocks: BBRKC (10%), EBS snow crab (25% reduced to 10% in 2016), and EBS Tanner crab (20%). Instead, the SSC justifies the 25% buffer for AIGKC based on: (1) the use of fishery CPUE rather than fishery independent surveys used for all other Tier 3 stocks, (2) uncertainties in size of maturity for AIGKC, including the untested regression approach involving chela height against carapace length, (3) uncertainties in natural mortality, (4) limited spatial coverage of the fishery with respect to the total stock distribution, and (5) the small number of vessels upon which CPUE is based. For these reasons, the SSC feels that larger ABC buffer is warranted for AIGKC than other Tier 3 crab stocks. Overfishing did not occur during 2015/16 because the estimated total catch did not exceed the Tier 5 OFL established in last year's assessment.

The SSC thanks the assessment authors for impressive efforts on this assessment over the years. The SSC also thanks the CPT for their careful review and excellent comments and suggestions. The SSC supports other recommendations offered by the CPT.

Bristol Bay Red King Crab (BBRKC)

GMACS

The CPT report included discussions during their spring meeting and the 2017 modelling workshop summarizing efforts to reconcile remaining differences between data sets, parameterization and structural choices used in the GMACS (Generalized Model for Alaska Crab Stocks) and current assessment models. The SSC was in full agreement that a substantial amount of progress has been made toward applying this modelling platform to BBRKC, but that further work is needed.

The SSC noted the value in the time-consuming process of reconciling model outputs and troubleshooting differences in the code and input data. The SSC supported the CPT's recommendations for further GMACS improvements including: 1) estimating initial numbers-at-length in the same manner as is done in the assessment model; and 2) estimating the growth transition matrix as in the assessment model. These and other changes are likely necessary to achieve a close enough match between the two model results to provide a starting point for transition to GMACS for future assessments. The SSC also supports the CPT's proposal to wait until 2018 to use the GMACS platform for the stock assessment in order to provide sufficient time to reconcile these remaining issues.

The SSC looks forward to the 2018 assessment using GMACS, and further supports the long-term plan of including the crab assessment authors as part of the development team for GMACS. With identification of a designated lead to maintain the central code repository, and manage version and quality control, this can be a successful open-source tool for future assessments. The SSC encourages continued communication between current authors and GMACS development efforts, transitioning from separate to cooperative efforts.



UNITED STATES DEPARTMENT OF COMMERCE
 National Oceanic and Atmospheric Administration
 National Marine Fisheries Service
 Alaska Fisheries Science Center, RACE Division
 Kodiak Laboratory
 301 Research Ct.
 Kodiak, AK 99615

Scott Goodman, Vice President
 Natural Resources Consultants, Inc.
 4039 21st Avenue West, Suite 404
 Seattle, WA 98199 USA

August 3, 2017

Dear Scott,

This is an account of the process to approve and use the east and west Aleutian Islands Golden King Crab population dynamics models written by Shareef Siddeek from the Alaska Department of Fish and Game. The North Pacific Fisheries Management Council Crab Plan Team (CPT) reviewed a number of aspects of the stock assessment model and CPUE data culminating in acceptance of the model in October 2016 by the CPT and Council Science and Statistical Committee (SSC). The Tier status for the stock was recommended and approved by the CPT and SSC in February 2017. The model was implemented in June 2017 with Council approval of the CPT and SSC recommended biological reference points (e.g. OFL, ABC).

The details of the reviews, recommendations, and acceptance of the model can be found in the CPT, SSC, and Council minutes at <https://www.npfmc.org/>. Please let me know if you need any additional information.

Sincerely,

Robert Foy, Chair
 Crab Plan Team (NPFMC)

Alaska Fisheries Science Center
 NOAA Fisheries
Robert.foy@noaa.gov
 907-942-0657





THE STATE
of ALASKA
GOVERNOR BILL WALKER

**Department of
Fish and Game**

DIVISION OF COMMERCIAL FISHERIES
Westward Region Office

351 Research Court
Kodiak, Alaska 99615-7400
Main: 907.486.1825
Fax: 907.486.1841

August 8, 2017

Scott Goodman
Natural Resources Consultants, Inc.
4039 21st Avenue West, Suite 404
Seattle, WA 98199

Dear Mr. Goodman:

The Alaska Department of Fish and Game set the Aleutian Islands golden king crab total allowable catch (TAC) for the 2017/18 season with acknowledgement of the approved stock assessment model, change in Tier status, and associated approved overfishing level (OFL). Although model output was not used in TAC setting for the 2017/18 fishing season because a Board of Fisheries (BOF) approved Aleutian Islands golden king crab harvest strategy is not currently in place, the OFL from the model did serve as a threshold to not be exceeded during TAC setting.

Sincerely,

A handwritten signature in blue ink, appearing to read "Benjamin Daly".

Benjamin Daly, PhD
Research Coordinator

Minor Non-Conformance #2 (Supporting Clause 12.13)

The summary information from the Assessment Team for this issue addressed coral impacts from AIGKC pot fishing in two important points: 1) “no spatial analysis is yet available which would allow an estimation of current and historic overlap of AIGKC pot fishing effort with the distribution of vulnerable coral and sponge habitats in the Aleutian Islands,” and 2) “it was not shown that outcome indicators are in place that are consistent with avoiding, minimizing, or mitigating the impact on habitats that are highly vulnerable to damage by pot gear.”

For the consideration of interaction of the AIGKC pot fishery with coral habitat we acknowledge the considerable review work accomplished by the GT assessment team. We have considered the summary statements above and have included new information to address the first, and some action steps to address the second. Importantly, we would reiterate that existing management oversight from NOAA/NMFS, NPFMC, and the State of Alaska are all prescriptive to required changes for the AIGKC pot fishery and other bottom contact fisheries in Alaska to adopt regulations when necessary which minimize harm to substrate and epifauna. In addition, the post-Crab Rationalization AIGKC fleet is greatly reduced, closely monitored, and fully compliant with all existing Federal and State commercial fishing regulations.

Spatial Analysis

The AIGKC fishery is executed over an expansive area covering approximately 18,000 square nautical miles. ADF&G Fishery Management Report No. 17-10 documents the greatly reduced nature of the AIGKC fishery in terms of active vessels and pot lifts (AMR 17-10, Table 1-4). To evaluate pot effort spatially across the both the east and west AI regulatory areas however, requires access to extensive confidential data (based on State of Alaska regulations per data access where a limited number of harvesters or processors are present). Currently there is no comprehensive ongoing analysis that condenses data to allow access for spatial analyses. However, some information was available from ongoing research (independent surveys) which allows for initial steps to evaluate reduced effort spatially. Figures 1 and 2 show the current versus historical effort in the AIGKC commercial pot fishery for a few example seasons prior to and after Crab Rationalization. In general, a coarse spatial analysis plotted all pot effort per season in a grid made of 2 nautical mile squares. In higher effort years and prior to rationalization the presence of pot effort (pot lifts) in grids ranged from about 30-50% of total historical fishing grounds. In the lower effort, post-rationalization years the grids with pot effort are significantly lower. The current effort is greatly reduced in terms of vessels fishing, pots lifted, and total footprint on bottom with an estimated current average footprint for all pots fished that is below 15% of historical. These example years are a subset of seasons, and **we would propose as a next action step for part of this plan that a full review of all years with consistent information available be completed.**

As noted in the GT assessment, current spatially sensitive areas for corals have been identified through the NPFMC process (EFH/HAPC) which led to identified Federal regulations further adopted by the State of Alaska. Referencing the same ongoing research mentioned above for independent surveys allowed for review of the spatial overlap of fishing effort and those defined sensitive areas. A second spatial review is shown in Figure 3 by a plot of all pot fishing effort (1990-2013) over the regulatory closure areas, and a plot of the spatial closures with effort after the regulation. This plot reflects full compliance by the AIGKC fishery with current spatially explicit regulations. The current and recent seasons were unavailable for this analysis and **we would propose as a next action step for part of this plan to update this plot to current.**

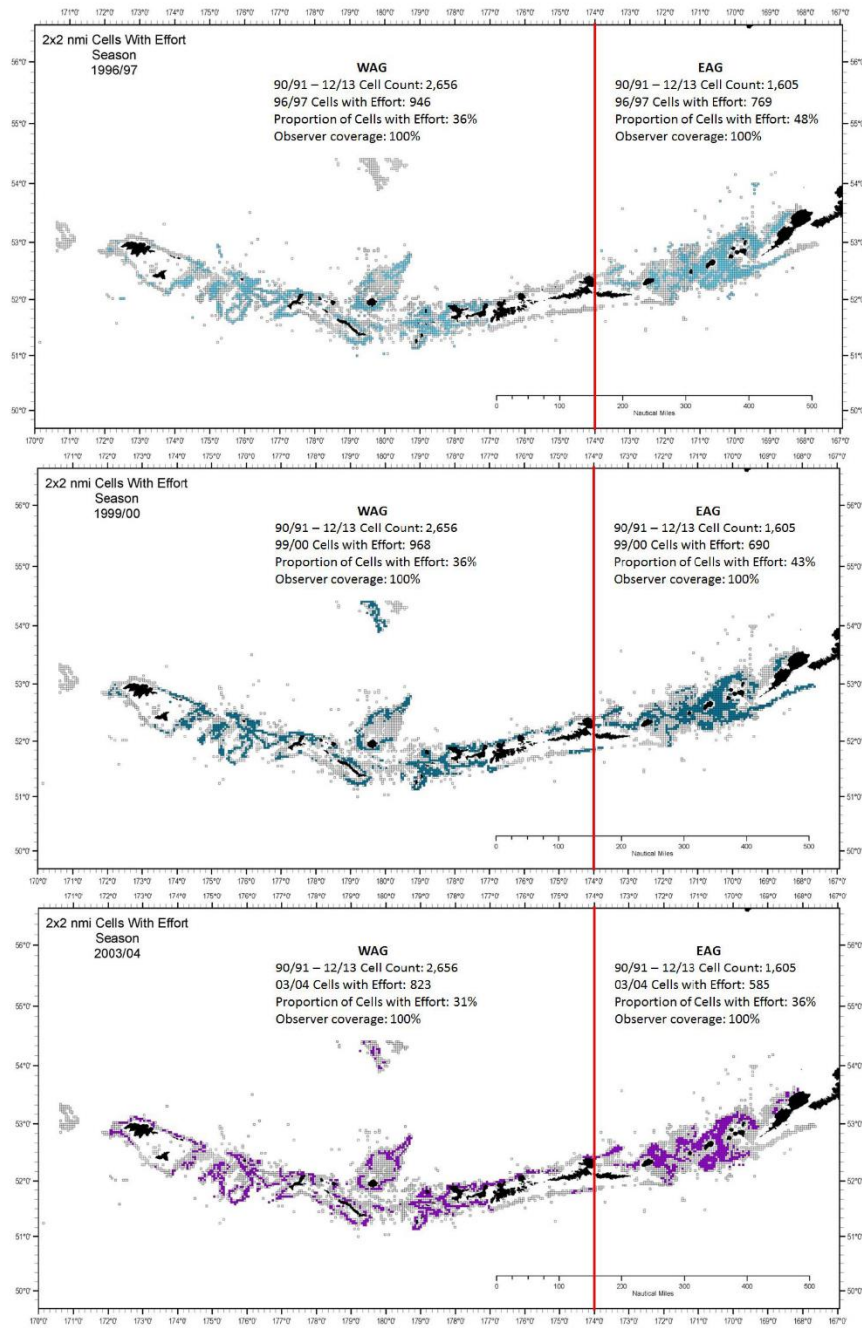


Figure 1. Spatial plots of effort from example seasons prior to Crab Rationalization (1996/97, 1999/00, 2003/04). Source: ADF&G, C. Siddon (Spatial data may be confidential).

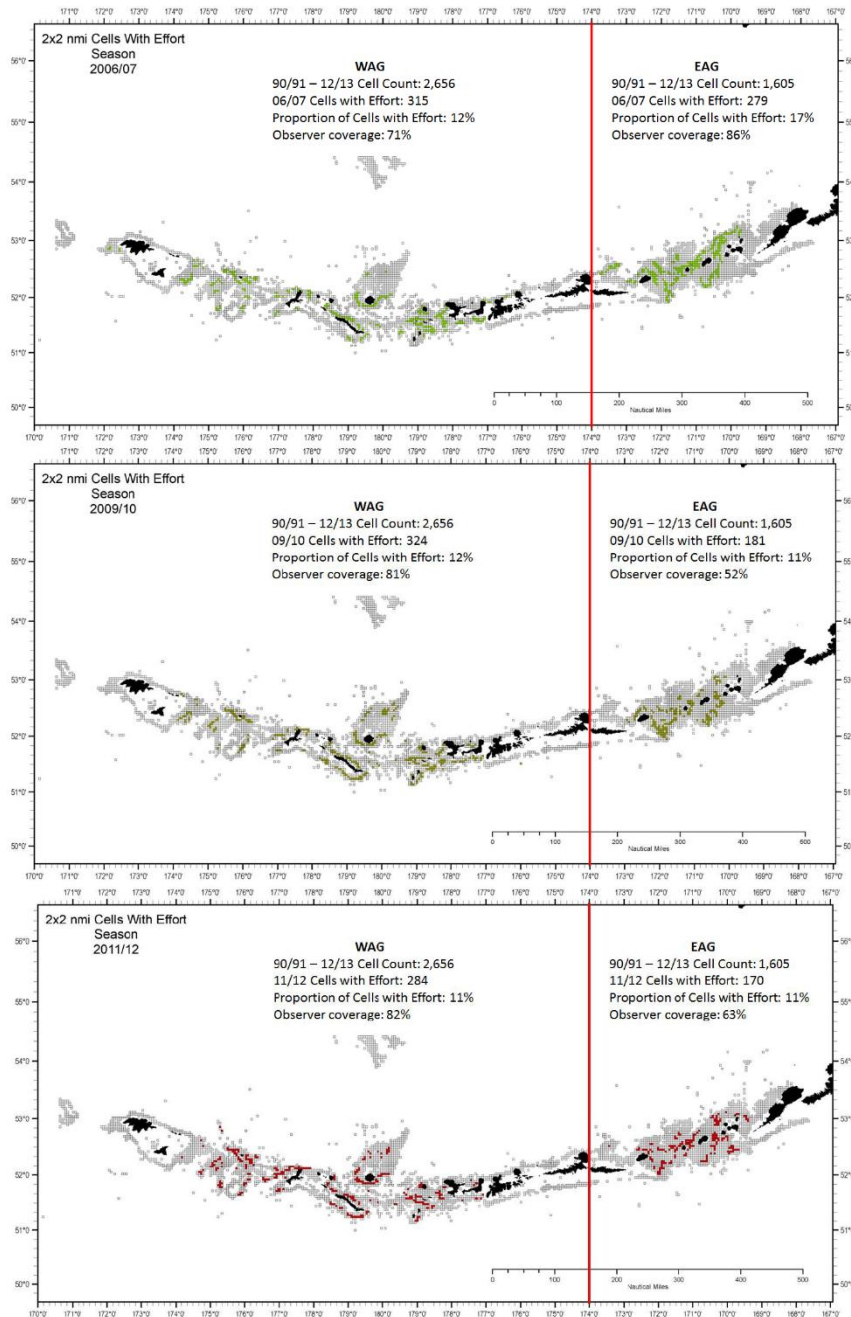


Figure 2. Spatial plots of effort from example seasons after Crab Rationalization (2006/07, 2009/10, 2011/12). Source: ADF&G, C. Siddon (Spatial data may be confidential).

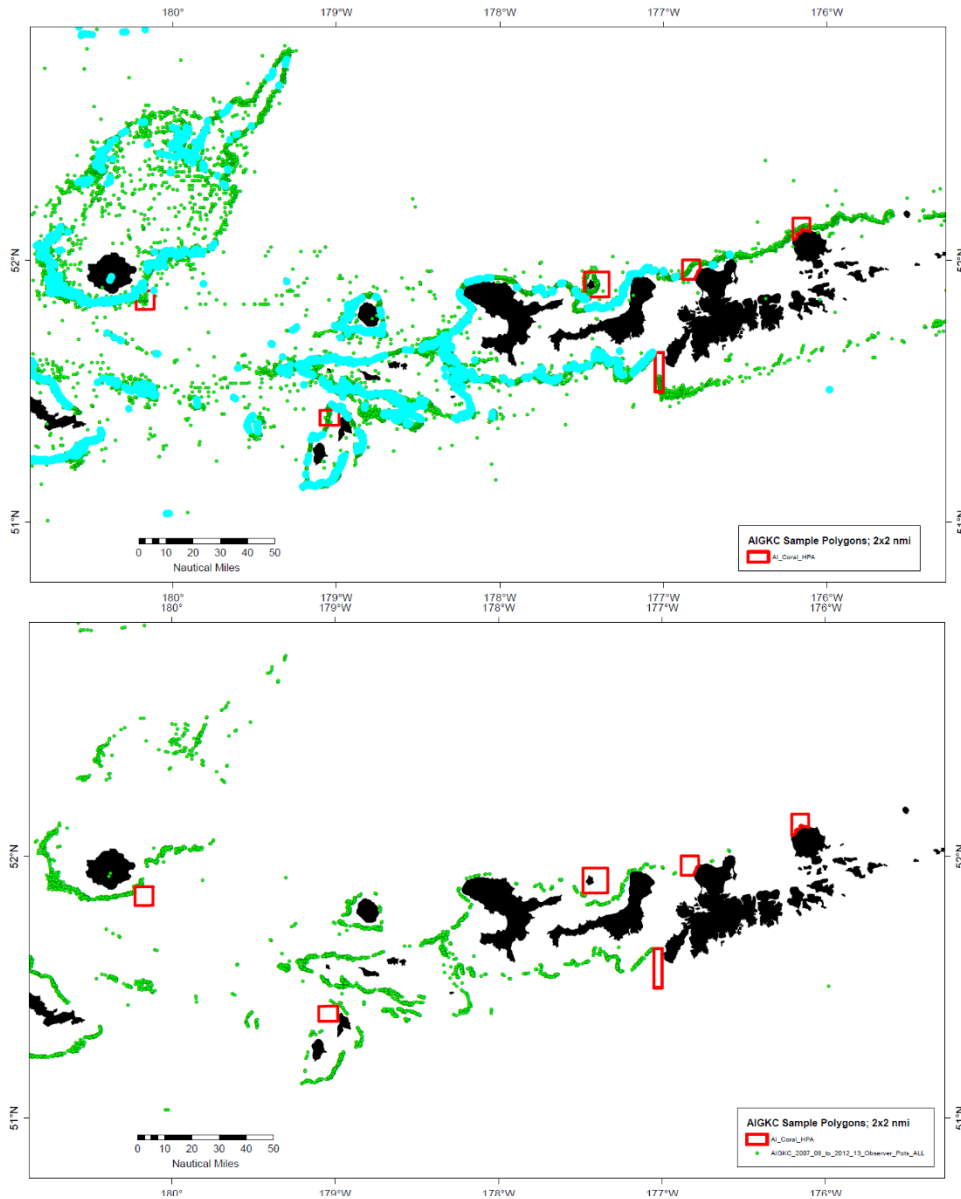


Figure 3. Spatial plots of effort in proximity to AI Coral Closure Area 1990-2013 top panel and 2007-2013 (after closure went into effect) bottom panel. Source: ADF&G, C. Siddon, L. Hulbert (Spatial data may be confidential).

Outcome indicators for AIGKC coral-pot interactions are not fully in place in the same way as other bottom contact fisheries in the Aleutians that have more participants, are more spatially broad, and are more closely regulated. While the remaining participants in the AIGKC pot fishery are acutely aware of regulations, observer data is closely monitored, and real time vessel monitoring (VMS) is in place, there are no current efforts to comprehensively build AIGKC bycatch data into habitat evaluation or modeling efforts.

A final component of review for the coral-pot overlap minor non-conformance issue is related to a review of the presence of bycatch in pots from ADF&G observer data over time. Some of the tabular information from observed presence of coral and other bycatch species is appropriately referenced in the GT assessment document. We are aware that there is specific information that may be compiled to track trends of coral bycatch but is limited for easy access and especially spatial review – also due to confidentiality. We have made initial contact with Dr. Ben Daly and Dr. Bill Gaueman of ADF&G who both have access to the required observer data. An initial review of a small portion of that data was recently shared which showed preliminary coral bycatch CPUE (pieces per observed pot lift) that was variable over the last 10 seasons. Current time constraints of both ADF&G personnel limit further and more complete analyses for now. **We propose that as a final action step to this plan that we complete a request for this data from ADF&G to be available for a collaborative review before the end of 2017.** Data and any analyses completed would be made available to the GT assessment team.

In summary, we propose to complete the following action steps before the next annual audit for three items:

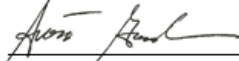
- 1) A complete historical spatial review of fishing effort as depicted in Figures 1 and 2 of this document which will include analysis of fishing effort in relation to the distribution of sensitive coral and sponge habitat using the best available information.
- 2) Update of the recent season's fishing effort in proximity to the coral closure areas.
- 3) A review of AIGKC observer pot bycatch data for coral species to evaluate trends in bycatch CPUE.

The BSCCG appreciates the opportunity to review the GT assessment comments and provide input for parts of this corrective action plan. We are also appreciative of assistance from the State of Alaska as there was a substantial amount of support from ADF&G researchers for access to the spatial information. As an industry stakeholder group with representation in cooperative research with other Alaska crab stakeholders and researchers we expect that steps in this action plan may be completed by mostly ADF&G and/or NMFS crab scientists. As with the GT assessment site visits and consultations prior to and during the assessment, we can help to coordinate and collaborate on further work as appropriate.

We hope you find this information useful in further consideration of the AIGKC assessment and corrective action steps to address the minor non-conformance issues mentioned. I am available for questions any time.

Sincerely,

BERING SEA CRAB CLIENT GROUP LLC



Scott Goodman (BSFRF, Executive Director)

9.3 Status of non-conformances

Non-conformance #1 (MINOR non-conformance: Clause 6.3)

The Assessment team confirms that further evidence submitted by Bering Sea Crab Client Group to address the non-conformance is sufficient to close non-conformance #1 with no further specific actions required by the Client. Annual surveillance audits will continue to review any up-dates, changes in circumstances and status as part of the normal audit procedure.

Status: Closed following submission of further evidence.

Non-conformance #2 (MINOR non-conformance: Clause 12.13)

The Corrective Action Plan was accepted by the Assessment Team and satisfactorily addresses the Non-Conformance. The action plan activities will be monitored during the annual surveillance audits of the fishery to confirm that implementation has taken place.

Status: Corrective Actions in place to be reviewed annually at surveillance audits

10. Recommendation and Determination

The Assessment Team recommend that the management system of the applicant fishery, U.S. Alaska Bering Sea and Aleutian Islands King, Tanner, and Snow crab commercial fisheries [Bristol Bay Red King crab (*Paralithodes camtschaticus*), St. Matthew Island Blue King crab (*Paralithodes platypus*), Tanner Crab (*Chionoecetes bairdi*), Aleutian Islands Golden King Crab (*Lithodes aequispinus*), and Eastern Bering Sea Snow crab (*Chionoecetes opilio*)] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) 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

ACIA 2004 Impacts of a Warming Arctic - by Arctic Climate Impact Assessment, pp. 144. ISBN 0521617782. Cambridge, UK: Cambridge University Press, December 2004.

ADF&G 2015 2015-2017 Commercial Fisheries Regulations for King and Tanner Crab Fisheries. Alaska Department of Fish and Game, 169 p.

ADF&G 2016 Alaska Department of Fish & Game (ADF&G) Bering Sea and Aleutian Islands (BSAI) crab observer program annual test fish report. Report to Crab Observer Oversight Task Force (COOTF). June 21, 2016. 19 p.

AFSC 2010 NOAA Alaska Fisheries Science Center Science Plan. U.S. Dep. Commer., NOAA Alaska Fisheries Science Center. 20 p.

ANS Task Force 2012 Aquatic Nuisance Species Task Force Strategic Plan (2013 – 2017). Aquatic Nuisance Species Task Force (ANSTF). May 3, 2012. 29 p.

Aydin, K., S. Gaichas, I. Ortiz, D. Kinzey, and N. Friday 2007 A comparison of the Bering Sea, Gulf of Alaska, and Aleutian Islands large marine ecosystems through food web modeling. NOAA Tech. Memo. NMFS-AFSC-178. 298 p.

Barnard, D. R. 2008 Biodegradable twine report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 08-05, Anchorage.

Barnard, D.R. and R. Burt 2007 Alaska Department of Fish and Game summary of the 2005/2006 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 07-02, Anchorage.

Barnard, D.R. and R. Burt 2008 Alaska Department of Fish and Game summary of the 2006/2007 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 08-17, Anchorage.

Bass, R.E., A. I. Herson, and K. M. Bogdan 2001 The NEPA BOOK: A step-by-step guide on how to comply with the National Environmental Policy Act. 2001 (Second) Edition. Solano Press Books. ISBN 0-923956-67-0

Beamish, R.J. and C. Mahnken. 1999 Taking the next step in fisheries management. Ecosystem approaches for fisheries management. Alaska Sea Grant College Program. AK-SG-99-01.

Bechtol, W.R., G. H. Kruse, J. Greenberg, and H. Geier 2010 Analysis of the Minimum Size Limit for Eastern Bering Sea Tanner Crab Fisheries: A Preliminary Report. North Pacific Fishery Management Council, Anchorage, AK.

Blackhart, K. 2010 Proceedings. 11th National Stock Assessment Workshop: Characterization of scientific uncertainty in assessments to improve determination of acceptable biological catches (ABCs); Joint Session of the National Stock and Habitat Assessment Workshops: Incorporating habitat information in stock assessments; and 1st National Habitat Assessment Workshop: Moving towards a national habitat science program. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-112. 153 p.

Blau, S.F. 1986. Recent declines of red king crab (*Paralithodes camtschatica*) populations and reproductive conditions around the Kodiak Archipelago, Alaska, pp 360-369. In G. S. Jamieson and N. Bourne (eds.), North

Pacific Workshop on stock assessment and management of invertebrates. Canadian Special Publication of Fisheries and Aquatic Sciences 92.

Blau, S.F., and D. Pengilly 1994 Findings from the 1991 Aleutian Islands golden king crab survey in the Dutch Harbor and Adak management areas including analysis of recovered tagged crabs. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K94-35, Kodiak.

Blau, S.F., L.J. Watson, and I. Vining (1998) The 1997 Aleutian Islands golden king crab survey. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 4K98-30, Kodiak.

CEQ 2007 A Citizen's Guide to the NEPA. Having Your Voice Heard. Council on Environmental Quality, Executive Office of the President. December 2007. 45 p.

Chilton, E.A., K.M. Swiney, J.D. Urban, J.E. Munk, and R.J. Foy 2011 Ecosystem consideration indicators for Bering Sea and Aleutian Islands King and Tanner Crab Species NOAA NMFS AFSC, 2011.

Conan, G.Y. and M. Comeau (1986) Functional maturity and terminal molt of male snow crab, *Chionoecetes opilio*. Canadian Journal of Fisheries and Aquatic Sciences 43:1710-1719.

Crab Observer Training and Deployment Manual. September 2014. ADF&G Shellfish Observer Program. Dutch Harbor, unpublished.

Daly, B. J., C. E. Armistead, and R. J. Foy. 2016. The 2016 eastern Bering Sea continental shelf bottom trawl survey: Results for commercial crab species. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-327, 167 p. doi:10.7289/V5/TM-AFSC-327.

DOC 2016 The Department of Commerce Budget In Brief, Fiscal Year 2016. Penny Pritzker, Secretary. 160 p.

FAO Compliance Agreement (1993) AGREEMENT TO PROMOTE COMPLIANCE WITH INTERNATIONAL CONSERVATION AND MANAGEMENT MEASURES BY FISHING VESSELS ON THE HIGH SEAS. FAO, Rome

Fina, M. 2011 Evolution of Catch Share Management: Lessons from Catch Share Management in the North Pacific. Fisheries 36(4): 164-177. April 2011.

Gaeuman, W. B. 2010 Summary of the 2008/2009 mandatory shellfish observer program database for the rationalized crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 10-01, Anchorage.

Garber-Yonts, B., and J. Lee., 2016 2015 Stock Assessment and Fishery Evaluation Report for King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions: Economic Status of the BSAI Crab Fisheries, 2015. Grant, W. S., D. A. Zelenina, and N. S. Mugue 2014 Chapter 3. Phylogeography of Red King Crab - Implications for Management and Stock Enhancement. In: King Crabs of the World: Biology and Fisheries Management. Bradley G. Stevens (Ed.) CRC Press 2014, Pages 47–72, ISBN: 978-1-4398-5541-6.

Gravel, K. A., and D. Pengilly 2007 Investigations on reproductive potential of snow and Tanner crab females from the eastern Bering Sea in 2005. Alaska Department of Fish and Game, Fishery Data Series No. 07-23, Anchorage.

GTC 2012. FAO-Based Responsible Fisheries Management Certification: Full Assessment and Certification Report For The U.S. Alaska King and Snow Crab Bering Sea Commercial Fisheries. Global Trust Certification.

GTC 2013. FAO-Based RFM Certification Validation Report for US Alaska Golden King Crab Commercial Fishery. Report Code: AK/AIGK/001/2013.

Hankin, D. G., T. H. Butler, P. W. Wild, and Q. L. Xue (1997) Does intense fishing on males impair mating success of female Dungeness crabs? *Canadian Journal of Fisheries and Aquatic Sciences* 54:655-669.

Himes-Cornell, A., K. Hoelting, C. Maguire, L. Munger-Little, J. Lee, J. Fisk, R. Felthoven, C. Geller, and P. (2013) Community profiles for North Pacific fisheries - Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-259, Volume 1, 70 p.

IPHC 2015 International Pacific Halibut Commission. Annual Report 2015.

Jeanne M. Grasso, J.M. and G. F. Linsin 2011 Current Trends in MARPOL Enforcement. MARPOL Enforcement in the United States. *Maritime Professional*. May, 201

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.

Kruse, G.H., Livingston, P., Overland, J.E., Jamieson, G.S., McKinnell, S. and Perry, R.I. (eds.) 2006 Report of the PICES/NPRB Workshop on Integration of Ecological Indicators of the North Pacific with Emphasis on the Bering Sea. PICES Sci. Rep. No. 33, 109 pp

Leon, J. M., J. Shaishnikoff, E. Nichols, and M. Westphal. (2017) Annual management report for shellfish fisheries of the Bering Sea–Aleutian Islands Management Area, 2015/16. Alaska Department of Fish and Game, Fishery Management Report No. 17-10, Anchorage.

Livingston, P.A. 1989. Interannual trends in Pacific cod, *Gadus macrocephalus*, predation on three commercially important crab species in the eastern Bering Sea. *Fishery Bulletin* 87: 807-827.

Loher, T., P.S. Hill, G. Harrington, and E. Cassano. 1998. "Management of Bristol Bay red king crab: a critical intersections approach to fisheries management." *Reviews in Fisheries Science* 6(3):169-251.

Long, W. C., K. M. Swiney, C. Harris, H. N. Page, and R. J. Foy. 2013 Effects of ocean acidification on juvenile red king crab (*Paralithodes camtschaticus*) and Tanner crab (*Chionoecetes bairdi*) growth, condition, calcification, and survival. *PLoS ONE* 8(4): e60959. doi:10.1371/journal.pone.0060959.

Long, W.C., Van Sant, S.B., Swiney, K.M., R.J. Foy 2016 Decreased pH Changes Juvenile Blue King Crab Morphology and Decreases Growth and Survival. Alaska Marine Science Symposium, Anchorage, AK, Jan 2016 (2016 poster, .pdf, 1.16 MB) Online.

Lowry, L. F., K. H. Frost, and J. J. Burns (1980) Feeding of bearded seals in the Bering and Chukchi seas and trophic interaction with Pacific walruses. *Arctic* 33:330-342.

Martell, S. Comments on WAG Golden King Crab Model. Report for the January 2017 Crab Plan Team Discussion.

Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), commonly referred to as the Magnuson–Stevens Act (MSA). Enacted April 13, 1976. 16 U.S.C. §§ 1801-1884 as amended.

Marcello, L.A., Mueter, F.J., Dawe, E.G., and Moriyasu, M. 2012 Effects of temperature and gadid predation on snow crab recruitment: comparisons between the Bering Sea and Atlantic Canada. *Mar Ecol Prog Ser* 469:249-261.

McConnaughey, R. A., J. V. Olson, and M. F. Sigler 2009 Alaska Fisheries Science Center essential fish habitat data inventory. AFSC Processed Rep. 2009-01, 40 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

McConnaughey, R. A., K.L. Mier, and C.B. Dew. 2000. An examination of chronic trawling effects on soft-bottom benthos of the eastern Bering Sea. *ICES Journal of Marine Sciences* 57(5):1377-1388.

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.

Muto, M. M., V. T. Helker, R. P. Angliss, B. A. Allen, P. L. Boveng, J. M. Breiwick, M. F. Cameron, P. J. Clapham, S. P. Dahle, M. E., Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, R. C. Hobbs, Y. V., Ivashchenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbin 2016 Alaska marine mammal stock assessments, 2015. U.S. Dep. Commer., NOAA Tech. Memo.

NMFS AFSC-323, 300 p. doi:10.7289/V5/TM-AFSC-323.

NMFS 2000 Endangered Species Act, Section 7 Consultations-Biological Assessments for Marine Mammal. National Marine Fisheries Service, Alaska Region.

NMFS 2002 Endangered Species Act, Section 7 Consultations-Biological Assessments for Seabirds. National Marine Fisheries Service, Alaska Region.

NMFS 2004 Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p.

NMFS 2004 Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement. NOAA NMFS, NPFMC. August 2004. 1003 p.

NMFS 2005 Final EIS for Essential Fish Habitat Identification and Conservation in Alaska- April 2005.

NMFS 2010 Marine fisheries habitat assessment improvement plan. Report of the National Marine Fisheries Service Habitat Assessment Improvement Plan Team. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-108, 115 p.

NOAA Fisheries 2016 Crab Rationalization Program Cost Recover for Fishing Year 2015/2016. Sustainable Fisheries Division, NOAA Fisheries, 9 p.

NOAA NAO 2014 National Appeals Office Rules of Procedure. 15 CFR Part 906 [Docket No. 101019524–3999–02] RIN 0648–BA36, Federal Register Vol. 79, No. 25, February 6, 2014, Rules and Regulations.

NOAA OPR (2005) NOAA Fisheries Service Protected Resources Outreach and Education Strategic Plan, FY2005 – 2006. 27 p.

NPFMC 1994 Environmental Assessment/Regulatory Impact Review for Amendment 21a to the Bering Sea/Aleutian Islands Groundfish Fishery Management Plan. North Pacific Fishery Management Council, Anchorage, AK.

NPFMC 1995 Environmental Assessment/Regulatory Impact Review for Amendment 37 to the Bering Sea/Aleutian Islands Groundfish Fishery Management Plan. North Pacific Fishery

NPFMC 1998 Fishery Management Plan for the Bering Sea/Aleutian Islands king and Tanner crabs. North Pacific Fishery Management Council, Anchorage, AK.

NPFMC 2007 Aleutian Islands Fishery Ecosystem Plan. Prepared by: K. Aydin, S. Barbeaux, F. Bowers, V. Byrd, D. Evans, S. Gaichas, C. Ladd, S. Lowe, J. Olson, J. Sepez, P. Spencer, F. Wiese. For North Pacific Fishery Management Council. December 2007. 198 p. <https://www.npfmc.org/aleutian-islands-fishery-ecosystem-plan/>

NPFMC 2007 Environmental Assessment for Amendment 24. Overfishing definitions for Bering Sea and Aleutian Islands King and Tanner crab stocks. North Pacific Fishery Management Council, Anchorage, AK.

NPFMC 2008 Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, Anchorage, AK. <https://www.npfmc.org/>

NPFMC 2010 Crab bycatch in the Bering Sea/Aleutian Islands Fisheries. North Pacific Fishery Management Council, Anchorage, AK.

NPFMC 2010 Essential Fish Habitat (EFH) 5-year review for 2010: North Pacific Fishery Management Council, National Marine Fisheries Service Alaska Region.

NPFMC 2011 Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, October 2011. 229 p.

NPFMC 2012 Statement of Organization, Practices, and Procedures of the North Pacific Fisheries Management Council. Draft, 23 March 2012. 31 p.

NPFMC 2014 2015 EFH 5-Year Review - Approach: Review and Revision of EFH Components within the Council's Fishery Management Plans, and Prioritization of Stocks for Habitat Assessment. D2 EFH 5 year Approach, April 2014. 6 p.

NPFMC 2015 Development of a Bering Sea Fishery Ecosystem Plan. Discussion Paper – November 2015. C-7 BS FEP, December 2015. 31 p.

NPFMC 2016 Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. 2016 Final Crab SAFE, North Pacific Fishery Management Council, September 2016. 899 p.

NPFMC 2017 Bristol Bay Red King Crab PSC discussion paper, January 2017. D1 BBRKC PSC Discussion Paper. February 2017, 21 p.

Olson, J. 2015 Maintaining and Restoring Fish Habitats: Areas Closed to Bottom Trawling in the EBS/ AI and GOA. Last updated: August 2015. In: Zador, S., (Ed.) (2015) Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p.

Orlov 1998 The diets and feeding habits of some deep-water skates (Rajidae) in the Pacific waters off the Northern Kuril Islands and Southeastern Kamchatka. Alaska Fishery Research Bulletin. 5(1): 1-17.

Otto, R.S. and P.A. Cummiskey (1990) Growth of adult male blue king crab (*Paralithodes platypus*). In: B. Melteff (ed.) Proceedings of the International Symposium on King and Tanner crabs. Lowell Wakefield Fisheries Symposium Series, Alaska Sea Grant College Program Report No. 90-04. pp. 245-257.

Otto, R.S., and P.A. Cummiskey (1985) Observations on the reproductive biology of golden king crab (*Lithodes aequispina*) in the Bering Sea and Aleutian Islands. Proceedings of the International King Crab Symposium. University of Alaska Sea Grant Report No. 85-12, pp 123-135.

Otto, R.S., R. MacIntosh, and P. Cummiskey 1990 Fecundity and other reproductive parameters of female red king crab (*Paralithodes camtschatica*) in Bristol Bay and Norton Sound, Alaska. In: B. Melteff (ed.) Proceedings of the International Symposium on King and Tanner crabs. Lowell Wakefield Fisheries Symposium Series, Alaska Sea Grant College Program Report No. 90-04. pp. 65-90.

Parada, C., Armstrong, D.A., Ernst, B., Hinckley, S., and Orensanz JML 2010 Spatial dynamics of snow crab (*Chionoecetes opilio*) in the eastern Bering Sea: putting together the pieces of the puzzle. Bull Mar Sci , 2010, vol. 86: 413-37.

Patrick, W.S., P. Spencer, O. Ormseth, J. Cope, J. Field, D. Kobayashi, T. Gedamke, E. Cortés, K. Bigelow, W. Overholtz, J. Link, and P. Lawson. 2009. Use of productivity and susceptibility indices to determine stock vulnerability, with example applications to six U.S. fisheries. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-101, 90p.

Patrick, W.S., P. Spencer, J. Link, J. Cope, J. Field, D. Kobayashi, P. Lawson, T. Gedamke, E. Cortés, O. Ormseth, K. Bigelow, and W. Overholtz. 2010. Using productivity and susceptibility indices to assess the vulnerability of United States fish stocks to overfishing. Fishery Bulletin 108: 305-322.

Paul, A. J., and J. M. Paul 1997 Breeding success of large male red king crab *Paralithodes camtschaticus* with multiparous mates. Journal of Shellfish Research 16:379-381.

Paul, J. M., and A. J. Paul 1990 Breeding success of sublegal size male red king crab *Paralithodes camtschatica* (Tilesius, 1815) (Decapoda, Lithodidae). Journal of Shellfish Research 9:29-32.

Paul, J.M., A.J. Paul, and A. Kimker 1994 Compensatory feeding capacity of 2 brachyuran crabs, Tanner and Dungeness, after starvation periods like those encountered in pots. Alaska Fishery Research Bulletin 1:184-187.
Powell, G.C., R. Peterson and L. Schwarz 1983 The red king crab, *Paralithodes camtschatica* (Tilesius) in Norton Sound, Alaska: History of biological research and resource utilization through 1982. Division of Commercial Fisheries, Alaska Department of Fish and Game, Juneau, Alaska. Informational Leaflet No. 222, 104p.

Quandt, A. (1999) Assessment of fish trap damage on coral reefs around St. Thomas, USVI. Independent Project Report, UVI Spring 1999. p. 9.

Review of TACs Bering Sea Crab: 2016/17 Season. ADF&G Presentation to BSAI Crab Industry, October 12, 2016.

Rooper, C. 2016 Habitat. Structural Epifauna - Aleutian Islands. Pp.58-61 In: Zador, S., (Ed.) (201) Ecosystem Considerations 2016: Status of the Aleutian Islands Marine Ecosystem. NPFMC November 14, 2016, 110 p.

Rose, C.S., J.R. Gauvin, and C.F. Hammond 2010 Effective herding of flatfish by cables with minimal seafloor contact. Fishery Bulletin 108:136-144.

Rosenkranz, G.E. and M. Spafard 2010 Summary of observer data collected during the 2008/2009 Alaska weathervane scallop fishery. Alaska Department of Fish and Game, Fishery Data Series No. 10-97, Anchorage.

Sainte-Marie, B., S. Raymond, and J.C. Brethes 1995 Growth and maturation of the benthic stages of male snow crab, *Chionoecetes opilio* (Brachyura: Majidae). Canadian Journal of Fisheries and Aquatic Sciences 52:903-924.

Sainte-Marie, B., T. Gosselin, J.M. Sevigny, and N. Urbani 2008 The snow crab mating system: Opportunity for natural and unnatural selection in a changing environment. Bulletin of Marine Science 83:131-161.

Sato, T., and S. Goshima 2006 Impacts of male-only fishing and sperm limitation in manipulated populations of an unfished crab, *Hapalogaster dentata*. Marine Ecology-Progress Series 313:193-204.

Sato, T., M. Ashidate, and S. Goshima 2005a Negative effects of delayed mating on the reproductive success of female spiny king crab, *Paralithodes brevipes*. Journal of Crustacean Biology 25:105-109.

Sato, T., M. Ashidate, S. Wada, and S. Goshima 2005b Effects of male mating frequency and male size on ejaculate size and reproductive success of female spiny king crab *Paralithodes brevipes*. Marine Ecology-Progress Series 296:251-262.

Sato, T., M. Ashidate, T. Jinbo, and S. Goshima 2006 Variation of sperm allocation with male size and recovery rate of sperm numbers in spiny king crab *Paralithodes brevipes*. Marine Ecology-Progress Series 312:189-199.

Schwaab, E. C. 2011 NOAA Fisheries Habitat Blueprint (Memo to NOAA Fisheries Leadership Council) 2 p. Silver Spring, MD.

Seeb, J. E., G. H. Kruse, L. W. Seeb, and R. G. Weck. 1989. 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. Shellfish Docksides Sampling Manual. September 2014. ADF&G Docksides Sampling Program. Dutch Harbor, unpublished.

Siddeek, M.S.M., J. Zheng and D. Pengilly. Aleutian Islands Golden King Crab (*Lithodes aequispinus*) Model-Based Stock Assessment. Draft summary report for the January 2017 Crab Plan Team Discussion.

Sigler, M. F., M. F. Cameron, M. P. Eagleton, C. H. Faunce, J. Heifetz, T. E. Helser, B. J. Laurel, M. R. Lindeberg, R. A. McConnaughey, C. H. Ryer, and T. K. Wilderbuer 2012 Alaska Essential Fish Habitat Research Plan: A research plan for the National Marine Fisheries Service's Alaska Fisheries Science Center and Alaska Regional Office. AFSC Processed Rep. 2012-06, 21 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 17109 Pt. Lena Loop Road, Juneau, AK 99801

Sigler, M. F., R. J. Foy, J. W. Short, M. Dalton, L. B. Eisner, T. P. Hurst, J. F. Morado, and R. P. Stone. (2008) Forecast fish, shellfish and coral population responses to ocean acidification in the North Pacific Ocean and Bering Sea: An ocean acidification research plan for the Alaska Fisheries Science Center. AFSC Processed Rep. 2008-07, 35 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 17109 Point Lena Loop Road, Juneau AK 99801

Simenstad, C.A., J.S. Isakson, and R.E. Nakatani. 1977. Marine fish communities of Amchitka Island, AK, pp. 451-492. In M. L. Merritt and R. G. Fuller (eds.), *The Environment of Amchitka Island, Alaska*. U.S. ERDA, TID-26712.

Slater, L. M., K. A. MacTavish, and D. Pengilly (2010) Preliminary analysis of spermathecal load of primiparous snow crabs (*Chionoecetes opilio*) from the eastern Bering Sea, 2005-2008. In: G.H. Kruse, G.L. Eckert, R.J. Foy, R.N. Lipcius, B. Sainte-Marie, D.L. Stram, and D. Woodby (eds.), *Biology and management of exploited crab populations under climate change*. Alaska Sea Grant, University of Alaska Fairbanks.

Smith, B. D., and G. S. Jamieson. 1991. Possible consequences of intensive fishing for males on the mating opportunities of Dungeness crabs. *Transactions of the American Fisheries Society* 120:650-653.

Somerton, D.A. 1981 Regional Variation in the size of maturity of two species of Tanner crab (*Chionoecetes bairdi* and *C. opilio*) in the eastern Bering Sea, and its use in defining management subareas. *Can. J. Fish. Aquat. Sci.* Vol. 38, pp 163-174.

Somerton, D.A. and R.A. MacIntosh 1983a The size at sexual maturity of blue king crab, *Paralithodes platypus*, in Alaska. *Fish. Bull.* 81(3), pp 621-623.

Somerton, D.A. and R.S. Otto 1986 Distribution and reproductive biology of the golden king crab, *Lithodes aequispina*, in the eastern Bering Sea. *Fish. Bull.* 84(3), pp 571-584.

Spies, I., Aydin, K., Dan Nichol, D., Palsson, W., Jerry Hoff, J., and T.T. TenBrink 2016 Chapter 19. Assessment of the sculpin stock complex in the Bering Sea and Aleutian Islands. NPFMC Bering Sea and Aleutian Islands SAFE. North Pacific Fishery Management Council. December, 2016.

Starr, P. Comments on "*Aleutian Islands Golden King Crab (Lithodes aequispinus) Model-Based Stock Assessment. Draft summary report for the January 2017 Crab Plan Team Discussion*".

Starr, P. Report to the Aleutian King Crab Research Foundation (AKCRF) on the NPFMC Crab Modelling workshop, 17–19 January 2017.

Stockhausen, W.T. 2016 2016 Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. Alaska Fisheries Science Center, 23 September 2016. In: NPFMC 2016 Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. 2016 Final Crab SAFE, North Pacific Fishery Management Council, September 2016. 899 p.

Thompson, G.G. 2016 Chapter 2: Assessment of the Pacific Cod Stock in the Eastern Bering Sea. NPFMC Bering Sea and Aleutian Islands SAFE. North Pacific Fishery Management Council. December, 2016.

Ulmer 2000 *The Elements of Alaska's Sustainable Fisheries*. F. Ulmer in: *Sustainable Fisheries Management: Pacific Salmon*, E. Knudsen et al Editors, Lewis Publishers, 2000, p. 65.

Von Szalay, P.G., C.N. Roper, N.W. Raring, and M.H. Martin 2011 Data report: 2010 Aleutian Islands bottom trawl survey. U.S. Dep. Commerce., NOAA Technical Memorandum NMFS-AFSC-215.

Watson, L.J. 2004 The 2003 triennial Aleutian Islands golden king crab survey and comparisons to the 1997 and 2000 surveys (revised October 17, 2005). Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K04-42, Kodiak. [Revised 10/17/2005].

Watson, L.J., and R.K. Gish 2002 The 2000 Aleutian Islands golden king crab survey and recoveries of tagged crabs in the 1997–1999 and 2000–2002 fishing seasons. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K02-6, Kodiak.

Webb, J. and D. Woodby 2008 Long-term Alaska crab research priorities preliminary draft update, 2008. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 5J08-04, Juneau.

Wilderbuer, T.K., D.G. Nichol and J. Ianelli 2016 Chapter 4. Assessment of the yellowfin sole stock in the Bering Sea and Aleutian Islands. NPFMC Bering Sea and Aleutian Islands SAFE. North Pacific Fishery Management Council. December, 2016.

Zador, S., (Ed.) 2015 Ecosystem Considerations 2015: Status of Alaska's Marine Ecosystems. NPFMC November 16, 2015, 297 p.

Zheng, J. 2008 Temporal changes in size at maturity and their implications for fisheries management for eastern Bering Sea Tanner crab. *Journal of Northwest Atlantic Fishery Science* 41:137-149.

Zheng, J. and D. Pengilly. 2011 Overview of Proposed Harvest Strategy and Minimum Size Limits for Bering Sea District Tanner Crab. Alaska Department of Fish and Game, Special Publication No. 11-02, Anchorage.

Zheng, J., G.H. Kruse, and D.R. Ackley 2001 Spatial distribution and recruitment patterns of snow crabs in the eastern Bering Sea. Spatial Processes and management of marine populations. Alaska sea grant college program. AK-SG-01-02, 2001.

Appendices

Appendix 1 – Assessment Team

Based on the technical expertise required to carry out the above fishery assessment, Global Trust Certification Ltd., is pleased to confirm the Full Assessment team members for the fishery as follows.

Dr. Ivan Mateo (Lead Assessor)

Dr. Ivan Mateo has over 20 years' experience working with natural resources population dynamic modeling. His specialization is in fish and crustacean population dynamics, stock assessment, evaluation of management strategies for exploited populations, bioenergetics, ecosystem-based assessment, and ecological statistical analysis. Dr. Mateo received a Ph.D. in Environmental Sciences with Fisheries specialization from the University of Rhode Island. He has studied population dynamics of economically important species as well as candidate species for endangered species listing from many different regions of the world such as the Caribbean, the Northeast US Coast, Gulf of California and Alaska. He has done research with NMFS Northeast Fisheries Science Center Ecosystem Based Fishery Management on bioenergetic modeling for Atlantic cod. He also has been working as environmental consultant in the Caribbean doing field work and looking at the effects of industrialization on essential fish habitats and for the Environmental Defense Fund developing population dynamics models for data poor stocks in the Gulf of California. Recently Dr. Mateo worked as National Research Council postdoc research associate at the NOAA National Marine Fisheries Services Ted Stevens Marine Research Institute on population dynamic modeling of Alaska sablefish.

Dr. Gerald P. Ennis (Assessor)

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 has focused primarily on lobster fishery and population biology and on various aspects of larval, juvenile and adult lobster behavior and ecology 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

Dr. Wes Toller

Wes has an extensive background in fisheries management and habitat conservation. As owner and operator of his own consulting business since 2010, Wes has worked closely with a number of leading certification schemes including the Marine Stewardship Council (MSC) and Aquaculture Stewardship Council (ASC) to develop and improve processes for auditing and accreditation of sustainability standards. He previously worked as a program manager with Accreditation Services International (ASI) where he helped establish the company's nascent MSC Program. Wes has an in-depth knowledge of ISO requirements and international best practices that pertain to eco-labelling. He has a detail-oriented work style and wide ranging interests. Wes has experience in many subject areas within the field of sustainability, and a specialist in sustainable use of fishery resources in the field of fisheries management and marine science. Wes received his doctorate in biological sciences from the University of Southern California. He currently resides in Seattle

Appendix 2

Stakeholders comments



4824 Harbor Lane
Everett, WA 98203

T 360-440-4737
F 206-801-5803
steve@wafro.com

December 06, 2017

To:

Global Trust Certification Ltd.
3rd Floor, Block 3, Quayside Business Park,
Mill Street, Dundalk, Co. Louth, Ireland.

Re:

RFM Certification for the U.S. Alaska Bering Sea and Aleutian Islands King,
Tanner and Snow Crab Commercial Fisheries (AK/CRA/002/2017)

Quota Share Leasing, LLC is a Processor Quota Share holder in the Eastern Aleutian Islands Golden King Crab fishery; we also manage crab assets in this and other crab fisheries for non-affiliated entities through various lease or contract arrangements. As a significant participant in these fisheries, and having reviewed the Public Comment Draft, we support the recommendations of the Assessment Team (page 12):

*The Assessment Team recommends that the management system of the applicant fishery, U.S. Alaska Bering Sea and Aleutian Islands King, Tanner, and Snow crab commercial fisheries [Bristol Bay Red King crab (*Paralithodes camtschaticus*), St. Matthew Island Blue King crab (*Paralithodes platypus*), Eastern Bering Sea Tanner Crab (*Chionoecetes bairdi*), Aleutian Islands Golden King Crab (*Lithodes aequispinus*), and Eastern Bering Sea Snow crab (*Chionoecetes opilio*)] legally employing pot gear within Alaska jurisdiction (200 nautical miles EEZ) 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.*

We would like to note that, with the exception of two minor non-conformance issues (which we address below) the Evidence Rating for all Supporting Clauses is HIGH and the Non-Conformance Rating for all Supporting Clauses (except as noted) is NONE.

Concerning the two Minor Non-Conformance issues (Clauses 6.3 and 12.13), the Assessment Team has accepted the Corrective Action Plan(s) submitted by the Client, and indicated that an annual review of those plans will occur during surveillance audits. We support this course of action.

In conclusion, we believe that the Public Comment Draft supports Recertification of the the Bering Sea and Aleutian Islands King, Tanner and Snow crab fisheries, the St. Matthew Island Blue King crab fishery and the Eastern Bering Snow crab fishery; as well as the Initial Certification of the Eastern Bering Sea Tanner and Aleutian Islands Golden King crab fisheries.

Thank you for this opportunity to comment,

A handwritten signature in black ink, appearing to be 'S. Minor', written in a cursive style.

Steven K. Minor
Managing Member

Appendix 3

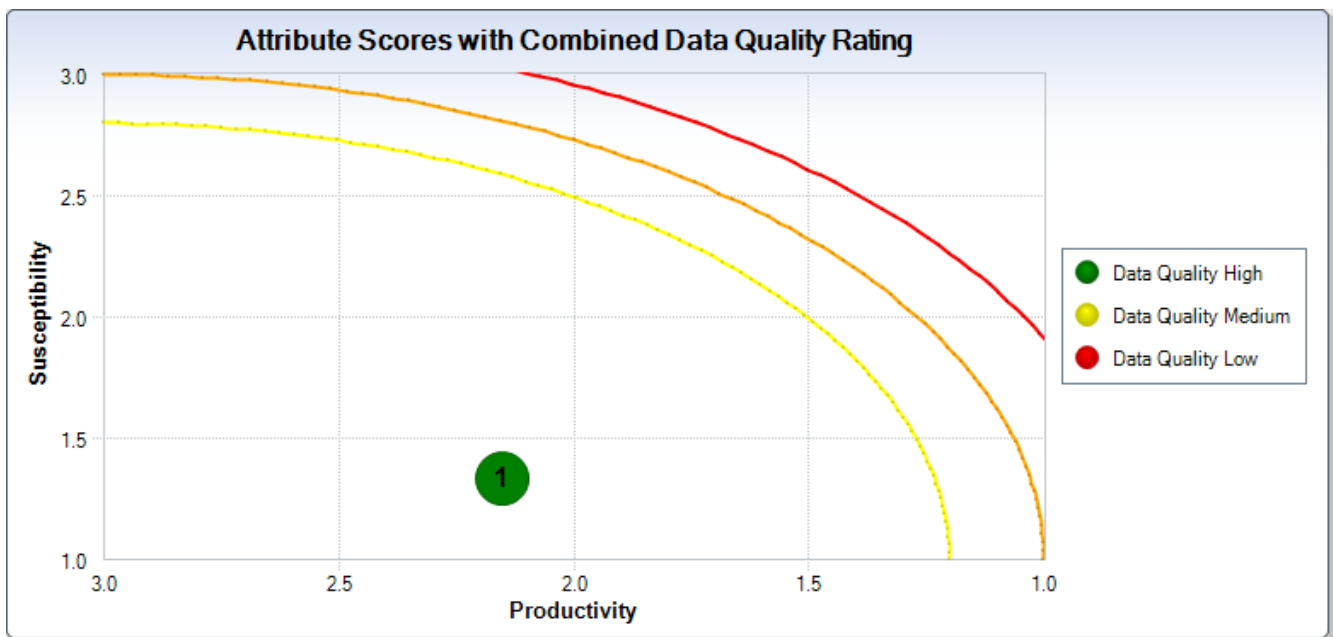
Aleutian Islands Golden King Crab Fishery preliminary (post-workshop) PSA data attribute references:

Data quality scores ranged from 1 to 5 as follows:

- 1: (Best data): Information is based on established and substantial data.
- 2: (Adequate data): Information with limited coverage and corroboration.
- 3: (Limited data): Limited confidence; may be based on similar taxa.
- 4: (Very limited data): Expert opinion or based on the general literature review.
- 5: (No data): No information on which to base score.

Application of the PSA shows favourable results with a low vulnerability score of 0.91 derived for the stock under consideration, the Aleutian Islands Golden King crab fishery.

The PSA plot for the AI Golden king crab shown below indicates that the fishery is well within precautionary limits, represented by the first line on the right side. In fact, it was noted that a fishery would have to be almost twice as vulnerable as in this case before the Vulnerability score would trigger a minor non-conformance (i.e. touching the yellow line = vulnerability score equal or more than 1.8). In the plot below, reaching and extending over the yellow line would trigger a minor non-conformance (NC), reaching and extending over the orange one would trigger a major NC and reaching and extending over the red line would trigger a critical non-conformance.



Productivity	HIGH (3)	MODERATE (2)	Low (1)	Attribute Score	Data Quality Score	Comment	Reference
<p>Population growth (r): This is the intrinsic rate of population growth or maximum population growth that would be expected to occur in a population under natural conditions (i.e., no fishing), and thus directly reflects stock productivity. The scoring definitions were taken from Musick (1999), who stated that <i>r</i> should take precedence over other productivity attributes (e.g., given a weighting of 4) as it combines many of the other attributes defined below.</p>	>0.5	0.5-0.16 (midpoint 0.10)	<0.16	1.5	3	<p>This value for golden King crab is absent and therefore borrowed from a similar stock.</p> <p>The natural growth rate of Norway Red King Crab stock (<i>r</i>) was estimated to 0.227, which is in the same range (<i>r</i>=0.212) as for king crab males in their natural area of distribution in Alaska (Zhou et al. 1998).</p> <p>Expert opinion decided that Golden King crab was in the low-moderate productivity range when compared to other king crabs and therefore to give this attribute a more conservative score of 1.5, instead than 2.</p>	http://www.ibranian.net/navon/paper/BIO_ECONOMIC_MODELLING_OF_THE_RED_KING_CRAB_INVASION.pdf?paperid=8298811
<p>Maximum age (t_{max}): Maximum age is a direct indication of the natural mortality rate (<i>M</i>), where low levels of <i>M</i> are negatively correlated with high maximum ages (Hoenig 1983). The scoring definitions were based on the ANOVA applied to the observed fish stocks considered to be representative of U.S. fisheries (Appendix A). The <i>t_{max}</i> for a majority of these fish ranges between 10 to 30 years.</p>	<10 years	10-30 years (midpoint 20 years)	>30 years	2	3	<p>Red king crabs (<i>Paralithodes camtschaticus</i>) 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. The male's leg span was nearly 5 feet across. NOAA estimates a max age of 21 years for red king crab.</p> <p>Blue King crabs (<i>Paralithodes platypus</i>) are known to be as big as 18 pounds.</p> <p>Tanner crab may live to an estimated maximum age of 14 years.</p> <p>When compared to red and blue king crabs, golden king crab are smaller in size, averaging 5-8 pounds.</p> <p>Based on the above, expert opinion estimates maximum age to be 20-25 years for Golden King Crab, based on red king crab and a 0.18 – 0.23 mortality</p>	http://www.adfg.alaska.gov/index.cfm?adfg=animals.listinvertebrates http://www.afsc.noaa.gov/Education/factsheets/10rkc_fs.pdf
<p>Maximum size (L_{max}): Maximum size is also correlated with productivity, with large fish tending to have lower levels of productivity (Roberts and Hawkins 1999), though this relationship tends to degrade at higher taxonomic levels. The scoring definitions were based on the ANOVA applied to the observed fish stocks</p>	<60 cm	60-150 cm (midpoint 105 cm)	>150 cm	3	1	<p>In the ADF&G small mesh pot study (2012/13), crab lengths were reported in 5 mm size bins. The largest females caught were in the bin from 150.5 to 155.5mm carapace length; the largest males caught were in the size bin from 185.5 to 190.5 mm carapace length (see Table 14 and Figure 11).</p> <p>Up to 220 mm max size.</p> <p>Expert opinion considered that the sizes proposed in the PSA are finfish specific and therefore inadequate. Experts considered that Aleutian Islands king crab is on the small side of the king crab range, giving it a score of 3.</p>	http://www.adfg.alaska.gov/fedaiddocs/FDS13-41.pdf

<p>considered to be representative of U.S. fisheries (Appendix A). The L_{max} for a majority of these fish ranges between 60 to 150 cm TL.</p>							
<p>Growth coefficient (k): The von Bertalanffy growth coefficient measures how rapidly a fish reaches its maximum size, where long-lived, low-productivity stocks tend to have low values of k (Froese and Binohlan 2000). The attribute scoring definitions based upon the ANOVA applied to the fish stocks considered to be representative of U.S. fisheries was 0.15 to 0.25. This is roughly consistent with the values obtained from Froese and Binohlan's (2000) empirical relationship $k = 3/t_{max}$ of 0.1 to 0.3, based upon t_{max} values of 10 and 30.</p>	<p>>0.25</p>	<p>0.15-0.25 (midpoint 0.20)</p>	<p><0.15</p>	<p>2</p>	<p>3</p>	<p>Growth coefficient (k) has been estimated as 0.2556 for males, 0.2352 for females Norwegian red King Crab based on length based methods. L infinity for males is 192.5 mm and for females is 158.6 mm. Borrowing this information, the score assigned is 2.</p>	<p>http://icesjms.org/fordjournals.org/content/early/2014/08/18/icesjms.fsu138.full.pdf</p>
<p>Natural mortality (M): Natural mortality rate directly reflects population productivity, as stocks with high rates of natural mortality will require high levels of production in order to maintain population levels. Several methods for estimating M rely upon the negative relationship between M and t_{max}, including Hoenig's (1983) regression based upon empirical data, the quantile method that depends upon exponential mortality</p>	<p>>0.40</p>	<p>0.20-0.40 (midpoint 0.30)</p>	<p><0.20</p>	<p>2</p>	<p>1</p>	<p>The default natural mortality rate assumed for king crab species by NPFMC (2007b) is: $M=0.18$.</p> <p>There is also another value estimated by the tier 4 model discussed in the GKC Assessment Model as part of the CPT May 2016 meetings. The value estimated keeps M constant at 0.23 yr⁻¹ (the mean value from EAG and WAG M estimates). The model was not accepted this year. (http://legistar2.granicus.com/npfmc/meetings/2016/5/937_A_Crab_Plan_Team_16-05-09_Meeting_Agenda.pdf)</p> <p>M = 0.205 is the average between the 2 values, therefore the score assigned is 2</p>	<p>North Pacific Fishery Management Council (NPFMC). 2007b. Public Review Draft: Environmental Assessment for proposed Amendment 24 to the Fishery Management Plan for Bering Sea and Aleutian Islands King and Tanner Crabs to Revise Overfishing Definitions. 14 November 2007. North Pacific</p>

<p>rates (Hoenig 1983), and Alverson and Carney's (1975) relationship between mortality, growth, and <i>tmax</i>. The attribute scoring thresholds from the ANOVA applied to the fish stocks considered to be representative of U.S. fisheries was 0.2 to 0.4, and were roughly consistent with those produced from Hoenig's (1983) empirical regression of 0.14 to 0.4, based on <i>tmax</i> values of 10 and 30.</p>							<p>Fishery Management Council, Anchorage.</p>
<p>Fecundity (i.e., the number of eggs produced by a female for a given spawning event or period) varies with size and age of the spawner, so we followed Musick's (1999) recommendation that fecundity should be measured at the age of first maturity. As Musick (1999) noted, low values of fecundity imply low population productivity but high values of fecundity do not necessarily imply high population productivity; thus, this attribute may be more useful at the lower fecundity values. The scoring definitions were taken from Musick (1999), which range between fecundities of 1,000 and 100,000.</p>	<p>>100,000 0</p>	<p>1000-10,000</p>	<p><1000</p>	<p>2</p>	<p>1</p>	<p>Between 10k and 30k larger than other crab's eggs. Still in the tens of thousand, not hundreds.</p>	<p>http://www.afsc.noaa.gov/Education/factsheets/10_gkc_fs.pdf</p>
<p>Breeding strategy: The breeding strategy of a stock provides an indication of the level of mortality that might be expected for the offspring in the first stages of life. To estimate offspring mortality, we used</p>	<p>0</p>	<p>1-3</p>	<p>>4</p>	<p>2</p>	<p>4</p>	<p>A score of 0 is assigned and is based on placement of larvae in water column after a year, deeper water maybe safer than shallow water.</p> <p>A score of 1 is assigned based on 1 year of parental protection/ gestation period.</p>	

<p>Winemiller's (1989) index of parental investment. The index ranges in score from 0 to 14 and is composed of: 1) the placement of larvae or zygotes (i.e., in nest or into water column; score ranges from 0 to 2); 2) the length of time of parental protection of zygotes or larvae (score ranges from 0 to 4); and 3) the length of gestation period or nutritional contribution (score ranges from 0 to 8). To translate Winemiller's index into our 1-3 ranking system, we examined King and McFarlane's (2003) parental investment scores for 42 North Pacific stocks. These 42 stocks covered a wide range of life-histories and habitats, including 10 surface pelagic, 3 mid-water pelagic, 3 deep-water pelagic, 18 near-shore benthic, and 9 offshore benthic stocks. Thirty-one percent of the stocks had a Winemiller score of zero, and 40% had a Winemiller score of 4 or higher, so 0 and 4 were used as the breakpoints between our ranking categories.</p>						<p>A score of 1 is assigned based on the fact that larvae do not need to feed as soon as others because they are feeding on a yolk sac.</p> <p>Average of 1 between the 3 indexes gives a score of 1, giving an attribute score of 2.</p>	
<p>Recruitment pattern: Stocks with sporadic and infrequent recruitment success often are long-lived and thus might be expected to have lower levels of productivity (Musick 1999). This attribute is intended as a coarse index to distinguish stocks with sporadic recruitment patterns and high frequency of year-class</p>	<p>Highly frequent recruitment success (>75% of year classes are successful)</p>	<p>Moderately frequent recruitment success (between 10% and 75% of year classes are</p>	<p>Infrequent recruitment success (<10% of year classes are successful)</p>	<p>3</p>	<p>1</p>	<p>Female lithodids molt before copulation and egg extrusion (Nyblade 1987). From their observations on embryo development in golden king crab, Otto and Cumiskey (1985) suggested that time between successive ovipositions was roughly twice that of embryo development and that spawning and molting of mature females occurs approximately every two years. Sloan (1985) also suggested a reproductive cycle >1 year with a protracted barren phase for female golden king crab. Data from tagging studies on female golden king crab in the Aleutian Islands are generally consistent with a molt period for mature females of 2</p>	<p><u>2015 Crab SAFE</u></p>

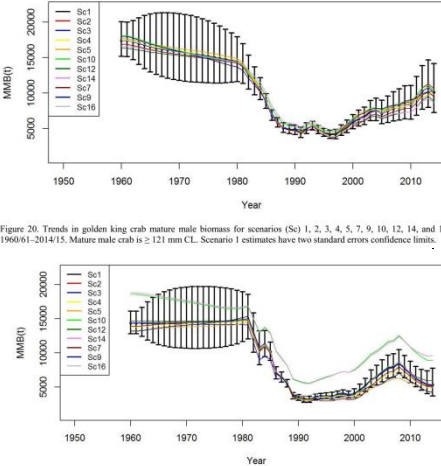
<p>failures from those with relatively steady recruitment. Thus, the frequency of year-class success (defined as exceeding a recruitment level associated with year-class failure) was used for this attribute. Because this attribute was viewed as a course index, the VEWG chose 10% and 75% as the breakpoints between our ranking categories so that scores of 1 and 3 identified relatively extreme differences in recruitment patterns.</p>		<p>successful)</p>				<p>years or less and that females carry embryos for less than two years with a prolonged period in which they remain in barren condition (Watson et al 2002). From laboratory studies of golden king crab collected from Prince William Sound, Paul and Paul (2001) estimated a 20-month reproductive cycle with a 12-month clutch brooding period. The success of asynchronous and aseasonal spawning of golden king crab may be facilitated by fully lecithotrophic larval development (i.e., the larvae can develop successfully to juvenile crab without eating; Shirley and Zhou 1997).</p> <p>The argument here is that because the larvae can develop successfully to juvenile crab without the need to feed on external sources they have a higher chance of success than other crabs.</p> <p>Given the above argument and the fact that catch is consistent over time relative to other crab stocks over the past 20 years a score of 3 has been assigned.</p>	
<p>Age at maturity (<i>tmat</i>): Age at maturity tends to be positively related with maximum age (<i>tmax</i>), as long-lived, lower productivity stocks will have higher ages at maturity relative to short-lived stocks. The attribute scoring definitions based upon the ANOVA applied to the fish stocks considered to be representative of U.S. fisheries was 2 to 4 years. This range is lower than that observed from Froese and Binohlan's (2000) empirical relationship between <i>tmat</i> and <i>tmax</i>, which was 3 to 9 based upon values of <i>tmax</i> of 10 and 30. However, the Froese and Binohlan (2000) used data from many fish stocks around the world, which may not be representative of U.S. stocks. For the PSA, the thresholds obtained from the ANOVA applied to</p>	<p><2 years</p>	<p>2-4 years (midpoint 3.0 years)</p>	<p>>4 years</p>	<p>1</p>	<p>2</p>	<p>ADFG website mentions 5-8 lbs as max. weights for Golden king crab.</p> <p>Male red king crabs typically grow larger than females, and their sex is determined by examining their abdomen. Red king crab typically achieves sexual maturity at 7 years, although mating and reproduction usually does not occur until ages 8–9 (NMFS 2004). Blue king crab reaches sexual maturity between 5 and 6 years (NMFS 2004). The age of sexual maturity for golden king crab is unknown, but it typically becomes mature at carapace lengths of 92–130 mm (3.6–5.1 in) for males and 98–111 mm (3.9–4.4 in) for females (NMFS 2004) (Danner 2007). This roughly correlates to an age of 6 -7 years for Golden King crab, based on similar carapace length/age correlations for male red king crabs (Webb 2014). A score of 1 is applied.</p>	<p>http://safinacenter.org/documents/2016/03/alaska-king-crab-full-species-report.pdf</p> <p>Webb 2014 page 293 https://books.google.ie/books?hl=en&lr=&id=cq3MBQAAQBAJ&oi=fnd&pg=PA285&ots=2FwWbWXZAN&sig=hA9A9CnYkG3dCHHUbkWrOwz3TEo&redir_esc=y#v=onepage&q&f=true</p>

stocks considered representative of U.S. fisheries were used.							
<p>Mean trophic level: The position of a stock within the larger fish community can be used to infer stock productivity, with lower-trophic-level stocks generally being more productive than higher-trophic-level stocks. The trophic level of a stock can be computed as a function of the trophic levels of the organisms in its diet. For this attribute, stocks with trophic levels higher than 3.5 were categorized as low productivity stocks and stocks with trophic levels less than 2.5 were categorized as high-productivity stocks, with moderate productivity stocks falling between these bounds. These attribute threshold roughly categorize piscivores to higher trophic levels, omnivores to intermediate trophic levels, and planktivores to lower trophic levels (Pauly et al. 1998).</p>	<2.5	2.5 – 3.5 (mid pint 3)	>3.5	3	2	<p>Golden king crab 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.</p> <p>A score of 3 is applied</p>	<p>http://www.adfg.alaska.gov/index.cfm?adfg=goldenkingcrab.main</p>
Susceptibility	Low (1)	Moderate (2)	High (3)	Attribute Score	Data Quality Score	Comment	Reference
<p>Management strategy: The susceptibility of a stock to overfishing may largely depend on the effectiveness of fishery management procedures used to control catch (Sethi et al. 2005, Rosenberg et al. 2007, Shertzer et al. 2008, Dankel et al. 2008). Stocks that are managed using catch</p>	Targeted stocks have catch limits and proactive accountability measures; non target	Targeted stocks have catch limits and reactive accountability measures	Targeted stocks do not have catch limits or accountability measures; non target stocks are closely	1	1	Targeted stocks have catch limits (TAC, ABC and OFL) and proactive accountability measures; non target stocks are closely monitored (i.e. ADFG observer program).	<p>http://www.adfg.alaska.gov/FedAidPDFs/FDS14-49.pdf</p>

<p>limits for which the fishery can be closed before the catch limit is exceeded (i.e., in-season or proactive accountability measures) are considered to have a low susceptibility to overfishing. However, stocks that do not have specified catch limits or accountability measures are highly susceptible to overfishing if their abundance trends are not monitored. Stocks that are managed using catch limits and reactive accountability measures (e.g., catch levels are not determined until after the fishing season) are considered to be moderately susceptible to overfishing or becoming overfished.</p>	<p>stocks are closely monitored</p>		<p>monitored</p>			<p>Appendix C21--Total pot lift contents for 499 pot lifts sampled during the 2013/14 golden king crab fishery east of 174° W long.</p> <table border="1"> <thead> <tr> <th>Commercial crab species</th> <th>Number</th> <th>Other species</th> <th>Number</th> <th>Other species</th> </tr> </thead> <tbody> <tr> <td>Golden King Crab</td> <td></td> <td>Anthomastus sp.</td> <td>3</td> <td>Pacific cod</td> </tr> <tr> <td>legal</td> <td>17,923</td> <td>arrowtooth flounder</td> <td>2</td> <td>Pacific hake</td> </tr> <tr> <td>sublegal</td> <td>5,094</td> <td>basket star</td> <td>106</td> <td>Pacific herring</td> </tr> <tr> <td>female</td> <td>5,038</td> <td>brittle star unident.</td> <td>24</td> <td>Pacific ocean perch</td> </tr> <tr> <td>Scarlet King Crab</td> <td></td> <td>bryozoan unident.</td> <td>30</td> <td>Pleuronectidae unident.</td> </tr> <tr> <td>legal</td> <td>28</td> <td>Calcigorgia sp.</td> <td>3</td> <td>Primnoidea</td> </tr> <tr> <td>sublegal</td> <td>3</td> <td>capelin</td> <td>1</td> <td>Primnoidea unident.</td> </tr> <tr> <td>female</td> <td>5</td> <td>chiton unident.</td> <td>2</td> <td>red-tree coral</td> </tr> <tr> <td></td> <td></td> <td>Crypthelia sp.</td> <td>5</td> <td>sea anemone unident.</td> </tr> <tr> <td></td> <td></td> <td>Cup coral unident.</td> <td>4</td> <td>sea urchin unident.</td> </tr> <tr> <td></td> <td></td> <td>Cyclohelia sp.</td> <td>9</td> <td>shrimp unident.</td> </tr> <tr> <td></td> <td></td> <td>Distichopora sp.</td> <td>3</td> <td>skate unident.</td> </tr> <tr> <td></td> <td></td> <td>Errinopora sp.</td> <td>6</td> <td>snail unident.</td> </tr> <tr> <td></td> <td></td> <td>Fanellia sp.</td> <td>3</td> <td>soft coral unident.</td> </tr> <tr> <td></td> <td></td> <td>Flabellum sp.</td> <td>3</td> <td>sponge unident.</td> </tr> <tr> <td></td> <td></td> <td>flatfish unident.</td> <td>3</td> <td>starfish unident.</td> </tr> <tr> <td></td> <td></td> <td>hydroid unident.</td> <td>18</td> <td>stony coral unident.</td> </tr> <tr> <td></td> <td></td> <td>jellyfish unident.</td> <td>2</td> <td>Stylaster sp.</td> </tr> <tr> <td></td> <td></td> <td>Kamchatka coral</td> <td>12</td> <td></td> </tr> </tbody> </table> <p>A score of 1 is assigned</p>	Commercial crab species	Number	Other species	Number	Other species	Golden King Crab		Anthomastus sp.	3	Pacific cod	legal	17,923	arrowtooth flounder	2	Pacific hake	sublegal	5,094	basket star	106	Pacific herring	female	5,038	brittle star unident.	24	Pacific ocean perch	Scarlet King Crab		bryozoan unident.	30	Pleuronectidae unident.	legal	28	Calcigorgia sp.	3	Primnoidea	sublegal	3	capelin	1	Primnoidea unident.	female	5	chiton unident.	2	red-tree coral			Crypthelia sp.	5	sea anemone unident.			Cup coral unident.	4	sea urchin unident.			Cyclohelia sp.	9	shrimp unident.			Distichopora sp.	3	skate unident.			Errinopora sp.	6	snail unident.			Fanellia sp.	3	soft coral unident.			Flabellum sp.	3	sponge unident.			flatfish unident.	3	starfish unident.			hydroid unident.	18	stony coral unident.			jellyfish unident.	2	Stylaster sp.			Kamchatka coral	12																																																																																																																														
Commercial crab species	Number	Other species	Number	Other species																																																																																																																																																																																																																																			
Golden King Crab		Anthomastus sp.	3	Pacific cod																																																																																																																																																																																																																																			
legal	17,923	arrowtooth flounder	2	Pacific hake																																																																																																																																																																																																																																			
sublegal	5,094	basket star	106	Pacific herring																																																																																																																																																																																																																																			
female	5,038	brittle star unident.	24	Pacific ocean perch																																																																																																																																																																																																																																			
Scarlet King Crab		bryozoan unident.	30	Pleuronectidae unident.																																																																																																																																																																																																																																			
legal	28	Calcigorgia sp.	3	Primnoidea																																																																																																																																																																																																																																			
sublegal	3	capelin	1	Primnoidea unident.																																																																																																																																																																																																																																			
female	5	chiton unident.	2	red-tree coral																																																																																																																																																																																																																																			
		Crypthelia sp.	5	sea anemone unident.																																																																																																																																																																																																																																			
		Cup coral unident.	4	sea urchin unident.																																																																																																																																																																																																																																			
		Cyclohelia sp.	9	shrimp unident.																																																																																																																																																																																																																																			
		Distichopora sp.	3	skate unident.																																																																																																																																																																																																																																			
		Errinopora sp.	6	snail unident.																																																																																																																																																																																																																																			
		Fanellia sp.	3	soft coral unident.																																																																																																																																																																																																																																			
		Flabellum sp.	3	sponge unident.																																																																																																																																																																																																																																			
		flatfish unident.	3	starfish unident.																																																																																																																																																																																																																																			
		hydroid unident.	18	stony coral unident.																																																																																																																																																																																																																																			
		jellyfish unident.	2	Stylaster sp.																																																																																																																																																																																																																																			
		Kamchatka coral	12																																																																																																																																																																																																																																				
<p>Area overlap: This attribute pertains to the extent of geographic overlap between the known distribution of a stock and the distribution of the fishery. Greater overlap implies greater susceptibility, as some degree of geographical overlap is necessary for a fishery to impact a stock. The simplest approach is to determine, either qualitatively or quantitatively, the proportion of the spatial distribution of a given fishery that overlaps that of the stock, based on known geographical distributions of both. If data regarding spatial distributions are lacking, inferences on areal overlap may be made from knowledge of depth distributions</p>	<p>< 25% of the stock occurs in the area fished</p>	<p>Between 25% and 50% of the stock occurs in the area fished</p>	<p>>50% of the stock occurs in the area fished</p>	<p>1</p>	<p>1</p>	<p>Table 5. Total fished area (square miles) and relative proportion of area fished (relative to maximum area fished) during 1985/86-2014/15 in EAG.</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Fished Area (sq.miles)</th> <th>Relative Proportion</th> <th>Year</th> <th>Fished Area (sq.miles)</th> </tr> </thead> <tbody> <tr><td>1985</td><td>257,180</td><td>0.57</td><td>2005</td><td>134,060</td></tr> <tr><td>1986</td><td>281,826</td><td>0.63</td><td>2006</td><td>140,498</td></tr> <tr><td>1987</td><td>244,721</td><td>0.54</td><td>2007</td><td>164,523</td></tr> <tr><td>1988</td><td>278,705</td><td>0.62</td><td>2008</td><td>157,924</td></tr> <tr><td>1989</td><td>450,286</td><td>1.00</td><td>2009</td><td>139,148</td></tr> <tr><td>1990</td><td>188,461</td><td>0.42</td><td>2010</td><td>155,592</td></tr> <tr><td>1991</td><td>257,978</td><td>0.57</td><td>2011</td><td>125,924</td></tr> <tr><td>1992</td><td>234,338</td><td>0.52</td><td>2012</td><td>141,013</td></tr> <tr><td>1993</td><td>158,490</td><td>0.35</td><td>2013</td><td>147,034</td></tr> <tr><td>1994</td><td>257,087</td><td>0.57</td><td>2014</td><td>136,227</td></tr> <tr><td>1995</td><td>280,213</td><td>0.62</td><td></td><td></td></tr> <tr><td>1996</td><td>269,754</td><td>0.60</td><td></td><td></td></tr> <tr><td>1997</td><td>263,378</td><td>0.58</td><td></td><td></td></tr> <tr><td>1998</td><td>166,178</td><td>0.37</td><td></td><td></td></tr> <tr><td>1999</td><td>176,031</td><td>0.39</td><td></td><td></td></tr> <tr><td>2000</td><td>171,383</td><td>0.38</td><td></td><td></td></tr> <tr><td>2001</td><td>144,729</td><td>0.32</td><td></td><td></td></tr> <tr><td>2002</td><td>138,283</td><td>0.31</td><td></td><td></td></tr> <tr><td>2003</td><td>120,167</td><td>0.27</td><td></td><td></td></tr> <tr><td>2004</td><td>87,066</td><td>0.19</td><td></td><td></td></tr> </tbody> </table> <p>Table 19. Total fished area (square miles) and relative proportion of area fished (relative to maximum area fished) during 1985/86-2014/15 in WAG.</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Fished Area (sq.miles)</th> <th>Relative Proportion</th> <th>Year</th> <th>Fished Area (sq.miles)</th> </tr> </thead> <tbody> <tr><td>1985</td><td>35,082</td><td>0.60</td><td>2008</td><td>26,226</td></tr> <tr><td>1986</td><td>54,680</td><td>0.93</td><td>2009</td><td>29,622</td></tr> <tr><td>1987</td><td>45,732</td><td>0.78</td><td>2010</td><td>37,396</td></tr> <tr><td>1988</td><td>55,326</td><td>0.94</td><td>2011</td><td>26,242</td></tr> <tr><td>1989</td><td>57,678</td><td>0.98</td><td>2012</td><td>30,759</td></tr> <tr><td>1990</td><td>57,164</td><td>0.97</td><td>2013</td><td>43,957</td></tr> <tr><td>1991</td><td>51,506</td><td>0.88</td><td>2014</td><td>41,569</td></tr> <tr><td>1992</td><td>53,059</td><td>0.90</td><td></td><td></td></tr> <tr><td>1993</td><td>32,066</td><td>0.55</td><td></td><td></td></tr> <tr><td>1994</td><td>50,503</td><td>0.86</td><td></td><td></td></tr> <tr><td>1995</td><td>51,717</td><td>0.88</td><td></td><td></td></tr> <tr><td>1996</td><td>46,477</td><td>0.79</td><td></td><td></td></tr> <tr><td>1997</td><td>53,534</td><td>0.91</td><td></td><td></td></tr> <tr><td>1998</td><td>42,970</td><td>0.73</td><td></td><td></td></tr> <tr><td>1999</td><td>51,592</td><td>0.88</td><td></td><td></td></tr> <tr><td>2000</td><td>58,644</td><td>1.00</td><td></td><td></td></tr> <tr><td>2001</td><td>50,478</td><td>0.86</td><td></td><td></td></tr> <tr><td>2002</td><td>51,968</td><td>0.89</td><td></td><td></td></tr> <tr><td>2003</td><td>53,717</td><td>0.92</td><td></td><td></td></tr> <tr><td>2004</td><td>52,812</td><td>0.90</td><td></td><td></td></tr> <tr><td>2005</td><td>29,039</td><td>0.50</td><td></td><td></td></tr> <tr><td>2006</td><td>34,008</td><td>0.58</td><td></td><td></td></tr> <tr><td>2007</td><td>35,811</td><td>0.61</td><td></td><td></td></tr> </tbody> </table> <p>Chris Siddon (ADF&G) presentation at May 2015 crab plan team meeting.</p> <p>ADF&G has data on historic fishing grounds based on approximately 20 years of observed pot lifts. The proportion of</p>	Year	Fished Area (sq.miles)	Relative Proportion	Year	Fished Area (sq.miles)	1985	257,180	0.57	2005	134,060	1986	281,826	0.63	2006	140,498	1987	244,721	0.54	2007	164,523	1988	278,705	0.62	2008	157,924	1989	450,286	1.00	2009	139,148	1990	188,461	0.42	2010	155,592	1991	257,978	0.57	2011	125,924	1992	234,338	0.52	2012	141,013	1993	158,490	0.35	2013	147,034	1994	257,087	0.57	2014	136,227	1995	280,213	0.62			1996	269,754	0.60			1997	263,378	0.58			1998	166,178	0.37			1999	176,031	0.39			2000	171,383	0.38			2001	144,729	0.32			2002	138,283	0.31			2003	120,167	0.27			2004	87,066	0.19			Year	Fished Area (sq.miles)	Relative Proportion	Year	Fished Area (sq.miles)	1985	35,082	0.60	2008	26,226	1986	54,680	0.93	2009	29,622	1987	45,732	0.78	2010	37,396	1988	55,326	0.94	2011	26,242	1989	57,678	0.98	2012	30,759	1990	57,164	0.97	2013	43,957	1991	51,506	0.88	2014	41,569	1992	53,059	0.90			1993	32,066	0.55			1994	50,503	0.86			1995	51,717	0.88			1996	46,477	0.79			1997	53,534	0.91			1998	42,970	0.73			1999	51,592	0.88			2000	58,644	1.00			2001	50,478	0.86			2002	51,968	0.89			2003	53,717	0.92			2004	52,812	0.90			2005	29,039	0.50			2006	34,008	0.58			2007	35,811	0.61		
Year	Fished Area (sq.miles)	Relative Proportion	Year	Fished Area (sq.miles)																																																																																																																																																																																																																																			
1985	257,180	0.57	2005	134,060																																																																																																																																																																																																																																			
1986	281,826	0.63	2006	140,498																																																																																																																																																																																																																																			
1987	244,721	0.54	2007	164,523																																																																																																																																																																																																																																			
1988	278,705	0.62	2008	157,924																																																																																																																																																																																																																																			
1989	450,286	1.00	2009	139,148																																																																																																																																																																																																																																			
1990	188,461	0.42	2010	155,592																																																																																																																																																																																																																																			
1991	257,978	0.57	2011	125,924																																																																																																																																																																																																																																			
1992	234,338	0.52	2012	141,013																																																																																																																																																																																																																																			
1993	158,490	0.35	2013	147,034																																																																																																																																																																																																																																			
1994	257,087	0.57	2014	136,227																																																																																																																																																																																																																																			
1995	280,213	0.62																																																																																																																																																																																																																																					
1996	269,754	0.60																																																																																																																																																																																																																																					
1997	263,378	0.58																																																																																																																																																																																																																																					
1998	166,178	0.37																																																																																																																																																																																																																																					
1999	176,031	0.39																																																																																																																																																																																																																																					
2000	171,383	0.38																																																																																																																																																																																																																																					
2001	144,729	0.32																																																																																																																																																																																																																																					
2002	138,283	0.31																																																																																																																																																																																																																																					
2003	120,167	0.27																																																																																																																																																																																																																																					
2004	87,066	0.19																																																																																																																																																																																																																																					
Year	Fished Area (sq.miles)	Relative Proportion	Year	Fished Area (sq.miles)																																																																																																																																																																																																																																			
1985	35,082	0.60	2008	26,226																																																																																																																																																																																																																																			
1986	54,680	0.93	2009	29,622																																																																																																																																																																																																																																			
1987	45,732	0.78	2010	37,396																																																																																																																																																																																																																																			
1988	55,326	0.94	2011	26,242																																																																																																																																																																																																																																			
1989	57,678	0.98	2012	30,759																																																																																																																																																																																																																																			
1990	57,164	0.97	2013	43,957																																																																																																																																																																																																																																			
1991	51,506	0.88	2014	41,569																																																																																																																																																																																																																																			
1992	53,059	0.90																																																																																																																																																																																																																																					
1993	32,066	0.55																																																																																																																																																																																																																																					
1994	50,503	0.86																																																																																																																																																																																																																																					
1995	51,717	0.88																																																																																																																																																																																																																																					
1996	46,477	0.79																																																																																																																																																																																																																																					
1997	53,534	0.91																																																																																																																																																																																																																																					
1998	42,970	0.73																																																																																																																																																																																																																																					
1999	51,592	0.88																																																																																																																																																																																																																																					
2000	58,644	1.00																																																																																																																																																																																																																																					
2001	50,478	0.86																																																																																																																																																																																																																																					
2002	51,968	0.89																																																																																																																																																																																																																																					
2003	53,717	0.92																																																																																																																																																																																																																																					
2004	52,812	0.90																																																																																																																																																																																																																																					
2005	29,039	0.50																																																																																																																																																																																																																																					
2006	34,008	0.58																																																																																																																																																																																																																																					
2007	35,811	0.61																																																																																																																																																																																																																																					

<p>of the fishery and the stock. For example, an upper bound estimate of areal overlap may be made from knowledge of the portion of fishing effort that occurs in the areas which encompass the depths occupied by a species.</p>						<p>historic area that is currently fished in a given year averages 20% in the EAG. Since rationalization in 2005, the cumulative area fished in the EAG is approximately 50%. Percentages are similar for the WAG, with a cumulative of 45% of the habitat fished since 2005. The proportion of historic area that is currently fished in a given year averages 20% in the WAG.</p> <p>Score of 1 is applied</p>	
<p>Geographic concentration: Geographical concentration is the extent to which the stock is concentrated into small areas. The rationale for including this attribute is that a stock with a relatively even distribution across its range may be less susceptible than a highly aggregated stock. For some species, a useful measure of this attribute is the minimum estimate of the proportion of area occupied by a certain percentage of the stock (Swain and Sinclair 1994), which can be computed in cases where survey data exist. For many stocks, this index gives a general index of areal coverage that relates well to geographic concentration. However, some stocks can cover a small area even though the stocks were not concentrated in a small number of locations (i.e., a “patchy” stock that is distributed over the survey area). Thus, some refinements to the index may be necessary to characterize geographic concentration in these cases.</p>	<p>Stock is distributed in >50% of its total range</p>	<p>Stock is distributed in 25% to 50% of its total range</p>	<p>Stock is distributed in <25% of its total range</p>	<p>1</p>	<p>1</p>	<p>Based on 20 years of observer data the area fished for golden king crab covers 233,800 square kilometers (90,271 square miles). This makes just the commercially fishable Aleutian Islands golden king crab habitat larger than all but eleven of the US states. It is known that females and juvenile males inhabit many areas that are not fished commercially because of the depth and the desire not to catch them. The historical fishing area stretches approximately 800 miles from 167 degrees West long. to 172 degrees east longitude.</p> <p>The stock is distributed across all of his range. Score of 1</p>	<p>Chris Siddon (ADF&G) presentation at May 2015 crab plan team meeting.</p>

<p>Vertical overlap: Similar to geographical overlap, this attribute concerns the position of the stock within the water column (i.e., demersal or pelagic) relative to the fishing gear. Information on the depth at which gear is deployed (e.g., depth range of hooks for a pelagic longline fishery) and the depth preference of the species (e.g., obtained from archival tagging or other sources) can be used to estimate the degree of vertical overlap between fishing gear and a stock.</p>	<p><25% of the stock occurs in the depths fished</p>	<p>Between 25% and 50% of the stock occurs in the depths fished</p>	<p>>50% of stock occurs in the depths fished</p>	<p>2</p>	<p>2</p>	<p>Depths fished in the 2013 survey ranged 120 fathoms (219 m) to 350 fathoms (640 m) with a mean depth of 193.6 fathoms (354 m). Scientists think only a small portion of the crab population lives at fishable depths, and a much larger population lives in deeper water. Golden, or brown, king crab occur from the Japan Sea to the northern Bering Sea (ca. 61° N latitude), around the Aleutian Islands, on various sea mounts, and as far south as northern British Columbia (Alice Arm) (Jewett et al. 1985). They are typically found on the continental slope at depths of 200–1,000 m on extremely rough bottom. They are frequently found on coral bottom. Commercial fishing for golden king crab in the Aleutian Islands Area typically occurs at depths of 100–275 fathoms (183–503 m). During the 2012/13 season the pots sampled by at-sea observers were fished at an average depth of 176 fathoms (322 m; N=499) in the area east of 174° W longitude and 158 fathoms (289 m; N=1,223) for the area west of 174° W longitude (Gaeuman 2014).</p> <p>Based on the above, the commercial fishery targets the average depths of about 183 to 503 m (just over 320 m range) while golden king crabs are found at depths of 200–1,000 m (about 800 m range).</p> <p>About 40% of the stock occurs in the depths that are fished.</p> <p>A score of 2 is applied</p>	<p>http://www.adfg.alaska.gov/index.cfm?adfg=wildlife_news.view_article&articles_id=599 http://www.adfg.alaska.gov/fedaid/pdfs/FDS13-41.pdf <u>2015 Crab SAFE</u></p>																																										
<p>Fishing mortality rate (relative to M): This criterion is applicable to stocks where estimates of both fishing mortality rates (<i>F</i>) and (<i>M</i>) are available. Because sustainable fisheries management typically involves conserving the reproductive potential of a stock, it is recommended that the average <i>F</i> on mature fish be used where possible as opposed to the fully selected or “peak” <i>F</i>. We base our thresholds on the conservative rule of</p>	<p><0.5</p>	<p>0.5-1.0</p>	<p>>1</p>	<p>2</p>	<p>2</p>	<p>If <i>M</i> can be assumed to be equivalent to the OFL limit (i.e. the upper limit of <i>F</i>, the fishing mortality, before overfishing occurs), then it would be just over 50%</p> <p>$F/M = 0.5$</p> <p><i>Status and catch specifications (1000 t) of Aleutian Islands golden king crab</i></p> <table border="1"> <thead> <tr> <th>Year</th> <th>MSST</th> <th>Biomass (MMB)</th> <th>TAC</th> <th>Retained Catch^a</th> <th>Total Catch^a</th> <th>OFL</th> </tr> </thead> <tbody> <tr> <td>2011/12</td> <td>N/A</td> <td>N/A</td> <td>2.72</td> <td>2.71</td> <td>2.95</td> <td>5.17</td> </tr> <tr> <td>2012/13</td> <td>N/A</td> <td>N/A</td> <td>2.85</td> <td>2.84</td> <td>3.12</td> <td>5.69</td> </tr> <tr> <td>2013/14</td> <td>N/A</td> <td>N/A</td> <td>2.85</td> <td>2.89</td> <td>3.19</td> <td>5.69</td> </tr> <tr> <td>2014/15</td> <td>N/A</td> <td>N/A</td> <td>2.85</td> <td>2.77</td> <td>3.08</td> <td>5.69</td> </tr> <tr> <td>2014/15</td> <td>N/A</td> <td>N/A</td> <td>2.85</td> <td></td> <td></td> <td>5.69</td> </tr> </tbody> </table> <p><small>a. Total retained catch plus estimated bycatch mortality of discarded bycatch during groundfish fisheries.</small></p> <p>Estimated fishing mortality rate by stock assessment is about 0.2, equal to fishing mortality.</p> <p>$F/M = 1$</p>	Year	MSST	Biomass (MMB)	TAC	Retained Catch ^a	Total Catch ^a	OFL	2011/12	N/A	N/A	2.72	2.71	2.95	5.17	2012/13	N/A	N/A	2.85	2.84	3.12	5.69	2013/14	N/A	N/A	2.85	2.89	3.19	5.69	2014/15	N/A	N/A	2.85	2.77	3.08	5.69	2014/15	N/A	N/A	2.85			5.69	
Year	MSST	Biomass (MMB)	TAC	Retained Catch ^a	Total Catch ^a	OFL																																											
2011/12	N/A	N/A	2.72	2.71	2.95	5.17																																											
2012/13	N/A	N/A	2.85	2.84	3.12	5.69																																											
2013/14	N/A	N/A	2.85	2.89	3.19	5.69																																											
2014/15	N/A	N/A	2.85	2.77	3.08	5.69																																											
2014/15	N/A	N/A	2.85			5.69																																											

<p>thumb that the M should be an upper limit of F (Thompson 1993; Restrepo et al. 1998), and thus F/M should not exceed 1. For this attribute, we define intermediate F/M values as those between 0.5 and 1.0; values above 1.0 or below 0.5 are defined as high and low susceptibility, respectively.</p>						<p>Average M 0.75 = Score of 2 that uses the average M between the 2 values.</p>	
<p>Biomass of Spawners (SSB) or other proxies: Analogous to fishing mortality rate, the extent to which fishing has depleted the biomass of a stock relative to expected unfished levels offers information on realized susceptibility. One way to measure this is to compare the current stock biomass against an estimate of B_0 (the estimated biomass with no fishing). If B_0 is not available, one could compare the current stock size against the maximum observed from a time series of population size estimates (e.g., from a research survey). If a time series is used, it should be of adequate length (e.g., > 5 years). Note that the maximum observed survey estimate may not correspond to the true maximum biomass for stocks with substantial observation errors in survey biomass estimates. Additionally, stocks may decline in abundance from environmental factors not related to susceptibility to the fishery, so this should be considered in</p>	<p>B is > 40% of B_0 (or maximum observed from time series of biomass estimates)</p>	<p>B is between 25% and 40% of B_0 (or maximum observed from time series of biomass estimates)</p>	<p>B is < 25% of B_0 (or maximum observed from time series of biomass estimates)</p>	<p>1</p>	<p>2</p>	 <p>Figure 20. Trends in golden king crab mature male biomass for scenarios (Sc) 1, 2, 3, 4, 5, 7, 9, 10, 12, 14, and 16 1960/61-2014/15. Mature male crab is ≥ 121 mm CL. Scenario 1 estimates have two standard errors confidence limits.</p> <p>Figure 37. Trends in golden king crab mature male biomass for scenarios (Sc) 1, 2, 3, 4, 5, 7, 9, 10, 12, 14, and 16 1960/61-2014/15. Mature male crab is ≥ 121 mm CL. Scenario 1 estimates have two standard errors confidence limits. Scenario 10 (green line, dome shaped selectivity) and 14 (violet line, area shrinkage factor on CPUE) predictions are higher than the rest.</p> <p>Based on preliminary model results not yet accepted by the CPT, it seems that the EAG is 66% of B_0 (assuming B_0 was the 1980 biomass given the fishery started in 1981) and WAG is 33% of B_0 based on the same reason as for the EAG.</p> <p>SSB appears to be about 50% of B_0. Score of 1</p>	<p>GKCAssessModel_Spring2016CPT_May2016Draft6</p>

<p>evaluating depletion estimates. Notwithstanding these issues, which can be addressed with the data quality score described below, some measure of current stock abundance was viewed as a useful attribute.</p>							
<p>Seasonal migrations: Seasonal migrations either to or from the fishery area (i.e. spawning or feeding migrations) could affect the overlap between the stock and the fishery. This attribute also pertains to cases where the location of the fishery changes seasonally, which may be relevant for stocks captured as bycatch.</p>	<p>Seasonal migrations decrease overlap with the fishery</p>	<p>Seasonal migrations do not substantially affect the overlap with the fishery</p>	<p>Seasonal migration increase overlap with the fishery</p>	<p>1</p>	<p>1</p>	<p>Recoveries during commercial fisheries of golden king crab tagged during ADF&G surveys (Blau and Pengilly 1994; Blau et al. 1998; Watson and Gish 2002; Watson 2004, 2007) provided no evidence of substantial movements by crab in the size classes that were tagged (males and females ≥ 90-mm carapace length [CL]). Maximum straight-line distance between release and recovery location of 90 golden king crab released prior to the 1991/92 season and recovered through the 1992/93 season was 33.1 nm (61.2 km; Blau and Pengilly 1994). Of the 4,053 recoveries reported through 14 March 2008 for the golden king crab tagged and released between 170.5° W longitude and 171.5° W longitude during the 1997, 2000, 2003, and 2006 triennial ADF&G Aleutian Island golden king pot surveys, none were recovered west of 174° W longitude and only four were recovered west of 172° W longitude (V. Vanek, ADF&G, Kodiak, personnel communication).</p> <p>Based on the above, seasonal migrations do not affect overlap with the fishery, and a score of 1 is applied</p>	<p>2015 Crab SAFE page 839</p>
<p>Schooling, aggregation, and other behaviors: This attribute encompasses behavioral responses of both individual fish and the stock in response to fishing. Individual responses may include, for example, herding or gear avoidance behavior that would affect catchability. An example of a population-level response is a reduction in the area of stock distribution with reduction in population size, potentially leading to increases in</p>	<p>Behavioral responses decrease the catchability of the gear</p>	<p>Behavioral responses do not substantially affect the catchability of the gear</p>	<p>Behavioral responses increase the catchability of the gear (i.e. hyperstability of the CPUE with schooling behavior)</p>	<p>1</p>	<p>2</p>	<p>It is apparent from the ADF&G small mesh pot study that areas that are fished commercially for legal males also contain substantial populations of females and sub-legal males. Females and sub-legal males also appear to be dispersed in areas and depths that legal males do not inhabit in large numbers. Indications from commercial fishermen are that they can continue to fish the same general areas and maintain reasonable catch rates. This indicates that behavioral responses do not substantially affect the crab catchability. It also indicates that harvest rates may be low.</p> <p>A score of 1 is applied.</p>	<p>http://www.adfg.alaska.gov/fedaid/pdfs/FDS13-41.pdf</p>

<p>catchability (MacCall 1990).</p>							
<p>Morphology affecting capture: This attribute pertains to the ability of the fishing gear to capture fish based on their morphological characteristics (e.g., body shape, spiny versus soft rayed fins). Because gear selectivity varies with size and age, this measure should be based on the age or size classes most representative of the entire stock.</p>	<p>Species shows low selectivity to the fishing gear</p>	<p>Species shows moderate selectivity to the fishing gear</p>	<p>Species shows high selectivity to the fishing gear</p>	<p>1</p>	<p>1</p>	<p>From the contact-selection curve fit to our data, we estimated that the size at 50% probability of retention for males by the pots fished during the current commercial fishery in the area east of 174° W longitude is approximately 135-mm CL, the same as the CL at recruitment to legal carapace width estimated by Tracy (1998) for Aleutian Islands golden king crab and close to the 136-mm CL that is used as a proxy for minimum legal carapace width in the current stock assessment model (Siddeek et al. 2013a). Furthermore, the probability of retention by pots estimated from the fitted contact-selection curve is only 75% for males at 141-mm CL and does not exceed 99% until sizes >160-mm CL. Estimated probability of retention by pots decreases steeply from 50% for males at 135-mm CL to 25% at 128-mm CL.</p> <p>Juveniles and females are very well excluded from commercial pots. It is not clear what percentage if moderate or high numbers of adult males are captured.</p> <div> </div> <p><small>Figure 21. Trends in pot fishery full selection total fishing mortality of golden king crab for scenario model fits in the EAG, 1981–2014 (note: 1981 refers to the 1981/82 fishing year).</small></p> <p>Commercial pots are designed to reduce catch of females and sublegal males. AD&G research shows they are very effective at reducing catch of these non-commercial crab. Additionally, fishermen avoid areas and depths where non-commercial crab predominate. In the areas commercially fished during ADF&G research legal males made up only 22.5% of the crab caught in small mesh pots. Legal male crab made up 66.5% of the crabs caught in commercial pots. During this research, it was shown that commercial pots also release many legal male crabs just above legal size. Thus, it does not appear that legal male crab are aggregated relative to sublegal and female crab in the commercial fishing areas.</p> <p>Score of 1 low selectivity based on the age or size classes most representative of the entire stock that can be encountered (i.e.</p>	<p>http://www.adfg.alaska.gov/fedaid/pdfs/FDS13-41.pdf</p> <p>GKCAssessModel_Spring2016CPT_May2016Draft6</p> <p>http://www.adfg.alaska.gov/fedaid/pdfs/FDS13-41.pdf</p>

						bell shaped distribution of populations where adults are at tail end of the distribution). All females and juveniles escape.																		
Survival after capture and release: Fish survival after capture and release varies by species, region, and gear type or even market conditions, and thus can affect the susceptibility of the stock. When data are lacking, the VEWG suggest using NMFS' forthcoming National Bycatch Report to estimate bycatch mortality. The report will provide comprehensive estimates of bycatch of fish, marine mammals, and non-marine mammal protected resources in major U.S. commercial fisheries, and should allow users to develop a proxy based on similar fisheries.	Probability of survival > 67%	33% < probability of survival < 67%	Probability of Survival < 33%	1	2	<p>Urban noted that one observation from this study was that golden king crab appear to be more hardy than red king crab. As an example, clipping the leg of a golden king crab caused only 3% mortality; significant mortality (80%) required complete severing of the leg.</p> <p>The CPT discussed the apparently greater "hardiness" of golden king crab relative to red king crab and some members of the public suggested that this observation could justify reducing the handling mortality used for golden king crab to less than 0.2.</p> <p>The CPT was unable to recommend a change to the golden king crab handling mortality on the basis of what was presented during the meeting and recommended that it stay at the status quo 0.2 until some data providing estimates of the handling mortality rate are presented. A score of 1 is provided</p>	<p>Page 175 of the 2015 Crab SAFE</p> <p>Page 177 of the 2015 Crab SAFE</p>																	
Desirability/value of the fishery: This attribute assumes that highly valued fish stocks are more susceptible to overfishing or becoming overfished by recreational or commercial fishermen due to increased effort. To identify the value of the fish, we suggest using the price per pound or annual landing value for commercial stocks (using the higher of the two values, see table 3 in the report). Commercial landings can be found at: www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html and www.st.nmfs.noaa.gov	Stock is not highly valued or desired by the fishery	Stock is moderately valued or desired by the fishery	Stock is highly valued or desired by the fishery	3	1	<p>2010-2014 average for AIGKC =</p> <ul style="list-style-type: none"> \$ 4.22/lb \$ 24 million gross revenue ex-vessel value <p>The AIGKC fishery is considered highly valued and desired.</p> <p>Table 3. The susceptibility scoring thresholds for desirability/value</p> <table border="1"> <thead> <tr> <th rowspan="2">Sector</th> <th rowspan="2">Measure</th> <th colspan="2">Susct</th> </tr> <tr> <th>Low (1)</th> <th>M</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Commercial</td> <td>\$/lb</td> <td>< \$1.00</td> <td>\$1</td> </tr> <tr> <td>Annual landings value</td> <td>< \$500,000</td> <td>\$</td> </tr> <tr> <td>Recreational</td> <td>% Retention</td> <td>< 33%</td> <td></td> </tr> </tbody> </table> <p>A score of 3 is provided based on high desirability/value of the fishery</p>	Sector	Measure	Susct		Low (1)	M	Commercial	\$/lb	< \$1.00	\$1	Annual landings value	< \$500,000	\$	Recreational	% Retention	< 33%		<p>Page 14 of the 2015 Crab Economic SAFE</p>
Sector	Measure	Susct																						
		Low (1)	M																					
Commercial	\$/lb	< \$1.00	\$1																					
	Annual landings value	< \$500,000	\$																					
Recreational	% Retention	< 33%																						

/st1/recreational/queries/index.html							
<p>Fishery Impacts to EFH or Habitat in general for non targets. A fishery may have an indirect effect on a species via adverse impacts on habitat. Defining these effects is the focus of environmental impact statements or essential fish habitat evaluations that have been conducted by NMFS, and this work can be used to evaluate this attribute. Thus, the impacts on habitat may be categorized with respect to whether adverse impacts on habitat are minimal, temporary, or mitigated.</p>	<p>Adverse effects absent, minimal or temporary</p>	<p>Adverse effects more than minimal or temporary but are mitigated</p>	<p>Adverse effects more than minimal or temporary and are not mitigated</p>	<p>1</p>	<p>1</p>	<p><i>Effects of Crab Fishing Gear on Seafloor Habitat</i></p> <p>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.</p> <p>Based on the perceived limited impact of the crab fishery a score of 1 is applied</p>	<p>Page 22 of the 2010 Crab SAFE</p> <p>http://www.npfc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/511Chapters/Ecosystem_CrabSAFE.pdf</p>