

7 Norton Sound Red King Crab

Fishery information relative to OFL setting

This stock supports three main fisheries: summer commercial, winter commercial, and winter subsistence. The summer commercial fishery, which accounts for the majority of the catch, reached a peak in the late 1970s at a little over 2.9 million pounds retained catch. Retained catches since 1982 have been below 0.5 million pounds, averaging 0.3 million pounds, including several low years in the 1990s. As the crab population rebounded, retained catches have increased somewhat to around 0.4 million pounds in recent years

Data and assessment methodology

Four types of surveys have occurred periodically during the last three decades: summer trawl, summer pot, winter pot, and preseason summer pot, but none of these surveys have been conducted every year. To improve abundance estimates, a male-only length-based model of male crab abundance was previously developed that combines multiple sources of data. A maximum likelihood approach was used to estimate abundance, recruitment, and selectivity and catchability of the commercial pot gear. The model has been updated with the following data: 1980–2012 winter pot survey, and 2013/2014 winter commercial and subsistence catches. In addition, the 1976–2011 trawl survey data were revised, but with no new years of data available (the next survey is scheduled for 2014). The current model assumes a constant $M=0.18\text{yr}^{-1}$, except for a fixed value of 0.648yr^{-1} for the largest length class. Logistic functions are used to describe fishery and survey selectivities, except for a dome-shaped function examined for the winter pot fishery.

The author summarized six model run alternatives, with the base model (Model 0) and alternatives originating from the 2014 modeling workshop. The CPT selected Model 2io as the recommended configuration based on: separate selectivities for NMFS and ADF&G trawl surveys; inclusion of winter survey data as a means of informing the winter fishery harvest, (although this had negligible impact on model results); and estimation of a growth matrix inside the model (separated for newshell and oldshell crab).

Stock biomass and recruitment trends

Mature male biomass was estimated to be at an historic low in 1982 following a crash from the peak biomass in 1977. The MMB then exhibited an upward trend from a recent low in 1997 to a peak in 2010, before declining in recent years. Estimated recruitment was weak during the late 1970s and high during the early 1980s, with a slight downward trend from 1983 to 1993. Estimated recruitment has been variable but with a slight increase in recent years.

Tier determination/Plan Team discussion and resulting OFL and ABC determination

The team recommended Tier 4, stock status b, for Norton Sound red king crab. For the recommended Model 2io, the author presented stock status information for retained catch. Model-based total catch estimates were provided, however, these estimates were model-generated from limited observer data and the team did not recommend their use in generating a total catch OFL. Thus the OFL and ABC are based on retained catch (only).

The estimated abundance and biomass in 2014 using model 2io are:
Mature male biomass: 3.71 million lb with a standard deviation of 0.64 million lb.

The $B_{MSY \text{ proxy}}$, calculated as the average of mature male biomass during 1980-2014, was $B_{MSY \text{ proxy}} = 4.19$

BSAI Crab SAFE

million lb. The $F_{MSY\ proxy}$ is $M = 0.18\ yr^{-1}$ and the $F_{OFL} = 0.157\ yr^{-1}$, because the 2014 mature male biomass is less than $B_{MSY\ proxy}$ with the CPT choosing the default of $\gamma = 1.0$, is.

The maximum permissible ABC would be 0.463 million lb, based on retained catch. The CPT recommended an ABC less than the maximum permissible due to concerns with model specification, lack of bycatch data as well as issues noted with the M employed for the largest length group. The CPT recommended an ABC = 90% of the OFL (10% buffer) of 0.417 million pounds.

Status and catch specifications (million lbs.)

Year	MSST	Biomass (MMB)	GHL	Retained Catch	Total Catch	OFL	ABC
2010/11	1.56	5.44	0.40	0.42	0.46	0.73	
2011/12	1.56	4.70	0.36	0.40	0.43	0.66	0.59
2012/13	1.76	4.59	0.47	0.47	0.47	0.53	0.48
2013/14	2.06	5.00	0.50	0.35	0.35	0.58	0.52
2014/15	2.11	3.71	TBD	TBD	TBD	0.46	0.42

Status and catch specifications (1000t)

Year	MSST	Biomass (MMB)	GHL	Retained Catch	Total Catch	OFL	ABC
2010/11	0.71	2.47	0.18	0.19	0.22	0.33	
2011/12	0.71	2.13	0.16	0.18	0.20	0.30	0.27
2012/13	0.81	2.08	0.21	0.21	0.21	0.24	0.22
2013/14	0.93	2.16	0.23	0.16	0.16	0.26	0.24
2014/15	0.96	1.68	TBD	TBD	TBD	0.21	0.19

Total catch in 2013/14 did not exceed the OFL for this stock thus overfishing is not occurring. Stock biomass is above MSST; thus, the stock is not overfished.

Additional Plan Team recommendations

The CPT has the following recommends for the next assessment:

- construct a likelihood profile for M for all size classes vs. a single M for the largest size class and a separate M for the remaining classes;
- explore different weighting schemes for the tag data.

Due to the availability of survey and catch data, the assessment cannot be finalized for the September CPT cycle as planned. Thus the CPT recommends finalizing the assessment at a mid-year meeting (see CPT report for more details).

8. Aleutian Islands golden king crab

Fishery information relative to OFL setting

The directed fishery has been prosecuted annually since the 1981/82 season. Retained catch peaked in 1986/87 at 14.7 million lb and averaged 11.9 million lb over the 1985/86-1989/90 seasons. Average harvests dropped sharply from 1989/90 to 1990/91 to a level of 6.9 million lb for the period 1990/91–1995/96. Management based on a formally established GHL began with the 1996/97 season. The 5.9 million lb GHL established for the 1996/97 season, which was based on the previous five-year average catch, was subsequently reduced to 5.7 million lb beginning in 1998/99. The GHL (or TAC, since 2005/06) remained at 5.7 million lb for 2007/08, but was increased to 6.0 million lb for the 2008/09-2011/12 seasons, and to 6.3 million lb for the 2012/13 and 2013/2014 seasons. Average annual retained catch for the period 1996/97–2007/08 was 5.6 million lb, and 6.0 million lb for the period 2008/09-2012/13. The retained catch for 2012/13 was 6.3 million lb. This fishery is rationalized under the Crab Rationalization Program. The 2013/14 season ends by regulation on 15 May 2013.

Non-retained bycatch occurs mainly in the directed fishery, and to a minor extent in other crab fisheries. Bycatch also occurs in fixed-gear and trawl groundfish fisheries although that bycatch is low relative to the weight of bycatch in the directed fishery. Total annual non-retained catch of golden king crab during crab fisheries has decreased relative to the retained catch since the 1990s. It decreased from 13.8 million lb in 1990/91 (199% of the retained catch) to 9.1 million lb in 1996/97 (156% of the retained catch), and to 4.3 million lb in the 2004/05 season (78% of the retained catch). Bycatch in the post-rationalized fishery (2005/06-2012/13) has ranged from 2.5 million lb in 2005/06 (46% of the retained catch) to just over 3.0 million lb for 2007/08 (55% of the retained catch). Bycatch mortality has correspondingly decreased since 1996/97 both in absolute weight and relative to the retained catch weight. Estimated total mortality (retained catch plus bycatch in crab and groundfish fisheries) ranged from 5.8-9.4 million lb over 1995/96–2012/13. Estimated total mortality in 2012/13 was 6.9 million lb.

Data and assessment methodology

Available data used in the Tier 5 assessment are from ADF&G fish tickets (retained catch numbers, retained catch weight, and pot lifts by ADF&G statistical area and landing date), size-frequencies from samples of landed crabs, at-sea observations from pot lifts sampled during the fishery (date, location, soak time, catch composition, size, sex, and reproductive condition of crabs, etc.), and bycatch estimates from the groundfish fisheries. These data are available through the 2012/13 season; complete data from the 2013/14 fishery season, which ends on 15 May 2014, are not currently available. Most of the available data were obtained from the fishery which targets legal-size (≥ 6 -inch CW) males and trends in the data can be affected by changes in both fishery practices and the stock. Data from triennial pot surveys (last performed in 2006) in the Yunaska-Amukta Island area of the Aleutian Islands, approximately 171° W longitude, and tag recoveries from crabs released during the triennial pot surveys are also available, but are not included in the Tier 5 assessment. The triennial survey is too limited in geographic scope and too infrequent to provide a reliable index of abundance for the Aleutian Islands area. A new survey as well as an assessment model are currently being developed for this stock.

Stock biomass and recruitment trends

Although a stock assessment is in development, it has not yet been accepted for use in management. There are consequently no estimates of stock biomass. Estimates of recruitment trends and current levels relative to virgin or historic levels are also not available.

Summary of major changes

Fishery data have been updated with the results for 2012/13: retained catch for the directed fishery and bycatch estimates for the directed fishery, non-directed crab fisheries, and groundfish fisheries.

BSAI Crab SAFE

Tier determination/Plan Team discussion and resulting OFL and ABC determination

The CPT recommends that this stock be managed as a Tier 5 stock in 2014/15. B_{MSY} and MSST are not estimated for this stock. Observer data on bycatch from the directed fishery and groundfish fisheries provides the estimate of total bycatch mortality. Bycatch data from the directed fishery for years after the 1990/91 season (excluding 1993/94 and 1994/95 seasons due to insufficient data) and from the groundfish fisheries since the 1993/94 season were used. There are no directed fishery observer data prior to the 1988/89 season and observer data are lacking or confidential for four seasons in at least one management area in the Aleutian Islands during 1988/89–1994/95.

This assessment author recommended using the same approach for determining the 2014/15 total catch OFL as was used to determine the 2013/14 total catch OFL. This approach uses data for 1985/86–1995/96 to estimate the mean retained catch in the crab fisheries, and bycatch data for 1990/91–95/96 to estimate the mean bycatch rate (0.363):

$$OFL_{2013/14} = (1 + R_{90/91-95/96}) \cdot RET_{85/86-95/96} + BM_{GF,93/94-08/09} = 12,537,757 \text{ lb}$$

where,

- $R_{90/91-95/96}$ is the average of the annual ratios of bycatch mortality due to crab fisheries to retained catch in pounds over the period of the subscribed years, excluding 1993/94–1994/95 due to data confidentiality and lack of data,
- $RET_{85/86-95/96}$ is the average annual retained catch in the directed crab fishery over the period 1985/86–1995/96), and
- $BM_{GF,93/94-08/09}$ is the average of the annual estimates of bycatch mortality due to groundfish fisheries over the period 1993/94–2008/09.

The assessment author recommended a 25% buffer between the OFL and ABC, which is an increase over the 10% buffer used in recent years. The author noted that the time-period used to determine the OFL for Tier 5 stocks should be representative of a stock’s productivity. In the past, the CPT has suggested various time ranges to compute the OFL, which suggests uncertainty regarding the time-period to represent productivity and the basis for setting the OFL. The assessment author noted that the ABC for the Tier 5 Adak red king crab stock is based on a 40% buffer, and three of the six FMP stocks that are surveyed by the EBS bottom trawl survey have buffers >10%. The CPT agreed that there is more uncertainty than is accommodated by a 10% buffer; however, the CPT agreed that uncertainty estimation issues should be more comprehensively addressed in the September CPT meeting and thus recommended the status quo 10% buffer for 2014/15 for this stock. The CPT recommended ABC is 11,283,981 lb.

BSAI Crab SAFE

Historical status and catch specifications (millions lb.) of Aleutian Islands golden king crab

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2010/11	NA	NA	5.99	5.97	6.56	11.06	NA
2011/12	NA	NA	5.99	5.96	6.51	11.40	10.26
2012/13	NA	NA	6.29	6.27	6.87	12.54	11.28
2013/14	NA	NA	6.29			12.54	11.28
2014/15	NA	NA	6.29 ^A			12.54	11.28

^A The 2014/15 TAC specified in ADFG regulation; however, the TAC is not established until the specifications are approved.

Historical status and catch specifications (thousand t) of Aleutian Islands golden king crab

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2010/11	NA	NA	2.72	2.71	2.98	5.02	NA
2011/12	NA	NA	2.72	2.71	2.95	5.17	4.66
2012/13	NA	NA	2.85	2.84	3.12	5.69	5.12
2013/14	NA	NA	2.85			5.69	5.12
2014/15	NA	NA	2.85 ^A			5.69	5.12

^A The 2014/15 TAC specified in ADFG regulation; however, the TAC is not established until the specifications are approved.

No overfished determination is possible for this stock given the lack of biomass information. Catch in 2012/13 was below the OFL therefore overfishing did not occur.

Additional Plan Team recommendations

The CPT notes inconsistencies in how uncertainty is characterized between the OFL and ABC for the BSAI crab stocks. The CPT recommends the buffer for this stock be revisited after it conducts a more complete review on the methods used to establish buffers across all BSAI crab stocks.

The CPT received an update on the proposed assessment model for Aleutian Islands golden king crab. However, the short lead-time for document review prevented the CPT from conducting a full review of the proposed model. A more thorough review of the model will occur at the September 2014 CPT meeting.

10 Adak red king crab, Aleutian Islands

Fishery information relative to OFL and ABC setting

The domestic fishery has been prosecuted since 1960/61 and was opened every season through the 1995/96 season. Since 1995/96, the fishery was opened only in 1998/99, and from 2000/01-2003/04. Peak harvest occurred during the 1964/65 season with a retained catch of 21.19 million lb. During the early years of the fishery through the late 1970s, most or all of the retained catch was harvested in the area between 172° W longitude and 179° 15' W longitude. As the annual retained catch decreased into the mid-1970s and the early-1980s, a large portion of the retained catch came from the area west of 179° 15' W longitude.

Retained catch during the 10-year period, 1985/86 through 1994/95, averaged 0.94 million lb, but the retained catch during the 1995/96 season was low, only 0.04 million lb. There was an exploratory fishery with a low guideline harvest level (GHL) in 1998/99; three Commissioner's permit fisheries in limited areas during 2000/01 and 2002/03 to allow for ADF&G-Industry surveys, and two commercial fisheries with a GHL of 0.50 million lb. during the 2002/03 and 2003/04 seasons. Most of the catch since the 1990/91 season was harvested in the Petrel Bank area (between 179° W longitude and 179° E longitude) and the last two commercial fishery seasons (2002/03 and 2003/04) were opened only in the Petrel Bank area. Retained catches in those two seasons were 0.51 million lb (2002/03) and 0.48 million lb (2003/04). The fishery has been closed since the end of the 2003/04 season.

Non-retained catch of red king crabs occurs in both the directed red king crab fishery (when prosecuted), in the Aleutian Islands golden king crab fishery, and in groundfish fisheries. Estimated bycatch mortality during the 1995/96-2012/13 seasons averaged 0.002 million lb in crab fisheries and 0.019 million lb in groundfish fisheries. Estimated annual total fishing mortality (in terms of total crab removal) during 1995/96-2012/13 averaged 0.091 million lb. The average retained catch during that period was 0.070 million lb. This fishery is rationalized under the Crab Rationalization Program only for the area west of 179° W longitude. Bycatch in 2012/13 was 196 lb in crab fisheries and 428 lb in groundfish fisheries (total catch 624 lb).

Data and assessment methodology

The 1960/61-2007/08 time series of retained catch (number and pounds of crabs), effort (vessels, landings and pot lifts), average weight and average carapace length of landed crabs, and catch-per-unit effort (number of crabs per pot lift) are available. Bycatch from crab fisheries during 1995/96-2012/13 and from groundfish fisheries during 1993/94-2012/13 are available. There is no assessment model for this stock. The standardized surveys of the Petrel Bank area conducted by ADF&G in 2006 and 2009 and the ADF&G-Industry Petrel Bank surveys conducted in 2001 have been too limited in geographic scope and too infrequent for reliable estimation of abundance for the entire western Aleutian Islands area.

Stock biomass and recruitment trends

Estimates of stock biomass are not available for this stock. Estimates of recruitment trends and current levels relative to virgin or historic levels are not available. The fishery has been closed since the end of 2003/04 season due to apparent poor recruitment. An ADF&G-Industry survey was conducted as a commissioner's permit fishery in the Adak-Atka-Amlia Islands area in November 2002 and provided no evidence of recruitment sufficient to support a commercial fishery. A pot survey conducted by ADF&G in the Petrel Bank area in 2006 provided no evidence of strong recruitment. A 2009 survey conducted by ADF&G in the Petrel Bank area encountered a smaller, ageing population with the catch of legal male

BSAI Crab SAFE

crab occurring in a more limited area and at lower densities than were found in the 2006 survey and provided no expectations for recruitment. A test fishery conducted by a commercial vessel during October-December 2009 in the area west of Petrel Bank yielded only one legal male red king crab.

Tier determination/Plan Team discussion and resulting OFL and ABC determination

The CPT recommends that this stock be managed under Tier 5 for the 2014/15 season. The CPT concurs with the assessment author’s recommendation of an OFL based on the 1995/96–2007/08 average total catch following the recommendation of the SSC in June 2010 to freeze the time period for computing the OFL at 1995/96–2007/08. The CPT recommends an OFL for 2014/15 of 0.12 million lb.

The Team continues to have concerns regarding the depleted status of this stock. Groundfish bycatch in recent years has accounted for the majority of the catch of this stock. The maximum permissible ABC is 0.11 million lb based on the Tier 5 control rule of a 10% buffer on the OFL.

The CPT recommends an ABC of 0.074 million lb for 2014/15, which is below the maximum permissible ABC (maxABC = 0.11 million lb). Industry has expressed interest in past years in an exploratory fishery around the Adak area based on anecdotal information that there may be legal crab available in this stock. Industry chose not to conduct a test fishery in 2012/13 and no such test fishery has been scheduled to date for 2014.

Status and catch specifications (millions of lb) of WAI RKC.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2010/11	NA	NA	Closed	0	0.004	0.124	
2011/12	NA	NA	Closed	0	0.002	0.124	0.027
2012/13	NA	NA	Closed	0	<0.001	0.124	0.074
2013/14	NA	NA	Closed			0.124	0.074
2014/15	NA	NA	Closed			0.124	0.074

Status and catch specifications (t) of WAI RKC.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2010/11	NA	NA	Closed	0	1.81	56.25	
2011/12	NA	NA	Closed	0	1.00	56.25	12.00
2012/13	NA	NA	Closed	0	<1.00	56.25	33.57
2013/14	NA	NA	Closed			56.25	33.57
2014/15	NA	NA	Closed			56.25	33.57

Note that the tons table has been calculated from the lb table and rounded to the nearest two decimal places

No overfished determination is possible for this stock given the lack of biomass information. Catch in 2012/13 was below the OFL therefore overfishing did not occur.

BSAI Crab SAFE

Additional Plan Team discussion

The plan team discussed the history of catch of the stock in continuing to recommend the status quo ABC. A State of Alaska Board of Fisheries meeting in March 2014 divided the area into two management districts: 1) west of 179 degrees W longitude and 2) 171 to 179 degrees W longitude. Pot limits were established at 10 pots per vessel in state waters and 15 pots in federal waters. The season open date was changed from October 15 to August 1 and federal waters would be closed when the GHLL is less than 250,000 lbs (113 t).

BSAI Crab SAFE

Table 3 Crab Plan Team recommendations May 2014
 (Note diagonal fill indicated parameters not applicable for that tier level while shaded sections are to be filled out for the final SAFE in September 2014)

Chapter	Stock	Tier	Status (a,b,c)	F _{OFL}	B _{MSY} or B _{MSYproxy}	Years ¹ (biomass or catch)	2014 ² ₃ MMB	2014 MMB / MMB _{MSY}	γ	Mortality (M)	2014/15 OFL mill lb	2014/15 ABC mill lb
1	EBS snow crab	3										
2	BB red king crab	3										
3	EBS Tanner crab	4										
4	Pribilof Islands red king crab	4										
5	Pribilof Islands blue king crab	4										
6	St. Matthew Island blue king crab	4										
7	Norton Sound red king crab	4	b	0.18	4.19	1980-current [model estimate]	3.71	0.89	1.0	0.18 0.68 (>123 mm)	0.46	0.42 ⁴
8	AI golden king crab	5				See intro chapter					12.54	11.28
9	Pribilof Island golden king crab	5										
10	Adak red king crab	5				1995/96– 2007/08					0.12	0.07

1 For Tiers 3 and 4 where B_{MSY} or B_{MSYproxy} is estimable, the years refer to the time period over which the estimate is made. For Tier 5 stocks it is the years upon which the catch average for OFL is obtained.

2 MMB as projected for 2/15/2015 at time of mating.

3 Model mature biomass on 7/1/2014

4 Retained catch only

BSAI Crab SAFE

Table 4 Maximum permissible ABCs for 2014/15 and Plan Team recommended ABCs for those stocks where the Plan Team recommendation is below the maximum permissible ABC as defined by Amendment 38 to the Crab FMP. Note that the rationale is provided in the individual introduction chapters for recommending an ABC less than the maximum permissible for these stocks. Values are in millions lb.

Stock	Tier	2014/15 <i>MaxABC</i>	2014/15 ABC
Norton Sound red king crab	4b	0.46	0.42
Adak red king crab	5	0.11	0.07