Agenda Item C-6(g)(1)
OCTOBER 2012

2012 Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries in the Bering Sea and Aleutian Islands

Introduction

The annual stock assessment and fishery evaluation (SAFE) report is a requirement of the North Pacific Fishery Management Council's *Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs* (FMP), and is a federal requirement [50 CFR Section 602.12(e)]. The SAFE report summarizes the current biological and economic status of fisheries, total allowable catch (TAC) or Guideline Harvest Level (GHL), and analytical information used for management decisions. Additional information on Bering Sea/Aleutian Islands (BSAI) king and Tanner crab is available on the NMFS web page at http://www.fakr.noaa.gov and the Alaska Department of Fish and Game (ADF&G) Westward Region Shellfish web page at: http://www.cf.adfg.state.ak.us/region4/shellfsh/shelhom4.php.

This FMP applies to 10 crab stocks in the BSAI: 4 red king crab, *Paralithodes camtschaticus*, stocks (Bristol Bay, Pribilof Islands, Norton Sound, and Adak), 2 blue king crab, *Paralithodes platypus,* stocks (Pribilof District and St Matthew Island), 2 golden (or brown) king crab, *Lithodes aequispinus,* stocks (Aleutian Island and Pribilof Islands), Eastern Bering Sea (EBS) Southern Tanner crab, *Chionoecetes bairdi*, and EBS snow crab *Chionoecetes opilio*. All other BSAI crab stocks are exclusively managed by the State of Alaska.

The Crab Plan Team (CPT) annually assembles the SAFE report with contributions from ADF&G and the National Marine Fisheries Service (NMFS). This SAFE report is presented to the North Pacific Fishery Management Council (NPFMC) and is available to the public on the NPFMC web page at: http://fakr.noaa.gov/npfmc/membership/plan_teams/CRAB_team.htm. Under a process approved in 2008 for revised overfishing level (OFL) determinations, and new ACL requirements in 2011, the CPT reviews four assessments in May to provide recommendations on OFL, ABC, and stock status specifications for review by the Council's Science and Statistical Committee (SSC) in June. In September, the CPT reviews the remaining assessments and provides final OFL and ABC recommendations and stock status determinations. Additional information on the OFL and ABC determination process is contained in this report.

The CPT met from September 18-21, 2012 in Seattle, WA to review the final stock assessments as well as additional related issues, to provide the recommendations and status determinations contained in this SAFE report. This final 2012 Crab SAFE report contains all recommendations for all 10 stocks including those whose OFL and ABC were determined in June 2012. This SAFE report will be presented to the Council in October for their annual review of the status of BSAI Crab stocks. Members of the team who participated in this review include the following: Bob (Chair), Ginny Eckert (Vice-Chair), Wayne Donaldson, Bill Bechtol, Karla Bush, Heather Fitch, Brian Garber-Yonts, Jason Gasper, Steve Martell, Doug Pengilly, André Punt, Lou Rugolo, Shareef Siddeek, Diana Stram, and Jack Turnock.

Stock Status Definitions

The FMP (incorporating all changes made following adoption of Amendment 24) 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 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.

Maximum sustainable yield (MSY) is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. MSY is estimated from the best information available.

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

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

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

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

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

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

Status Determination Criteria

The FMP defines the following status determination criteria and the process by which these are defined following adoption of amendment 24 and 38.

Status determination criteria for crab stocks are annually calculated using a five-tier system that accommodates varying levels of uncertainty of information. The five-tier system incorporates new scientific information and provides a mechanism to continually improve the status determination criteria as new information becomes available. Under the five-tier system, overfishing and overfished criteria and acceptable biological catch (ABC) levels are annually formulated. The annual catch limit (ACL) for each stock equals the ABC for that stock. Each crab stock is annually assessed to determine its status and whether (1) overfishing is occurring or the rate or level of fishing mortality for the stock is approaching overfishing, (2) the stock is overfished or the stock is approaching an overfished condition, and (3) the catch has exceeded the ACL.

For crab stocks, the overfishing level (OFL) equals 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.

Each year, NMFS will determine whether a stock is in an overfished condition by comparing annual biomass estimates to the established MSST, defined as ½ B_{MSY}. For stocks where MSST (or proxies) are defined, if the biomass drops below the MSST (or proxy thereof) then the stock is considered to be overfished. MSSTs or proxies are set for stocks in Tiers 1-4. For Tier 5 stocks, it is not possible to set an MSST because there are no reliable estimates of biomass.

If overfishing occurred or the stock is overfished, section 304(e)(3)(A) of the Magnuson-Stevens Act, as amended, requires the Council to immediately end overfishing and rebuild affected stocks.

The Magnuson-Stevens Act 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 GHLs 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 Council, SSC, and CPT will review (1) the stock assessment documents, (2) the OFLs and ABCs, and total allowable catches or guideline harvest levels, (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 Chapter 4 of the FMP. Information pertaining to economic, social and ecological factors relevant to the determination of optimum yield is provided in several sections of the FMP, including sections 7.2 (Management Objectives), Chapter 11, Appendix D (Biological and Environmental Characteristics of the Resource), and Appendix H (Community Profiles).

For each crab fishery, the optimum yield range is 0 to < OFL catch. For crab stocks, the OFL is the annualized maximum sustainable yield (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 objectives and economic and social objectives of the FMP (see sections 7.2.1 and 7.2.2) under a variety of future biological and ecological conditions. It enables the State of Alaska 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 FMP section 8.2.2, the State of Alaska 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, detailed in Table 6-1 and 6-2. 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 F_{OFL}. Three levels of stock status are specified and denoted by "a," "b," and "c" (see Table 6-1). The F_{MSY} control rule reduces the F_{OFL} as biomass declines by stock status level. At stock status level "a," current stock biomass exceeds the B_{MSY}. For stocks in status level "b," current biomass is less than B_{MSY} but greater than a level specified as the "critical biomass threshold" (β).

In stock status level "c," the ratio of current biomass to B_{MSY} (or a proxy for B_{MSY}) 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 F_{OFL}.

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 F_{OFL} 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 Report. 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 Report, the Crab Plan Team 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 State of Alaska 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.

Tiers 1 through 3

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

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 SSC 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 SSC 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

Tier 5 stocks have no reliable estimates of biomass and only historical catch data is 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 SSC 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.

Figure 1. Overfishing control rule for Tiers 1 through 4. Directed fishing mortality is 0 below β.

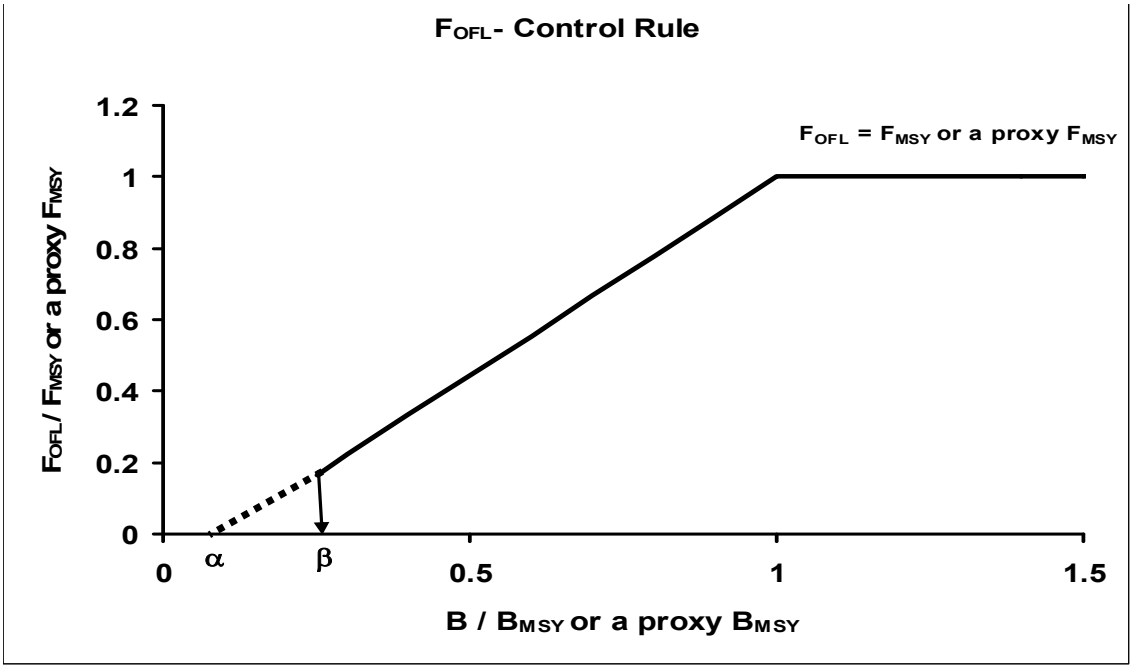

Table 1 Five-Tier System for setting overfishing limits (OFLs) and Acceptable Biological Catches (ABCs) for crab stocks. The tiers are listed in descending order of information availability. Table 2 contains a guide for understanding the five-tier system.

Information available	Tier	Stock status level	F_{OFL}	ABC control rule
B, B_{MSY}, F_{MSY}, and pdf of F_{MSY}	**1**	a. $\frac{B}{B_{msy}} > 1$	$F_{OFL} = \mu_A$ =arithmetic mean of the pdf	
		b. $\beta < \frac{B}{B_{msy}} \leq 1$	$F_{OFL} = \mu_A \frac{B/B_{msy} - \alpha}{1-\alpha}$	ABC≤(1-b_y) * OFL
		c. $\frac{B}{B_{msy}} \leq \beta$	*Directed fishery F = 0* $F_{OFL} \leq F_{MSY}$†	
B, B_{MSY}, F_{MSY}	**2**	a. $\frac{B}{B_{msy}} > 1$	$F_{OFL} = F_{msy}$	
		b. $\beta < \frac{B}{B_{msy}} \leq 1$	$F_{OFL} = F_{msy} \frac{B/B_{msy} - \alpha}{1-\alpha}$	ABC≤(1-b_y) * OFL
		c. $\frac{B}{B_{msy}} \leq \beta$	*Directed fishery F = 0* $F_{OFL} \leq F_{MSY}$†	
B, $F_{35\%}^{*}$, $B_{35\%}^{*}$	**3**	a. $\frac{B}{B_{35\%*}} > 1$	$F_{OFL} = F_{35\%}^{*}$	
		b. $\beta < \frac{B}{B_{35\%}^{*}} \leq 1$	$F_{OFL} = F^{*}_{35\%} \frac{\frac{B}{B^{*}_{35\%}} - \alpha}{1-\alpha}$	ABC≤(1-b_y) * OFL
		c. $\frac{B}{B_{35\%}^{*}} \leq \beta$	*Directed fishery F = 0* $F_{OFL} \leq F_{MSY}$†	
B, M, $B_{msy^{prox}}$	**4**	a. $\frac{B}{B_{msy^{prox}}} > 1$	$F_{OFL} = \gamma M$	
		b. $\beta < \frac{B}{B_{msy^{prox}}} \leq 1$	$F_{OFL} = \gamma M \frac{B/B_{msy^{prox}} - \alpha}{1-\alpha}$	ABC≤(1-b_y) * OFL
		c. $\frac{B}{B_{msy^{prox}}} \leq \beta$	*Directed fishery F = 0* $F_{OFL} \leq F_{MSY}$†	
Stocks with no reliable estimates of biomass or M.	**5**		OFL = average catch from a time period to be determined, unless the SSC recommends an alternative value based on the best available scientific information.	ABC≤0.90 * OFL

*35% is the default value unless the SSC recommends a different value based on the best available scientific information.
† An $F_{OFL} \leq F_{MSY}$ will be determined in the development of the rebuilding plan for an overfished stock.

Table 2 A guide for understanding the five-tier system.

- F_{OFL} — the instantaneous fishing mortality (F) from the directed fishery that is used in the calculation of the overfishing limit (OFL). F_{OFL} is determined as a function of:
  - F_{MSY} — the instantaneous F that will produce MSY at the MSY-producing biomass
    - A proxy of F_{MSY} may be used; e.g., $F_{x\%}$, the instantaneous F that results in x% of the equilibrium spawning per recruit relative to the unfished value
  - B — a measure of the productive capacity of the stock, such as spawning biomass or fertilized egg production.
    - A proxy of B may be used; e.g., mature male biomass
  - B_{MSY} — the value of B at the MSY-producing level
    - A proxy of B_{MSY} may be used; e.g., mature male biomass at the MSY-producing level
  - β — a parameter with restriction that $0 \leq \beta < 1$.
  - α — a parameter with restriction that $0 \leq \alpha \leq \beta$.
- The maximum value of F_{OFL} is F_{MSY}. $F_{OFL} = F_{MSY}$ when $B > B_{MSY}$.
- F_{OFL} decreases linearly from F_{MSY} to $F_{MSY} \cdot (\beta-\alpha)/(1-\alpha)$ as B decreases from B_{MSY} to $\beta \cdot B_{MSY}$
- When $B \leq \beta \cdot B_{MSY}$, $F = 0$ for the directed fishery and $F_{OFL} \leq F_{MSY}$ for the non-directed fisheries, which will be determined in the development of the rebuilding plan.
- The parameter, β, determines the threshold level of B at or below which directed fishing is prohibited.
- The parameter, α, determines the value of F_{OFL} when B decreases to $\beta \cdot B_{MSY}$ and the rate at which F_{OFL} decreases with decreasing values of B when $\beta \cdot B_{MSY} < B \leq B_{MSY}$.
  - Larger values of α result in a smaller value of F_{OFL} when B decreases to $\beta \cdot B_{MSY}$.
  - Larger values of α result in F_{OFL} decreasing at a higher rate with decreasing values of B when $\beta \cdot B_{MSY} < B \leq B_{MSY}$.
- The parameter, b_y, is the value for the annual buffer calculated from a P* of 0.49 and a probability distribution for the OFL that accounts for scientific uncertainty in the estimate of OFL.
- P* is the probability that the estimate of ABC, which is calculated from the estimate of OFL, exceeds the "true" OFL (noted as OFL') (P(ABC>OFL').

Crab Plan Team Recommendations

Table 3 lists the team's recommendations for 2012/2013 on Tier assignments, model parameterizations, time periods for reference biomass estimation or appropriate catch averages, OFLs and ABCs. The team recommends three stocks be placed in Tier 3 (EBS snow crab, Bristol Bay red king crab and EBS Tanner crab), four stocks in Tier 4 (St. Matthew blue king crab, Pribilof Islands blue king crab, Pribilof Islands red king crab, and Norton Sound red king crab) and three stocks in Tier 5 (Aleutian Islands golden king crab, Pribilof Islands golden king crab, and Adak red king crab). Table 4 lists those stocks for which the team recommends an ABC less than the maximum permissible ABC for 2012/13. Stock status in relation to status determination criteria are evaluated in this September report (Table).

The team has general recommendations for all assessments and specific comments related to individual assessments. All recommendations are for consideration for the 2013 assessment. The general comments are listed below while the comments related to individual assessments are contained within the summary

of CPT deliberations and recommendations contained in the stock specific summary section. Additional details regarding recommendations are contained in the Crab Plan Team Report (September 2012 CPT Report).

General recommendations for all assessments

1. The team recommends that all assessment authors document assumptions and simulate data under those assumptions to test the ability of the model to estimate key parameters in an unbiased manner. These simulations would be used to demonstrate precision and bias in estimated model parameters.
2. The CPT recommends the listing of sigmas instead of absolute weights as being more informative for factors such as L_{50} and β. Also, the team recommends specifying weights for the penalties on L_{50} and β from the standard errors from the analysis on which the estimates for these parameters were based.
3. The team requests all authors to consult the Guidelines for SAFE preparation and to follow the Terms of Reference as listed therein as applicable by individual assessment for both content and diagnostics.
4. The team requests that to the extent possible assessments include a listing of the tables and figures in the assessment (i.e., Table of Tables, Table of Figures).

By convention, the CPT used the following conversions to include tables in both lb and t in the status status summary sections:

- lb to t [/2.204624]
- t to lb [x 0.453592]

Economic SAFE overview

The economic status chapter summarizes exvessel and first wholesale value, vessel crew and processing sectors employment and wages, and IFQ catch share performance for BSAI FMP crab stocks.

Highlights in the 2012 economic status report

- Approximately 100 catcher vessels and three catcher processors currently participate in FMP fisheries, delivering to twenty processing facilities.
- Vessel consolidation, following crab rationalization has largely stabilized over the last three years.
- During calendar year 2011
  - 70.2 million lb were landed in all FMP crab fisheries.
  - Bristol Bay red king crab exvessel and first wholesale prices reached historic high values.
  - Exvessel value for all FMP fisheries was $258 million, with a first wholesale value of $363 million.
  - There were an estimated 967 crew positions on 77 vessels.
  - Total labor payment was approximately $34.7 million to crew members and $16.1 million to vessel captains.
  - Processing labor was estimated at 681,000 hours, generating $8 million in income.
- Catch-share program economics are reported based on Office of Science and Technology (OST) protocols.
  - Catch-share utilization has reached 99.5 percent across all currently open rationalized fisheries.
  - The IFQ cost-recovery averaged 1.35 percent over the last three crab years.

Stock Status Summaries

1 Eastern Bering Sea Snow crab

Fishery information relative to OFL setting

The total catch in the 2011/12 fishery was estimated at 44,600 t (including model estimated bycatch) and the retained catch in the directed fishery was 40,500 t. This is below the 2011/12 OFL of 73,500 t. Since 1992 when observers were placed on the boats, estimated discard mortality from the directed pot fishery has averaged 15.5% with an assumed discard mortality rate of 50%. Snow crab is also taken as bycatch in the trawl fishery and estimates of trawl bycatch in recent years are less than 1% of the total snow crab catch. Current estimates of stock status have been above $B_{35\%}$(154,669 t) for the past three years.

Data and assessment methodology

The stock assessment is based on a size- and sex-structured model in which crabs are categorized into immature, mature, new and old shell. The growth transition matrix is based on an exponential growth function with the transition probability based on a gamma distribution where the variance term for the growth increment is fixed. The model is fitted to abundance data from the NMFS trawl survey, total catch data from the directed fishery and the bycatch data from the trawl fishery, size frequency data by maturity status for the male crab pot fishery, female bycatch in the crab pot fishery, trawl fishery bycatch. The model is also fitted to the 2009 and 2010 Bering Sea Fisheries Research Foundation study area biomass estimates and length frequency data. There were no changes to the model for the 2012 assessment, with the exception of the addition of fishery and survey data.

An additional model scenario (Model 1) was presented that assumed a curvilinear relationship between pre-molt and post-molt size. The new growth model assumes that the molt increment decreases with increasing carapace width. Model 1 resulted in a decrease in the OFL from 73,500 t to 51,600 t. The CPT recommends the base model for setting the OFL.

Stock biomass and recruitment trends

Observed survey mature male biomass decreased from 167,400 t in 2011 to 120,800 t in 2012. Observed survey mature female biomass also decreased from 280,000 t in 2011 to 220,600 t in 2012. The trends in model predictions were consistent with trends in the recent survey data.

Tier determination/Plan Team discussion and resulting OFL/ABC determination Status and catch specifications

The CPT recommends that the EBS snow crab is a Tier 3 stock so the OFL will be determined by the $F_{35\%}$ control rule. The team recommends that the proxy for B_{MSY} ($B_{35\%}$) be the mature male biomass at mating based on average recruitment over 1979 to present (154,669 t), and hence the minimum stock size threshold (MSST) is 77,300 t. The CPT recommends that the ABC be less than maximum permissible ABC and concurs with the authors recommendation to use a default 10% buffer for setting the ABC.

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

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	74.1	109.3[A]	26.6	26.5	31.5	35.1	
2009/10	66.6	127.7[B]	21.8	21.8	23.9	33.1	
2010/11	73.7	196.6[C]	24.6	24.7	26.7	44.4	
2011/12	77.3	165.2[D]	40.3	40.5	44.7	73.5	66.2
2012/13		146.3[D]				67.8	61.0

Historical status and catch specifications for snow crab (millions of lb).

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	163.4	241.0 [A]	58.6	58.4	69.4	77.4	
2009/10	146.8	281.5 [B]	48.1	48.1	52.7	73.0	
2010/11	162.5	433.4 [C]	54.2	54.5	58.9	97.9	
2011/12	170.4	364.2 [D]	88.8	89.3	98.5	162.0	145.8
2012/13		322.6 [D]				149.5	134.5

A – Calculated from the assessment reviewed by the Crab Plan Team in September 2009
B – Calculated from the assessment reviewed by the Crab Plan Team in September 2010
C – Calculated from the assessment reviewed by the Crab Plan Team in September 2011
D – Calculated from the assessment reviewed by the Crab Plan Team in September 2012

Additional Plan Team recommendations

The CPT also recommends that further investigations using the empirical growth data from recent molt-increment studies continue and that this information be more formally integrated into the model.

2 Bristol Bay Red King Crab

Fishery information relative to OFL setting.

The commercial harvest of Bristol Bay red king crab dates to the 1930s, initially prosecuted mostly by foreign fleets but shifting to a largely domestic fishery in the early 1970s. Retained catch peaked in 1980 at 129.9 million lb (58.9 thousand t), but harvests dropped sharply in the early 1980s, and population abundance has remained at relatively low levels over the last two decades compared to those in the 1970s. The fishery is managed for a TAC coupled with restrictions for size (≥ 165.1mm (6.5 in) carapace width), sex (male only), and season (no fishing during mating/molting periods). Prior to 1990, the harvest rate was based on estimated population size and prerecruit and postrecruit abundances at survey time, and varied from 20% to 60% of legal males. In 1990, the harvest strategy became 20% of the mature male (≥120-mm CL) abundance, with a maximum of 60% on legal males, and a threshold abundance of 8.4 million mature females. The current stepped harvest strategy allows a maximum harvest rate of 15% of mature males, but also incorporates a maximum harvest rate of 50% of legal males, a threshold of 14.5 million lb (6.6 thousand t) of effective spawning biomass (ESB), and a minimum GHL of 4.0 million lb (8.8 thousand t) to prosecute a fishery. The TAC increased from 15.5 million lb (34.2 thousand t) for the 2006/07 season to 20.4 million lb (45.0 thousand t) for the 2007/08 and 2008/09 seasons, and then declined through the next two seasons to 14.9 million lb (32.8 thousand t) for 2010/2011. Catch of legal males per pot lift was relatively high in the 1970s and low in the 1980s to mid-1990s. Following implementation of the crab rationalization program in 2005, CPUE increased to31 crab/pot in 2006, but fell to 18 crab/pot by 2010/11. Annual non-retained catch of female and sublegal male RKC during the fishery averaged less than 3.9 million lb (8.6 thousand t) since data collection began in 1990. Estimated fishing mortality ranged from 0.3 to 0.4 yr^{-1} following implementation of crab rationalization. Total catch (retained and bycatch mortality) increased from 17.0 million lb (7.7 thousand t) in 2010/11 to 23.4 million lb (10.6 thousand t) in 2008/09, but has decreased each season since then; total retained catch in 2011/12 was 7.95 million lb (3.61 thousand t).

Data and assessment methodology

The stock assessment model is based on a sex- and size-structured population dynamics model incorporating data from the NMFS eastern Bering Sea trawl survey, commercial catch, and at-sea observer data program. Annual stock abundance is estimated for male and female crabs ≥ 65-mm carapace length during 1968/69−2011/12 to the time of the 2012 survey and mature male biomass is projected for 15 February 2013. Catch data (retained catch numbers, retained catch weight, and pot lifts by statistical area and landing date from the fishery which targets males ≥ 165mm (6.5 in. carapace width) were obtained from ADF&G fish tickets and reports, red king crab and Tanner crab fisheries bycatch data from the ADF&G observer database, and groundfish trawl bycatch data from the NMFS trawl observer database. Catch and bycatch data were updated with data from the 2011/12 crab fishery year. The 2012 assessment was based on the base model (model 7ac from 2011 assessment). This model assumes three levels of molting probabilities, a constant natural mortality $M = 0.18yr^{-1}$ (but with additional natural mortality for males and females during 1980−1984 and for females during the "split period" 1976−1979 and 1985−1993), incorporates the BSFRF data, estimates effective sample sizes, estimates proportions in initial years, and (with respect to the "Bristol Bay retow data") uses only the standard survey data for males and uses the retow data for females.

Stock biomass and recruitment trends

Model estimates of total survey biomass increased from 74.2 thousand t in 1968 to 280.4 thousand t in 1978, fell to 36.1 thousand t in 1985, generally increased to 88.5 thousand t in 2007, and declined to 71.5 thousand t in 2012. Estimated recruitment was high during the 1970s and early 1980s and has been generally low since 1985. Near term outlook for this stock is a continued declining trend. Recruitment has been very poor in the last 6 years. 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 survey.

Tier determination/Plan Team discussion and resulting OFL and ABC determination
The CPT supports the use of base model for the 2012 assessment for stock status determination.

The Plan Team recommends Bristol Bay red king crab as a Tier 3 stock. The team recommends that the proxy for B_{MSY} ($B_{35\%}$) be the mature male biomass at mating, computed as the average recruitment from 1984 to the last year of the assessment (2012) multiplied by the mature male biomass-per-recruit corresponding to $F_{35\%}$ less the mature male catch under an $F_{35\%}$ harvest strategy. Estimated $B_{35\%}$ is 60.7 million lb (27.5 thousand t).

The team recommends that the total-catch OFL for 2012/13 be set according to the base model and the calculated OFL is 17.55 million lb (7.96 thousand t). The team recommends that the ABC for 2012/13 be set below the maximum ABC (17.50 million lb, or 7.94 thousand t). The team noted a downward trend in most-recent biomass estimates in the retrospective assessment analysis, giving rise to concerns that the 2012 MMB may be over-estimated. The team recommends that a 10% buffer from the OFL be used to set the ABC at 15.80 million lb (7.17 thousand t).

The stock is estimated to have been above MSST in 2011/12, hence the stock was not overfished in 2011/12 (Table, below). Overfishing did not occur in 2011/12. The stock at 2012/13 time of mating is projected to be 58.0 million lb (26.32 thousand t), which is above the MSST and 96% of the B_{MSY} calculated from the 2012 assessment. Hence the stock is not projected to be in overfished condition in 2012/13.

Status and catch specifications (millions of lb) for Bristol Bay red king crab

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	34.2[A]	87.8[A]	20.37	20.32	23.43	24.20	
2009/10	31.3[B]	89.0[B]	16.00	16.03	18.32	22.56	
2010/11	30.0[C]	72.0[C]	14.84	14.91	17.00	23.52	
2011/12	30.4[D]	68.1[D]	7.83	7.95	9.01	19.39	17.46
2012/13		58.0[D]				17.55	15.80

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

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	15.56[A]	39.83[A]	9.24	9.22	10.48	10.98	
2009/10	14.22[B]	40.37[B]	7.26	7.27	8.31	10.23	
2010/11	13.63[C]	32.64[C]	6.73	6.76	7.71	10.66	
2011/12	13.77[D]	30.88[D]	3.55	3.61	4.09	8.80	7.92
2012/13		26.32[D]				7.96	7.17

A – Calculated from the assessment reviewed by the Crab Plan Team in September 2009
B – Calculated from the assessment reviewed by the Crab Plan Team in September 2010
C – Calculated from the assessment reviewed by the Crab Plan Team in September 2011
D – Calculated from the assessment reviewed by the Crab Plan Team in September 2012

3 Eastern Bering Sea Tanner crab

Fishery information relative to OFL setting.

Eastern Bering Sea (EBS) Tanner crabs are caught as bycatch in the groundfish fisheries, scallop fisheries, in the directed Tanner crab fishery (principally as non-retained females and sublegal males), and in other crab fisheries (notably, eastern Bering Sea snow crab and to a lesser extent in the fishery for Bristol Bay red king crab). Two directed fisheries, one east and one west of 166˚ W longitude, harvest EBS Tanner crab. Under the Crab Rationalization Program, ADF&G sets separate TACs and NMFS issues separate individual fishing quota (IFQ) for these two fisheries. However, one OFL is set for EBS Tanner crab because there is no evidence that EBS Tanner crab is not one stock. Both fisheries were closed from 1997 to 2004 due to low abundance and the fisheries were closed again for the 2010/11 and 2011/12 crab fishery years. NMFS declared this stock overfished in 1999 and the Council developed a rebuilding plan. In 2005/06, abundance increased to a level to support a fishery in the area west of 166^0 W. ADF&G opened both fisheries for the 2006/07 to 2008/09 crab fishing years and to the area east of 166˚ W longitude only in 2009/10. In 2007, NMFS determined the stock was rebuilt because spawning biomass was above B_{MSY} for two consecutive years. The mature male biomass was, however, estimated to be below the Minimum Stock Size Threshold ($0.5B_{MSY}$) 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. New minimum size limits adopted by the Alaska Board of Fisheries were implemented for the 2011/12 fishing season.

Data and assessment methodology

A stock assessment model has been developed for EBS Tanner crab. This model was reviewed several times by the CPT and the SSC, and during the January 2011 and 2012 stock assessment workshops. The SSC accepted the model for use in specifications for 2012 and determined it as a Tier 3 stock. In addition, a model configuration was identified as a candidate base model. The model is structured by size, sex, shell condition, and maturity state. It uses available information on the magnitude and size-composition of the landings and discards by the directed fishery, and bycatch in the Bristol Bay red king crab, EBS snow crab, and groundfish fisheries. It also uses index and size-composition data from the NMFS trawl survey. The model includes prior distributions on parameters related to growth, natural mortality, catchability, and changes in recruitment and in the proportion maturing.

Stock biomass and recruitment trends

The MMB peaked in the mid-1970s and early 1990s; MMB at the time of mating was highest at the start of modeled period (February 1975; 317.2 thousand t), with secondary peaks in February 1990 (71.6 thousand t) and February 2010 (71.2 thousand t). MMB has subsequently declined. Recruitment is estimated to have peaked before 1974, the first year for which survey data are included in the assessment. Subsequent peaks in recruitment occurred during 1985/86 and 2009/10. The MMB in February 2012 is estimated to be 58.59 thousand t from the assessment compared to the 26.06 thousand t from the Tier 4 control rule. The primary reasons for increase in the estimate of biomass compared to the 2011 assessment are that: (a) the assessment allows for selectivity being a logistic function of size and estimates a survey catchability to be 0.72, and (b) because the catch for 2011/12 was less than the 2011/12 OFL. The MMB projected for February 2013 is 42.74 thousand t under the assumption that the total catch for 2012/13 equals the OFL. The 2012 survey estimated a high abundance of pre-recruit females.

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

The team recommends the OFL for this stock be based on the Tier 3 control rule. Application of the Tier 3 control rule requires a set of years for defining the mean recruitment corresponding to B_{MSY}, $\overline{R}_{MSY}$. This mean recruitment should reflect the current environmental conditions. The CPT has previously requested that the analysts examine available data to assess whether a change in productivity has occurred. The analysts provided results for four alternative sets of years for defining $\overline{R}_{MSY}$. They noted that the

recruitments which led to the large biomass in the early 1970s were substantially larger than the subsequent recruitment and that there was no evidence for a substantial change in the ratio of recruitment (at spawning) to the corresponding mature male biomass (e.g., R/MMB). Some members of the team were concerned about using the recruitment estimates for 1966-73 because there are no direct estimates of these recruitments. The CPT explored the relationship between log(R/MMB) and MMB and identified a change in this relationship in 1985 (1990 year of recruitment to the model). This analysis is appended to the Tanner crab assessment chapter. The team consequently recommended that $\overline{R}_{MSY}$ be set to the mean recruitment from 1990 onwards. The resulting estimate of B_{MSY} is 22.80 thousand t and hence MSST is 11.40 thousand t. This value for B_{MSY} is substantially lower than the $B_{MSYPROXY}$ used for the 2011/12 assessment. Consequently, the current assessment implies that the stock was not overfished in 2010 and is well above B_{MSY} currently. The change in stock status is therefore not a consequence of the model or new data but rather an analysis (appended to the stock assessment chapter) of the model estimates of recruitment and MMB.

Based on the estimated biomass at 15 February 2013, the stock is at Tier 3 level a. The F_{MSY} proxy ($F_{35\%}$) is 0.61 yr^{-1}, and the 2012/13 F_{OFL}=0.61yr^{-1} under the Tier 3 OFL Control Rule, equating to a total male and female catch of 19.02 thousand t. The marked change in OFL arises because of (a) the change from a Tier 4 OFL calculation to a model-based assessment where catchability is estimated and (b) the stock is now estimated to be above B_{MSY}. The absolute change in biomass due to the move to an assessment model is not unexpected.

Two methods have been applied to identify whether and when changes in productivity have occurred, based on the log recruits- per- MMB vs MMB. A weighted regression approach identified a shift in productivity in 1990 but the possibility this is due to depensation has yet to be explored quantitatively. The team recommends that the ABC reflect this uncertainty and proposes that the ABCs for 2012/13, 2013/14 and 2014/15 increase proportionally from the 2011/12 OFL of 2.75 thousand t to 19.02 thousand t in 2014/15 (or the estimated OFL for that year). A 3-year period was selected because fluctuations in abundance of EBS Tanner crab have occurred over 3-5 years, and 3 years should be sufficient for the additional analyses and for the model to stabilize. This leads to a recommended ABC for 2012/13 of 8.17 thousand t.

Historical status and catch specifications (millions lb) for eastern Bering Sea Tanner crab

Year	MSST	Biomass (MMB)	TAC (east + west)	Retained Catch	Total Catch	OFL	ABC
2008/09 b/	94.89 d/	118.23 d/A	4.30	1.94	4.96	15.52	
2009/10	92.37 d/	62.70 d/B	1.34 a/	1.32	3.73	5.00	
2010/11	91.87 d/	58.93 d/C	0.00	0.00	1.92	3.55	
2011/12	25.13	129.17 D	0.00	0.00	2.73 e/	6.06	5.47
2012/13		94.22 c/D				41.93	18.01

(b) Historical status and catch specifications (thousand t) for eastern Bering Sea Tanner crab

Year	MSST	Biomass (MMB)	TAC (east + west)	Retained Catch	Total Catch	OFL	ABC
2008/09 b/	43.04 d/	53.63 d/A	1.95	0.88	2.25	7.04	
2009/10	41.90 d/	28.44 d/B	0.61 a/	0.60	1.69	2.27	
2010/11	41.67 d/	26.73 d/C	0.00	0.00	0.87	1.45	
2011/12	11.40	58.59 D	0.00	0.00	1.24 e/	2.75	2.48
2012/13		42.74 c/D				19.02	8.17

a/ Only the area east of 166 deg. W opened in 2009/10;
b/ Biomass and threshold definitions based on survey estimates derived using 50ft net width area-swept calculations
c/ Projected 2012/13 MMB at time of mating after extraction of the estimated total catch OFL.
d/ Based on mature male biomass at the time of mating inferred from the NMFS survey under the assumption Q=1
e/ Observed total catch – the model over predicts bycatches in the snow crab and groundfish fisheries.
A – Calculated from the assessment reviewed by the Crab Plan Team in September 2009
B – Calculated from the assessment reviewed by the Crab Plan Team in September 2010
C – Calculated from the assessment reviewed by the Crab Plan Team in September 2011
D – Calculated from the assessment reviewed by the Crab Plan Team in September 2012

EBS Tanner crab MMB was above B_{MSY} at the time of mating in mid-February 2012. Overfishing did not occur during the 2011/12 fishing year because total catch losses (1.24 thousand t) did not exceed the total catch OFL (2.75 thousand t).

Additional Plan Team comments

Given the marked change in B_{MSY} (and hence MSST), the team strongly recommends that further analyses be conducted to examine whether productivity has indeed changed and to assess whether the lower recent productivity is perhaps due to depensation rather than a change in productivity.

4 Pribilof Islands red king crab

Fishery information relative to OFL setting

The ADF&G has not published harvest regulations for the Pribilof Islands red king crab fishery. The fishery began in 1973 as bycatch during the blue king crab fishery. The directed red king crab fishery opened with a specified GHL for the first time in September 1993. Beginning in 1995, combined Pribilof Islands red and blue king crab GHLs were established. Declines in crab abundance of both king crab stocks from 1996 to 1998 resulted in poor fishery performance during those seasons with annual harvest levels below the GHLs. The Pribilof red king crab fishery was closed from 1999 through 2011/12 due to uncertainty in estimated red king crab survey abundance and concerns for incidental catch and mortality of Pribilof blue king crab which was an overfished and severely depressed stock. Prior to the closure, the 1998/99 harvest was 246.9 t (0.544 million lb). The non-retained catches, with application of bycatch mortality rates, from pot and groundfish bycatch estimates of red king crab ranged from 2.8 t (0.001 million lb) to 192.1 t (0.424 million lb) during 1991/92 to 2011/12.

Data and assessment methodology

Although a catch survey analysis which incorporated data from the trawl survey, commercial catch, pot survey and at-sea observer data has been used for assessing the stock in the past, the 2012 assessment is based on trends in male mature biomass (MMB) at the time of mating inferred from NMFS bottom trawl survey from 1975-2012 and commercial catch and observer data from 1973/74 to 2011/12. The revised time-series of historical NMFS trawl survey abundance estimates were used in this assessment. The 2011/12 assessments of non-retained catch from all non-directed pot and groundfish fisheries were included in the SAFE report. Groundfish catches of red king crab are reported for all crab combined by federal reporting areas. Catches from observed fisheries were used to estimate total annual catch. An F_{OFL} for 2012/13 was determined using a mean MMB at the time of mating, the default γ value of 1.0 and an M of $0.18yr^{-1}$. As recommended by the CPT (September 2011) and SSC (October 2011), the annual index of MMB for this stock was derived as the 3-yr running average centered on the current year MMB and weighted by the inverse variance. The $B_{MSY\ proxy}$ was calculated using the unaveraged observed survey MMBs from 1991-2011. The resultant F_{OFL} from the control rule was applied to the projected legal male biomass at the time of the fishery to determine the total male catch OFL.

Stock biomass and recruitment trends

The stock exhibited widely varying mature male and female abundances during 1975-2011. The average MMB estimated for 2012 was 4,175 t (9.20 million lb). Retained catches have not occurred since the 1998/99 season. Non-directed discard losses in the pot fisheries decreased in recent years, and there are no discard losses in the current year. Mature stock biomass declined in 2008/09 and 2009/10 followed by increases in MMB in 2010/11 and 2011/12. The estimated biomass of pre-recruit size crab remained relatively constant over the past decade although pre-recruit sized crab may not be well sampled by the NMFS survey. Bycatch losses resulting from the fixed gear groundfish fleet increased slightly from 2010/11 to 2011/12, while losses resulting from discards in the groundfish trawl fleet increased from 3,870 t (8.53 million lb) to 4,780 t (10.53 million lb) between 2010/11 to 2011/12. In 2012, estimates of legal male biomass and mature male biomass increased substantially relative to 2011, whereas mature female biomass decreased from 817 t to 663 t.

In 2011/12, 7.21 t of male and female blue king crab were caught in groundfish fisheries (fixed gear (1.24 t) and trawl gear (5.97 t)) which are 33% greater than was caught in 2010/11 groundfish fisheries. The catch was mostly in non-pelagic trawls (83%) followed by longline (12%), and pot (5%) fisheries. The

targeted species in these fisheries were Pacific cod (17%), flathead sole (38%), pollock (4%), yellowfin sole (40%), and traces <1% found in the rock sole fisheries. Unlike previous years no bycatch was observed in Alaska plaice fisheries in 2011/12.

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

Based on available data, the author recommended classification for this stock is Tier 4 for stock status level determination. For 2011/12 the $B_{MSY\ proxy}$ =5,136 t of MMB_{mating} derived as the mean of 1991/92 to 2011/12. MMB varied considerably during these periods likely leading to varying estimates of B_{MSY}. Male mature biomass at the time of mating for 2012/13 was estimated at 3,302 t. The $B/\ B_{MSY\ Proxy}$ =0.65 and F_{OFL}=0.11. $B/\ B_{MSY\ Proxy}$ is < 1, therefore the stock status level is *b*. For the 2012/2013 fishery, the total catch OFL was estimated at 569 t of crab. The projected exploitation rates based on full retained catches up to the OFL for LMB and $MMB_{fishery}$ are 0.11 and 0.12, respectively.

The author recommended an ABC less than the maximum permissible as calculated by the maxABC control rule. The CPT concurred with the author's recommendation to set the ABC below the maximum permissible, given the relative amount of information available for Pribilof Island red king crab. For 2012/13 using the recommended $B_{MSYprox}$, the multiplier equivalent to a P* of 0.49 was 0.88. The maxABC was thus estimated to be 501 t. Incorporating additional uncertainty by applying a σ_b of 0.45 resulted in a multiplier of 0.80 and a recommended ABC of 455 t (1.00 million lb).

Historical status and catch specifications (million lb) of Pribilof Islands red king crab

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	4.39	11.06[A]	0	0	0.021	3.32	
2009/10	4.22	4.46[B]	0	0	0.006	0.50	
2010/11	4.97	5.44[C]	0	0	0.009	0.77	
2011/12	5.67	5.68[D*]	0	0	0.011	0.87	0.68
2012/13		7.28[E**]				1.25	1.00

Historical status and catch specifications (t) of Pribilof Islands red king crab

Year	MSST	Biomass (MMB_{mating})	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	1,990	5,020[A]	0	0	10	151	
2009/10	1,914	2,175[B]	0	0	2.7	227	
2010/11	2,255	2,754[C]	0	0	4.2	349	
2011/12	2,571	2,775[D*]	0	0	5.4	393	307
2012/13		3,302[E**]				569	455

A – Based on survey data available to the Crab Plan Team in September 2008 and updated with 2008/2009 catches
B – Based on survey data available to the Crab Plan Team in September 2009 and updated with 2009/2010 catches
C – Based on survey data available to the Crab Plan Team in September 20010 and updated with 2010/2011 catches
D – Based on survey data available to the Crab Plan Team in September 2011 and updated with 2011/2012 catches
E - Based on survey data available to the Crab Plan Team in September 2012
*– 2011/12 estimates based on 3 year running average
** – 2012/13 estimates based on weighted 3 year running average

The stock was above MSST in 2011/2012 and is hence not overfished. Overfishing did not occur during the 2011/2012 fishing year.

5 Pribilof Islands blue king crab

Fishery information relative to OFL setting.

The Pribilof blue king crab fishery began in 1973, with peak landings of 11.0 million lb during the 1980/81 season. A steep decline in landings occurred after the 1980/81 season. Directed fishery harvest from 1984/85 until 1987/88 was annually less than 1.0 million lb with low CPUE. The fishery was closed from 1988 until 1995. The fishery reopened from 1995 to 1998. Fishery harvests during this period ranged from 1.3 to 2.5 million lb. The fishery closed again in 1999 due to declining stock abundance and has remained closed through the 2011/12 season. The stock was declared overfished in 2002.

Data and assessment methodology

NMFS conducts an annual trawl survey that is used to produce area-swept abundance estimates. The CPT has discussed the history of the fishery and the rapid decline in landings. It is clear that the stock has collapsed, although the annual area-swept abundance estimates are imprecise.

The survey biomass time series was re-calculated with a new area definition that includes an additional 20 nm strip east of the Pribilof District. MMB was estimated using a three-year running average centered on the current year weighted by the inverse variance of the area-swept estimate. Groundfish bycatch for 2011/12 was calculated with improved spatial resolution using a catch-in-areas database (CIADB) that uses the new stock boundary area which includes the 20nm strip to the east instead of only the area (NMFS reporting area 513) that was used in prior years.

Stock biomass and recruitment trends

The survey biomass time series was recalculated in 2011 to include actual measured net widths. Based on 2012 NMFS bottom-trawl survey, the estimated total mature-male biomass increased to 644 t from 461 t in 2011. The 2012/13 MMB at mating is projected to be 496 t (1.09 million lb) which is about 13% of $B_{MSYproxy}$. The Pribilof blue king crab stock biomass continues to be low. From recent surveys there is no indication of recruitment.

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

This stock is recommended for placement into Tier 4. B_{MSY} was estimated using the time period 1980/81 - 1984/85 plus 1990/1991-1997/1998. This range was chosen because it eliminates periods of extremely low abundance that may not be representative of the production potential of the stock. B_{MSY} is estimated at 3,944 t (8.70 million pounds).

The retained catch OFL is 0 because the 2011/12 estimate of MMB is less than 25% B_{MSY}. Due to the Tier level and stock status an F_{OFL} must be determined for the non-directed catch. Ideally this should be based on the rebuilding strategy. Due to inadequate progress towards rebuilding, a new rebuilding plan has been developed and is in final review with the Secretary of Commerce.

The OFL for 2012/13 was estimated at 1.16 t (0.003 million lb), the same as the 2011/12 OFL. The OFL is estimated from the average groundfish bycatch between 1999/00 and 2005/06.

The CPT concurred with the author's recommendation to set ABC less than the maximum permissible by employing a 10% buffer consistent with a Tier 5 average catch calculation. The ABC was estimated at 1.04 t (0.002 million lb.).

Historical status and catch specifications (t) of Pribilof Islands blue king crab in recent years.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	2,105[A]	110[A]	closed	0	0.5	1.81	
2009/10	2,105[B]	401[B]	closed	0	0.5	1.81	
2010/11	2,105[C]	286[C]	closed	0	0.18	1.81	
2011/12	2,247[D]	365[D]*	closed	0	0.36	1.16	1.04
2012/13		496[E]**				1.16	1.04

Historical status and catch specifications (million lb) of Pribilof Islands blue king crab in recent years.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	4.64	0.25 [A]	closed	0	0.001	0.004	
2009/10	4.64	0.88 [B]	closed	0	0.001	0.004	
2010/11	4.64	0.63 [C]	closed	0	0.0004	0.004	
2011/12	4.95	0.80 [D] *	closed	0	0.0008	0.003	0.002
2012/13		1.09 [E] **				0.003	0.002

A – Based on survey data available to the Crab Plan Team in September 2008 and updated with 2008/09 catches.
B – Based on survey data available to the Crab Plan Team in September 2009 and updated with 2009/10 catches.
C – Based on survey data available to the Crab Plan Team in September 2010 and updated with 2010/11 catches.
D – Based on survey data available to the Crab Plan Team in September 2011 and updated with 2011/12 catches.
E – Based on survey data available to the Crab Plan Team in September 2012.
*- 3- year average survey biomass
**- weighted 3-year running average

The total catch for 2011/12 (0.36 t, 0.0008 million lb) was less than the 2011/12 OFL (1.16 t, 0.003 million lb) so overfishing did not occur during 2011/12. The 2012/13 projected MMB estimate of 496 t (1.09 million lb) is below the proxy for MSST (MMB/B_{MSY} = 0.13) so the stock continues to be in an overfished condition and failed to rebuild within the maximum required rebuilding time.

Additional Plan Team comments

The Council in June 2012 approved a revised rebuilding plan in June 2012. The new rebuilding plan closes the Pribilof Island Habitat Conservation Zone to groundfish vessels fishing with pot gear year-round. This closure is anticipated to be implemented in late 2013. This area is already closed to trawling.

The State of Alaska closed additional statistical areas to crab fishing for the 2011/12 season based on all locations that the survey caught blue king crab.

6 Saint Matthew blue king crab

Fishery information relative to OFL setting

The fishery was prosecuted as a directed fishery from 1977 to 1998. The fishery developed when ten U.S. vessels harvested 1.202 million pounds during 1977/78. Harvests peaked in 1983/84 when 9.454-million pounds were landed by 164 vessels. Harvest were fairly stable from 1986/87 to 1990/91, averaging 1.252-million pounds annually, then increased to a mean catch of 3.297-million lb during the 1991/92 to 1998/99 seasons. The fishery was declared overfished and closed in 1999 when the stock size estimate was below the MSST. In November of 2000, Amendment 15 to the FMP was approved to implement a rebuilding plan for the St. Matthew Island blue king crab stock. The rebuilding plan included a harvest strategy established in regulation by the Alaska Board of Fisheries, an area closure to control bycatch, and gear modifications. In 2008/09 and 2009/10, the MMB was above B_{MSY} for two years and the stock declared rebuilt in 2009.

The fishery re-opened in 2009/10 with a TAC of 1.167 million lb and 0.461 million lb of retained catch were harvested. The 2010/11 TAC was 1.600 million pounds and the fishery reported a retained catch of 1.264 million pounds The 2011/12 harvest of 1.88 million lb represented 74% of 2.54 million lb TAC; the 2011/12 CPUE of 9.0 crab/pot was down 11% from the 2010/11 CPUE. Bycatch of non-retained blue king crab has been observed in the Saint 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 Saint 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.

Data and assessment methodology

A three-stage catch-survey analysis (CSA) 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 are used as a proxy to identify legal males. The CSA incorporates the following data: (1) commercial catch data from 1978 to 2011/12; (2) annual trawl survey data from 1978 to 2012; (3) triennial pot survey data from 1995 to 2010; (4) bycatch data in the groundfish trawl and groundfish fixed-gear fisheries from 1991 to 2012; and (5) ADF&G crab-observer composition data for the years 1990/91–1998/99, 2009/10–2011/12. Trawl survey data are from summer trawl survey for stations within the St. Matthew Section. Trawl survey data provided estimates of density (number/nm^2) at each station for males in the three size categories.

Pot survey data are from the July–August 1995, 1998, 2001, 2004, 2007, and 2010 ADF&G triennial pot surveys for Saint Matthew Island blue king crab. The pot survey samples areas of high-relief habitat important to blue king crab, particularly females, that the NMFS trawl survey cannot sample. Data used are from only the 96 stations fished in common during each of the five surveys. The CPUE (catch per pot lift) indices from those 96 stations for the male categories listed above were used in the assessment.

NMFS observer data were used to estimate groundfish trawl and fixed-gear bycatch. Bycatch composition data were not available so total biomass caught as bycatch was estimated by summing blue king crab biomass from federal reporting areas 524 and 521 according to gear type.

Stock biomass and recruitment trends

The stock is estimated to have been above B_{MSY} during 2008/09 through 2011/12 and is projected to be above B_{MSY} in 2012/13. The MMB has fluctuated substantially over three periods, increasing during 1978 to 1981 of the first period from 7.6 to 17.6 million lb, followed by a steady decrease to 2.9 million lb in

1985. The second period had a steady increase from 1986 to 13.3 million lb in 1997 followed by a rapid decline to 2.8 million lb in 1999. The third period had a steady increase in all size classes from 2000 to 12.4 million lb in 2012/2013.

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

The CPT and SSC recommends that the stock be in Tier 4, with gamma (γ)=1 used for calculating F_{OFL}, and stock status level a. The CPT discussed 5 alternative model options and accepted the base model. The CPT modified its recommended time period for estimating $B_{MSYproxy}$ to be the full assessment time period of 1978 to 2011/12 because there is no additional information to suggest productivity changed over time. The $B_{MSYproxy}$ during this time period is 7.93 million lb. The OFL is a total male OFL, as recommended by the team. The maxABC is based on CV = 0.5 and P*=0.49, which is 2.24 million pounds. However, due to the nature of the scientific uncertainty in the OFL, the team recommended a 10% buffer for an ABC of 2.02 million lb (916 t) due to structural assumptions and observational uncertainties in this assessment.

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

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	4.0	10.74[A]	closed	closed	0.20	1.63 [retained]	
2009/10	3.4	12.76[B]	1.17	0.46	0.53	1.72	
2010/11	3.4	14.77[C]	1.60	1.26	1.41	2.29	
2011/12	4.0	11.09[D*]	2.54	1.88	2.10	3.74	3.40
2012/13		12.41[D]				2.24	2.02

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

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	1.81	4.87[A]	closed	closed	0.09	0.74 [retained]	
2009/10	1.52	5.79[B]	0.53	0.21	0.24	0.78	
2010/11	1.52	6.70[C]	0.73	0.57	0.64	1.04	
2011/12	1.81	5.03[D*]	1.15	0.85	0.95	1.70	1.50
2012/13		5.63[D]				1.02	0.9

A – Calculated from the assessment reviewed by the Crab Plan Team in September 2009
B – Calculated from the assessment reviewed by the Crab Plan Team in September 2010
C – Calculated from the assessment reviewed by the Crab Plan Team in September 2011
D – Calculated from the assessment reviewed by the Crab Plan Team in September 2012
* Biomass estimate based upon survey biomass not model-based estimate

The total male catch for 2011/12 (2.1 million lb) was less than the 2011/12 OFL (3.74 million lb) so overfishing did not occur during 2011/12. Likewise, the 2011/12 MMB (11.09 million lb) is above the MSST (4.0 million lb) so the stock is not overfished.

Additional Plan Team recommendations

The team made additional recommendations for the stock assessment model for the 2012 assessment cycle. The CPT recommends a combination of models B1 and C for the next assessment cycle (varying Q and M simultaneously). These recommendations are contained in the September 2012 Crab Plan Team report.

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 275,000 pounds, including several low years in the 1990s. Retained catches in the past four years have been about 400,000 pounds.

Data and assessment methodology

Four types of surveys have been conducted 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 length-based model of male crab abundance was previously developed that combines multiple sources of data. The 1976-2011 trawl survey data were revised and there were no new sources of data added to the assessment. 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 data from 2011/12 winter pot survey, 2011 summer commercial fishery, 2011 summer trawl survey, 2010/2011 winter commercial and subsistence finalized catch, and the 2011/2012 winter commercial and subsistence catch (based on available data). The current model assumes $M=0.18yr^{-1}$ for all length classes, except $M=0.68\ yr^{-1}$ for the largest (> 123 mm CL) length group.

The assessment author revised the model in order to identify a set of model specifications such that the extreme retrospective patterns seen in last year's assessment are no longer present.

Stock biomass and recruitment trends

Mature male biomass was estimated to be on an upward trend following a recent low in 1997 and an historic low in 1982 following a crash from the peak biomass in 1977. 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 highly variable but on an increasing trend in recent years.

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

The team recommended Tier 4 stock status for Norton Sound red king crab. The estimated abundance and biomass in 2012 are:

Legal males: 1.38 million crabs with a standard deviation of 0.13 million crabs.
Mature male biomass: 4.25 million lb with a standard deviation of 0.39 million lb.

Average of mature male biomasses during 1980-2012 was used as the B_{MSY} proxy and the CPT chose gamma =1.0 to derive the F_{MSY} proxy.
Estimated B_{MSY} proxy, F_{MSY} proxy and retained catch limit in 2012 are:

- B_{MSY} proxy = 3.51 million lb,
- F_{MSY} proxy = 0.18

The maximum permissible ABC would be 0.53 million lb. The CPT recommended an ABC less than the maximum permissible due to potential 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 0.48 million pounds.

Status and catch specifications (million lb)

Year	MSST	Biomass (MMB)	GHL	Retained Catch	Total Catch	OFL	ABC
2008/09	1.78[A]	5.24	0.41	0.39	0.43	0.68[A]	
2009/10	1.54[B]	5.83	0.38	0.40	0.43	0.71[B]	
2010/11	1.56[C]	5.44	0.40	0.42	0.46	0.73[C]	
2011/12	1.56[D]	4.70	0.36	0.40	0.43	0.66[D]	0.59
2012/13	1.76[E]	4.59				0.53[E]	0.48

Status and catch specifications (kt)

Year	MSST	Biomass (MMB)	GHL	Retained Catch	Total Catch	OFL	ABC
2008/09	0.81[A]	2.38	0.19	0.18	0.21	0.31[A]	
2009/10	0.70[B]	2.64	0.17	0.18	0.22	0.32[B]	
2010/11	0.71[C]	2.47	0.18	0.19	0.22	0.33[C]	
2011/12	0.71[D]	2.13	0.16	0.18	0.20	0.30[D]	0.27
2012/13	0.80[E]	2.08				0.24[E]	0.22

[A]-Calculated from the assessment reviewed by the Crab Plan Team in May 2008

[B]-Calculated from the assessment reviewed by the Crab Plan Team in May 2009

[C]-Calculated from the assessment reviewed by the Crab Plan Team in May 2010

[D]-Calculated from the assessment reviewed by the Crab Plan Team in May 2011

[E]-Calculated from the assessment reviewed by the Crab Plan Team in May 2012

Total catch in 2011/12 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 notes that this stock assessment should be reviewed in a modeling workshop in January 2013. The values for the biological parameters should be more clearly documented and discussed at the upcoming workshop. The team recommends considering starting the model in 1980.

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. Average retained catch for the period 1996/97–2007/08 was 5.6 million lb, and 5.8 million lb for the period 2008/09-2010/11. The Alaska Board of Fisheries increased the TAC for this stock to 6.3 million lb in March 2012. This fishery is rationalized under the Crab Rationalization Program. The 2011/12 season remains open until 15 May 2012.

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 has ranged from 2.5 million lb in 2005/06 (46% of the retained catch) to 3.0 million lb for 2007/08 (55% of the retained catch) during the six seasons prosecuted as rationalized fisheries (2005/06–2010/11). 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 1995/96–2010/11. Estimated total mortality in 2010/11 was 6.6 million lb.

Data and assessment methodology

Available data 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.), triennial pot surveys in the Yunaska-Amukta Island area of the Aleutian Islands approximately 171° W longitude, tag recoveries from crabs released during the triennial pot surveys, and bycatch from the groundfish fisheries. These data are available through the 2010/11 season and the 2006 triennial pot survey. 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. 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 triennial survey was scheduled for 2009, but was cancelled. An assessment model is 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

In March 2012, the BOF approved a change that increased the TAC by 5% (from 6.0 to 6.3 million lb) for this fishery, apportioned to 3.3 million lb and 3.0 million lb respectively for the areas east and west of 174° W longitude. Fishery data have been updated with the results for 2010/11: retained catch for the directed fishery and bycatch estimates for the directed fishery, non-directed crab fisheries, and groundfish fisheries. This assessment follows the methodology recommended by the CPT in May 2011 and the SSC

in June 2010 and 2011.

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 2011/12. 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 provided two alternatives for calculating the 2012/13 total catch OFL. The assessment author recommended the use of Alternative-2 for establishing the 2012/13 OFL. Alternative-2 differs from Alternative-1 in the years used to estimate the mean annual rate of bycatch mortality to retained catch in the crab fisheries. Alternative-2 uses four years of data available over 1985/86–1995/96, whereas Alternative-1 uses seventeen years of data available over 1985/86-2008/09 recommended by the SSC as likely providing a more robust estimate than a shorter time period. For Alternative-1, this mean annual rate of bycatch mortality is 0.240, whereas that for Alternative-2 is 0.363. The main rationale for choosing Alternative 2 was that using the four years of data available over 1985/86–1995/96 to estimate the mean annual bycatch mortality rate was more appropriate than using the average retained catch over 1985/96-1995/96 as a measure of sustainable catch. The CPT concurred with the author's recommendation.

Alternative-2:

$$OFL_{Alt\text{-}1,\,2012/13} = (1+R_{90/91\text{-}95/96})\bullet RET_{85/86\text{-}95/96} + BM_{GF,93/94\text{-}08/09} = 12{,}537{,}757 \text{ lb}$$

where,

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

The team concurred with the author's recommendation to set the ABC based on the maximum permissible from the ABC control rule which specifies an ABC based on a 10% buffer on the OFL. The recommended ABC is 11,283,981 lb under Alternative-2.

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

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	NA	NA	5.99	5.68	6.31	9.18[A]	
2009/10	NA	NA	5.99	5.91	6.51	9.18 [A]	
2010/11	NA	NA	5.99	5.97	6.56	11.06	
2011/12	NA	NA	5.99	5.96	6.51	11.40	10.26
2012/13	NA	NA				12.54	11.28

A – retained catch

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

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	NA	NA	2.72	2.58	2.86	4.16 [A]	
2009/10	NA	NA	2.72	2.68	2.95	4.16 [A]	
2010/11	NA	NA	2.72	2.71	2.98	5.02	
2011/12	NA	NA	2.72	2.71	2.95	5.17	4.66
2012/13	NA	NA				5.69	5.17

A – retained catch

No overfished determination is possible for this stock given the lack of biomass information. Total catch in 2011/12 was below the OFL, thus overfishing did not occur. The final 2011/12 total catch relative to the 2011/12 OFL and ABC will be reviewed by the CPT in September 2012.

Additional Plan Team recommendations

The CPT has reviewed draft versions of a developing stock assessment model for this stock. The most recent version was reviewed at the 2012 Crab Modeling Workshop. The team reviewed progress on validating the data sources considered in the model along with a preliminary analysis of catch effort standardization at its May 2012 CPT meeting, and identified further analyses (see the May 2012 CPT report). The author is revising the model in accordance with review comments and recommendations of the Workshop and CPT meeting and will present an update on the model to the CPT in September 2012. This model is recommended for additional review at the 2013 Model Workshop.

9 Pribilof District Golden King Crab

Fishery information relative to OFL setting

The Pribilof District fishery for male golden king crab ≥ 5.5 in carapace width (≥ 124 mm carapace length) developed in the 1981/82 season. The directed fishery mainly occurs in Pribilof Canyon of the continental slope. Peak directed harvest is 856-thousand lb during the 1983/84 season. Historical fishery participation has been sporadic and retained catches variable. The current fishing season is based on a calendar year. Since 2000, the fishery was managed for a guideline harvest level (GHL) of 150-thousand lb. Non-retained bycatch occurs in the directed fishery, Bering Sea snow crab, Bering Sea groundfish, and historical grooved Tanner crab fisheries. Estimated total fishing mortality in crab fisheries averages 78-thousand lb (2001-2011). Crab mortality in groundfish fisheries (July 1–June 30, 1991/92–2010/11) averages 6-thousand lb. There was no participation in the directed fishery from 2006-2009; two vessels participated in 2011. Pribilof District golden king crab is not included in the Crab Rationalization Program.

Data and assessment methodology

Total golden king crab biomass has been estimated during the NMFS upper-continental-slope trawl surveys in 2002, 2004, 2008, and 2010. There is no assessment model for this stock. Fish ticket and observer data are available (including retained catch numbers, retained catch weight, and pot lifts by statistical area and landing date), size-frequency data from samples of landed crabs, and pot lifts sampled during the fishery (including date, location, soak time, catch composition, size, sex, and reproductive condition of crabs, etc.), and from the groundfish fisheries. Much of the directed fishery data are confidential due to low number of participants.

Stock biomass and recruitment trends

Estimates of stock biomass (all sizes, both sexes) were provided for the Pribilof Canyon. The 2008 Pribilof Canyon area-swept estimate of golden king crab biomass from the triennial slope survey was 2.03 million lb (CV=38%). This estimate is not being used for estimating stock biomass because it does not represent the whole distribution of the stock.

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

The Team recommends this stock be managed under Tier 5 in 2013.

The assessment author presented two alternatives for establishing the OFL. The Team concurs with the author's recommendation for an OFL based on Alternative 1 for 2013 of 0.2 million lb and the maximum permissible ABC of 0.18 million lb. The ABC was derived by applying the Tier 5 control rule a 10% buffer of the OFL, ABC = 0.9 * OFL. The OFL was derived based on the following data:

$OFL_{TOT,2013} = (1+R_{2001-2010}) * RET_{1993-1998} + BM_{NC,1994-1998} + BM_{GF,92/93-98/99}$

- $R_{2001–2010}$ is the average of the estimated average annual ratio of pounds of bycatch mortality to pounds of retained in the directed fishery during 2001–2010.
- $RET_{1993-1998}$ is the average annual retained catch in the directed crab fishery during 1993–1998 (period of unconstrained catch).
- $BM_{NC,1994-1998}$ is the estimated average annual bycatch mortality in non-directed crab fisheries during 1994–1998.
- $BM_{GF,1992/93–1998/99}$ is the estimated average annual bycatch mortality in groundfish fisheries during 1992/93–1998/99.

The average of the estimated annual ratio of pounds of bycatch mortality to pounds of retained in the directed fishery during 2001–2010 is used to estimate bycatch mortality in the directed fishery during 1993–1998 because, whereas there are no data on bycatch for the directed fishery during 1993–1998,

there are such data from the directed fishery during 2001–2010 (excluding 2006–2009, when there was no fishery effort).

The estimated average annual bycatch mortality in non-directed fisheries during 1994–1998 is used to estimate the average annual bycatch mortality in non-directed fisheries during 1993–1998 because there is no bycatch data available for the non-directed fisheries during 1993.

The estimated average annual bycatch mortality in groundfish fisheries during 1992/93–1998/99 is used to estimate the average annual bycatch mortality in groundfish fisheries during 1993-1998 because 1992/93–1998/99 is the shortest time period of crab fishery years that encompasses calendar years 1993–1998.

Status and catch specifications (millions lb)

Year	MSST	Biomass (MMB)	GHL	Retained Catch	Total Catch	OFL	ABC
2009	N/A	N/A	0.15	0	0.001	0.17[A]	
2010	N/A	N/A	0.15	Conf.	Conf.	0.17[A]	
2011	N/A	N/A	0.15	Conf.	Conf.	0.18	
2012	N/A	N/A	0.15	Conf.	Conf.	0.20	0.18
2013	N/A	N/A				0.20	0.18

A= Retained-catch OFL
Conf. = confidential

Status and catch specifications (t)

Year	MSST	Biomass (MMB)	GHL	Retained Catch	Total Catch	OFL	ABC
2009	N/A	N/A	68	0	0.5	77.1[A]	
2010	N/A	N/A	68	Conf.	Conf.	77.1[A]	
2011	N/A	N/A	68	Conf.	Conf.	81.6	
2012	N/A	N/A	68	Conf.	Conf.	90.7	81.6
2013	N/A	N/A				90.7	81.6

A= Retained-catch OFL
Conf. = confidential

No overfished determination is possible for this stock given the lack of biomass information. Although catch information is confidential under Alaska statute (AS 16.05.815) the assessment author indicated that the total catch did not exceed the OFL of 0.20 million lb therefore overfishing did not occur. The 2012 fishery is ongoing until the GHL is achieved or until December 31.

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 1995/96-2009/10 seasons averaged 0.003 million lb in crab fisheries and 0.022 million lb in groundfish fisheries. Estimated annual total fishing mortality (in terms of total crab removal) during 1995/96-2009/10 averaged 0.109 million lb. The average retained catch during that period was 0.084 million lb. This fishery is rationalized under the Crab Rationalization Program only for the area west of 179° W longitude.

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 1995/96-2009/10 and from groundfish fisheries during 1993/94-2009/10 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 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 2012/13 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 2012/13 of 0.12 million lb..

The team recommends that the directed fishery remain closed given concerns of stock status.
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.

As in 2011, the CPT recommends an ABC of 0.074 million lb for 2012/13, which is below the maximum permissible ABC (maxABC = 0.11 million lb). This recommended ABC is based on the maximum annual groundfish and crab fishery bycatch during the period 1995/96–2009/10. Industry has expressed interest in a test fishery around the Adak area based on anecdotal information that there may be legal crab available in this stock. ADF&G has estimated a mortality of about 0.05 million lb to prosecute a test fishery. The CPT notes that the recommended ABC of 0.074 million lb for 2012/13 would allow for the proposed test fishery.

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

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	NA	NA	Closed	0	0.014	0.46[A]	
2009/10	NA	NA	Closed	0	0.012	0.50[A]	
2010/11	NA	NA	Closed	0	0.004	0.12	
2011/12	NA	NA	Closed	0	0.009	0.12	0.03
2012/13	NA	NA				0.12	0.07

A-Retained catch OFL based on 1984/85-2007/08 mean retained catch

Status and catch specifications (t) of Adak RKC.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2008/09	NA	NA	Closed	0	6.35	208.7[A]	
2009/10	NA	NA	Closed	0	5.44	226.8[A]	
2010/11	NA	NA	Closed	0	1.81	54.43	
2011/12	NA	NA	Closed	0	0.02	54.43	12.0
2012/13	NA	NA				54.43	33.57

A-Retained catch OFL based on 1984/85-2007/08 mean retained catch

No overfished determination is possible for this stock given the lack of biomass information. Total catch was 0.0045 million lb, below the OFL in 2010/11, therefore overfishing did not occur.

Table 3 Crab Plan Team recommendations for September 2012 (stocks 1-6). Note that recommendations for stocks 7-10 represent those final values recommended by the SSC in June 2012. Note diagonal fill indicates parameters are not applicable for that tier level. Values in metric tons (t).

Chapter	Stock	Tier	Status (a,b,c)	F_{OFL}	B_{MSY} or $B_{MSYproxy}$	Years[1] (biomass or catch)	2012/13[2 3] MMB	2012 MMB / MMB_{MSY}	γ	Mortality (M)	2012/13 OFL	2012/13 ABC
1	EBS snow crab	3	b	1.42	154.7	1979-current [recruitment]	146.3	0.95		0.23(females) 0.329 (imm) 0.273 (mat males)	67.8	61.02
2	BB red king crab	3	b	0.31	27.5	1984-current [recruitment]	26.32	0.96		0.18default Estimated[4]	7.96	7.17
3	EBS Tanner crab	3	a	0.61	22.80	1990-current [recruitment]	42.74	1.87		0.337 (females), 0.252 (mat male), 0.249 (imm males and females)	19.02	8.17
4	Pribilof Islands red king crab	4	b	0.11	5.14	1991-current	3.30	0.64	1.0	0.18	0.60	0.46
5	Pribilof Islands blue king crab	4	c	0	3.94	1980-1984 1990-1997	0.50	0.13	1.0	0.18	0.00116	.00104
6	St. Matthew Island blue king crab	4	a	0.18	3.56	1978-current	5.63	1.58	1.0	0.18	1.02 [total male catch]	0.92 [total male catch]
7	Norton Sound red king crab	4	a	0.18	3.51	1983-current [model estimate]	4.25	1.21	1.0	0.18 0.68 (>123 mm)	0.24 [total male]	0.22 [total male]
8	AI golden king crab	5				See intro chapter					5.69	5.12
9	Pribilof Island golden king crab	5				See intro chapter					0.09	0.08
10	Adak red king crab	5				1995/96–2007/08					0.05	0.03

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 2/15/2013 at time of mating.
3 Model mature biomass on 7/1/2012
4 Additional mortality males: two periods-1980-1985; 1968-1979 and 1986-2008. Females three periods: 1980-1984; 1976-1979; 1985 to 1993 and 1968-1975; 1994-2008. See assessment for mortality rates associated with these time periods.

Table 4 Maximum permissible ABCs for 2012/13 and Crab Plan Team recommended ABCs for those stocks where the CPT 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 1000 t. Note that recommendations for Norton Sound red king crab and Adak red king crab represent those final values recommended by the SSC in June 2012.

Stock	Tier	2012/13 *Max*ABC	2012/13 ABC
EBS Snow Crab	3b	67.60	61.02
BBRKC	3b	7.94	7.17
Tanner Crab	3a	19.01	8.17
PIRKC	4b	0.501	0.455
PIBKC	4c	0.00116	0.00104
SMBKC	4a	1.02	0.92
Norton Sound RKC	4a	0.24	0.22
Adak red king crab	5	0.045	0.03

Table 5. Stock status in relation to status determination criteria 2011/12
(Note diagonal fill indicates parameters not applicable for that tier level)

Chapter	Stock	Tier	MSST	B_{MSY} or $B_{MSYproxy}$	2011/12[4] MMB	2011/12 MMB / MMB_{MSY}	2011/12 OFL 1000 t	2011/12 Total catch	Rebuilding Status
1	EBS snow crab	3	77.3	154.67	165.2	1.07	73.5	44.7	
2	BB red king crab	3	13.77	27.54	30.88	1.12	8.80	4.09	
3	EBS Tanner crab	3	11.40	22.80	58.59	2.57	2.75	1.24	
4	Pribilof Islands red king crab	4	2.57	5.14	2.78	0.54	0.39	0.005	
5	Pribilof Islands blue king crab	4	2.25	4.49	0.37	0.08	0.0012	0.0004	overfished
6	St. Matthew Island blue king crab	4	1.81	3.62	5.03	1.39	1.70 [total male catch]	0.95 [total male catch]	
7	Norton Sound red king crab	4	0.71	1.42	2.13	1.50	0.3	0.20	
8	AI golden king crab	5					5.17	2.95	
9	Pribilof Islands golden king crab	5					0.09	Conf.	
10	Adak red king crab	5					0.05	0.02	

4 MMB as estimated during this assessment for 2011/12 as of 2/15/2012.