

Public Testimony Sign-Up Sheet

Agenda Item C-3(d) CRAB SALES REPORT

SATURDAY 10 am

	NAME (PLEASE PRINT)	AFFILIATION
1	Arni Thomson	ACC
2	Leonard Herzog	Alaska King Crab Harvesters Coop
3	Frank Kelly	City of Umanak
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NOTE to persons providing oral or written testimony to the Council: Section 307(1)(I) of the Magnuson-Stevens Fishery Conservation and Management Act prohibits any person "to knowingly and willfully submit to a Council, the Secretary, or the Governor of a State false information (including, but not limited to, false information regarding the capacity and extent to which a United State fish processor, on an annual basis, will process a portion of the optimum yield of a fishery that will be harvested by fishing vessels of the United States) regarding any matter that the Council, Secretary, or Governor is considering in the course of carrying out this Act.

Crab Plan Team Report

The Crab Plan Team (CPT) met May 11-12 and May 15, 2009, at the Alaska Fisheries Science Center in Seattle, WA.

All Crab Plan Team members were present:

Forrest Bowers (ADF&G-Dutch Harbor), Chair

Ginny Eckert (UAF/UAS), Vice-Chair

Diana Stram (NPFMC)

Doug Pengilly (ADF&G-Kodiak)

Gretchen Harrington (NOAA Fisheries –Juneau)

Wayne Donaldson (ADF&G-Kodiak)

Jack Turnock (NOAA Fisheries/AFSC-Seattle)

Shareef Siddeek (ADF&G-Juneau)

Herman Savikko (ADF&G-Juneau)

Lou Rugolo NOAA Fisheries /AFSC-Kodiak)

André Punt (Univ. Of Washington)

Bill Bechtol (UAF)

Bob Foy (NOAA Fisheries /AFSC-Kodiak)

Josh Greenberg (UAF)

Brian Garber-Yonts (NOAA Fisheries-AFSC Seattle)

Members of the public (and state and agency staff) present for all or part of the meeting included: Jennifer Mondragon (NMFS AKR), Diana Evans (NPFMC), Craig Rose (NMFS/AFSC), Lori Swanson (Groundfish Forum), Doug Woodby (ADF&G), Arni Thompson (ACC), Jie Zheng (ADF&G), Linda Kozak, Jack Tagart (BSFRF), Jim Stone (Alaska Scallop Association), Brent Paine (UCB), Dick Powell (Patricia Lee), Doug Kinzey (UW), Phil Hanson (Unisea), Braxton Dew (NMFS/AFSC), George Hall, Martin Dorn (NMFS/AFSC), Kevin Kaldestad (Mariner Co-op), Lance Farr (Kevleenk), Anne Hollowed (NMFS/AFSC), Pat Livingston (NMFS/AFSC), John Gauvin, Jason Anderson, Tom Casey

Administrative

The agenda (attached) was approved. Additional agendas are attached for the data weighting workshop, as well as the revised Friday, May 15, CPT agenda. The CPT minutes from the September 2008 meeting were approved.

Crab bycatch accounting in the groundfish fisheries

Jennifer Mondragon (NMFS AKR) provided the team with an update on a catch accounting correction for crab bycatch in the groundfish fixed gear fisheries. The issue is observed samples that contained too many crab to be identified by species by the observer on board and were thus recorded as unidentified crab in the observer database. In these situations, the observers subsample the crab and identify the subsampled crabs to species. However, crab subsampled to the species level were not being extrapolated in the database to unidentified crab, thus resulting in an underestimate of the fixed gear bycatch of crab. Because there are no fixed gear bycatch limits (the focus in the NMFS Catch Accounting System has always been on extrapolation of trawl catch towards PSC limits), the oversight was only recently discovered. The database has been reprogrammed to extrapolate samples from 2008 forward. Although current sampling includes weight and/or number, random weight subsamples are still being used to apportion bycatch to species. The issue primarily relates to pot gear and has the greatest impact on the bycatch of bairdi and opilio. The team discussed the magnitude of bycatch by vessels using pot gear. There are no PSC limits currently for fixed gear. Team members felt that a sensitivity analysis on the

impacts of this additional mortality on stock assessments may be warranted. Groundfish pot bycatch is currently included as a small contribution to trawl bycatch. The team suggested that each assessment author break out individual bycatch estimates by gear type (e.g., pot, trawl, longline) in the groundfish fisheries, so that the contribution of each gear type on the total bycatch mortality estimated for the groundfish fisheries can be assessed and compared.

Jennifer noted that the programming solution only revises bycatch estimates from 2008 forward, and a similar correction is not yet available for pre-2008 bycatch. An additional problem exists because the current groundfish bycatch limits are in numbers, but bycatch is currently modeled in weight in stock assessments. Thus, post-recruit and pre-recruit crabs are considered equivalent in terms of PSC limits. However, the observer data do have additional detail available on size of crab.

Jennifer noted that the next steps are to write up results of the bycatch extrapolation and proposed solution for distribution to the CPT by mid-June. She requested some guidance from assessment authors on when annual bycatch data should be made available for assessment purposes, noting that all data are not available until several months after the groundfish fisheries close at the end of December. Authors noted that making bycatch data available by late July would fit with the availability of survey data for incorporation into the final SAFE in September.

Jennifer also noted that the groundfish bycatch numbers provided to stock assessment authors did not consider any bycatch mortality rate multiplier to obtain the actual removal from the population.

The programmers are also working to estimate bycatch spatially. Prior to 2009, catch estimates cannot be split to areas smaller than federal reporting areas. However, it will be possible to split these data to ADF&G state statistical areas for the 2009/2010 crab season onwards. Bob Foy noted that extrapolation to unobserved fishing areas will still be problematic, particularly at small scale boundaries.

The team discussed the estimates of variance on the extrapolated unobserved catch and the need to account for uncertainty in catch and assessment estimates.

EBS bottom trawl survey reanalysis

Bob Foy summarized issues with reanalysis of the time-series of crab trawl survey estimates. An overview of corrections to date is contained in the Introduction to the Crab SAFE Report; a full report will be available for the final SAFE in September 2009. Database corrections resulted in either increased or decreased estimates of the number of crab by species for some years. There were some substantial changes to the time-series of the snow crab abundance estimates.

Unmeasured crab is a common problem for the early survey series, particularly for blue crab before 1981. There is no documentation of why some catches were weighed but not measured for length; one possibility is these catches were from non-standard survey tows. These records were previously distributed across the length distribution when computing abundance estimates, but are currently excluded. The CPT discussed how best to estimate the distribution of these crabs so as to use them when estimating abundance. Team members noted that they should be retained as previously distributed, it made clear that this had been done. Assessment authors should be allowed to modify how these crab are handled in the assessment.

Bob requested CPT guidance on what information to include in the data revision (providing a graph of what is currently included when computing abundance estimates), and how to evaluate the consequences of individual modifications. For example, there is an indication that the data for the early years are more affected by the unmeasured crab. The CPT noted that the effect of incremental changes in abundance estimates resulting from each adjustment needs to be well documented.

Survey information, as corrected to date, was provided to stock assessment authors and used in all May 2009 assessments except for Tanner and snow crab. Bob noted that analysts are still developing a consistent treatment of strata over years so that each year will not need to be modeled separately. Thus, the analysts are attempting to develop consistent strata assumptions and treatment by time period. Feedback on their approach would be useful.

The team discussed the ACL implications of the variance calculation. Should we go beyond management districts to report biomass estimates and variance from the surveys? Should it be on a case-by-case basis with assessment authors or general policy?

There is a benefit to some consistency in efforts to break up strata by species. The CPT agreed that ideally everyone would use the same database. Therefore, we need an established process and protocol for acquiring data. There could be a single data source (likely the Kodiak lab). Other needs (e.g., maturity information) could be provided to assessment authors, but each author needs to work with the Kodiak lab to ensure that abundance estimates are calculated in a manner which is consistent with how the standard estimates are computed.

Feedback was also sought from the CPT on which surveys to include when computing the time-series of abundance estimates, and how to incorporate special projects. Bob proposed three strategies for future analysis: (1) only include standard tows; (2) include all possible surveys; (3) include standard tows and some "appropriate" surveys. These analyses will be brought back for reevaluation by the CPT with each assessment author separately. In some instances, special projects might help to better understand a stock, although this could compromise the consistency of abundance estimates.

The team also discussed the advantages and disadvantages of moving to a time-series of abundance estimates when the reanalysis is not yet complete. Not all assessment authors used the new dataset in the draft assessments presented at the meeting.

CPT recommendation: The CPT recommended using only standard surveys by year as an index. Special projects and hot spots could then be analyzed separately to give better information about interannual variability. The team also discussed the tradeoffs of moving to a time-series of abundance estimates when the reanalysis is not yet complete. The CPT agreed that the final assessments in September 2009 should include the same historical data as presented in May 2009 (e.g., revised abundance time series except for snow and Tanner crab), but all assessments in May 2010 should use the revised abundance data.

Bob proposed vetting the survey re-analysis through the CPT next year, or possibly through a small workgroup comprised primarily of assessment authors. The team requested possible Council support for hosting a survey workshop. While recognizing the simpler logistics of using a smaller workgroup/public workshop, some assessment authors felt that the selection of survey data would benefit from full CPT review. This workshop must probably occur in the fall (public meeting if possible to involve available CPT members), after which a larger group would meet for review purposes. The scope and timing of the meeting will be discussed further at the September CPT meeting.

OFL stock assessment review

Norton Sound red king crab:

Jie Zheng summarized the revised NSRKC assessment. Because this fishery opens in June, the OFL for this stock is recommended by the CPT at the May meeting.

Jack Turnock noted that the CPT's preferred model from the previous year's assessment should be included in the suite of scenarios examined for the new assessment, in order to evaluate the impact of the changes in assessment methodology. This recommendation will be folded into the crab stock assessment guidelines for the 2010 assessments.

Team members commented on the CVs and relative weighting, suggesting that results be evaluated to indicate whether weighting is appropriate. Jie should explore whether there is evidence for over-dispersion, for example, by evaluating how often the predictions are outside of the confidence intervals for the data.

The CPT discussed the justification for the zero handling mortality rate employed and questioned the justification as described in the assessment. The author assumed the only source of handling mortality is temperature-related freezing, but the team finds this assumption to be invalid. The team discussed additional mortality due to physical handling. The team recommends sensitivity tests be conducted next year based on plausible levels of handling mortality (using Bristol Bay red king crab as a benchmark). In the absence of any observer data on bycatch for this fishery, one suggestion was to estimate a fixed catch discard (e.g. 10% - 20% of retained) for comparison against the assumption of zero handling mortality.

The current assessment uses $M=0.30\text{yr}^{-1}$ versus 0.18yr^{-1} last year). The CPT discussed the validity of this change in M , noting that the likelihood profile for M in the assessment document does not fully justify this modification. If the assessment is using the argument that the likelihood profile is flat, then M should be based on Y axis scale, and not a visual evaluation of the profile. The CPT also disagreed with the assumption that the maximum age is 15 years, which is implicit in a natural mortality rate of 0.30yr^{-1} .

The team discussed the likelihood profiles of M presented in the assessment (Figure 2) and did not consider the rate of 0.30 to be adequately supported by either profile. The author argued that the likelihood profiles are essentially flat beyond $M=0.30$ and that constituted justification for the choice. The team observed that such a finding must be evaluated on the basis of the change in log likelihood units equivalent to a 95% confidence interval on the Y-axis. Inspection of the change in M within approximately 2 log likelihood units for either profile did not support the assertion that $M=0.30$. The team requested that the author provide a comprehensive rationale for selecting M from the log likelihood profile and a more informative discussion of model sensitivity to varying values of M .

The author supported the choice of $M=0.30$ based on longevity. The author assumed that longevity (T_{\max}) for Norton Sound red king crab was 15 y. For the unexploited stock, a $T_{\max}=15$ y under a 1% rule corresponds to a $M=0.30$, viz 15 represents the 99th percentile of the age distribution of a virgin stock. $T_{\max}=25$ y previously used corresponds to a $M=0.18$ under a 1% rule.

The author's assumed $T_{\max}=15$ y was based on mark-recapture results on Norton Sound red king crab. Here, 15 y = the approximate mean age at tagging (7-8 y) plus the maximum years at large of a recovered tag (7 y). The team noted that the maximum recovery period (7 y) depended on the underlying mark-recapture program to provide crab at maximum age which was not evaluated. The team noted that the estimated 15 y age only represents a minimum estimate of T_{\max} by definition; e.g., observations are not on an unexploited stock and adequacy of the mark-recapture program to provide recoveries 17-18 y at large. The team was concerned that the strong pattern exhibited by results of the retrospective analysis indicates that model results may be upward biased.

The team discussed the estimated selectivity for small crab, noting that selectivity on small animals changed with M , but with flat selectivity for $M < \sim 0.29\text{yr}^{-1}$. It was also unexpected to see estimates of MMB and legal males increase with decreasing M below $\sim M=0.30\text{yr}^{-1}$. The team noted that additional information should be included in the assessment to better understand parameter estimation as currently

specified in model. Also, the assessment should include the previous year's OFL and catch for determination of overfishing.

The current assessment uses a gamma value of 0.6. The CPT noted that insufficient justification was given for a gamma different from 1.0. It was further noted that the author chose to modify F_{msy} proxy to $0.18yr^{-1}$ (which is equivalent to the previous M value and a gamma of 1.0) without a clear justification. The author should provide strong justifications for rejecting the calculated F_{35} .

The CPT discussed the choice of model parameters, did not agree with the listed rationale for M and gamma, raised the possibility that the model itself is mis-specified, and could consequently not support the author's preferred scenario. The CPT requested a revised assessment be presented. The revised assessment should be based on $M = 0.18yr^{-1}$ and gamma = 1. The revised assessment was presented on Friday of the CPT meeting and is included in the draft SAFE Report for May 2009.

Next year's assessment should explore the implications of including bycatch and discard estimates in the assessment, and also include the total catch for the year to date and compare this against the model assumptions of catch. The subsequent assessment should include a Tier 5 calculation.

St Matthew blue king crab:

Jie Zheng summarized changes to the assessment for St. Matthew blue king crab. The team discussed the residual patterns (which suggest a lack of independence within years) and likelihood components. Some suggestions included formulating the likelihood component for the catch and survey-at-length (currently assumed to be independent between size-classes) as total catch/survey index and proportions by size-class (as in the snow crab assessment). The CPT noted that scenario 4 did not fit the data adequately. The team again requests confidence intervals on survey estimates and in tables and figures.

The author recommended scenario 2. The CPT requested a sensitivity analysis or additional justification on the molting probability penalty.

The CPT discussed the years used to calculate the proxy B_{msy} (B_{ref}), noting that the current B_{ref} depends on the selected years. Because this stock has never been fished at B_{msy} , B_{ref} is poorly estimated. Consequences of a potentially inappropriate basis for the B_{msy} proxy include an arbitrary determination of increased stock status. There is a dichotomy between indications of depressed stock status and model estimates of stock rebuilding. The team notes that absent any changes to B_{ref} , it is likely the final assessment in September will indicate the stock to be rebuilt.

No crab pot bycatch was included in the assessment this year or last, and the model only considers males, so the current OFL only pertains to retained male catch. Reiterating a previous request, the team would like to see bycatch included in the September 2009 final assessment so that a total catch OFL can be calculated for this stock. The team continued discussion of inherent issues with B_{ref} estimation, but could not find a better approach than that used in the assessment. The team noted that the qualitative perception of stock status is unchanged regardless of B_{msy} proxy chosen, but that substantial analysis is needed to better estimate an appropriate B_{ref} for this stock. A different form of analysis may be needed to better estimate B_{msy} .

Eastern Bering Sea Tanner crab:

Lou Rugolo summarized the EBS Tanner crab assessment. The team discussed the potential impact in future assessments of corrected bycatch estimates given the previous discussion of groundfish pot crab bycatch. Currently, the model does not separate crab bycatch in the various groundfish fisheries by gear type (e.g., trawl, longline, pot) in the assessment.

The final assessment will compare observed discard losses against model predictions for groundfish trawl and opilio pot fisheries. The team noted that caveats were necessary in all tables regarding draft OFLs for the May draft assessment in order to be clear that values listed in the assessment are not the final 2009/2010 OFLs. The team approved the author's recommendation for model parameters and the time period for B_{ref} .

The author noted that work continues on a length-based model extending to 1968 for this stock, with tentative plans to present the preliminary model structure at the September 2009 CPT meeting.

Snow Crab:

Jack Turnock summarized the snow crab assessment; no structural changes were made to the model this year. The previous assessment included many modifications in response to a 2008 CIE review. The CPT noted that of the team's comments from the previous year, the assessment author only addressed requests for better documentation; the CPT expects comments on future assessments will be considered on an annual basis.

André Punt noted that, after recoding in ADMB and FORTRAN, the model performs as specified, representing a validation on model specification.

Jie Zheng noted that the CVs for the survey data were reduced below their actual values, and expressed concern that the survey data are being overweighted. Further discussion was deferred to the assessment/weighting workshop. The CPT recommended that the survey CVs not be reduced next year; rather the weights on other data components should be reduced. The retrospective analysis should be repeated as reweighting may cause substantial changes.

The team discussed rebuilding probabilities for this stock; 2010 is the 10-year benchmark for the rebuilding plan. At issue is the probability of the stock being above B_{msy} in 2009/2010 and 2010/2011 (rebuilt status is defined as two consecutive years above B_{msy}). Based on the assessment analysis, obtaining a 50% probability of rebuilding to B_{msy} in 2009/2010 will require a fishing mortality rate equal to 16% of F_{35} .

The team discussed projecting forward in 2009/2010 for determination of whether or not the stock is above B_{35} . There are some timing issues to be clarified with respect to when this determination is made, and using which data (i.e., forward forecast to following spring or backwards hindcast of previous year using new data). The CPT requested a clarifying letter from NMFS AKR and/or NOAA GC regarding the process and steps necessary to rebuild the stock to B_{35} within the rebuilding timeframe, with the accompanying rationale and analysis for reference to the rebuilding trajectories contained in the stock assessment. The team requested that this letter also include information on what happens if measures are taken to rebuild the stock in this time frame and it does not rebuild.

The CPT recommended that the total catch during 2009/2010 be no higher than that corresponding to the harvest rate which would lead to a 50% probability of rebuilding to B_{35} beginning in 2009/2010, as determined by the probability projections in the final stock assessment in September 2009.

CPT recommends that the snow crab assessment in September 2009 include explicit information detailing snow crab bycatch in the groundfish fisheries by gear type (pot, trawl, longline) as well as model assumptions of bycatch. The CPT also requested that the author revise the write up of the snow crab assessment document, considering previous recommendations for completeness; for example, incomplete reference list remains the same each year, etc.

Bristol Bay red king crab:

Jie Zheng provided an overview of the BBRKC assessment. A CIE review of this assessment will occur in June 2009.

The CPT commented that the assessment needs to include the model configuration used last year for comparison against any new scenarios. It is hard to understand the implications of model changes without the results of the original configuration.

This year's assessment included additional natural mortality (males and females 1980 – 1984; females 1976 – 1979 and 1985 – 1993) and two scenarios included data from the 2007 and 2008 BSFRF surveys. The team discussed the inclusion in the assessment of a prior for catchability obtained by comparing the BSFRF and NMFS indices, and noted that it was not correct to use the priors as well as the BSFRF and NMFS survey data, as this leads to some of the data being "double-counted". The team noted that it was difficult to assess the fit to BSFRF data in the absence of diagnostic statistics. As a general rule, any data utilized must be listed in the assessment document. There were also large difference in the biomass estimates during the late 1970 – 1980s between scenarios with and without the BSFRF data, but why inclusion of these 2007 and 2008 survey data should impact early biomass estimates was not clear. Finally, the CPT queried the lack of information on the length-composition of the BSFRF survey. Jie noted that he did not receive any length-composition data for that survey.

CPT discussed the appropriate time period for defining B_{ref} , noting the author's suggestion to use 1995-2008. The CPT previously requested additional time periods for B_{ref} to facilitate fuller discussion.

Although the overall fit to the data as presented may suggest the use of configuration model 1, the team recommends scenario 3 as the preferred model, primarily because the BSFRF data are not documented, and model fit is not presented, in the assessment. Although scenario 3 has the fewest changes (no BSFRF survey) from last year's assessment, the increase in biomass in recent years is difficult to understand. Some members felt that the information as presented was insufficient to retain this stock in Tier 3 and discussed dropping it to Tier 4.

The team had extensive discussions regarding the time period to use in defining B_{ref} , with recommendations for further analyses to differentiate changes in the model. Some team members felt that the years presented for B_{ref} consideration should also include a pre-collapse time period (1968 – 1980). Other members noted that we have excluded years of high harvest rates prior to a collapse for other stocks. Some team members suggested that for consistency we should either use all the data for all stocks, or use only the recent conditions. For this stock we could also exclude the high harvest rate and crash years, but include the available information before and after the excluded years. Ultimately, the team considered the following time periods for B_{ref} :

- 1- all years
- 2- current year set (1995 – 2008): current environmental conditions
- 3- only pre-collapse (not yet presented)
- 4- 1985 – 2008 included

The team discussed the relationship presented in Figure 35 of the assessment, noting that serial correlation and, thus, time, may be more important than MMB in terms of stock productivity. Team members noted that recruits per spawner may provide a better indicator than the Figure 35 relationship.

The majority of the CPT favored the author's suggestion to base B_{ref} on 1995 – 2008, but this was not a consensus position given issues noted previously.

Different crab stock are currently treated inconsistently with respect to periods of productivity. The team requests additional presentations next year on the changing conditions and productivity in the Bering Sea,

and its possible relevance to crab stock dynamics. Team members noted, however, that while changing conditions in the Bering Sea can be characterized, it is unlikely that the impacts of such changes are consistent across all crab stocks, as they are likely highly stock-specific.

Aleutian Islands golden king crab:

The CPT considered assessments for AIGKC based on Tiers 4 and 5, noting that the OFL for this stock needs to be determined at this meeting because the fishery opens in August. Siddeek presented an overview of his AIGKC assessment model. The team discussed to what extent the eastern and western components represent a single stock. Subsequent discussion noted that there is currently only a single stock-wide OFL; to establish separate OFLs by region would require an FMP amendment. The model assumes mixing between stocks and the team recommends evaluation of CPUE disaggregated by the hot spots to see if there are similar trends in each area.

The CPT, noting that the penalty on fishing mortality was not well documented, discussed the use of CPUE with respect to the relevant SSC comment (i.e. the SSC did not intend for CPUE to be removed entirely from assessment, its intent was instead that consideration be given to scenarios with and without these data). Other comments on the model include:

- Fits to the discard size-composition data suggest that the model is mis-specified.
- Retained selectivity. Three selectivity patterns were included in the assessment; the CPT was unclear what fully-selected F means when selectivity does not reach 1.0 at any size.
- Discard of large crab: the model suggests that some large crab are not being retained. It was also noted that some large crabs known as "leather backs" may be discarded
- Equation 25 may be redundant since catch is already in Equation 21, although it should be clarified what is observed and what is predicted, and model sensitivity to removal should be examined.
- Note that the penalties are in different units such that equivalent penalty terms can have substantially different effects on model performance.
- Equations 10 and 11: clarify typos on variables for C and D
- Recommendation to include scenarios with and without commercial CPUE data.

The CPT agreed that the draft Tier 4 assessment reflects a considerable improvement to last year's approach, but that, as noted above, further work is needed before this assessment can form the basis for management advice.

Linda Kozak recommended that the author look at model runs with only post-rationalization CPUE, given some concerns that deadloss/discard numbers seem inaccurate and there may be extrapolation issues.

The SSC did not agree with the CPT recommendation for the retained catch OFL time period for this stock in 2008/2009. The author presented 3 time periods for consideration for the 2009/10 fishing season, all within the 1985/1986–1995/1996 time period of unconstrained catch under the current size limits: 1985/1986–1995/1996; 1987/1988–1995/1996; and 1990/1991–1995/1996. The author noted that observer data on bycatch from the directed fishery is too incomplete to provide estimates of total catch for the time periods under consideration; there is no observer data from the directed fishery prior to the 1988/1989 season and observer data are lacking or confidential for at least one management area in the Aleutian Islands for four seasons of seven seasons during 1988/1989–1994/1995. The CPT discussed justification for why the team continues to disagree with the SSC recommendation from 2008/09 to use the full 1985/1986–1995/1996 time period to compute OFL. The CPT did not want to include consider the early years, 1985/1986–1989/1990, within the period when catch was unconstrained. During the early years of the unconstrained catch period, annual catch and catch rates decreased dramatically and appear to have not been sustainable. As a result, the CPT chose the later period of unconstrained catch, 1990/1991–1995/1996, that provided more stable harvests and was prior to the constrained catch period.

The CPT recommends the use of the time period from 1990/1991-1995/1996 for a retained catch OFL of 6.93 million, although this recommendation was not unanimous.

Pribilof Island red king crab:

Bob Foy presented an overview of the PIRKC assessment. There were no proposed changes to last year's approach to OFL calculations. Comparative information on a B_{msy} proxy with years based on average survey abundance over 1980 – 2009 will continue to be included in the final assessment. Updated survey information using the updated dataset were provided. Final stock status and resulting OFL will be provided in the final assessment with incorporation of the 2009 summer survey.

The September 2009 revision will provide comparisons on how model calculations would have changed had the corrected survey information been included last year.

The team agreed with the author's recommendations on the basis for the B_{msy} proxy as well as for the model parameters.

Pribilof Islands blue king crab:

Bob Foy provided an overview of the PIBKC assessment. Discussion of the rebuilding plan alternatives for this stock was scheduled for Friday. No changes to the assessment are proposed this year. The updated survey time-series was used in the assessment.

The author reviewed the non-directed OFL recommendation from September 2008 and updated information from the 2008 Pacific cod pot bycatch. Pacific cod pot bycatch was revised downward from preliminary estimates, but still represents approximately 8,000 lbs of bycatch in the fishery for 2008. However, in 2008/2009 to date there was limited bycatch (~30 lbs) accruing against the 4,000 lb non-directed OFL.

The team agreed with the author's recommendations on the basis for the B_{msy} proxy, as well as the model parameters.

Pribilof Islands golden king crab:

Doug Pengilly provided an update on the forthcoming Pribilof Island Golden King Crab (PIGKC) assessment. No documentation was provided at this meeting, given that there is no new information to be included in the OFL calculation for 2009/2010. The team supported the author's recommendation to use the same years for calculating the retained catch OFL for this stock. Bycatch data will be compiled and included in the September assessment.

Adak red king crab:

Doug Pengilly provided an update on the OFL recommendation last year for Adak RKC. The SSC differed from the CPT in their 2008/2009 OFL recommendation. Doug provided an overview of information to be included in the 2009 September assessment report and that a pot survey in the Petrel Bank area is planned for November-December 2009. The team discussed OFL options as presented in the presentation by the author including status quo, alternate time periods, and an OFL based only upon the Petrel Bank region. No total catch OFL computation is provided at this time due to the lack of observer data on bycatch during this fishery prior to 1988/1989 and confidentiality of observer data from the fishery during the 1990/1991, and 1992/1993–1994/1995 seasons. Given the gaps in data on bycatch from the directed fishery, a total catch OFL can not be directly estimated for the time period that the retained catch OFL for 2008/2009 was based on (1985/1986 – 2007/2008). Hence the author recommended that the 2009/2010 OFL for fishery be established as a retained catch OFL. Bycatch estimation for this stock remains problematic and the team reviewed previous discussions regarding options for a bycatch-only OFL; options for different retained catch OFL; and means to estimate bycatch for a total catch OFL.

The team recommends establishing an OFL for this stock consistent with the approach recommended by the SSC last year (as a retained catch and freezing years considered through 2007/2008). The team reiterates previous concerns about stock status, outlook for this stock, and data collection priority.

Linda Kozak commented that industry would like to participate in the survey this year to help define areas surveyed. She commented that industry is specifically not fishing in areas where Adak RKC would likely be found as bycatch in the golden king crab fishery.

CPT recommendation on Tier 5 stock assessments. The timing for final assessments for Tier 5 stocks should be done annually in May and only brought back to the CPT as an agenda item in September, should there be new information over the summer and/or modification to CPT recommendations from the SSC. This year the other two Tier 5 assessments (Adak RKC and PIGKC) will be finalized in September; next year they will be on the May schedule.

Workshop:

A separate report is being prepared for presentation to the CPT in September for the stock assessment/data weighting workshop in which the CPT participated May 13 - 14. Issues pertinent to the CPT discussion and SSC review this spring include the following:

- Ecosystem chapter: Proposal that some ecosystem considerations by crab stock be provided by the Kodiak lab for presentation at (an extended) May 2010 meeting, with the idea to move toward further consideration in individual stock assessments or as a summary over time as applicable.
- Economic chapter possibly to move in similar direction.
- Terms of Reference for assessments will be finalized and circulated at the CPT September 2009 meeting.

Pribilof Island blue king crab rebuilding plan alternatives

As a follow up to last year's discussion of the need to revise the Pribilof Island blue king crab rebuilding plan, the team discussed the rebuilding plan alternatives put forward last September. The team understands the Council is scheduled to consider initiating an analysis for a revised rebuilding plan at the June 2009 Council meeting.

The alternatives proposed by the team last year include:

1. PIHCZ closed to all groundfish fishing.
2. PIHCZ closed to Pacific cod pot fishing.
3. Analyze ADF&G crab closure areas applied to all groundfish and just Pacific cod pot fishery: between 168 and 170 W long., and between 57 and 58 N lat.
4. Analyze new closure configurations which cover the entire distribution of the PIBKC stock (all groundfish or Pacific cod pot fishery only).
5. Gear modifications to Pacific cod pot gear that could reduce bycatch of blue king crab.

An additional alternative was put forward by the stock assessment author regarding increased observer coverage. The team noted that increased observer coverage will improve estimates of catch accounting, but is not necessarily a rebuilding alternative. The team discussed a combination of full observer coverage on the pot cod fleet and caps on PIBKC bycatch in that fleet as a possible proposed alternative. Members of the public suggested both cap alternatives be considered, as well as consideration given to current enhancement efforts. Overall, the team highlights the issue of observer coverage in the pot Pacific cod fishery, and notes that increased observer coverage in this fishery would be beneficial in providing better bycatch estimates for blue king crab.

The team suggests considering all of the previous alternatives with the exception of gear modifications (number 5 above). While the team encourages on-going efforts in gear modification, there does not seem

to be anything on the horizon that would be immediately applicable to the recovery of PIBKC, given the timeframe for this rebuilding analysis.

The team recommends addition of a PSC cap in other fisheries to the list of alternatives for consideration in a revised rebuilding plan. The team encourages on-going research on enhancement collectively with the corollary research on larval transport and habitat. The team notes that enhancement efforts at the Seward shellfish hatchery remain experimental and unproven at a production level in the near term. However, the team would welcome a presentation on enhancement efforts and their possible link to stock recovery for this species.

Trawl Sweeps

Diana Evans (NPFMC) and Craig Rose (NMFS AFSC) provided an overview of the proposed trawl sweeps gear modification and related revision of the St. Matthew Habitat Conservation Area (HCA) being put forward for initial review to the Council in June 2009. The analysts were seeking CPT input on the appropriate extent of the St. Matthew HCA to adequately protect St. Matthew blue king crab stock. They were specifically seeking guidance on the eastern boundary of the HCA in relation to the "finger" area.

The team questioned to what extent the proposed trawl sweeps will be appropriate to protect king crab; Craig Rose noted the modified sweeps reduced bycatch of Tanner and snow crabs and that research this summer will provide information specific to king crab.

The team discussed the spatial extent of a recovered BKC stock compared with current catches representative of the recovering stock. Team members noted that the previous St. Matthew king crab stock comprised a much broader spatial distribution than the current stock, which has been compressed spatially as well in abundance since its collapse and subsequent (current) rebuilding phase.

The CPT did not recall being consulted on the original St. Matthew HCA configuration prior to Council action on the closure. Previous discussions with the CPT from Council analysts had indicated some interest in protecting St. Matthew BKC and EBS snow crab stocks, but actual closure configurations were not proposed to the CPT. The focus of previous discussions was related to the spatial extent of the snow crab stock. The CPT requested additional time to comply with the Council's request for comment on the adequacy of the current St. Matthew HCA as it relates to the St. Matthew BKC stock.

The CPT was asked to comment on both the adequacy of that closure as well as concerns or recommendations with modifying the current finger-configuration of the gear modification closure. John Gauvin stressed the importance of this region for the rock sole fishery. The team noted that the western edge of the finger region gets into the distribution of females of the St. Matthew BKC stock. The team discussed that its preference is to wait for results of the proposed summer pot study to make a recommendation on the appropriateness of the closure area.

The CPT would like to better evaluate the closure configuration of the HCA in September and tasked Bob Foy with providing updated information to the team in September on the St. Matthew BKC distribution in relation to these closure boundaries. The CPT would also like to see a more detailed depiction of groundfish fishing effort around St. Matthew Island. The team recognizes that this delay might require follow-up analysis to what is proposed for Council review in the fall, but the team did not feel fully qualified to make these recommendations without further discussion and evaluation. The team requested further information on the fishery distribution in this region, as well as information on the sex distribution of St. Matthew BKC in NMFS crab survey in this region. The team notes that the distribution of snow crab may also be affected by the proposed trawl area.

Crab Prohibited Species Catch limits in Groundfish and Scallop Fisheries

Diana Stram summarized the existing crab catch limits in the BSAI groundfish and scallop fisheries. The team has noted multiple times that these limits should be reevaluated in the context of new crab OFLs and the lack of feedback between crab and groundfish FMPs, particularly with respect to crab bycatch in the BSAI groundfish fisheries, and that these catches currently accrue towards crab OFLs under the Crab FMP. Any impact on catch levels as a result of an overfishing determination for exceeding a crab OFL will only be counted against the directed crab fishery regardless of what caused the catch to exceed that level (e.g., even if it was caused by excess bycatch in the groundfish fisheries). Currently PSC limits in the BSAI groundfish FMP exist for red king crab, Tanner crab and EBS snow crab in the trawl fisheries only as time/area closures triggered by PSC caps. There are no crab bycatch limits in any fixed gear groundfish fisheries.

Given the issues brought forward from the NMFS AKR on fixed gear bycatch, the team recommends a reevaluation of groundfish and scallop PSC limits in light of crab stock sizes, total catch OFL structure and changes in the groundfish fisheries fishing practices, fleet sizes, etc. For all stocks with a total catch OFL, a means is needed to allocate shares of total catch between directed and non-directed catch, including all gears. Consideration should also be given to the actual sizes of crabs caught since currently limits are formulated solely on number of crab (with no distinction on size, sex, or maturity). The CPT encourages the Council to initiate an analysis of all PSC limits for crab species under the new catch OFLs.

The team further notes that the use of total catch OFLs allow for setting upper limits (caps) to bycatch and that upper limits (caps) may be needed to assure that the total catch OFL is not exceeded. The team further noted these catches may or may not represent a conservation problem but regardless the current system may cause problems for the directed crab fishery as populations decline and this could be affecting crab stock recovery. An analysis of the appropriateness of the current bycatch and limits would indicate to what extent this additional catch in other fisheries is affecting individual crab stocks.

While this may be primarily an allocation issue in terms of who catches the crab and where the control mechanisms lie with no feedback to other FMPs, it could hypothetically drive an overfishing determination. All sources of fishing mortality should have controls, including bycatch from the non-directed fishery.

Jim Stone noted that scallop bycatch limits are structured based upon biomass thresholds and fishery closures have occurred in the past for crab bycatch. He also commented that the fleet operates responsively to avoid areas of high crab bycatch. The team noted that bycatch of Tanner crabs in the scallop fishery is not the dominant issue, and clarified that the primary concern is crab bycatch in groundfish fisheries in terms of the potential to drive overfishing. The team does recommend however that assessment authors consider all sources of crab mortality, including bycatch in the scallop fishery, when compiling assessments, something that has not always been done.

Crab Economic SAFE discussion

Brian Garber-Yonts (NMFS AFSC) provided an update on discussions by the CPT economic working group in structuring a forthcoming comprehensive Crab Economic SAFE chapter. He provided both short and long-term objectives for the economic SAFE for Crab. The team discussed the timing of presentation and production of an economic SAFE chapter and indicated that September is the appropriate time for that information to be presented in conjunction with the final Crab SAFE Report. Brian provided an overview of many issues relative to production of this report, including the status of available data, data quality review, and the annual and 5-year reports produced in conjunction with the Crab Rationalization

Program. Also discussed was development of a secure data portal, housed and maintained by AKFIN, that would provide authorized users with access to microdata and pre-defined aggregate statistical information integrated from all ADFG/CFEC and NMFS databases relevant to the BSAI crab fisheries.

Brian reviewed the Crab Economic Data Report data quality assessment process as directed by the Council. While recognizing the cooperation and time devoted by the PNCIAC membership in the assessment, he requested a means for the CPT to participate in future data quality evaluation. He suggested that the involvement of the CPT in evaluating data quality and recommending standards for data quality assessment would add an appropriate layer of scientific review to the existing process.

A proposed outline of the items to be included in a crab economic SAFE document was provided. For the September 2009 report, the outline follows the model of the BSAI Groundfish Economic SAFE chapter. Brian suggested that a more integrated approach to using available socioeconomic information in SAFE reports may be warranted. The team discussed the idea of having a larger workshop to discuss Economic SAFE reports in general (i.e., for groundfish, crab and scallop) and the need for an improved process and clearer objectives for incorporating socioeconomic analysis of fisheries into the fishery evaluation component of SAFE reports.

Jack Taggart suggested that while providing data and tables via AKFIN (as discussed previously) would be useful for analysis and assessment authors, these tables and data should likewise be accessible to the public. (Brian noted that microdata would continue to be treated as confidential and only disclosed to authorized data users.)

The team noted that issues related to data quality may also be incentive-based in that there is a greater incentive to improve data when relative data importance (i.e., their utility in decision-making) increases. Team members further commented that evaluation of crab caught incidentally in other fisheries may help characterize economic losses of bycatch.

New Business

The team discussed the urgent need to streamline meeting discussions and presentations, noting that this meeting was particularly challenging in content and length. Some ideas include the following:

- Provide presentation outlines for assessment review in May and September.
- No written comments on agenda items distributed to the plan team in advance of the meeting, all comments to be made in person at the meeting.
- Add a day to the May meeting (i.e., May 4 days, September 3 days)

Diana Stram offered to circulate agenda items and discussion timing for September in the next several weeks, and provide a draft agenda very early in order to facilitate streamlining the discussions. The fall meeting is scheduled for September 14 – 16 at the AFSC in Seattle. Either a half-day or a full day of the meeting will be in conjunction with the groundfish plan team meeting, depending upon agenda items of joint interest (e.g. ACLs, EFH). An ACL workshop involving many CPT members will occur May 21-22. Diana will circulate a report produced as a result of the ACL workshop to the entire team once it is finalized for SSC review in June 2009.

The meeting adjourned at 4:20 pm, Friday, May 15, 2009.

NPFMC CRAB PLAN TEAM
Draft Agenda 4/13/09vers. – May 11-12, 15, 2009
Traynor Room, AFSC, Seattle

Monday May 11		
Administration	8:30 am	<ul style="list-style-type: none"> • Introductions • Additions to agenda and approval of agenda • Review and approval of May 2008 minutes
Crab bycatch accounting in groundfish fisheries	8:45am	<ul style="list-style-type: none"> • Discussion of catch accounting issues for crab stock assessments
EBS bottom trawl survey reanalysis	10:00am	<ul style="list-style-type: none"> • Discussion on recent and planned changes to the 1975-2008 time series for abundance and variance calculation
LUNCH	12:00 pm	
OFL stock assessment review:		
Norton Sound red king crab	1:00pm	<ul style="list-style-type: none"> • Stock assessment overview • Stock status and OFL determination
St. Matthew blue king crab	2:00pm	<ul style="list-style-type: none"> • Stock assessment overview; changes from previous assessment
BREAK	2:45pm	
EBS Tanner crab	3:00 pm	<ul style="list-style-type: none"> • Stock assessment overview; changes from previous assessment
Bristol Bay red king crab	3:45 pm	<ul style="list-style-type: none"> • Stock assessment overview; changes from previous assessment • Plans for CIE review focus
EBS snow crab	4:15 pm	<ul style="list-style-type: none"> • Stock assessment overview; changes from previous assessment
Tuesday May 12		
Aleutian Island golden king crab	8:30am	<ul style="list-style-type: none"> • Stock assessment overview, proposed model-based assessment • CPT tier recommendation for Sept assessment
BREAK	10:30	
Pribilof Island red king crab	10:45 am	<ul style="list-style-type: none"> • Stock assessment overview; changes from previous assessment
Pribilof Island blue king crab	11:15 am	<ul style="list-style-type: none"> • Stock assessment overview; changes from previous assessment
Pribilof Island golden king crab	11:45am	<ul style="list-style-type: none"> • Stock assessment overview; changes from previous assessment
LUNCH	12:00 pm	
Adak (AI) red king crab	1:00 pm	<ul style="list-style-type: none"> • Stock assessment overview; changes from previous assessment • Discussion of plans for survey and assessment
BREAK	2:45pm	
OFL Recommendations finalization	3:00 pm	Review OFL recommendations, Report writing, Report finalization
Wednesday May 13		Stock assessment/data weighting workshop: agenda TBD
Thursday May 14		
Friday May 15		
Pribilof Island blue king crab rebuilding plan alternatives	8:30 am	<ul style="list-style-type: none"> • Discuss preliminary analysis of CPT recommendations for PIBKC rebuilding plan alternatives; • CPT recommendations (to Council) for alternatives
BREAK	10:15am	
Trawl Sweeps	10:30am	<ul style="list-style-type: none"> • Council request for CPT comment regarding the boundaries of the St. Matthew HCA (and proposed open portion of NBS Research Area) rel to crab stock protection
Discard rates/PSC caps	11:30 am	<ul style="list-style-type: none"> • Overview of origin of discard rates used in groundfish and scallop fisheries, and PSC caps for BSAI groundfish FMP and Scallop FMP; • CPT recommendations (if necc) re new directions
LUNCH	12:15 pm	
Economic SAFE discussion	1:15 pm	<ul style="list-style-type: none"> • Draft SAFE report chapter; results of workgroup discussions (tasked at Sept 08 CPT mtg)
New business	3:30	
ADJOURN	4:00 pm	

NPFMC CRAB PLAN TEAM
Revised agenda remaining 5/14/09 1pm version
 May 15, 2009
Traynor Room, AFSC, Seattle

Friday May 15		
Stock assessments: remaining review issues	8:30 am	<ul style="list-style-type: none"> • Snow crab – clarifying recommendation on rebuilding F rate reduction • Norton Sound RKC-review results of model simulations with $\gamma=1$, $M=0.18$ • BBRKC -clarify model choices by CPT • Tier 5 assessments-clarify timing and recommendations by CPT
OFL Recommendations finalization	9:15 am	Review OFL recommendations, Report writing, Report finalization
<i>BREAK</i>	10:15am	
Pribilof Island blue king crab rebuilding plan alternatives	10:30 am	<ul style="list-style-type: none"> • Discuss preliminary analysis of CPT recommendations for PIBKC rebuilding plan alternatives; • CPT recommendations (to Council) for alternatives
Trawl Sweeps	11:30am	<ul style="list-style-type: none"> • Council request for CPT comment regarding the boundaries of the St. Matthew HCA (and proposed open portion of NBS Research Area) rel to crab stock protection
<i>LUNCH</i>	12:30 pm	
Discard rates/PSC caps	1:30 pm	<ul style="list-style-type: none"> • Overview of origin of discard rates used in groundfish and scallop fisheries • PSC caps for BSAI groundfish FMP and Scallop FMP; • CPT recommendations (if necc) re new directions
Economic SAFE discussion	2:30 pm	<ul style="list-style-type: none"> • Draft SAFE report chapter; results of workgroup discussions (tasked at Sept 08 CPT mtg)
New business	3:30	<ul style="list-style-type: none"> • Sept plan team meeting: timing (14-16 Sept), agenda • ACLs-workshop, analyses for amendments, CPT review (winter mtg: discuss timing)
<i>ADJOURN</i>	4:00 pm	

ALASKA CRAB STOCK ASSESSMENT WORKSHOP
Draft Agenda 3/20/09vers. – May 13-14, 2009
Traynor Room, AFSC, Seattle

Wednesday May 13		
Administration	8:30 am	<ul style="list-style-type: none"> • Introductions • Additions to draft agenda and approval of agenda
Stock assessment reporting:		
Stock Assessment TOR	8:45 am	<ul style="list-style-type: none"> • Punt presentation (30 minutes) • Discussion / modifications • ACL / OFL needs
<i>BREAK</i>	<i>10:30</i>	
Stock Assessment TOR	10:45am	<ul style="list-style-type: none"> • Stock-specific actions • Data rich – snow crab • Data moderate – AI Golden king crab • Data moderate – Norton Sound red king crab
<i>LUNCH</i>	<i>12:00 pm</i>	
Data weighting and diagnostics:		
Practices in other assessments	1:00 pm	<ul style="list-style-type: none"> • Hulson overview (30 minutes) • Ianelli presentation (EBS pollock) (20 minutes) • Dorn presentation (GOA Pollock) (20 minutes) • Dichmont presentation (Australia) (20 minutes)
<i>BREAK</i>	<i>2:45pm</i>	
Initial Recommendations	3:00 pm	<ul style="list-style-type: none"> • Group discussion – what is appropriate for crab • Initial recommendations – data weighting • Initial recommendations – diagnostics • Workplan for overnight analyses
Thursday May 14		
Reprise	8:30am	<ul style="list-style-type: none"> • Results of overnight analyses • Snow crab (Turnock) • Red king crab (Zheng) • AI Golden king crab (Sideek) • Norton Sound rd king crab (Zheng)
<i>BREAK</i>	<i>10:30</i>	
Final recommendations	10:45 am	<ul style="list-style-type: none"> • Synthesis of examples • Final recommendations – data weighting • Final recommendations – fit diagnostics
<i>LUNCH</i>	<i>11:45 am</i>	
Overfishing levels for Tier 4 stocks (calculating Gamma):		
Background and history	12:45 pm	<ul style="list-style-type: none"> • Quinn presentation (background) (20 minutes) • Current approach (Stram / Punt?) (20 minutes) • Likely stocks for Tier 4 (group)
Proxy approaches to estimating $F_{x\%}$	1:45pm	<ul style="list-style-type: none"> • Maturity • Selectivity • Natural mortality • Growth
<i>BREAK</i>	<i>2:45pm</i>	
Reprise	3:00 pm	<ul style="list-style-type: none"> • Recommendations
Conclusions	4:00 pm	<ul style="list-style-type: none"> • Overview of recommendations (Punt) • Plans for September CPT meeting
<i>ADJOURN</i>	<i>4:00 pm</i>	

Stock Assessment and Fishery Evaluation Report
for the
KING AND TANNER CRAB FISHERIES
of the
Bering Sea and Aleutian Islands Regions

2009 BSAI Crab SAFE (Draft)

Compiled by

The Plan Team for the King and Tanner Crab Fisheries
of the Bering Sea and Aleutian Islands

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May 2009



North Pacific Fishery Management Council
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Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries Fisheries of the Bering Sea and Aleutian Islands Regions

Table of Contents

Summary

Introduction	1
Stock Status definitions	1
Status Determination Criteria	2
Crab Plan Team Recommendations	7
Stock Status Summaries	8

Stock Assessment Section

1. EBS snow crab	1-1
2. Bristol Bay red king crab	2-1
3. EBS Tanner crab	3-1
4. Pribilof Islands red king crab	4-1
5. Pribilof District blue king crab.....	5-1
6. Saint Matthew blue king crab	6-1
7. Norton Sound red king crab	7-1
8. Aleutian Islands golden king crab (assessment)	8-1
8a. Aleutian Islands golden king crab (model).....	8a-1
9 Pribilof Island golden king crab [<i>Not included. Final for September only.</i>]	
10 Adak red king crab [<i>Not included. Final for September only.</i>]	

2009 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 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/shellfish/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), EBS 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, the Crab Plan Team reviews draft assessments in May to provide recommendations in a draft SAFE report for review by the Council's Science and Statistical Committee (SSC) in June. In September, the CPT reviews final assessments and provides final OFL recommendations and stock status determinations. Additional information on the new OFL determination process is contained in this report.

The Crab Plan Team met from May 11 to 15, 2009 at the Alaska Fisheries Science Center in Seattle WA to review the draft stock assessments and survey and bycatch data issues, in order to provide the recommendations and status determinations contained in this report. Members of the team who participated in this review include the following: Forrest Bowers (Chair), Ginny Eckert (Vice-Chair), André Punt, Jack Turnock, Shareef Siddeek, Bill Bechtol, Josh Greenburg, Herman Savikko, Brian Garber-Yonts, Gretchen Harrington, Doug Pengilly, Bob Foy, Lou Rugolo, Wayne Donaldson, and Diana Stram. The Team will review revised assessments in September 2009 and will revise this report accordingly at that time to form the final 2009 Crab SAFE report. The final 2009 Crab SAFE report will be presented to the Council in October for their annual review of the status of BSAI Crab stocks.

The CPT participated in the Alaska Crab Stock Assessment Workshop on May 13 and 14. The goal of the workshop was to establish a set of standards for use in all modeling efforts and resolve issues related to the weighting of data sources, such as appropriate weights for different likelihood components and the most appropriate ways to estimate effective sample sizes for length and size composition data. A workshop report will be produced that is prescriptive, provides guidance to assessment authors, and ensures that the stock assessments approach these issues in a similar way. The report from this workshop will be presented to the CPT in September 2009 and included in the final SAFE to inform the models for the 2010/11 assessment cycle.

Stock Status Definitions

The FMP (incorporating all changes made following adoption of Amendment 24) contains the following stock status definitions:

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.

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 criterion are annually formulated and assessed to determine the status of the crab stocks and whether (1) overfishing is occurring or the rate or level of fishing mortality for a stock or stock complex is approaching overfishing, and (2) a stock or stock complex is overfished or a stock or stock complex is approaching an overfished condition.

Overfishing is determined by comparing the overfishing level (OFL), as calculated in the five-tier system for the crab fishing year, 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. This 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 will be set for and compared to the retained catch.

NMFS will determine whether a stock is in an overfished condition by comparing annual biomass estimates to the established MSST, defined as $\frac{1}{2}$ 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.

Annually, the Council, Scientific and Statistical Committee, and Crab Plan Team will review (1) the stock assessment documents, (2) the OFLs and total allowable catches or guideline harvest levels for the upcoming crab fishing year, (3) NMFS's determination of whether overfishing occurred in the previous crab fishing year, and (4) NMFS's determination of whether any stocks are overfished.

Five-Tier System

The OFL for each stock is annually estimated for the upcoming crab fishing year using the five-tier system, detailed in Table 6-1 and 6-2. First, a stock is assigned to one of the five tiers based on the availability of information for that stock and model parameter choices are made. Tier assignments and model parameter choices are recommended through the Crab Plan Team process to the Council's Scientific and Statistical Committee. The Council's Scientific and Statistical Committee will recommend tier assignments, stock assessment and model structure, and parameter choices, including whether information is "reliable," for the assessment authors to use for calculating the OFLs based on the five-tier system.

For Tiers 1 through 4, once a stock is assigned to a tier, the stock status level is determined 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).

Lastly, in stock status level "c," current biomass is below $\beta * (B_{MSY}$ or a proxy for B_{MSY}). 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 Scientific and Statistical Committee 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 Scientific and Statistical Committee recommends an alternative value based on the best available scientific information.

OFLs will be calculated by applying the F_{OFL} and using the most recent abundance estimates. The Crab Plan Team will review stock assessment documents, the most recent abundance estimates, and the proposed OFLs.

The Alaska Fisheries Science Center will set the OFLs consistent with this FMP and forward OFLs for each stock to the State of Alaska prior to its setting the total allowable catch or guideline harvest level for that stock's upcoming crab fishing season.

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) per recruit equal to $X\%$ of the equilibrium level in the absence of any fishing.

The OFL calculation accounts for all losses to the stock not attributable to natural mortality. The OFL is the total catch limit 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 lacking. Therefore, it is not possible to estimate the spawner-recruit relationship. However, there is sufficient information for simulation modeling that captures the essential population dynamics of the stock as well as the performance of the fisheries. The simulation modeling approach employed in the derivation of the annual OFLs captures the historical performance of the fisheries as seen in observer data from the early 1990s to present and thus borrows information from other stocks as necessary to estimate biological parameters such as γ .

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

If the information necessary to determine total catch OFLs is not available for a Tier 4 stock, then the OFL is 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 from this approach, therefore, would be the total catch OFL.

Tier 5

Tier 5 stocks have no reliable estimates of biomass or M and only historical data of retained catch is available. For Tier 5 stocks, the historical performance of the fishery is used to set OFLs in terms of retained catch. The OFL represents the average retained catch from a time period determined to be representative of the production potential of the stock. The time period selected for computing the average catch, hence the OFL, would be based on the best scientific information available and provide the appropriate risk aversion for stock conservation and utilization goals. In Tier 5, the OFL is specified in terms of an average catch value over a time period determined to be representative of the production potential of the stock, unless the Scientific and Statistical Committee recommends an alternative value based on the best available scientific information.

For most Tier 5 stocks, only retained catch information is available so the OFL will be estimated for the retained catch portion only, with the corresponding overfishing comparison on the retained catch only. In the future, as information improves, the OFL calculation could include discard losses, at which point the OFL 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 .

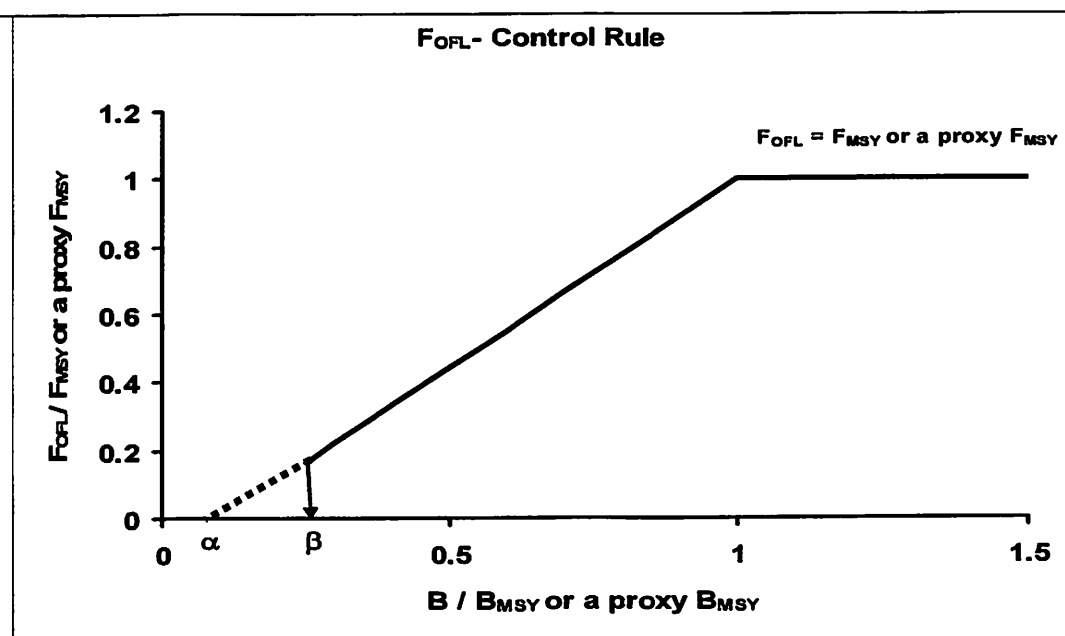


Table 1. Five-Tier System for setting overfishing limits for crab stocks. The tiers are listed in descending order of information availability. Table 6-2 contains a guide for understanding the five-tier system.

Information available	Tier	Stock level	status	F_{OFL}
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. $\beta < \frac{B}{B_{msy}} \leq 1$		$F_{OFL} = \mu_A \frac{\frac{B}{B_{msy}} - \alpha}{1 - \alpha}$
		c. $\frac{B}{B_{msy}} \leq \beta$	Directed fishery $F = 0$ $F_{OFL} \leq F_{MSY}^\dagger$	
B, B_{MSY}, F_{MSY}	2	a. $\frac{B}{B_{msy}} > 1$		$F_{OFL} = F_{msy}$
		b. $\beta < \frac{B}{B_{msy}} \leq 1$		$F_{OFL} = F_{msy} \frac{\frac{B}{B_{msy}} - \alpha}{1 - \alpha}$
		c. $\frac{B}{B_{msy}} \leq \beta$	Directed fishery $F = 0$ $F_{OFL} \leq F_{MSY}^\dagger$	
$B, F_{35\%}, B_{35\%}$	3	a. $\frac{B}{B_{35\%}^*} > 1$		$F_{OFL} = F_{35\%}^*$
		b. $\beta < \frac{B}{B_{35\%}^*} \leq 1$		$F_{OFL} = F_{35\%}^* \frac{\frac{B}{B_{35\%}^*} - \alpha}{1 - \alpha}$
		c. $\frac{B}{B_{35\%}^*} \leq \beta$	Directed fishery $F = 0$ $F_{OFL} \leq F_{MSY}^\dagger$	
$B, M, B_{msy^{prox}}$	4	a. $\frac{B}{B_{msy^{prox}}} > 1$		$F_{OFL} = \gamma M$
		b. $\beta < \frac{B}{B_{msy^{prox}}} \leq 1$		$F_{OFL} = \gamma M \frac{\frac{B}{B_{msy^{prox}}} - \alpha}{1 - \alpha}$
		c. $\frac{B}{B_{msy^{prox}}} \leq \beta$	Directed fishery $F = 0$ $F_{OFL} \leq F_{MSY}^\dagger$	
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.

*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 that 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 $F_{MSY}(\beta-\alpha)/(1-\alpha)$ 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 $\beta \cdot B_{MSY} < B \leq B_{MSY}$.

Overview of changes to the EBS bottom trawl survey timeseries

The EBS bottom trawl time series for crab has been revised from 1975 to 2008. Changes include error fixes and the inclusion of recalculated area swept estimates with net width estimated from net mensuration data instead of a fixed value. Thirty nine individual crab data points affecting abundance estimates at 19 stations were amended after transcription errors were found in the database. The error fixes resulted in minor survey catch count changes in 34 of the data points. Five fixes, however, resulted in increases or decreases in the survey catch count between 1000 and 2000 crabs. Using net width estimated from net mensuration data resulted in changes to all haul records from 1983 to 2008. The range of average net widths estimated in the revised time series was 14.9 to 17.4 m effectively increasing the area swept from a fixed net width of 15.3 m which was used previously. This revised time series was used for the 2009/2010 assessments for Bristol Bay red king crab, Pribilof Islands red king crab, Pribilof Islands blue king crab, and Saint Matthews blue king crab. A more detailed description of the survey changes made for this 2009/2010 assessment cycle will be provided in the final September SAFE.

Crab Plan Team Recommendations

Table 3 lists the team's final recommendations on Tier assignments, model parameterizations, time periods for reference biomass estimation or appropriate catch averages, OFLs, and whether an OFL is applied to retained catch only or to all catch. The team recommends two stocks be placed in Tier 3 (EBS snow crab and Bristol Bay red king crab), five stocks in Tier 4 (EBS Tanner crab, St. Matthew blue king crab, Pribilof Island blue king crab, Pribilof Island red king crab and Norton Sound red king crab) and three stocks in Tier 5 (AI

golden king crab, Pribilof Island golden king crab and Adak red king crab).

The team has general recommendations for all assessments and specific comments related to individual assessments. All recommendations are for consideration for the 2010 assessment cycle unless indicated otherwise. The general comments are listed below while the comments related to individual assessments are contained within the summary of plan team deliberations and recommendations contained in the stock specific summary section. Additional details regarding recommendations are contained in the Crab Plan Team Report (May 2009 CPT Report). Terms of references for Crab Stock assessments following the crab stock assessment workshop will be provided to the Crab Plan Team and authors in September 2009 and will contain additional information guidelines for the material to be included in subsequent assessments.

General recommendations for all assessments

- The assessments should provide complete documentation on model formulation, assumptions, data sources and all calculations used when computing the OFL.
- Any tables depicting commercial fishery harvest or performance should be updated to include the most current information available.
- If the fishery year does not correspond to a calendar year then the fishery year notation should be used (e.g., 2007/08)
- The assessments must include consistent key management-related stock status information
- The assessments should include results based on the modeling approach used in the previous years to allow comparisons to be made with the proposed modeling approach for the current year.
- Estimates of precision for the survey data should be included in all assessments.
- Data (e.g. bycatch, survey) used in the assessment should be included in documentation.
- Table headings should clearly and accurately describe the data, including indicating when the values include a handling mortality assumption and the assumption used.
- Responses to all comments by the SSC and CPT on the September and May drafts of the stock assessment should be clearly addressed and responded to in the assessment.
- Research on handling mortality rates needs to be performed to better specify handling mortality rates used in the analyses.

Stock Status Summaries

1 Eastern Bering Sea Snow Crab

Fishery information relative to OFL setting.

The snow crab fishery has been opened, and harvest reported, every year since the 1960s. Prior to 2000, the GHL was 58% of abundance of male crab over 101 mm CW, estimated from the survey. The target harvest rate was reduced to 20% following the declaration of the stock as overfished in 1999, and the GHL/TAC since 2000 has been based on a harvest strategy that aims to allow recovery to a proxy for B_{MSY} .

Data and assessment methodology

The assessment is based on a size-structured population dynamics model in which crabs are categorized into mature, immature, new shell and old shell crabs by sex. The model is fitted to data on historical catches (landed and discard), survey estimates of biomass, and fishery, discard and survey size-composition data. It covers the 1978-2008 seasons and estimates abundance from 25-29mm to 130-135mm using 5mm size bins. The results of the annual Bering Sea bottom trawl survey are analyzed in three periods: before 1982, 1982-88, and 1989 onwards, with different selectivity and catchability parameters for each period. The model is based on the assumption of a terminal molt at maturity. The 2009 assessment is based on the same model and estimation framework as the 2008 assessment. Research is currently underway to evaluate net selectivity, evaluate the performance of the assessment method using the Management Strategy Evaluation approach, and to explore spatial structure and spatially-structured population dynamics models for snow crab. The assessment team did not implement all of the recommendations from the September CPT meeting, noting that work to estimate selectivity needs to be completed first.

The draft assessment does not use the revised EBS bottom trawl survey time-series.

Stock biomass and recruitment trends

Mature male biomass (MMB at the time of mating) peaked between the late-1980s and mid-1990s, declined to a minimum in 2002 and has increased thereafter. The increase in mature male biomass has been greater than in mature female biomass. Recruitment has varied considerably over the period 1979-2008, with the recruitment (at 25mm) in 1987 the highest on record. Recent recruitment has been near or above average. There are systematic deviations among the time-trajectories of biomass in the retrospective analysis, although the magnitudes of the deviations are generally small. However, the CPT noted that these deviations may be underestimated owing to the way the survey data were weighted.

Tier determination/Plan Team discussion and resulting OFL determination

The CPT recommends that snow crab is a Tier 3 stock so the OFL will be based on the $F_{35\%}$ control rule. The team recommends that the proxy for B_{MSY} ($B_{35\%}$) be the mature male biomass at mating, computed as the average recruitment from 1979 to the last year of the assessment multiplied by the mature male biomass-per-recruit corresponding to $F_{35\%}$, less the mature male catch under an $F_{35\%}$ harvest strategy. The MSST is defined as half of the proxy for B_{MSY} . The assessment presented to the CPT will be updated by incorporating 2009 survey and fishery data into the base model to calculate the 2009/10 OFL and MSST.

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

Year	Biomass (MMB)	OFL	TAC	Retained Catch	Total Catch
2005/06	NA		36.9	37.0	42.3
2006/07	NA		36.2	36.4	43.4
2007/08	NA		63.0	63.0	76.4
2008/09	260.1	77.3	58.6	TBD	TBD
2009/10	TBD	TBD	TBD	TBD	TBD

Stock status determination relative to overfishing and overfished criteria will be made following review of an updated assessment that incorporates the 2009 survey.

Additional Plan Team recommendations

The CPT discussed several issues related to the rebuilding plan for snow crab. Specifically, (a) that the target year for rebuilding is 2011, which is 10 years from when the Secretary of Commerce approved the rebuilding plan, but that the EA prepared for the rebuilding plan analyzed the probability of rebuilding to 2010 and (b) that "being rebuilt" is defined in the FMP as when the mature male biomass is above the B_{MSY} for two years and that this two year requirement is unique to the FMP and not a statutory or National Standard 1 guidelines requirement. This information should be accurately described in the stock assessment.

The team recommends that the total catch in 2009/10 be no higher than the harvest rate which would lead to a 50% probability of rebuilding to $B_{35\%}$ beginning in 2009/10 as determined by the probability projections in the final stock assessment in September 2009.

The September assessment should: (a) update the reference list, (b) re-run the model setting the lambda on the survey data to unity and adjusting the remaining lambdas – this will not change the point estimates of the model outputs, but should widen the confidence intervals making them more realistic, (c) focus projections on the probability of recovery to a B_{MSY} proxy of $B_{35\%}$ (rather than the pre-Amendment 24 B_{MSY} proxy of 921.6t of total mature biomass), although a comparison with the previous B_{MSY} proxy should continue to be reported, and (d) include explicit information detailing the bycatch by sector as well as model assumptions of bycatch.

The next assessment should consider: (a) imposing a penalty to prevent the probability of maturity declining with increasing size if maturity is estimated within the model, (b) set the effective sample sizes for the length-frequency data based on the effective sample sizes estimated from the fit of the model, (c) explore whether it is possible to improve the residual patterns for the length-frequency data by modifying how maturity, growth and natural mortality are modeled and the implications of the change in distribution of the population over time, (d) reducing the number of size classes for females, and (e) fitting to the discard length-frequency data for males rather than to the total length-frequency data for males (to avoid fitting to the retained length-frequency data twice).

Ecosystem Considerations summary

No additional ecosystem considerations were included in the assessment at this time.

2 Bristol Bay red king crab

Fishery information relative to OFL setting.

The commercial harvest of Bristol Bay red king crab (BBRKC) 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 lbs, but harvests dropped sharply in the early 1980s, and population abundance has remained at relatively low levels over the last two decades compared to that seen in the 1970s. The fishery is managed for a TAC coupled with restrictions for size (≥ 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, 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 lbs of effective spawning biomass (ESB), and a minimum GHL of 4.0 million lbs to prosecute a fishery. A TAC of 18.3 million lbs was established for the 2005/6 season, reduced to 15.0 million lbs for the 2006/7 season, and increased to 20.4 million lb for the 2007/8 season and 20.3 million lbs for the 2008/9 season. Catch of legal males per pot lift was relatively high in the 1970s, low in the 1980s to mid-1990's, and increased to an average of 29.7 crab/pot lift over the last three years; CPUE increased markedly with the implementation of the crab rationalization program in 2005. Annual non-retained catch of female and sublegal male RKC during the fishery averaged less than 3.9 million lbs since data collection began in 1990. Estimates of fishing mortality ranged from 0.28 to 0.38 yr^{-1} following implementation of crab rationalization. Total catch was 22.7 million lbs in 2005/6, declined to 17.2 million lbs in 2006/7 and increased to 23.2 million lbs in 2007/8. Retained catch was 20.3 million lbs in the 2008/9 fishery.

Data and assessment methodology

The stock assessment model is based on a length-structured population dynamics model incorporating data from the eastern Bering Sea trawl survey, commercial catch, and at-sea observer data program. Stock abundance is estimated for male and female crabs ≥ 65 -mm CL during 1968-2008, an extension from the previous assessment which considered an assessment period of 1985-2007. Catch data (retained catch numbers, retained catch weight, and pot lifts by statistical area and landing date from the fishery which targets males ≥ 6.5 " 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. The assessment included data from 1968 to 2008 as requested by the CPT in May 2008. There were a number of other changes to the assessment, including re-analysis of the trawl survey data based on revised estimates of the area-swept, from 1975 to 2008, and allowances for changes over time in the size at maturity for females, and mortality. The author evaluated three model scenarios: (1) a constant natural mortality (0.18yr^{-1}) with additional "unexplained" mortality for males and females, and incorporating Bering Sea Fisheries Research Foundation (BSFRF) survey data for 2007 and 2008; (2) constant $M = 0.18\text{yr}^{-1}$ with BSFRF 2008 survey data; and (3) similar to scenario 1, but without BSFRF data.

Stock biomass and recruitment trends

Estimates of total stock biomass increased from 186 million lbs in 1968 to 536 million lbs in 1979, then decreased sharply to a low of 75 million lbs in 1985. Total stock biomass increased generally from 1985 to 247 million lbs in 2008. Recent above-average year classes have largely recruited into the fished population with no evidence of new strong recruitment. Mature male biomass at mating increased from 100 million lbs in 2007/8 to 116 million lbs in 2008/9.

Tier determination/Plan Team discussion and resulting OFL determination

All data used in the model need to be tabulated in the document and fits to all data components shown in

figures. For example, model estimates of pot discard catch and total catch from all sources should be included in the catch table for all years (1968 to present) and the BSFRF survey indices should be tabulated and the fit to them shown.

The team noted that the use of the NMFS survey data to set a prior for estimation of Q for the BSFRF survey is not appropriate as this uses the data twice.

Additional mortality for 1976-1993 is estimated in the model and referred to as natural mortality. The CPT recommends this additional mortality be referred to as unknown mortality, which could be fishing mortality or natural mortality. The CPT also requests better justification for the time periods used for unknown mortality estimation and exploration of alternative periods.

The CPT considered four time periods for estimation of $B_{35\%}$ including: (1) adopt the author's recommendation using recruitment from 1995 to present; (2) 1985 to present, (3) all years, 1968 to present, and (4) pre-collapse years, 1968 to 1980. The team discussed whether changes in stock production have occurred over period 1968 to present. The team recommended the author's suggested time period of 1995-current for estimation of $B_{35\%}$. For Spring 2010, the team recommends additional analyses into whether stock production has changed over time, including a discussion on regime shifts in the Bering Sea and possible mechanisms for effects on red king crab recruitment.

The CPT recommended model scenario 3. The team did not have sufficient information regarding the BSFRF survey results, and in any case, not all of the BRFRF data were included in the assessment to recommend a model scenario which incorporates these data.

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 1995 to the last year of the assessment multiplied by the mature male biomass-per-recruit corresponding to $F_{35\%}$ less the mature male catch under an $F_{35\%}$ harvest strategy.

Historical status and catch specifications (million lbs.) of BBRKC in recent years.

Year	Biomass (MMB)	OFL	TAC	Retained Catch	Total catch
2005/06	NA		18.3	18.3	22.72
2006/07	NA		15.5	15.4	17.22
2007/08	NA		20.4	20.4	23.23
2008/09	95.6	24.2	20.3	20.3	TBD
2009/10	TBD	TBD	TBD	TBD	TBD

Stock status determination relative to overfishing and overfished criteria will be made following review of an updated assessment that incorporates the 2009 survey.

Additional Plan Team recommendations

For the September 2009 assessment, the CPT requests that model scenarios 1 and 2 be retained in conjunction with model 3 scenario which is recommended for OFL setting in the 2009/10 fishing year. The Plan Team identified the need for all model input data to be tabulated.

Future assessments include some analysis of model sensitivity to different weightings (lambdas). The magnitudes of lambdas have a direct affect on projected biomass and likelihood profiles because increasing lambdas impact the widths of the profiles. In terms of evaluating uncertainty in some of the forcing parameters, the team recommends that the authors provide a plot of a likelihood profile for some of the

parameters such as trawl survey catchability and M . It was also recommended that the author consider parameter estimation in a fully Bayesian context. Figures of standardized residuals should be provided, along with providing clarification on whether the residual patterns reflect a cohort effect or a growth effect. The team also requested clarification of the effect of aging errors on molt probability. The team recommends that a column be added in the catch table for total catch (all sources of catch) for all years.

Ecosystem Considerations summary

A variety of ecological factors likely affect BBRKC recruitment and growth, although the mechanisms are unclear. For example, previous research suggested BBRKC recruitment trends may partly relate to decadal shifts in physical oceanography. Recruitment may also relate to spatial and temporal patterns in groundfish distributions. Finally, spatial distributions of RKC females have likely shifted in response to changes in near bottom temperatures.

3 Eastern Bering Sea Tanner crab

Fishery information relative to OFL setting.

Two fisheries, one east and one west of 166° W. longitude, harvest eastern Bering Sea (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, NMFS will set one OFL for the eastern Bering Sea Tanner crab because evidence indicates that the EBS Tanner crab is one stock. Both fisheries were closed from 1997 to 2005 due to low abundance. NMFS declared this stock overfished in 1999 and the Council developed a rebuilding plan. In 2005, abundance increased to a level to support a fishery in the area west of 166° W. longitude. ADF&G opened both fisheries for the 2006/07 to 2008/09 crab fishing years. In 2007, NMFS determined the stock was rebuilt because spawning biomass was above B_{MSY} for two consecutive years.

Tanner crab are caught as bycatch in the groundfish 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 the Bristol Bay red king crab).

Data and assessment methodology

This stock is surveyed annually by the NMFS EBS trawl survey. Although a stock assessment model has been developed for the eastern portion of the stock, this model is not employed to assess the stock because it does not cover the entire EBS. Area-swept estimates of biomass from the EBS trawl survey are used to estimate biomass of stock components: mature male biomass (MMB), legal male biomass (LMB), and females. Fish ticket data are used for computing retained catch and observer data from the crab, and groundfish fisheries are used to estimate the non-retained catch; assumed handling mortality rates for fishery components are used to estimate the discard mortality.

Stock biomass and recruitment trends

Mature male biomass (MMB) and legal male biomass (LMB) showed peaks in the mid-1970s and early 1990s. MMB at the survey revealed an all-time high of 623.9 million pounds in 1975, and a second peak of 255.7 million pounds in 1991. From late-1990s through 2007, MMB has risen at a moderate rate from a low of 25.1 million pounds in 1997. Post-1997, MMB at the time of survey increased to 185.2 million pounds in 2007 and subsequently decreased to 143.1 million pounds in 2008. In the 2008 survey, estimated abundance of legal males increased over the 2007 abundance estimate by 9%; however, the 2008 survey showed a marked decline in estimated abundance across all other size classes of males and females (see Figure 9 in the stock assessment).

Tier determination/Plan Team discussion and resulting OFL determination

The team recommends the OFL for this stock be based on the Tier 4 control rule because no stock assessment model has been developed for the entire EBS stock. The team recommends that B_{REF} is based on the average mature male biomass (MMB) for the years 1975-1980, discounted by fishery removals (retained and non-retained mortalities) and natural mortality between the time of survey and the time of mating. This time period is thought to represent the reproductive potential of the stock because it encompasses periods of both high and low stock status equivalently. This equates to a B_{REF} of 189.76 MMB. The team recommends that gamma (γ) be set to $\gamma=1.0$.

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

Year	Biomass (MMB)	OFL	TAC (east + west)	Retained Catch	Total Catch†
2005/06	86.24		1.6	0.95	4.19
2006/07	126.58		2.97	2.12	11.95
2007/08	150.74		5.62	2.11	8.80
2008/09	108.28	15.52	4.3	1.7	TBD
2009/10	TBD	TBD	TBD	TBD	TBD

† Total catch estimates are calculated using handling mortality rates, per Table 4 in the stock assessment.

Stock status determination relative to overfishing and overfished criteria will be made following review of an updated assessment that incorporates the 2009 survey

Additional Plan Team recommendations

- Use most recent data available, including revised survey data and revised bycatch data from the groundfish fisheries.
- The assessment should provide complete documentation on data sources and the calculations and assumptions used in the stock assessment for computing OFL. Table headings should clearly and accurately describe the data, including indicating when data includes a handling mortality assumption.

Ecosystem Considerations summary

Ecosystem considerations for this stock were not discussed by the CPT.

4 Pribilof Islands red king crab*Fishery information relative to OFL setting*

There is no harvest strategy for this fishery in State regulation. The fishery began as bycatch in 1973 during the blue king crab fishery. A red king crab fishery opened with a specified GHL for the first time in September 1993. The 1993/94 fishery yielded 2.6 million pounds under a 3.4 million pound GHL, with the highest catches occurred east of St. Paul Island, but harvests also south, southwest, west, and northeast of St. Paul Island. The 1994 fishery was also prosecuted with a specified red king crab GHL. Since 1995, a combined GHL for red and blue king crabs was set and ranged from 1.25 to 2.5 million pounds. The fishery has remained closed since 1999 because of uncertainty with estimated red king crab survey abundance and concerns for incidental catch and mortality of blue king crab, an overfished and very depressed stock. Prior to the closure, the CDQ harvest (3.5%) in 1998/99 was 35,958 pounds. The non-retained catches (without application of bycatch mortality rate) from pot and groundfish bycatch estimates of red king crab ranged from 0.11 to 0.19 million pounds during 1991/92 – 2007/08.

Data and assessment methodology

Although a catch survey analysis has been used for assessing the stock in the past, which incorporated data from the eastern Bering Sea trawl survey, commercial catch, pot survey, and at-sea observer data; for this assessment, trends in MMB at mating are based on NMFS annual trawl survey estimates for 1980-2009 and incorporated commercial catch and observer data. The revised NMFS trawl survey historical abundance estimates were used in this assessment. For 2009 reference points' estimation, an F_{OFL} is determined using a mean mature male biomass (MMB) at the time of mating (projected to mating time), the default γ value of 1, and an M value of 0.18yr^{-1} . The stock assessment analyzes two time period options for estimating mean MMB as a proxy B_{MSY} , 1991-2008 and 1980-2008. This F_{OFL} is applied to the projected legal male biomass at the time of the fishery to determine the catch OFL. Total crab removal (retained, and directed and non-directed bycatch losses) with legal male biomass and MMB are used to estimate the exploitation rates on legal male and mature male biomasses, respectively, at the time of the fishery.

Stock biomass and recruitment trends

The stock exhibited widely varying mature male and female abundances during 1980-2008. The estimate of MMB from the 2008 survey was 12.49 million pounds. The recruitment trend appeared to be highly variable. However, survey estimates are highly influenced by the results of a limited number of tows with non-zero catches. Red king crabs have been historically harvested with blue king crabs and are currently the dominant of the two species in this area.

Tier determination/Plan Team discussion and resulting OFL determination

This stock is recommended to be in Tier 4. For the 2009/2010 fishery, the CPT recommends using the period 1991-2009 to determine mean MMB at mating time as a proxy B_{MSY} . The estimated proxy B_{MSY} is X million pounds. The team recommends that γ be set to 1.0.

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

Year	Biomass (MMB)*	Total Catch OFL	TAC	Retained Catch	Total Catch
2005/06	2.59		Closed	0	0.064
2006/07	13.87		Closed	0	0.024
2007/08	14.70		Closed	0	0.008
2008/09	9.26	3.32	Closed	0	TBD
2009/10	TBD	TBD	TBD	TBD	TBD

*Note this biomass is projected to the time of mating.

The 2009 MMB estimate of X is compared with the proxy for MSST (half of mean mature male biomass for 1991-2008) to determine whether the stock is overfished or not. The CPT will evaluate whether overfishing occurred during 2008/2009 when the total catches for 2008/2009 become available.

Additional plan team recommendations

The CPT looks forward to an update on the catch survey model is for May 2010.

Ecosystem Considerations summary

There have been no direct studies of the prey of Pribilof Islands red king crab. Studies in other areas indicate that red king crab diet varies with life stage and that red king crabs are opportunistic omnivorous feeders, eating a wide variety of microscopic and macroscopic plants and animals. Pacific cod is the major predator of red king crab in the eastern Bering Sea. Recruitment trends for red king crab in the eastern Bering Sea may be partly related to decadal shifts in climate and physical oceanography. Strong year classes were observed when temperatures were low and weak year classes were observed when temperatures were high, but temperature alone cannot explain year class strength trend. The lack of king crab recruitment in the Pribilof Islands area may be the result of a large-scale environmental event affecting abundance and distribution.

Seasonal ice cover has an effect on primary productivity and hence crab recruitment, but the effect of changes in ice cover on benthic communities of the Pribilof Islands are not well known. The trawl fishery ban around the Pribilof Islands protects red king crab critical habitat in this area. The extent that pot gear impacts benthic habitat is not well known and most likely depends on the substrate.

5 Pribilof District blue king crab

Fishery information relative to OFL setting.

The Pribilof blue king crab fishery began in 1973, with peak landing of 11.0 million lbs in the 1980/81 season. A steep decline in landings occurred after the 1980/81 season. Directed fishery harvest from 1983 until 1987 was annually less than 1.0 million lbs with low CPUE. The fishery was closed in 1988 until 1995. The fishery reopened from 1995 to 1998. Fishery harvests during this period ranged from 1.3 to 0.5 million lbs. The fishery closed again in 1999 due to declining stock abundance and has remained closed through the 2008/09 season.

Estimated total mature biomass, based on the ADF&G catch-survey model decreased from 7.0 million lbs in 2001 to 4.5 million lbs in 2002, a level below MSST and resulting in the stock being declared overfished in 2002.

Data and assessment methodology

The NMFS conducts an annual trawl survey that is used to produce area-swept abundance estimates. In 2009 NMFS updated the trawl survey time series resulting in a minor adjustment in current and historical survey biomass and a minor adjustment in the B_{MSY} calculation. The CPT 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.

Stock biomass and recruitment trends

Based on 2008 NMFS bottom-trawl survey, the estimated total mature-male biomass of 0.29 million pounds is higher than the 2007 estimate of 0.17 million pounds. However, the 2008 estimate is only 0.03 of B_{MSY} . The Pribilof blue king crab stock continues to show no indications of recovery. From recent surveys there is no indication of recruitment.

Tier determination/Plan Team discussion and resulting OFL determination

This stock is recommended for placement into Tier 4. The time period for B_{MSY} is 1980-84 plus 1990-97, excluding the period 1985-1989. 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 as 9.01 million pounds. MSST is one half of the B_{MSY} .

The CPT recommended $\gamma = 1$, given the absence of information presented to establish an alternate value at this time. Natural mortality was $M=0.18\text{yr}^{-1}$.

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

Year	Biomass MMB*	OFL	TAC	Retained Catch	Total Catch
2005/06	0.68		closed	0	0.002
2006/07	0.33		closed	0	0.004
2007/08	0.66		closed	0	0.060
2008/09	0.24	0.004	closed	0	TBD
2009/10	TBD	TBD	Closed	0	TBD

*Note this biomass is at the time of mating. The value for 2008/09 is projected.

The 2009 MMB estimate of X is compared with the proxy for MSST to determine whether the stock is overfished or not. The CPT will evaluate whether overfishing occurred during 2008/2009 when the total catches for 2008/2009 become available.

Additional Plan Team recommendations

The rebuilding plan needs to be revised given new estimates of stock status parameters. Management options for revising the rebuilding plan are contained in the Crab Plan Team minutes (May 2009).

6 St. Matthew blue king crab

Fishery information relative to OFL setting

The fishery was prosecuted as a directed fishery from 1977 to 1998. The stock was declared overfished and closed in 1999, and has been under a rebuilding plan since 2000. The fishery has remained closed since 1999.

Data and assessment methodology

A four-stage catch survey analysis that incorporates annual trawl survey data from 1978 to present, triennial pot survey data from 1995 to 2007, and commercial catch data from 1978 to 2007, and uses a maximum likelihood approach to estimate male crab biomass and abundance forms the basis for the assessment. The model links crab abundance in four crab stages based on a growth matrix, estimated mortalities, and molting probabilities. The four stages are prerecruit-2s (90-104 mm CL), prerecruit-1s (105-119 mm CL), recruits (newshell 120-133 mm CL), and postrecruits (oldshell \geq 120 mm CL and newshell \geq 134 mm CL). The assessment considered five scenarios to related natural mortality (M) or survey catchability (Q). The first three scenarios include estimated M for one year (1999), while the other two assume that M was constant over time. The scenario with q and M fixed (with estimating M in 1999) was selected by the CPT because of the uncertainty in parameter estimation.

Stock biomass and recruitment trends

MMB has fluctuated greatly in three waves. The first pulse increased from 7.6 to over 17.6 million lbs from 1978 to 1981, followed by a steady decrease to 2.9 million lbs. in 1985. The second pulse had a steady increase from the low in 1985 to 13.3 million lbs. in 1997 followed by a rapid decrease to 2.8 million lbs. in 1999. The third pulse had a steady increase from the low in 1999 to its present high of over 10.7 million lbs. in 2008.

Tier determination/Plan Team discussion and resulting OFL determination

St. Matthew blue king crab is recommended as a Tier 4 stock. The $B_{MSYproxy}$ varies as a function of years used to calculate average MMB. The time period selected by CPT for estimating $B_{MSYproxy}$ was 1989 to current. This because the stock was harvested at extremely high rates before 1986 and this time period incorporates stock rebuilding several years after the stock crash. $B_{MSYproxy}$ during this time period is 7.39 million lbs. and $\gamma = 1$.

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

Year	Biomass* (MMB)	OFL	TAC	Retained Catch	Total Catch
2005/06	NA		closed	closed	TBD
2006/07	NA		closed	closed	TBD
2007/08	NA		closed	closed	TBD
2008/09	10.74	1.63 [retained]	closed	closed	TBD
2009/10	TBD	TBD	TBD	TBD	TBD

*Note this biomass is projected to the time of mating.

The 2009 MMB estimate of X is compared with the proxy for MSST to determine whether the stock is overfished or not. The CPT will evaluate whether overfishing occurred during 2008/2009 when the total catches for 2008/2009 become available.

Additional Plan Team recommendations

- 1) The model should continue to be refined for review at the May 2010 CPT meeting to allow this stock to be considered for Tier 3.
- 2) Bycatch data in all fisheries must be compiled to generate a total catch OFL. Note this needs to be done for the September 2009 assessment to calculate a total (male) catch OFL in the 2009/10 fishery. The model should be modified in the future to allow for the total catch OFL to include both males and females.
- 3) Confidence intervals are needed on model output as well as CVs for survey data. The assessment needs to include figures showing data and fits to these data for both pot and trawl surveys including confidence intervals on data and model results.
- 4) The assessment should also examine the sensitivity of the weighting choices employed in the model to examine relative influence on results [e.g. conducting the assessment using each of the two indices of abundance in turn (pot and trawl survey)].
- 5) Include separate likelihood components for the total number of crab and the breakdown to size-class to address lack of independence in the residuals evident in the bubble plots.
- 6) Report the number of parameters used in each of the model scenarios.
- 7) Justify how changes in molting probability affect model results.
- 8) Use the existing model and conduct a simulation to determine how the stock would, hypothetically, respond to fishing at the proxy for F_{MSY} as an exercise to inform B_{MSY} .

Ecosystem Considerations summary

Information on habitat, prey availability and predator trends are needed with greater spatial and temporal resolution in order to better understand how they may vary with St. Matthew blue king crab abundance.

7 Norton Sound Red King Crab

Fishery information relative to OFL-setting

Norton Sound red king crab harvest occurs in three fisheries: summer commercial, winter commercial, and winter subsistence fishery. The summer commercial fishery is the major fishery. Commercial fishing started in 1977 and, since 1994, commercial vessels were restricted harvesting Norton Sound red king crab only. In 1998, Community Development Quota groups were allocated a portion of the summer fishery quota. The winter commercial fishery is relatively small averaging 2,400 crabs annually during 1997-2007. The subsistence fishery, which averaged 5,300 crabs during 1978-2007, occurs mainly during the winter via hand lines and pots deployed through the near shore ice.

The management strategy for Norton Sound red king crab involves a stepped harvest rate (HR). The guideline harvest level for the summer fishery is established at three levels based on estimated legal biomass (ELB): (1) HR = 0% for ELB < 1.5 million lbs; (2) HR ≤ 5% for ELB from 1.5 to 2.5 million lbs; and (3) HR ≤ 10% for ELB > 2.5 million pounds.

Data and assessment methodology

Fishery-dependent data are available for the three fisheries. Fishery-independent data are available through four surveys: summer trawl, summer pot, winter pot, and a preseason pot survey. Surveys are conducted periodically with no survey being conducted on an annual basis. No observer program-based bycatch or discard data is available for the fisheries. A length-based stock model was developed to estimate annual stock abundance for the period 1976-2007. Summer commercial fishery data are available from 1977. The current 2009 stock assessment was updated with data from the 2008 fall trawl survey, 2008 winter pot survey, and the 2008 summer commercial fishery. The 2008/09 retained fishery catch data used in the analysis are incomplete. No directed fishery discard losses, or stock losses resulting from non-directed fishery bycatch were included in this 2009 assessment.

Stock biomass and recruitment trends

Estimated legal stock abundance was high during the 1970s, low in the early 1980s and mid 1990s, and has gradually trended upward since 1996. Estimated recruitment was low in the late 1970s and early and late 1990s, and higher in the early 1980s, mid 1990s, and early 2000s, with a generally upward trend in the most recent seasons.

Tier determination, Plan Team discussion and OFL determination

The Crab Plan Team discussed the current stock assessment model. The CPT had major concerns about the suitability of the model presented for OFL-setting, and offered several recommendations and requests of the authors:

1. The team requested that the assessment model from the previous year be included in the current assessment in order to evaluate the impact of changes made to the model, and to have those results as a fall-back option if the current model is unsuitable and rejected for OFL-determination.
2. In this assessment, stock losses due to natural mortality and only retained catch are considered. Mortalities due to directed fishery discards and non-directed bycatch are not included; thus, handling mortality is explicitly set equal to zero. The team discussed the justification for a zero handling mortality rate assumption and questioned the justification as described in the assessment.

The author justified this rate based on the absence of observer data. The author also justified the lack of discard and bycatch mortality as the only source of such mortality is temperature (i.e. freezing) induced and this is not significant due to the timing of the fishery. This justification was considered inadequate by the team and the assumption of zero non-retained mortality to be implausible. The team noted other sources of potential mortality such as that resulting from handling stress and physical damage of non-retained crab. The team recommended that in the absence of observer data on discards and bycatch, the assessment should include a sensitivity analysis as to a plausible range of non-retained mortalities. The team also suggested that the approach used in the Bristol Bay red king crab assessment for estimating discard catch in the directed fishery be used as a benchmark, and that these results be compared to those resulting from the zero non-retained mortality assumption.

3. The team did not approve the model scenario which included a naturally mortality rate = 0.3 and requested instead the use of 0.18. The team discussed the likelihood profiles of M presented in the assessment (Chapter 7, Figure 2) and did not consider the rate of 0.30 to be adequately supported by either profile. The team also did not support natural mortality arguments based on longevity as presented in the assessment.
4. The team had major concerns about the use of $\gamma = 0.6$ in the 2009 OFL analysis and requested that the model be reevaluated with a $\gamma = 1$ as their preferred alternative. The assessment was modified to include this.
5. The team requests that the assessment be updated for September 2009 with the 2008/09 retained catch included in order to determine if overfishing was occurring in 2008/09.
6. The team requests further analysis of the retrospective pattern in the assessment given concerns regarding the consistent pattern indicating an overestimate of biomass compared to the trawl survey.
7. The team approved the authors' recommendation of the use of 1983-2009 to estimate the B_{MSY} proxy which excludes the 1976-1982 period due to uncertainty in biomass estimates, however the team requests that author provide a more complete rationale for choice of range of years in future assessments.
8. The team recommended inclusion of an assumed bycatch and discard mortality for the subsequent assessments.
9. The team requested that the subsequent assessment also include a Tier-5 calculation.

The team recommended Tier 4 stock status for a 2009/10 retained catch OFL of 0.7125 million pounds. The B_{MSY} proxy is 3.07 million lbs, F_{MSY} proxy = 0.18, MMB in 2009 = 5.83 million lbs. This OFL is established in June 2009 in order to allow for the summer fishery.

Historical status and catch specifications (million lbs.) of Norton Sound red king crab

Year	Biomass (MMB)	OFL	TAC	Retained Catch	Total Catch
2005/06	3.89		0.37	0.40	
2006/07	3.62		0.45	0.45	
2007/08	4.40		0.32	0.31*	TBD
2008/09	5.24	0.68 [retained]	0.41	0.39*	TBD
2009/10	5.83	0.71 [retained]	TBD	TBD	TBD

*Summer fishery only. Small winter and subsistence fisheries not included.

The 2009 MMB estimate of 5.83million lbs is compared with the proxy for MSST to determine whether the stock is overfished or not. The CPT will evaluate whether overfishing occurred during 2008/2009 when the total catches for 2008/2009 become available.

Additional Plan Team recommendations

The team also recommended that the summary fishery performance table include the most recent year's catch, the corresponding estimated catch used in the stock assessment model and the OFL. Finally, figures should be clearly configured for ease of interpretation (e.g., X-axes offset in the comparison of observed

and estimated abundances, and the most recent observations clearly marked showing the relationship between harvest rates and mature male biomass).

The team reiterated the ongoing request that the assessment show results of sensitivity analyses for key model parameters to assist in evaluating alternative model specifications.

8 Aleutian Islands golden king crab

Fishery information relative to OFL setting

The fishery has been prosecuted as a directed fishery since the 1981/82 season and has been open every season since then. Retained catch peaked during the 1985/86–1989/90 seasons (average catch of 11.9 million lbs), but average harvests dropped sharply from the 1989/90 to 1990/91 season and the average harvest for the period 1990/91–1995/96 was 6.9 million lbs. Management for a formally established GHL was first introduced with a 5.9-million lb GHL in the 1996/97 season, subsequently reduced to 5.7-million lbs beginning with the 1998/99 season. The GHL (or TAC, since the 2005/06 season) remained at 5.7 million lbs through the 2007/08 season. In March 2008 the Alaska Board of Fisheries set the TAC for this stock in regulation at 5.985 million pounds. Average retained catch for the period 1996/97–2007/08 was 5.6 million lbs, including 5.5 million lbs in the 2007/08 season. This fishery is rationalized under the Crab Rationalization Program.

Data and assessment methodology

There is no assessment model in use for this stock. 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-frequency data from samples of landed crabs, at-sea observer data from pot lifts sampled during the fishery (date, location, soak time, catch composition, size, sex, and reproductive condition of crabs, etc), data from a triennial pot survey in the Yunaska-Amukta Island area of the Aleutian Islands (approximately 171° W longitude), recovery data from tagged crabs released during the triennial pot surveys and bycatch data from the groundfish fisheries. These data are available through the 2007/08 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.

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. However, there is good evidence that the sharp increase in CPUE of retained legal males during recent fishery seasons was not due to a sharp increase in recruitment of legal-size males.

Tier determination/Plan Team discussion and resulting OFL determination

AIGKC is recommended for Tier 5 stock in 2009/2010. B_{MSY} and MSST are not estimated for this stock. Observer data on bycatch from the directed fishery is too incomplete to provide estimates of total catch for the time periods under consideration; there is no observer data from the directed fishery prior to the 1988/89 season and observer data are lacking or confidential for at least one management area in the Aleutian Islands for four seasons of seven seasons during 1988/89–1994/95. Hence, OFL was recommended for this year as a retained catch OFL. The time period for calculating average catch was selected as 1990/1991 to 1995/1996 because before 1990, during a period of unconstrained harvest, there were indications (declining CPUE and catch) that large catches prior to 1990 were not sustainable. Post 1996 harvests were constrained by a constant GHL/TAC and therefore may not be representative of true production potential. The CPT believes that the 1990/1991 to 1995/1996 time period best represents the sustainable, long-term production potential of the stock. This recommendation differs with the approach taken by the SSC in June 2008. However the

reasons for recommending the year period 1990/1991 - 1995/1996 to calculate the OFL persist from the prior year's assessment.

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

Year	Biomass (MMB)	OFL (retained)	TAC	Retained Catch	Total Catch*
2005/06	NA		5.70	5.52	8.06
2006/07	NA		5.70	5.22	7.87
2007/08	NA		5.70	5.51	8.76
2008/09	NA	9.18	5.99	TBD	TBD
2009/10	NA	6.93	TBD	TBD	TBD

*total catch listed here has not been discounted for mortality of bycatch and discards, groundfish bycatch data is for calendar years 2005, 2006, and 2007 respectively.

No overfished determination is possible for this stock given the lack of biomass information. The CPT will evaluate whether overfishing occurred during 2008/09 when the catches for 2008/09 become available.

Additional Plan Team recommendations

The plan team reviewed a new stock assessment model for Aleutian Islands golden king crab (Chapter 8b). Use of an assessment model could allow for this stock to be moved to Tier 4 and would provide focus for establishing research and data collection priorities. The team feels that the model has been improved greatly from the 2008 iteration. The team recommends incorporation of plan team comments into the model for the September 2009 plan team meeting but did not recommend adopting the model for OFL determination in this year. Specific comments on model suggestions are contained in the May Crab Plan Team report.

Ecosystem Considerations summary

The assessment author should reference the Aleutian Islands Fishery Ecosystem Plan in future assessment reports. The author reviewed the June 2008 SSC comments on ecosystem considerations for this stock. However an ecosystem discussion was not included in the assessment. The specific SSC comments regarding sea bird predation on larval crabs may be difficult to address for this stock.

9 Pribilof Islands golden king crab

Fishery information relative to OFL setting

The domestic fishery around the Pribilof Islands for male golden king crab ≥ 5.5 in. CW (≥ 124 mm. CL) developed in 1982. Since then, fishery participation has been sporadic and retained catches variable. The fishery has been managed for a GHF of 0.15 million lbs since 2000. Non-retained bycatch occurs in the directed fishery as well as in the Bering Sea snow crab and grooved Tanner crab fisheries. This fishery was not included in the Crab Rationalization Program. This fishery is the only fishery considered here in which the fishery year corresponds with the calendar year; the fishery opens on January 1 and is open year round operating under an ADF&G commissioner's permit. No permits have been issued since 2005 for this fishery.

Data and assessment methodology

There is no survey and no assessment model in use for this stock. Available data are from fish tickets (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 at-sea observer data from 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 is confidential due to low numbers of participating vessels or processors.

Stock biomass and recruitment trends

Estimates of stock biomass are not available. Between 2002 and 2005, the average size of legal male golden king crab taken in the commercial fishery decreased while CPUE increased, which may suggest some recruitment to the legal male portion of the stock during that period.

Tier determination/Plan Team discussion and resulting OFL determination

The team recommends that this stock be assigned to Tier 5 due to the lack of available biomass information. No assessment was presented for this stock at the meeting; the assessment will be presented at the September 2009 CPT meeting when the OFL for 2010 will be recommended. However, options for time periods and for considering a total catch OFL were presented. Due to the lack of observer data on bycatch during this fishery prior to 2001, a total catch OFL can not be estimated for the time period that the retained catch OFL for 2009 was based on (1993–1999). Due to either confidentiality of retained catch data or lack of observer data a total catch OFL can only be computed from the average of the 2001 and 2002 seasons, both of which were fished under the constraint of a 150,000 pound GHL. Hence it is recommended that the 2010 OFL for fishery be established as a retained catch OFL. It is also recommended that time periods for computing the OFL not include any seasons after 2007.

Status and catch specifications (million lbs.) of Pribilof Islands golden king crab

Year	Biomass (MMB)	OFL	GHL	Retained Catch	Catch (non retained all fisheries)
2007	NA		0.15	0	(not available)
2008	NA		0.15	0	(not available)
2009	NA	0.17 [retained]	0.15	0	(not available)
2010	NA	TBD[retained]	TBD	TBD	TBD

No overfished determination is possible for this stock given the lack of biomass information. The CPT will evaluate whether overfishing occurred during 2008 in September 2009.

Additional Plan Team recommendations

All sources of mortality should be included in the next assessment for the years when bycatch data is available.. The team recommends that additional information from the NMFS slope survey be included in the assessment for 2009.

10 Adak red king crab, Aleutian Islands*Fishery information relative to OFL setting*

The domestic fishery has been prosecuted since 1961 and was opened every season through the 1995/96 season. Non-retained catch of red king crabs occurs in both the directed red king crab fishery and in the Aleutian Islands golden king crab fishery. Estimated non-retained catch during the 1996/97-2008/09 seasons has been low (less than 50,000 lbs) and was less than 10 percent of the retained catch in 2002/03 and 2003/04 seasons.

Peak harvest occurred during the 1964/65 season with a retained catch of 21 million pounds. Most or all of the retained catch was harvested in the area between 172° W longitude and 179° 15' W longitude during the early years of the fishery through the late 1970s. The area west of 179° 15' W longitude began to account for a larger portion of the retained catch as the annual retained catch decreased into the mid-1970s and the early-1980s. Retained catch during the 10-year period 1985/86 through 1994/95 averaged 943,000 lbs, but the retained catch during the 1995/96 season was only 39,000 lbs. The fishery was opened only occasionally since the 1995/96 seasons. There was an exploratory fishery with a low GHL in 1998/99; three ADF&G Commissioner's permit fisheries in limited areas during 2001 and 2002 to allow for ADF&G-Industry

surveys, and two commercial fisheries with a GHL of 500,000 lbs 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 seasons (2002/03 and 2003/04) were opened only in the Petrel Bank area. Retained catch in the last two commercial fishery seasons was 506,000 lbs (2002/03) and 479,000 lbs (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, in the Aleutian Islands golden king crab fishery, and groundfish fisheries. Estimated non-retained catch during the 1996/97-2006/07 seasons averaged 26,000 lbs per year. This fishery is rationalized under the Crab Rationalization Program only for the area west of 179° W longitude.

Data and assessment methodology

There is no assessment model in use for this stock. ADF&G conducts periodic pot surveys in the area. Prior to the 2006 survey, the last one conducted was in 2001, performed with industry participation under provisions of an ADF&G commissioner's permit. In 2006, ADF&G also conducted "niche" fishing in addition to their regular survey design. Pots were fished at locations between the survey stations, in strings similar to commercial fishing, utilizing the expertise of the vessel captain to provide location and pot spacing. Niche fishing was conducted to the northwest portion of the Petrel Bank, the area that produced the highest catch of red king crabs during the 2006 survey. Comparisons with the November 2001 industry survey were made for both the 2006 survey and niche fishing. Due to differences in fishing practices, direct comparisons cannot be made between the CPUE of legal males obtained during this survey with that obtained during the 2001 industry survey. Recognizing the limitations in making direct comparisons of the CPUE of legal males between the 2006 survey and the November 2001 survey, the following observations on CPUE of legal males during the 2006 survey and niche fishing relative to results of the November industry survey provide strong evidence that the abundance of legal red king crabs in the Petrel Bank area was substantially lower in November 2006 than in November 2001. ADF&G attempted to do another systematic pot survey in 2007, but did not receive any bids for the charter. For 2009, the department will be chartering a large crab pot vessel to conduct a red king crab survey and research activities in the Petrel Bank waters of the Aleutian Islands. The charter will take place between November 1 and December 5, 2009. Future pot surveys will be dependent upon ADF&G's ability to secure bids for charter work. ADF&G has also been in discussion with industry representatives concerning their desire for ADF&G review of future, detailed proposals for survey work in this area.

The red king crab survey is too limited in geographic scope and too infrequent to provide a reliable index of abundance for the Aleutian Islands area.

Stock biomass and recruitment trends

Estimates of stock biomass are not available for this stock. No stock assessment model has been developed for this stock. Estimates of recruitment trends and current levels relative to virgin or historic levels are not available. However, preliminary evidence indicates that red king crab stocks in the Adak area remain at low levels of abundance.

Tier determination/Plan Team discussion and resulting OFL determination

The team recommends this as a Tier 5 stock in 2009. B_{MSY} and MSST are not estimated. In May 2008 the CPT recommended that the OFL for 2008/09 be set at 26,287 pounds of bycatch only (representing the estimated average annual bycatch for the period 1996-2007). In June 2008 the SSC recommended that the 2008/09 OFL be set at 464,762 pounds of retained catch, computed as the average retained catch over the time period 1985/86-2007/08. Although the CPT disagreed with the SSC recommendation for the 2008/09, that formed the basis for the OFL that year. The CPT acknowledges the lack of information is problematic.

No assessment was presented for this stock at the meeting; the assessment will be presented at the September 2009 CPT meeting when the OFL for 2009/2010 will be recommended. However, options for time periods and for considering a total catch OFL were presented. Due to the lack of observer data on bycatch during this

fishery prior to 1988/89 and confidentiality of observer data from the fishery during the 1990/91, and 1992/93–1994/95 seasons, a total catch OFL can not be estimated for the time period that the retained catch OFL for 2008/09 was based on. Hence it is recommended that the 2009/2010 OFL for fishery be established as a retained catch OFL. It is also recommended that seasons after 2007-2008 not be included in the time period for computing the OFL.

Historical status and catch specifications (millions of lbs) of Adak RKC.

Year	Biomass (MMB)	OFL	TAC	Retained Catch	Total Catch
2005/06	NA		Closed	0	0.004
2006/07	NA		Closed	0	0.01
2007/08	NA		Closed	0	0.011
2008/09	NA	0.46 [retained]	Closed	0	TBD
	NA	TBD			
2009/10		[retained]	TBD	TBD	TBD

*catch listed here has not been discounted for mortality

No overfished determination is possible for this stock given the lack of biomass information. The CPT will evaluate whether overfishing occurred during 2008/09 when the catches for 2008/09 become available.

Additional Plan Team recommendations

At the May 2009 meeting, the Plan Team discussed long-term plans for the assessment of this stock. While this fishery has a long history, with the domestic fishery dating back to 1961, much of the data on the stock prior to the early-to-mid 1980s are difficult to retrieve and analyze. Changes in definitions of fishery statistical areas over the history of the fishery also makes it difficult to assess geographic trends in effort and catch over much of the fishery's history. Efforts to compile metadata would be very valuable.

Ecosystem Considerations summary

This stock is unsurveyed, remote, and data-poor. As information on predator/prey relationships becomes available, it will be included.

Table 3. Crab Plan Team recommendations May 2009
 (Note shaded sections are to be filled out for the final SAFE in September 2009)

Chapter	Stock	Tier	Status (a,b,c)	B _{MSY} or		Years ¹ (biomass or catch)	2009 ^{2,3}		2009 MMB / MMB _{MSY}	γ	Mortality (M)	2009/10 OFL mill lbs [retained]
				F _{OFL}	B _{MSYproxy}		MMB					
1	EBS snow crab	3				1979-current [recruitment]					0.23 (males, immat.) 0.29 (mature females)	
2	BB red king crab	3				1995-current [recruitment] ⁵				n/a	0.18 default, estimated otherwise ⁴	
3	EBS Tanner crab	4			189.76	1969-1980 [survey]				1.0	0.23	
4	Pribilof Islands red king crab	4				1991-current [survey] ⁵				1.0	0.18	
5	Pribilof Islands blue king crab	4			9.01	1980-1984; 1990-1997 [survey] ⁵				1.0	0.18	
6	St. Matthew Island blue king crab	4				1989-current [model estimate] ⁵				1.0	0.18 (1978-98, 2000-08); 1.8 (1999)	[total male catch]
7	Norton Sound red king crab	4	a	0.18	3.07	1983-current [model estimate]	5.83	1.9		1.0	0.18	0.7125 [retained]
8	AI golden king crab	5				1990/91-1995/96 [retained catch]						6.93 [retained]
9	Pribilof Island golden king crab	5		n/a		TBD [retained catch]				n/a		TBD [retained]
10	Adak red king crab	5				TBD [retained catch]						TBD [retained]

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 2/15/2010 at time of mating.

3 Model mature biomass on 7/1/2009

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.

5 Revised EBS trawl survey timeseries data used

Table 4. Additional model parameters recommended by the Crab Plan Team May 2009.

Note these recommendations are based on information presented by assessment authors. The CPT did not differ from authors' recommendations but requests that the final assessment be consistent with these values

Stock	Handling mortality crab fisheries	Handling mortality groundfish fishery
BB red king crab	0.2	0.8
Pribilof red king crab	0.2	0.8
Pribilof blue king crab	0.2	0.8
EBS snow crab	0.5	0.8
EBS Tanner crab	0.5	0.8
St. Matthew Island blue king crab	0.2	0.8