

Crab Plan Team Report

The Crab Plan Team (CPT) met March 29-April 1, 2010 at the Alaska Fisheries Science Center in Seattle, WA.

Crab Plan Team members present:

<i>Forrest Bowers, Chair</i>	<i>(ADF&G)</i>
<i>Ginny Eckert, Vice-Chair</i>	<i>(Univ. of Alaska – Fairbanks and Sitka)</i>
<i>Diana Stram</i>	<i>(NPFMC)</i>
<i>Doug Pengilly</i>	<i>(ADF&G – Kodiak)</i>
<i>Gretchen Harrington</i>	<i>(NOAA Fisheries – Juneau)</i>
<i>Wayne Donaldson</i>	<i>(ADF&G – Kodiak)</i>
<i>Jack Turnock</i>	<i>(NOAA Fisheries/AFSC – Seattle)</i>
<i>Shareef Siddeek</i>	<i>(ADF&G – Juneau)</i>
<i>Herman Savikko</i>	<i>(ADF&G – Juneau)</i>
<i>Lou Rugolo</i>	<i>(NOAA Fisheries /AFSC – Kodiak)</i>
<i>André Punt</i>	<i>(Univ. of Washington)</i>
<i>Bill Bechtol</i>	<i>(Univ. of Alaska – Fairbanks)</i>
<i>Bob Foy</i>	<i>(NOAA Fisheries /AFSC – Kodiak)</i>
<i>Brian Garber-Yonts</i>	<i>(NOAA Fisheries – AFSC Seattle)</i>

*Josh Greenberg was absent. (Univ. of Alaska – Fairbanks)

Members of the public and State of Alaska (State), Federal Agency, and Council staff present for all or part of the meeting included: Pat Livingston, Clayton Jernigan, Jack Tagart, Lenny Herzog, John Gauvin, Tom Casey, Arni Thomson, John Olson, Matt Eagleton, Diana Evans, Sarah Melton, Ed Poulson, Stefanie Moreland, Scott Miller, Russ Nelson, Scott Goodman, Steve Hughes, Grettar Gudmanson, Anne Hollowed, Doug Woodby, Bob Lauth, Craig Rose, Buck Stockhausen, Tom Wilderbuer, Martin Dorn, Paul Spencer, Sandra Lowe, Rob Rogers, Jay Bowlden, Lance Farr, Tom Suryan, Kevin Kaldestad, Jim Stone, Neil Rodriguez, Jie Zheng, Linda Kozak, and Dick Powell.

The attached agenda was approved for the meeting.

Essential Fish Habitat (EFH) 5-year review

Diana Evans and Matt Eagleton provided an overview of the EFH 5-year review requirements and progress-to-date. Bob Foy coordinated the review of EFH Fishery Management Plan (FMP) text by the individual crab assessment authors, and presented the findings to the CPT. During the course of the discussion, Craig Rose and John Olson provided further clarification about the methodology used for the evaluation of fishing impacts on crab EFH. It is important to recognize that for crab species, the Level 1 EFH description is defined by general distribution only. The CPT noted there was some inconsistency among the criteria used by the authors in their reviews, and tried to address that in their recommendations, as follows.

General CPT Recommendations:

- **The CPT recommends that further analysis be undertaken to evaluate fishing effects on crab stocks, and to decide whether the conclusions in the FMP are valid.** CPT notes that the methodology used in the 2005 effects of fishing analysis may not adequately capture actual impacts of fishing on crab populations. Other parameters may need to be considered for crab stocks, such as the importance of spawning and larval distribution relative to oceanographic currents (pelagic habitat) for crab settlement. This is applicable to the assessment of all crab stocks. Additionally, the conclusions imply that more is known about the effects of fishing on the

habitat needs and life history stages of crab (especially growth to maturity) than can be substantiated, based on research-to-date.

- **Additionally, research over the next five years should be directed to allow a better definition of “essential” habitat for crab species.**
- The CPT recommends that the clarification that Level 1 EFH definition has been accepted by the Council as the general distribution of the species should be explicitly added to the FMP text and maps for all species. Given the clarification (by the presenters), the CPT recommends no changes be made to the map descriptions for crab species because no additional information on crab distribution was provided.
- In conjunction with the revisions to general EFH information noted by the authors in Appendix 3, new studies may be available on trophic information. The description of the fishery may need to be revised for some species for consistency.
- Changes to the crab review summary table (Table 8 in the EFH summary report) are noted below in shading.
- Recommendations on the crab FMP EFH text should be considered a high priority for Council action.

Red King Crab Recommendations:

- **CPT agrees with the assessment author that there is evidence that the effect of fishing on spawning/ breeding populations could be substantial.** As per the CPT’s general recommendation above, further evaluation is required to determine whether a change to the FMP’s conclusions is warranted.
- **The Council should consider identifying red king crab spawning habitat as a HAPC priority type.** A specific area in southwest Bristol Bay has been identified that may provide important habitat for red king crab spawning, with direct oceanographic transport to juvenile rearing areas. **Should the Council choose to move forward with this as a HAPC priority, the CPT will be prepared to put forward a proposal to the Council to nominate this area as a HAPC in the time frame the Council allows for these proposals, as it appears to meet the criteria identified by the Council for HAPCs (e.g., ecological function and rarity).**
- **The CPT is generally concerned about fishery interactions with red king crab in this area, for both bycatch and habitat impacts. If this concern cannot be addressed through the HAPC process, the CPT would like the Council to consider alternative mechanisms for protecting crabs in this area.**

Blue King Crab Recommendations:

- As noted above, the CPT disagrees with assessment author’s recommendation to change EFH information from ‘Level 1’ (where information is available to describe EFH) to ‘Unknown,’ based on the presenter’s clarification.
- The CPT agrees with assessment author’s modification of the effects of fishing on growth to maturity from minimal and temporary (MT) to unknown. No studies are available on growth to maturity, such that a conclusion of MT could be supported.

Golden King Crab Recommendations:

- As with blue king crab, the CPT recommends retaining current description of EFH (based on general distribution) for late juvenile, adult, and egg life history stages, with appropriate clarifications added.
- The CPT recommends modifying the water column association for larvae (table on page 31 of Appendix 3) from ‘P’ (pelagic) to ‘U’ (unknown).
- For the evaluation of fishing effects, the CPT recommends that the MT conclusion be provisionally retained for spawning and breeding (consistent with the rationale for blue king crab,

where some information is available on the number of breeding crabs caught as bycatch in fishing operations). The CPT supports ‘unknown’ for the other conclusions.

Tanner Crab Recommendations:

- The CPT disagrees with the assessment author’s proposed change to the EFH description for eggs, based on the presenter’s clarification that the rationale for this determination is that egg distribution can be reasonably inferred from adult distribution.
- The CPT recommends that the fishing effects evaluation conclusions be modified to ‘unknown’ for consistency with the approach discussed under the CPT’s general recommendations above.

Snow Crab Recommendations:

- As with snow crab, the CPT recommends modifying the fishing effects conclusions to be consistent with previously articulated recommendations. The summary text should be edited to include this rationale.

Species	Recommended changes to the FMP text										Worksheet recommendations		Plan Team: priority recommendation	
	EFH description			General information							2005 evaluation of fishing effects on EFH	HAPC		EFH conservation and enhancement
	text	map	available level of information	tables of associations	life history, gen. distribution	Trophic information	biological/ habitat associations	literature	description of fishery					
Red king crab	-	-	-	yes	yes	- yes	-	-	yes	yes	yes	-	high	
Blue king crab	-	-	yes no	yes	e/c	- yes	e/c	-	e/c	yes	-	-	high	
Golden king crab	yes no	-	yes no	yes	yes	- yes	yes	yes	yes	yes	-	-	high	
Tanner crab	e/c	-	e/e no	yes	yes	yes	yes	yes	yes	e/e yes	-	-	high	
Snow crab	-	-	-	yes	yes	yes	yes	yes	yes	e/e yes	-	-	high	

e/c = editorial changes only

EFH Research Priorities:

- **The CPT recommends a research priority to determine critical spawning and nursery grounds for all crab species.** Information from this research could be used in future HAPC considerations. Research should look at substrate needs as well as pelagic habitat (e.g., the importance of oceanographic transport mechanisms) in determining critical spawning areas.
- **Analyze temporal trends in spatial distribution of crab stocks to assess the current EFH descriptions.** Include historical data and analyze shifts in distribution over time.
- **Evaluate relationships between, and functional importance of, habitat-forming living substrates to juvenile and adult crab.**
- **Quantify crab habitat characteristics utilizing appropriate technology to allow increased precision of survey catch rate estimates.**

Survey Time Series Revisions

Bob Foy summarized work done since the September 2009 CPT meeting to standardize the trawl time series. Recall that changes implemented to the time series data released to the assessment authors last September included error fixes, substitution of measured survey net width for the previous assumed net width and incorporation of unmeasured crab, and a time series based only on standard tows. Additional work has been ongoing over the winter, but remains incomplete. Specific aspects currently under review include: (1) which data sets to include in survey estimates; (2) how to treat areas that were not sampled during portions of the time series; and (3) how to treat special tows, hot spots, re-tows (currently apply only the 2nd tow), and high density tows. A more focused effort is needed for analysis of the survey spatial and temporal data; specifically, how changes to survey estimates may be driven more by shifts in the actual survey area rather than from changes in stock abundance; and how pre-1975 assessment data might be incorporated. Based on sequential periods of approximately similar spatial distribution in the trawl survey, eight different sequences of survey years have been identified.

CPT Recommendations:

- The upcoming assessments should use the existing time series structure as made available in September 2009, but updated for an additional year of survey data because:
 - Work is still ongoing on those revisions; and
 - The assessment authors and the CPT are currently involved with a variety of changes due to the stock assessments related to development of ACLs, the development of several rebuilding plans, etc. Thus, it would be less complex to not revise the survey time series in the assessment at this time, but instead to apply the same basic time series that was applied in September 2009.
- Any future updates to the survey structure should be presented in September and not in May because the assessments are due in May.

Eastern Bering Sea (EBS) Snow Crab: Review net selectivity and model sensitivity, recommend direction for May assessment, and plans for 2010 cooperative survey.

Updated EBS Snow Crab Assessment:

The CPT was briefed by Jack Turnock on the sensitivity of the results of the snow crab assessment and on how survey selectivity and catchability are treated, taking account of the survey data collected by the Bering Sea Fishery Research Foundation (BSFRF) and the NMFS in 2009. The estimates of survey selectivity were based on data from 108 tows in three subsets of the survey region. Unlike the September 2009 assessment, all of the model runs presented were based on survey indices computed using measured net widths and the survey data were weighted using the survey coefficients of variation (rather than being overweighted). The survey indices of abundance and the associated length composition data from the 2009 BSFRF survey and the associated NMFS tows were included as separate data components in the assessment. Turnock presented the results of eight sets of model specifications (based on different assumptions regarding parameters that are fixed or estimated).

The CPT **agrees** with the general approach used to include the BSFRF survey data in the assessment but notes that the fit of the model to the length-frequency data for BSFRF survey is very poor. **The CPT recommends that a model configuration that is able to fit all of the data sources be created and identify five possible ways to improve the fit of the model to the BSFRF length-frequency data: (1) disaggregate the data spatially and perhaps fit the model to each of the three subsets of the survey region separately; (2) replace the logistic selectivity function with a selectivity pattern that is smooth but more flexible than the logistic curve (the selectivity pattern needs to account for both gear selectivity and availability); (3) drop the data for size-classes smaller than 40mm (or 50mm); (4) estimate natural mortality with a prior based on the results of the Canadian tagging data**

(consider re-analyzing the Canadian data using mark-recapture methods); and (5) estimate growth within the model. It may be necessary to combine some of items (1)-(5) to create a model which fits all of the data adequately.

The CPT recommends that the assessment for May 2010 include at least: (a) the current base model; (b) a model that sets Q to 0.75; and (c) a model which assumes the Somerton selectivity and sets Q to 0.75. A likelihood profile for survey Q should also be reported in the assessment.

The CPT notes that considerable work remains to complete the stock assessment for EBS snow crab. Moreover, the assessment is needed for both the Rebuilding Plan and ACL environmental assessment (EA) and for status determination and Over Fishing Limit (OFL) calculation. **The CPT suggests the following work plan: (a) the period between now and the May 2010 CPT meeting should be used primarily to explore model formulations as outlined above; (b) the final ACL/rebuilding calculations should be based on the model selected during the May 2010 CPT meeting using the data currently available; and (c) status determination and OFL calculation should be based on the model selected during the May 2010 CPT meeting and should also take account of the data from the 2009/10 fishing season and the 2010 survey.** The CPT notes that this may mean that, for example, the estimate of the time to recover to B_{MSY} may differ between the analyses in the final EA and those presented to the CPT in September 2009.

Plans for the 2010 BSFRF Survey:

Robert Foy summarized the proposed survey plan for 2010. The design for the BSFRF survey attempts to overcome the difficulties caused by the spatial and temporal differences between the NMFS and BSFRF tows during 2009. These difficulties are partially a cause of the current problems associated with including the BSFRF survey data in the stock assessment. Side-by-side surveys will be conducted north-east of the Pribilof Islands including the high density area around St. Matthew Island. The area chosen for the side-by-side sampling includes a number of covariates likely to impact survey selectivity, based on past research.

The CPT **supports** the proposed design, noting that it overcomes several of the problems with the 2009 design. The CPT notes, however, that the proposed design does not encompass the same area as the NMFS survey because the design reflects a balance between being representative and logistically feasible. The CPT **encourages** continued efforts to ensure that the sampling will be representative of the entire population because this will ease later data analysis. The CPT also **emphasizes** the importance of the survey researchers continuing to work closely with the assessment author to ensure that the data collected during the survey can be easily included in the May 2011 stock assessment.

Crab Annual Catch limits and Rebuilding

General:

The CPT **emphasizes** the importance of assessment authors following the guidelines for stock assessments adopted last year and the need for assessments to fully document the stock assessment method if this has not been published.

The team **clarified** that the analysis defines buffer as a multiplier, not the difference between ABC and OFL. This should be modified in the next draft for consistency (so that the buffer is between OFL and ABC and the value in calculations is defined as a multiplier).

If a single P^* is chosen, the buffer depends on the perception of uncertainty, but future uncertainty is unknown. There should be a discussion in the next draft of the implications of changes in the estimate of

how much uncertainty there is on the size of the buffer if the P* method is applied and the risk of overfishing if the fixed buffer method is applied.

The results in which the State strategy constrains the outcome of the ABC control rule provide the best appraisal of the economic impacts of the alternatives, while the results in which the State strategy is ignored provide the best appraisal of the biological (stock risk) impacts of the alternatives. The CPT **recommends** that results be presented for both of these cases for all stocks.

The CPT **recommends** that the fit of the assumed stock-recruitment relationship to the stock and recruitment data be reported for all stocks, and that the definition of the probability of overfishing be included in the headers for the tables which report this probability. The team recommends that the authors individually determine which S-R curve is to be carried forward in the analysis, the use of B-H or Ricker S-R relationship.

The team agreed that for the initial draft review there must be a focus on how to effectively communicate results to the public so that the public may provide informed comments to the Council.

For all tables, the analysis should use 2 decimal places, and units presented in metric tonnes (t). The remainder of comments on the analysis are provided by Chapter below. The team **notes** that the presumption of the entire analysis is that, on average, the estimate of the OFL is correct given the level of information available by stock (i.e., that precautionary assumptions are not included in the estimation of the OFL). A graph should be added showing OFL, TAC and buffers for all stocks to show relative impacts of alternatives.

Chapters 1 and 2

Diana Stram provided a review of the timing and objectives for the CPT's review and presented an overview of Chapters 1 and 2 of the analysis. She provided the following (attached) overview of the objectives for the CPT to review and comment on at this time, noting that the opportunity to comment on a preferred alternative will be provided at either the May or September 2010 CPT meetings.

- The team clarified that the analysis defines buffer as a multiplier, not the difference between ABC and OFL. This should be modified in the next draft for consistency (so that the buffer is between OFL and ABC and the value in calculations is defined as a multiplier).
- If a single P* is chosen, the buffer depends on the perception of uncertainty, but future uncertainty is unknown. There should be a discussion in the next draft of the implications of changes in the estimate of how much uncertainty there is on the size of the buffer if the P* method is applied and the risk of

Accountability Measures:

This draft EA does not include alternatives for AMs, but they must be included in the next draft.

The CPT is **concerned** that implementing AMs with this action could result in only the directed crab fishery being subjected to any AM constraints, regardless of what source of fishing mortality caused the ACL to be exceeded. The CPT believes that all sources of fishing mortality should be held accountable for their contribution to removals under AMs.

The CPT notes that limits on the groundfish fishery are included in the "Alternatives considered and not carried forward" section of the EA. It **recommends** that a discussion paper should be drafted that considers the issues related to groundfish bycatch of crab identified previously by the Council's Advisory Panel (AP). The CPT also notes, however, that crab bycatch in the groundfish fisheries has both allocative and conservation impacts. The fraction of the ACL/Annual Biological Catch (ABC) that consists of bycatch in groundfish fishery will be substantial for some stocks. The State has no control of this component of mortality. The CPT therefore **requests** that Council staff assemble data for some crab

stocks (e.g., Tanner) to assess the temporal and spatial overlap between groundfish fisheries and crab abundance, and to assess the fraction of the ACL (for various buffer levels) that would consist of bycatch in the groundfish fishery and report these assessments to the CPT in May 2010.

The CPT feel that an appropriate way to move forward with AMs, and to begin feedback with the groundfish FMP, is to use the Pribilof Island blue king crab rebuilding plan crab bycatch limits in groundfish fisheries as a starting point. This approach could provide an example of how future crab bycatch limits in groundfish fisheries may be applied for all crab stocks. The Tanner crab rebuilding plan may also consider measures to limit Tanner crab bycatch in the groundfish fishery.

Options for modifying the NPFMC review process:

The CPT reviewed three options for modifying the Council review process of crab OFLs/ACLs. The CPT discussed the three Options related to timing and felt that Option 1 (delay TAC-setting to provide for SSC recommendation on the ABC in conjunction with the October Council meeting) was the most viable. The CPT recommended that the discussion of these options should be expanded to include issues such as: (1) the process for issuance of Individual Fishing Quotas / Individual Processor Quotas has been streamlined and can occur within one week; and (2) the public may be disadvantaged by a truncated process. The CPT is interested in public comment on whether fishery participants would benefit from greater lead time between TAC announcement and the start of the fishery.

Chapter 3: Methodology

André Punt, Doug Pengilly, and Brian Garber-Yonts summarized the methodology for the ACL analysis, including: (1) options of buffers and the P* method; and (2) the process to examine short-term (2009/2010 fishing year), medium-term (2009-2015), and long-term (30-year) effects on total catch, directed catch, Mature Male Biomass (MMB), probability of overfishing, probability of being overfished, and gross revenue (under different discount rates). Aspects of harvest control by either ABC or State control rules were discussed. Additional clarity is needed on assigning uncertainty, perhaps to include uncertainty associated at stock assessment tiers.

CPT Recommendations:

- The assessment should conduct the medium- and long-term projections of both with and without removals imposing the State control rule.
- Care should be taken to make sure that the buffer is the difference between the OFL and the ABC, and not the multiplier on the OFL.
- The analysis needs to clarify the criteria by which additional uncertainty (σ_b) is set for each stock, including the potential specification of default values. **The CPT recommends that the final values recommended in the EA be the default for σ_b , noting that characterizing this as a default allows future modifications by the SSC contingent on stock assessment information or stock status changes.**
- Add a table or graph to exhibit the relationship between variance and the resultant error bounds; i.e., what is the relative increase in the bounds from a unit increase in sigma?
- For the analysis process, an equation should be inserted showing how the numbers-at-length are used when computing the estimated OFL/ABC.
- The text needs to clarify that $P^* = 0.5$ is provided only for comparative purposes (i.e., a representative bound), because National Standards require that $P^* < 0.5$.
- Authors need to verify that the definition of probability of being overfished is consistent among different assessments; e.g., does the probability overfished for the long-term simulations indicate being overfished at least once during the 30-year period or an annual probability of being overfished?

- A figure should be added showing the stock-recruit relationship.
- Because individual simulations are highly variable, the CPT suggested that a figure could be provided in the Methods section that shows how the individual simulations vary over time. The legend could be clarified within chapters that the dark line is a median.
- To reduce redundancy, the table showing the relationships among P*, the additional uncertainty, and the buffer, should be moved from the species-specific chapters to Chapter 3.
- Uncertainty is likely underestimated in the economics analysis. Aspects to consider include:
 - Uncertainty in (PRR) (Table 3-6) might also be incorporated into overall economic model;
 - Ratios of prices by species (Table 3-5) are treated as without variability, but variability does exist in the prices (send variability estimates to Andre).
- Section X.1.1 in each assessment should list the coefficient of variation (CV) for MMB.
- Andre to check on use of 3-y versus best-estimate lag in model for Recruit year
- Additional economic issues to be resolved for the next iteration of the ACL analysis are:
 - More fully addressed P* alternatives and compare to fixed buffers;
 - Characterize tradeoff of risk reduction/costs and time-varying uncertainty;
 - Utilize species cost information, where available, rather than proxies.
- Economic analysis issues related to rebuilding:
 - Clarification on which snow crab and Tanner crab rebuilding alternatives should be reflected in the economic analysis is needed.
 - Clarification on the confounding of discounting rates and the time series of the buffer effects is needed.
 - Qualitatively discuss further economic impacts (processors, change in fishing behavior, etc.).
- General comment for all chapters: be consistent in presentation of data in tables in regards to number of decimal places.

Chapter 6: Bristol Bay Red King Crab (BBRKC)

Andre Punt provided an overview of the BBRKC chapter.

Additional Uncertainty:

Uncertainty in the 2009 MMB estimate is low (CV = 5%), but unknown levels of uncertainty in some assessment and control rule parameters (e.g., fixed M or $F_{35\%}$) exist. **Therefore, the CPT recommends that an additional CV value of 0.2 is appropriate for this stock.**

Chapter 4: Snow Crab

Jack Turnock introduced the results of the rebuilding analysis and ACL calculations for EBS snow crab.

Uncertainty Characterization:

In relation of uncertainty characterization, the estimate of uncertainty from the assessment for snow crab (CV = 0.086) is higher than for BBRKC (CV = 0.05). Reasons for this include higher survey CVs and that more parameters are estimated. **The CPT recommends that the EA should note that survey catchability is estimated and not pre-specified, and that some aspects of growth (e.g., terminal molt) are estimated. The CPT recommends that a CV of 0.2 best characterizes uncertainty for EBS snow crab.**

ACL Analysis:

In relation to the ACL analysis, the CPT **recommends** that:

- In order to ease the comparison of impacts among buffers, results should be provided for a base model for all buffers from 0.1 to 1 in steps of 0.1, in addition to a buffer of 0.75, and results should be provided for a subset of the buffers for all of the models.
- Add the breakdown of the ABC among fleets to the header for Table 4.1.
- The results in Table 4.1 should be checked because there appears to be an error in how P^* and/or the buffer are calculated for some options.

General Rebuilding:

The CPT **emphasizes** that the EA needs to be clear that the number of years a stock needs to be assessed to be above B_{MSY} before it is considered to be recovered is a decision point for the analysis. The results in the EA for EBS snow and Tanner crab are based on a definition for “rebuilt” that involves the mature male biomass (MMB) being above B_{MSY} (or its proxy) for two years in a row. The reason behind this definition is that status determination has, in the past, been based on survey estimates of abundance (rather than model outputs). These estimates can fluctuate substantially from one year to the next. Using a two-year rule for defining recovery leads to more confidence that recovery has indeed occurred. In contrast, while model-based estimates of biomass do vary from one year to the next, this variability is likely to be much less than for individual survey estimates of MMB. The CPT therefore **requests** additional direction from the Council on whether to continue basing the analysis on this definition of recovery or to include an option in the EA to modify this definition for EBS snow and Tanner crab. The consequences of being rebuilt are not currently accounted for in the analysis; e.g., what F is applied after the stock is defined as rebuilt?

The CPT **recommends** that the option to annually increase the probability of rebuilding should be moved to the “Alternatives considered and not carried forward” section because it is problematic to analyze the impacts of this option. The intent of this option can be captured by the selection of an alternative in which the probability of rebuilding by T_{target} is greater than 0.5. The CPT also **recommends** that staff reorganize the alternatives so it is more clear that Alternatives 6-8 have more opportunity for course correction to account for inevitable uncertainty in the assessment outcomes and recruitment success, yet still achieve rebuilding. There is also a need to add text to Section 3 that illustrates the operational aspects of rebuilding and revising rebuilding owing to course correction. This could involve plots that show how the rate of fishing mortality could be adjusted on an annual basis using examples of how the results of assessment change.

In relation to the rebuilding analysis, the CPT **recommends** that:

- Results should be provided for all model configurations and for a subset of assumptions regarding fishing mortality once the stock is assessed to be rebuilt.
- Add a column that reports the probability of being rebuilt, defined as above B_{msy} once before and including the current year, and the probability of being rebuilt for two years in a row.
- Compute and report the probability that the stock would be assessed to be rebuilt, given that it is and is not actually rebuilt using the projection model.

Chapter 5: Tanner Crab

Lou Rugolo and Jack Turnock presented an overview of the Tanner crab chapter and the draft Tanner crab assessment model.

Tanner Crab Model:

The *C. opilio* length based stock assessment model was adapted to *C. bairdi* population and fishery dynamics. Model B_{ref} was 118,600 t, compared to the 83,850 t estimate based on survey estimates of MMB. The major issue with the model was the lack of fit to the MMB from ~2000 to 2009, where the model predicted estimates of female mature biomass are above, and MMB are below, the corresponding survey estimates. **The authors were asked to run different scenarios based on these comments to assess the model performance at the May 2010 CPT meeting.**

The CPT recommended that the model may be used for ACL analysis as the basis for long-term projections. The current model (presented at this meeting) will be used for development of initial review EA in June 2010. For this analysis, the current model should be used to estimate the long term impact. The Tier 4 control rule (using survey estimates as well as model output) should be used to evaluate short-term impacts. Results should not be presented for medium-term predictions to avoid giving the impression that such results are reliable.

The CPT noted that rebuilding plan development will be delayed until it is possible to find a model that better fits the data. The CPT will review a revised model in May 2010 and reassess the timeline and alternatives for rebuilding based on that review. The understanding is that the rebuilding plan analysis must be completed within two years of when the actual determination of overfished is made.

CPT Requests:

The CPT makes the following specific **requests** to the assessment authors for the May 2010 assessment review:

- Units that were used to fit the data need to be clarified. The units should be based on collected measurement (i.e., catch in number instead of catch in weight).
- Authors should consider the results of the Bechtol et al. 2010 study on minimum size limit. There is genetic research that addresses geographic stock separation and warrants review by the CPT. The SSC convened a workshop on genetic stock separation in 2009. The report from this workshop should be considered by the CPT, discussed at the May CPT meeting, and potentially presented at that time.
- Consider size distribution of Tanner crab east and west of 166 longitude.
- Add the profile for 'M.'
- Fit a gamma distribution to the growth data.
- Address lack of model fit to MMB and females:
 - Show residual patterns for the model fit to MMB.
 - Change m/f ratios at birth to potentially help fit the sexes similarly to the survey.
 - Research the probability of maturity at size over time.
 - Consider a spatially segregated approach.
- Address the survey length versus carapace width fits.
- Assess the growth or maturity functions to fix the model specification.

Tanner Crab ACL Analysis:

- Uncertainty in the model
 - The CPT **recommends** that additional uncertainty be 0.4, similar to other Tier 4 stocks.
 - Add the uncertainty associated with fixed q , tier 4 control rule, and the survey data in this section.
- Model description
 - Specify in the text to distinguish between the short-term tier 4 control rule and the model used for long-term projection.

- Projections
 - In the short term ACL calculations, ADFG TAC needs to be added to the headers and units need to be standardized.
 - This table will be replaced with a Tier 4 analysis.

Chapter 10: Norton Sound Red King Crab

Diana Stram provided an overview of the results of the Norton Sound red king crab analysis (Chapter 10 of the preliminary review draft EA).

Needed Edits to the Text:

- Section 10.1.1 (Uncertainty in stock assessment) needs to provide the estimated coefficient of variation for the estimate of mature male biomass.
- Text in Section 10.1.1 (Uncertainty in stock assessment) stating, “Given the relative amount of information available for NSRKC, an additional variance level of 0.2 or 0.4 seems warranted” needs to be changed to, “Given the relative amount of information available for NSRKC, an additional variance level of 0.4 seems warranted.” (but see below)

The CPT Recommends:

- There is additional uncertainty relative to other Tier 4 stocks due to lack of bycatch data and estimates. During discussion on the lack of bycatch estimates, the Norton Sound red king crab stock assessment author expressed plans to estimate the bycatch using BBRKC selectivity. It was also noted that there has apparently been some limited observer coverage recently (an ADF&G biologist served as on-board observer one season and there has been some voluntary reporting of bycatch and discards by harvesters) and that that data may be available by the May 2010 meeting.
- Should consider employing higher additional uncertainty with $CV > 0.4$ (e.g., consider $CV = 0.6$) until directed fishery bycatch estimates are available.
- Although the stock is surveyed, the periodic / triennial nature of the survey (as opposed to an annual survey) is an additional source of uncertainty that should be noted in the text of the draft EA.
- There were questions on the summer commercial fishery versus the winter commercial and the subsistence fishery. The analysis only considers the economic outputs for the summer fishery that is fished according to the State harvest strategy and will need to be clarified in the text. (The State harvest strategy applies only to the summer commercial fishery and the catch in the winter commercial fishery. The subsistence fishery is apparently small relative to the summer commercial fishery.)
- The economic analysis will need to adjust prices from Bristol Bay (larger retained size and fall / winter fishery) to Norton Sound (summer fishery and smaller retained size).

Chapter 7: Pribilof Island Red King Crab (PIRKC)

Bob Foy presented the overview of the results for the PIRKC analysis.

Characterization of Uncertainty:

- The CPT noted that there was no discussion of the model. The CPT recommends that further discussion of the proposed assessment model occur at the May 2010 CPT meeting.
- Add to the text on uncertainty that analysis employs model under development and not reviewed by the CPT.
- The CPT **recommends** that the value considered for additional uncertainty of 0.4 may be insufficient and recommends the use of a higher value (e.g., 0.6).

- Need to correct survey CV in model; used 0.145, but should be 0.637.

Impacts of Alternatives:Medium-Term Impacts:

- Recommend deleting sentence on p.227 referring to 20% exploitation rate and 60% cap on harvest of legal males.

Long-Term Impacts:

- Table 7.7, column “P[overfished]” – clarify why for this assessment the stock is shown as currently overfished; need to note that this is not the model used for the status of stock determination

General Comments:

- The CPT **recommends** for Table 7.1 (Short-Term); Andre used CSA model to calculate the OFL for 2009 and hence ABCs for different buffer levels; need to add an equivalent table needs to be added which is based on survey data, buffers and Tier-4.

Chapter 8: Pribilof Island Blue King Crab

Bob Foy presented the analysis for PIBKC. There has been similar model development to PIRKC. The model has been modified from the State catch survey analysis model used for TAC setting. The model incorporates bycatch of fixed gear and groundfish. The model has not been reviewed by the CPT and has not been used previously for assessments.

The “Characterization of uncertainty” section needs to include that the model is under development. The CPT **recommends** that the additional uncertainty of 0.4 may be insufficient and a higher value (e.g., 0.6) should be considered.

Chapter 9: St Matthew Blue King Crab

Diana Stram presented the analysis for this stock. The team noted that many of the suggestions for improvement for the previous chapters apply to this chapter.

Uncertainty in Stock Assessment:

The CPT noted that this stock is also a candidate for using a higher additional CV than 0.4. Uncertainty in the survey estimates should be added due to the availability of the stock to the survey; i.e., the catchability of mature crab to the survey.

Andre will redo calculations using the same method to characterize parameter uncertainty as was used for snow crab in Tables 9-1 and 9-2. The CPT discussed why the long term trajectories show biomass dipping below B_{MSY} in Figure 9-3. Andre Punt said that he will look into this.

Chapter 11: Aleutian Island Golden King Crab (AIGKC)

Siddeek Shareef and Doug Pengilly provided an overview of the AIGKC analysis. This analysis includes both a Tier 4 and Tier 5 formulation for presentation of impacts.

Tier 4 AIGKC Model:

The CPT received a presentation on the male-only length-based assessment model. Separate models have been developed for each stock (Dutch Harbor and Adak). This model is under development and has not yet been accepted for assessment purposes. Results of the model indicate that the ABC is high relative to the current harvest. This model will be presented to the CPT in May 2010 for possible use in the

2010/2011 assessment cycle. The CPT recommends using the model to evaluate ACL alternatives and options under a Tier 4 control rule.

Tier 4 Review:

The CPT recommends an additional CV level of ~0.4 (medium level). The CPT notes that relative to other stocks with no consistent survey (i.e., PIRKC), there is more information on this stock.

Tier 5 Review:

The CPT recommends an additional CV level of ~0.5, given current information availability on this stock in relation to other Tier 5 stocks.

Chapter 12: Pribilof Islands Golden King Crab (PIGKC)

Doug Pengilly provided an overview of results from the analysis for the PIGKC stock.

The CPT Recommends:

- The PIGKC GHLL is not established by State regulation. A brief discussion of accountability measures centered around ADF&G's ability to control harvest should be included since the fishery is not rationalized. This discussion should characterize, however, that typically the fleet is small, there are low pot limits, 100% observer coverage, and the fishery has successfully been contained to the GHLL in prior years.
- A high level of additional CV (e.g., 0.6) is recommended due to high uncertainty in total-catch OFL. There is more uncertainty than for AIGKC (when treated as a Tier 5 stock) due to the number of years with no catch or effort data and to 1998 being the last year of catch data used to compute the OFL.

Chapter 13: Adak Red King Crab

Doug Pengilly provided an overview of results from the analysis for the PIGKC stock.

The CPT notes that additional uncertainty is high and recommends a high additional CV (e.g. 0.6).

Comparison of Alternatives

Diana Stram provided an overview of the section comparing results across alternatives (Chapter 2 section 2.4) and sought feedback from the CPT on additional comparisons to include for the initial review draft.

The team made the following **suggestions**:

- Include a characterization of which stocks have assessment models to highlight the relative levels of information available by stock;
- Provide a 'look up' table of buffers and P*s across all stock pulling the results for the recommended additional uncertainty
- Compile a table which characterizes the relative uncertainty by stock;
- Include figures which indicate the relative harvest constraint at different buffer levels by stock (i.e., similar to those included in the PIGKC chapter).
- Discussion of relative risk for Tier 5 stocks given implications in the AIGKC analysis of Tier 4 versus 5 in comparison to the other Tier 5 stocks.

Pribilof Island Blue King Crab Rebuilding Plan

Bob Foy and Scott Miller provided an overview of the preliminary review draft of the PIBKC rebuilding plan. **In discussing alternative 5, the CPT recommends considering analysis of different levels of PSC besides default OFL in current analysis; e.g. ABCs considered in the ACL analysis. The CPT also recommends considering modifying the alternatives to include the alternative area closures which are triggered by a range of PSC cap levels. In conjunction with ACL discussions of accountability measures, the team notes that any PSC cap would require revision of the BSAI groundfish FMP.**

Rebuilding Projections

- S-R: noted that comparison b/w random recruitment and S-R curves should include earlier years to provide better comparison; as performed, comparison confounded with difference in S-R over time; could improve potential for random recruitment specification to produce rebuilding
- if random recruitment is representative of current environmental conditions, and current B_{MSY} is unattainable, suggestion that lower B_{MSY} should be identified under this scenario

Impacts of Alternatives on Rebuilding:

- **The projected rebuilding response to changes in bycatch reductions is minimal, and projections indicate no significant difference between any of the alternatives in potential for rebuilding. Therefore the CPT notes that the only benefit of alternatives is the prevention of overfishing. The alternatives should be analyzed relative to the probability of preventing overfishing.**

Additional Recommendations:

- Request for map with stock boundaries for St. Matthew BKC in relation to those for PIBKC.
- Add B_{MSY} to population projection plots.
- Noted that negative MMB is incorrect (check model constraints);
- Show projection with recruitment/year.
- Evaluate probability of overfishing due to bycatch only over the rebuilding timeframe.
- More simulations could be run if there is a desire to reduce the jaggedness of the median projections.
- Stellar Sea Lions (SSL) closures within alternative closure areas should be noted.
- Include extent of halibut fishing activity within alternative closure areas and associated bycatch (to the extent the data is available).
- Add a comparison between PIRKC and hair crab population trends.
- Incorporate figures that break down historical distribution of population segments (size/sex).
- Summarize historical bottom temperatures.
- **Discuss the allocative implications of including bycatch in catch limitations under both ACL and rebuilding analyses; in context of PIBKC, discuss relative merits of spatial closure versus PSC, where PSC limit has potential to force broad fishery suspensions**
- Given objective of eliminating any take of blue king crab, CPT highlights importance of distributing burden of conservation on all fishery participants.
- **Consider including a trigger cap alternative (e.g., combining PSC/ACL levels with spatial closures) in the range of alternatives for analysis**
- Analysis of status quo should evaluate the impacts on relative bycatch of PIBKC of the Pribilof Islands Habitat Closure Zones (PIHCZ) closure following implementation.

Economic Impacts:

- Noted that confidential nondisclosure limitations constrain resolution and detail of reporting economic effects; e.g., aggregation of CP and CV revenues and use of 1st wholesale value

Recommendations:

- Add six year average and std dev of revenue and catch under EA alternative as summary.
- Add relative value or revenue at risk as % of total revenue of affected sectors.

New Business

The CPT approved the September 2009 minutes and discussed agenda items for the May 2010 meeting noting this meeting is in Girdwood. The Team intends to review the ACL and rebuilding analyses again at the May meeting and potentially comment on preferred alternative approaches at that time.

Objectives for CPT Review and Recommendation to the analyses by section:

This outline was provided to the team by Diana Stram prior to their review of the analyses in order to highlight potential areas for additional clarification and recommendations on the preliminary analysis of ACLs and rebuilding.

- Assessment overview
 - Is information sufficient to provide understanding of stock status and assessment?
- Uncertainty in stock assessment
 - Is uncertainty inherent in the assessment characterized correctly?
 - Is the recommendation of additional uncertainty appropriate?
 - Does the recommendation follow naturally from the listed uncertainty in the section?
- Impacts of alternatives
 - Are the direct effect impacts reasonable?
 - What should be done differently for initial draft?
 - What additional sections will be considered for initial draft?
- Additional aspects
 - Are there additional items we would like to see in initial review draft?
 - Should sub sections be unified and moved elsewhere?
 - Additional figures/tables?
 - How best to characterize results for communicating to public?

Rebuilding Plans:

- All ACL considerations, in addition
 - Are alternatives sufficient?
 - Implications
 - Are rebuilding scenarios reasonable?
 - Additional scenarios
 - Additional economic evaluations
- Rebuilding plans
 - Alternatives 2 and 3
 - Framed as target years for rebuilding to B_{MSY} with pre specified probability.
 - Options for probabilities to T_{TARGET} (fixed probabilities increasing)
 - Max rebuilding T_{END} (snow) T_{MAX} (Tanner)
- Comparison of alternatives
 - How uncertainty is considered?
 - Within assessment uncertainty
 - How is additional uncertainty characterized?

NPFMC CRAB PLAN TEAM

DRAFT AGENDA (FEBRUARY 20, 2010 VERSION)March 29-April 1st 2010

A. Crab Plan Team		
Monday March 29		Traynor Room (all week)
9:00	Introductions	Introductions, Additions to agenda and approval of agenda, Review and approval of September 2009 minutes, discussion of report finalization, May meeting agenda topics
9:15	Essential Fish Habitat	Review EFH designations by species and recommend changes as necessary
10:45	<i>Break</i>	
11:00	EFH Cont'	
12:00	<i>Lunch</i>	
13:00	Survey time series revisions	Review time series revisions and strata; recommend whether to use revised dataset in 2010 assessments
14:00	EBS snow crab	Review net selectivity results and model sensitivity, recommend direction for May assessment, recommend direction for 2010 survey
15:00	<i>Break</i>	
15:15	EBS snow crab Cont'	
Tuesday March 30		
9:00	Crab ACLs and rebuilding	Review preliminary draft and recommend changes
10:00		Review Alternatives: Chapter 2 Review methodology for ACL projections; organization of results presentation: short-term, medium-term, long-term (biological and economic)
10:45	<i>Break</i>	—
11:00		Results for BBRKC
12:00	<i>Lunch</i>	
13:00	Crab ACLs and rebuilding (cont')	Snow crab ACL and rebuilding results
15:00	<i>Break</i>	—
15:15		Tanner crab ACL and rebuilding results
Wednesday March 31st		
9:00	Crab ACLs and rebuilding (cont')	NSRKC, PIRKC, PIBKC (ACL only),
10:45	<i>Break</i>	—
11:00		St Matthew BKC, AIGKC (Tier 4 and Tier 5 comparison)
12:00	<i>Lunch</i>	
13:00	Crab ACLs and rebuilding (cont')	Tier 5 stocks: PIGKC, Adak RKC
14:00		Comparison of results across all alternatives for ACLs
15:00	<i>Break</i>	—
15:15	PIBKC rebuilding plan	Review alternatives, impacts on rebuilding PIBKC stocks, impacts on groundfish fisheries and economic analysis
Thursday April 1		
9:00	PIBKC rebuilding plan (cont')	Continue with review of impacts, recommendations on analysis and alternatives
10:45	<i>Break</i>	

11:00	Crab Plan Team report	Report finalization: all sections and recommendations on screen
12:00	<i>Lunch</i>	—
13:00	Crab Plan Team report (cont ²)	Report finalization: all sections and recommendations on screen
15:00	<i>Break</i>	—
15:15	New business	Additional topics or discussion for May or September meetings, planning for May meeting, discuss additional new business as necessary
17:00	<i>Adjourn</i>	—