

Crab Plan Team Report

The Crab Plan Team (CPT) met May 10-14, 2010 in Girdwood, AK.

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)</i>
<i>Bill Bechtol</i>	<i>(Univ. of Alaska – Fairbanks)</i>
<i>Karla Bush</i>	<i>(ADF&G – Juneau)</i>
<i>Wayne Donaldson</i>	<i>(ADF&G – Kodiak)</i>
<i>Brian Garber-Yonts</i>	<i>(NOAA Fisheries – AFSC Seattle)</i>
<i>Josh Greenberg</i>	<i>(Univ. of Alaska – Fairbanks)</i>
<i>Gretchen Harrington</i>	<i>(NOAA Fisheries – Juneau)</i>
<i>Doug Pengilly</i>	<i>(ADF&G – Kodiak)</i>
<i>André Punt</i>	<i>(Univ. of Washington)</i>
<i>Jack Turnock</i>	<i>(NOAA Fisheries/AFSC – Seattle)</i>
<i>Lou Rugolo</i>	<i>(NOAA Fisheries /AFSC – Kodiak)</i>
<i>Shareef Siddeek</i>	<i>(ADF&G – Juneau)</i>
<i>Diana Stram</i>	<i>(NPFMC)</i>

Bob Foy (NOAA Fisheries /AFSC – Kodiak) was absent.

Members of the public and State of Alaska (State), Federal Agency, and Council staff present for all or part of the meeting included: Jack Tagart, Lenny Herzog, Arni Thomson, John Olson, Matt Eagleton, Diana Evans, Sarah Melton, Ed Poulson, Doug Woodby, Jie Zheng, Richard Tuluk, Maura Sullivan, Skip Gish, Earl Krygier, Sarah Hinkley, Anne Vanderhoeven, Stew Grant, Charlie Lean, Bob Clark, Heather McCarty, Toshihide Hamazaki, Linda Kozak, Dick Powell, and Dick Tremaine.

The attached agenda was approved for the meeting.

EFH/HAPC update

Diana Evans and Matt Eagleton updated the team on the Council action on EFH and HAPC at the April Council meeting. The Council initiated a discussion paper to look at the Team's March 2010 recommendations with respect to crab EFH and potential HAPC priorities. The paper, as outlined, will address four topics: a) re-evaluating the methodology used for assessing adverse impacts of fishing on crab EFH, in order to capture all appropriate habitat parameters for crab (including pelagic habitat); b) identifying the habitat needs of crab stocks by life history stage, and re-evaluating the conclusions in the EFH EIS and FMP about the effects of fishing on those life history stages (including additional information about the thresholds used to identify "minimal and temporary" effects in the EIS); c) information about habitat usage of red king crab and the potential for adverse interactions in southwest Bristol Bay, where there has recently been an increase both in the red king crab population and in trawling activities; and d) information about changes in crab spatial distribution (especially for red king crab) in recent years, to determine whether the Council's existing area closure protection measures are still appropriate (this latter topic was added at the request of the Council). It was noted that the discussion paper should allow the Team to identify important research priorities for crab habitat. The discussion paper is tentatively scheduled to be presented to the Council in December 2010.

The Team identified that it is important to continue to provide input to the Council on this issue, and will attempt to schedule a review of the draft paper for the September 2010 Plan Team meeting. The Team

agreed with the outline of the discussion paper, as presented. The Team noted the importance that this discussion paper reiterate the Team's concern over habitat of red king crab in southwest Bristol Bay. There may also be bycatch interactions, but those are being addressed separately through the Team's bycatch discussions, and this paper should specifically focus on the interaction of the fisheries with crab habitat.

Pribilof Island blue king crab rebuilding plan

Diana Stram updated the Team on the status of the PIBKC rebuilding plan. The Team would like to review the initial review draft at its September 2010 meeting. This review would focus on identification of a preferred alternative for rebuilding the stock and for the analytical approach to be used for analysis. In addition to the current alternatives, the Team requests that analysts consider a stair-step cap closure in the suite of area-closure alternatives (i.e., where the trigger cap is stair-stepped to close progressively larger areas at different cap levels).

Paper presentations

“Patterns of larval snow crab transport in the Bering Sea, and its relation to temperature, cod predation, ice, and recruitment”

Sarah Hinckley provided a summary of work done by her and her colleagues (David Armstrong, Carolina Parada, Julian Burgos, Billy Ernst, Jose Maria (Lobo) Orensanz, Jeff Napp, Albert Hermann, Gordon Kruse, Bernard Megrey) on patterns of snow crab recruitment as a function of larval transport, temperature, ice cover, and cod predation. They created an individual based model (IBM) that uses input from 1978-2003 on female reproductive index, a ROMS oceanographic model, bottom temperatures during NMFS surveys, ice cover, chlorophyll-a from the ice-edge bloom, a cod predation index and outputs larval settlement and recruitment patterns. The results suggest that warm and cold years have different larval trajectories and different optimal settlement areas. In cold years, optimal settlement areas occur over a broader segment of the BS, whereas in warm areas, these areas are restricted in size and are farther to the northwest. Retention of crab larvae is seen in all years in areas off the Pribilofs and St. Matthew Islands. Larval transport is always to the north, outside of these retention areas; larvae are transported farther north in warm years. The parameters that were included in the best fit multiple regression model of the model output with recruitment from the snow crab stock assessment (lagged several years) included proportion settling in the EBS, spawning location, settlement location, mean bottom temperature at settlement, mean cod CPUE years 3 after settlement (an index of cod predation), and mean chlorophyll-a (a proxy for prey near ice-edge blooms).

This modeling project is largely completed, and the authors are willing to provide the model and model output to others that may be interested in using it for further research or management purposes. CPT offered comments that the Hinckley et al. model could use more recent data for model validation purposes. Improvements on how to link the Hinckley et al. model with the stock assessment were suggested (merge covariates from IBM directly into the assessment or account for the variance-covariance structure of the recruitment estimates from the assessment when fitting the GAMs model). Sarah acknowledged that the model needs to be validated with field observations on larval and newly settled crab distributions, although some of this work has been done, and shows quite good results (not shown). After validation, the model could have potential uses for rebuilding analyses, projecting pre-recruits, identifying important spawning areas, analyzing impacts of fishing, and others. The CPT acknowledged the large contribution of this body of work to our understanding of the dynamics of snow crab in the Bering Sea and thanked Sarah for her presentation.

“Analysis of minimum size limit for Eastern Bering Sea Tanner Crab fisheries”

Bill Bechtol provided a summary of an analysis of the potential impacts of a change in size limit for Tanner crabs conducted by himself, Gordon Kruse, Joshua Greenberg, and Hans Geier. They examined the effect of changing size limits for male Tanner crabs to sizes ranging from 115-150 mm CW (5 mm

bins) for catch and discard mortality using historical TACs, yield-per-recruit, and SSB-per-recruit. Results suggest that changing the size limit is projected to have no effect on how mature female biomass is used when setting harvest levels, but would increase the abundance of legal males (because the definition of legal crabs would change), decrease the average weight of legal males, and result in fewer pot pulls in the directed fishery with resultant decreases in discard mortality. An economic analysis suggests that the fishery is not economically profitable currently, and that inconsistency in product availability has damaged market demand and the premium price previously garnered for Tanner crab. Stew Grant reported that the previously published genetic analysis suggesting genetic differentiation between the Eastern and Western region are not supported with a reanalysis of the data using modern analytical techniques. However, the power to detect population structure using this allozyme data set was low. Additional genetic markers are available and may be used in the future to evaluate genetic stock structure for EBS Tanner crab.

The proportion of the population that is reproducing, percent mature, is well above 80% at the current size limit. The percent mature at different sizes has varied over time and geographic areas. For example, greater than 75% of males are mature at 115 mm CW in the Western region, but the size at which 50% are mature is approximately >138 mm CW (the current size limit) in the Eastern region during the current low productivity period. Decreasing the size limit would cause a reduction in SSB-per-recruit, especially for the Eastern region. This analysis only examined bycatch mortality from the directed fishery, and assumes discard mortality in other fisheries would not change with this size limit change. Bycatch differs in the two regions. Further analysis is required to include this non-directed bycatch mortality.

Ecosystem Considerations

The CPT appreciates the efforts of the analysts in drafting this chapter as an important annual contribution to the SAFE report. The CPT agreed that the ecosystem considerations sections in each of the SAFE chapters be moved from the chapters and incorporated into the new ecosystem considerations chapter. Each stock assessment author should remove the ecosystem section of their chapter and provide it to Liz Chilton for incorporation into the ecosystem consideration chapter. Once completed, this chapter should be organized to facilitate finding ecosystem considerations for each stock (in the ecosystem status indicators section of the chapter). A summary of ecosystem concerns should eventually be included in the SAFE Introduction. The ecosystem chapter would be prepared by NMFS biologists and reviewed by CPT. Some suggestions for inclusion in the final chapter for September 2010 include identification of possible management-related reference points for the ecosystem indicators. Fishery impacts on the ecosystem though directed and bycatch mortality are addressed in the SAFE chapters and so do not need to be included here.

Stock Assessment Review:

The team made final OFL recommendations for four stocks at this meeting: AIGKC, PIGKC, NSRKC and Adak RKC. The team noted that authors must compile final total catch information from the previous season for the September 2010 meeting to complete the status determination (overfishing determination) aspect of the final SAFE report at that time even though the assessments for these stocks will not be updated for the final SAFE report in September 2010. This information will be included in the SAFE introduction in September.

Tier determination and model recommendations are made for the assessments for the remaining six stocks, to be completed for the final assessment in September 2010. These recommendations are contained in the SAFE Introduction. Additional discussion and recommendations by stock are listed below.

General

Some assessments provided results in metric tons. The CPT recommendation to use metric tons refers only to the ACL analysis and traditional assessment currencies (lbs) should continue to be used in stock assessments.

The team requested that all assessments explain how the groundfish bycatch data are used in the assessment and that all assessment chapters should be consistent in distinguishing and separately presenting groundfish bycatch from fixed gear fisheries and trawl gear fisheries.

Snow Crab

The CPT was briefed by Jack Turnock who presented the results of seven variants of the EBS snow crab model. Six of these models included the survey data collected by the Bering Sea Fishery Research Foundation (BSFRF) and the NMFS in 2009 in the likelihood function. A number of other changes were made to the assessment based on the recommendations of the CPT and SSC at their May and September 2009 and April 2010 meetings. The fit of the model to the BSFRF length-frequency data was considerably better in the current set of models than those presented to the CPT in April 2010. This is due primarily to dropping the length-frequency data for animals smaller than 40 mm CW (as recommended by the CPT in April). The assessment team did not consider all of the recommendations of the April 2010 meetings.

The CPT noted that the selectivity pattern for the NMFS survey suggests that fairly small animals are fully selected to the gear. It noted that this contradicted the “Somerton selectivity curve”, at least for males. Members discussed reasons why the model might suggest that selectivity for smaller animals was fairly high, including that natural mortality for smaller animals was, in fact, (much) larger than that for larger animals.

The CPT evaluated the six models when deciding on their recommended model (this model will be used to evaluate stock status relative to the overfished threshold and to determine the OFL for 2010/11). Two main views emerged within the CPT. One view considered that Model 1 (equivalent to the model recommended in 2009) should be recommended for use as the basis for the 2010 assessment. This model provides an adequate fit to the data and does not attempt to estimate growth and natural mortality, parameters which may be confounded with selectivity. The members of the CPT who supported Model 1 also noted that the Canadian tagging data suggested that M was lower than 0.29yr^{-1} and that the estimate of Q for females from Model 5 was 0.58, i.e. substantially below that for males. The second view considered that Model 5 should be recommended for use as the basis for the 2010 assessment. This model provides the best fit to the data and is selected as best among the six models using AIC. The estimate of natural mortality and growth from model 5 are also not implausibly different from the values used in earlier models. Those supporting Model 5 also noted that the extent of confounding between M and selectivity in integrated models such as that for EBS snow crab is not as marked as would be the case for models such as Virtual Population Analysis.

After much discussion, the majority of the CPT supported model 5 as the recommended model.

Bristol Bay red king crab:

See the introduction to the SAFE report for comments on this assessment. There were no additional comments outside of these.

Tanner Crab:

Lou Rugolo summarized the Tanner crab assessment. The current analysis estimates a likely upper limit on MMB at time of mating (final results depend on fishery performance). It is estimated from the 2009 survey that the stock was below the MSST at that time, and the catches during the 2009/10 fishery will

further result in MMB at mating in 2010 being below MSST. A formal determination of the stock being overfished will occur with the Fall 2010 assessment.

The CPT had the following recommendations for the authors:

- Include CV's with point estimates in the tables.
- Determine whether "groundfish" discards are based on all groundfish fisheries or only trawl fisheries.
- Revise the text for OFL calculation (Eq. 3 and 4) to represent what was actually done.
- Remove Appendix A as it came from a prior assessment.
- Provide the September meeting with a summary of progress with the new model. The CPT may recommend an additional CPT meeting may be necessary depending on progress and the necessity of this model for the rebuilding plan.
- Rebuilding plan considerations
 - Review recommendations from April 2010 ACL workshop for components relevant to the Tanner crab assessment.
 - Consider alternatives that are similar to those in the snow crab rebuilding plan.
- Consider an assessment model with different size limits for areas east and west of 166; do not consider a spatial movement model due to the associated complexity and development time.

St. Matthew blue king crab:

No additional comments- see Crab SAFE introduction for CPT recommendations on this stock

Pribilof Island red king crab:

- The CSA model was not presented to the CPT. This model will be presented in September 2010 with the intent of model approval in May 2011 for use in setting the 2011/12 OFL.
- The assessment methodology remains unchanged from last year.
- The 'Total Crab @ survey' column in Table 4 is incorrect and needs to be recalculated.
- Confidence intervals are still missing from Tables 3 and 4. They must be provided in the September assessment.
- Equation 3 is the same as equation 1 and needs to be corrected for females.
- Reorganize the chapter so that it is in standard format of text, tables, and figures.

Pribilof Islands blue king crab:

- The CSA model was not presented to the CPT. This model will be presented in September 2010 with the intent of model approval in May 2011 for use in setting the 2011/12 OFL.
- The 'Total Crab @ survey' column in Table 4 is incorrect and needs to be recalculated.
- Equation 3 is the same as equation 1 and needs to be corrected for females.
- Reorganize the chapter so that it is in standard format of text, tables, and figures.
- A more complete analysis of spatial and temporal distributions of bycatch needs to be presented in conjunction with the initial draft of the rebuilding plan.
- All tables on page 1 should be updated for final assessment in September 2010.

Norton Sound red king crab:

Jie Zheng presented the Norton Sound red king crab assessment. Jie identified the SSC and CPT recommendations regarding the 2009/10 assessment and the subsequent changes made in this year's assessment. Major changes include specification of $M=0.18\text{yr}^{-1}$ and $\gamma=1.0$. The CPT recommended that the next iteration explain the derivation of weights on fishing effort data.

Jie presented seven model alternatives, including the 2009/10 selected model and six model configurations with different assumptions. The conclusion that selectivity is uniform across all sizes should be re-evaluated for model 5, which specified a maximum effective sample size of 100 for the commercial catch and winter surveys. Further biological justification should be provided for the value of M to 0.288yr^{-1} for last length group in model 6. It was noted that the assumption that M is higher for the largest crab is not made in the assessments of other RKC stocks and alternative explanations include the potential that last length group moves to inaccessible area, resulting in lower selectivity. The lack of large individuals in the catch and survey is dealt with in two different ways in the assessment: dome-shaped selectivity (models 1-5) and higher M (models 6 and 7). The analysis should isolate effect of selectivity.

Aleutian Islands golden king crab:

Tier 4 discussion

The model is based on data from the 1990/91 seasons for the eastern stock and from the 1989/90 season for the western stock.

Model recommendations:

- Check whether the residual variance is compatible with the pre-specified CVs (check the residual patterns to the model fit). Increase the CV inputs (or estimate the extent of overdispersion) if needed
- Include CIs on annual CPUE graphs of model fits
- Include bubble plots
- Run the model with M fixed at 0.18yr^{-1} .
- Selectivity for the eastern stock: why are the large crab not available? The shape of the dome is not realistic. Explore standard models in which selectivity is asymptotic for at least one of the periods. Look for empirical evidence such as the size distribution of crab at depth to examine the plausibility of dome-shaped selectivity. Is the need for dome-shaped selectivity a consequence of the model assuming a growth transition matrix that implies higher growth than is actually the case?
- There are tagging data to estimate growth for golden king crab. The CPT recommends including growth data from tagging in the assessment to estimate growth within the model. Andre Punt has a paper in ICES journal on how to do this and will distribute to assessment author.
- Do not apply the selectivity curve when calculating MMB.
- Using λ as a correction factor makes it hard to see what the productivity of the stock actually is, it's biologically confusing.
- Model framework looks correct, but secondary fixes need to be worked on. CPT would like to see the model again before Tier 4 adoption.
- Calculate F_{35} for evaluation whether the stock could be moved to Tier 3.
- It appears from Table 3, that some parameters are hitting bounds; this needs to be checked and if parameters hit bounds reported.
- Molting probability is quite different between east and west. However, there are no data on growth in west. The CPT recommends using the tagging data from the east to estimate molting probabilities and use the same molting probability east and west.
- There was some discussion on various gamma values (1, 0.5 and 0.25). Clear justification for gamma alternatives should be included in future assessments.

While the model is much improved, the CPT would like to see the alternative model scenarios recommended above (concerning molting probabilities, fishery selectivity, M , growth) before adoption of the model.

Tier 5 discussion

CPT recognizes that using a Tier 5 approach which is based on data obtained from the fishery is sensitive to changes in fishing practices.

A retained catch OFL using the years 1985/86 through 1995/96 would be 9.18 million lbs. This year range was chosen by the SSC for the past two seasons. It represents the years after the legal size changed from 6.5 inches to 6.0 inches and is before the fishery was managed under a GHM or TAC.

The CPT recommended that a total-catch OFL be established for the 2010/11 Aleutian Islands golden king crab season. The CPT requested that the total-catch OFL be computed according to the following alternative:

1. $OFL_{TOT(1)} = (1 + RATE_{05/06-08/09}) \cdot OFL_{RET(85/86-95/96)} + MGF_{96/97-08/09}$
2. $OFL_{TOT(2)} = (1 + RATE_{96/97-04/05}) \cdot OFL_{RET(85/86-95/96)} + MGF_{96/97-08/09}$
3. $OFL_{TOT(3)} =$ Average of total catch for all components in Table 4 in assessment.

where:

$(RATE_{05/06-08/09}) =$ mean of annual Rate = (bycatch mortality in crab fisheries)/(retained catch) over the period 2005/06–2008/09,

$(RATE_{96/97-04/05}) =$ mean of annual Rate = (bycatch mortality in crab fisheries)/(retained catch) over the period 1996/97–2004/04,

$OFL_{RET(85/86-95/96)} =$ mean of annual retained catch over the period 1985/86–1995/96 (this is the retained-catch OFL that was established for the 2008/09 and 2009/10 Aleutian Islands golden king crab seasons, 9.18-million pounds), and

$MGF_{96/97-08/09} =$ mean of annual bycatch mortality in groundfish fisheries over the period 1996/97–2008/09.

The following information is relevant should the SSC chose to employ a methodology such as that proposed under alternatives 1 or 2 to establish a total catch OFL for the 2010/11 season

- Although data on bycatch during the crab fisheries exists for the golden king crab fishery seasons in the now defunct Adak and Dutch Harbor Areas during 1988/89–1995/96 and for groundfish fisheries in reporting areas 541, 542, and 543 during 1992/93–1995/96, only bycatch mortality estimates from crab and groundfish fishery observer data collected during 1996/97–2008/09 were available to the CPT at this meeting (see Table 4 of the May 2010 SAFE Aleutian Islands golden king crab chapter).
- Both $OFL_{TOT(1)}$ and $OFL_{TOT(2)}$ assume that bycatch mortality during the groundfish fisheries is independent of the retained catch during the golden king crab fishery and varies more-or-less randomly about a mean value estimated by $MGF_{96/97-08/09}$. On the other hand, $OFL_{TOT(1)}$ and $OFL_{TOT(2)}$ both assume that bycatch during the crab fisheries (which mainly occurs during the directed golden king crab fishery; see Table 2 of the Aleutian Islands golden king crab chapter) depends on the retained catch.

The data. The data are in Table 4 the Aleutian Islands golden king crab chapter. From that table, $MGF_{96/97-08/09}$ is given as 0.03-million pounds.

Annual values of Rate = (bycatch mortality in crab fisheries)/(retained catch) computed from the table are given in Table A1.

From Table A1, $(RATE_{05/06-08/09}) = 0.10$ and $(RATE_{96/97-04/05}) = 0.25$.

Annual bycatch mortality in the crab fisheries and Rate are plotted against retained catch in Figure A1. The value for 1998/99 (retained catch = 4.94-million pounds, bycatch mortality in crab fisheries = 1.48-

million pounds) is something of an outlier. The correlation between bycatch mortality in crab fisheries and retained catch is:

- $r = 0.45$ for all years ($n=13$),
- $r = 0.83$ for all years with 1998/99 excluded ($n=12$),
- $r = 0.38$ for 1996/97–2004/05 ($n=9$),
- $r = 0.80$ for 1996/97–2004/05 with 1998/99 excluded ($n=8$), and
- $r = 0.35$ for 2005/06–2008/09 ($n=4$).

The correlation between Rate = (bycatch mortality in crab fisheries)/(retained catch) and retained catch is similar:

- $r = 0.31$ for all years ($n=13$),
- $r = 0.80$ for all years with 1998/99 excluded ($n=12$),
- $r = 0.11$ for 1996/97–2004/05 ($n=9$),
- $r = 0.75$ for 1996/97–2004/05 with 1998/99 excluded ($n=8$), and
- $r = -0.02$ for 2005/06–2008/09 ($n=4$).

Rate = (bycatch mortality in crab fisheries)/(retained catch) tended to decrease with year during 1996/97–2008/09, from 0.26–0.31 during 1996/97–2000/01 to 0.09–0.11 during 2005/06–2008/09 (Table A1, Figure A2). The correlation between Rate = (bycatch mortality in crab fisheries)/(retained catch) and fishery year during 1996/97–2008/09 is $r = -0.96$.

Total-catch OFL computations.

1. $OFL_{TOT(1)} = (1+RATE_{05/06-08/09}) \cdot OFL_{RET(85/86-95/96)} + MGF_{96/97-08/09}$
 $= (1+0.10) \cdot (9.18\text{-million pounds}) + 0.03\text{-million pounds}$
 $= 10.13\text{-million pounds}$
2. $OFL_{TOT(2)} = (1+RATE_{96/97-04/05}) \cdot OFL_{RET(85/86-95/96)} + MGF_{96/97-08/09}$, where
 $= (1+0.25) \cdot (9.18\text{-million pounds}) + 0.03\text{-million pounds}$
 $= 11.51\text{-million pounds}$
3. $OFL_{TOT(3)} = 6.8\text{-million pounds}$ (from Table 4 of AI GKC assessment chapter)

See table, below.

$OFL_{RET(85/86-95/96)}$ (the retained-catch OFL for the 2008/09 and 2009/10 Aleutian Islands golden king crab fishery seasons compared with two alternatives for the total-catch OFL for the 2010/11 Aleutian Islands golden king crab fishery season.

$OFL_{TOT(1)}$	$OFL_{TOT(2)}$	$OFL_{TOT(3)}$
10.1-million pounds	11.5-million pounds	6.8-million pounds

Table A1. Annual values of Rate = (bycatch mortality in crab fisheries)/(retained catch) computed from the annual values retained catch and crab fishery bycatch mortality given in Table 4 of the May 2010 SAFE Aleutian Islands golden king crab chapter.

Season	Retained Catch	Crab	Rate
1996/97	5,815,772	1,815,110	0.312
1997/98	5,945,683	1,738,534	0.292
1998/99	4,941,893	1,477,655	0.299
1999/00	5,838,788	1,510,314	0.259
2000/01	6,018,761	1,780,307	0.296
2001/02	5,918,706	1,377,692	0.233
2002/03	5,462,455	1,134,264	0.208
2003/04	5,665,828	994,697	0.176
2004/05	5,575,051	864,203	0.155
2005/06	5,520,318	504,747	0.091
2006/07	5,262,342	514,608	0.098
2007/08	5,508,100	606,926	0.110
2008/09	5,680,084	552,735	0.097
Mean, 96/97–04/05	5,686,993	1,410,308	0.25
CV of Mean	2%	8%	8%
Mean, 05/06–08/09	5,492,711	544,754	0.10
CV of Mean	2%	4%	4%
Mean, 96/97–08/09	5,627,214	1,143,984	0.20
CV of Mean	1%	12%	12%

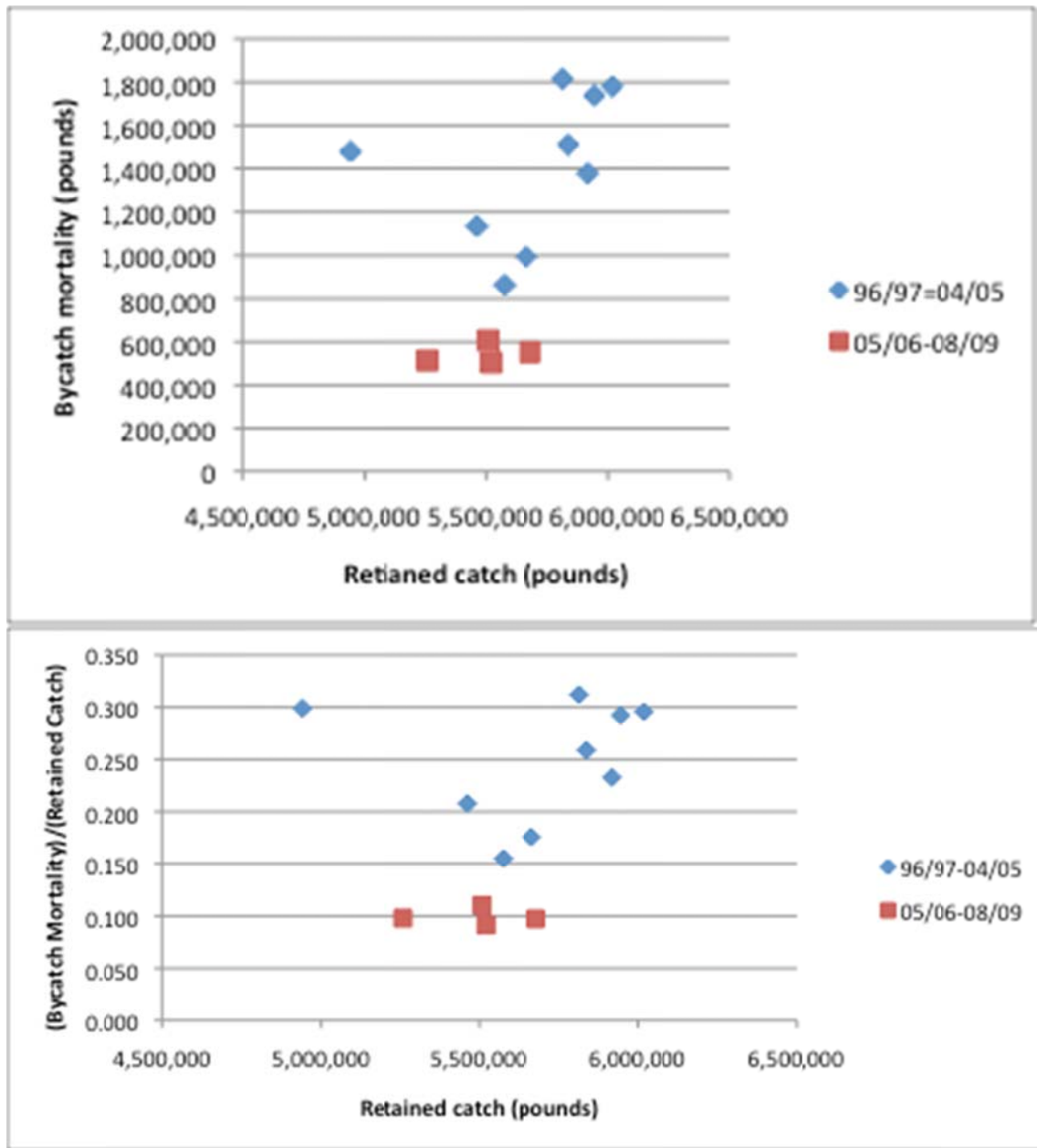


Figure A1. Annual bycatch mortality in the crab fisheries (top panel) and Rate (bottom panel) plotted against retained catch in the 1996/97–2008/09 Aleutian Islands golden king crab fishery seasons.

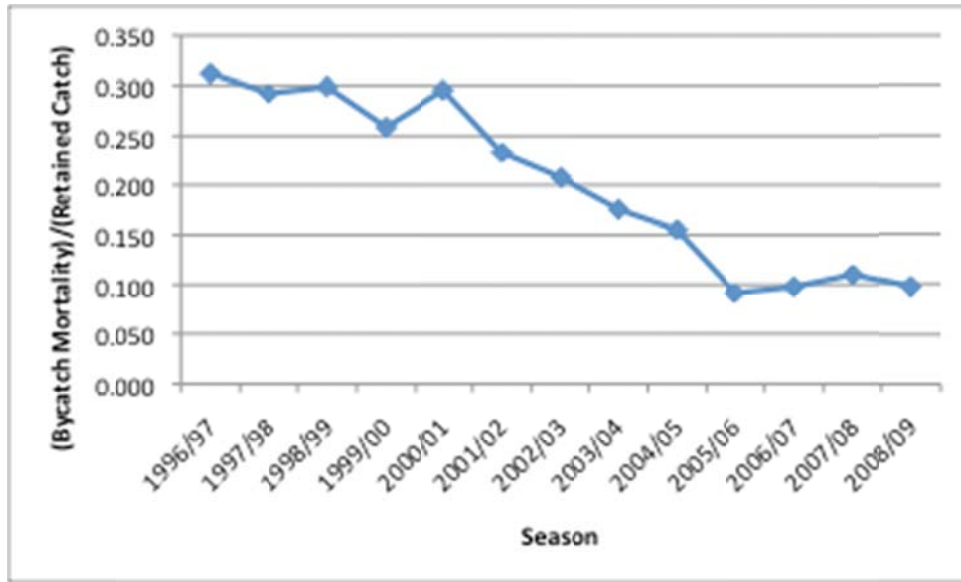


Figure A1. Annual Rate = (bycatch mortality in crab fisheries)/(retained catch) plotted against fishery season during the 1996/97–2008/09 Aleutian Islands golden king crab fishery seasons.

Pribilof Islands golden king crab:

No additional comments- see Crab SAFE introduction for CPT recommendations on this stock.

Adak red king crab:

No additional comments- see Crab SAFE introduction for CPT recommendations on this stock.

Crab Bycatch in Groundfish Fisheries

Diana Stram presented a draft discussion on crab bycatch in groundfish fisheries. This discussion paper was initiated based on a request from the CPT in March 2010 that was supported by the SSC, AP, and Council in April 2010. The CPT has expressed a desire to initiate a discussion on crab bycatch in the groundfish fisheries several instances in the past, but the requirement that ACLs/AMs be implemented for each FMP crab stock has placed renewed emphasis on this topic.

Diana provided a review of crab bycatch in groundfish fisheries by crab species and gear type for the 2003/04-2008/09 time period. This included a description of existing PSC levels and closure areas in groundfish fisheries. She described the current procedure used by catch accounting staff to convert observer-collected crab bycatch data into the format needed by various end users.

The team recommended that an analysis of crab bycatch in groundfish fisheries be initiated based on the Council’s April 2010 request and made the following additional recommendations for inclusion in the analysis:

- An effort should be made to convert all crab bycatch regulatory thresholds to weight rather than numbers and that crab bycatch should be reported as weight. Doing so would standardize crab bycatch in groundfish fisheries to the same currency used in crab stock assessments and would reduce uncertainty resulting from multiple conversions from weight to numbers and back to weight.

- The discussion paper should include sample sizes on the figures depicting sex ratio and size frequency of crab bycatch in various groundfish fisheries. Graphical depictions of size data should include some reference to average size of crabs taken in the directed crab fisheries as a point of comparison.
- The analysis should discuss the implications of the disconnect between timing of the groundfish assessment cycle/fishing year (calendar year) compared to the crab fishing year and consider alternatives for modifying the crab bycatch accounting process to best conform to the crab fishing year.

The Team agreed that current crab PSC limits in groundfish fisheries are not reflective of annual crab abundance and that crab PSC limits in groundfish fisheries should be responsive to annual changes in crab stock status. One approach identified by the Team to achieve this is to set crab PSC limits based on a percentage of the annual ACL for each crab stock.

The CPT agreed that the boundaries of existing crab closure areas should be examined in the context of current crab stock distribution. Existing closure areas do not encompass the entire distribution of each crab stock and crab bycatch can occur outside of the closure areas without accruing towards PSC limits. The team recommends that all crab bycatch in groundfish fisheries should accrue towards a PSC limit give the moves to towards total-catch OFLs for all crab stocks. In addition, the Team agreed that current PSC thresholds should be re-examined; PSC thresholds should be set based on biological impact to a given crab stock and should be considered for each groundfish sector. PSC thresholds could trigger complete fishery closures, or time and area closures. Additional consideration should be given to PSC caps that are stair-stepped based upon crab stock status.

The Team recognized that individual crab stocks may be particularly impacted by bycatch during biologically-sensitive time periods and in specific locations. In this context, the team requested that the analysis include a discussion of the size- and sex-composition of red king crab bycatch in Bristol Bay by location, time period, and groundfish fishery. In addition to the request for Bristol Bay red king crab, the team expressed a desire to prioritize analysis of bycatch in groundfish fisheries of crab stocks under a rebuilding plan (e.g. Pribilof blue king crab, EBS Tanner crab).

The Team again reiterates their recommendation that the Council move forward with an analysis of PSC limits in groundfish fisheries specified at the Crab stock level in light of implementation of ACLs and the AMs. The CPT would like to review any analysis that is initiated by the Council on crab stock PSC limits.

Crab Annual Catch limits and Rebuilding

General:

The CPT appreciates the immense amount of work and effort from the analysts in revising this analysis. The initial review draft is greatly improved from the preliminary draft and includes much more summary information and clarifications pertinent to understanding the complex decision-points that will be put forward to the Council for final action in October. The CPT will review and comment on the revised summary information in September (in the public review draft) with the intention to provide a recommendation on a preferred approach for establishing ACLs by stock at that time as well as a preferred alternative rebuilding strategy for snow crab. The Team requested clarification on the degree of specificity necessary in the AMs as presented in the initial review draft. The Team reiterates their concerns that any overage of an ACL which could trigger an AM would only impact the directed fishery regardless of why the ACL was exceeded (i.e. bycatch in groundfish fisheries). The Team recommended that additional uncertainty levels for σ_b at low, medium and high levels should be considered in the analyses and when computing ABCs. However, the Team recommended that these default levels be established as 0.2, 0.3 and 0.4 respectively. Furthermore the team recommended that the St. Matthew

stock qualified as a medium (not high) level σ_b because this assessment is based on adequate data is has a stable assessment (unlike PIBKC and PIRKC and the Tier 5 stocks).

Chapter 4: Snow Crab

Jack Turnock introduced the results of the rebuilding analysis and the ACL calculations for EBS snow crab. The CPT noted that the analyses had been revised extensively in response to the suggestions made during the Spring 2010 meetings of the CPT and SSC.

The CPT had the following recommendations which apply to both the ACL and rebuilding analyses:

- The years in all tables should indicate that what is presented are fishing and not calendar years.
- All references to stock-recruitment relationships should be removed as this is discussed in Chapter 3.
- The analyses should be changed to focus on model 5 if the SSC agrees with the CPT recommendation that this model is to be preferred.
- The text should clearly explain the reasons for the including a range of models in the chapter and state which model (1 or 5 depending on the SSC decision) is used in the bulk of the scenarios (and why) and which models are presented only for sensitivity purposes. The results for the non-preferred models should be discussed in separate “sensitivity test” sections within the ACL and rebuilding parts of the chapter.

In relation the rebuilding analyses, the CPT recommended:

- The catch for 2010/11 should be based on 75% of the F_{OFL} for all alternatives because the rebuilding plan will only impact management starting in 2011/12. This may change the values for T_{MIN} and even the number of alternatives.
- T_{MIN} should be computed with the groundfish catch included. This should not impact any of the results noticeably.
- The last column of the summary table should have a “% of F_{OFL} ” header. If this table contains a “NA”, a footnote should be added explaining what this means. The revenue forecasts need to be added to this table.
- A table should be added which lists the results if rebuilding is defined as recovery to B_{MSY} once (instead of for two years in a row).
- Option 1 should be defined in terms of 8 years after the start of the rebuilding plan, i.e. 2019/20. Option 1 is meant to represent an approach that provides additional time for rebuilding within the current harvest constraint of 75% F_{OFL} in order to provide additional time to annually correct for the rebuilding trajectory.
- The write-up needs to be extended to describe the methods and results in more detail. Specific areas where additional information is needed include: (a) mention that a strategy of 80% of F_{OFL} is implemented following recovery, (b) mention that alternative models are presented as sensitivity tests to indicate what might happen if the stock assessment is changed, (c) include the economic results and discuss these, and (d) indicate which alternatives / options lead to a reduction in MMB in the short term.
- The plots can be improved by: (a) using different line-styles for the various alternatives / options so that they can be distinguished in black-and-white copies and perhaps show the results in multi-panel plots instead of single plot, and (b) adding B_{MSY} on the plots of MMB.
- The results for the economic analyses should be presented for 5-, 10- and 15- year periods and reformatted to better emphasize the relative ranks of the alternatives.
- The economic analysis should scale the results to be relative to the status quo baseline
- economic forecasts should also start at the year of implementation of the rebuilding plan.

In relation to the ACL analyses, the CPT recommended:

- The reference to “set to point estimate” in table 4-1 should be deleted.

- The table of long-term results for P* values should be based on the multipliers computed from the log-normal distribution rather than chosen so that the probability of overfishing in 2038 equals the pre-specified values for P*.
- Figure 4-10 should be redrawn to reflect changes in buffer values rather than multipliers.

Chapter 5: Tanner Crab

- Figure 5-5 should be redrawn to reflect changes in buffer values rather than multipliers.
- Economic results need to be added

Chapter 6: Bristol Bay Red King Crab (BBRKC)

No additional comments outside of general changes.

Chapter 7: Pribilof Island Red King Crab (PIRKC)

Need to clarify that results employ a model under development which results in different σ_w values than those listed for comparison from the survey.

Chapter 8: Pribilof Island Blue King Crab

Need to clarify that results employ a model under development which results in different σ_w values than those listed for comparison from the survey.

Chapter 9: St Matthew Blue King Crab

The team recommended that a medium level of uncertainty ($\sigma_b = 0.4$) be assumed when computing ABCs for the St. Matthew blue king crab stock.

Chapter 10: Norton Sound Red King Crab

No additional comments outside of general changes.

Chapter 11: Aleutian Island Golden King Crab (AIGKC)

No additional comments outside of general changes.

Chapter 12: Pribilof Islands Golden King Crab (PIGKC)

No additional comments outside of general changes.

Chapter 13: Adak Red King Crab

No additional comments outside of general changes.

Economic SAFE

Brian Garber-Yonts outlined a draft of the BSAI crab Economic SAFE. The document is nearly complete with most tables and figures available. Interpretive text will be added by June 2010 and the complete document will be available for inclusion in the final crab SAFE in October 2010. The author would like to circulate the current draft of the document for public review and comments prior to finalizing the document for September. This will likely be done by web-posting either via the AFSC or the Council website (or both)

The author has begun to include stock-specific economic extracts, including summaries of employment, earnings, and participation by fishery to the assessment authors and will continue to do so on an annual basis. There is some difficulty in accessing ex-vessel price data for some stocks, particularly EBS Tanner crab. Price data for EBS Tanner are confounded because EBS Tanner crab are delivered at ports where other Tanner crab stocks are landed.

The team recommended that the figures depicting vessel days should be reexamined to insure that fishing days are correctly characterized during the rationalized period. The team suggested that the Tanner crab figures could be improved by removing vessels that only made small bycatch landings of Tanner crab and focusing on those vessels that were involved in directed Tanner crab harvesting.

The Team requested that captain and crew share payment depictions be expressed as a percentage of total ex-vessel value to better illustrate potential changes from rationalization. In addition, the CPT inquired about QS lease rates in the rationalized fisheries. Data on lease rates were not presented due to issues of data quality.

The team requests that, if possible, a presentation on the CRP 5-year review be provided at the September 2010 CPT meeting.

New Business

The team discussed scheduling and timing for the September CPT meeting. The following items were discussed for consideration at the next meeting, with priority for timing on items in bold. The Team decided the meeting should be 4 days (instead of 3) and will occur September 13-16, 2010 at the Alaska Fisheries Science Center.

September 2010 CPT meeting topics:

Final SAFE reports (6):

- **Snow**
- **BBRKC-including CIE review results and plans**
- **Tanner**
- **PIRKC**
- **PIBKC**
- **St Matts BKC**
- **survey overview and results**
- **ACL/Snow crab rebuilding analysis: discussion to review revised summary information and select preferred alternative**
- **Review initial review draft of PIBKC rebuilding plan EFH discussion paper**
- **Model review day**
 - **Tanner crab model review**
 - PIRKC/PIBKC model review
 - **AIGKC model review**
- **James Murphy snow crab spatial dynamics presentation**
- Presentation on crab crew remuneration
- Overview of final Economic SAFE
- 5 year economic review of CRP
- Crab Ecosystem considerations chapter
- **general update on Council actions from June**

The May CPT meeting will be May 9-13, 2011 in Juneau (possibly at TSMARI).

The meeting adjourned at 4:00pm.

North Pacific Fishery Management Council Crab Plan Team Meeting
 May 10-14, 2010
 Hotel Alyeska, Girdwood, AK

AGENDA

Monday, May 10		Room (TBD, all week)
9:00	Administration	<ul style="list-style-type: none"> • Introductions, agenda, minutes, meeting goals, and 2001 timing
9:45	EFH / HAPCs	<ul style="list-style-type: none"> • Update from the April 2010 Council Meeting
10:15	PIBKC Rebuilding Plan	<ul style="list-style-type: none"> • Update on status and timing on Pribilof Islands blue king crab
	Break 10:30 – 10:45	
10:45	Paper Presentations	<ul style="list-style-type: none"> • Snow crab larval drift – <i>Hinckley</i> • Snow crab spatial dynamics (T) – <i>Murphy</i>
Noon		Lunch
1:00	Paper Presentations (cont as necc)	<ul style="list-style-type: none"> • Snow crab spatial dynamics (T) – <i>Murphy</i>
2:15	Ecosystem Appendix	<ul style="list-style-type: none"> • Chapter outline for CPT approval – <i>Foy</i>
	Break 3:00 – 3:15	
3:15	Stock Assessment Review / OFL	<ul style="list-style-type: none"> • EBS Tanner crab: assessment and discuss rebuilding alternatives
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Tuesday, May 11		
9:00	Stock Asses. / OFL cont.	<ul style="list-style-type: none"> • Norton Sound red king crab, St. Matthew blue king crab • Bristol Bay red king crab
	Break 10:30 – 10:45	
Noon		Lunch
1:00	Break 3:00 – 3:15	<ul style="list-style-type: none"> • Bering Sea snow crab • Pribilof red and golden king crab • Aleutian Islands red and golden king crab, Pribilof Islands golden
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Wednesday, May 12		
9:00	Crab Bycatch	<ul style="list-style-type: none"> • Discussion paper on crab bycatch in the groundfish fisheries
10:00	ACLs / AMs	<ul style="list-style-type: none"> • Discussion on initial review draft of annual catch limits and accountability measures (Changes to Chapters 1 and 2)
	Break 10:30 – 10:45	
Noon		Lunch
1:00		<ul style="list-style-type: none"> • Bristol Bay red king crab
1:30	Break 3:00 – 3:15	<ul style="list-style-type: none"> • Norton Sound red king crab, St. Matthew blue king crab
3:15		<ul style="list-style-type: none"> • Pribilof red and blue king crab
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Thursday, May 13		
9:00	ACLs / AMs cont.	<ul style="list-style-type: none"> • EBS Tanner crab
9:30	Break 10:30 – 10:45	<ul style="list-style-type: none"> • Bering Sea snow crab
Noon		Lunch
1:00		<ul style="list-style-type: none"> • Bering Sea snow crab rebuilding plan
2:00	Break 3:00 – 3:15	<ul style="list-style-type: none"> • Aleutian Islands red and golden king crab • Pribilof Islands golden king crab
3:15	ACLs	<ul style="list-style-type: none"> • Finalize ACL discussion
	End of day 4:00	<i>Note must adjourn from room at 4pm!</i>
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Friday, May 14		
9:00	ACLs (cont if needed)	<ul style="list-style-type: none"> • Finalize ACL discussion (if necessary)

May 2010 draft Crab Plan Team Report

9:30	Economic SAFE	• Discussion
	Break 10:30 – 10:45	
10:45	SAFE / Minutes	• Complete the draft SAFE report and CPT minutes
Noon		Lunch
1:00	SAFE / Minutes cont.	• Cont' draft SAFE report and CPT minutes
4:00	New Business	
4:30		Adjourn