Oct 08

Public Testimony Sign-Up Sheet

Agenda Item C-2(a) BSAI Crab Issues SAFE

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1	TERRY HAINES	CITY KODIAK
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NOTE to persons providing oral or written testimony to the Council: Section 307(1)(I) of the Magnuson-Stevens Fishery Conservation and Management Act prohibits any person " to knowingly and willfully submit to a Council, the Secretary, or the Governor of a State false information (including, but not limited to, false information regarding the capacity and extent to which a United State fish processor, on an annual basis, will process a portion of the optimum yield of a fishery that will be harvested by fishing vessels of the United States) regarding any matter that the Council, Secretary, or Governor is considering in the course of carrying out this Act.

AGENDA C-2(a)
OCTOBER 2008

MEMORANDUM

TO: Council, SSC and AP Members

FROM: Chris Oliver DO for
Executive Director

DATE: September 25, 2008

SUBJECT: BSAI Crab Issues

ESTIMATED TIME
12 HOURS
All C-2 Items

ACTION REQUIRED

Receive Crab Plan Team Report; Approve BSAI Crab SAFE; and Adopt OFLs

BACKGROUND

The Crab Plan Team met at the Alaska Fisheries Science Center in Seattle from September 16-18, 2008 to review the status of stocks and to compile the annual Stock Assessment and Fishery Evaluation (SAFE) report. The Crab SAFE report was mailed to you September 22nd. This is the first year of the new process for annual determination of Crab OFLs and the Crab Plan Team is part of the newly established review process for BSAI crab assessments. There are 10 crab stocks in the BSAI Crab FMP and all 10 must have annually established OFLs. Six of the ten stocks have OFLs established following the summer survey information availability. Two of the ten stocks (Norton Sound red king crab and AI golden king crab) have OFLs which were established following review and recommendations by the CPT and SSC in the Spring of 2008 in order to allow for the summer fisheries for these stocks. The remaining two stocks (Adak red king crab and Pribilof Islands golden king crab) have OFLs recommended based on Tier 5 formulation (average catch). The CPT compiles the introduction to the SAFE Report and provides stock assessment and OFL recommendations within it, with additional recommendations and discussions included in the CPT Report. The Crab Plan Team Report is attached as Item C-2(a)(1) and the Introduction to the SAFE Report is attached as Item C-2(a)(2).

Crab Plan Team Report

The Crab Plan Team convened their Fall meeting from September 16-18, 2008 at the Alaska Fisheries Science Center in Seattle, WA.

All Crab Plan Team members were present:
Forrest Bowers (ADF&G-Dutch Harbor), Chair
Ginny Eckert (UAF/UAS), Vice-Chair
Diana Stram (NPFMC)
Doug Pengilly (ADF&G-Kodiak)
Gretchen Harrington (NOAA Fisheries –Juneau)
Wayne Donaldson(ADF&G-Kodiak)
Jack Turnock (NOAA Fisheries/AFSC-Seattle)
Shareef Siddeek (ADF&G-Juneau)
Herman Savikko (ADF&G-Juneau)
Lou Rugolo NOAA Fisheries /AFSC-Kodiak)
André Punt (Univ. Of Washington)
Bill Bechtol (UAF)
Bob Foy (NOAA Fisheries /AFSC-Kodiak)
Josh Greenberg (UAF)

Members of the public (and state and agency staff) present for all or part of the meeting included: Anne Vanderhoven (BBEDC), Arni Thompson (ACC), Gretar Gundersson (Fishing Associates), Ron Nomuma, Linda Kozak,Erik Olson (NorthWest Farm Credit), Garry Loncon (Royal Aleutian Seafoods),Rob Rogers (Icicle),Jie Zheng (ADF&G), Keith Colburn (F/V Wizard), Phil Hanson (Unisea), Scott Campbell (F/V Seabrooke), John Jorgensen (Alaska Crab Producers Coop), Brett Reasor (Royal Aleutian Seafoods/UNISEA), Jeff Chrush (University of Washington), Heather Lazrus (Pacific States Marine Fisheries Commission), Jack Tagart (Tagart Consulting), Jim Stone (Ocean Fisheries), Doug Woodby (ADF&G), Mark Gleason (University of Washington), Stuart Fritz (F/V Seabrooke), Dick Tremaine (NSEDC), Kevin Kaldestad (MCH Coop).

Administration

Agenda
The team approved the attached agenda for the meeting after noting that the assessment for St. Matthew blue king crab would be taken up first under stock assessment review. Linda Kozak requested the CPT address the proposed North Aleutian Island basin oil drilling and the potential impacts on red king crab stocks. The team noted that other agencies are already evaluating this, and the team will request a brief presentation from the relevant agency personnel in May to advise the team as to the status of the analysis and projected impacts on crab.

Review and Approve Minutes
The Team reviewed and approved the May 2008 minutes: Minor editorial changes from the draft version as circulated were noted.

Revise Terms of Reference
The team revised their terms of reference to better reflect the intent of the OFL review process and the current terms for CPT officers. The revised TORs are attached.

Election of officers
The team unanimously re-elected Forrest Bowers (Chair) and Ginny Eckert (Vice Chair) for two year terms.

Annual Catch Limit (ACL) discussion
Diana provided the team an overview of the status of the proposed rule for ACLs, and the Council's comment letter to the agency regarding the proposed rule. She noted that the Crab FMP will need to be revised to allow for ACLs, which may be equal to or less than ABCs. This will represent a major amendment to the Crab FMP and to the nature of State/Federal management given that ABCs are not currently established annually for crab stocks. For the Pribilof blue king crab stock or any stock where overfishing is occurring, the FMP amendment to revise the rebuilding plan and accommodate new ACLs needs to be approved in 2010 (i.e. possibly by the end of 2010). The CPT will receive copies when the final ACL rule is published and then plan to discuss amending the FMP accordingly.

Upcoming CPT meetings
May 2009 meeting: week of May 11th. Timing: 3-4 days (May 12-15th), Location: Anchorage or Girdwood.
September 2009 meeting: September 15-17th Location: AFSC, Seattle.

Economic discussions

Crab Rationalization Program overview
Glenn Merrill provided an overview presentation of the Crab Rationalization Program; its structure, and current modifications and concerns. A short overview document was provided for the team (appended to minutes). The Team commented on the extent to which other economic factors may be affecting observed economic impacts in the fishery. Forrest noted that consolidation of the crab processing sector began prior to the implantation of the CR program. Trends in other fisheries provide information on observed changes such as consolidation of the fishery. The concerns of exceeding TAC is less of an issue now under rationalization; previously the risk of overharvesting was always high despite stringent management efforts to conservatively manage the fishery

Lou requested a summary of information regarding the net economic impact of the program with respect to crew size, efficiency, employment and other factors. The intent of the economic reporting requirements were to begin to characterize these changes. However, Glenn noted that the complexity in evaluating crew data is difficult and pre-rationalization data against which the current employment situation can be compared are limited. Obtaining estimates of the value of quota shares is difficult given that there are not many trades (such as with the halibut and sablefish quotas) on which to estimate relative value. Josh questioned the ability to track quota value changes to better characterize trends. Siddeek requested additional information regarding the highgrading issue. Glenn noted that the only example of highgrading to date was in the BBRKC fishery during the first year of implementation, following a decrease in the TAC. The snow crab fishery continues to be an issue however with respect to the difference between the legal size and the preferred market size.

Discussion by members of the public referred to the Council's ability to choose to hold auctions under the MSA and the problems this could pose. Glenn noted that to date this has not occurred and in fact seems unlikely.

Economic SAFE discussion
Brian Garber-Yonts provided the team an overview of plans for contributions to a Crab Economic SAFE report modeled on the Groundfish Economic SAFE. This includes development of a core set of tables to be updated annually in the Crab Economic SAFE. He also noted several draft papers that were provided to the team for possible inclusion in the SAFE report. The team discussed what, if anything, to include in this year's SAFE report and to what extent the presented contributions are to be included this year given the inability of team to review and comment effectively on them. Garber-Yonts noted that AFSC was not advocating for inclusion of the papers in the SAFE, but that he had been contacted regarding the Crab SAFE on short notice and the documents provided had been requested by members of the CPT despite his explanation that they would not be available in time to review.

The team discussed the timing for reviewing economic information in order to include and synthesize this information into the Economic SAFE for Crab annually. The team discussed how these documents should be reviewed annually, and how to formulate a crab economic SAFE. Team members noted that many analyses are being directly reported to the Council and should not necessarily be included as a plan team contribution, both to avoid repetition as well as avoid some inappropriate plan team approval of something outside of the team's expertise by virtue of including it in the SAFE report.

The team decided to appoint a work group (Josh Greenberg, Forrest Bowers and Gretchen Harrington) to meet with AFSC economists and discuss what should be included in an economic report. This would facilitate the CPT's ability to take ownership of the information presented in the SAFE report. The team discussed the necessity of reviewing some form of draft chapter at the May 2009 meeting so that it can be included in the following SAFE report.

Summary of EDR data
Brian Garber-Yonts provided a summary of EDR available information, the context under which data are collected, and the status of a validation review (PNCIAC public review). The SSC and Council will discuss and deliberate on this at the October meeting. Reports from PNCIAC and AFSC will be provided to the Council. Some issues with data quality were noted. Brian noted that resolving the data quality issues has slowed down the ability to do any analysis on these data for the 3 year review.

Glenn Merrill requested clarification regarding other papers being prepared and to what extent they rely on EDR data, noting that the validity of those data are being currently examined. Brian noted that agency peer-review requirements for academic publications and the Council's determination of the utility of the data are not necessarily similar. Thus some scientific publications are being prepared using the EDR data irrespective of the Council's determination of the adequacy of these data. Diana and Glenn both commented regarding the difficulty this may pose when these peer-reviewed publications are then employed elsewhere and/or cited to the Council for management purposes if the underlying data itself were flagged initially as questionable. There was considerable concern expressed that EDR data would be used for scientific publications by AFSC economists prior to resolving issues related to the validity of these data. Brian replied that the distinction he had drawn was a technical point and that in fact, regarding the EDR data, AFSC has determined to use the Council's process for data quality assessment and the SSC as the peer-review body for purposes of satisfying federal Data Quality Act requirements for the EDR database. He also noted that none of the studies referred to have advanced to the stage of performing analysis of EDR data and none included EDR variables that have been identified in the Council's data quality review as problematic.

Crew Community issues
Heather Lazrus provided an overview of a draft paper on crew member issues. She highlighted where some of the sectors of the target community are under-represented in this research (eg. former crew members) and how the authors are trying to either caveat this or work to increase their data in these categories. She indicated the author's desire for additional feedback on their data limitations and findings to continue to improve their study. Forrest suggested that captains or boat owners be contacted to obtain contact information for crew members (current or past). The team discussed the conclusions in the paper as related to safety. Heather indicated that rationalization is a necessary step to improving safety, but it does not on its own ensure any increase in the safety of operations. Forrest noted that while delivery schedules between processors and harvesters may be agreed upon preseason, in practice they are not closely adhered to and that conclusions in the paper suggesting that delivery schedules are compromising safety might warrant further attention. Heather commented that there may be a difference in scheduling constraints based upon the season and fishery in which sampling occurred with differences among fisheries and individual vessels based on their historical relationships with processing plants..

Heather noted that one purpose of this paper is that it will be used as a platform to highlight issues that may merit further consideration. This could be to focus further study or suggest augmentation of existing data collections efforts. However she noted that the paper is final as currently drafted and will be published as preliminary findings. Questions were posed regarding the statistics as reported in Table 4. Glenn noted that the use of pre- and post-rationalization impacts are also affected by issues such as fuel costs and quotas and other background changes in the prosecution of the fishery. These are qualitative issues but important to discuss in conjunction with expressed conclusions regarding consolidation.

Import pricing model
Mike Dalton provided an overview of a model being constructed to evaluate import prices and Alaska wholesale prices for king crab. This report is being provided in conjunction with the Council's 3 –year review of the CRP. André noted that the author could explore models in which: (a) there is a 0-lag covariate to allow immediate impacts to be considered, and (b) test the restriction of zero-correlation in errors between prices. There could be some possibility of a within-season effect that is not yet considered.

The author responded to André's suggestions by noting that the form of the system with i) zero-correlation between errors and ii) contemporaneous (i.e. 0-lag) covariates is known as a structural VAR. The structural VAR has a parameter identification problem and can yield inconsistent parameter estimates. This problem is overcome by writing the structural VAR in reduced-form which is the model that was presented. In this case, the reduced-form error terms are linear combinations of the (uncorrelated) structural errors. Consequently, the covariance matrix of the reduced-form VAR can have non-zero correlation between error terms even though the structural errors are uncorrelated. If zero-correlation between errors in the reduced-form VAR is not rejected, then effects of 0-lag terms in the structural VAR are not significant.

André noted that the length of the time series (n=16 years) probably means low power in the tests that were presented.

André noted a trade-off between forecast intervals among the 3 models that were presented. In particular, the order-3 model involves estimating more parameters, creating wider forecast

intervals, and thus may only give the appearance of a better comparison between predicted and observed values.

The team greatly appreciated the presentations provided by the AFSC economists and looks forward to cooperative efforts to develop an Economic SAFE report for BSAI crab.

Survey Overview

Bob Foy provided an overview of the 2008 NMFS EBS trawl survey results for crab. Bob noted that several stations were re-sampled after the survey due to the delayed molt status of red king crabs in the original sample. Average bottom water temperatures were much colder this year than in previous recent survey years. The team discussed the implications of the strategy of re-tows and how these tows are treated in stock assessments Bob noted that the NMFS Kodiak lab will be working this winter to revise their calculations and to standardize and document their methods. Bob noted that the lab intends to also revisit historical hot spot calculations (including cold spot calculations) and evaluate the impact of modifying these calculations using data for historical surveys. New survey estimates of abundance will include coefficients of variation (CV). Consideration will be given to effects of hot spots on abundance estimates, fixed versus actual footrope width in the CPUE estimates, and differences in fishing power between vessels.

Steve Hughes presented an overview of the results of the BSFRF trawl survey. He noted the differences between the NMFS survey and the BSFRF survey, including the survey area, the sampling protocol, the net width and the tow time. The ability to have comparable data by virtue of the changes to the footrope, doors and other changes may compromise the ability to compare with historical data from NMFS due to effective changes in selectivity. Lou commented that the observed differences in length frequency modes between 2007 and 2008 could not be a consequence of growth alone, as was indicated in the presentation.

Scott Goodman provided additional comparative information on the results from the NMFS and BSFRF surveys. Jack noted that the two surveys do not occur at the same time so there is the potential for animals to shift locations between when the two surveys take place. Plots of bottom water temperature and crab density between years show inconsistent relationships. Andre noted that it would be useful to use the results from the NMFS and BSFRF surveys to enable estimates of survey catchability (with associated measures of precision) to be computed. These estimates could be used to inform whether the results of the assessment would be impacted by their inclusion.

Steve Hughes discussed the potential to continue this survey as a cooperative venture with ADFG and NMFS. He noted that they will hold a workshop with NMFS and ADFG early in 2009 to review the science and background of the survey and to discuss policy issues in the cooperative effort. He requested any comments from CPT members on this cooperative survey and presence at the workshop.

Groundfish Fishery Bycatch

Jennifer Mondragon provided an overview of the NMFS catch accounting system and bycatch estimation procedure. Brian Mason was available to answer questions regarding the observer program procedures for sampling. Questions have been raised in the past by the team and assessment authors regarding the spatial and temporal availability and resolution of groundfish bycatch data. Crab are estimated by number not weight and no mortality rate is applied to the data. This estimate is then extrapolated to the unobserved fleet by federal reporting area. Jennifer noted that the data could be reported at finer resolution (ADF&G statistical areas) than

federal reporting areas, but this was not possible at present. She stated that she could work within the needs of assessment authors to provide data at the resolution needed for assessments and management advice. Assessment authors need to provide Jennifer with specification (spatial, temporal and fishery) for how they would like the bycatch data to be reported.

Historical reports will be only available at the federal reporting area level, but future reports will be available on finer scales because each trip will be reported by state statistical area on production reports next year. Data are estimated by week, target and fishery.

Team members asked questions regarding the availability of VMS data and the potential for more spatially explicit resolution for catch reporting. Steve Lewis is currently working on a model which could use these data.

Some authors noted that having the information on both the gear and target of the fishery is useful. This would also allow for additional information on the relative level of observer coverage. The team discussed the necessity for variance estimates on bycatch to meet proposed ACL requirements. NMFS Catch Accounting is working on assessing this for the future. Mid-June is still the target time period for acquiring annual bycatch data from groundfish fisheries. Data are reported by crab fishing year from July 1-June 30th.

The estimates of the weight of crab in bycatch is currently calculated by multiplying bycatch in number by the average weight of crabs in the sample. Jennifer requested feedback from the CPT on this procedure. André suggested that these data (bycatch in number, bycatch in weight, and average weight) should be reported to the individual assessment authors. The team agreed that there should be an approved protocol for calculating bycatch (in weight) for each assessment to avoid the application of *ad hoc* subjective decisions on annual basis. There is an explicit difference between data that would be useful to the assessment authors for model fitting (i.e. using numbers of crabs not mean weight) from the data that is needed to debit against the accounting for OFL purposes to determine annual overfishing.

Authors commented that bycatch length-frequency information is also necessary, but is limited. Jennifer noted that a subset of the team could evaluate an appropriate protocol for estimating bycatch length-frequencies. The team requested that Bob Foy be the point person between the assessment authors and NMFS Catch Accounting for obtaining bycatch data at the appropriate scale to be useful to assessment authors. Bob Foy is continuing to work with NMFS Catch Accounting to clarify the explicit weight relationship from the reported estimate of numbers of crab. The authors will also provide to CA the finer spatial resolution by stock in anticipation of more fine scale reporting by ADFG reporting area.

Brian noted that observers take length and weights of all crabs sampled. No shell condition information is noted. He noted that hybrid crabs are not delineated to species just noted that there are hybrids. All of this information is contained in the observer manual.

Handling Mortality discussion
The team discussed the need for literature review to identify the scientific basis for the rates employed for handling mortality in groundfish and scallop fisheries. Diana and Bob agreed to work on compiling relevant information for a possible presentation to the team in May 2009.

OFL Stock Assessment Review:

The team conducted a detailed review of each stock assessment and provided detailed comments to the assessment authors. To the extent possible, the assessment authors revised the stocks assessments to reflect the team comments for the final assessments provided in the 2008 SAFE report. The SAFE report executive summary contains the status determination criteria recommend by the team and provides a brief summary of the assessment information. The team made additional comments on the assessments to be incorporated in the next assessment cycle.

General remarks

- The team agreed that assessment documents presented to September meetings should be the "track changes" version of the May assessment, to facilitate evaluating changes from that version.
- The team agreed that it is important to fully justify the basis for the use of weights, 'lambdas,' that are assigned to different data types. It was noted that weighting by survey CVs was ideal, but that the validity of this depended on CVs be correctly calculated.
- Jennifer Boldt should be requested to give an overview presentation on AIFEP and Ecosystem Considerations information to the team at its September 2009 meeting. Assessment authors working on the two AI stocks should incorporate the AIFEP into the ecosystem considerations portion of their assessments where applicable.
- The choice of weighting factors, survey CVs, and effective sample sizes can effect the outcome of an assessment as well as measures of uncertainty. The team recommends that an effort be made to develop standard methods for specifying (and justifying) the assumptions regarding how different data sources are weighted. (Andre and Diana! This is bullet 2 repeated in a different way!!)
- A checklist of the items which should be included in stock assessments on which OFL determinations are based should be developed. This checklist would include a table of survey estimates (and their associated CVs) by year. Having a standard approach to reporting assessment results will help the review process as well as how the work of the team is documented.
- Whenever possible survey estimates of abundance should be accompanied by measures of their precision because it is hard to assess model performance without this information.

St. Matthew Blue King crab

Jie Zheng provided an overview of the St. Matthew blue king crab assessment including his responses to team recommendations from May. The team discussed the availability of historical Pacific cod pot bycatch data which the author believed led to the inability to estimate a total catch OFL for this stock. Bob asked for clarification that this comment is specific to the 'historical' bycatch estimates for this stock. The team would like the St. Matthews blue king crab OFL to be a total catch OFL and requested that the assessment author include the groundfish bycatch data in the model and assessment.

The CPT noted an error in the SAFE executive summary from May. This summary indicates that the preferred model had fixed values for M and q (model 1) However, Jie clarified that although q was fixed and M was fixed for all years except 1999, the value for M for 1999 was treated as an estimated parameter. The CPT agreed to the recommendation of an OFL based on model (1), and thanked Jie for providing models 4 and 5, which helped to understand the behavior of the model. The team noted that key information on the reliability of the model (4) [fixed M and q] was provided by the retrospective patterns, but that this did not appear in the assessment, but should be added along with other information on the performance of model (4).

The time period for calculating B_{MSY} selected by the CPT and SSC was 1989-2008. However, this time-period was not included in the draft assessment report, but should be. Jie agreed and made this change in the final stock assessment for the SAFE.

André noted that a choice between the five models could be based on either: (a) evidence for model-mispecification based on, for example, a runs test, or (b) the application of model selection methods. He noted that it did not appear that any of the models could be rejected on the basis of runs tests and that the ability to use values for the likelihood as the basis for model selection (and construction of likelihood profiles) relied on the values assumed for the weights ('lambdas'), but these were not fully justified in the assessment report.

Jack commented that selectivity might be changing not the actual abundance and this should be further examined.

André requested clarification on why the model is predicting such extreme increases in MMB when none of the data seems to suggesting this. Jie noted that part of the reason for the increase is that the catch for 2008/09 was assumed to be zero because the fishery will remain closed. The CPT noted that this approach for projection has not been adopted for any other stock and recommended that the MMB series be updated under the assumption that catch equals the OFL. Jie agreed and made this change in the final stock assessment for the SAFE.

Jack provided some slides on ACLs and OFLs for St. Matthew blue king crab to illustrate the consequences of decisions on the relative risks of exceeding the OFL. He presented calculations using survey biomass estimates of calculated OFL and biomass reference points for the St. Matthew stock.

Snow Crab

Jack Turnock presented an overview of the Snow crab assessment, noting changes from the May version as well as the consequences of including the 2008 summer survey data. Jack noted that with the model tends to fit the 2008 survey estimate better than the 2007 estimates because it is more precise. Including the 2008 survey information indicated a decline in biomass to ~55% of B_{MSY} in February 2009. The team noted that the assessment was not modified to incorporate any of the team's requests from the May 2008 review. The team recommended that these recommendations and those identified for the next assessment be made in the next stock assessment for review by the CPT in May 2009.

The team discussed the observed change in biomass and relative length between the 2007 and 2008 surveys. Projections last year predicted an increase in survey biomass as compared to model results after fitting to the observed decline in 2008.

André commented that it would be useful to see the results from the May and September versions of the model to help assess the impact of the additional data..

The large males were further south in the 2008 survey compared to the 2007 survey. In contrast, the location of the fishery in 2008 was fairly similar to than in 2007. Figure 54 shows the retrospective indication of overfishing and the updated model results indicate that fishing mortality has exceeded $F_{35\%}$ during the last several years. While this does not trigger an overfishing declaration, it is an indication that there might be a need for an increase in the buffer between the OFL and the TAC.

Jie commented on indications that survey catchability estimates might be too high. It was noted that this could arise because the assessment fails to account for the spatial structure of the population, survey and fishery. The team supports work to construct a spatially structured assessment model to better examine this issue.

The team discussed the need to revise the rebuilding plan for snow crab to incorporate the Amendment 24 reference points and hence a rebuilt target of B_{MSY} based on mature male biomass. The previous B_{MSY} was based on total spawning biomass. The stock assessment included the projected rate of rebuilding using both estimates of B_{MSY}. The stock was intended to be rebuilt by 2010 under the rebuilding plan. However, the project rebuilding probabilities for both rebuilding targets is very low, as detailed in the stock assessment.

Siddeek questioned the negative value for likelihood in Table 8 for fishery length retained. Jie expressed concern that this is not possible under the formulas provided in the documentation in the assessment itself although it is possible in general with a multi-nomial distribution. Siddeek requested that "lambdas" be reevaluated.

The team discussed the issue of splitting the OFL between the north and south, catch as noted on page 4 of the assessment reported. Doug noted that if additional conservation measures are warranted it might be better to lower the overall TAC rather than attempting to spatially divide the OFL or TAC because the dividing line may shift overtime but a line dividing the TAC, and hence the quota share, would need to be set in both state and federal regulations.

Bristol Bay Red King Crab

Jie Zheng provided an overview of the Bristol Bay red king crab assessment. Jie noted that his estimates of survey biomass differed only slightly from those computed by NMFS. The team noted that it was anticipated a single time-series of abundance estimates and survey length-frequencies will be developed and agreed by NMFS and ADF&G so that they can be included in the May 2009 assessments. It was noted that likelihood component for the survey estimates of abundance should be modified so that it is clear that the survey CV depends on year.

Jie noted that per suggestions by SSC and CPT all weighting factors will be reevaluated and this information will be included in the May 2009 assessment.

The team recommended that the assessment author consider estimating the extent of highgrading in 2005, 2006 and 2007 inside the model and setting the extent of future highgrading when calculating OFLs based on recent years (i.e. not 2005). Members of the public requested that it remain outside the model for that single year ((because the highgrading incident occurred in only one year).

The team requested reevaluating the residual patterns and suggested that the results of this re-evaluation be presented to the team in May 2009 for further discussion.

The team requested additional information be included in the May 2009 assessment regarding which parameters are fixed and which are estimated. It was noted that the likelihood profiles in the assessment report indicate that catchability (q) is estimable and different from the assumed values. This may be a consequence of the assumed weights and the issue of the values (and treatment) of q should be explored during the next assessment.

The team noted that in the May 2008 meeting that a model using the whole time series of available data (1969 to present) was requested but not provided in the assessment. Jie Zheng said that he will provide a model using the 1969 to present data at the May 2009 CPT meeting.

Tanner crab

Lou Rugolo provided an overview of the Tanner crab assessment, highlighting changes from the May assessment and the results of the 2008 survey as compared to the 2007 survey. Lou highlighted some new information acquired on the directed fishery discards for the last few years as well as the groundfish fishery bycatch. This information was not available in May. The assessment uses a different way of estimating the projected trawl fishery bycatch than was used in May (using an average of the 2003-2007 groundfish fishery trawl bycatch). A one-to-one ratio of males to females (by number) is assumed for the trawl bycatch and estimates are made for the mean weight of males in the bycatch.

The team requested additional clarification regarding the bycatch information, in particular, the assumptions made about the size, sex and weight of bycatch. If data are collected to shed additional light on these assumptions they should be included in future assessments.

The team discussed the bycatch and discards as estimated in the model. It was noted that (a) the OFL for Tanner crab is explicitly linked to the estimated catch of snow crab (assumed to be based on the $F_{40\%}$ control rule), and (b) the directed Tanner crab fishery has much higher discards than previously realized (which reduces the component of the OFL available which can be landed).

Lou reviewed the SSC recommendations from June 2008 and mentioned that the authors' recommendations differ from those of the SSC. Lou presented additional information from that presented in the assessment to address SSC recommendations. The team discussed the position of adopting or disregarding the SSC's recommendations. For example, the authors chose to use a different gamma than the one (2.1) recommended during the June SSC meeting (based on May CPT recommendations). Lou revised the final assessment for the SAFE to reflect the SSC's recommendations for the years used to estimate B_{MSY}. The team also requested that the total catch OFL include all catch, male and female, from all fisheries. A new table 7 will replace that in the text containing the OFL stock and fishery metrics.

Jack Turnock presented an overview of the appendix to the Tanner crab assessment report. This document was provided to the team after the assessment was distributed but prior to the meeting (Friday before the meeting it was posted). This appendix addresses the SSC's recommendation regarding the value of gamma, specifically an attempt was made to calculate $F_{35\%}$ using fishery and biological information (based on defining the B_{MSY} proxy using the survey data for 1975-80). The team welcomed the calculations but noted that they were by necessity preliminary. In particular, the team noted that fishery bycatch and retained selectivity were estimated from the data for the two most recent years (under the assumption that a change in selectivity had occurred) and that future selectivity will be the same as selectivity in those two years. However, this estimation was not conducted in the context of a stock assessment. The team endorsed the approach of using the last two years of data rather than information included in the EA due to the dramatic change in the prosecution of the fishery since it reopened as a directed fishery. However, Siddeek requested that further exploration be done of the full data set in order to estimate selectivities.

Pat Livingston (SSC Chair) participated to provide further guidance on the intent of the SSC's comments in this topic. She indicated She indicated the SSC was interested in seeing a

methodology for incorporating selectivity and growth in the stocks assessment and from this analysis, then determining if it is more appropriate for this calculation.

Jack Tagart expressed concern with the application of the process as observed in the first year, believing that the SSC has recommended (directed) that a gamma of 2.1 be used to calculate the OFL. The team noted there is no agreed stock assessment for this stock which makes developing a basis for providing OFL recommendations particularly difficult.

In summary, the CPT considered two major issues regarding the OFL for Tanner crab:

- Specification of the B_{MSY} proxy. It considered two options (1975-80 – the period recommended in May; 1969-80 – the period recommended by the SSC). The ideal period should 'represent the reproductive pattern of the stock, encompassing highs and lows'. The team noted that there are several concerns with the early survey data, including availability of the raw data and coverage.
    - Jie indicated that the survey expanded its area in 1975 to encompass more of the Bering Sea and Tanner crab habitat.
    - Bob Foy provided the team with an overview of the historical coverage of the crab survey since 1971 (information for 1969 was not available). The team noted that survey coverage throughout the 1970s is somewhat similar as compared to the more extensive more standardized coverage from 1980 on. Survey coverage in 1971 is patchy but that for 1974-75 seems similar.
    - Jack and Lou expressed concerns about the use of the 1969 data from INPFC reports. Lou noted that from the data perspective there is a break in data quality of relative bin sizes from 1976 on. The team discussed that rationale seems to exists to include 1974 rather than a cut-off of 1975. The team notes inclusion of 1974 could be requested for the 2009 assessment to evaluate for B_{MSY} proxy.

  The team recognized that the SSC had made a specific recommendation regarding the period to be included when calculating the OFL and discussed to what extent this new information allows the team to disregard the SSC's recommendation to use all years until 1980. After much discussion, the team found no compelling evidence that data from 1975 onwards is markedly improved over the data for 1969-74, and, recognizing that the SSC had specifically recommended 1969-80, recommended that the OFL for 2008-09 be based on a B_{MSY} proxy defined over the years 1969-80.
- The choice of gamma. Although the team appreciated the work conducted by the authors to estimate $F_{35\%}$, and noting that results were not markedly sensitive to whether gamma was set to 1 or $F_{35\%}$ was used to calculate the OFL, it agreed to continue to use the author's selection (gamma = 1) for this year. The team agreed that using a gamma of 2.1 would be inappropriate because it is based on fishery selectivity patterns which contradict those estimated from the most recent data.

Lou presented updated calculations on three definitions for the B_{MSY} proxy (e.g, 1969-1989; 1975-1980; 1969-2007). The full time series (1969-2007) was requested by the SSC for comparative purposes but is not considered to be a viable option for the B_{MSY} proxy.

The team notes that we need to strive for consistency in assessment methodology for Tier determination for stocks. The team notes that the Tanner crab stock is particularly problematic given that more information exists for this stock than for all other Tier 4 stocks. In striving to incorporate all information as it exists to the extent possible the team feels that the Tiers 3 and 4 are becoming blurred and some Tier 3 applications (calculation of $F_{35\%}$) are being striven for with

a Tier 4 stock. It continued to support the development of a full stock assessment model for eastern Bering Sea Tanner crab.

The Team would like to request that the SSC in the future provide more specific details and rationale regarding recommendations as noted in their minutes.

Norton Sound red king crab

Jie Zheng provided an overview of the Norton Sound red king crab assessment. This is one of those stocks where an OFL is determined in the spring so the assessment is unchanged since May 2008, except for the addition of some response to the team's May comments on the assessments. The team reiterates its comments on the model from May and anticipates the revised assessment will address those comments.

Aleutian Island golden king crab

Doug Pengilly presented an overview of the SSC's changes in June 2008 which modified the CPT's recommended OFL for the 2008/09 fishing season.

Siddeek presented an overview of the AI golden king crab stock assessment model. If approved by the CPT and SSC this model would be employed next year for assessment purposes and would serve to elevate the AIGKC stock to Tier 4. The team raised the following technical comments on the assessment:

- Use of CPUE data. Standardization of the data prior to their incorporation is desirable. Sensitivity should be examined to ignoring these data owing to concerns regarding the use of catch-rate as an index of relative abundance in stock assessments.
- Tag loss. The model ignores systematic tag loss, which could be important as the tagging data likely have an important impact of the outcome of the assessment and systematic tag loss could be confounded with fishing mortality. Sensitivity should be conducted to various plausible levels of systematic tag loss.
- Weighting of the tag data. The tagging data are treated as if each tag is independent of the others. Sensitivity to the assumed weighting scheme should be examined (e.g. by treating each 'tag event' as an independent observation).
- Parameters hitting bounds. Many of the estimated fishing mortality rates are on the bounds assumed for these parameters. This is undesirable and should be explored further.
- Initial size structure. Consideration should be given to estimating the initial size-structure (perhaps penalized in some way).
- Fits to the discard data for the western area. The model overpredicts discards in early years in the time-series (this may be related to the assumption that size-structure in the first year is known in relative terms).
- Realism of the population trajectory for the western area. The MMB for the western stock drops in 1998. Fishing industry previously indicated that the mesh size on pot gear changed in this period. The team noted the predicted trajectory of population size seems contrary to the data.
- The 1998/99 catch. The team discussed why the fleet did not harvest the available GHL in 1998/1999, noting that outside of this one year the catch trajectory is smooth. A sensitivity test should explore increasing the assumed harvest for this year to the GHL to see what impact this has on the relative trajectory and trend.

Different selectivity patterns are used to represent the different time periods of the fishery. The assessment author may wish to reevaluate the time periods chosen as more information on

changes in gear used in the fishery becomes available. André noted that the equations in the assessment report do not reflect the time-varying selectivity and need to be revised accordingly. In additional CVs need to be included in all tables and the OFL control rule needs to specifically mentioned and the information needed to apply it summarized in the assessment report. Forrest agreed to help compile information on changes in gear configuration based on port sampling which observes gear and summarize any changes due to regulatory requirements.

Pribilof Island blue king crab:

Bob Foy provided an overview of the changes made to the PIBKC assessment since May. Specifically estimates for F_{OFL} are presented. The team discussed the recommendation for assessing gamma and the difficulties that may be encountered in doing so given lack of information available for this stock to calculate gamma. Bob noted that the surveyed blue king crab (similar to other species) were in a later stage of reproduction in the 2008 survey due to the colder bottom water temperatures. Bob noted that only area 513 was used to calculate bycatch for PIBKCs for the calculation of the OFL, but notes that more spatially explicit bycatch will be considered next year as some of the bycatch is underestimated by not including the portion of 521 that includes PIBKC bycatch. There is limited trawl bycatch of PIBKC given the trawl closures surrounding the Pribilofs but bycatch does occur in the fixed gear groundfish fisheries, particularly the Pacific cod pot fishery.

The 2008 survey estimate is 3% of the B_{MSY} proxy, well below β, the threshold for setting the directed fishery F is 0. The stock is closed and has been since 1998 with additional trawl restrictions in place and remains under a rebuilding plan.

The team discussed how the (bycatch) F_{OFL} could be set, and the necessity of revising the rebuilding plan for this stock. Given the current status of the stock, the team is concerned about the need for additional restrictions on bycatch in other groundfish fisheries to (possibly) allow the stock to rebuild. The team expressed concerns regarding recent bycatch trends in the Pacific cod pot fishery.

The team discussed the (bycatch) F_{OFL} for this stock given the continuing downward trend in stock size (and hence the lack of any indication of stock recovery). The team feels strongly that any bycatch in this fishery is impeding stock recovery, and would like to see an analysis which identifies which changes in the Pacific cod fishery that has led to increased bycatch of blue king crab.

The team feels that the Council should consider closing the Pribilof Island habitat conservation area to all groundfish fishing, noting that the stock remains overfished and that the higher bycatch in groundfish fisheries may, in fact, be overfishing. The team feels that NMFS and the Council need to communicate regarding the necessity of prioritizing the revision of the existing rebuilding plan to examine further measures to restrict bycatch in the groundfish fishery.

The team discussed the following alternatives for the (bycatch) F_{OFL} for the non-directed fisheries:

- A zero OFL – considered inappropriate because it would impede any research on this stock.
- 0.016 million lbs (the average bycatch over the last 10 years) – considered inappropriate because this period includes the two recent years of high (and perhaps unsustainable) bycatch

- 0.02 millions lbs (last years bycatch rate scaled by the 2008 survey estimated) – considered inappropriate because this period includes a year of high (and perhaps unsustainable) bycatch
- 0.007 millions lbs (the average bycatch from 1999/00 – 2005/06; years after the closure of the directed fishery until the bycatch increased markedly in 2006/07). [This estimate is 0.004 million lbs when handling mortality is accounted for]

The team chose to select the fourth alternative for OFL determination noting that this level of catch may still be unsustainable given the stock's current reproductive capacity. However, the team felt that this level of bycatch better represented the historical amounts given that it excludes the last two years when a radical shift in fishing practices appeared to have occurred.

The team requests the Council consider revising the existing rebuilding plan to prevent overfishing by examining further measures to restrict bycatch in the groundfish fisheries. The team discussed alternative management measures to be analyzed in a revised rebuilding plan analysis for this stock. The team recommends consideration of the following alternatives:

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

Analysis should cover changes in the Pacific cod pot fishery distribution in recent years. The ADF&G pot survey is on-going and may provide additional information on stock status and distribution of PIBKC and this information should be included in the analysis.

Pribilof Island red king crab

Bob Foy provided an overview of the red king crab assessment noting changes from May and survey results from the 2008 survey. Here bycatch information summarizes only 521 so as not to include BBRKC contribution from 513. This likely underestimates bycatch of PIRKC given the observed bycatch in the northwest corner of the 513 management area.

The team notes continued issues with the uncertainty estimates inherent in the survey biomass estimates for this stock. The team discussed the necessity of establishing an OFL with additional precaution due to high uncertainty with this stock estimate The team concluded the the OFL should be calculated using the best available information and that TAC level is the more appropriate place for adding additional precaution in acceptable catch levels.

The team requested additional information for the next year's assessment which further evaluates the individual fishery contributions to the bycatch. The team also requests the addition of CVs for all historical estimates from the survey.

Pribilof Island golden king crab

Doug Pengilly explained that there are no changes to the assessment from May. The fishery operates on a Commissioner's permit and no applications have been made for directed fishing on this stock in recent years. No new catch information is available for this stock. There may be

some additional information available from the recent EBS trawl survey on the AIGKC stock. These data will be processed over the winter and available information will be provided to the stock assessment author for the following year.

Adak red king crab

Doug Pengilly provided an overview of the Adak red king crab assessment. Changes from the May assessment include incorporation of SSC recommendations from June 2008 on OFL determination as well as responding to comments to the extent that this was possible. The remaining comments from the SSC and CPT will be addressed in the May 2009 version.

In June 2008, the SSC disagreed substantially with the plan team's recommendation in June 2008. The team discussed the difference between what the SSC and CPT OFL recommendations, noting that the teams concerns regarding the status of the stock remain. The team had a lengthy discussion of the inherent problems in the process put in place for Tier 5 stocks. In particular, the OFL relates to retained catch only and the value recommended by the SSC allows for effectively unconstrained exploitation of this stock.

Linda Kozak commented on the CPT's previous recommendation as compared to the SSC's decision. If the OFL is established at a very low level she remains concerned that test fisheries for research purposes cannot be conducted. ADF&G staff discussed that to have a test fishery, a TAC must be established. Any OFL established this year would not impact a test fishery the following year.

Wayne suggested that in May a longer discussion be held for this stock particularly with regards to how to best assess long-term stock status. Forrest indicated that ADF&G is trying to include this stock in a plan for triennial surveys. The team will include an agenda items to discuss on long-term assessment methods for this stock.

The team discussed the problems with being able to regulate the unconstrained bycatch in this stock. If the stock were in a higher Tier this would be possible thus the team discussed what would be necessary to move it to Tier 4. Forrest noted there is increased interest in Pacific cod fishing in the Aleutian Islands and no bycatch limits are established in this fishery thus there is potential for increased groundfish effort in this region and the associated bycatch in these fisheries.

The team proposes a one day workshop prior to the May meeting to discuss some of the issues that pertain to the assessment and model configuration for next year. ?? Is this different from the stock assessment workshop described below??

The team considered the need for a one day workshop prior to the May meeting to discuss some of the issues that pertain to the assessment and model configuration for next year.

Options considered by the team for OFL setting for this stock are:

1. Concur with SSC's retained catch OFL (with caveats)
2. CPT recommendation from May 2008 for a bycatch OFL
3. Recommend the CPT's bycatch OFL the as the retained catch OFL.
4. Calculate a total catch OFL by adding in the bycatch to the retained catch estimate.

Calculating a total catch OFL would cause the OFL to be applied to total catch but would allow for an increase in the OFL over the bycatch OFL. The team requested that the assessment author analyze a total catch OFL for the next assessment cycle.

The team disagrees strongly with the SSC on their OFL. However after lengthy discussions and heated arguments regarding balancing the process of OFL setting, SSC recommendations and the need for stock conservation, the team without consensus forwarded the SSC's OFL for this stock.

Bob Foy suggested that Tier 5 assessments with no new data should not be on our agenda and that the OFLs provided by the SSC in June should be the final OFL for those stocks.

Stock assessment workshop

The plan team discussed the value of having a one-day workshop to resolve issues related to how data sources are weighted and alternative models compared when an assessment include several data sources. Diagnostics, residuals, lambda weighting, other issues with how to appropriately weight data sources could be discussed. How to determine the gamma value for Tier 4 stocks can also be discussed. Team members noted that the intent of the workshop would have to be to compile a workshop report that is prescriptive enough to provide guidance to assessment authors.

This idea will be brought forward to the SSC at the upcoming Council meeting for comment and consent on this approach and organization thereof.

Meeting adjourned to a formal work session to finalize the SAFE report at 2pm on 18 September.

PLAN TEAM FOR THE KING AND TANNER CRAB FISHERIES
OF THE BERING SEA/ALEUTIAN ISLANDS

TERMS OF REFERENCE
(as revised by the Plan Team 9/08 changes from 2005 are in **bold/and ~~strikeout~~**)

1. Establishment. The North Pacific Fishery Management Council (Council) shall establish a Plan Team for the king and Tanner crab fisheries of the Bering Sea/Aleutian Islands (BS/AI) area. The Plan Team will provide the Council with advice in the areas of regulatory management, natural and social science, mathematics, and statistics as they relate to the king and Tanner crab fisheries of the BS/AI area.

2. Membership. Plan Team members will be appointed from government agencies, academic institutions, and organizations having expertise relating to the crab fisheries of the BS/AI. Normally, the Plan Team will consist of at least one member from the Council staff, the National Marine Fisheries Service (NMFS), the Alaska Department of Fish & Game, the University of Alaska, and other universities and institutions. Alternate members may be assigned to participate in case a member cannot attend a meeting. With the consent of the sponsoring agency or institution, nominations may be made by the Council, the Scientific and Statistical Committee (SSC), the Advisory Panel (AP), or the Plan Team. All nominations will be subject to approval by the SSC, with the Council retaining final appointment authority. Appointments should reflect the Plan Teams' responsibility to evaluate and make recommendations on management, biological, economic and social conditions of the fisheries.

3. Organization. The Plan Team will be directed by a chairperson, and may divide some of its responsibilities among work groups organized according to subject matter. A work group may also include members from the BS/AI groundfish Plan Team. Each work group will be directed by a work group leader.

   (a) Rules of order. In general, rules of order will be informal. Plan Team decisions will be reached by consensus, whenever possible. If a decision is required and consensus cannot be reached, the opinion of the majority will prevail. In representing the Plan Team publicly, the spokesperson will take care to relate Plan Team opinions accurately, noting points of concern where consensus cannot be reached.

   (b) Meetings. A minimum of two Plan Team meetings will be held annually in so far as practicable to discuss harvest levels, status and management of the BSAI crab stocks. The timing and scope of meetings, in so far as practicable, will be as follows; a spring meeting will be held with the intention of reviewing stock assessment modeling, preliminary stock assessments for OFL recommendations and any additional issues pertinent to the summer research schedule. A following fall meeting will be held with the intention to discuss the status of stocks. This meeting would be intended to occur prior to the TAC determinations by the state. It is understood that this status of stocks meeting does not preclude additional Inter-agency meetings prior to TAC setting. The Plan Team chairperson may call other meetings as necessary. The Crab Plan Team may meet separately or jointly with the BSAI Groundfish Plan Team to discuss areas of joint concern. A draft agenda will be prepared in advance of each meeting by the Council staff in consultation with the chairperson, and may be revised by the Plan Team during the meeting. Minutes of each meeting will be prepared by the Council

staff, distributed to Plan Team members, and revised as necessary at or before the subsequent Plan Team meeting. The Chairperson (or designee) will report the Team's finding to the Council.

(c) Selection of officers. Officers (Plan Team Chair, Vice Chair and Work group leaders) will be selected at the meeting preceding the annual Plan Team meeting or as vacancies arise. The Plan Team Chair and Vice Chair will be selected at the **Fall** meeting for two-year **renewable** terms. ~~It is the intent of the Team that after two years the Vice Chair will succeed as Chair and the following election will be for the position of Vice Chair..~~ Work group leaders will be selected for one-year terms. There will be no limit on the number of consecutive terms that officers may serve.

4. Functions. The Plan Teams' primary function is to provide the Council with the best available scientific information, including scientifically based recommendations regarding appropriate measures for the conservation and management of the BS/AI king and Tanner crab fisheries. All recommendations must be designed to prevent overfishing while achieving optimum yield (National Standard 1). All recommendations must also be scientifically based (National Standard 2), drawing upon the Plan Teams' expertise in the areas of regulatory management, natural and social science, mathematics, and statistics. Finally, uncertainty must be taken into account wherever possible (National Standard 6).

   (a) SAFE report. The Plan Team compiles a SAFE report for the BS/AI king and Tanner crab fisheries on an annual basis. The SAFE report provides the Council with a summary of the most recent biological condition of the crab stocks and the social and economic condition of the fishing and processing industries. The SAFE report summarizes the best available scientific information concerning the past, present, and possible future condition of the crab stocks and fisheries, along with ecosystem concerns.

   (b) Plan amendments. The Plan Team may also play a role in the development and evaluation of amendments to the BS/AI king and Tanner crab fishery management plan, as well as evaluate amendments to the groundfish fishery management plan that may affect the conservation and management of BS/AI crab resources.

   (i) The Plan Team may evaluate amendment proposals and forward their recommendations to the Council.

   (ii) In addition, the Plan Team may develop their own amendment proposals.
   (iii) Once an amendment proposal has been accepted for consideration by the Council, an analytical team may be assembled by the responsible agencies. Every analytical team should include at least one member from the Plan Team, drawn from the appropriate working group(s), whenever possible.
   (iii) Once an amendment analysis has been completed, it may be reviewed by the Plan Team. The Plan Team's comments, if any, are then forwarded to the SSC, AP, and Council.

   (c) Peer Review. The plan team deliberations shall constitute part of the peer review process specified by current OMB policies provided that members directly involved in the production of a scientific product will recuse themselves from the review.
   (d) Stock assessment review and recommendations for annual OFL specifications. The plan team shall annually review stock assessments at the spring plan team meeting for

recommending OFL levels for two stocks (Norton Sound red king crab and AI golden king crab) and for providing recommendations on appropriate tier levels and model and assessment methodology for the remaining 8 stocks**(10 stocks annually).** These recommendations are provided to the NPFMC SSC for their subsequent review and recommendations in June. The team shall review **updated** stock assessments in the fall including final OFL levels for all stocks. These assessments shall be included in the final Crab SAFE report provided to the Council to inform them of the annual status of BSAI Crab stocks.

Crab Plan Team
Background on Crab Rationalization Program
NMFS Alaska Region

General Background

All nine major BSAI crab fisheries are managed under the crab rationalization program (Program), a limited access privilege program implemented on April 1, 2005. One of benefits expected to arise from the Program is ending the "race for fish," thereby allowing participants time to tailor their business operations to achieve the greatest market benefit, reduce costs, and improve safety.

The Program allocates exclusive harvesting and processing privileges to holders of transferable harvester quota share (QS), and processor quota share (PQS). QS and PQS are derived from historic harvesting and processing activities. NMFS issued QS to catcher vessel owners, catcher/processor owners, and crew. Most of the total QS issued went to catcher vessel owners. PQS was issued to historically active processors. QS and IFQ may be held only by U.S. citizens. PQS and IPQ are not subject to this restriction. QS and PQS can yield an annual harvesting individual fishing quota (IFQ) individual processing quota (IPQ), respectively.

Each year, ADF&G determines the total allowable catch (TAC) of the various crab fisheries, and NMFS allocates that TAC. First, NMFS allocates 10 percent of the TAC to the Western Alaska Community Development Quota (CDQ) Program which represents specific coastal communities adjacent to the Bering Sea and Aleutian Islands. The CDQ allocation is further allocated among six CDQ groups representing specific groups of communities. NMFS also allocates 10 percent of the TAC for the Western Aleutian Islands golden king crab fishery to a specific entity representing the community of Adak, which is managed similar to a CDQ group. Second, NMFS then allocates the remaining amount of the TAC to each qualified QS holder as IFQ. NMFS will issue IFQ to a QS holder only if they meet requirements to apply for IFQ by August 1 of each year, submit an annual economic data report, and pay required fees. Each year, harvesters can choose to assign their QS and resulting IFQ to a harvesting cooperative. A harvester cooperative must comprise at least four unique QS holders who are not affiliated with each other through more than a 10 percent direct or indirect ownership interest, or do not otherwise control each other.

The Program limits the amount of QS that any one person may hold, and the amount of IFQ that a person may use. These limits, commonly called use caps vary for each fishery, whether the QS is held by vessel owners or crew, and the nature of the QS/IFQ holder. For example, QS/IFQ holders that also hold PQS or IPQ are subject to a specific use cap, persons who hold QS or IFQ only another use cap, and CDQ groups who also hold QS and IFQ a different cap. The method for calculating the use cap differs for each of these three groups of QS/IFQ holders. The Program has a "grandfather exemption" that allows harvesters initially allocated more QS than the use cap to continue to hold their initially allocated QS, and use any resulting IFQ, above the use cap.

The Program also establishes limits on the amount of PQS a processor can hold and the amount of IPQ from that PQS that they can use. This limit is set at 30 percent of the initially allocated PQS pool. The Program has a grandfather exemption for processors over this use cap.

The Program also limits the amount of IFQ that can be harvested by a vessel. This use does not apply if all of the crab harvested by a vessel is derived from IFQ that is assigned to a cooperative.

Harvesters and processors can transfer their QS/IFQ and PQS/IPQ to other harvesters and processors respectively subject to limits on the amount transferred and the person eligible to receive the transfer. For example, a person cannot transfer crew QS/IFQ to a person who is not a valid crew member meeting specific requirements. Also, transfers are not approved if they would cause a person to exceed a use cap. The IFQ held by the cooperative can only be transferred to

other cooperatives, and IFQ not assigned to a cooperative can only be transferred to other non-cooperative IFQ holders.

Ninety percent of the IFQ derived from catcher vessel owner QS must be delivered to a processor holding IPQ. This type of IFQ is called Class A IFQ. Each year, harvesters and processors must match up their Class A IFQ and IPQ shares on a one-to-one basis. The remaining 10 percent of the IFQ issued to catcher vessel owners is called Class B IFQ and can be delivered to any processor without matching to a specific amount of IPQ. NMFS issues an amount of IPQ to each IPQ holder that is equal to the amount of Class A IFQ provided the PQS holder meets requirements to apply for IPQ by August 1 of each year, submit an annual economic data report, and pay required fees. For most crab fisheries, Class A IFQ and IPQ shares are also subject to requirements that they be delivered within specific geographic regions, known as regionalization.

Most crab fisheries, including the two largest crab fisheries, Bristol Bay red king crab and Bering Sea snow crab, are regionally designated for the North Region (i.e., north of 54° 20' N. lat.), or the South Region (i.e., any location south of 54° 20' N. lat.) based on historic delivery patterns. St. Paul is the only significant crab processing port in the North Region. Dutch Harbor (Unalaska), King Cove, and Kodiak are some of the larger crab processing ports in the South region. The Western Aleutian Islands golden king crab fishery is regionally designated with 50% of the Class A IFQ and IPQ for the West Region (i.e., West of 174 ° W. long.) and the remaining 50% is undesignated and may be delivered anywhere. The Eastern and Western tanner crab (*C. bairdi*) fisheries are not subject to regional delivery. The table below shows the proportion of the Class A IFQ and IPQ that must be delivered within these regions.

Crab fishery	Percentage of Class A IFQ & IPQ by region	Pounds of Class A IFQ & IPQ by region (2007/2008)
Eastern Aleutian Islands golden king crab (EAG)	100 % South	2,243,082 lb. South
Western Aleutian Islands golden king crab (WAG)	50 % West 50 % Undesignated	570,932 lb. West 569,855 lb. Undesignated
Western Aleutian Islands red king crab (WAI)	100 % South	Fishery Not Open – No Class A IFQ or IPQ
Eastern Bering sea Tanner crab (C. bairdi) (EBT)	100 % Undesignated	2,525,080 lb. Undesignated
Western Bering sea Tanner crab (C. bairdi) (WBT)	100 % Undesignated	1,592,952 lb. Undesignated
Bristol Bay red king crab (BBR)	2.7 % North 97.3 % South	388,006 lb. North 14,893,400 lb. South
Bering Sea snow crab (*C. opilio*) (BSS)	47 % North 63 % South	21,073,807 lb. North 23,957,111 lb. South
Pribilof Islands red and blue king crab (PIK)	67.5 % North 32.5 % South	Fishery Not Open – No Class A IFQ or IPQ
St. Matthew's blue king crab (SMB)	78.3 % North 21.7 % South	Fishery Not Open – No Class A IFQ or IPQ

Historic processing ports, such as Dutch Harbor, St. Paul, King Cove, and Kodiak, are also provided a right-of-first-refusal that gives them the first opportunity to purchase any PQS that is offered for transfer if that PQS was earned from processing in their communities. During the first two years of the Program, IPQ for most crab fisheries was subject to a "cooling off" period that limited the ability of crab to be delivered outside of the community where the PQS was earned.

The Program requires that Class A IFQ and IPQ holders establish an arbitration system to resolve any price or delivery disputes. Class A IFQ holders who are not otherwise affiliated with IPQ holders can unilaterally trigger a binding arbitration proceeding if disputes cannot be settled.

The Program limits the ability of vessels used in the snow crab fishery from fishing in the GOA. Specifically, vessels are limited to sideboard limits that control the total amount of Pacific cod that can be harvested to reduce impacts on other GOA groundfish fisheries. The Program also includes extensive monitoring & enforcement, and recordkeeping and reporting requirements, including a detailed annual economic data report.

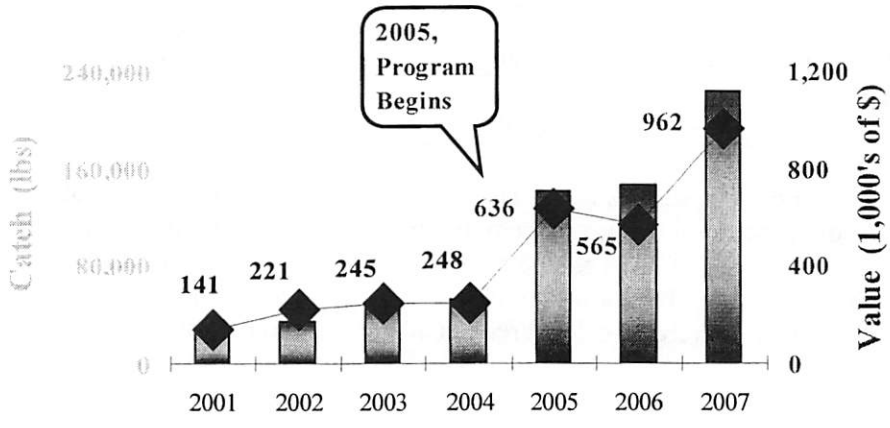
Trends in Fishery Performance Under the Program

- The number of vessels fishing decreased by nearly 2/3 from the number actively fishing prior to the Program. Some of the decrease in the number of vessels active may be due to 25 vessels being removed in the crab buyback program in December 2004, just prior to the first year of fishing under the Program in 2005/2006. The following table shows the total number of active vessels in the BSAI crab fisheries managed under the Program.

Crab Fishing Year	Number of Active Catcher Vessels	Number of Active Catcher/Processors	Total Number of Active Vessels
2000/2001	246	10	253
2001/2002	235	11	243
2002/2003	238	11	247
2003/2004	247	9	254
2004/2005	245	9	256
2005/2006 (1st year)	100	5	101
2006/2007	87	5	91
2007/2008	83	5	87

- An increasing number of QS holders have chosen to participate in cooperatives. In 2007/2008, more than 99 percent of all IFQ was issued to cooperatives. In most fisheries, the number of active cooperatives is decreasing, indicating that harvesters have found substantial organizational or financial benefits to collaboration through better coordination on landings, tailoring fishing capacity to TAC, and collective price negotiation.
- The remaining vessels harvest a greater proportion of the catch and appear to be more profitable. Figure 1 provides an example for catcher vessels for one fishery.

Figure 1: Median catch & mean exvessel value per catcher vessel Bristol Bay red king crab (Source: NMFS, NPFMC)



- To a varying extent, in all crab fisheries, actual fishing time has increased. The greatest increase is observed in the snow crab fishery, and least in the Bristol Bay red king crab fishery. Prior to the rationalization program, in most fisheries vessels made a single delivery after a fishery closing. Under the rationalization program, almost all vessels make multiple deliveries in a season, fishing closer to the vessel's capacity prior to making deliveries.
- Crew employment has decreased with the consolidation of the fishery. The precise number of crew previously employed on vessels that are no longer employed is not known, but various estimates suggest several hundred up to a thousand crew positions may have been lost. Prior to the Program, many of the crew positions were short term positions and may not have provided the total annual income to crew.
- In most cases, crew employed by vessels fishing in the program are reported to have more stable and better paying positions than prior to the program's implementation. Many crew are reported to rely exclusively on crab fishing for their income. Other crew are reported to work on the crab vessel in other fisheries or tendering, relying on employment from their crab fishing vessels for all of their income. Precise data on crew employment pre and post-Program implementation are not available.
- The amount of QS transferring varies per fishery per year. For the Bristol Bay red king crab fishery ranged from 1.3 % in 2007/2008 to 7.7 % in 2006/2007, and in the snow crab fishery ranged from 1.9 % in 2007/2008 to 6.8 % in 2006/2007. An average of roughly 5 % of the QS pool transferred per year.
- In almost all crab fisheries, there has been limited consolidation of the amount of vessel owner QS held per person, and there are roughly the same number of QS holders now as in the first year of implementation. The average and mean amount of QS held by crew has increased by roughly 10 % in most crab fisheries, and there are roughly 10 % fewer QS holders. Little or no consolidation in crew QS has been observed in the Western Aleutian Islands golden king crab, St. Matthew, and Pribilof Island fisheries. Overall, roughly 10 % of the QS in all fisheries is now held by persons who were not initially allocated QS in any of the BSAI crab fisheries.
- Overall, a greater percentage of the PQS pool has transferred. At a minimum only none of the Western Aleutian Island red king crab PQS pool transferred in 2005/2006, and at a maximum 43.6 % of the Western Aleutian Island golden king crab fishery PQS pool transferred in 2007/2008. Generally, extensive IPQ transfers, or leases have occurred each year. Initially, there were substantially fewer persons holding PQS, roughly 20 unique persons among all the fisheries. Overall there has been greater consolidation of PQS and IPQ than QS and IFQ. One large merger between two companies (Nichiro-Maruha) is responsible for much of this consolidation, although other new PQS holders have purchased into the fishery. In both the Eastern and Western Aleutian Islands golden king crab fishery there are two new PQS holders who now hold roughly 30 % of the combined PQS pools in those fisheries that had not previously held PQS in any crab fishery.
- Since implementation of the Program no crab fishery has exceeded its TAC, and in most cases the TAC is fully harvested. Prior to the Program, harvest relative to the GHL was often less fully harvested or exceeded, though by a somewhat limited amount.
- Deadloss in the Bristol Bay red king crab and the Aleutian Islands golden king crab fisheries has decreased post-rationalization, compared to the seasons immediately preceding implementation of the Program. In the Bering Sea *C. opilio* fishery, the rate of deadloss is comparable to that which occurred in the two most recent years before rationalization.
- There is no clear pattern indicating that rail dumping or handling mortality has changed in the fishery. Some conjecture that because the seasons are longer and vessels tend to avoid poor weather that may increase handling mortality. However, there are no conclusive data on handling mortality changes.

- Although soak times in the fisheries have increased and a definite correlation exists between extended soak times and legal male catch exists, the levels of sublegal and female catch under the Program remains within the range of bycatch levels from years prior to rationalization.
- Pot loss and ghost fishing may have decreased under the Program, but conclusive data are not available. With the decrease in the number of vessels participating in the crab fisheries, overall there is less gear on the fishing grounds post-Program implementation. Although each pot is used more frequently during a fishing season, the higher catch per unit effort under the Program still results in an overall reduction in gear.
- For all fisheries, fewer pots are registered, fewer pot lifts recorded, and on average greater CPUE per pot has been observed for all crab fisheries after Program implementation. The following table provides simple statistics on pot use in the various fisheries.

Fishery	Season	Number of pots registered*	Registered pots per vessel	Number of pot lifts *	Lifts per registered pot*	Average catch per unit effort (crabs per pot lift) *	Pounds per pot
Bering Sea *C. opilio*	2001	40,379	195	176,930	4.4	97	129.7
	2002	37,807	199	308,132	8.2	76	96.1
	2003	20,452	108	139,279	6.8	154	182.4
	2004	14,444	76	110,087	7.6	157	199.3
	2005	12,840	77	69,863	5.4	239	324.3
	2005 - 2006	13,734	176	108,320	7.9	204	306.9
	2006 - 2007	10,851	155	80,112	7.4	332	408.2
	2007 - 2008	13,647	175	129,457	9.5	349	438.2
Bristol Bay red king crab	2000	26,352	108	98,694	3.7	12	75.7
	2001	24,571	107	63,242	2.6	19	121.5
	2002	25,833	107	68,328	2.6	20	128.4
	2003	46,964	188	128,430	2.7	18	110.9
	2004	49,506	197	90,976	1.8	23	152.7
	2005 - 2006	15,713	177	99,573	6.3	25	165.4
	2006 - 2007	14,685	181	64,325	4.4	34	215.9
	2007 - 2008	11,885	161	101,734	8.6	28	180.1
Eastern Aleutian Islands golden king crab	2000 - 2001	10,598	707	71,551	6.8	10	43.1
	2001 - 2002	12,927	680	62,639	4.8	12	49.9
	2002 - 2003	11,834	623	52,042	4.4	12	53.1
	2003 - 2004	12,518	695	58,883	4.7	11	49.3
	2004 - 2005	13,165	658	34,848	2.6	18	81.7
	2005 - 2006	8,833	1,262	21,898	2.5	25	117.3
	2006 - 2007	8,150	1,358	23,839	2.9	24	112.9
	2007 - 2008	4,200	1,050	20,496	4.9	28	131.3
Western Aleutian Islands golden king crab	2000 - 2001	8,910	743	101,239	11.4	7	28.7
	2001 - 2002	8,491	943	105,512	12.4	7	25.5
	2002 - 2003	6,225	1,038	78,979	12.7	8	33.0
	2003 - 2004	7,140	1,190	66,236	9.3	10	39.8
	2004 - 2005	7,240	1,207	56,846	7.9	12	46.4
	2005 - 2006	4,800	1,600	27,503	5.7	21	86.6
	2006 - 2007	6,000	2,000	22,694	3.8	20	88.2
	2007 - 2008	4,800	1,600	25,287	5.3	21	88.8

Sources: *ADFG Annual Management Report and **fishtickets and ***NMFS RAM catch data (for 2005-2006, 2006-2007, and 2007-2008)

- During the first year under rationalization of the Bristol Bay red king crab fishery, the number of legal male crabs captured during the fishery and subsequently discarded was dramatically higher than discard rates in previous years, and represented approximately 20 percent of legal male red king crab caught. ADF&G reacted to the 2005-2006 discard issue by downwardly adjusting the TAC determination for the 2006-2007 season, thus resulting in an economic penalty for the share holders in that season. Discarding of legal males did not occur on a similar scale in 2006-2007, and no further downward adjustment was made for the 2007-2008

season. High grading and increases in discard rates have not been an issue in other fisheries or seasons.

- Overall fuel use in the fleet has decreased. Although vessels are active for a longer period of time, the total number of vessels active is lower. Many vessel owners report that under the Program vessel operators have made efforts to operate the vessels more efficiently (e.g., traveling to the grounds at optimal speeds, coordinating deliveries to minimize travel distance). The precise reduction in fuel use is not known because data of fuel use pre and post-Rationalization are not adequately comprehensive. Some have asserted that the overall "carbon footprint" of the BSAI crab fisheries is smaller.
- Safety has improved. Fatalities in the BSAI crab fisheries averaged 3 per year from 1996 through March 31, 2005 prior to implantation. From April 1, 2005 through the 2007/2008 there have been no fatalities in any BSAI crab fishery managed under the Program. In most fisheries, the average size of the vessels actively fishing increased after Program implementation. Some of this may be due to the buyback of smaller vessels in December 2004.
- Price negotiations, though still complex and contentious, appear to be more successfully addressed through private contractual arrangements rather than relying on the arbitration system. Unlike previous years, during the 2007/2008 crab fishing year, no binding price arbitrations occurred. The process for determining the historic revenue share between harvesters and processors continues to be reviewed by industry participants.

Current Concerns

- The decrease in the number of active vessels concerned that some crew and community representatives, primarily from Kodiak, that the Program has unduly limited employment opportunities. Others have argued the crew still working are long-term skilled participants who are better paid then before the Program. The Council has considered
- Some allege that the requirement that 90% of the Class A IFQ must be delivered to processors with matching IPQ decreases potential market opportunities. The Council is considering a range of modifications that would eliminate PQS & IPQ in some or all fisheries, or reduce the percentage of Class A IFQ issued to catcher vessel owners from 90% to some lower level.
- Processors and some communities and harvesters have argued that eliminating PQS & IPQ or reducing the Class A IFQ percentage below 90% would harm processing investments, destabilize communities reliant on crab, and introduce additional complexity to a relatively new system that could increase costs and have unintended consequences. Some have pointed to the fact that there were no arbitrations between Class A IFQ and IPQ holders this year over price or delivery disputes as an indication that the market is balanced between harvesters and processors.
- Some harvesters have proposed the Council should develop emergency relief exemptions from regional delivery requirements. NMFS has expressed concern that it may not be possible to establish objective emergency criteria. St. Paul has expressed concerns that it may lose out on substantial catch if the vessel operator makes the emergency declaration unilaterally. The Council is reviewing options to allow a vessel operator, processor, and community to jointly declare an emergency and relieve a harvester and processor from regional delivery requirements.
- Harvesters remain concerned that Council considerations to reestablish a vessel use cap for cooperative IFQ would reduce many of the economic efficiencies gained under the Program.
- Many harvesters have expressed frustration that NMFS has not yet published a proposed rule for a loan program to allow crew to purchase QS. The Council provided NOAA Financial Services its preferred options in February 2008.

NPFMC CRAB PLAN TEAM

Draft Agenda 9/9/08vers. –September 16-18, 2008

Observer Training Room, AFSC, Seattle

Tuesday September 16		
Administration	9:00 am	• Introductions • Additions to agenda and approval of agenda • Review and approval of May 2008 minutes • Review Terms of Reference • Election of officers (*not since May 2006*) • ACL update
Economic Discussion	9:30 am	• Overview of Crab Rationalization Program (Glenn Merrill) • Discussion of Economic Data Review (EDR) issues (Garber-Younts) • Summary of 3-year review documentation for CRP (Garber-Younts) • Economic SAFE report, AFSC paper overview for poss. Inclusion in SAFE • Structure and content plan for future • How to merge with existing reports, and studies • Economic analyses by Council and NMFS economists
Survey overview	11:00am	• NMFS 2008 summer trawl survey overview, discuss recalculated historical results (Foy) • BSFRF update(Hughes), BSFRF-NMFS plans for collaboration
LUNCH	*12:00 pm*	
Bycatch	1:00 pm	• NMFS catch accounting data (Jennifer Mondragon) • Handling mortality rates utilized for Crab, Groundfish and Scallop fisheries necessity for research and review as applicable
OFL Stock assessment Review:	2:15 pm	• General discussion of objectives for review, SAFE structure revisions and timing
BREAK	*2:45pm*	
EBS snow crab	3:00 pm	• Stock assessment overview • Stock status and OFL determination
Bristol Bay red king crab	4:00 pm	• Stock assessment overview • Stock status and OFL determination
Wednesday September 17		
EBS Tanner crab	9:00am	• Stock assessment overview, changes recommended by CPT, SSC • Stock status and OFL determination
BREAK	*10:15*	
EBS Tanner crab (cont)	10:30 am	*continued*
St. Matthew blue king crab	11:15 am	• Stock assessment overview: changes recommended by CPT, SSC • Stock status and OFL determination
LUNCH	*12:00 pm*	
Norton Sound red king crab	1:00 pm	• Stock assessment model review: changes recommended by CPT, SSC
BREAK	*2:45pm*	
AI golden king crab	3:00pm	• Stock assessment model review (for 2009 OFL)
Thursday September 18		
Pribilof Island blue king crab	9:00 am	• Stock assessment overview: changes recommended by CPT, SSC, discuss rebuilding plan revisions • Stock status and OFL determination
Pribilof Island red king	9:45 am	• Stock assessment overview: changes recommended by CPT, SSC

crab		• Stock status and OFL determination
BREAK	10:15am	
Pribilof golden king crab	10:30am	• Stock assessment overview as necessary
Adak red king crab	11:00 am	• Stock assessment overview as necessary
LUNCH	*12:00 pm*	
SAFE Report finalization	1:00 pm	**Review OFL recommendations, Report writing, Report finalization, Discuss plans for improvements for 2009 SAFE**
ADJOURN	5:00 pm	

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

2008 BSAI Crab SAFE

Compiled by

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

With Contributions by

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September 2008

North Pacific Fishery Management Council
605 W. 4th Avenue, #306
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Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries Fisheries of the Bering Sea and Aleutian Islands Regions

Table of Contents

2008 Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries in the Bering Sea and Aleutian Islands

Introduction

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

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

The report is assembled by the Crab Plan Team (CPT) with contributions from the Alaska Department of Fish and Game (ADF&G) and the National Marine Fisheries Service (NMFS), and is available to the public and presented to the North Pacific Fishery Management Council (NPFMC) on an annual basis. Under a process approved in 2008 for revised overfishing level (OFL) determinations, the Crab Plan Team reviews draft assessments in May to provide recommendations in a draft SAFE report for review by the Council's Science and Statistical Committee (SSC) in June. In September the CPT reviews final assessments and provides final OFL recommendations and stock status determinations. Additional information on the new OFL determination process is contained in this report. The Crab Plan Team met from September 16-18, 2008 at the Alaska Fisheries Science Center in Seattle WA to review the status of stocks and stock assessments in order to provide the recommendations and status determinations contained in this report. Members of the team who participated in this review include the following: Forrest Bowers (Chair), Ginny Eckert (Vice-Chair), André Punt, Jack Turnock, Shareef Siddeek, Bill Bechtol, Josh Greenburg, Herman Savikko, Gretchen Harrington, Doug Pengilly, Bob Foy, Lou Rugolo, Wayne Donaldson, and Diana Stram. This report builds upon recommendations contained in the May 2008 report.

Stock Status Definitions

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

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

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

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

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

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

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

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

Status Determination Criteria

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

Status determination criteria for crab stocks are annually calculated using a five-tier system that accommodates varying levels of uncertainty of information. The five-tier system incorporates new scientific information and provides a mechanism to continually improve the status determination criteria as new information becomes available. Under the five-tier system, overfishing and overfished criterion are annually formulated and assessed to determine the status of the crab stocks and whether (1) overfishing is occurring or the rate or level of fishing mortality for a stock or stock complex is approaching overfishing, and (2) a stock or stock complex is overfished or a stock or stock complex is approaching an overfished condition.

Overfishing is determined by comparing the overfishing level (OFL), as calculated in the five-tier system for the crab fishing year, with the catch estimates for that crab fishing year. For the previous crab fishing year, NMFS will determine whether overfishing occurred by comparing the previous year's OFL with the catch from the previous crab fishing year. This catch includes all fishery removals, including retained catch and discard losses, for those stocks where non-target fishery removal data are available. Discard losses are determined by multiplying the appropriate handling mortality rate by observer estimates of bycatch discards. For stocks where only retained catch information is available, the OFL will be set for and compared to the retained catch.

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

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

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

Five-Tier System

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

For Tiers 1 through 4, once a stock is assigned to a tier, the stock status level is determined based on recent survey data and assessment models, as available. The stock status level determines the equation used in calculating the F_{OFL}. Three levels of stock status are specified and denoted by "a," "b," and "c" (see Table 6-1). The F_{MSY} control rule reduces the F_{OFL} as biomass declines by stock status level. At stock status level "a," current stock biomass exceeds the B_{MSY}. For stocks in status level "b," current biomass is less than B_{MSY} but greater than a level specified as the "critical biomass threshold" (β).

Lastly, in stock status level "c," current biomass is below β * (B_{MSY} or a proxy for B_{MSY}). At stock status level "c," directed fishing is prohibited and an F_{OFL} at or below F_{MSY} would be determined for all other sources of fishing mortality in the development of the rebuilding plan. The Council will develop a rebuilding plan once a stock level falls below the MSST.

For Tiers 1 through 3, the coefficient α is set at a default value of 0.1, and β set at a default value of 0.25, with the understanding that the Scientific and Statistical Committee may recommend different values for a specific stock or stock complex as merited by the best available scientific information.

In Tier 4, a default value of natural mortality rate (M) or an M proxy, and a scalar, γ, are used in the calculation of the F_{OFL}.

In Tier 5, the OFL is specified in terms of an average catch value over an historical time period, unless the Scientific and Statistical Committee recommends an alternative value based on the best available scientific information.

OFLs will be calculated by applying the F_{OFL} and using the most recent abundance estimates. The Crab Plan Team will review stock assessment documents, the most recent abundance estimates, and the proposed OFLs. The Alaska Fisheries Science Center will set the OFLs consistent with this FMP and forward OFLs for each stock to the State of Alaska prior to its setting the total allowable catch or guideline harvest level for that stock's upcoming crab fishing season.

Tiers 1 through 3

For Tiers 1 through 3, reliable estimates of B, B_{MSY}, and F_{MSY}, or their respective proxy values, are available. Tiers 1 and 2 are for stocks with a reliable estimate of the spawner/recruit relationship, thereby enabling the estimation of the limit reference points B_{MSY} and F_{MSY}.

- Tier 1 is for stocks with assessment models in which the probability density function (pdf) of F_{MSY} is estimated.
- Tier 2 is for stocks with assessment models in which a reliable point estimate, but not the pdf, of F_{MSY} is made.

- Tier 3 is for stocks where reliable estimates of the spawner/recruit relationship are not available, but proxies for F_{MSY} and B_{MSY} can be estimated.

For Tier 3 stocks, maturity and other essential life-history information are available to estimate proxy limit reference points. For Tier 3, a designation of the form "F_X" refers to the fishing mortality rate associated with an equilibrium level of fertilized egg production (or its proxy) per recruit equal to X% of the equilibrium level in the absence of any fishing.

The OFL calculation accounts for all losses to the stock not attributable to natural mortality. The OFL is the total catch limit comprised of three catch components: (1) non-directed fishery discard losses; (2) directed fishery discard losses; and (3) directed fishery retained catch. To determine the discard losses, the handling mortality rate is multiplied by bycatch discards in each fishery. Overfishing would occur if, in any year, the sum of all three catch components exceeds the OFL.

Tier 4

Tier 4 is for stocks where essential life-history, recruitment information, and understanding are lacking. Therefore, it is not possible to estimate the spawner-recruit relationship. However, there is sufficient information for simulation modeling that captures the essential population dynamics of the stock as well as the performance of the fisheries. The simulation modeling approach employed in the derivation of the annual OFLs captures the historical performance of the fisheries as seen in observer data from the early 1990s to present and thus borrows information from other stocks as necessary to estimate biological parameters such as γ.

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

If the information necessary to determine total catch OFLs is not available for a Tier 4 stock, then the OFL is determined for retained catch. In the future, as information improves, data would be available for some stocks to allow the formulation and use of selectivity curves for the discard fisheries (directed and non-directed losses) as well as the directed fishery (retained catch) in the models. The resulting OFL from this approach, therefore, would be the total catch OFL.

Tier 5

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

time period determined to be representative of the production potential of the stock, unless the Scientific and Statistical Committee recommends an alternative value based on the best available scientific information.

For most Tier 5 stocks, only retained catch information is available so the OFL will be estimated for the retained catch portion only, with the corresponding overfishing comparison on the retained catch only. In the future, as information improves, the OFL calculation could include discard losses, at which point the OFL would be applied to the retained catch plus the discard losses from directed and non-directed fisheries.

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

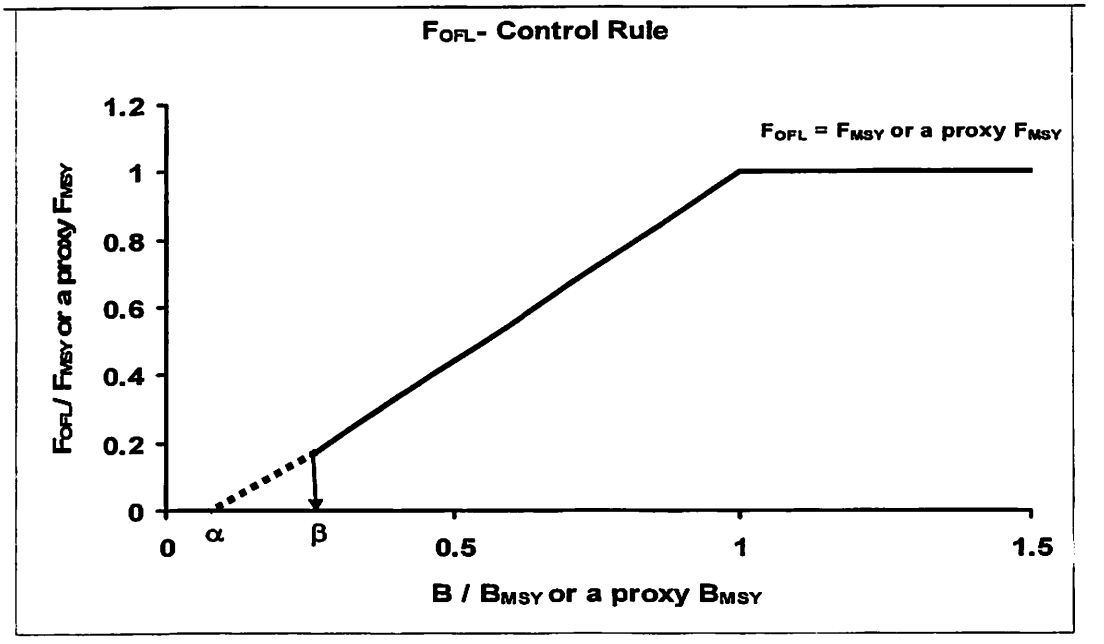

Table 1. Five-Tier System for setting overfishing limits for crab stocks. The tiers are listed in descending order of information availability. Table 6-2 contains a guide for understanding the five-tier system.

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

*35% is the default value unless the SSC recommends a different value based on the best available scientific information.

† An $F_{OFL} \leq F_{MSY}$ will be determined in the development of the rebuilding plan for that stock.

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

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

Crab Plan Team Recommendations

This was the first year of implementation of the new process for annual stock assessment and OFL determination for all ten BSAI crab stocks. The Crab Plan Team commends all of the stock assessment authors on the assessments produced (Chapters 1-10) under a limited time frame and with great attention to providing comprehensive details on a stock by stock basis.

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

The team understands that under this new process, the CPT has the ability to provide recommendations for consideration in the following assessment cycle on an annual basis. The team has general recommendations for all assessments and specific comments related to individual assessments. All recommendations are for consideration for the 2009 assessment cycle unless indicated otherwise. The general comments are listed below while the comments related to individual assessments are contained within the summary of plan team deliberations and recommendations contained in the stock specific summary section. Additional details regarding recommendations are contained in the Crab Plan Team Report (September 2008 CPT Report).

General recommendations for all assessments

- The assessments should provide complete documentation on model formulation, assumptions, data sources and all calculations used in the stock assessment for computing the OFL.
- For stocks where biomass estimates for OFL setting are based on survey estimates, consideration should be given to averaging recent abundance to obtain a more reliable estimate of current stock size.
- Future stock assessments should provide a full analysis on the choice of gamma and a full evaluation of alternatives relative to the default value, γ=1, and the appropriateness of this default value.
- All three rebuilding plans (EBS snow crab, Saint Matthew blue king crab and Pribilof District blue king crab) need to be revised given new estimates of stock status parameters.
- Research on handling mortality rates needs to be performed to better specify handling mortality rates used in the analysis.
- The assessments must include consistent key management-related stock status information
- The assessments should include model-predictions from April models on fits to the data for September assessments to allow the impact of adding new data to be determined.
- The Plan Team encourages the authors to work closely with NMFS survey staff to ensure consistency between ADF&G and NMFS survey estimates.
- Estimates of precision with the survey values should be included in all assessments.
- For consistency with Amendment 24, the term "total catch OFL" should consistently be applied only to the total catch of males and females in all fisheries.
- Responses to all comments by the SSC on the May draft of the stock assessment should be clearly addressed and responded to in the September draft.

Stock Status Summaries

1 Eastern Bering Sea Snow Crab (*C. opilio*)

Fishery information relative to OFL setting.

The snow crab fishery has been opened, and harvest reported, every year since the 1960s. Prior to 2000, the GHL was 58% of abundance of male crab over 101 mm CW, estimated from the survey. The target harvest rate was reduced to 20% following the declaration of the stock as overfished in 1999, and the GHL/TAC since 2000 has been based on a harvest strategy that aims to allow recovery to the proxy for B_{MSY} established in 1998 (921.6 million lbs of total mature biomass).

Data and assessment methodology

The assessment is based on a size-structured population dynamics model in which crabs are categorized into mature, immature, new shell and old shell crabs by sex. The model is fitted to data on historical catches (landed and discard), survey estimates of biomass, and fishery, discard and survey size-composition data. It covers the 1978-2008 seasons and estimates abundance from 25-29mm to 130-135mm using 5mm size bins. The results of the annual Bering Sea bottom trawl survey are analyzed in three periods: before 1982, 1982-88,

and 1989 onwards, with different selectivity and catchability parameters for each period. The model is based on the assumption of a terminal molt at maturity. Unlike previous assessments, the 2008 assessment pre-specified rather than estimated the parameters determining growth. Two variants of the assessment were presented to the CPT in May 2008, which selected the base model (in which maturity is not estimated within the assessment, but is rather pre-specified based on auxiliary analysis).

The assessment was modified for 2008 in response to an external industry review and a review by the CIE. Specifically, the model is no longer fitted to length data by shell condition, but rather to data combined over shell condition, and it now assumes that females and males grow at the same rate at 25mm. The treatment of the size distribution of recruits has been revised to improve the residual patterns for the length-frequency data. The assessment may be refined again in the next year based on further consideration of the comments from the CIE review and the CPT.

Compared with the assessment presented to the CPT in May 2008, the final assessment uses catch and fishery length-frequency data for the 2007/08 season as well as survey abundance and length-frequency data for 2008.

Stock biomass and recruitment trends

Mature male biomass (at the time of mating) peaked between the late-1980s and mid-1990s, declined to a minimum in 2002 and has increased thereafter. The increase in mature male biomass has been greater than in mature female biomass. Recruitment has varied considerably over the period 1979-2008, with the recruitment (at 25mm) in 1986 the highest on record. Recruitment between 2003 and 2006 is estimated to be near or above average, while the estimated recruitments for 2007 and 2008 are below average.

Tier determination/Plan Team discussion and resulting OFL determination

The CPT recommends that snow crab be a Tier 3 stock so the OFL is based on the $F_{35\%}$ control rule. The team recommends that the proxy for B_{MSY} ($B_{35\%}$) be the mature male biomass at mating, computed as the average recruitment from 1979 to the last year of the assessment multiplied by the mature male biomass-per-recruit corresponding to $F_{35\%}$ less the mature male catch under an $F_{35\%}$ harvest strategy. The estimate of B_{MSY} is 317.7 million lbs. The MSST is defined as half of the proxy for B_{MSY} (158.9 million lbs).

Status and catch specifications (millions lbs.) of snow crab

Year	Biomass (MMB)	OFL	TAC	Retained Catch	Total Catch
2005/06	188		37.2	37.0	46.9
2006/07	218		36.6	36.4	49.4
2007/08	218		63.0	63.0	78.6
2008/09	251.1	77.3	TBD	TBD	TBD

The 2008/09 MMB exceeds the proxy for MSST so the stock is not currently overfished. This stock is in Tier 3b stock status. The CPT will evaluate whether overfishing occurred during 2008 when the catches for 2008/09 become available.

The CPT notes that compared to the distribution from surveys, the catch is highly concentrated spatially. This could lead to exploitation rates in the south that exceed the desired rate. In principle, an OFL could be computed for the area in which the fishery operates, for example by applying OFL control rule to the estimated fraction of the population in that area. However, it is not clear how concentrated the stock is at the time of the fishery compared to when the survey takes place.

Additional Plan Team recommendations

The next assessment should: (a) include retrospective analyses, (b) update the reference list, (c) include a full description of the model, including its forecast component and the weights assigned to the penalties and likelihood components, (d) expand the description of the way in which discards are treated in the model, (d) include past GHLs in the table of catches, and (e) further justify the values chosen for the weighting factors (the lambdas) and explore sensitivity to alternative values. The next assessment should also consider: (i) imposing a penalty to prevent the probability of maturity declining with increasing size if maturity is estimated within the model, (ii) set the effective sample sizes for the length-frequency data based on the effective sample sizes estimated from the fit of the model, (iii) explore whether it is possible to improve the residual patterns for the length-frequency data by modifying how maturity, growth and natural mortality are modeled and the implications of the change in distribution of the population over time, (iv) reduce the number of size classes for females, and (v) include measures of uncertainty for estimated quantities such as recruitment, and mature male biomass. Responses to all comments by the SSC on the May draft of the stock assessment should be clearly addressed and responded to in the September draft.

The CPT supports development of a spatially-structured stock assessment model so that the implications of differences in where the catch is taken and where the survey finds snow crab can be evaluated.

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

2 Bristol Bay red king crab (BBRKC)

Fishery information relative to OFL setting.

The commercial harvest of BBRKC dates to the 1930s, initially prosecuted mostly by foreign fleets but shifting to a largely domestic fishery in the early 1970s. Retained catch peaked in 1980 at 129.9 million lbs, but harvests dropped sharply in the early 1980s, and population abundance has remained at relatively low levels over the last two decades compared to the 1970s. The fishery is managed for a TAC coupled with restrictions for size ($\geq$ 6.5-in CW), sex (male only), and season (no fishing during mating/molting periods). Prior to 1990, the harvest rate was based on population size, and prerecruit and postrecruit abundances, and varied from 20% to 60% of legal males. In 1990, the harvest strategy became 20% of mature male ($\geq$120-mm CL) abundance, with a maximum of 60% on legal males, and a threshold abundance of 8.4 million mature females. The current stepped harvest strategy allows a maximum of 15% of mature males but also incorporates a cap of 50% of legal males, a threshold of 14.5 million lbs of effective spawning biomass (ESB), and a minimum GHL of 4.0 million lbs to prosecute a fishery. A TAC of 18.3 million lbs was established for the 2005 season, reduced to 15.5 million lbs for the 2006 season, and increased to 20.4 million lb for the 2007 season. Average retained catch for the period 2005 to 2007 was 18.0 million lbs. Catch abundance of legal males per pot lift was relatively high in the 1970s, low in the 1980s to mid-1990's, and has gradually increased since 2000 to an average of 29.7 crab/pot lift over the last three years; CPUE increased markedly with the implementation of crab rationalization in 2005. Annual non-retained catch of female and sublegal male RKC during the fishery averaged 1.7 million lbs since data collection began in 1990. Estimates of fishing mortality have ranged from 0.28 to 0.38 following implementation of crab rationalization. Total catch (retained and bycatch mortality) was 22.7 million lbs in 2005, declined to 17.2 million lbs in 2006 and increased to 23.3 million lbs in 2007.

Data and assessment methodology

The stock assessment model involves a length-based model incorporating data from the eastern Bering Sea trawl survey, commercial catch, and at-sea observer data. Stock abundance is estimated for male and female crabs $\geq$ 65-mm CL during 1985 to 2008. Catch data (retained catch numbers, retained catch weight, and pot

lifts by statistical area and landing date from the fishery which targets males ≥6.5-in CW) were obtained from ADF&G fish tickets and reports, fishery bycatch data from the ADF&G observer database, and groundfish trawl bycatch data from the NMFS trawl observer database.

Stock biomass and recruitment trends

Estimates of stock biomass have generally increased since 1985, but remain well below historic levels of the 1970s. Recent above-average year classes have largely recruited into the fished population with no evidence of new strong recruitment. Mature male biomass increased from 72.3 million lbs in 2005 to 95.6 million lbs in 2008.

Tier determination/Plan Team discussion and resulting OFL determination

The authors are commended for updating the assessment per May CPT and June SSC recommendations. However, the team made several recommendations for improvements to the assessment. For example, to the extent possible, the model should incorporate data prior to 1985. It was also suggested that future assessments include some analysis of model sensitivity to different weightings (lambdas). The magnitude of lambdas has a direct effect on projected biomass and catch likelihood profiles because increasing lambdas artificially decreases the width of the profiles. It was also recommended that the author consider parameter estimation in a Bayesian context. The authors noted that patterns seem to exist in the trawl survey residuals for female crab; the female maturity curve is currently knife-edged. It is requested that the authors examine scenarios which attempt to address the female trawl survey residual patterns. In addition, it is requested that when key parameters are fixed in the model, more justification, such as a sensitivity analysis, should be included for estimating parameters external to the model. The CPT specifically recommended investigating the sensitivity of the survey q which is fixed in the model. The team recommends that these additional analyses be incorporated into the assessment for the Spring 2009 review.

The Plan Team concurs with the author in recommending Bristol Bay red king crab as a Tier 3 stock. The team recommends that the proxy for B_{MSY} ($B_{35\%}$) be the mature male biomass at mating, computed as the average recruitment from 1995 to the last year of the assessment multiplied by the mature male biomass-per-recruit corresponding to $F_{35\%}$ less the mature male catch under an $F_{35\%}$ harvest strategy. Estimated $B_{35\%}$ is 75.11 million lb in 2008. Total catch OFL includes discard and retained male catch and male trawl bycatch, but not female pot or trawl bycatch.

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

Year	Biomass (MMB)	OFL	TAC	Retained Catch	Total catch
2005/06	79.92		18.3	18.3	22.72
2006/07	82.03		15.5	15.4	17.22
2007/08	85.94		20.4	20.4	23.22
2008/09	95.6	24.2	TBD	TBD	TBD

The 2008/09 MMB exceeds the proxy for MSST so the stock is not currently overfished. This stock is in Tier 3a stock status. The CPT will evaluate whether overfishing occurred during 2008 when the catches for 2008/09 become available.

Additional Plan Team recommendations

The Plan Team encourages the authors to work closely with NMFS survey staff to ensure consistency between ADF&G and NMFS survey estimates. A follow-up to this process would also be the inclusion of estimates of precision with the survey values. Survey abundances should be tabulated in the assessment.

Ecosystem Considerations summary

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

3 Eastern Bering Sea Tanner Crab (*C. bairdi*)

Fishery information relative to OFL setting.

Two fisheries, one east and one west of 166° W. longitude, harvest eastern Bering Sea (EBS) Tanner crab. Under the Crab Rationalization Program, ADF&G sets separate TACs and NMFS issues separate IFQ for these two fisheries. However, NMFS will set one OFL for the eastern Bering Sea Tanner crab because evidence indicates that the EBS Tanner crab is one stock. Both fisheries were closed from 1997 to 2005 due to low abundance. NMFS declared this stock overfished in 1999 and the Council developed a rebuilding plan. In 2005, abundance increased to a level to support a fishery in the area west of 166° W. longitude. ADF&G opened both fisheries for the 2006/07 and 2007/08 crab fishing years. In 2007, NMFS determined the stock was rebuilt.

Tanner crab are caught as bycatch in the groundfish fisheries, in the directed Tanner crab fishery itself (principally as non-retained females and sublegal males), and in crab fisheries directed on other species (notably, eastern Bering Sea snow crab and the Bristol Bay red king crab).

Data and assessment methodology

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

Stock biomass and recruitment trends

Mature male biomass (MMB) and legal male biomass (LMB) showed peaks in the mid-1970s and early 1990s. MMB at the survey revealed an all-time high of 623.9 million pounds in 1975, and a second peak of 255.7 million pounds in 1991. From late-1990s through 2007, MMB has risen at a moderate rate from a low of 25.1 million pounds in 1997 to its current level of 143.1 million pounds in 2008.

In the 2008 survey, estimated abundance of legal males increased over the 2007 abundance estimate by 9%; however, the 2008 survey showed a marked decline in estimated abundance across all other size classes of males and females.

Tier determination/Plan Team discussion and resulting OFL determination

The team recommends this stock as a Tier 4 stock because no stock assessment model has been developed for the entire EBS stock.

B_{MSY} proxy is estimated at 189.76 million pounds MMB at the time of mating, based on the SSC's recommendation that B_{MSY} proxy be calculated as the average mature male biomass (MMB) for the years

1969-1980, discounted by fishery removals (retained and non-retained mortalities) and natural mortality between the time of survey and the time of mating. This sequence of years extends those included in the May CPT recommendation (1975-1980). However the team notes that adding data from surveys prior to 1975 adds to existing data quality and availability issues including that the surveyed area expanded through the 1970s to 1980, when the area surveyed is roughly what it remains to date; and data retrieval is an issue (data from 1969 through the 1970s generally must be gleaned from various published summaries and is generally not retrievable from databases). The SSC in June 2008 also asked that results be examined for 1969-2007 data. The authors noted that the post-1980 data may not be appropriate: post 1980-data had a history of stock collapse, closures, and imposition of a rebuilding plan.

The recommended OFL is based on γ=1.0. An alternative analysis, based on $F_{35\%}$/M, was presented to the CPT in response to an SSC recommendation. $F_{35\%}$/M was re-estimated by the assessment authors rather than being set to 2.1 because the fishery selectivity appears to have changed since the EA was conducted. However, this analysis remains preliminary and the CPT look forward to seeing an updated analysis based on a stock assessment model in May 2009.

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

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

The 2008/09 MMB exceeds the proxy for MSST so the stock is not currently overfished. The stock is in Tier 4b stock status. The CPT will evaluate whether overfishing occurred during 2008 when the catches for 2008/09 become available.

Additional Plan Team recommendations

- For consistency with Amendment 24, the term "total catch OFL" should consistently be applied only to the total catch of males and females in all fisheries.
- Based on the assessment, much of the data and information needed to develop a stock assessment model for the entire EBS stock may exist. It is recommended that development of such a model should proceed; the stock assessment model developed for the eastern portion of the EBS Tanner crab stock should be reviewed for adaptation for a model to apply to the full EBS.
- Future spring stock assessments should provide a full analysis on the choice of gamma and a full evaluation of alternatives relative to the default value, γ=1, and the appropriateness of the default value.
- The assessment should provide complete documentation on data sources and the calculations and assumptions used in the stock assessment for computing OFL. The total catch OFL should be clearly specified and provided in a table focused on deriving that OFL. Information on sub-dividing the OFL among catch components should be presented clearly.
- Research on handling mortality rates needs to be performed to better specify handling mortality rates used in the analysis.

- The team will revise the terms of reference for assessments to include key management related stock status information consistently.
- Responses to all comments by the SSC on the May draft of the stock assessment should be clearly addressed and responded to in the September draft.
- The next assessment should include a full and reasonably detailed discussion on the pre-1980 data quality issues for both the survey and fishery data.

Ecosystem Considerations summary

Although studies are limited, the EBS Tanner crab fisheries do not appear to negatively impact any ecosystem components. Climate change may negatively impact Tanner crab abundance through increasing predator abundance, decreasing benthic production, and the potential for decalcification in a more acidic ocean.

4 Pribilof Islands red king crab

Fishery information relative to OFL setting.

There is no harvest strategy for this fishery in State regulation. The fishery began as bycatch in 1973 during the blue king crab fishery. A red king crab fishery opened with specified GHL for the first time in September 1993. The 1993 fishery yielded 2.6 million lbs under a 3.4 million lb GHL, with highest catches occurred east of St. Paul Island, but harvests also south, southwest, west and northeast of St. Paul Island. The 1994 fishery was also prosecuted with a specified red king crab GHL. Since 1995, a combined GHL for red and blue king crabs was set and ranged from 1.3 to 2.5 million lbs. The fishery has remained closed since 1999 because of uncertainty with estimated red king crab survey abundance and concerns for incidental catch of blue king crab that are in a depressed state. The non-retained catches from pot and groundfish bycatch estimates of red king crab ranged from 0.01 to 0.19 million lbs during 1992-2008.

Data and assessment methodology

Although a catch survey analysis has been used for assessing the stock in the past, which incorporated data from the eastern Bering Sea trawl survey, commercial catch, pot survey, and at-sea observer data; for this assessment trends in MMB at mating are based on NMFS annual trawl survey estimates for the period 1980-2008 and incorporated commercial catch and observer data. For 2008 reference points' estimation, an F_{OFL} was determined using a mean mature male biomass (MMB) at the time of mating, 2008 MMB (projected to mating time), a default λ value of 1, and an M value of 0.18. This F_{OFL} was used on the legal male biomass at the time of the fishery to determine the catch OFL. Total legal crab removal (retained and bycatch losses) with legal biomass and MMB were used to estimate the exploitation rate at the time of the fishery.

Stock biomass and recruitment trends

The stock exhibited widely varying mature male and female abundances during 1980-2008. The 2007 survey time estimate of MMB was 16.58 million pounds and dropped to 12.49 million pounds in 2008. The recruitment trend appeared to be highly variable. However, survey estimates are highly influenced by the results of a limited number of tows with non-zero catches. Red king crabs have been historically harvested with blue king crabs and are currently the dominant of the two species in this area.

Tier determination/Plan Team discussion and resulting OFL determination

Two sets of data series, 1991-2007 and 1980-2007, were considered to determine mean MMB at mating as proxy B_{MSY}. The first series produced a mean estimate of 8.66 million pounds and is recommended by the CPT and SSC. The second series produced a mean estimate of 5.91 million pounds which was requested by the SSC for comparison purposes. The 2008 MMB at mating exceeded both proxy B_{MSY} values.

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

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

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

The 2008/09 MMB exceeds the proxy for MSST so the stock is not currently overfished. This stock is in Tier 4a stock status. The CPT will evaluate whether overfishing occurred during 2008 when the catches for 2008/09 become available.

Additional Plan Team recommendations

There are concerns about the unreliability of biomass estimates and blue king crab bycatch mortality would occur in a directed red king crab fishery.

Ecosystem Considerations summary

There have been no direct studies of the prey of Pribilof Islands red king crab. Studies in other areas indicate that red king crab diet varies with life stage and that red king crabs are opportunistic omnivorous feeders, eating a wide variety of microscopic and macroscopic plants and animals. Pacific cod is the major predator of red king crab in the eastern Bering Sea. Recruitment trends for red king crab in the eastern Bering Sea may be partly related to decadal shifts in climate and physical oceanography. Strong year classes were observed when temperatures were low and weak year classes were occurred when temperatures were high, but temperature alone cannot explain year class strength trend. The lack of king crab recruitment in the Pribilof Islands area may be the result of a large-scale environmental event affecting abundance and distribution. The seasonal ice cover has an effect on primary productivity and hence crab recruitment, but the changes in the ice cover on benthic communities of the Pribilof Islands are not well known. The trawl fishery ban around the Pribilof Islands protects the critical habitat of the red king crab in this area. The extent that pot gear impacts benthic habitat is not well known and most likely depends on the substrate.

5 Pribilof District blue king crab

Fishery information relative to OFL setting.

The Pribilof blue king crab fishery began in 1973, with peak landing of 11.0 million lbs in the 1980/81 season. A steep decline in landings occurred after the 1980/81 season. Directed fishery harvest from 1983 until 1987 was annually less than 1.0 million lbs with low CPUE. The fishery was closed in 1988 until 1995. The fishery reopened from 1995 to 1998. Fishery harvests during this period ranged from 1.3 to 0.5 million lbs. The fishery closed again in 1999 due to declining stock abundance and has remained closed through the 2007/08 season.

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

Data and assessment methodology

The NMFS conducts an annual trawl survey that produces area-swept abundance estimates, and ADF&G is

developing a catch-survey analysis model. In addition ADF&G is conducting a triennial pot survey of Pribilof king crab in September 2008. Those results will be available later this winter. However, because the model was not reviewed, the OFL determination is based on area-swept abundance estimates at the time of mating.

The CPT discussed the history of the fishery and the rapid decline in landings. It is clear that the stock has collapsed, although there is imprecision in the annual area-swept abundance estimates. The CPT discussed averaging recent biomass estimated to account for annual fluctuations to reduce noise in the data. For stocks where biomass estimates for OFL setting are based on survey estimates consideration should be given to averaging recent abundance estimate to obtain a more reliable estimate of current stock size.

Stock biomass and recruitment trends

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

Tier determination/Plan Team discussion and resulting OFL determination

This stock is placed into Tier 4, stock status level c. The time period for B_{MSY} is 1980-84 plus 1990-97, excluding the 1985-1989 period. This was chosen as it eliminates periods of extremely low abundance. B_{MSY} is estimated as 9.28 million pounds. MSST is one half of the B_{MSY}. The retained catch OFL is 0 because the 2008 estimate of MMB is less than 25% B_{MSY}. Due to the Tier level and stock status an F_{OFL} must be determined for the non-directed catch. Ideally this should be based on the rebuilding strategy, however the rebuilding plan needs to be revised to be consistent with amendment 24. However in the absence of a revised rebuilding strategy, the CPT recommends an OFL equal to the average catch since the directed fishery was closed (1999) through to 2006/07. Since this time period bycatch in the Pacific cod pot fishery has increased dramatically and is not representative of a sustainable yield. The total catch OFL (after discounting for mortality) for 2008/09 is 0.004 million pounds.

The CPT recommended gamma = 1, given the absence of information presented to establish an alternate value at this time. Natural mortality was M=0.18

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

Year	Biomass MMB*	OFL	TAC	Retained Catch	Total Catch
2005/06	0.68		closed	0	0.002
2006/07	0.33		closed	0	0.004
2007/08	0.66		closed	0	0.060
2008/09	0.25	0.004	closed	0	TBD

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

The 2008/09 MMB is below the proxy for MSST so the stock is currently overfished. This stock is in Tier 4c stock status. The CPT will evaluate whether overfishing occurred during 2008 when the catches for 2008/09 become available.

Additional Plan Team recommendations

The rebuilding plan needs to be revised given new estimates of stock status parameters Management options for revising the rebuilding plan are contained in the Crab Plan Team minutes (September 2008)

6 St. Matthew blue king crab (St. Matthew BKC)

Fishery information relative to OFL setting

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

Data and assessment methodology

A four-stage catch survey analysis incorporates annual trawl survey data from 1978 to 2008, triennial pot survey data from 1995 to 2007, and commercial catch data from 1978 to 2007, and uses a maximum likelihood approach to estimate male crab biomass and abundance. The model links crab abundance in four crab stages based on a growth matrix, estimated mortalities, and molting probabilities. The four stages include prerecruit-2s (90-104 mm CL), prerecruit-1s (105-119 mm CL), recruits (newshell 120-133 mm CL), and postrecruits (oldshell ≥ 120 mm CL and newshell ≥ 134 mm CL). The model was developed for five scenarios in which either one or both parameters of natural mortality (M) or survey catchability (q) were fixed (M = 0.18 and Q = 1). The first three scenarios include estimated M for one year (1999), while the other two assume that M was constant over time. The scenario with q and M fixed (with estimating M in 1999) was selected by the CPT because of the uncertainty in parameter estimation.

Stock biomass and recruitment trends

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

Tier determination/Plan Team discussion and resulting OFL determination

St. Matthew BKC is recommended as a Tier 4 stock in 2008. The B_{MSY}^{proxy} varies as a function of years used to calculate average mature male biomass. The time period selected by CPT for estimating B_{MSY}^{proxy} was 1989 to 2008 because before 1986, the fishery was harvested at extremely high rates and this time period incorporates stock rebuilding several years after the stock crash. B_{MSY}^{proxy} during this time period is 7.39 million lbs. Gamma was recommended to be 1. OFL was set for this year using the Tier 4 control rule. A retained catch OFL was used because bycatch data was not included in this year's assessment.

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

Year	Biomass* (MMB)	OFL	TAC	Retained Catch	Total Catch
2005	5.291		closed	closed	TBD
2006	7.069		closed	closed	TBD
2007	9.682		closed	closed	TBD
2008	10.74	1.63 [retained]	TBD	TBD	TBD

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

The 2008/09 MMB is above the proxy for MSST so the stock is not currently overfished. This stock is in Tier 4a stock status. The CPT will evaluate whether overfishing occurred during 2008 when the catches for 2008/09 become available.

Additional Plan Team recommendations

The model should continue to be refined for review at the May 2009 CPT meeting to allow this stock to be considered for Tier 3 Further analyses are needed to explore scenarios of constant M over the whole time period, including runs tests and justifications of lambda with log-likelihood analyses. Bycatch data in all fisheries must be compiled to generate a total catch OFL for the May 2009 assessment. The CVs of the survey data should be used in the assessment next year. The assessment needs to include figures showing data and fits to these data for both pot and trawl surveys including confidence intervals on data and model results. The assessment should also examine the sensitivity of the weighting choices employed in the model to examine relative influence on results [e.g. conducting the assessment using each of the two indices of abundance in turn (pot and trawl survey)].

Ecosystem Considerations summary

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

7 Norton Sound Red King Crab

Fishery information relative to OFL-setting

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

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

Data and assessment methodology

Fishery-dependent data are available for the three fisheries. Fishery-independent data are available through four surveys: summer trawl, summer pot, winter pot, and a preseason pot survey. Surveys are conducted periodically with no survey being conducted on an annual basis. No bycatch or discard data is available for the fisheries. A length based stock model was developed to estimate annual stock abundance for the period 1976-2007. Summer commercial fishery data are available from 1977.

Stock biomass and recruitment trends

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

Tier determination, Plan Team discussion and OFL determination

The Crab Plan Team discussed the current status of the stock abundance model and had several concerns. The team notes that most model parameters are fixed and recommends that the justification for this be provided as well as a sensitivity analysis conducted to evaluate alternative values. Selectively is currently pre-specified to increase with size. Model results appear to indicate that something is mis-specified in the way that the model

reaches each selectivity. The assessment should include greater sensitivity tests, particularly a range of weights on various parameters considered. Model specification should be investigated and alternative configuration sought as an improvement over the current model.

The team discussed alternative OFL setting approaches for this stock given concerns expressed about the model. Three alternative approaches are put forward: (1) use of the model estimate (understanding the issues inherent in the model estimate and suggestions for the following year); (2) use of the survey biomass estimate to calculate a Tier 4 OFL; and (3) placing this stock in to Tier 5 and basing an OFL on average catch. While the team expressed concerns as noted previously with the model and assessment as currently formulated, the team concluded that use of survey biomass estimates not presented was not sufficient, and that use of a Tier 5 formulation when biomass estimates are available is inappropriate.

The team chose to go forward with a Tier 4 recommendation for this stock and the use of the model biomass estimates to determine an appropriate OFL. The team discussed the author's recommendation of the use of the years 1983-2008 in order to exclude the 1976-1982 period. The start date of 1983 was chosen over 1980 due to representing the first appearance of post-regime shift recruitment. Gamma was recommended at 1.0 due to issues with the model and assumptions regarding selectivity in the model.

The team agreed with the assessment author's recommendation for the years under consideration for the BMSY proxy, and resulting OFL. For 2008, the B_{MSY} proxy is 3.57 million lbs, F_{MSY} proxy = 0.18, B = 5.24 million lbs, and LMB = 4.1162 million lbs. The 2008 OFL for retained catch is 0.246 million crabs or 0.68 million lbs. This OFL was established in June 2008 in order to allow for the summer fishery.

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

Year	Biomass (MMB)	OFL	TAC	Retained Catch	Total Catch
2005	3.89		0.37	0.40	
2006	3.62		0.45	0.45	
2007	4.40		0.32	0.31*	TBD
2008	5.24	0.68 [retained]	0.41	0.39*	TBD

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

The 2008/09 MMB is above the proxy for MSST so the stock is not currently overfished. This stock is in Tier 4a stock status. The CPT will evaluate whether overfishing occurred during 2008 when the catches for 2008/09 become available.

Additional Plan Team recommendations

The team requested that additional information be included in future assessment reports on asymptotic standard errors and selectivity parameters (to indicate which are fixed not estimated). The team discussed the rationale for using the M value of 0.18 and its basis on laboratory studies. Some team members did not agree with this estimate usage for this stock noting that model information could be used to inform the best estimate. The team recommends that alternative M values be examined in the next assessment. The team recommends exploration of a broader range of models and sensitivity analyses for this stock for the May 2009 assessment. The team further recommends the authors include a clear explanation of the gamma value chosen for future models. The assessment authors should also provide a more complete rationale for choice of range of years.

The SSC requested a presentation on this model at the October meeting.

8 Aleutian Islands golden king crab (AIGKC)

Fishery information relative to OFL setting

The fishery has been prosecuted as a directed fishery since the 1981/82 season and has been open every season since then. Retained catch peaked during the 1985/86–1989/90 seasons (average catch of 11.9 million lbs), but average harvests dropped sharply from the 1989/90 to 1990/91 season and average harvests for the period 1990/91–1995/96 was 6.9 million lbs. Management for a formally established GHL was first introduced with a 5.9-million lb GHL in the 1996/97 season, subsequently reduced to 5.7-million lbs beginning with the 1998/99 season. The GHL (or TAC, since the 2005/06 season) has remained at 5.7 million lbs through the current season. Average retained catch for the period 1996/97–2006/07 was 5.6 million lbs, including 5.3 million lbs in the 2006/07 season. This fishery is rationalized under the Crab Rationalization Program.

Data and assessment methodology

There is no assessment model in use for this stock. Available data are from fish tickets (retained catch numbers, retained catch weight, and pot lifts by statistical area and landing date), size-frequency data from samples of landed crabs, at-sea observer data from pot lifts sampled during the fishery (date, location, soak time, catch composition, size, sex, and reproductive condition of crabs, etc), data from a triennial pot survey in the Yunaska-Amukta Island area of the Aleutian Islands (approximately 171° W longitude), recovery data from tagged crabs released during the triennial pot surveys and bycatch data from the groundfish fisheries. These data are available through the 2006/07 season and the 2006 triennial pot survey. Most of the available data were obtained from the fishery which targets legal-size (≥6-inch CW) males and trends in the data can be affected by changes in both fishery practices and the stock. The triennial survey is too limited in geographic scope and too infrequent to provide a reliable index of abundance for the Aleutian Islands area.

Stock biomass and recruitment trends

Estimates of stock biomass are not available for this stock. Estimates of recruitment trends and current levels relative to virgin or historic levels are not available. However, there is good evidence that the sharp increase in CPUE of retained legal males during recent fishery seasons was not due to a sharp increase in recruitment of legal-size males.

Tier determination/Plan Team discussion and resulting OFL determination

AIGKC is recommended as a Tier 5 stock in 2008/2009. B_{MSY} and MSST are not estimated for this stock. OFL was set for this year using a retained catch OFL. The SSC differed with the Plan Team's recommended OFL in June 2008 (to use the time period for calculating average catch between 1990/1991 to 1995/1996 as prior to 1990, there were indications that harvest was not sustainable) and instead selected a longer time period over which to average catch. The time period recommended by the SSC is 1985/1986 to 1995/1996. This resulted in a retained catch OFL of 9.18 million pounds. This OFL was established in June 2008 due to the timing of the summer fishery.

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

Year	Biomass (MMB)	OFL	TAC	Retained Catch	Total Catch*
2005/06	NA		5.70	5.52	8.08
2006/07	NA		5.70	5.22	8.01
2007/08	NA		5.70	5.51	TBD
2008/09	NA	9.18 [retained]	5.99	TBD	TBD

*catch listed here has not been discounted for mortality

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

Additional Plan Team recommendations

The plan team reviewed a new stock assessment model for Aleutian Islands golden king crab (Chapter 8b). The plan team recommends continued development of the stock assessment model and presentation to the SSC in October. The team recommends incorporation of plan team and SSC comments into the model for the May 2009 plan team meeting. Use of an assessment model will allow for this stock to be moved to Tier 4 and would provide focus for establishing research and data collection priorities.

Sufficient bycatch data exists to generate a total catch OFL and needs to be synthesized with an analysis for future assessments.

Ecosystem Considerations summary

The assessment author should reference the Aleutian Islands Fishery Ecosystem Plan in future assessment reports. No ecosystem considerations were considered at this time.

9 Pribilof Islands golden king crab

Fishery information relative to OFL setting

The domestic fishery around the Pribilof Islands for male golden king crab ≥5.5 in. CW (≥124 in. CL) developed in 1982. Since then, fishery participation has been sporadic and retained catches variable. The fishery has been managed for a GHL of 0.15 million lbs since 2000. Non-retained bycatch occurs in the directed fishery as well as the Bering Sea snow crab fishery and Bering Sea grooved Tanner crab fishery. No vessels participated in the fishery in 2006 or 2007. This fishery was not included in the Crab Rationalization Program. This fishery opens on January 1 and is open year round operating under a commissioners permit. No permits have been issued since 2005 for this fishery.

Data and assessment methodology

There is no survey and no assessment model in use for this stock. Available data are from fish tickets (including retained catch numbers, retained catch weight, and pot lifts by statistical area and landing date), size-frequency data from samples of landed crabs, and at-sea observer data from pot lifts sampled during the fishery (including date, location, soak time, catch composition, size, sex, and reproductive condition of crabs, etc), and from the groundfish fisheries. Much of the directed fishery data is confidential due to low numbers of participating vessels or processors.

Stock biomass and recruitment trends

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

recruitment to the legal male portion of the stock during that period.

Tier determination/Plan Team discussion and resulting OFL determination

The team recommends that this stock be assigned to Tier 5 due to the lack of available biomass information. Catch history from 1993-1999 is proposed for OFL determination resulting in an OFL of 0.17 million lbs. This OFL is proposed for retained catch only.

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

Year	Biomass (MMB)	OFL	GHL	Retained Catch	Catch (non retained all fisheries)
2005/06	NA		0.15	Confidential*	0.019
2006/07	NA		0.15	0	(not available)
2007/08	NA		0.15	0	(not available)
2008/09	NA	0.17 [retained]	TBD	TBD	TBD

* Confidential data not available due to a total of less than three vessels or processors participating in the fishery

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

Additional Plan Team recommendations

All sources of mortality should be included in the assessment next year. The team recommends that additional information from the NMFS slope survey be included in the assessment for 2009.

10 Adak red king crab, Aleutian Islands

Fishery information relative to OFL setting

The domestic fishery has been prosecuted since 1961 and was opened every season through the 1995/96 season. Non-retained catch of red king crabs occurs in both the directed red king crab fishery and in the Aleutian Islands golden king crab fishery. Estimated non-retained catch during the 1996/97-2007/08 seasons has been low (less than 50,000 lbs) and was less than 10 percent of the retained catch in 2002/03 and 2003/04 seasons.

Peak harvest occurred during the 1964/65 season with a retained catch of 21 million pounds. During the early years of the fishery through the late 1970s, most or all of the retained catch was harvested in the area between 172° W longitude and 179° 15' W longitude. As the annual retained catch decreased into the mid-1970s and the early-1980s, the area west of 179° 15' W longitude began to account for a larger portion of the retained catch. Retained catch during the 10-year period 1985/86 through 1994/95 averaged 943,000 lbs, but the retained catch during the 1995/96 season was only 39,000 lbs. Since the 1995/96 seasons, the fishery was opened only occasionally. There was an exploratory fishery with a low GHL in 1998/99; three Commissioner's permit fisheries in limited areas during 2001 and 2002 to allow for ADF&G-Industry surveys, and two commercial fisheries with a GHL of 500,000 lbs during the 2002/03 and 2003/04 seasons. Most of the catch since the 1990/91 season was harvested in the Petrel Bank area (between 179° W longitude and 179° E longitude) and the last two commercial seasons (2002/03 and 2003/04) were opened only in the Petrel Bank area. Retained catch in the last two commercial fishery seasons was 506,000 lbs (2002/03) and 479,000 lbs (2003/04). The fishery has been closed since the end of the 2003/04 season. Non-retained catch of red king crabs occurs in both the directed red king crab fishery, in the Aleutian Islands golden king crab fishery, and groundfish fisheries. Estimated non-retained catch during the 1996/97-2006/07 seasons averaged 26,000 lbs per year. This fishery is rationalized under the Crab Rationalization Program only for the area

west of 179° W longitude.

Data and assessment methodology

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

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

Stock biomass and recruitment trends

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

Tier determination/Plan Team discussion and resulting OFL determination

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

The CPT note that the SSC recommendation relates to long-term productivity of the resource, but reiterates its concerns regarding the current status of this stock. The CPT will further analyze existing information and provide an updated rationale for an appropriate OFL for this stock given its current state in May 2009.

The SSC recommended exploring the possibility of using biomass dynamics (production) model to assess this stock, if the large observed changes in the distribution of the fishery can be adequately addressed. Information on bycatch estimates for the crab and groundfish fisheries during the 2007/08 season are included in the document. The CPT recommends the assessment better integrate the available bycatch information provided and anticipates computation of a total catch OFL for this stock in the May 2009 assessment.

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

Year	Biomass (MMB)	OFL	TAC	Retained Catch	Total Catch
2005/06	NA		Closed	0	0.004
2006/07	NA		Closed	0	0.010
2007/08	NA		Closed	0	0.011
2008/09	NA	0.46 [retained]	Closed	0	TBD

*catch listed here has not been discounted for mortality

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

Additional Plan Team recommendations

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

Ecosystem Considerations summary

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

Table 3. Crab Plan Team final recommendations September 2008

Chap #	Stock	Tier (1-5) level	Stock Status level (a,b,c)	F_{OFL}	B_{MSY} or $B_{MSYproxy}$	Years[1] (biomass or catch)	2008[2,3] MMB	2008 MMB / MMB_{MSY}	Gamma γ.	Mortality (M)	2008/09 OFL mill lbs [note if retained only]
1	EBS snow crab	3	b	0.55	317.70	1979-2008 [recruitment]	251.10[2]	0.79	NA	0.23 0.29(mature females only)	77.30
2	BB red king crab	3	b	0.33	75.11	1995-2008 [recruitment]	95.58[2]	1.27		0.18	24.20[4]
3	EBS Tanner crab	4	b	0.12	189.76	1969-1980 [survey]	108.28[2]	0.57	1.0	0.23	15.52
4	Pribilof Islands red king crab	4	a	0.18	8.66	1991-2007 [survey]	9.26[2]	1.07	1.0	0.18	3.32
5	Pribilof Islands blue king crab	4	c	0	9.28	1980-1984; 1990-1997 [survey]	0.25[2]	0.03	NA	NA	0.004
6	St. Matthew Island blue king crab	4	a	0.18	7.39	1989-2008 [model estimate]	10.74[2]	1.45	1.0	0.18	1.63 [retained]
7	Norton Sound red king crab	4	a	0.18	3.57	1983-2008 [model estimate]	5.24[3]	1.47	1.0	0.18(M_1-M_5) 0.216(M_6)	0.68 [retained]
8	AI golden king crab	5	NA			1985/86-1995/96 [retained catch]	NA				9.18 [retained]
9	Pribilof Island golden king crab	5				1993-1999 [retained catch]					0.17 [retained]
10	Adak red king crab	5				1985/86-2007/08 [retained catch]					0.46 [retained]

1 For Tiers 3 and 4 where B_{MSY} or $B_{MSYproxy}$ is estimable, the years refer to the time period over which the estimate is made. For Tier 5 stocks it is the years upon which the catch average for OFL is obtained.
2 MMB as projected for 2/15/2009 at time of mating.
3 Model mature biomass on 7/1/2008
4 Does not include female bycatch