North Pacific Fishery Management Council

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REPORT
of the
SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
September 26th – September 28th, 2011

The SSC met from September 26th through September 28th, 2011 at the Grand Aleutian Hotel, Dutch Harbor Alaska.

Members present were:

Pat Livingston, Chair
NOAA Fisheries—AFSC

Farron Wallace, Vice Chair
Wash. Dept. of Fish and Wildlife

Jennifer Burns
University of Alaska Anchorage

Robert Clark
Alaska Department of Fish and Game

Anne Hollowed
NOAA Fisheries—AFSC

George Hunt
University of Washington

Gordon Kruse
University of Alaska Fairbanks

Kathy Kuletz
US Fish and Wildlife Service

Franz Mueter
University of Alaska Fairbanks

Jim Murphy
University of Alaska Anchorage

Lew Queirolo
NOAA Fisheries—Alaska Region

Terry Quinn
University of Alaska Fairbanks

Seth Macinko
University of Rhode Island

Kate Reedy-Maschner
Idaho State University, Pocatello

Ray Webster
International Halibut Commisson

Doug Woodby
Alaska Department of Fish and Game

Members absent were:

Vacant
Oregon Dept. Fish and Wildlife

C-1 (b) Initial review revised Salmon FMP

Sarah Melton (NPFMC) presented a workshop report and Gretchen Harrington (NMFS-AKR) provided details from the initial review draft Environmental Assessment (EA) for Amendment 12 to revise the FMP for salmon fisheries in the EEZ off the coast of Alaska (Salmon FMP). The scope of the current Salmon FMP covers all of the EEZ off Alaska and is divided into the East Area (EEZ waters east of Cape Suckling) and the West Area (EEZ to the west of Cape Suckling). There was no public testimony.

The SSC recommends that this document be released for public review, after minor comments and suggestions have been addressed.

The SSC appreciates the concise analysis of alternatives for the geographic scope of the FMP. Clear descriptions of each alternative are given as well as the pertinent National Standards that apply to the alternative to include or exclude the historical net fishing areas in the West Area EEZ. Although no specific examples are given, there is adequate description of how inclusion (Alternative 2) of the historic net fishing areas in the FMP would complicate and duplicate state management of salmon in these areas. As explained in the text and accompanying tables of catch, all three historic net fishing areas are portions of larger state-managed fishing districts that also include State waters. The EA argues that State management of fish stocks in these areas is identical to and coordinated with management of these salmon stocks in state waters. The draft EA then goes on to explain how the exclusion of these areas of the West Area EEZ from the FMP (Alternative 3) is consistent with guidelines for application of National Standard 3 (managing stocks as a unit across their range) and National Standard 7 (management measures should minimize costs and avoid unnecessary duplication).

The SSC also commends the analysts for a very thorough review of the current FMP with an analysis of revisions required to meet MSA provisions and clarify the delegation of salmon management to the State of Alaska. The draft EA clearly describes the escapement-based management system that the State of Alaska uses and how it relates to MSA provisions for an FMP as an alternative approach to meeting guidelines for National Standard 1 to prevent overfishing and achieve optimum yields. The draft EA explains that the State of Alaska also has regulatory policies and procedures for setting escapement goals, for addressing scientific uncertainty in setting goals and managing for them, and for conducting scientific peer review. These processes can be used as an alternative process to preparation of SAFE documents, SSC recommendations for OFL and ABC, and setting exploitation rate-based ACLs/AMs, such as those used for crab and groundfish.

The SSC provides the following comments and suggestions to be addressed before release to the public:

- The draft EA needs to clarify that under alternative 3, ESA issues in the three exempted net fisheries in the West Area would be handled through Section 10 consultations with the State of Alaska.
- Similarly, the draft EA needs to describe potential actions (e.g., amendment of the FMP) that could be taken if new or expanding salmon fisheries were developed in the three historical net fishery areas under alternative 3.
- Several written public comments that resulted from the Salmon FMP Workshop are concerned with competing interests and conflicts between user groups in the upper Cook Inlet area, and subsequent resolution as specified in National Standard 7. These drift net fishermen who fish in the EEZ are concerned that under alternative 3 they will lose federal oversight and the ability to appeal management decisions made by the State of Alaska to the Federal Courts. The EA should more clearly explain the impact of the PPA on these users and perceived loss of oversight and an appeals process. These sections from the FMP may not be sufficient to address these issues.
- The prey analysis for humpback whales needs to be included in the relevant section of the EA (page 136 of the draft EA).
- Provisions for management and monitoring of interactions of the three historic net fisheries with marine mammals needs to be more fully described for alternative 3 (the PPA).

- Observer data for interactions between marine birds and drift gill net fisheries in the West Area EEZ (page 142 of the draft EA) need to be reviewed more carefully with regard to the quality of available data, and should be updated with the latest information on marine bird distribution.

C-2 (a) Groundfish

General Groundfish Plan team recommendations

The SSC received a number of recommendations from the BSAI and GOA Plan teams. The SSC would also like to receive an electronic coy of the GPT research recommendations as soon as those are finalized. Grant Thompson (NMFS-AFSC) presented an Aleutian Islands Pacific cod report describing a tier 5 approach for estimating OFL's and ABC's in the Aleutian Island region. The SSC anticipates that finer geographical divisions of BSAI Pacific cod ABC and OFL will be considered during next year's specification process.

The SSC supports the GPT recommendations in a number of areas:

- Octopus natural mortality rate. The SSC recommends that the author consider and mention in the analysis whether any of the predation amounts from the predation-based estimate might be from fishery discards of octopus and not due to direct predation on octopus.
- Moving to a biennial schedule for updating SAFE chapters for Tier 5/6 stocks when new survey information is available is supported. Executive summaries only are prepared in off-years.
- The SSC echoed the GPT concerns about the NMFS stock assessment priority tool and the possible disadvantages it may have for providing support and continued improvement to the stock assessments for the well-managed North Pacific stocks.
- Incorporating total catch data into SAFE appendices this year as a precursor to incorporating into the stock assessment. This allows for assessment of the reliability of the data and allows examination of whether double-counting might be occurring, etc. before these data are actually used.
- Continued efforts to move grenadier into the FMP. The SSC continues to support this as a priority and has previously commented on this.
- Alternative methods for Bogoslof pollock ABC control rules.
- Explore an alternative for splitting skates into Alaska skate and Other skates, including improved species identification.
- AI cod model alternatives in the short term (Kalman filter approach for the next assessment cycle) and long term (age structured model)
- Provide additional information in the assessment on maturation studies supporting northern/Dusky rockfish.
- The SSC requests the GPT to verify whether dusky rockfish research recommendations are included in the GPT's research recommendations.

Harvest Specifications

The SSC received a presentation from Grant Thompson (NMFS-AFSC) on the proposed harvest specifications for groundfish in both the BSAI and the GOA for 2012 and 2013. The SSC recommends approval of these specifications, noting that these include moving yellowtail and widow rockfish out of the GOA pelagic shelf rockfish complex into the GOA other shelf rockfish group.

Pacific cod model run proposals

Grant Thompson (NMFS-AFSC) reported on the Teams' recommendations for Pacific cod model scenarios in the BSAI that will go forward for consideration at the November Plan Team meeting. The Teams examined five models that remained for consideration following the May Plan Team and June SSC meetings. Model performance was measured by: 1) how often the fits with random starting points reached the MLE (match rate), 2) the root mean squared deviation of the negative log likelihood from the minimum (likelihood variation), and 3) the CV of the estimate of present biomass.

The Teams requested Models 2b and 4 in November, and requested a brief investigation into the reasons for performance issues with Model 3. The Teams wanted to include Model 3 as well if a short investigation would improve performance. Grant resolved the issue with Model 3 and presented the results to the SSC and the SSC agrees that this model should be brought forward for consideration.

The SSC supports the Team's suite of models and two additional model runs. First, the SSC would like last years based model (Model 1) brought forward for consideration. Second, the SSC also requests an additional run using Model 3, but excluding the mean-size-at-age composition data, because of concerns with incorporation of this dataset. The conclusion may be that excluding these data sources is not a good idea, but at least an evaluation will have been done. The SSC notes that the Author has discretion for modest changes to the above models to improve performance.

C-2 (b) GOA Halibut PSC limits

The SSC received a presentation from Darrell Brannan and Mike Downs (NPFMC consultants). Public testimony was received from Bob Hezzle (Fisherman's Finest), Merrick Burden (Marine Conservation Alliance), Julie Bonney (Alaska Groundfish Databank) and Donna Parker (F/V Sea Star).

The draft RIR reflects an impressive effort to address this large and complex body of information and statistical data. The analysts have compiled a draft RIR that is exhaustive and comprehensive, while remaining accessible. The recommended modestly revised Council Problem Statement, presented in the draft, is a much improved characterization of the action under consideration.

The SSC appreciates the effort made by the analysts/authors to adhere to clear, consistent, and concise use of terminology, especially pertaining to the distinct categories of removals in the groundfish fisheries defined as incidental catch, PSC, and bycatch. The effort enhances clarity for the reader, avoiding the need to guess as to which category is being referenced. Care should be taken when expressing revenue estimates, to identify them correctly (e.g., 'gross') each time they are cited, and attribute them to the appropriate market transaction level (e.g., exvessel, first wholesale, export, final user/consumer).

The distinction between "personal-use" and "subsistence-use" has very important legal, management, social, and cultural implications. Confounding these two separate and unique forms of use, as has been done in sections of the RIR, impairs the ability of the Council and the public to fully appreciate the nature, distribution, and significance of the projected impacts of halibut PSC allowance reductions.

Criticism has been leveled in the past at the static nature of the economic impact estimates, and it remains a concern with the current analysis. However, until the necessary operational and economic data become

available and dynamic behavioral models of 'expected' vessel-level response to changes in input conditions, including management constraints, can be developed, the analyst can do little more than speculate. In the present context, the static outcome has been presented as an example of a worse (not worst) case result, supplemented with hypotheses of how more dynamic assumptions about fleet behavior may play out.

With specific reference to Appendix 7, the section contains a report on socioeconomic work contracted by the Council to examine how the proposed action affects communities. This is a compilation of existing and limited quantitative datasets and its presentation is constrained by confidentiality requirements. Qualitative analyses are meant to overcome the deficiencies in these data, however, there is limited existing research to draw upon, beyond the community profiles. Inclusion of findings from research by Courtney Carothers, Laurie Richmond, Emilie Springer, and Meredith Marcione could strengthen the document. Gale Vick of the Gulf of Alaska Coastal Communities Coalition is also a useful contact to enhance the social impact analysis.

Public testimony indicated that awareness and analyses of potential effects on communities and fishery sectors of the action are inadequate. For example, Appendix 7 has identified three communities that are most likely to be affected by the proposed action: Kodiak, Sand Point, and King Cove. The empirical basis for this expectation is limited. The ability to address how proposed actions might affect individual operations, local support services, or the sustained participation of the communities is compromised without additional information. This could be improved through short-term research in each community to assess community-level engagement and dependency on groundfish and halibut fisheries and potential effects on individual operations and support services. The conclusions of Appendix 7, that the communities and individual operations will not likely be significantly affected, have not been demonstrated nor sufficiently incorporated into the RIR.

Taking the EA/RIR/IRFA in total, the SSC has identified a number of deficiencies in the document: opportunities to improve the community impact analysis; interpretation of >26" halibut PSC savings economic and distributional impacts; inadequate evaluation of impacts of alternatives on apex predators (e.g., marine birds and mammals); among other technical matters. For example, the section addressing marine birds is generic to the GOA or even all of Alaska, and makes overarching statements about seabirds feeding over 'vast areas of ocean' on primarily plankton and fish, and therefore would be largely unaffected by the alternatives. These statements oversimplify marine bird use of specific habitats and benthic prey species in the GOA, resulting in little support for findings of no impact.

¶The SSC notes that in estimating halibut catch and revenue impacts, the incorrect table from Appendix 5 has been used. The authors' intent was to estimate impacts on 026 (>26 inches) fish, for which the correct Appendix 5 table is Table 3. Some discussion of U26 impacts should be included, although we note these accumulate over the longer term. The addition of more detailed information on halibut migration patterns in the EA would help the reader interpret the estimated impacts, which are based on the assumption of no movement of halibut.

The SSC recommends release of the draft for public review, once the suggested edits have been evaluated and appropriately addressed to the extent practicable. The SSC notes that no preliminary

preferred alternative (PPA) has yet been identified. If the Council identifies a PPA at this meeting, the draft document must address the procedural requirements of the RFA, prior to release.

The SSC also notes that the Groundfish Plan Team recommended consideration of a biomass-based cap. The SSC looks forward to hearing discussions of the Plan Team on how this might be analyzed in the future.

C-3 (a) Crab Economic Data Reports

The SSC received a staff report from Mark Fina (NPFMC) on this agenda item. Public testimony was provided by Edward Poulsen (Alaska Bering Sea Crabbers Association) and Steve Minor (Pacific Northwest Crab Industry Advisory Committee).

The SSC has long been on record bemoaning the predominance of qualitative treatment of economic and social impacts in analyses that come before the Council. The legal and policy barriers to acquiring quantitative empirical data finally changed during MSA reauthorization and under provisions of the Crab Rationalization authorizing legislation. As a result, NMFS and the Council, with considerable assistance from industry, developed the Economic Data Reports (EDR) as a mechanism for systematically acquiring, compiling, and analyzing these critically needed data in the context of BSAI crab fisheries.

The EDR process is charting a new path that offers the potential to significantly improve the quality of the economic analyses presented to the Council. Although this process has admittedly been imperfect and a source of frustration among all parties involved, **the collection of data beyond the revenue and landings data that are typically used in Council analyses is essential**. The SSC is concerned that should the crab EDR program fail, it will adversely impact the Council's ability to improve data collection in other fisheries and will be a lost opportunity to improve the economic analyses for years to come. Paradigm shifts are not simple to achieve and mandatory economic data collection for fisheries managed by this Council is just such a shift.

The SSC commends the work of the analyst. However, the document presented to the SSC for initial review raises a number of concerns. The assertion contained in the Problem Statement and embedded in the reconsideration action that the costs of the status quo are too great and that the benefits are minimal or altogether lacking is misleading. The Problem Statement, as currently worded, frames Alternative 1 (status quo) as a non-viable option, yet lacks a substantive analysis of how the benefits and costs of the status quo compare with those of the other two alternatives presented in the document. The SSC recommends that the Council revisit its Problem Statement, avoiding statements that foreclose its options and to broaden the suite of alternatives that can offer a middle-ground between status-quo and abandoning the efforts and investments made to date.

The SSC acknowledges that revisions to the current EDR program are necessary. The current EDR program reportedly imposes a substantial burden on industry (average 37 hours) and a revised EDR with lower compliance costs should be considered. The SSC also recognizes that, although there are data quality issues that should be addressed in a revised EDR, the statement regarding Alternative 2 on page 44 of the Initial Review Draft incorrectly states that "the types of analyses that may be undertaken are not reduced substantially." Both action alternatives propose to eliminate collection of most/all cost information, and as a result, the quality of the analyses that may be undertaken is reduced substantially,

essentially closing the door on any meaningful economic data collection. Rather than eliminate data elements with quality concerns, the SSC recommends that a middle ground be explored that continues to collect most of the key data elements in some form. This may entail scaling back the level at which the data are collected (e.g., aggregate across all crab fisheries, rather than by crab fishery). While there may still be issues about the data quality, an expectation of perfection in any complex program is simply unreasonable. Iterative improvement should be regarded as success and encouraged. As hard as it may be to carry this process forward, the need for these data has not diminished and the SSC still maintains strong support for the concept of a comprehensive Economic Data Collection Program.

The SSC also recommends that the Council reconsider whether the blind data collection process (described in section 2.4) needs to be continued. Although the SSC recognizes the importance of maintaining confidentiality, especially with the collection of cost data, it does not appear that the benefits of this added layer are justified by costs and complexities.

Finally, the formal report from CIE review of the EDR program is due next week. Although the CIE review was not intended to inform Council action, it is possible that the review may contain useful input to assist in the development of new alternatives for consideration.

The SSC requests an opportunity to review the EDR Revision document in its next iteration. **Given the concerns about the problem statement and the suite of alternatives, the SSC does not recommend release of the analysis for public review at the present time.**

C-3 (c) Crab SAFE

The intent of establishing ACLs was to provide a framework that would lead to a consistent approach for incorporating uncertainty into the specification process based on the best available assessment of stock status. However, assessment authors, the plan team, and the SSC continue to struggle with how to account for the generally recognized and considerable uncertainties in specifying OFL distributions. These uncertainties are illustrated by the large range of OFL estimates among different models for snow crab (Table 10 in snow crab assessment) and are not reflected in the often minimal buffer between maximum ABC and OFL (with $P^* = 0.49$ and model-based uncertainty only). We are concerned that this may result in somewhat arbitrary choices about additional precaution and potential inconsistencies in the way uncertainties are incorporated for different stocks. The SSC has strived for consistency and, with the exception of one stock, has applied a 10% buffer as recommended for some stocks by the CPT. However, we note that this approach has no rigorous basis except that it reflects the 10% buffer adopted for Tier 5 stocks. The SSC looks forward to seeing the results of the plan team's OFL pdf workgroup, and requests that this group consider this issue and provide recommendations on a unified approach for quantifying and incorporating uncertainty in OFL distributions under the current control rule.

In reviewing Table 5 of the Introduction to the Crab SAFE, the SSC noted that overfishing did not occur in 2010/11 for any of the crab stocks.

SSC recommendations for September 2011(stocks 1-6). Note that recommendations for stocks 7-10 represent those final values recommended by the SSC in June 2011. Note diagonal fill indicates parameters are not applicable for that tier level. Values in 1,000 (t), bold values indicate SSC recommendation differs from Crab Plan Team .

Chapter	Stock	Tier	Status (a,b,c)	F_{OFL}	B_{MSY} or $B_{MSYproxy}$	Years[1] (biomass or catch)	2011/12[2] [3] MMB	2011 MMB / MMB_{MSY}	γ	Mortality (M)	2011/12 OFL	2011/12 ABC
1	EBS snow crab	3	b	1.42	147.48	1979-current [recruitment]	133.8	0.91		0.23(females) 0.319 (imm) 0.299 (mat males)	73.50	**66.15**
2	BB red king crab	3	a	0.32	27.3	1984-2011	29.76	1.05		0.18default Estimated[4]	8.80	**7.92**
3	EBS Tanner crab	4	b	0.08	83.33	1974-1980	33.20	0.40	1.0	0.23	2.75	**2.48**
4	Pribilof Islands red king crab	4	b	0.08	5.14	1991/92-2010/11	2.58	0.50	1.0	0.18	0.393	0.307
5	Pribilof Islands blue king crab	4	c	0	**4.49**	**1980/81**-1984/85 1990/91/-1997/98	0.37	0.08	1.0	0.18	0.00116	0.00104
6	St. Matthew Island blue king crab	4	a	0.18	3.11	1989/90-2009/10	7.17	2.31	1.0	0.18	1.7	1.5 [total male catch]
7	Norton Sound red king crab	4	a	0.18	1.13	1983-current [model estimate]	2.13	1.9	1.0	0.18	0.30	**0.27**
8	AI golden king crab	5				See intro chapter					5.17	4.66
9	Pribilof Island golden king crab	5				See intro chapter					0.09	0.08
10	Adak red king crab	5				1995/96–2007/08					.054	**0.014**

[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 2/15/2012 at time of mating.
[3] Model mature biomass on 7/1/2011
[4] Additional mortality males: one period 1980-1984. Females three periods: 1980-1984; 1976-1979; 1985 to 1993. See assessment for mortality rates associated with these time periods.

Snow crab

The SSC received a presentation on the snow crab stock assessment from Jack Turnock (AFSC) and a summary of the relevant Crab Plan Team (CPT) discussions from Bob Foy (AFSC) and Diana Stram (NPFMC). In response to previous CPT and SSC recommendations, the current assessment explored 13 alternative models that focused on three primary issues: natural mortality (fixed vs. estimated), availability of crab to the BSFRF survey (logistic function vs. smooth function), and new growth estimates for snow crab from a recent analysis by Dave Somerton.

The SSC appreciates the clear presentation and documentation of the alternative models and the extensive outputs and diagnostics for three of the models. This model has undergone extensive revisions and improvements since last year and the SSC thanks the authors, CPT, and modeling workshop participants for working on a tight timeline to bring forward the current suite of informative models.

The SSC agrees with the CPT's recommendation to adopt model 6 as the best model for specification purposes and provides the following rationale:

- Natural mortality (M): There is considerable uncertainty about appropriate mortality rates for snow crab. The author's preferred model (Mod. 7) fixes M for females, immature males, and mature males based on uncertain estimates of maximum age of snow crab at M=0.23 (estimated by Hoenig's method). Estimating either immature M (Model 1) or mature M (Model 2, similar to the model approved last year) inside the model resulted in a much higher M and lower Q, while estimating both M values (Model 3) resulted in more modest increases in M with a higher mortality for immature males than for mature males. The resulting Q was close to empirical estimates of selectivity from the side-by-side comparisons and provided a much better fit to the length composition data and to other data components including survey biomass. The estimates of natural mortality and differences among models were similar for models 4-6, which used a smooth curve instead of a logistic curve for availability of crab to the BSFRF survey.
- Survey availability (Q): The smooth curve resulted in a considerable reduction in the negative log-likelihood (~ 11) and a further improved fit to the length composition data components (Table 16). Although the improved model fit nominally used 40 additional parameters, the actual difference in degrees of freedom judging by the shape of the smooth curves (Fig. A-25 of the supplemental Model 6 results) is likely to be closer to 3 or 4, thus the penalty for the additional parameters (~2*4=8) is exceeded by improvement in the likelihood. While the SSC was troubled by the shape of the curve, as well as the difference in curves between 2009 and 2010, we agreed with the CPT that differences in availability of certain size classes to the BSFRF survey could result in the estimated patterns.
- Growth: A new relationship between pre-molt carapace width and molting increment was recently estimated by Dave Somerton (Fig. A-21 in supplement) and was used in models 8-10. The estimated curve differs from the current assumption in the model that growth increments increase linearly with size of crab. The SSC shared the CPT's concerns about the data used to estimate this growth curve and believes that it would be premature to adopt a model using these growth estimates. Moreover, the SSC suggests that the new growth information, after appropriate review, should be incorporated in the model by allowing a similar quadratic or asymptotic

increase in growth increment with carapace width and using the parameters of the estimated curve as priors in the model.

The SSC offers these additional recommendations for the stock assessment authors:

- Because of considerable uncertainty in natural mortality (M) and difficulties in estimating M internally in the assessment, the uncertainty in estimates of M should be fully characterized in the assessment by including standard errors or a full posterior distribution for M.
- Female mortality remains fixed at M=0.23 in the model although females are generally believed to have higher mortality rates than males. Therefore, the authors should explore estimating female mortality in the model (as in the new Tanner crab model) or provide a better rationale for the choice of female M.
- Further examination of the survey availability curves is warranted to assess the justification for using a smooth curve in the model. The SSC suggests the use of the DIC instead of the AIC for selecting among alternative models as it provides an objective method for determining the effective number of parameters.
- To compare model-estimated selectivity to the empirical (Somerton) estimates, the weighting scheme for the empirical estimates of selectivity should be reviewed and clarified. In particular, the SSC is uncertain about whether estimates of selectivity at a given location were weighted twice in the process of scaling selectivity estimates up to the "average" selectivity experienced by the snow crab population within the survey area (p. 13).

ABC determination

The range of models examined in the current assessment highlights the considerable uncertainty in the choice of an appropriate model for specification purposes. We note the wide spread in the estimates of OFL among alternative models (Table 10), which arises from considerable uncertainty about natural mortality, growth, and the appropriate structure of the model. **Because of this uncertainty, the SSC recommends setting the ABC for snow crab below maximum permissible. After considerable discussion, the SSC selected a buffer of 10% between the estimated OFL and the ABC, resulting in a 2011/12 ABC for snow crab of 66,150 t.** The buffer was largely chosen for consistency with other stocks and with the recommended buffer for Tier 5 stocks. The SSC would have preferred to handle uncertainty in the OFL through use of extra uncertainty under the P* approach, but this approach does not result in any meaningful buffer between OFL and ABC with a P* = 0.49. We note that even with the 10% buffer, the resulting ABC exceeds the OFL estimates from many of the alternative models, implying considerable risk that the chosen ABC exceeds the "true" OFL.

For the next assessment cycle, the SSC further supports all of the CPT recommendations in the September 2012 CPT report. In addition, we request that the CPT discuss the SSC's long-standing concern over potentially high harvest rates on the southernmost portion of the stock, which may be disproportionately important to its overall reproductive success. The SSC would like to receive a recommendation from the CPT regarding the desirability of developing a spatial model for snow crab given limited resources and other priorities.

Bristol Bay Red King Crab

Drs. Robert Foy (NMFS-AFSC) and Diana Stram (NPFMC) provided an overview of the Bristol Bay Red King Crab stock assessment. The authors (Jie Zheng and Shareef Siddeek, ADF&G) introduced 11

models during the May CPT meeting. The SSC reviewed these models during their June 2011 meeting and accepted the authors' and CPT's recommendations that Model 7ac be used for this assessment. Relative to last year's assessment, Model 7ac has 3 levels of molting probabilities, estimates length proportions for the initial year, includes the BSFRF survey, estimates effective sample sizes, and uses standard survey tows only for males and use survey re-tows for females.
The SSC appreciated receiving a detailed evaluation of the rationale for calculation of B_{ref}. The SSC agrees with the CPT recommendation that the time period for estimation of B_{ref} should be changed to the period 1984 to 2011.

The SSC reviewed the sources of scientific uncertainty and agrees with the CPT that an additional buffer between ABC and OFL is needed. The sources of scientific uncertainty are as follows:

The 2011 survey biomass showed an unexpected decline in MMB.

- The 2011 survey shows below average recruitment since 2005.
- A retrospective pattern was detected where the model estimates of MMB have been adjusted downward for the last 5 years.
- The justification for special natural mortality periods for males and females requires additional exploration (see suggestions for next year).

The SSC did not accept the CPT's method for calculating an additional uncertainty buffer. As noted in June 2011, there is no agreement within the scientific community regarding when or if adjustments should be made to correct for retrospective trends in stock assessments. The SSC recommends that the buffer should simply be based on at 10% reduction from the OFL to provide a modest buffer between OFL and ABC and for consistency with other stocks.

The SSC recommends that the BBRKC stock should be managed as a Tier 3 stock. Specifically, the stock is projected to be in Tier 3a. The OFL and ABC for the 2011/2012 season are 8,800 t and 7,920 t, respectively.

Recommendations for next year:
The SSC notes that the authors' preferred model Model 7ac continues to apply higher M for the period 1980 through 1984 for males and 1980 through 1984, 1976 through 1979 and 1985 through 1993 for females. The SSC would like additional justification for these additional natural mortality periods. The SSC requests that the author include two new options next year: (1) an option with no additional M periods and (2) an option without additional M periods and an additional survey selectivity period in the early 1980s. The author's justification for adding additional mortality based on increasing predation by Pacific cod is inconsistent with the Ecosystem Chapter that states that there is little evidence for predation on BBRKC by Pacific cod.

The SSC also recommends that if the authors change their preferred model in the upcoming year they should bring forward the most recent SSC approved Model 7ac as well as the preferred model in the final SAFE. This will allow the SSC to compare the implications of adopting the proposed new model configuration. Proposed changes to the model should be brought forward for consideration during the May CPT meeting.

Bob Foy informed the SSC that the 2011 re-tow data revealed a marked decline in male survey catches. He speculated that this was due to dispersion of males during the summer. The CPT discussed this issue and concluded that the current practice of eliminating re-tow data for males should be continued to maintain the integrity of the time series. The SSC requests that the authors review the re-tow data for males to determine whether the decision to eliminate re-tow data for males is still the best use of the available data. Specifically the SSC is concerned that if the reduction in biomass was due to dispersion of males that the estimate based on more dispersed distributions may be the best estimate of biomass. Spatial patterns of male catches within the re-tow area may provide insights.

Other issues and concerns:
Figures 4 and 5 should be pivoted to allow one to see modal progressions.

Tanner crab
A stock assessment model has not yet been approved for use in annual management, although much progress has been made. The SSC anticipates that a model will be ready for use in the 2012/2013 cycle. In the interim, area-swept estimates of biomass from the eastern Bering Sea trawl survey are used to estimate biomass of mature males, legal males, and females. Male mature biomass was 23% higher than last year.

The methodology upon which the 2011 assessment is based is virtually identically to that used in 2010, except for a change in base years used for OFL calculations. Three options were presented: (a) 1974 through 1980, (b) 1974 through 1980 where mature male biomass was adjusted for catches under the F_{msy} proxy rather than actual catches, and (3) 1974 through 2010. The CPT recommended basing OFL on the B_{msy} proxy based on 1974 through 1980 without the adjustment reflecting advice from the February 2011 stock assessment workshop.

The CPT recommended a total catch OFL of 1,570 t for 2011/2012. This equals the author's value in the table on page 3 of the SAFE chapter (1,460 t) plus an additional loss of 110 t of females projected as bycatch discards. However, the calculation mistakenly used the 2010 survey value instead of the 2011 survey value. Thus, the total catch OFL considering this correction should be 2,750 t for 2011/2012. For ABC, the CPT recommended the maximum permissible ABC (i.e., ABC=OFL), because of an inherent buffer in the area-swept assessment, the lack of upward adjustment for catchability and gear selectivity. Namely, q is assumed to be 1.0 in the area-swept estimates, but field studies and ongoing modeling indicates that $q<1.0$ (as used in the assessment model under development). However, the SSC was uncomfortable with the lack of a buffer between ABC and OFL, given uncertainties in OFL itemized on p. 17 of the BSAI Crab SAFE Introduction: (a) pre-specified population dynamics parameters and life-history rates such as natural mortality, size-weight, and maturity; (b) the assumption $F_{msy} = M$; and (3) the assumption that B_{msy} is the average biomass over 1974 through 1980. The SSC discussed the author's recommendation to adjust OFL by 82% based on an assumed additional uncertainty of 0.3, but felt this estimate was too high, given the smaller buffers for stocks with less information.

For 2011/2012, the SSC supports the OFL of 2,750 t. However, the SSC recommends an ABC of 2,480 t, based on a 10% adjustment for uncertainty in OFL for reasons listed above. For next year's assessment, the SSC requests the assessment authors and CPT to reconsider appropriate methods to

specify an ABC that accounts for uncertainty in OFL estimation. In addition, in the unlikely event that the Tanner crab stock assessment model is not approved for next year's assessment, the SSC requests that the authors estimate biomass under tier 4 using estimates of $q<1$ based on NMFS field studies (underbag experiments) and ongoing modeling efforts. Additional recommendations are provided under the Tanner crab stock assessment modeling section of the SSC report.

Pribilof Islands Red King Crab

The fishery for red king crab in the Pribilof Islands district has been closed since 1999 due to concerns of low abundance, imprecision of biomass estimates, and pot bycatch of sympatric blue king crab, which are classified as overfished. Fishing mortality since the closure of the directed fishery has been limited to incidental catches in other crab fisheries and in groundfish fisheries.

The SSC supports the CPT recommendation to continue using the same base years as used previously (1991 to the current year) for determination of B_{MSY} for the Pribilof Islands red king crab stock. The SSC also supports a Tier 4b designation for this stock, noting that the estimate of mature male biomass (2.577 t) is below BMSY (5,143 t) and only slightly above MSST (2,572 t).

The SSC agrees with the CPT recommendation to include additional uncertainty ($\sigma_b = 0.4$) when calculating the ABC using the P* approach, which results in a multiplier of 0.78 times the estimated OFL (393 t). The resulting ABC is 307 t. The SSC's support for this approach is based in large part on the recognition that the brief history of exploitation of this stock makes it difficult to identify an appropriate period of time suitable for establishing B_{MSY}, such that the true distribution of the OFL is poorly known. The SSC recognizes that the appropriate value for σ_b is uncertain, and we accept the plan teams' choice given their expertise and their prior discussions on this issue.

Estimates of mature male biomass (MMB) were calculated in the assessment as a three-year moving average using the target year's value averaged with the prior 2 years. The SSC agrees with the assessment author and the plan team that a more appropriate calculation would center the average on the target year and encourage consideration of other methods, including weighted averages, in subsequent assessments. The SSC continues to look forward to the implementation of a catch-survey analysis for this stock.

Pribilof Islands Blue King Crab

The Pribilof Islands blue king crab fishery has been closed since 1999, due to low stock levels. The stock was declared overfished in 2002; a revised rebuilding plan is set for final action by the Council in October 2011.

The SSC agrees with the CPT recommendation for management of Pribilof Islands blue king crab under Tier 4, where $\gamma=1$, $M=0.18$. Estimates of mature male biomass (MMB) were calculated in the assessment as a three-year moving average using the target year's value averaged with the prior 2 years. The SSC agrees with the assessment author and the plan team that a more appropriate calculation would center the average on the target year and encourage consideration of other methods, including weighted averages, in subsequent assessments.

The CPT also recommended that the time periods for determining average MMB as a proxy for B_{MSY} be changed by adding in the earlier 1975/76 through 1979/80 time period to the time period used in the

September 2010 assessment (1980/81 through 1984/85 and 1990/91 through 1997/98; BMSY = 8,840 t). The CPT based their inclusion of these earlier data on a lack of evidence of a change in reproductive potential of the stock over these time periods. While the SSC understands the rationale for including the earlier time series into the BMSY proxy calculation, the addition of these data into the calculation more than doubles the estimate of BMSY (and MSST) over past assessments, with very little biological justification for adding these highly influential and uncertain data. The SSC recommends that the time periods from the September 2010 assessment be used to determine the average MMB as a proxy for BMSY (4,490 t)

The SSC agrees that this stock is in Tier 4c and accepts the CPT recommendations for OFL (116 t) and ABC (104 t) for 2011/12 based on the Tier 5-based method of averaging non-directed catch mortalities during 1999/00-2005/6 to determine the OFL and using a 10% buffer on OFL to determine the ABC. The SSC appreciates the recalculation of non-directed catches and mortalities in the SAFE chapter and continues to look forward to the implementation of a catch-survey analysis for this stock.

St Matthew Island Blue King Crab

The SSC was presented with a brief review of the fishery and the SAFE document. The stock is listed as Tier 4, and ABC/OFLs are calculated based on NMFS trawl survey estimates of male biomass. It was pointed out that total male biomass is now being used for this purpose, rather than mature male biomass as presented in the SAFE document. The SSC supported the CPT's recommendation for the ABC, including the use of a 10% buffer to account for uncertainty due to the mismatch between survey station distribution and the distribution of the crab stock. The author continues to refine the stock assessment model following recommendations from the CPT, and the SSC looks forward to reviewing the model in 2012. The SSC found the material on the model to be nicely presented, but had some recommendations for the authors. The way effective sample size is determined differs from what others do, and some explanation would be helpful. Also, the assumption of high mortality in 1998/99, and a rationale for that assumption needs to be provided. Finally, a couple of alternative models would be useful for comparison, including one that does not rely on assumption of high mortality in 1998/99.

Ecosystem SAFE

Bob Foy (NMFS-AFSC) summarized the rationale for selecting the ecosystem indicators, and the comments provided by the CPT at their September 2011 meeting. There were no public comments. The crab ecosystem SAFE chapter allows a synthetic treatment for all crab stocks, rather than having each factor being treated individually within the individual stock assessments. The focus is on identifying and selecting a suite of biological and physical ecosystem indicators that are known to impact crab populations, that can be correlated with crab population trends, and that are useful in predicting future crab population trends.

The SSC welcomed the approach presented in the ecosystems chapter for the crab SAFE, and appreciates the effort by the authors in developing the document and conducting such a thorough literature review. Once this document is more fully developed, the SSC would appreciate reviewing the ecosystem SAFE first, so that it may inform our reviews of the individual crab stocks.

The inclusion of an executive summary at the start of the chapter that provides information on the current status of the ecosystem indicators selected would improve readability. The SSC recommends that the

authors should distinguish between core ecosystem level changes that provide synthetic evaluations of changes for multiple crab stocks, and specific indicators that should be considered in the species specific SAFE chapters.

For example, core ecosystem level indicators might include an assessment of whether a regime shift has occurred that would influence carrying capacity or the shape of the stock recruit relationships. This ecosystem level assessment would be used when considering where to break the time series for estimation of Bref. The SSC (and the CPT) urges consideration of ecosystem data from before the deployment of the M2 mooring, and inclusion of information on the status of larger-scale climate indicators such as the Pacific Decadal Oscillation. In developing this section, it might be useful for the authors to consider the risk (susceptibility) analysis plots that have been developed by the Aleutian Islands FEP team. This would involve plotting risk based on exposure to the factor and vulnerability to the factor for a variety of crab stocks.

In all cases, the selected ecosystem indicators should have clear mechanistic links that tie them to important life history parameters of crab populations, and these links should be detailed and appropriate references provided. Lists of currently ongoing and proposed crab ecosystem research should provide information on the timing and status of the efforts (PIs, dates, funded?) so that the time frame for model improvements could be anticipated, and data gaps and needs could be targeted in the future.

In this effort, the SSC echoes the CPTs concern that time-lags between indicator status and stock response be carefully considered. Throughout, the SSC felt that it was important that indicator status, and the data linking indicators to crab parameters, be maintained as up-to-date as possible. This is particularly true for indices that may reflect state-changes in the ecosystem, or for data that was collected prior to currently recognized state changes and may therefore no longer be relevant. Similarly, care should be taken that the temporal and spatial resolution of the data be considered when possible, particularly as they differ from the M2 dataset. For example, predation and competition rates developed in one season (summer) may not be appropriate to apply to other seasons, when vulnerability may differ (such as during crab molt). The SSC urges an investigation into whether additional information on predator stomach contents (and the presence/amount of crab therein) exists, and/or if it would be possible to gather more appropriate data through spring cruises or alternate methodologies such as stable isotope analysis.

Conversely, the document highlights numerous cases where an environmental factor might impact a key aspect of the life history of a particular species of crab. The SSC recommends that these species specific case histories should be considered and discussed in the species specific SAFE chapters. Examples include: time trends in predation as a factor influencing M, time trends in temperature and/or prey availability on growth increments, and temperature on availability of crabs to fisheries or surveys.

In both the ecosystem chapter and the species specific SAFE chapters, authors should strive to transition from an assessment of the correlative relationship between environmental factors and population responses to a formal incorporation of environmental factors in the assessment. In addition, while single indicators may not correlate well with crab stock status, it may be useful to consider the cumulative impacts with appropriate time lags (e.g. total groundfish biomass rather than species specific biomass), and/or the impacts in spatially or temporally restricted areas (e.g. seabird predation during summer in the area immediately surrounding the Pribilof Islands).

Finally, although chapters mainly addresses how change in the ecosystem affects crab, the SSC notes that an ecosystem chapter could also address the impact of crab availability to other predators; e.g., marine birds that might not be abundant enough to influence crab recruitment, but that themselves might be influenced by the availability of crab larvae and juveniles. Additional detailed editorial comments were provided by SSC members to Dr Foy.

Economic SAFE

The SSC received an overview of the plans for the development for the Crab Economic SAFE from Brian Garber-Yonts (NMFS-AFSC). No public testimony was presented. The SSC did not receive a copy of the crab Economic SAFE; instead there is a brief discussion of a draft document as part of the Crab Plan Team report. The SSC was informed that the Alaska Fisheries Science Center is behind on development of the Economic SAFE. The very brief presentation suggests that some progress has been made in designing and constructing an Economic SAFE for BSAI Crab, although the information provided only hints at the key elements that the SSC hopes will be forthcoming, once the SAFE is actually made available for review. The plan is to include more analysis along with the usual tabular data. The intention is to have the SAFE include indicators for evaluating catch share programs. The SSC was informed that it is likely to see the completed SAFE in the coming spring.

There are plans to organize a workshop with SAFE users that will provide input into revisions of the SAFE, including further development of social and economic indicators. The SSC looks forward to hearing more about the workshop as it develops.

Without a complete SAFE, the ability of the SSC to provide substantive comments is limited. Nevertheless, the SSC offers some input, based on the discussion within Crab Plan Team report. The SSC is somewhat concerned by aspects of the attachment to the Crab Plan Team Report that summarizes economic conditions in the crab fisheries. The fundamental purpose that underlies SAFE documents is to communicate information to a relatively broad audience. While scientific rigor, accuracy, and precision is always the goal, the obligation to make the analyses accessible, to the extent practicable, is of equal importance. To this point, the SSC is concerned by what appears to be inclusion of pseudo-scientific rigor by the insertion of unnecessary scientific notation (e.g., 32×10^3 t). Quite apart from the fact that the number is incorrect (i.e., the correct conversion is ~31,760 t), rather than increase 'credibility', unnecessary use of such scientific notation works in just the opposite direction.

The SSC recommends that, to the extent practicable, the SAFE include an analysis and supporting discussion of global market conditions. Of particular interest are factors that could provide insights into patterns observed in the BSAI crab fishery data (e.g., how and why prices are changing over time), and possibly factors that could indicate a trend that may impact the crab fisheries in the future.

There is an incomplete sentence at the end of paragraph three on page 21 that should be completed, and there are several grammatical issues that will be identified and provided to the author(s). The SSC looks forward to receipt of the Draft Economic SAFE for the BSAI crab fisheries at its earliest availability.

Aleutian Island Golden King Crab Model

The SSC received a presentation from Siddeek (ADFG) on ongoing model development for the Aleutian Islands golden king crab stock. Authors incorporated many of the SSC and CPT recommendations into this version.

Although the current model fits some datasets well (e.g., length frequencies), several important issues remain. First, it is not clear that the length frequency data are very informative; that is, they seem almost static and it is not clear that time series of length frequency data show the progression of strong year classes through the fishery. Second, recent sharp increases in fishery CPUE are at odds with declines in survey catches and the relatively stable discard length data. There is major concern that changes in fishing behavior since fishery rationalization may bias the fishery CPUE time series. The authors have trimmed the very largest and smallest CPUEs using a 95th percentile rule in an attempt to remove effects of very small or large CPUEs, but very few outliers were actually removed. Although it may be wise to eliminate non-representative data from the analysis and perhaps some type of data trimming should be further investigated, this approach does not address the potential for systematic bias associated with potential widespread changes in fishing behavior. Third, the SSC is also concerned that the large number of penalty functions in the model may drive model results.

A detailed review of this assessment is planned for a crab modeling workshop in January 2012 and the SSC looks forward to receiving a revised assessment in the future. In preparation for this workshop, the SSC offers the following recommendations:

- Include models that evaluate and contrast alternative selectivity curves.
- Observer and retained data should be treated as in the Tanner assessment to illuminate the effects of observer assigned animals as discarded when they are actually landed.
- Investigate retained and bycatch CPUE time series in relation to soak times and time period and provide rationale for standardization. Cite any relevant published studies on soak time effects.
- Document and justify all penalty functions, constraints and weighting. The mean CPUE ratio penalty should not force the fit to be equal to the observed data. This issue needs more attention at the workshop.
- Properly document sample sizes and confidence intervals for CPUE time series.
- The extent and causes of legal discards should be more fully explained.
- Attempt to resolve fundamental issues among survey catches, fishery CPUE, and discard length data, particularly during the post-rationalization period. Divergent abundance trends inferred by CPUE from the pot survey and fishery are disconcerting. If trends in fishery CPUE data are largely due to fisher behavior, then model results based on them may not be useful. One approach to partially address these concerns is to try fitting the model without fishery CPUE data and other versions leaving out other data (e.g., length frequencies or survey data). This could also inform uncertainties about how informative the length frequency data may be. A second approach is to consider whether the rapid increase in biomass inferred from fishery CPUE is biologically possible, knowing what is known about golden king crab demographics. Finally, reconsider the length-frequency data. Is it possible that fishers are targeting depth zones with crabs of particular sizes?

- Carefully evaluate residuals for evidence of systematic patterns indicating model misspecification. For instance, residual plots seem to imply that the retention curve should be steeper in the discard length data to show a drop off in legal size.

C-3 (d) Pribilof BKC Rebuilding plan

The SSC received an informational report on the methodology for estimating catch estimates in the Pribilof district. We had no comments or recommendation.

C-3 (e) Tanner crab model and rebuilding alternatives

Tanner crab rebuilding alternatives

Jack Turnock and Lou Rugolo (NMFS-AFSC) presented information on stock projections and rebuilding analyses. The base version of the Tanner crab stock assessment model is being used to evaluate alternatives, including $F=F_{35\%}$, $F=0.75F_{35\%}$, and F=0 (except for groundfish discard mortality).

The CPT has provided useful advice on modifications of the rebuilding analyses, including, among other things, spatial analyses that lead to consideration of spatial closures in the snow crab fishery to avoid Tanner crab bycatch. The CPT noted that rebuilding does not appear to be sensitive to groundfish bycatch and therefore alternatives for additional constraints on the groundfish fishery do not appear to be necessary.

The SSC agrees with the CPT recommendations to expand the rebuilding alternatives. In addition, the SSC recommends that scenarios with F=0 should consider discard mortality of Tanner crabs in the snow and red king crab fisheries. Given trends in snow crab biomass, it may be necessary to explore various assumptions about future snow crab catches when examining this F=0 scenario. Finally, rebuilding analyses should consider the appropriate starting year, which serves as year 1 in the rebuilding analysis.

Tanner crab stock assessment model

Jack Turnock and Lou Rugolo (NMFS-AFSC) gave an update on progress they have made in developing a stock assessment model, with the goal of using the model for stock assessment next year and in the rebuilding analysis for this "overfished" stock. **The authors have made significant advances in model development and the SSC is optimistic that it will be ready for use in next year's assessment and in the rebuilding analysis.** The authors were very diligent in responding to previous CPT and SSC comments and suggestions.

The authors carefully compiled and validated data from the directed fishery and from discards in the snow crab, red king crab, and groundfish fisheries, including data on length frequencies. Model parameters include logistic survey selectivity parameters (3 periods), a prior on Q (0.88) in the third period, directed fishery selectivity (retention and total, 2 periods), discard selectivities for the three fisheries (3 periods), growth, natural mortality (including annual variation), recruitment means (2 periods) and deviations, and maturity.

Having 3 selectivity periods rather than 2 in the previous model solved a major lack of fit in the two peaks of the biomass estimates. There was an excellent fit to MMB and an adequate fit to female biomass. The fits to both male and female selectivities were excellent. Fishery, discard, and survey selectivity all varied over time by period. Recruits were better estimated than in the previous model. The model with the best

AIC had implausible MMB estimates, so further work is needed. The authors did find a base model that they believe is reasonable and have developed the code for doing projections and rebuilding analyses. They plan to use the average of selectivity over the last three years.

There will be another crab modeling workshop January, 2012 (with stock assessment authors, CPT members, SSC members, and perhaps others), and the Tanner crab model is one of the high priority models to examine and ideally finalize. The SSC endorses several suggestions in the CPT report to be considered before or during the workshop.

The SSC offers these additional suggestions:

- strengthen the rationale for a breakpoint in survey selectivity in 1987/88, which was chosen in part simply to coincide with that in the snow crab assessment, but does not necessarily reflect a major change in the survey,
- see if there is an alternative or additional breakpoint in survey selectivity around 1994 (potentially add a fourth selectivity period),
- profile the likelihood versus M to check its estimability,
- there was an underpowered survey vessel used in a few years; determine if the vessel should have its own Q,
- there has been discussion about M in several documents; it would be helpful to synthesize those discussions,
- as an alternative to distinct selectivity periods (or annually estimated Qs), examine if temperature affects survey Q,
- examine percent barren females versus sex ratio to check for changes in reproductive potential,
- strengthen justification for survey selectivity changes by working with the RACE survey group to see what likely direction of changes would be expected from the evolution of survey protocols over the years,
- consider whether the time series of length frequencies (Fig. 3 and 4) helps judge alternative models – for instance, is the apparent collapse in size structure in the early to mid 1980s more consistent with fishing or natural mortality than change in catchability, and
- change the scale on the x-axis of Fig. 4 so that any changes in female length frequencies can be more readily discerned.