North Pacific Fishery Management Council

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FINAL
SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
June 7-9, 2010

The SSC met during June 7-9, 2010 at the Centennial Hall, Sitka, Alaska. Members present were:

Pat Livingston, Chair *NOAA Fisheries—AFSC*	Farron Wallace, Vice Chair *Washington Depart of Fish and Wildlife*	Troy Buell *Oregon Department of Fish and Wildlife*
Robert Clark *Alaska Department of Fish and Game*	Keith Criddle *University of Alaska Fairbanks*	Anne Hollowed *NOAA Fisheries—AFSC*
George Hunt *University of Washington*	Gordon Kruse *University of Alaska Fairbanks*	Kathy Kuletz *US Fish and Wildlife Service*
Seth Macinko *University of Rhode Island*	Franz Mueter *University of Alaska Fairbanks*	Lew Queirolo *NOAA Fisheries—Alaska Region*
Terry Quinn *University of Alaska Fairbanks*	Ray Webster *International Halibut Commisson*	Doug Woodby *Alaska Department of Fish and Game*

Members absent were:

Sue Hills
University of Alaska Fairbanks

Plan Team Nominations

The SSC approves the nomination of Peggy Murphy to serve on the Scallop Plan Team and Chris Lunsford to serve on the GOA Groundfish Plan Team.

C-1 (b) Chum salmon PSC alternatives

Diana Stram (NPFMC), Jim Ianelli (AFSC), and Alan Haynie (AFSC) presented details from discussion papers concerning analysis of alternatives for addressing chum salmon prohibited species catch (PSC) in Bering Sea groundfish fisheries. Topics discussed were analytical techniques for evaluating area closures, estimation of AEQs derived from chum salmon PSC for various stock groupings, and evaluation of groundfish fleet behavior and economic effects under status quo chum salmon PSC management. Public testimony was given by Ed Richardson (Pollock Conservation Cooperative).

The analysis of area closures is much improved with a simple ranking of ADF&G statistical areas based on chum salmon PSC and pollock catch. Selection of 10 statistical areas based on this approach was straightforward and easy to understand. In the example provided, combinations of the 10 statistical areas into four geographical regions, with closures keyed to a three week "look ahead" of chum salmon PSC, provided a method of determining areas for closure that was robust to the temporal and spatial variability in PSC. The AEQ analysis will attempt to estimate removal rates of chum salmon in groundfish fisheries by individual stock of origin grouping to assess the impact of PSC on the inriver runs of chum salmon.

The status quo analyses will attempt to model groundfish fleet behavior to assess the impact of particular closure scenarios on this fleet.

The SSC commends the authors for their hard work on all aspects of this analysis. **The SSC agrees with the ranking approach used to select 10 statistical areas for potential closure and the concept of grouping statistical areas and temporal trends in PSC to identify regions for closure that are reactive to past trends and robust to variability in these trends. The SSC recommends that the analysis also consider the effect of cold versus warm years in the Bering Sea as an additional indicator of particular statistical areas or regions to potentially close. The AEQ analysis appears sound, using an age-length key to expand the age composition data and accounting for uncertainty in survival rates, maturation rates, and run sizes of stock groupings. The SSC also found the description of procedures for the status quo analysis sufficient for assessing the impact of closures on the groundfish fleet.** This issue involves presumptive entitlements on the part of stakeholders regarding the distribution of costs and benefits of salmon management. **The SSC recommends that the analysis also address economic, social, or other relevant impacts of both the status quo and closures to reduce chum salmon PSC in groundfish fisheries on salmon-directed commercial and subsistence fisheries across regions identified in the analysis.** This might require consultations with USFWS/Office of Subsistence Management, the State of Alaska, and stakeholders in these fisheries. Assessment of impacts, which may accrue to U.S. domestic salmon fisheries, will require adoption of plausible assumptions regarding the disaggregation of projected AEQ chum salmon to the scale of individual drainages, assumptions about state harvest management strategies, and assumptions about the numbers of fish that would be harvested by commercial, sport, personal use, and subsistence fishermen. The SSC recommends thorough examination of these potential impacts.

C-1(c) Chum Salmon Genetics/analysis

Jeff Guyon (AFSC) reviewed the results of a genetic stock composition analysis of the 2009 chum salmon bycatch samples and compared these with the results of previous analyses. The temporal and spatial mismatch between the distributions of the samples and the bycatch was discussed. Guyon noted that methods for adjusting results to reduce potential biases caused by this mismatch are under investigation. The SSC suggested the use of post-stratification as one approach to adjust for the mismatch and Guyon noted that the large sample sizes for chum salmon gives this approach more potential than for other fish stocks. The issue of sample sizes required to undertake the statistical analysis on a finer scale is being examined. The SSC agrees with the direction researchers are taking to reduce bias, both through improvements in future sampling and in considering changes to the analysis. **The SSC recommends that results based on the analysis of eight loci be presented in the future and suggested two changes to the future sampling design. The first suggestion is to deviate from a completely representative design by increasing samples taken in area/time strata, if precision in the estimates increase, or to gain a finer geographic resolution for regions of origin or of particular interest.** We note, however, that this may be difficult to achieve, due to the geographic concentration of bycatch. **The second suggestion is to consider a two-stage sampling program, in which large numbers of physical samples are taken, but only a subset is initially submitted for genetic analysis. Additional samples could be analyzed later if required to improve the results of subsequent analyses (e.g., AEQ).** Finally, the SSC notes that the AYK-SSI subsistence demand report (Wolfe et al., in preparation) may inform this issue.

C-2 (a) Initial review crab ACL and snow crab rebuilding

Diana Stram (NPFMC) presented the Initial Review Draft of the Environmental Assessment for two proposed amendments to the FMP for the Bering Sea and Aleutian Islands king and Tanner crab fisheries. Jack Turnock (AFSC) provided additional clarification and revision of the snow crab analyses, including

alternative snow crab models and rebuilding analysis. Public testimony was provided by Edward Poulsen (ICEPAC) and Arni Thomson (Alaska Crab Coalition).

The proposed actions in this EA consist of: (1) establishing ACLs for 10 crab stocks to meet requirements of the MSA; (2) revising the EBS snow crab rebuilding plan, because snow crab were not rebuilt by the end of the existing rebuilding time frame (2009/10).

The SSC has reviewed several iterations of the analyses contained in this Initial Review Draft and provided comments and guidance on the analyses several times, most recently in April. We appreciate the tremendous amount of effort that went into revising the analyses and note that the analysts have been very responsive to our comments and concerns in a very short time frame. **The SSC recommends that the Initial Review Draft be released for public review after the comments and suggestions below have been addressed. The SSC also requests an opportunity to comment on the final draft document in October, 2010.**

The EA document, while providing adequate information for decision making, is highly technical and could benefit from simplified explanations and illustrations of the Alternatives. The document should clearly articulate to the Council and to the public how the proposed approaches differ, for example, from the current groundfish control rule and from crab control rules. Graphics depicting the control rules could be included in the document to illustrate the different approaches.

The document should emphasize that the choice of the probability that ABC exceeds OFL (P*), which reflects the overall degree of risk aversion, is a policy choice by the Council. While it would facilitate the comparison of alternatives if the Council was to select a single P* to apply to all stocks, the Council's degree of risk aversion could depend on the economic or social importance of particular fisheries. The Council needs to clearly communicate its rationale for specification of P*. Similarly, the degree of uncertainty in the estimate of OFL needs to allow for flexibility to reflect our evolving understanding of uncertainty. Choosing an appropriate level of uncertainty is the primary means by which the P* approach provides for precautionary management. One advantage of this approach, as opposed to a constant buffer, is that it provides a strong incentive to reduce uncertainty in the estimates of OFL.

As part of the P* approach, the SSC endorsed the inclusion of low, medium, and high levels of additional uncertainty to reflect sources of uncertainty that are not accounted for within the stock assessments. For the analyses to be finalized, values for the additional uncertainty (σ_b) have to be chosen by the SSC and will become defaults under the P* approach. However, the default values should be evaluated annually by the assessment authors, CPT, and SSC to reflect our evolving understanding of the true magnitude of uncertainty in the OFL. The level of uncertainty is expressed as the standard error of the log-transformed OFL, which is approximately equal to the coefficient of variation (CV) of OFL over the range of values considered here. The current draft uses values of σ_b = 0.2, 0.4, and 0.6, but following much SSC discussion **the SSC accepted the May 2010 CPT recommendation to use values of 0.2, 0.3, and 0.4 for stocks with low, medium, and high levels of additional uncertainty, as classified in Table 2-5.** We note that these levels are considerably lower than the uncertainty levels chosen for groundfish by the Pacific Council (0.367, 0.72, and 1.44 for groundfish stocks classified as data-rich, data moderate, and data poor, respectively), but are comparable to estimates of σ_b by Hanselman (2009) for North Pacific groundfish stocks, which ranged from 0.04 to 0.51 among stocks and between two different methods.

The SSC provides the following rationale for the choice of σ_b = 0.2, 0.3, and 0.4:

- The CPT advised that levels up to 0.6, which implies a 95% confidence interval for OFL that ranges from 0.3*OFL to 3.3*OFL, were too large.

- These values are default values that can and should be changed as our understanding of uncertainty changes over time. In particular, uncertainty for stocks in the lower tiers (e.g., Tier 5) should be re-evaluated, if the P* approach is adopted, and may warrant different levels of uncertainty, particularly as new methods for determining the extra uncertainty are developed.

Key results of the analyses are included in Tables 2-11 and 2-12. Interpretation of results may be complicated by the fact that a given level of P* or a constant buffer could be associated with a probability of overfishing (ABC > OFL) that exceeds 50%. This is, in part, a consequence of the asymmetric distribution of OFL (long right tail of the distribution), which implies that the median is smaller than the mean and Pr(ABC > mean OFL) is larger than 50%. There is further confusion resulting from inconsistencies among chapters in the use of either the mean or the median to describe central tendency. While consistent use of the median would avoid some of these issues, the interpretation of OFL as a median is not consistent with current practice, which interprets OFL as the mean of an assumed or estimated distribution. The SSC would like to see a brief explanation, including a graph, of the effects of skewness in the distribution of OFL on the resulting buffer values and P* values to help readers interpret the results, as well as an explicit paragraph on whether the mean or the median was used in computing buffers in the individual chapters (with rationale).

While the results in Tables 2-11 and 2-12 appear to preclude the use of certain P* values or buffers for some stocks, because they would result in a 50% or greater chance of overfishing, the SSC notes that this problem could be avoided by specifying a P* value no greater than 0.x or a buffer no less than x%. Adjustments for individual stocks could then be made to assure that the probability of overfishing does not exceed 50%.

The SSC discussed the alternatives and options and has the following recommendations:

- Regarding the alternatives, the SSC notes that the P* approach directly accounts for uncertainty in setting ACLs below the OFLs, as mandated by the MSA, and provides a strong incentive to reducing the uncertainty in OFL through improvement to our understanding of stock dynamics. The SSC recommends the P* approach, because it is more directly responsive to changes in our understanding of uncertainty. The constant buffer approach provides a simpler and more easily understood approach to setting ABC below OFL and could be structured to provide an incentive to improve stock assessment by using increasing buffers for lower tiers. If the Council is not comfortable with the P* approach for data-poor stocks, a hybrid approach could be adopted that uses P* for Tier 1 through Tier 3 stocks and a constant buffer approach for stocks in the other tiers. However, such an approach would have to be carefully designed, to ensure that the implied buffer increases with the tier level to reflect higher levels of uncertainty for data poor stocks and provide a continued incentive to move stocks into higher tiers.
- Regarding options for the review process, the SSC felt that option 3, which requires an additional SSC meeting, either in person or via teleconference, may not be viable due to scheduling difficulties. With regard to option 4, setting OFL in June may be a viable option for some stocks, but should not be used as a general approach for all stocks, because of the lack of recent summer survey information in the determination of stock status.

Regarding the discussion of accountability measures, the SSC reiterates concerns that there is currently no mechanism to limit bycatch in other fisheries for any of the crab stocks. Hence, if an ACL is exceeded, any necessary adjustments would currently come out of the directed fishery. The SSC was encouraged to see that the Council is considering an analysis of PSC limits in groundfish fisheries and we look forward to seeing an analysis of such limits.

Snow crab rebuilding

The snow crab rebuilding analysis was folded into the ACL analyses to evaluate ACL alternatives under different rebuilding scenarios. The SSC notes that the rebuilding analyses should be updated with results from model 5, the recommended model for OFL determinations. The SSC discussed the choice of declaring stocks rebuilt after one or two years of exceeding the reference level. The 2-year requirement was selected in the original rebuilding plan, because of the high inter-annual survey variability that was used at that time to assess stock status in the absence of an assessment model. **We recommend the use of a 1-year requirement for rebuilding, because the stock is now assessed using a size based model that dampens inter-annual variability in spawning biomass.** Thus, the rationale for the 2-year requirement no longer applies. Moreover, the 1-year requirement is standard in other rebuilding plans.

All alternatives in the rebuilding plan include a provision to annually update F to maintain the specified probability of rebuilding. The SSC requests that additional information be provided in the document on how these adjustments would be made.

The SSC offers the following minor/editorial comments to the authors of the Initial Review Draft:

- Under Alternative 2 (constant buffer approach), please clarify that ABC = (1-buffer)*OFL. In the listed options, it would be useful to clarify the implied buffer value in parentheses, e.g., Option 3: ABC = 80% of OFL (20% buffer)
  Please check to make sure that 'buffer' is consistently used throughout the document. The text still uses 'buffer' instead of '1-buffer' in some places (e.g., 2.3.2.1). The use of "buffer level of 80%," when referring to the multiplier (= 100% - buffer), should be avoided.
- The structure of the Tanner crab chapter 5 should be made consistent with other chapters
- Plots of the probability of overfishing as a function of the buffer and the additional uncertainty (e.g., Fig. 6-7/6-8 on p. 149/150) should be made more legible, by increasing the size of the graphs or using a 2-D contour plot instead of the 3-D surface.
- Text under 2.2.3 (top of p. 15) is erroneous or unclear. We suggest replacing this text with corresponding text from the executive summary or similar language.
- Section 2.3.1.2: Briefly explain how σ_b was determined in the analysis of groundfish stocks (p.19). Also, the columns labeled "buffer" actually contain "1-buffer" values, so should be relabeled.
- Section 5.2.1 (p. 116): Correct the calculation of σ_{tot}. If σ_w = 0.14 and σ_b = 0.4, then σ_{tot}=sqrt($0.14^2 + 0.4^2$) = 0.424, which is different from the stated value (=0.403).
- P. 19 under Table 2-6: The estimated values σ_b do not agree with the table (should be 0.04 to 0.40 and 0.09 to 0.51). The value 0.09 comes from GOA ATF, not EBS pollock.
- Regarding the Pr(Overfished), briefly note what A and B refer to in each table header (e.g. Table 5-3).
- Fig. 5-4 appears to be identical to Fig. 5-3
- P. vii, first sentence of 2nd paragraph: Change "the most precise estimates of within assessment uncertainty" to "the lowest assessment uncertainty".
- Fig. 2-2: Use same x-axes in both panels for comparison.
- Table ES-3 and Table 2-4 have incomplete headers.
- P. 22: 'where x is the buffer level selected' should be replaced with "where 1-x is the buffer level selected".
- Fix references to other sections, which were frequently outdated.

Economic analyses

The SSC appreciates the efforts made by authors of the economic analyses to address our concerns with earlier drafts. The caveats pertaining to interpretation and application of the projected potential foregone gross revenues are critical additions to the narrative and should reduce the likelihood of misunderstanding of reported numerical results. The SSC recommends that the tabular displays of the relative economic performance of the competing alternatives, as projected in the model, be arrayed as percentage changes, rather than gross discounted present value estimates of foregone revenue. Before the ACL and overfishing analyses are released for public review, care needs to be taken to ensure that discussion of anticipated economic impacts are included for each stock and that 'placeholder' text be removed once the economic discussions have been added to the text.

C-2(b) Crab SAFE/OFLs

SSC recommendations June 2010 (Note diagonal fill indicates parameters not applicable for that tier level, blank indicates section to be filled out for the final SAFE in September 2010) (Bold indicates SSC changes)

Chapter	Stock	Tier	Status (a,b,c)	F_{OFL}	B_{MSY} or $B_{MSYproxy}$	Years [1/] (biomass or catch)	2010[1/] MMB	2010 MMB/ MMB_{MSY}	γ	Mortality (M)	2010/11 OFL mill lbs [retained]
1	EBS snow crab	3				1979-current [recruitment]				Male-estimated Female – 0.23	
2	BB red king crab	3				1995-current [recruitment]				0.18 default , estimated otherwise1/	
3	EBS Tanner crab	4			183.6	1969-1980 [survey]			1.0	0.23	
4	Pribilof Islands red king crab	4				1991-current [survey]			1.0	0.18	
5	Pribilof Islands blue king crab	4			9.28	1980-1984; 1990-1997 [survey]			1.0	0.18	
6	St. Matthew Island blue king crab	4				1989-current [model estimate]			1.0	0.18 (1978-98, 2000-08); 1.8 (1999)	[total male catch]
7	Norton Sound red king crab	4	a	0.18	3.12	1983-current [model estimate]	5.44	1.7	1.0	0.18	0.73
8	AI Golden king crab	5				**SSC formula**[1/]					**11.0**
9	Pribilof Island golden king crab	5				Plan team formula					0.18
10	Adak red king crab	5				1995/96-2007/08					0.12

[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 2/15/2011 at time of mating.
[3] Model male mature biomass on 7/1/2010
[4] Additional mortality males: two periods-1980-1985; 1968-1979 and 1986-2008. Females three periods: 1980-1984; 1976-1979; 1985 to 1993 and 1968-1975; 1994-2008. See assessment for mortality rates associated with these time periods.
[5] SSC formula $OFL_{TOT} = (1+RATE_{96/97-08/09}) * OFL_{RET(85-86-95/96)} + MGF_{96/97-08/09} = 9.18*1.2 + 0.3 = 11.0$

General comments:

The SSC requests that the Crab Plan Team and stock assessment authors for red king crab chapters either justify differences between stocks in handling mortality rates for crab pot discards, or adopt a single rate. In order to have greater consistency between assessments, the SSC recommends that catch statistics reported in the executive summary section contain both metric tons and pounds (millions).

It would be useful to consider presenting results from the newly developed projection models for stocks during the next assessment cycle. For example, the SSC notes that the projection model for Pribilof red king crab could be interpreted as an indication that the stock is approaching an overfished condition. This information should be provided in the SAFE when the assessments are finalized in the fall, even though OFL determinations will be based on Tier 4 considerations.

Snow crab

Public testimony was provided by Edward Poulsen (ICEPAC) and Arni Thomson (Alaska Crab Coalition).

We have reviewed several updates to the snow crab model since last year's SAFE in the context of ACL analyses and rebuilding. For this year's SAFE, the authors presented results from 7 models that address many of the recommendations previously made by the CPT and the SSC. We commend the authors on a clearly structured analysis that focused on incorporating incremental changes to the model and evaluating the consequences. The base model includes the BSFRF survey data, estimates the probability of maturing, estimates separate selectivity curves for males and females, and excludes small crab (< 40 mm) from the model. Important variations on the base model assess the effects of: fixing selectivity at the Somerton estimated curve, estimating M (with prior), and estimating growth-per-molt.

The current models generally improve on previous model fits, but there is still much uncertainty about selectivity and natural mortality. The authors carried forward two models that fixed selectivity at the estimated "Somerton curve" (as requested), but the model fits to survey biomass and other data components deteriorate substantially, with or without estimating natural mortality and growth. Other models fit the data reasonably well, with models 1 and 5 providing the best statistical fits. **The SSC concurs with the CPT that Model 5 provides the best overall fit and supports the use of this model for stock status determinations and specifications.**

The SSC offers the following comments and suggestions for further model improvements during the next assessment cycle:

- The SSC agrees with the recommendations of the CPT on page 9 of the SAFE Introduction. Specifically, the consequences of not placing penalties on M should be explored in Model 5 and/or other models. For model runs that constrain M, a clear rationale for the constraint should be provided.
- With regard to selectivity, we encourage further exploration of changes to the model that improve the fit to other data components, if selectivity is fixed at the Somerton curve or that result in a more realistic selectivity curve, if selectivity is estimated.
- Catchability (q) for females in model 5 is considerably lower than for males; therefore a discussion about the biological basis that may explain this difference should be included, if catchabilities are estimated separately.
- The model currently estimates both q and M and it would be useful to include a plot of the bivariate distribution of M against q. This would help clarify the influence of q and M in the

model to test the contention that q and M are less confounded in this kind of model than is typically the case in age-structured assessments (as per CPT minutes).

- We encourage and look forward to the further development of a spatial model for snow crab that may help resolve issues such as selectivity, poor fits to some length-frequency data, differential fishing mortalities, and the possibility of differential contribution to recruitment of local populations.
- The SSC requests some discussion and clarification on the possible influence of using NMFS survey data from within the "study area" (where experimental trawling was done) twice in the analysis: once to fit selectivities for the entire trawl survey area and once to fit selectivities within the "study area".
- Improvements in the snow crab model continue to be hampered by a lack of basic biological data on the stock and we encourage continued research on reproductive potential, movement, aging, growth, and other biological parameters.

The SSC also requests that analysis from the 2010 BSFRF survey be brought to the SSC, as early as possible, to provide us with an opportunity to review the results and provide suggestions on how to incorporate results in the assessment model for next years' assessment cycle.

Bristol Bay Red King Crab

The assessment is a straightforward update of the approach used last year. The model is a length-based population dynamics model using trawl survey, commercial catch, and observer data. Nine model scenarios were evaluated involving combinations of additional time-varying natural mortality for males and females (to the baseline of 0.18), an additional survey conducted by BSFRF, and estimation of molting probabilities. The selection of years for additional natural mortality was more consistent among males and females than last year. The authors were very responsive to CPT and SSC recommendations over the last year. Model selection was based on maximum likelihood.

The SSC agrees that Model 3 is suitable for basing stock status determination after the summer survey data are incorporated later this year. This model estimates additional natural mortality for males and females, uses the BSFRF survey, and does not estimate molting parameters. However, the SSC notes that Model 5, which sets additional mortality for females to 0, has a higher likelihood. This should not be possible, because Model 5 has one less parameter. This needs to be rechecked. It may be that these sex-specific differences in additional natural mortality are not needed. Also, the SSC recommends that the authors consider using AIC for model comparison for the sake of parsimony. (This can only be done when the same data are used.)

The SSC concurs with the CPT that the stock is in Tier 3. The SSC also agrees with the selected range of years, 1995 to the current year, for average recruitment and $B_{35\%}$. The SSC agrees with the authors' plan to continue to refine the model in terms of likelihood profiles for *M* and *q*, sensitivity to data weighting, use of Bayesian methods, and other topics described on pages 137–142 of the May 2010 SAFE.

The SSC notes that the time periods used for estimating survey selectivity do not match the time periods used for estimating survey catchability q. This does not seem realistic, since shifts in gear would be expected to influence both selectivity and q. The SSC requests that the authors examine a model with common time periods for q and selectivity.

On page 165, the author states that one explanation of the extra female mortality during 1976 through 1979 and 1985 through 1993 was increased bycatch (among other things). If the primary cause of the additional mortality is thought to be bycatch mortality, then this should be modeled as female fishing

mortality, rather than natural mortality, because the fishery impact would be over a discrete season, rather than an entire year. At a minimum, it should clarify and justify how the additional mortality was modeled.

On the bottom of page 166, the SSC notes that the pot male fishing mortality rate in the SAFE is not correct. This value should be 0.2.

The SSC notes that the values for 2009/10 OFL in the SAFE chapter and the ACL document do not match. The author should explain the reason for the difference.

For the Ecosystem Considerations chapter, the importance of king crab consumption of fish discards should be examined. This has been observed in the Barents Sea, where king crab distribution overlaps intensive fishing activity (G. Hunt, pers. comm.). Thus, it would be interesting to examine trajectories of crab populations in relation to the amount of groundfish discards.

If time permits, it would be useful for the CPT and SSC to see the CIE review report at their September/October 2010 meetings.

Eastern Bering Sea Tanner crab

Public testimony was received from Edward Poulsen (ICEPAC) and Ed Richardson (Pollock Conservation Cooperative).

It appears that Tanner crab abundance has fallen below the MSST, which will require a rebuilding plan to be developed. As explained in the SAFE summary (p.12), a stock assessment model is under development, but not yet ready for review. The plan is to get CPT and SSC review in September/October 2010, for use in the rebuilding plan to be drafted by May 2011. The SSC agrees that a workshop to aid model development would be useful. The SSC would like the authors to develop a model capable of handling two different minimum size limits, one in the eastern and another in the western areas as the Alaska Board of Fisheries may take such action at their next on BSAI crabs; this might be beneficial for optimal harvesting.

Lacking a stock assessment model, stock status determination continues to be based on the trawl survey. This year the revised survey estimates (corrected survey net width) were used for the first time. Final determination will be made after the summer survey.

The SSC concurs with the CPT that the stock is in Tier 4, given the survey series and an estimate of M, and with the use of a default value for gamma of 1 to set OFL. The SSC requests that the authors and CPT reconsider the choice of years to be used in calculating B_{msy}, currently 1969 through 1980. The two issues of data quality and regime shift need to be more fully addressed. Regarding the latter, is it possible that the generally warmer Bering Sea is in a new regime, with more groundfish predators (e.g., cod) and competitors (e.g., flatfish), which has caused a change in Tanner crab productivity. Two options might be to extend the time period to the current time or start the time period later, depending on identification of the shift.

The CPT recommended that the text for OFL calculation should be revised to represent what was actually done. It might be helpful for the CPT to elaborate on what was incorrect in the SAFE, so that the authors can make the appropriate changes.

Pribilof Islands Red King Crab

Public testimony was provided by Edward Poulsen (ICEPAC).

The Pribilof Islands red king crab fishery has been closed since 1999, due to concerns with high variability in survey estimates of blue king crab, which is taken as bycatch in the red king crab fishery. Results from the 2009 assessment survey indicate that the mature male biomass (at the time of mating for the 2009/10 season) had declined by roughly 60% from the prior year, closely approaching the minimum stock size threshold estimated for the 2008/09 season.

The SSC agrees with the CPT recommendations for continued management of Pribilof Islands red king crab under Tier 4, setting γ=1, with M=0.18, and using the 1991 through current time series for estimating the proxy for B_{MSY}. In regards to stock structure (SAFE page 314) the SSC suggests consulting Seeb and Smith (2005), as described on SAFE page 554 (Adak red king crab chapter), which describes stock structure of red king crab in waters off Alaska. As stated in SSC minutes from June of 2009, the SSC looks forward to the presentation of a catch-survey analysis for this stock in October 2010.

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 under development.

The SSC agrees with the CPT recommendation for management of Pribilof Islands blue king crab under Tier 4, where γ=1, M=0.18, and using the 1980 through 1984 and 1990 through 1997 time periods to determine the average MMB as a proxy for B_{MSY}. The SSC reiterates our request from June 2009 that an analysis be included in the revised rebuilding plan to examine information on stock separation from the St. Matthew Island blue king crab stock. The SSC continues to look forward to the implementation of a catch-survey analysis for this stock.

St. Matthew Blue King Crab

St. Matthew blue king crabs are assessed by a four-stage catch-survey analysis of males only. Five model scenarios will be analyzed using data updated with the 2010 survey data and 2009-2010 bycatch data, when these become available. The SSC concurs with the CPT and author in the recommendation of a Tier 4 designation and the use of model scenario 1 (i.e., the same as used in the previous year, with M fixed at 0.18 for 1978-1998 and 2000-2009, M estimated for 1999, and q fixed at 1.0). The SSC supports all of the CPT recommendations. With respect to the issue that the model cannot duplicate the large proportion of recruits seen in the pot surveys, the SSC recommends to the authors to attempt to identify the potential source(s) of this bias: 1) errors in the database, 2) mis-classification of shell age by the biologists on the surveys, and 3) different carapace wear/biofouling rates for this particular stock. Seemingly, some of these issues can be addressed by a mark and recapture study, cross-training of staff, or other approaches. Finally, on Figure 15 (p. 410), the year axis should be re-labeled with actual years.

Norton Sound Red King Crab

The assessment updated the length-based model presented in the 2009 SAFE. In response to previous SSC comments, the model now includes discard mortality and pot fishery PSC. In response to SSC comments, the author applied a handling mortality rate of 0.2. **The CPT recommended, and the SSC agrees, that the assessment model output should be used as the basis for estimating biological reference points for the 2010/11 season.**

The author considered seven models. **The CPT recommended, and the SSC agrees, that Model 6 should be used for estimation of the 2010/11 OFL.** While the SSC agrees with the use of Model 6 for the 2010/11 season, we request that the author provides a rationale for why larger crab would have a higher natural mortality rate (M=0.288), and why this added mortality at large sizes is applied to only this

population. The CPT also recommended, and the SSC concurs, that this stock qualifies for Tier 4 management and that the reference natural mortality rate for estimation of the OFL should be 0.18. The SSC continues to recommend that the reference time period for estimation of B_{MSY} proxy should be 1983 through 2009, and that gamma should be set at 1. **Based on these considerations, the SSC recommends a 2010/11 OFL for Norton Sound red king crab of 0.73 million pounds (total catch OFL).**

The SSC continues to encourage the author to work on the Norton Sound red king crab assessment model, with a long-term goal of moving this stock to Tier 3.

Aleutian Islands Golden King Crab

Public testimony was provided by Dick Tremaine (Norton Sound Economic Development Corporation) and Linda Kozak (F/V Patricia Lee and golden king crab harvesters).

No biomass estimates are available for this stock, as there is no accepted stock assessment model or comprehensive annual surveys. A partial survey planned for 2009 was cancelled. Therefore, the SSC agrees with the CPT recommendation to manage the Aleutian Islands golden king crab stock under Tier 5, using a total-catch OFL. This year would be the first implementation of a total-catch OFL; a retained-catch OFL (9.18 M lbs) had been used through 2009.

In their May 2010 report, the CPT developed three alternatives for computing a total-catch OFL, but could not come to a consensus recommendation. The first two alternatives were developed based on average bycatch mortality rate in the crab fisheries, average retained catch, and mean bycatch mortality in groundfish fisheries, using different time periods to compute these averages. The third alternative was based on the average of total catch for all components, as reported in Table 4 of the stock assessment. The SSC ruled out the third alternative, because it specified a total-catch OFL of 6.8 M lbs, which is significantly lower than the retained-catch OFL of 9.18 M lbs, without any biological justification. In considering the other two alternatives, the SSC discussed the merits of basing the bycatch mortality rate in crab fisheries on averages calculated over 2005/2006 through 2008/2009 (Alternative 1), versus 1996/1997 through 2004/2005 (Alternative 2). In the end, the SSC resolved that basing this bycatch mortality rate on the full time period (1996/1997 through 2008/2009) may be most robust, as it includes the most data. Thus, the SSC recommends its own alternative:

$OFL_{TOT(4)} = (1+RATE_{96/97\text{-}08/09}) \bullet OFL_{RET(85/86\text{-}95/96)} + MGF_{96/97\text{-}08/09} = 11.0$ million lbs
where:
$RATE_{96/97\text{-}08/09}$ = mean annual rate = (bycatch mortality in crab fisheries)/(retained catch) over the period 1996/97-2008/09.
$OFL_{RET(85/86\text{-}95/96}$ = mean annual retained catch over the period 1985/86-1995/96, and
$MGF_{96/97\text{-}08/09}$ = mean of annual bycatch mortality in groundfish fisheries over the period 1996/97-2008/09.

The SSC recommends that this time period be frozen, to stabilize the control rule.

The SSC appreciates the opportunity to examine the stock assessment model, which is still undergoing development. The SSC suggests that Table 2 (page8-24) would be easier to use and interpret if the values in the footnotes (a-h) were incorporated into the body of the table. The SSC compliments the CPT on their excellent comments to the authors on the assessment model and endorses those recommendations. The SSC anticipates reviewing an assessment model for potential adoption in 2011.

Pribilof Islands Golden King Crab

The Pribilof Islands golden king crab stock has supported small and sporadic fisheries. There was no fishing effort during 2006 through 2009. Although there were trawl surveys in the Pribilof Canyon area in 2002 and 2008, biomass estimates of mature males are unavailable. Therefore, the SSC supports the CPTs recommendation to manage this stock under Tier 5. The SSC also supports the CPTs recommended use of a total-catch OFL = 0.18 M lbs for the first time in the Pribilof District in 2011. This total-catch OFL was derived from a relationship between the previous retained-catch OFL (based on the 1993 through 1998 seasons) and crab bycatch mortality in groundfish and non-directed crab fisheries based on catches in federal reporting areas 513, 517, and 521 during 1991/92 through 2008/09:
$OFL_{TOT} = 1.05 * OFL_{ret} + 0.006$.

Adak Red King Crab

There is no assessment model for this stock. The fishery was closed for the 2009/10 season. In response to previous SSC comments, the author estimated non-retained mortality during crab and groundfish fisheries for the period 1995/96 through 2008/09. The author assumed a handling mortality rate of 0.2 for Adak red king crab that were captured and discarded in the AI Golden king crab fisheries. The handling mortality for king crabs captured and discarded by fixed gear and trawl groundfish fisheries was assumed to be 0.5 and 0.8, respectively. The SSC requests that the 2006 and 2009 description of the survey be expanded to include CPUE or biomass estimates for the regions surveyed. **The CPT recommended, and the SSC agrees, that the base time period for estimation of the OFL should be changed to 1995/96** through **2007/08 (this time period will then be fixed) to allow the estimation of a total catch OFL. Based on these considerations, the SSC recommends a 2010/11 OFL for Adak red king crab of 0.12 million pounds (total catch OFL).**

C-2(d) Tier 6 working group/workshop request

The Council requested the SSC hold a special workshop to evaluate and consider new approaches for groundfish Tier 6 ACL estimation. The SSC agrees to hold the workshop this summer and will involve stock assessment authors of Tier 6 stocks and other experts. The workshop will likely be conducted via tele/video conference.

C-3 Scallop ACLs

Diana Stram (NPFMC) provided an overview of the Initial Review Draft of the EA to comply with ACLs for the scallop FMP. Jim Stone (Alaska Scallop Association) provided public testimony.

The SSC last reviewed ACL alternatives in the preliminary review draft at the April 2010 meeting. The most significant changes include the development of alternatives to implement OFLs, based on total catch rather than retained catch (as requested by the SSC), use of P* to evaluate the alternative buffer approaches, and development of alternatives to address non-weathervane scallop species.

The SSC recommends releasing the document for public review after the issues itemized below have been addressed. The SSC does not request to see the document again prior to final action. The SSC provides two pieces of advice to the Council for their consideration during final action. First, we observe that, since fishery rationalization, quota management has been extremely precise for the scallop fishery, and this high level of precision indicates that management uncertainty for this stock would be low. Second, estimates of P* presented in Table 4-2 indicate that Alternatives 2a and 2b (P*=0.5) are not viable options, because ACL guidelines specify that the probability of overfishing must be less than 50% (however, see SSC comments on this issue below).

The SSC compliments the preparers for addressing previous SSC comments and for a thorough analysis of the ACL issue for this data-limited scallop fishery. The SSC recommends addressing the following comments prior to release of the document for public review:

1. While Table 4-2 indicates P* values of 0.5 (implying a 50% chance of overfishing) under Alternatives 2a and 2b, the rightmost column of the lower section of Table 3-1 (also shown in Table 4-1) indicates that the history of fishery management since 1998/99 has yielded a significant buffer between actual annual catches and MSY (the upper end of the statewide Guideline Harvest Ranges, GHR). Future use of ACLs would seem to imply reduced probability of overfishing. Taken together, this would imply a probability of exceeding a statewide ACL of less than 0.5, in practice, under Alternatives 2a and 2b. The SSC recommends that the analyst consider whether or not the information provided in Table 3-1 may inform the estimation of P* for Alternatives 2a and 2b. At a minimum, it would be helpful to compare the proposed 10% or 25% buffers to the buffers that have been realized historically.
2. The EA provides four alternatives, however, there are a number of instances (e.g., pages i, 1, and others) where it states that there are five alternatives. This should be corrected.
3. The accountability measures are described conceptually on page 9. The SSC recommends that these ideas be stated more fully as options, similar to those developed for the crab ACLs. For instance, it might be expected that an ACL overage in one year would result in a compensatory reduction in catch specifications in the following year.
4. On page 10 (and p. 38), please clarify, if possible, whether the limited personal use and subsistence harvests of other scallop species occurs in State or Federal waters. This information may bear on a future determination of whether these species are "generally retained" in Federal waters and whether they could be considered as ecosystem component species.
5. On page 11, approach #1 should refer to setting of OFLs, not ABCs.
6. On page 13, in the discussion about spatial scales, consider briefly discussing the understanding that scallop stocks are structured meta-populations, in which subpopulations of sedentary individuals are connected with each other through the dispersal of pelagic larvae. This connectivity supports the preparer's choice to not consider finer-scale management units. The SSC will provide references to the analysts, separately.
7. On page 15, consider labeling the rightmost column in the lower panel as "%MSY".
8. Please refer to Table 3-3 on the bottom of p. 16.
9. In section 3.5 on page 25, consider clarifying that the P* method was used to evaluate Alternatives 2-4, so that the public does not misconstrue this as a 5th alternative.
10. On page 40, please split Figure 4-2 into two figures. The figure includes too much information and is difficult to interpret, particularly in black and white.
11. Crab bycatch limits are shown in Table 5-1 on p. 46. Consider also presenting recent actual bycatch estimates shown in Table 3 on p. 13 of the 2009 Scallop SAFE.
12. Please fix a couple of typos: (a) fishing season "1999/00" on the bottom of p. 45, and (b) "Merritt" on p. 45 and p. 50.

C-4 Observer Program

Staff presentations were provided by Nicole Kimball (NPFMC), Darrell Brannan (NPFMC), Martin Loefflad (AFSC) and Craig Faunce (AFSC). Public testimony was provided by Richie Davis (Seafood Producers Cooperative), Bob Alverson (Fishing Vessel Owners Association), Kathy Hansen (Southeast

Alaska Fishermen's Association), Linda Behnken (Alaska Longline Fishermen's Association), and Paul McGregor (At-Sea Processor Association).

Concerns about the limited extent of observer coverage of smaller vessels are well known; solutions have been elusive. The SSC supports renewed attention to this issue and appreciates staff efforts to characterize alternative mechanisms for funding an expansion of the observer program. While the Initial Review Draft EA/RIR/IRFA includes a lot of useful information, **there are a number of issues that should be addressed before the document is released for Public Review.**

1. The analysis should include a discussion that relates the levels of observer coverage anticipated under the action alternatives to levels of coverage needed to meet the Council's purpose and need, and the requirements of federal statutes and executive orders. This could be accomplished, in part, by: (a) adding an appendix that draws on prior analyses (e.g., Volstad et al. 1997[1], Miller et al. 2007[2]) to characterize relationships between sample size, sampling strategies, catch/bycatch frequencies, and the precision of estimates; including examples of fisheries (e.g., halibut IFQ) conducted from small, currently unobserved, vessels; and (b) adding a discussion of the motivation for gathering observer data (e.g., bycatch/PSC accounting, biological data, monitoring seabird and marine mammal interactions) and of the levels of observer coverage needed to provide each of these types of information. The degree of observer coverage might differ, depending on sector and fishing location. If there are different observer coverage needs for different fisheries/fleets, these differences should be clearly identified and explained.
2. The document should lay out the process to be used for determining observer coverage, placement, and projects to meet the goals and objectives of the new program. In the past, this has been done mainly with regard to achieving specified levels of precisions (reduced uncertainty), which depend directly on sample size. In the new program, it is equally important to address accuracy (reduced bias) related to nonrandom placement of observers in partially observed fisheries (e.g., 30% covered vessels). Two types of bias have emerged as being important: deployment bias (lack of randomness in placing observers) and behavior bias (vessels changing fishing behavior when an observer is present).
3. The current draft analysis proceeds from a presumption that the number of observer days is insufficient and incorrectly apportioned. The analysis also assumes that the full 2% maximum fee assessment is anticipated in the first year of the program, should the fee assessment structure be selected. Some alternatives start with estimating the maximum fee receipts and maximum number of observer days that would result. While more observer days may lead to improved precision of estimates, without a power analysis, the marginal contribution of additional observer-days is unclear. Moreover, the analysis fails to note the tradeoff between program costs and program benefits. Clearly, the program costs are an increasing function of the number of observer-days, with each incremental increase in observer-days leading to an ever increasing incremental cost. At the same time, while each additional observer-day may improve the precision and reduce the bias of estimates, it is also clear that each additional observer day results in a decreasing contribution to knowledge and the precision of catch/bycatch/PSC estimates, etc. The analysis should provide a discussion of these tradeoffs and should, to the extent possible, quantify these tradeoffs in physical and/or monetary units.
4. The draft RIR needs to be expanded to provide a more thorough discussion of how the costs of the alternatives will be distributed across fleets, communities, and regions. The analysis should also discuss the distributional consequences of using gross revenues as a basis for collecting fees—a gross

[1] Volstad et al. (1997) Analytical and Statistical Review of Procedures for Collection and Analysis of Commercial Fishery Data used for Management and Assessment of Groundfish Stocks in the U.S. Exclusive Economic Zone off Alaska.
[2] Miller, T. J., Skalski, J. R., and Ianelli, J. N. 2007. Optimizing a stratified sampling design when faced with multiple objectives – ICES Journal of Marine Science, 64, 97–109.

revenue-based fee is an inherently regressive taxation structure that has a higher marginal impact on low-profit fisheries (or operations within a fishery), than it does on high profit fisheries (or operations within a fishery). The regressive nature of a revenue-based fee could be offset, in part, by setting different fee-rates in different fisheries. Other distributional consequences of a revenue-based fee structure could be addressed through varying the fee-rate across fisheries, in proportion to their total catches or in proportion to the volume and composition of their incidental and prohibited species catches. The draft analysis should also include a section on alternatives considered, but not evaluated, explaining why these alternatives were not carried forward in the analysis (e.g., monitoring from chase boats, use of electronic monitoring, and logbooks).

5. The implications of various treatments of ex vessel prices as bases for fee collection need to be more fully explained: (a) Using a moving average to smooth prices through time is problematic for time series characterized by trends. When the time series trends upwards, the moving average price will always be lower than the most recent price and fees collected based on the moving average price will be less than fees collected under the most recent price. Similarly, when the time series trends downwards, the moving average price will always exceed the most recent price and fees collected based on the moving average price will be more than fees collected under the most recent price.

   (b) The proposed use of COAR prices as a basis for fee collection is ungainly and, because it relies on lagged time series, will suffer the same problems evidenced by the moving average. That is, when prices are trending upwards (or downwards), reliance on 2-year-old COAR data will lead to lower (or higher) fees, compared to fees that would be collected using current prices. (c) An autoregression on past prices will more closely track time series characterized by a trend, but will miss turn-points in the time series. (d) If the time series of COAR prices behaves as a martingale (a type of stochastic process), moving average and autoregressive models will provide poor predictions of price and will lead to fee collections that will not closely approximate fees that would be collected using current prices. The SSC observed that 2008 was an anomalously "high" value year, while 2009 was an anomalously "low" value year. Inclusion of the former, without the latter, could bias interpretation of the observer fee revenue impacts. The SSC encourages the use of the most complete and current data.

6. The distinction between decisions about desired coverage levels and decisions about how to pay for those levels should be more clearly articulated in the analysis. A variety of biological , social, economic, statistical, political, and logistical considerations might inform decisions about the former, while the options for the latter have been broadly defined in statute. Thus, a rationale tying coverage levels to catch and/or bycatch levels could be paired with any of the funding options considered in the analysis.

D-1(a) Initial Review of Pacific cod sideboards crab vessels

Jon McCracken (NPFMC) presented an overview of the draft RIR/IRFA. The analysis is suitable for release for public review after it has undergone a thorough proof-reading to fix typographical errors.

D-1(b) MRA Adjustment BSAI Arrowtooth Flounder Fishery

Jon McCracken (NPFMC) presented an overview of the draft EA/RIR/IRFA to revise the maximum retainable amounts (MRA) of groundfish incidentally harvested in the directed fishery for arrowtooth flounder in the BSAI. There was no public testimony on this agenda item.

At issue is the fact the current MRA amounts (set at zero for many species) were established when there was no market for arrowtooth flounder and, thus, no justification for allowing arrowtooth as an MRA basis species. Since that time, a nascent fishery appears to have developed in the BSAI and there may be interest in promoting the development of this fishery. The draft EA/RIR/IRFA describes a range of alternatives the Council may consider in evaluating how to address this developing fishery. The SSC

notes some contradiction in the analysis, between suggesting that increased MRA amounts might be necessary to promote development of a directed fishery and the argument that increases in MRA amounts are necessary because of the development of a directed fishery. **The SSC believes the analysis should be released for public review, following some revisions to the assessment of impacts presented in the draft.** Specifically, the draft analysis concludes that there are little to no impacts associated with the various alternatives. However, as the analysis notes, increased MRA amounts can be expected to increase effort in the arrowtooth fishery (whether in pursuit of arrowtooth per se or as part of the MRA basis species for a "topping off" strategy, discussed in the analysis). This increased effort will have a variety of impacts associated with it that should be acknowledged before the analysis is released for public review. These impacts will likely have both distributional and ecological affects. If increased MRA amounts induce topping off on turbot, after the directed turbot fishery has closed, as discussed in the analysis, this will mean less of the overall turbot TAC is available to be taken in the directed turbot fishery. On the ecological side, more fishing (for arrowtooth) will mean more ecological impacts from fishing. The SSC notes that these ecological impacts will include effects on predator/prey relationships.and there is room for different societal assessments of the costs and benefits of such effects.

D-2(c) Pacific cod model run proposals

Grant Thompson (AFSC) reported on a special Groundfish Plan Team meeting on May 6 to synthesize desired model scenarios for Pacific cod in the BSAI and GOA, following an SSC recommendation from December 2009. There were 24 proposals from interested parties, the Plan Teams, the SSC, and stock assessment author Thompson. These were grouped into 6 main categories:

1. Current
2. Housekeeping
3. Consideration of informative priors and estimating Q
4. No age data
5. No age data + internal estimation of growth variance
6. No age data + internal estimation of growth variance + time-varying growth.

The Plan Team examined the proposals and either placed them in the categories or left them out. This will result in 6 model sets in the BSAI and 5 in the GOA, which Thompson felt was achievable in the time available.

The SSC supports this suite of models, with two modifications. SSC proposal 3 is to exclude fishery age composition data, because of concerns about the spatial distribution and having only one year of data. SSC proposal 4 is to exclude IPHC survey data in the BSAI, because it conflicts with other data series. The SSC requests that these two proposals be included in the housekeeping category, because achieving stability in the data sources used in a stock assessment is desirable. 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 encourages continued ageing of the Pacific cod winter fishery age samples and acquisition of length composition from the IPHC survey. The assessment author is encouraged to evaluate these data for inclusion in the model, after a sufficient time series has been acquired.