REPORT
of the
SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
June 2nd – 4th, 2014

The SSC met from June 2nd through 4th at the Nome Mini Convention Center and Nome Elementary School, Nome, AK

Members present were:

Pat Livingston, Chair *NOAA Fisheries—AFSC*	Robert Clark, Vice Chair *Alaska Department of Fish and Game*	Chris Anderson *University of Washington*
Jennifer Burns *University of Alaska Anchorage*	Alison Dauble *Oregon Dept. of Fish and Wildlife*	Sherri Dressel *Alaska Department of Fish and Game*
Anne Hollowed *NOAA Fisheries—AFSC*	George Hunt *University of Washington*	Gordon Kruse *University of Alaska Fairbanks*
Seth Macinko *University of Rhode Island*	Steve Martell *Int'l. Pacific Halibut Commission*	Franz Mueter *University of Alaska Fairbanks*
Lew Queirolo *NOAA Fisheries—Alaska R egion*	Terry Quinn *University of Alaska Fairbanks*	Kate Reedy *Idaho State University Pocatello*
Matt Reimer *University of Alaska Anchorage*	Farron Wallace *NOAA Fisheries—AFSC*	

C-1 BSAI Crab

At this meeting, the SSC is providing the OFL/ABC recommendations for three crab stocks (Tables 1 and 2). We also provide modeling advice on EBS snow and Tanner crab, Bristol Bay red king crab, Pribilof Island red king crab, and St. Matthew Island blue king crab, and recommendations on a variety of other issues. Diana Stram (NPFMC) and Jack Turnock (NMFS AFSC) presented Crab Plan Team (CPT) recommendations for these three stocks, model reviews, and CPT discussions on other issues.

General recommendations

The SSC recommends conducting a workshop to address procedures for assigning buffers for data-poor stocks. Since 2010, there have been a number of new data poor methods that have been developed to address stocks that lack relative abundance information and how the use of catch only data could be used to develop approximate distributions or at least minimum estimates of Maximum Sustainable Yield. Simulation studies based on these data-poor stocks (e.g., scallops and crabs) can be conducted to examine how historical variability in catch and trends in mean size of the catch could be used to develop procedures for setting appropriate buffers for stocks that are not surveyed. The Scallop and Crab Plan Teams should structure the workshop in such a way that the needs of both teams are addressed. The outcome of such a workshop should clearly articulate the procedures and minimum requirements for establishing 10%, 20%,…, X% buffers such that they can be consistently applied across a range of species and different stocks. This workshop should include participants from all Plan Teams that are dealing with Tier 5 assessments.

EBS Snow Crab

The snow crab assessment model underwent external review by the Center for Independent Experts (CIE) in January 2014. The three CIE reviewers made a number of recommendations, some of which should be given higher priority over others. The key recommendations from the review include: improving model documentation, including snow crab outside the survey area in the population, estimating survey catchability with respect to the experimental trawl using the Nephrops net, attempting to estimate natural mortality based on shell condition information, conducting a comprehensive sensitivity analysis, collecting new growth information, and incorporating immature male and female biomass into the assessment likelihood components. The SSC discussed the merits of some of these recommendations and concluded that all of these are reasonable and should be taken into consideration. Natural mortality is a major source of uncertainty in this assessment and the SSC considers development of ageing methods to estimate total mortality rate and improve estimates of natural mortality rates a high research priority. Some work addressing direct ageing based on the method developed by Kilada et al. (2013) is ongoing. Another topic of importance is integrating the chela height data directly in the assessment model. The chela height ratio data suggest that there is considerable variability in size at maturity for males over time. These data could easily be accommodated, but would require a non-parametric approach in estimating the proportion mature by size class, as the empirical data do not suggest a sigmoid relationship. Another suggestion was to use the shell condition information to better inform natural mortality rates. The SSC briefly discussed that there was no objective method for assigning an age to the alternative shell conditions, and assigning a shell condition is a subjective process itself.

The CIE reviewers also made a number of research recommendations, not all of which the SSC felt were appropriate in the short-term, such as a spatially explicit assessment model. The SSC discussed the challenges of developing a spatially explicit assessment model, especially since the spatially explicit data required are not available. It may be more reasonable to use a spatially explicit model for exploring alternative management procedures in a research setting than it would be to assess spatial abundance directly. The SSC does recommend further research on growth rates, molting probabilities, and ways to obtain better estimates of natural mortality rates for this species at this time. The SSC also encourages continued development of the Generic Model for Alaskan Crab Stocks (Gmacs) software and testing this new platform on multiple crab species, stocks, and simulated data.

An update on the snow crab stock assessment model was provided. Four alternative model scenarios were explored, where the base model (Model 0) is the same model that was used in September 2013. The alternative models explored alternative growth models and penalties on the fishing mortality rate deviations. Model 1 explores a two-segment growth model, Model 2 explores the effects of fishing mortality rate deviations, and Model 3 is a combination of Models 1 and 2. The CIE panel was concerned about convergence issues for the alternative models. However, the analyst identified a reporting error in the table of likelihoods and clarified that convergence was obtained for the alternative models. For Model 1, there were no significant improvements in fit to all the data by adopting a disjointed growth curve. In the case of Model 2, overall mean fishing mortality rates increase, with extremely high estimates of F during periods of large landed catch. The model fit the catch data well but could not be justified because there is no discard catch data in the early time periods to corroborate these estimates.

For the September assessment the SSC agrees with the CPT recommendations that Model 0 go forward along with a Model 1 scenario with an alternative parameterization of the growth model that is continuous and differentiable. The SSC has the following additional recommendations:

- Conduct additional sensitivity analyses on the penalties to constrain fishing mortality rate deviations and their impacts on biological reference points.
- Investigate direct integration of the chela height data into the assessment model.
- Explore time varying maturity options and potential environmental covariates as an explanation for the observed variability in male maturity-at-length.

The SSC further requests detailed information on the new length-frequency information to be considered for use in the stock assessment model and details regarding the re-analysis of the landed-length composition data. Lastly, the SSC requests that the author provide a rationale for the various weightings used in the likelihood composition. Specifically, the SSC asks whether inverse variance weighting was used and how the effective sample size was determined for the length composition data.

Bristol Bay Red King Crab

The authors have been responsive to previous CPT and SSC comments from May-June 2013 and September-October 2013, in giving responses to all comments and making substantive changes in the SAFE. At its October 2013 meeting, the SSC identified four issues regarding this assessment:

1) Disentangling causes of shifts in distribution – The authors indicated that adequate data are not available to accomplish this task but that a more in-depth analysis would be provided in the September SAFE report. The SSC believes that some progress can be made and encourages further study.
2) Consistent approach for treatment of non-surveyed areas (along with flatfish assessments) – The authors investigated whether the flatfish approach of adjusting biomass using a linear regression approach would be applicable to RKC. The authors responded that the approach would not work and that the selectivity function was adequate to adjust for the non-surveyed areas. The SSC agreed with these findings.
3) Maturity data and modeling – There is a need for better data and modeling. The authors intend to accomplish this task by examining data on growth increments for females in Kodiak to better understand maturity in Bristol Bay, which has limited data on female growth. Consequently, a smooth growth function will be developed instead of the crude step function currently used. The SSC notes that this topic should be a specific research priority and that direct information on female growth in Bristol Bay is needed.
4) Predation pressure – Predation pressure may be an important factor affecting recruitment and mortality. Mortality is thought to be most important during the molting phase. The authors noted that data are not available during the molting period, because the survey is done in the summer. Also the predation is likely to be highest on juveniles that occupy shallower nearshore waters not surveyed. The SSC believes that progress can be made in three directions. First, a study of potential environmental and biological covariates should be undertaken. Second, there should be a research priority to undertake a study of predation of juveniles in their habitat. Third, there should be a field study to collect groundfish food habits during winter when mature male crab are molting.

At this meeting, the SSC reviewed the authors' proposed model scenarios in response to prior CPT and SSC reviews. The seven model scenarios are: Model 4 – the model used in the 2013 assessment with survey catchability Q = 0.896, Model 4b – Model 4 with Q estimated, Models 4n and 4nb – Models 4 and 4b except with updated data, Models 4nb0.5 and 4nb2 – Model 4nb halving and doubling, respectively, the value for the prior for Q, and Model 4nb7 – Model 4nb with an estimated natural mortality parameter M for 2006-2010.

Estimated survey biomasses were similar among the first six models, but different for Model 4nb7. The reason for the difference is that Model 4nb7 estimated a higher M (= 0.28) than the status quo (M = 0.18). Model 4nb7 fitted the trawl survey data better but resulted in a much lower OFL. The CPT recommended dropping Models 4 and 4b because they did not use new survey data revisions. So Models 4n and 4nb were recommended for September 2014. It recommended that Model 4nb7 be held back despite its better fit until corroborating evidence for higher M can be sought and a plausible mechanism identified.

The SSC concurs with the PT recommendations, except that it would like Model 4nb7 or similar models to be investigated further for September 2014, if time permits. Similar models include the random walk model investigated in June 2013 or a model that uses environmental (e.g., SST) or biological (e.g., Pacific cod abundance) covariates. These models may provide insights into processes influencing natural mortality rates. The SSC agrees with the CPT that new procedures would be needed to accommodate estimation of biological reference points under assumptions of time varying M. A critical issue is to consider what "equilibrium" means under time varying M (especially when M is increasing in the most recent time period).

The SSC found that the nomenclature for models was confusing and recommends that a more straightforward system be used. Also, the SSC encourages authors to continue to investigate whether recruitment is related to environmental or biological variables.

<u>EBS Tanner Crab</u>

There have been a number of changes to key data sets used in this assessment including revised at-sea observer sample data and dockside size composition data in the crab fisheries (1990-2012) and groundfish fisheries (1972-2012). The 1995 retained catch sample was not included in the revised data set due to low sample sizes. The revised numbers of crabs from dockside and at-sea observer sampling were found to be substantially different in some years compared to those used in the 2013 assessment model (base model). Sample sizes in the groundfish fishery were also found to be substantially different in some years between the assessment and the revised data set. These differences were due to inclusion of joint venture fishery datasets and a shift from calendar year to FMP crab year (July 1-June 30). The assessment author evaluated the impact of the revised data sets on assessment results and found only slight changes in model estimated mean recruitments.

The assessment author proposed four modeling scenarios including: (1) the base model, (2) base model with discard mortality formulation similar to that used in the Gmacs model, (3) base model with Bristol Bay red king crab bycatch estimated, and (4) base model with the changes included in Models 2 and 3.

Recruitment and mortality trends were very similar among models while the MMB in Models 2 and 4 leveled off during the last few years compared to the base model. The estimate of the 50%-selection parameter for the directed fishery for 1996 hit its lower bound in all model scenarios except the base model using the original assessment dataset. Based on these results the CPT provided a number of recommendations to the stock assessment author for further development and evaluation. **There was some discussion about whether the CPT was requesting two or three model formulations (see p. 12 of the CPT report) and the SSC requests the CPT clarify this with the assessment author.**

The SSC agrees with CPT recommendations and provides the following recommendations to the assessment author:

- Examine retrospective patterns between alternative models being brought forward
- Use the new handling mortality rate (0.321), as recommended by the CPT
- As the ABC calculations are now at the third (final) stair step, the SSC advises the assessment author to explore the buffer between ABC and OFL and asks the author and Plan Team to consider the control rule for this stock. The author and Plan Team are referred to the discussion in the SSC's report for October 2013.
- Explore model fit to survey data using only male information

The SSC notes that the assessment author is developing completely new model code (TCSAM2014) that is based on the Tanner crab model used in the 2013 stock assessment. The SSC encourages new model development and looks forward to reviewing the revised assessment in the future.

Pribilof Islands Red King Crab

The assessment authors developed a new model (an integrated length-based assessment model) for PIRKC for use as a Tier 3 assessment, and compared the approach and results with the status quo, survey-based Tier 4 assessment. The model appears to be an improvement over the 3-year running average approach currently used in the Tier 4 assessment and acts to smooth the erratic survey time series more logically, although there is the cost of additional assumptions implicit in constructing a model.

The SSC supports the CPT recommendation for the continued development of the integrated length-based model for presentation to the CPT in September 2014 and the specific suggestions given by the CPT to the authors for attention and work prior to the September 2014 CPT meeting. These involve constructing a profile of the catchability likelihood, using a better growth model, dealing with sparse size frequency data, and including additional data sources. The CPT recommended that PIRKC be kept in Tier 4, instead of elevating it to Tier 3, until data and analysis for estimating and reducing the current high uncertainty on the maturity curve for males, growth per molt, and survey and fishery selectivity are available.

Consequently, the SSC asks the CPT to further consider and comment at their September meeting on which tier they recommend, as the SSC will consider accepting the new model either as a Tier 3 or Tier 4 assessment for 2014/15 specifications at the October SSC meeting. The survey-based, 3-year running average, Tier 4 approach should be brought to the September 2014 meeting as the default approach. PIRKC may continue to be recommended as being in Tier 4, because the stock is relatively data-poor and

numerous assumptions on key Tier 3 parameters are made. However, the advantage of the modeling approach used in Tier 3, in terms of better utilizing available data, could overcome these limitations.

There are multiple sources of uncertainty for PIRKC. The authors clearly identified these sources of uncertainty and explained how they can be accounted for in setting the OFL and ABC. The SSC notes that the female biomass in the eastern Bering Sea (EBS) bottom trawl survey is the lowest biomass observed since 1988, suggesting that additional precaution may be desirable when setting the ABC.

The authors noted that several hauls were occasionally taken at a single survey station in the EBS bottom trawl survey and that 'haul', in this instance, does not refer to the high-density sampling in which the 'corners' of a station are trawled, but instead refers to multiple samples from a given location. The SSC requests the authors include a description of the years and locations these multiple hauls occurred and what process was used to determine when multiple hauls would be taken. The SSC also asks the authors to provide equations to explain how annual survey estimates, confidence intervals, and coefficients of variation (CVs) were calculated and, additionally, how multiple hauls were treated when calculating survey point estimates, confidence intervals and CVs.

St. Matthew Island Blue King Crab

The Saint Matthew Island blue king crab stock is currently managed under Tier 4 using biomass estimates from a three-stage catch-survey analysis first approved by the CPT and SSC in 2012. While the model was judged adequate for setting reference points, some concerns with the model structure and performance were highlighted in the 2013 assessment cycle, including uncertainty in natural mortality, the use of an appropriate stage-transition matrix and a strong retrospective pattern. No document was available for review, but the author, at the CPT meeting, discussed efforts to improve the stage-transition matrix using growth data from crab tagged during the 1995 ADF&G pot survey and presented an updated ten-year retrospective plot. **The SSC encourages these explorations and also re-iterates its request from the October 2013 minutes to explore the effects of varying natural mortality in the model, for example using a likelihood profile on M.**

Norton Sound Red King Crab

Roy Ashenfelter (crab subsistence harvester) and Charlie Lean (Local Advisory Committee, ADF&G) gave public testimony.

The SSC finds that the authors have addressed all of the comments and suggestions made by the CPT and SSC at their meetings.

This SAFE chapter has benefitted from careful review during the January 2014 crab modeling workshop. The authors addressed several of the recommendations from that workshop. Specifically, the following explorations were undertaken:

- The penalty on recruitment (σ_R) was changed to 0.5.
- The authors explored several ways to simplify the model:
    a. assuming selectivity for the ADF&G and NMFS trawl surveys are the same;
    b. estimating the growth and molting parameters within the model; and
    c. removing all or part of the winter pot survey data.

The authors brought forward the following suite of models:

- The base model (Model 0) was developed during the January 2014 modeling workshop and has separate selectivity curves for the NMFS and ADF&G trawl surveys. Tagging data are not included. Growth transition parameters are estimated outside the model. Winter survey CPUE is not included but other winter survey data information (length frequencies) is used.
- Model 1 is the same as Model 0, except that it has identical selectivity curves for the NMFS and ADF&G trawl surveys.
- Subsequent models are all variants of Model 0 with separate selectivity curves.
- The next three models (collectively named Model 2) include historical tagging data to allow exploration of the estimability of growth parameters inside the model. Estimation inside the model is intended to avoid confounding with fishery selectivity. These models differ in how molting probability is treated:
    - Model 2i – molting probability is the same for newshell and oldshell crab, and molting probability parameters are estimated,
    - Model 2io – molting probability is different for newshell and oldshell crab, and molting probability parameters are estimated,
    - Model 2ii - molting probabilities are fixed at 1 for all length classes.
- Model 3 includes the winter survey CPUE data and winter length frequency as a means to inform the winter fishery harvest.
- Model 4 was the same as Models 0 and 3, except that it excluded all winter survey data.

The SSC was confused by the nomenclature used for the models and suggests that a more straightforward system be used.

SSC Model Evaluation

Model 1: This model, which assumes identical selectivity curves for the NMFS and ADF&G trawl surveys, produced no change in the likelihood. The SSC notes that from model parsimony one would select combined trawl selectivity parameters, especially if treating them separately does not improve model fit. However, since other model explorations were not conducted using Model 1, the SSC accepted the separate estimation of selectivity for the two surveys for this assessment but encourages further examination of models with identical selectivity parameters in the next assessment.

Model 2: Including tag recovery data resulted in an estimated molting probability of 0.999 when newshell and oldshell were combined in the likelihood (Model 2i). The assumption (Model 2ii) or estimation (Model 2i) of molting probabilities at a value near 1 (Model 2.i or Model 2.ii) implies that all crab are newshell, so that oldshell crabs are supposedly absent. The SSC agrees with the author that this is not the case. When oldshell and newshell crabs were separated in the likelihood, molting probability estimates were biologically plausible. The SSC agrees with the authors and CPT that growth and maturity parameters can be estimated within the model when newshell and oldshell crabs have different molting probabilities. Thus, Model 2io is preferred over Models 0, 2i, and 2ii.

Model 3: Including winter pot survey CPUE resulted in poorer model fits (higher log-likelihood for each component). The SSC interprets these results as an indication that the winter pot survey CPUE may be an unreliable index of abundance, as suggested by public testimony, and hence, Model 3 is less plausible.

Model 4: Removing the winter pot survey CPUE data and the winter length frequency caused difficulty in meaningfully estimating winter pot survey selectivity and getting convergence of model parameters. Hence, Model 4 is not viable. These results suggest that the winter length frequency data do provide useful information regarding size frequency of crab available to winter fisheries.

SSC Recommendations

Based on these considerations, the SSC agrees with the author and the CPT that the best model is Model 2io. The SSC agrees with the CPT conclusion that the stock should be managed in Tier 4, and current stock status places it in Tier 4b. The author and the CPT noted that discard estimates in the NSRKC model are derived from only 2 to 4 observations from up to 60 vessels annually, and sampling trips are opportunistic, meaning that the discard data may be very uncertain and possibly biased. **Thus, the SSC recommends that only retained catch be used for OFL/ABC calculations** and agrees with the CPT that there is insufficient data to adequately estimate discards for setting OFL/ABC**.**

It is difficult with the current stock assessment schedule to obtain important new data to update the stock assessment and OFL/ABC determinations in time for the September CPT meeting. Harvesting occurs in both summer and winter; summer fishing can start in May and extend into September; and one of the most informative data sources is the triennial trawl survey that occurs in August. To address these concerns, the CPT recommended that a revised annual schedule be followed: setting the 2014/2015 OFL/ABC from the current stock assessment for this year only, and in the future, addressing model structure revisions at the September CPT meeting and adding a mid-winter meeting the following January to review the annual stock assessment for NSRKC and to set OFL/ABC in time for a May fishery. Under this adjustment, the assessment cycle will be changed to July-June. **The SSC endorses this approach and anticipates reviewing future stock assessments and setting OFL and ABC at its February meeting.**

The SSC recommends that the 2014/15 OFL be set at a retained catch of 210 t. Given the uncertainty with this model noted above and consistent with past practice, the SSC agrees with the CPT recommendation of a 10% buffer for the ABC, resulting in a retained catch of 190 t. Here, the SSC references its general recommendation that a rigorous approach be investigated for setting the appropriate buffer for all crab stocks. The current biomass of this stock is 1,680 t, which is above the MSST (996 t) and thus the stock is not overfished. The total (projected) catch in 2013/2014 did not exceed the OFL and thus overfishing has not occurred.

The SSC concurs with the CPT recommendations for future model improvements for NSRKC, including: (a) exploring different weighting schemes for the tag data; (b) relaxing some of the parameter bounds; and (c) constructing a likelihood profile for a single M for all size classes and one for when M differs between the last size-class and the other size-classes. In addition, the SSC would like further information on the effects of sea ice and salinity on the winter survey, as suggested by public testimony. The SAFE should acknowledge the importance of NSRKC to subsistence users. The SSC also requests in

the future that the authors and CPT provide a clear and thorough rationale for their choice of a preferred model and the selection of the Tier level. In light of the choice of Model 2io (with growth estimation inside the model) as the preferred model, it would be useful to reconsider Models 1, 3, and 4 (pooled selectivity over the two surveys and treatment of the winter survey data) with this feature. Also, the connection between growth and molting parameters and the resulting growth transition matrix should be better described in the SAFE text.

Aleutian Islands Golden King Crab

This is a Tier 5 stock, with a single OFL and ABC, but the TAC is split between the western and eastern Aleutian Islands in areas 541-543 at 174 degrees W. The assessment author recommended adjusting the ABC buffer for this stock from 10% to 25% based on the following arguments: there is uncertainty regarding the appropriate years to compute the OFL, the CPT has suggested various year ranges in the past, the ABC for the Western Aleutian Island red king crab stock is based on a 40% buffer, and of the six FMP stocks that are surveyed by the EBS bottom trawl survey the ABCs for three stocks use buffers >10% (30% for Tanner crab, and 20% for PIRKC and SMBKC). It is difficult to argue that there is greater uncertainty for these three surveyed stocks than for un-surveyed AI golden king crab. The CPT agreed with the author that there is more uncertainty, but could not agree on a process by which to set an appropriate buffer for this stock. **The SSC recommends that a 25% buffer suggested by the author be adopted for setting the ABC for this stock.** The OFL for the stock is 5,690 t (12.54 million pounds), and with a 25% buffer the ABC would be 4,265 t (9.40 million pounds). Catch in 2012/2013 did not exceed the OFL, therefore, overfishing is not occurring.

Western Aleutian Islands Red King Crab

The SSC reviewed the 2014 SAFE chapter for the Western Aleutian Islands red king crab (RKC), formerly referred to as the Adak RKC stock. In March 2014, the Alaska Board of Fisheries established two districts for RKC in the Aleutians (Adak and Petrel Bank) and to avoid confusion, this stock will now be referred to as the "Western Aleutian Islands" (WAI) RKC stock.

There is no assessment model for this stock. This fishery has been closed since the end of the 2003/04 season. In agreement with the CPT, **the SSC continues to recommend that this stock be managed as a Tier 5 stock for the 2014/15 season and agrees with the recommended OFL of 56t (0.124 million pounds).** This OFL is based on the 1995/96 – 2007/08 average total catch, as recommended by the SSC in 2010. Catch in the 2012/13 season did not exceed the OFL, therefore, overfishing is not occurring. No overfished status determination is possible for this stock, given the lack of a biomass estimate.

The SSC remains concerned about the lack of data and the depleted status of this stock. Both the CPT and the assessment author recommended an ABC, reduced from the maximum permissible, of 34t (0.074 million pounds). The SSC recommended this ABC in 2013/14, specifically to accommodate a potential test fishery to collect much needed data. This test fishery was not executed in 2013/14 and there are no plans currently for a test fishery or any other surveys in 2014/15, although the development of a cooperative Adak red king crab survey is a priority for the Aleutian King Crab Research Foundation. **Given the ongoing concerns regarding the depleted stock status and the lack of any planned surveys, the SSC concurs with the CPT and assessment author on a reduced ABC of 34t (0.074 million pounds) and continues to strongly encourage efforts to gather additional information on the**

status of this stock. However, the SSC noted that reductions in the ABC may be necessary in the future, especially as discussions on how to consistently incorporate uncertainty in data-poor stocks move forward. Finally, the SSC questioned whether this stock has reached a minimum stock size threshold below which reproduction potential is dramatically impacted, and noted that this is a valid concern for WAIRKC, as has been shown with some other crab stocks.

Table 1. SSC OFL and ABC recommendations for four crab stocks on June 4th, 2014. **Recommendations are marked in bold where SSC recommendations differ from those of the Crab Plan Team.** (Note diagonal fill indicated parameters not applicable for that tier level while shaded sections are to be filled out for the final SAFE in September 2014).

Chapter	Stock	Tier	Status (a,b,c)	F_{OFL}	B_{MSY} or $B_{MSYproxy}$ (kt)	Years[1] (biomass or catch)	2014[2] [3] MMB (kt)	2014 MMB / MMB_{MSY}	γ	Mortality (M)	2014/15 OFL (kt)	2014/15 ABC (kt)
1	EBS snow crab	3										
2	BB red king crab	3										
3	EBS Tanner crab	4										
4	Pribilof Islands red king crab	4										
5	Pribilof Islands blue king crab	4										
6	St. Matthew Island blue king crab	4										
7	Norton Sound red king crab	4	b	0.157	1.90	1980-current [model estimate]	1.68	0.88	1.0	0.18 0.68 (>123 mm)	0.21	0.19[4]
8	AI golden king crab	5				See intro chapter					5.69	**4.26**
9	Pribilof Island golden king crab	5										
10	Western AI red king crab	5				1995/96–2007/08					0.05	0.03

[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 average catch for OFL is obtained.
[2] MMB as projected for 2/15/2015 at time of mating.
[3] Model mature biomass on 7/1/2014
[4] Retained catch only

Table 2. Maximum permissible ABCs for 2014/15 and SSC recommended ABCs for those stocks where the SSC recommendation is below the maximum permissible ABC, as defined by Amendment 38 to the Crab FMP. Note that the rationale is provided in the individual introduction chapters for recommending an ABC less than the maximum permissible for these stocks. Values are in thousand metric tons.

Stock	Tier	2014/15 *Max*ABC	2014/15 ABC
Norton Sound red king crab	4b	0.21	0.19
Aleutian Islands golden king crab	5	5.12	4.26
Western AI red king crab	5	0.05	0.03

C-2 Observer Program

A presentation was given by Craig Faunce (NMFS-AFSC) and Jason Gasper (NMFS-AKRO) on the North Pacific Groundfish and Halibut Observer Program Annual Report (Annual Report). Public testimony was provided by Julie Bonney (Alaska Groundfish Data Bank) and Chad See (Freezer Longline Coalition).

The SSC first expressed its concern about lack of observer information in the late 1980s as the conversion from the foreign to the domestic fishery was happening. It noted that the lack of a fishery data collection program was jeopardizing the ability to provide necessary scientific and fishery information and analysis to conserve and protect fishery resources for the long-term benefit of the nation. The Council family responded in a timely fashion to implement an observer program. Thereafter, the SSC continually identified key elements for a rationale observer program, including proper statistical sampling goals and design. One important aspect of a proper program is a periodic process for reviewing the objectives, statistical properties of accuracy and precision, and implementation issues associated with the program. **The SSC is heartened to see that the first annual review of the observer program is now underway and sees it as a major milestone for the successful management of North Pacific fisheries. We acknowledge the dedication and tireless work of the staff of the observer program to make this happen.**

The Annual Report is well written and provides useful information on the implementation of the restructured observer program in 2013. The report is largely responsive to SSC comments about the program provided during the October 2013 and February 2014 meetings. Observer-collected data provide essential biological samples and fishery-dependent information for management of sustainable fisheries in waters off Alaska. The Annual Report provides an overview of the program, including coverage levels, description of the fee collection program, programmatic and contract costs, compliance and enforcement, as well as metrics on the performance of the deployment plan.

Success of the restructured program under partial observer coverage varied among the three deployment strata: trip selection pool, vessel selection pool, and dockside coverage. Trip selection was the most successful aspect of the program, based on various performance metrics including attainment of planned

coverage targets. The main issue with this portion of the program was the need to reduce coverage levels during June 22 through August 17 to avoid going over budget before the end of the year. A second difficulty was the ability of vessels to enter multiple trips into the Observer Declare and Deploy System (ODDS), and then fish the trips in a self-selected order. This allowed trips flagged for observation to be deferred to a later date or avoided altogether. In 2014, this flexibility was removed, likely solving this potential source of bias.

On the other hand, coverage levels for vessel selection were less than expected. Additionally, random selection of vessels, which was used during January through October, was abandoned and all eligible vessels were selected during the last period, November through December. Inability to meet coverage levels in vessel selection was attributable to several factors. First, selection of vessels for observer coverage in 2013 was based on fishing activity prior to 2013. As a result, selection included vessels that fished prior to 2013, but did not fish in 2013, resulting in "over-coverage." Second, some vessels fishing in 2013 had no chance of being selected because they did not fish during that time period in 2012, resulting in "under-sampling." Third, many vessels were excused from sampling by "conditional releases," owing to purported lack of bunk space or life raft capacity. It was reported that 52% of vessels and 50% of trips that were expected to be observed were not, owing to conditional releases. Observer program staff have struggled to distinguish legitimate situations in which no bunks exist for an observer, versus cases in which this loophole is being exploited by those wishing to avoid observer requirements altogether. The analysts presented information showing that the probability of making a fishing trip declines after vessels have been selected for observer coverage.

Dockside coverage sampled 99.8% of pollock offloads in the BSAI, but only 73% of pollock offloads in the Gulf of Alaska, falling short of the goal to sample all pollock offloads. Dockside deployments were designed to meet sampling requirements for salmon genetics according to the protocol of Pella and Geiger (2009). Problems included instances in which notification of delivery was not provided, instances when observers were not available in the location and at the time of delivery, and instances in which salmon held by the processing plant did not represent a census of all salmon PSC. During 2013, the observer program switched from systematic random sampling, in which all deliveries are observed and every 10^{th} Chinook and every 30^{th} chum salmon are sampled, to simple random sampling, in which deliveries from observed vessels are sampled and every salmon is observed, to address these issues. This change appeared to improve program performance for salmon PSC sampling.

The SSC offers the following recommendations to the Council:

1. **The SSC supports the NMFS recommendation to move all participants from the vessel selection category into the trip selection category for 2015.** Concerns about bias in data resulting from the vessel selection category as currently structured are very high, owing to two sources of bias. First, the sampling pool of vessels for selection of coverage in 2013 was not the same as the pool of vessels actually fishing in 2013, which resulted in sampling frame bias. Second, vessels in the vessel selection category had an apparent greater ability to game the system by seeking conditional releases or by just not fishing after being selected for sampling. If the Council opts to move all participants from the vessel selection category to the trip selection category and changes the current policy of not considering conditional releases for vessels in trip selection, the SSC would support NMFS' recommendation to limit releases, because of the large

impact of releases on the percent of non-response (vessels that were selected and fished, but were not observed).

2. **If the Council opts to retain the vessel selection category, the SSC recommends some sort of pre-registration program in which vessels must register their intent to fish.** An approach could be adopted similar to that used for trip selection. It is important that the sampling pool of vessels matches the pool of vessels actually fishing in the current year. In addition, if the Council opts to retain the vessel selection category, the SSC recommends changes to the conditional release policy to reduce bias (see bullet 3).
3. **Changes to the conditional release policy are needed to reduce biases in the observer data collection program.** The goal should be to restrict conditional releases to legitimate cases only. The results of the first year of the restructured observer program have shown that the current conditional release policy has a large adverse impact. To reduce this impact, industry involvement is essential.
4. The SSC endorses changes made to the program to improve salmon PSC sampling in pollock offloads; however, additional analyses may be helpful.
5. The SSC also endorses other program changes needed to prevent the manipulation of trip order in the trip selection category.
6. The SSC encourages development of a way to link data from the Observer Declare and Deploy System (ODDS) to the e-Landings system. Inclusion of a trip identifier is required for some data analyses.

The SSC offers the following recommendations to the Observer Program:

1. The SSC appreciates the variety of statistics included in the current annual report. In addition to numbers of trips and deployments, information on rates of coverage would be helpful. The SSC also looks forward to future estimation of variance of catch statistics (directed, bycatch, PSC).
2. The SSC also would appreciate analyses that compare various shared trip attributes (e.g., landed species composition) on both observed and unobserved vessels as indicators of the observer effect or lack thereof. Another informative analysis could be to examine the potential association of prohibited species catch (PSC) with trip attributes on observed vessels. If associations are found, PSC rates in shoreside offloads from unobserved vessels could be compared for evidence of bias.
3. The SSC appreciates that the focus of the report is the evaluation of the 2013 program. However, we recommend that the report clarify what changes have already been made to the program to address problems identified. These changes were nicely highlighted in the presentation, but a bit obscure in the document.
4. Public testimony raised concerns about the availability of sufficient numbers of lead-level-2 observers in the program. The observer program should continue to work with observer providers to seek to improve recruitment and retention of a sufficient pool of experienced observers.

Although the restructured observer program addresses a number of problems with the former program, the SSC remains concerned about the ability to extrapolate PSC and bycatch from observed vessels to the entire fishery. The ability to extrapolate accurately is still potentially limited by coverage levels and bias introduced by the presence of an observer. This is a high-priority, long-term issue. A fundamental question is, "what are the goals and objectives of the observer program and are they being met?" Program objectives may vary by species. For instance, for target species, objectives might

involve estimation of total fishing mortality, with specified accuracy and precision, so as to assure, with a high level of confidence, that overfishing does not occur. Different objectives may be suited for PSC species, seabirds, and marine mammals. Currently, the observer coverage level seems to be driven largely by budget constraints and it is not at all clear that an 11% to 15% coverage level is sufficient to meet objectives nor are the objectives clearly defined.

Other observer programs should be consulted for additional innovations. Beyond the coverage levels needed to meet objectives, some other programs have shown demonstrable incentives for much higher levels of coverage, and coverage on vessels less than 40 feet. For instance, reductions in discards have resulted in higher catch limits in the British Columbia trawl fishery.

C-5 Chinook/Chum Salmon PSC

The SSC reviewed two discussion papers presented by Diana Stram (NPFMC), Jim Ianelli (NMFS-AFSC), and Alan Haynie (NMFS-AFSC). The papers were prepared in response to a Council motion from October 2013, to provide an initial evaluation of the regulatory changes needed to incorporate Bering Sea chum salmon PSC avoidance into the Chinook salmon Incentive Plan Agreements (IPAs). The objectives of the motion are to prioritize Chinook salmon PSC avoidance, while preventing substitution of chum salmon PSC, focusing specifically on avoidance of Alaska chum salmon stocks; and allowing flexibility to harvest pollock in times and places that best support those goals. The motion specifically requested an evaluation of potential changes to the IPA objectives and reporting requirements, including the rolling hotspot system, as well as evaluating six specific measures to potentially refine Chinook salmon PSC controls in Bering Sea pollock fisheries. Incentive Plan Agreement (IPA) representatives for the inshore, offshore, and mothership sectors were given an opportunity to provide feedback concerning potential IPA modifications for reducing Chinook PSC (Discussion Paper 2). Public testimony was provided by James Mize (representative for the MSSIP IPA), Roy Ashenfelter (Kawerak), Tim Smith (Norton Sound/Bering Strait Regional Aquaculture Association), Brandon Ahmasuk (Kawerak), Donald Johnson (local subsistence user), and Rose Fosdick (Kawerak, self).

In general, the discussion papers adequately responded to the Council's request for the evaluations contained in their motion. These papers provide the Council with vital information from which to further focus their efforts to limit Chinook and chum salmon PSC mortality, to the extent practicable. The SSC looks forward to a succinct and targeted problem and needs statement from the Council concerning Chinook and chum PSC, as well as the accompanying analyses needed to support each of the potential alternatives**.**

In reviewing the discussion papers, the SSC had the following comments regarding the examined salmon PSC reduction measures and the proposed IPA modifications provided by the IPA representatives:

- The discussion paper indicates there is very little correlation between adult equivalent (AEQ) PSC and run size of Chinook salmon (Figure 4 on page 14). However, we note that there does appear to be a positive relationship between AEQ PSC and run size for all run years, except 2006 through 2009, especially for the Coastal Western Alaska stock grouping. Chinook salmon run size may be important in determining the magnitude of PSC, especially at low run sizes.
- More analysis is needed to identify potential performance "outliers" in the analysis of penalizing vessels with relatively high PSC rates in the pollock fishery. The level of aggregation among

vessels, cooperatives, and fleets to determine average and standard deviation of PSC rates will need to be carefully considered to accurately portray salmon PSC avoidance ability.

- It is not clear from the analysis whether the industry-proposed IPA modifications would provide meaningful incentives for vessels to avoid Chinook PSC at all times, nor is it clear how these incentives would translate into reduced Chinook PSC. Depending on the future alternatives selected by the Council, additional analysis on the efficacy of these IPA modifications is needed.
- It would be useful to frame the projected effects of different management measures in terms of tradeoffs. Possible useful tradeoffs include: PSC salmon per unit of pollock catch; pollock revenue foregone per PSC salmon avoided; Chinook PSC per chum PSC; and unit of pollock landing foregone per salmon returning to coastal communities.

With respect to the information needed to support further action by the Council, the SSC had the following comments:

- "Command-and-control" types of alternatives—such as shortening the pollock B-season, changing the PSC accounting system, requiring the use of salmon excluders, etc.—are not easily adapted to changing fishery conditions, and often fail to align industry incentives with Council objectives. Such measures can therefore produce unexpected outcomes that differ from those desired by the Council.
- Well-designed "incentive-based" alternatives can provide the industry with incentives to avoid salmon PSC at all times, while supplying the industry with flexibility to avoid PSC in an effective/appropriate manner. Such measures may therefore be more appropriate for addressing PSC issues identified by the Council.
- The Council should consider how new policy measures could interact with prevailing regulations and IPA structures, particularly those that are already providing incentives to avoid salmon PSC.
- If Chinook salmon run size is considered in potential alternatives, it will likely influence the range of years of data that should be included in any analysis of the alternatives. For example, rather than using all available years of data, an analysis of PSC rates may need to include or exclude years of high AEQ PSC (2006 through 2009) depending on the alternative being analyzed.
- As salmon run size changes from high to low, the costs and benefits of PSC avoidance, borne by different user groups (subsistence, commercial, sport salmon, and the pollock fleet), change and potential alternatives will have to take this into account.
- The SSC continues to support research priorities that focus on gaining a better understanding of the physical and biological determinants of chum and Chinook salmon abundance in Alaska, and the relationship between Chinook and chum salmon PSC and run sizes in Western Alaska communities.
- Genetic techniques to improve resolution of regional stock groupings of Chinook salmon are evolving (e.g., discrimination of Norton Sound stocks from the Coastal Western Alaska grouping) and should be incorporated into future analysis as this new information becomes available.
- It will be important to analyze the social and non-monetary effects of potential alternatives on subsistence users in western Alaska. This will require additional data collection, including metrics to determine the viability (i.e., predictability and stability of the fishery over time) of subsistence fisheries, in the face of declining abundance of Chinook salmon (cf. research priority 228).

C-6 Crab ROFR

The SSC received a presentation of the draft RIR/IRFA for the proposed action from Rachel Baker (NMFS AKRO). Public testimony was received from Frank Kelty (City of Unalaska) and Heather McCarty (Central Bering Sea Fishermen's Association).

The SSC recommends that the draft be released for public review and that the following changes be incorporated before release, if possible:

1) The consideration of distributional changes in crab processing in the communities of interest should be expanded and clarified. As the text notes at the bottom of page 13, there have been substantial shifts in processing activity. However, the current draft is somewhat opaque on the full scope of these changes. For example, it is hard for the reader to interpret what has really happened in Kodiak given the information presented in Table 5 versus that presented in Table 6. The SSC recommends that a comparison of absolute pounds processed in each community in 2005-06 compared to 2012-13 (or the most recent years for which data are available) would help the reader understand the extent of distributional changes in processing activity. In Table 5, the only category gaining percentage of Processor Quota Share (PQS) is "None" with several communities losing some or all of the PQS to which ROFR applies. The analysis does not fully address how the alternatives will improve this trend.

2) The SSC recommends that the analysts provide a discussion of how these distributional changes are regarded by the relevant communities; and how they view the value of the ROFR provision. ROFR has never been used as designed or intended, and the analysis should explore the barriers the entities/communities face within the context of how the alternatives may alleviate those barriers. In particular, it would be useful to hear from community representatives on why there have been no instances of using the existing ROFR provision.

3) It is hard to understand the additional benefit, or leverage, provided to communities by Alternative 2. This is not to say that such benefits are not provided, just that these are difficult to grasp by the reader of the analysis. The SSC requests a more expansive discussion that highlights the *practical* distinction between Alternative 2 and the status quo (Alternative 1).

4) The SSC requests that more neutral language be used to describe possible actions by eligible communities. If communities elect to exercise the ROFR provision, they are not "intervening," but simply "exercising the ROFR,", as envisioned.

C-7 CDQ Pacific cod

The SSC received a presentation from Sarah Marrinan (NPFMC), with a subsequent summary from Sally Bibb (NMFS-AKRO) of the NMFS C-7 Action Assessment. Public comment was offered by Tim Smith (Norton Sound/Bering Strait Regional Aquaculture Association) and Eric Osborn (CDQ commercial fisherman, Nome).

The SSC appreciates the excellent presentation and effective initial draft analysis of various options for creating new Pacific cod fishing opportunities for the CDQ village small vessel fleets. Expectations are that, under the proposed amendment, the Pacific cod fishery would be prosecuted in association with the

halibut CDQ and IFQ fishery, and that the footprint of the fishing effort would not significantly change relative to current spatial distribution.

This is the initial review and awaits identification of a Preliminary Preferred Alternative (PPA). The draft presents a good foundation upon which the Council may choose to construct a complete amendment. The document analyzes three action alternatives that offer several distinct management approaches, and provides useful contextual information on each alternative and the associated options. The draft, in combination with the associated NMFS Agenda Item C-7 Assessment, effectively highlights some of the important data limitations and deficiencies confronting the analysis.

The SSC recommends release of the draft for public review, subject to inclusion of the following key elements (to the extent practicable):

- There is little discussion of the commercial scale infrastructure currently in place or that may be needed to realize the desired result (e.g., access to processing, cold storage, transshipment, consolidation, and marketing). These aspects deserve more complete consideration in the analysis.
- The alternatives would result in redistribution of CDQ Pacific cod harvest from a predominantly large, fully observed, C/P FLL fleet, to a geographically dispersed, more numerous, historically unobserved small boat CV fleet. While no net change in the allocated CDQ amounts would occur, this redistribution may pose challenges with respect to management design; including catch accounting, impacts on non-CDQ TAC from CDQ overages, monitoring, and fishery enforcement.
- The NMFS Agenda Item C-7 Assessment report should be included in the action document package, as it explicitly addresses the catch accounting, non-CDQ TAC impacts of CDQ overages, monitoring and fishery enforcement, as well as other specific matters, such as the potential interaction with Steller Sea Lion protection measures.
- The importance of VMS for management and enforcement needs was emphasized, specifically with respect to fleet members operating vessels 46' LOA and smaller. A full characterization of the costs and logistical challenges associated with VMS for this segment of these village-based fleets would be very informative.
- The action alternatives propose to move the CDQ small boat fleets into the partial observer coverage category. An analysis of observer coverage and logistics costs for this fleet segment would also be informative.
- An elaboration of the resource-risks and management complexities that accompany the proposed redistribution of CDQ Pacific cod fixed gear fishing effort should be provided.

D-1 BSAI PSC Halibut Stocks Impact

Jane DiCosimo (NPFMC) gave an overview of this topic and Heather Gilroy (IPHC) gave an overview of the discussion paper, assisted by Steve Martell (IPHC, SSC).

This discussion paper by IPHC staff is a result of a request by the Council to IPHC for a summary of the status of Pacific halibut in the BSAI and of the impact of PSC on the halibut resource and its directed longline fisheries. Both NPFMC and IPHC need this summary to determine if additional management measures are needed.

The discussion paper presents a thorough summary of the information available about the halibut resource in the BSAI and the associated uncertainties. There has been a substantial decline in halibut biomass in the BSAI since the late 1990s. BSAI surveys and coast-wide tagging information show that the Bering Sea is a nursery area that produces juveniles that can disperse through the entire range of Pacific halibut. With a 32" retention size limit in the directed fishery and gear selectivity toward larger fish, information about smaller fish, less than 26" (U26 halibut), is poor. Halibut over 26" are labeled O26 halibut. The NMFS bottom trawl survey catches smaller fish, and data from these surveys suggest changes in the population, including higher natural mortality, changes in dispersion, or recruitment. However, this information is also uncertain, due to incomplete geographic coverage. Much of the coast-wide incidental fishing mortality in non-target fisheries occurs in the BSAI and is comprised of small fish. The SSC notes that uncertainties in estimates of discards in the directed fishery are likely to be reduced by the increased coverage under the new observer program.

The impact of this incidental fishing mortality on the halibut resource and the directed fishery is studied using the Stock Synthesis assessment model, the results of which only address the changes in the O26 estimates of biomass and catch mortality. To approximate the relative impacts of U26 loss, the reported mortality/PSC (U26 only) is increased to a level that would produce a similar value for spawning potential ratio (SPR, the magnitude of spawning stock biomass resulting from a given amount of recruitment) in the assessment model. **The authors obtained reasonable results that provide an initial look at bycatch/PSC (as contextually appropriate) impacts.** Different values for both coast-wide and BSAI bycatch/PSC were selected. As expected, higher /PSC results in lower directed fishery catch. These results show that the impact of /PSC on directed fishery yield comes about equally from mortality of O26 halibut and that of U26 halibut. A 20% reduction in coast-wide bycatch/PSC produced an increase in directed fishery catch from 24.5 million lbs. to 26.0 million lbs., about 6%. Another important finding is that a reduction in bycatch/PSC has the biggest effect in Area 4CDE (Bering Sea), the area with the highest PSC mortality.

Work is underway to improve the impact analysis, by constructing a more refined equilibrium age-structured approach (Martell et al., attachment to this agenda item). Two important features of this approach are: (1) the joint probability of mortality due to the minimum size limit and the discard mortality rate, and (2) the cumulative effects of size-selective fishing (fast-growing fish have a higher total mortality). The SSC looks forward to seeing the results of this analysis.

D-5 Research Priorities for Scallop and Crab

The SSC reviewed and updated the Scallop and Crab Plan Teams' research priorities (see Appendix A1). Minor modifications to priorities and wording of particular items were made in addition to deleting redundant items or consolidating similar items (see Appendix A2). The SSC plans to create a subgroup to develop draft definitions of the levels (critical, high, medium, and low), by which it will rank priorities in the future, and noted the continued re-evaluation of the relative importance of each priority ranking, specifically as it relates to the large number of high priorities for crab. For the research priorities outlined in this SSC report, we used the definition for the critical category as, 'those items that are important information for setting allowable catch limits and for fishery management actions'. The SSC also plans to create a subgroup that will specifically consider and review priorities that concern social science issues.

The SSC has the following recommendations for continued database development:

1. Include the ability to track changes by multiple different entities in the titles, descriptions, and priority rankings;
2. Separate the SSC priority ranking from that of the Council, so the SSC can track changes they make to their ranking over time; and
3. Include an option to produce a summary table that lists the titles and priority rankings by each of the Plan Teams, the SSC, and Council (with track changes).

The SSC requests that the Groundfish Plan Team consider the SSC's December 2013 comments on C-5 octopus and skate discussion paper on EGOA skate fishery and GOA octopus fishery for addition to current research priorities.

D-6 BS Trawl Salmon Excluder EFP

John Gauvin (Gauvin and Associates, LLC & North Pacific Fisheries Research Foundation) gave an overview of his application for a new exempted fishing permit (EFP). The packet included a letter in support of the application from AFSC, and a draft Environmental Assessment (EA). No public testimony was received.

The purpose of the EFP request is to allow the development and testing of a trawl salmon excluder device. This request is the latest in a long-term effort to design and test a salmon excluder that facilitates consistent escapement of salmon, low escapement of pollock, and that is workable for the fleet. The over and under escapement design proposed for testing in this EFP was initially deployed in 2012 and 2013 in the Gulf of Alaska, under a prior EFP. By the end of the experiment, it consistently provided ~40% Chinook escapement with < 3% pollock loss. Vessels fishing in the Bering Sea are larger, have higher horsepower, and operate in waters with different salmon and pollock densities, necessitating a new round of testing.

The EFP proposal is for test fishing by one or two vessels in the winter 2015, summer/fall 2015, and winter 2016 seasons. The experimental design is solid, and the requested harvest amount is based on a need for 10 to 12 tows per test, a number that has provided good confidence intervals in prior EFP tests. Two sea samplers will be deployed on each contracted vessel. These sea samplers act as observers and also conduct genetic sampling and coded wire tag monitoring for all captured salmon. Genetic data from prior EFPs have already proven of interest.

Relative to the application reviewed, the plans for monitoring escapement have been modified to rely solely on cameras, instead of cameras on the bottom and a recapture net on the top. This change is based on a previously successful test done in the Gulf of Alaska of the camera estimates relative to those from the recapture net, where the results indicated that escapement estimates from the cameras matched the escapement estimates in the recapture net. Video footage is of sufficient quality to distinguish salmon and pollock, quantify escapement of these (and other species), and allow for some estimation of salmon size. While the video feed is not live, spot checks of the videos are done in the field to ensure that the trawls are occurring in waters with an appropriate mix of species. Some testing of the effect of the camera lights has been done, with no effect apparent. This method precludes obtaining biological samples from escaping salmon, although captured salmon are sampled.

The EA associated with this EFP concludes that issuing the EFP will have no net adverse effects on the stocks or ecosystem, and this conclusion is well supported with detailed information. The AFSC staff review of the EFP supports approval of this request. The cover letter from NOAA does note that approval is contingent on the TAC amounts being set sufficiently below the ABC for BS pollock in the 2015 and 2016 harvest specifications to meet the EFP amounts. **The SSC notes that the Council should be aware of the need for a total of 5,000 mt of pollock in 2015 and 2,500 mt in 2016 for this EFP to be conducted**.

The SSC commends the investigators for their efforts to develop and test gear modifications that have the potential to significantly reduce PSC rates in the Bering Sea pollock fishery. The EA appears to be complete and the application well-written. **The SSC recommends that the Council approve the EFP application.**

Appendix A1. SSC Research Priorities for Crab and Scallops.

Res_ID	Res_Title	Status	Priority
145	**Continuation of State and Federal annual and biennial surveys**	**Underway**	Critical
165	**Conduct routine surveys of subsistence in the northern Bering Sea and Arctic Ocean**	**Partially underway**	Critical
249	**Assess the movement of Steller sea lions, northern fur seals, Tanner crab, snow crab, and Pacific cod**	**Partially underway**	Critical
146	**Improve surveys in untrawlable habitat, particularly for rockfish, Atka mackerel, and sculpins**	**Partially underway**	Critical
229	**Evaluate the effectiveness of setting ABC and OFL levels for data-poor crab stocks**	**Partially underway**	Critical
144	**District-wide survey for demersal shelf rockfish in Southeast Alaska**	**No action**	Critical
157	**Improve methods of monitoring fishery interactions**	**Underway**	High
158	**Research ecosystem indicators and their thresholds for inclusion in ecosystem-level management strategy evaluation.**	**Underway**	High
159	**Evaluate interactions between fisheries and pinnipeds**	**Underway**	High
160	**Assess vital rates of Steller sea lions**	**Underway**	High
161	**Assess the health of Stellar sea lions**	**Underway**	High
162	**Quantify killer whale predation of Steller sea lions (M)**	**Underway**	High
389	**Investigate ecosystem effects and inter-species interactions of halibut**	**Underway**	High
173	**Expand studies to identify stock and management boundaries**	**Underway**	High
226	**Continue to evaluate the economic effects from fishery policy changes on coastal communities.**	**Underway**	High
176	**Refine methods to incorporate uncertainty into harvest strategies for groundfish**	**Underway**	High
177	**Conduct prospective and retrospective analyses of changes in the spatial and temporal distribution of fishing effort in response to management change**	**Underway**	High
180	**Economic, social, and cultural valuation research on protected species**	**Underway**	High
181	**Foraging ecology studies of Steller sea lions**	**Underway**	High
187	**Maintain indicator-based ecosystem assessment for EBS.**	**Underway**	High
192	**Collect, analyze, and monitor diet information**	**Underway**	High

230	**Examine social and economic interactions between coastal communities and commercial fisheries**	**Underway**	High
366	**Continue to investigate time variation and the shape of fishery and survey selectivity models**	**Underway**	High
367	**Continue to improve stock assessment methodology with respect to uncertainty**	**Underway**	High
385	**Study Pacific halibut PSC, bycatch, and discard behavior in fisheries**	**Underway**	High
250	**Conduct ecosystem structure studies**	**Underway**	High
388	**Study temporal and spatial patterns in size-at-age of Pacific halibut**	**Underway**	High
156	**Improve knowledge for salmon PSC impact assessment**	**Underway**	High
155	**Evaluation of salmon PSC mitigation measures**	**Underway**	High
154	**Pacific cod stock assessment for the Aleutian Islands**	**Underway**	High
153	**Study vertical distribution of Pacific cod to better understand catchability**	**Underway**	High
151	**Develop a spatially-explicit model for BSAI pollock**	**Underway**	High
150	**Maintain the core biological and oceanographic data (e.g., biophysical moorings, stomach data, zooplankton, age 0 surveys) necessary to support integrated ecosystem assessment**	**Underway**	High
170	**Quantitative reproductive index for the surveyed BSAI crab stocks**	**Underway**	High
148	**Spatial distribution of male snow crab**	**Partially underway**	High
149	**Improve handling mortality rate estimates for crab**	**Partially underway**	High
163	**Conduct routine fish, crab, and oceanographic surveys in the northern Bering Sea and Arctic Ocean**	**Partially underway**	High
164	**Effects of trawling on female red king crab and subsequent recruitment**	**Partially underway**	High
166	**Estimate scallop stock abundance**	**Partially underway**	High
169	**Studies on factors that affect catchability particularly for King and Tanner crab**	**Partially underway**	High
171	**Acquire basic life history information (e.g., natural mortality, growth, size at maturity) for data-poor stocks.**	**Partially underway**	High
174	**Develop spatially explicit stock assessment models**	**Partially underway**	High
175	**Develop age-structured models for scallop assessment**	**Partially underway**	High
178	**Develop a framework for collection of economic information**	**Partially underway**	High

179	**Conduct pre- and post-implementation studies of the benefits and costs, and their distribution, associated with dedicated access privileges**	**Partially underway**	High
182	**Evaluate current and alternative Council PSC/bycatch reduction initiatives**	**Partially underway**	High
183	**Research the role of habitat in population dynamics and ecosystem processes**	**Partially underway**	High
188	**Develop indicator-based ecosystem assessments for AI (in progress), GOA, Arctic.**	**Partially underway**	High
189	**Develop stock-specific ecosystem indicators and incorporate into stock assessments**	**Partially underway**	High
190	**Collect and maintain time series of ocean pH**	**Partially underway**	High
191	**Assess whether changes in pH and temperature would affect managed species, upper level predators, and lower trophic levels.**	**Partially underway**	High
206	**Biomass indices and alternate methodologies for lowest tier groundfish species**	**Partially underway**	High
384	**Effects of changes to the observer program**	**Partially underway**	High
147	**Life history research on non-recovering crab stocks**	**No action**	High
368	**Develop a simulation model of Steller sea lion fishery interactions**	**No action**	High
172	**Develop and validate aging methods for crabs.**	**No action**	High
364	**Updated sperm whale stock assessment**	**No action**	High
167	**Alternative approaches to acquire fishery-independent abundance data for Aleutian Islands golden king crab**	**No action**	High
212	**Develop methods to estimate sea lion abundance**	**Underway**	Medium
251	**Modeling studies of ecosystem productivity**	**Underway**	Medium
236	**Conduct studies of sperm whale and killer whale depredation of catch in long-line fisheries and surveys**	**Underway**	Medium
211	**Benefits and costs of directed halibut catch and halibut PSC utilization**	**Underway**	Medium
209	**Investigate factors affecting the guided angler sector of the halibut fishery**	**Underway**	Medium
208	**Research on stock- recruit relationships**	**Underway**	Medium
202	**Methods for reliable estimation of total removals**	**Underway**	Medium
223	**Develop and evaluate global climate change models (GCM) or downscaled climate variability scenarios to assess impacts to recruitment, growth and spatial distributions.**	**Underway**	Medium
221	**Collect maturity scans during fisheries that target spawning fish**	**Underway**	Medium

217	**Impact of fisheries on benthic habitat and trophic interactions**	**Underway**	Medium
214	**Evaluate the impact of seabird bycatch in fisheries on bird populations, and methods to reduce**	**Underway**	Medium
391	**Investigate spatial stock dynamics and population connectivity for Tanner Crab (2 stocks)**	**Pending**	Medium
224	**Climate and oceanographic information covering a wider range of seasons**	**Partially underway**	Medium
225	**Development of projection models to evaluate (a) the robustness and resilience of different management strategies under varying environmental and ecological conditions and (b) to forecast seasonal an**	**Partially underway**	Medium
228	**Conduct studies documenting the subsistence harvest (patterns, norms, quantities) in communities affected by Council actions.**	**Partially underway**	Medium
246	**Cooperative research efforts to supplement existing at-sea surveys that provide seasonal, species-specific information on upper trophic levels**	**Partially underway**	Medium
247	**Assess the relative importance of non-commercially exploited species to human communities**	**Partially underway**	Medium
218	**Survey capability for forage fish**	**Partially underway**	Medium
222	**Improve estimates of natural mortality (M) for Pacific cod.**	**Partially underway**	Medium
244	**Collect and maintain time-series data on the community composition, production and biomass of benthic invertebrate and vertebrate fauna**	**Partially underway**	Medium
243	**Collect and maintain data on forage fish community composition and abundance**	**Partially underway**	Medium
241	**Develop bottom and water column temperature database and indices**	**Partially underway**	Medium
240	**Develop a multivariate index of the climate forcing of the Bering Sea shelf**	**Partially underway**	Medium
239	**Assess the extent of the distribution of corals**	**Partially underway**	Medium
238	**Develop a GIS relational database for habitat, to include a historical time series of the spatial intensity of interactions between commercial fisheries and habitat.**	**Partially underway**	Medium
237	**Improved habitat maps**	**Partially underway**	Medium
235	**Investigate gear modifications and changes in fishing practices to reduce bycatch and PSC**	**Partially underway**	Medium

234	**Analyze current determinants of demand for principal seafood products**	**Partially underway**	Medium
232	**Develop management strategy evaluations that incorporate changing climate and market economic conditions.**	**Partially underway**	Medium
184	**Evaluate efficacy of habitat closure areas and habitat recovery**	**Partially underway**	Medium
186	**Collect and maintain zooplankton and meroplankton biomass and community composition time series**	**Partially underway**	Medium
203	**Improve discard mortality rate estimates for scallops**	**Partially underway**	Medium
204	**Tagging studies of Aleutian Islands Pacific cod and Atka mackerel**	**Partially underway**	Medium
205	**Age determination methods for Pacific cod, Pacific sleeper sharks, and spiny dogfish**	**Partially underway**	Medium
210	**Develop bioeconomic models**	**Partially underway**	Medium
213	**Assess the impact of the displacement of the groundfish fleet on Northern fur seals**	**Partially underway**	Medium
231	**Retrospective analysis of the impact of Chinook salmon PSC avoidance measures on the BSAI pollock fishery**	**Partially underway**	Medium
215	**Determine potential impacts of fishing activities on marine mammals**	**No action**	Medium
227	**Improve estimation of fishery interactions with non-target groundfish, and prohibited species.**	**No action**	Medium
390	**Assess the population status of harbor seals in the Aleutian Islands and determine factors affecting their population trajectories**	**No action**	Medium
383	**Determine quantitative indicators of spatial structure, particular for walleye pollock and Pacific cod**	**No action**	Medium
245	**Assess the impact of increases in recovering whale populations on lower trophic level energy pathways**	**No action**	Medium
382	**Investigate in situ methods of tagging species that experience barotrauma**	**No action**	Medium
381	**Effects of changes to the observer program**	**No action**	Medium
207	**Analyses of fishery effort and observer data for scallops**	**No action**	Medium
219	**Monitor skate egg case concentration sites**	**No action**	Medium
168	**Assess seasonal diets and species interactions of fish and shellfish**	**No action**	Medium
220	**Research on survey analysis techniques for species that exhibit patchy distributions**	**No action**	Medium
365	**Retrospective analysis of the impact of Chinook PSC avoidance measures on communities of western Alaska**	**No action**	Medium

242	**Collect and maintain primary production time series**	**No action**	Medium
233	**Develop an ongoing database of product inventories**	**No action**	Medium
248	**Measure and monitor fish composition**	**No action**	Medium
363	**Area-specific variability in scallop population processes**	**No action**	Medium
386	**Investigate long term effects of fishing on Pacific halibut**	**Underway**	Low
387	**Determine effects of migration on the Pacific halibut population and management**	**Underway**	Low
193	**Improve species identification**	**Partially underway**	Low
216	**Assess whether Bering Sea canyons are habitats of particular concern**	**Partially underway**	Low
195	**Conduct multivariate analysis of bycatch data from the scallop observer program**	**Partially underway**	Low
194	**Identification and integration of archived data**	**Partially underway**	Low
361	**Effects of Ocean Acidification on Scallops**	**No action**	Low
362	**Monitoring potential water quality impacts**	**No action**	Low
200	**Monitor contaminant flux and loads in lower and higher trophic levels, and assess potential for impact on vital rates.**	**No action**	Low
197	**Develop methodologies to monitor for new/emerging diseases and/or parasites among exploited species and higher trophic levels**	**No action**	Low
196	**Evaluate hybridization of snow and Tanner crabs.**	**No action**	Low
198	**Initiate and expand non-market valuation research of habitat, ecosystem services, and passive use considerations**	**No action**	Low

Appendix A2. Priority changes and items consolidated into other research priorities.

Res_ID	Res_Title	Status	Old_Priority	New_Priority
229	**Evaluate the effectiveness of setting ABC and OFL levels for data-poor crab stocks**	**Partially underway**	Medium	Critical
165	**Conduct routine surveys of subsistence in the northern Bering Sea and Arctic Ocean**	**Partially underway**	High	Critical
249	**Assess the movement of Steller sea lions, northern fur seals, Tanner crab, snow crab, and Pacific cod**	**Partially underway**	Medium	Critical
230	**Examine social and economic interactions between coastal communities and commercial fisheries**	**Underway**	Medium	High
250	**Conduct ecosystem structure studies**	**Underway**	Medium	High

226	**Continue to evaluate the economic effects from fishery policy changes on coastal communities.**	**Underway**	Medium	High
206	**Biomass indices and alternate methodologies for lowest tier groundfish species**	**Partially underway**	Medium	High
391	**Investigate spatial stock dynamics and population connectivity for Tanner Crab (2 stocks)**	**NEW**	Pending	Medium
186	**Collect and maintain zooplankton and meroplankton biomass and community composition time series**	**Partially underway**	High	Medium
184	**Evaluate efficacy of habitat closure areas and habitat recovery**	**Partially underway**	High	Medium
168	**Assess seasonal diets and species interactions of fish and shellfish**	**No action**	High	Medium
216	**Assess whether Bering Sea canyons are habitats of particular concern**	**Partially underway**	Medium	Low
152	**Studies to identify crab stock boundaries**	**No action**	High	Consolidated
185	**Maintain moorings and develop/maintain a sea ice formation, sea ice retreat, and spring bloom indices for the EBS**	**Partially underway**	High	Consolidated
199	**Assess the synergistic effects of ocean acidification, oil, dispersants, and changes in temperature on productivity of marine species.**	**No action**	Low	Consolidated
201	**Catch accounting of crab sex and size**	**Partially underway**	Medium	Consolidated