



## SCIENTIFIC AND STATISTICAL COMMITTEE REPORT TO THE NORTH PACIFIC FISHERY MANAGEMENT COUNCIL June 3<sup>rd</sup> –5<sup>th</sup>, 2019

The SSC met from June 3<sup>rd</sup> through 5<sup>th</sup> at Centennial, Sitka, AK.

Members present were:

Anne Hollowed, Co-Chair  
*NOAA Fisheries—AFSC*

Chris Anderson  
*University of Washington*

Jason Gasper  
*NOAA Fisheries – Alaska Region*

George Hunt  
*University of Washington*

Andrew Munro  
*Alaska Dept. of Fish and Game*

Ian Stewart  
*Intl. Pacific Halibut Commission*

Gordon Kruse, Co-Chair  
*University of Alaska Fairbanks*

Amy Bishop  
*Alaska Sea Life Center*

Dana Hanselman  
*NOAA Fisheries—AFSC*

Dayv Lowry  
*Washington Dept. of Fish and Wildlife*

Matt Reimer  
*University of Alaska Anchorage*

Sherri Dressel, Vice Chair  
*Alaska Dept. of Fish and Game*

Mike Downs  
*Wislow Research*

Brad Harris  
*Alaska Pacific University*

Franz Mueter  
*University of Alaska Fairbanks*

Heather Renner  
*U.S. Fish and Wildlife Service*

Members absent were:

Kate Reedy  
*Idaho State University Pocatello*

Alison Whitman  
*Oregon Dept. of Fish and Wildlife*

### General SSC Comments

With a heavy heart, the SSC acknowledged the passing of Dr. Terrance Quinn II on May 3, 2019. Terry was our mentor, teacher, guide, and friend. He was the longest serving member of the SSC, with membership dating back to 1986. The NPFMC's reputation for successfully building sustainable fisheries by adopting fair and equitable harvest policies can be traced to Terry's careful attention to detail and thoughtful scientific advice. In recognition of his contributions to the SSC, David Witherell made a wooden gavel for the SSC with the following inscription: *In Memory of Terry Quinn II 2019, Scientific and Statistical Committee*. This gavel will remind current and future SSC chairs to consider Terry's voice of reason when discussing issues at the nexus between science and management. We will miss him.

Three SSC members attended a workshop on Ecosystem Socio-economic Profiles (ESPs) in May 2019. The SSC was pleased to learn of the progress on the ESP and its connections to the risk table. In addition, the Bering Sea FEP and Crab Plan Team reports highlighted the range of approaches currently in development. During the October 2017 SSC meeting the SSC requested stock-specific ecosystem status (i.e., "OK-ness") and "inference of impending decline" specific to groundfish stock assessments. Given that the risk table and ESP are clearly in development and are likely to evolve in important ways, the SSC suspends its requests for "OK-ness" and "inference of impending decline" for individual stock authors of all assessments. The combined efforts of developing ESPs for key species, the planned fall and spring meetings of the Ecosystem Status Report team to assess ecosystem change, and the development of risk

tables should provide the information needed to inform the NPFMC of relevant ecosystem change. The SSC appreciates the responsiveness of the authors and the Plan Teams to previous requests. The SSC would like to see how these new processes and products develop to determine if they are able to provide the type of information needed to provide an early detection of ecosystem change. In addition, risk tables only need to be produced for groundfish assessments that are in a “full” year in the cycle. For now, ESPs may be developed for crabs, but risk tables will not be requested until after the groundfish model has become more refined.

### **7<sup>th</sup> National Meeting of the Scientific Coordination Subcommittee (SCS7)**

Anne Hollowed provided an update on planning for the 7th National Meeting of the Scientific Coordination Subcommittee (i.e., 7th national SSC meeting). In May 2019, the Council Coordination Committee approved the NPFMC’s proposal to host the 7th national SSC meeting. The meeting will be held next summer in Sitka, AK. The proposed themes for the meeting are:

1. How to incorporate ecosystem indicators into the stock assessment process.
2. Management of interacting species in consideration of ecosystem-based fishery management (EBFM).
3. How to assess and manage species exhibiting distributional change.

Dr. Diana Stram will work with the SSC co-chairs to plan this meeting. The SSC expects that most SSC members will participate in this workshop. The meeting will be open to the public and attendance by government employees, academics, students, and other interested participants is encouraged.

### **C-1 BSAI Crab**

Jim Armstrong (NPFMC), Martin Dorn (NMFS-AFSC), and Katie Palof (ADF&G) presented a summary of Crab Plan Team (CPT) discussions and recommendations, including: a summary of the Aleutian Islands golden king crab and Pribilof Islands blue king crab final SAFE assessments and specifications; preliminary assessments for EBS Tanner crab, St. Matthew blue king crab, EBS snow crab, Pribilof red king crab, and Bristol Bay red king crab; and a St. Matthew blue king crab rebuilding plan progress report. Madison Shipley (master’s student at the University of Washington) presented an ongoing management strategy evaluation for EBS Tanner Crab. There was no public testimony.

### **General comments to stock assessment authors**

The SSC reminds all stock assessment authors to implement the guidelines for model numbering for consistency and easier version tracking over time, and emphasizes how important this is for SSC review.

### **Aleutian Islands golden king crab**

Aleutian Islands golden king crab (AIGKC) is managed as a Tier 3 stock using a length-based stock assessment modeling framework that was first recommended by the CPT and approved by the SSC in the 2017/18 specifications cycle. The model establishes a single OFL and ABC for the stock, although separate models are fit for the eastern (EAG) and western (WAG) stock components. The male-only, length-based integrated stock assessment model is fit to data on catches and discards in the directed fishery, discards in the groundfish fishery, standardized indices of abundance based on observer data, fish ticket CPUE data, length-frequency data for the directed fishery (landings and total catch), and mark-recapture data. The model was initialized in 1960 under equilibrium assumptions and allowed to estimate recruitments to 1985 when stock assessment data first became available. Natural mortality was estimated in initial model runs, with likelihood profiles suggesting a value of 0.21, which is used for current assessment model scenarios. A knife-edge maturity is assumed at 111 mm carapace length (CL) based on chela height data. Size frequency likelihoods comprise a large part of the total likelihood, and were weighted by the Francis’ re-weighting method in all scenarios.

The stock assessment was updated with fishery data for the 2017/18 and 2018/19 fishing years (retained catch and size compositions for the directed fishery, total catch and size compositions, groundfish bycatch and size compositions, and observer CPUE). In last year's assessment, the 2017/18 season fishery data were not available in time for assessment and the OFL and ABC had to be projected for the 2018/19 fishing season using the assessment with 2016/17 fishing season data and best estimated total catch in the 2017/2018 season. The 2018/19 fishery data were incorporated into this year's assessment due to early completion of the 2018/19 fishery. Thus, it was not necessary to project total catch in the terminal year to project the OFL and ABC for the 2019/20 season.

Five model scenarios were explored in this assessment cycle for both the EAG and WAG based on the addition of new data and alternative ways to obtain abundance indices from fishery CPUE data (CPUE standardization). Three model scenarios that include data from the 2018/19 fishing year (19\_0, 19\_1, and 19\_2/19\_2a) were considered for ABC and OFL specifications:

- Model 18\_0 was last year's base model (Model 17\_0) with 2017/18 fishery data.
- Model 18\_1 is the same as Model 18\_0 except the number of gear codes was reduced for observer CPUE standardization.
- Model 19\_0 is the same as Model 18\_0 with 2018/19 fishery data.
- Model 19\_1 is the same as Model 18\_1 with 2018/19 fishery data.
- Model 19\_2 is the same as Model 19\_1 plus a year-area interaction factor during 1995/96 - 2018/19 for WAG.
- Model 19\_2a is the same as Model 19\_1 plus a year-area interaction factor during 2005/06 - 2018/19 for EAG.

The CPT reviewed each of the model variants for 2019 (19\_0, 19\_1, 19\_2, and 19\_2a) and recommended using model 19\_1 for OFL/ABC specifications in 2019/20 due to the fact that it resulted in similar model performance as the model used last year with simplified gear codes. While Models 19\_2 and 19\_2a include year-area interaction factors, which may be important for fishery CPUE standardization, the CPT had concerns about the fishing footprint calculation and about the lack of use of the year-area interaction factor during 1995/96-2004/05 for EAG due to the high estimated log (CPUE) variances. **The SSC agrees with the CPT to use Model 19\_1 for 2019/20 specifications, as well as with the use of a 25% buffer for the reasons outlined by the SSC in their June 2017 minutes. The resulting OFL for 2019/20 is 5,249 t (11.57 million lb) and the ABC is 3,937 t (8.68 million lb). AIGKC was not subject to overfishing in 2018/2019 and was not overfished.**

The SSC noted:

- Relatively small changes in CPUE after standardization (Fig. B6, B7)
- Retained and total catch length frequency distributions are fit well (Fig. 9 and 10); but fits are poor for groundfish discarded bycatch (Fig. 11).
- Observed and predicted retained, total, and groundfish catch fit well (Fig. 17 and 35).
- Larger confidence intervals in MMB for EAG (Fig. 26) and some retrospective patterns in MMB for EAG in recent years (Fig. 23). The SSC agrees with the CPT recommendation to examine this further.

The SSC appreciates the authors' responsiveness to previous CPT and SSC comments. The SSC commends the authors on their quick response to the Center of Independent Experts (CIE) recommendation to consult with the industry and reduce the degrees of freedom in the CPUE standardization by combining gear types

that have similar selectivity. The SSC also commends authors on the collection of the length-weight data from the independent survey sampling to update the length-weight relationship separately for EAG and WAG. The SSC is particularly pleased to learn about the collection of new chela height data. As maturity has been a large area of uncertainty in this assessment, analysis of new chela height data may be particularly informative. Additionally, the SSC commends extension of the survey into the WAG for the first time and is very supportive of authors' attempts to include survey data in the next assessment. The SSC reiterates its request for a brief description of the cooperative survey in the assessment document, including the area sampled, size composition, and a summary of trends in CPUE. The goal should be to routinely include August survey data in the assessment conducted in April. The SSC suggests the authors continue to look for the source of large estimated recruitment in recent years and reiterates its request that the author remove one dataset (or a subset of years within one dataset) at a time from the model as one way to potentially identify the source. The SSC appreciates the retrospective analysis of MMB that removes one year of data at a time (Fig. 23 and 41), but its request to remove one dataset at a time is different. The SSC also supports the following CPT recommendations:

- Model 19\_1 should be used as the base model for OFL and ABC determination for the 2019/20 season.
- Additional development is needed for fishery CPUE standardization, including further development in year-area interactions, focusing on estimating fishing footprints for each 30X30 nm block as area weights (see additional suggestions below).
- Additional work is needed to obtain an index using the cooperative pot survey data for use in the EAG assessment model. Before the survey data can be used in the model, analyze the survey length composition data to check for cohort progress over time to support recent high recruitment estimates for EAG.
- The chela measurement data should be reanalyzed using recently collected fishery and survey data to better estimate the maturity of AIGKC.
- The bias of retrospective estimates for EAG needs to be checked and investigated for any model misspecifications.
- Uncertainty of recruitment estimates in the terminal years should be accessed in each assessment to determine how many years of recruitment estimates in the terminal years should be excluded for B35% estimation. The range of years to used to estimate B35% should not be considered fixed.
- Use of GMACS for the AIGKC assessment should be explored.

The SSC commends the authors for starting to explore year-area interactions and the fishery footprint and agrees with the CPT that the definition of area and the area weighting need additional work. Presently, the fishing footprint includes any 30X30 nmi grid cell in which at least one golden king crab pot was sampled by observers during 1995/96 to 2018/19 (Fig. B.1) without weighting among grid cells. The SSC notes that sampling of a single crab pot in one 30X30 nmi grid may not be representative of the fishery. Alternatives might include estimating the area covered by 95% of the sampled fishery catches so as to exclude isolated locations (exploratory pots?) with rare samples. Also, the 30X30 nmi grid cell size appears rather large and may exaggerate the fishery footprint especially in the complex geography of the Aleutians. The authors might consider the use of a smaller grid cell size, which may better represent the spatial distribution of the fishery footprint. Other geostatistical tools might be explored, as well. Perhaps data products and analyses from the recent Essential Fish Habitat 5-yr review can be used to estimate the AIGKC fishery footprint. See:

- NMFS Catch-in-Areas database (<https://inport.nmfs.noaa.gov/inport/item/27363>) which includes observed and unobserved spatially referenced fishery catch by gear.
- NOAA Habitat document: [ftp://ftp.library.noaa.gov/noaa\\_documents.lib/NMFS/TM\\_NMFS\\_AFKR/TM\\_NMFS\\_FAKR\\_15.pdf](ftp://ftp.library.noaa.gov/noaa_documents.lib/NMFS/TM_NMFS_AFKR/TM_NMFS_FAKR_15.pdf)
- Recent publication: Smeltz T.S., Harris B.P., Olson J., and Sethi S.A. 2019. A seascape scale habitat model to support management of fishing impacts on benthic ecosystems. Canadian Journal of Fisheries and Aquatic Sciences, in press: <https://www.nrcresearchpress.com/doi/abs/10.1139/cjfas-2018-0243#.XPVqN4hKhgA>
- NOAA Tech Memos on Species Distribution Modeling for AI species EFH (see page 226 for AIGKC): <https://www.fisheries.noaa.gov/resource/document/model-based-essential-fish-habitat-definitions-gulf-alaska-groundfish-species>

Also, work is currently underway to assess fishery footprints in the AI using species distribution models. Nothing is published from this effort yet, but contacts include John Olson (NOAA Habitat) and Chris Rooper (Canada DFO).

The SSC notes that a new harvest strategy based on model-estimated mature male abundance was accepted by the Alaska Board of Fisheries (BOF) in March 2019, specifying a 15% maximum harvest rate on MMB for EAG and a 20% maximum harvest rate on MMB for WAG, and is expected to be implemented for the 2019/20 fishery.

Finally, the SSC understands that the BOF might consider a shift in the fishing season for AIGKC to be more consistent with processor capability. As timing of fishery and survey data are critical to the stock assessment, the SSC wishes to express interest to be included in discussions with ADF&G about potential changes to fishing seasons.

### **Pribilof Islands blue king crab**

The Pribilof Islands Blue King Crab (PIBKC) assessment is on a biennial schedule and 2019 was a full assessment. The assessment methodology for 2019 is identical to that in 2017 (approved in 2015). The directed fishery has been closed since 1999/2000, and the stock was declared overfished in 2002. New data included NMFS survey data for 2018, and fishery bycatch for 2017/18 and 2018/19. It was noted that the high coefficient of variation in the trawl survey estimates was caused by the small amount of crab caught in the survey. New research on survey designs for PIBKC was mentioned, but the SSC recognizes that at such low stock sizes different survey designs are unlikely to produce appreciably more precise estimates because of the spatial rarity of crab. The assessment uses a random effects time series model fit to MMB estimates from the NMFS bottom trawl survey. Projection of 2019/20 MMB at mating includes discard mortality for both males and females and uses average discard mortality relative to MMB applied to 2019/20. The time period of MMB for  $B_{MSY}$  estimation was 1980/81-1984/85; 1990/91-1997/98.  $B_{MSY}$  was estimated at 4,106 t while the current MMB is far below that at 175 t. **The stock remains overfished with no signs of recovery. Overfishing will be evaluated at the September CPT meeting. The author and CPT recommended a Tier 5 OFL of 1.16 t based on average fishing mortality during 1999/2000-2005/06, and an ABC of 0.87 t based on a 25% buffer to the OFL.** This represented no change from the last specification and the SSC agreed with the OFL, ABC, and ABC buffer recommendations. The SSC supports the CPT recommendation to keep the assessment on a 2-year cycle for OFL setting. The SSC noted that the document was very large (in storage) and the authors should consider switching from vector graphics to raster graphics. In addition, much of the critical data and figures are repeated from the main documents into the appendices multiple times. The SSC appreciates the authors' use of RMarkdown, but would like to see the appendices integrated into the main SAFE for the next full assessment. The SSC also

encourages that the stock structure template used for groundfish be considered for either PIBKC specifically or blue king crab in general within the next 2 years.

### **EBS Tanner Crab**

The author presented new model scenarios in which he addressed a number of comments from the CPT and SSC:

- Errors in the input sample sizes for size composition data were discovered. After correction of these errors, the model was no longer sensitive to changes in catch resulting from reclassification of incidental catch to the appropriate fleets.
- The SSC had previously commented about a number of parameters that were hitting bounds. This problem was solved by reparameterizing the growth model and eliminating parameters associated with probability of terminal molt.
- The SSC also previously commented that the author should justify fitting both abundance and biomass indices in the model or fit only one index. The author agreed from now on to only fit one index. As these two indices are not independent data sources, the SSC supports this choice. The rationale to select between the two indices might include consideration about which one represents the primary data collection and which one is a derived index. The choice should be justified in the September assessment.

The assessment report also included:

- Information on attempts to incorporate the side-by-side BSFRF trawl survey data,
- Discussions about the overestimation of large crab abundance in the model, and
- A proposed suite of model scenarios for the September 2019 CPT meeting.

*Incorporating BSFRF side-by-side data:* The SSC appreciates the author's attempts to incorporate the BSFRF side-by-side data. BSFRF data were incorporated using an approach similar to that used in the snow crab assessment. The approach estimates annual sex- and size-specific availability parameters that reflect the fraction of crab within the BSFRF survey area. The CPT outlined a number of steps needed to more fully vet this approach for incorporating the BSFRF data before it can be fully endorsed. The SSC supports these CPT recommendations.

*Overestimation of large crab abundance:* The SSC appreciates the author's attempts to understand the causes of overestimation of large crab abundance. The SSC was somewhat surprised that overestimation was insensitive to changes in natural mortality. Nevertheless, the SSC supports the author's rationale to first explore the possibility that decreases in growth and left-shifted probability of terminal molt may improve the model fit to large male data. The SSC also recommends:

- Considering the possibility of changes in growth over time (specifically, a decline in growth) or spatial differences in growth between the east (e.g., Bristol Bay) and west (e.g., Pribilofs). If spatial patterns exist (faster growth in east, slower in the west), have declining catches in the east led to an increase in the proportion of smaller crab from the west in the size frequency data? Perhaps existing data on size composition and shell age can be examined for the potential influence of such spatial and temporal trends.
- Consideration of time-varying selectivity (annually or in blocks related to the residual pattern) to account for the observed patterns. If this is ruled out as a cause of overestimation of large crab abundance, a rationale for the focus on growth should be provided.

*Author's proposed model scenarios for fall 2019:* The author proposed seven models for September 2019.

In addition to the 2018 base model, these include the base model with various updated datasets, and other models representing incremental changes to include fits to male chela height data, a male maturity classification ogive, and incorporation of BSFRF side-by-side data. The CPT and SSC support these recommended models for September 2019. The SSC appreciates the incremental changes in the various models, which will facilitate a clear understanding of the effects of each change on model results.

### **St. Matthew blue king crab**

Authors of the St. Matthew blue king crab (SMBKC) stock assessment proposed three alternative models for fall 2019:

- The base (2018 accepted) model updated with 2019 data,
- A “Fit survey” model, which considers increased weighting of survey data in the model, and
- A model fit to VAST-estimated survey data.

The CPT and SSC support these model alternatives. The assessment authors will also bring forward additional information related to the specification of the  $B_{MSY}$  proxy (see the “St. Matthew blue king crab rebuilding plan progress report” section).

### **EBS snow crab**

The SSC greatly appreciates the assessment author’s thorough consideration of various features of the stock assessment model that have been the basis of CPT and SSC comments in recent years. Features considered included natural mortality, growth, shell condition, skip molting, catchability, recruitment deviations, maturity, data weighting, and incidental catch.

The author’s consideration of natural mortality is much appreciated. A case is made that natural mortality may be higher than previously assumed. These higher estimates seem more consistent with at least some of the data on snow crab in the eastern Bering Sea (Murphy et al. 2018).

Regarding growth, a kinked growth curve has been a source of model instability. The author showed that new growth data support a linear growth model, rather than piecewise linear growth as used in the past. However, the author reported that efforts to date to use a simple linear growth model estimated within the snow crab assessment model resulted in non-convergence. The SSC is pleased that additional growth data are currently being collected on BSFRF research cruises with a focus on gaps in pre-molt length data. Natural mortality and growth are critical features of the model, and it is important to correctly include them in the model.

The author and CPT offered excellent ideas on how to proceed to resolve ongoing issues. The SSC recommends:

- Development of a prioritized research plan to improve the snow crab assessment. It may be helpful to organize the plan into categories: (1) analyses conducted within the assessment model, (2) analyses conducted outside the model, (3) development of alternative models (e.g., GMACS, simplified model), and (4) collection of new data.
- Prioritize work that can be conducted with existing data and staff resources versus new work that requires new funding.
- Given the complexity of the current snow crab model, the proposed development of a simple model that is successively expanded with additional features is an excellent approach to incrementally examine the effects of different data sets, assumptions and model features. This could lead to a better model with more stable parameter estimates and reference points for management in the future. For instance, questions about a higher natural mortality might be informed by a simpler model.

The assessment author presented five models:

- 18.1: Accepted (base) model in 2018 fit to 2018 data
- 19.1: 18.1 and including a prior on the sex ratio
- 19.2: 19.1 and fixing growth to a linear relationship, which was fit outside of the model
- 19.3: 19.1 and weighting growth twice as heavily
- 19.4: 19.1 and using VAST survey estimates and CVs

Among these, the only models that converged were the base model and model 19.1 that added a prior on the sex ratio. However, with respect to model 19.1, at this time it is not clear how to select the priors for the sex ratio. Thus, these model alternatives provide little insights about model alternatives to bring forward for 2019.

Based on these model results and the author's helpful review of key model features, the CPT provided the following recommendations on models for the September 2019 assessment:

- Status quo model (18.1)
- Model with higher natural mortality
- Model with linear growth for females and kinked growth for males
- Model with linear growth for both females and males
- Models that estimate different size distributions for males and females

The SSC supports these CPT recommendations. Given the assessment author's review and the results of Murphy et al. (2018), it is prudent to explore a model with higher natural mortality. Also, the SSC agrees with the author that questions about a higher natural mortality might be informed by a simpler model.

The SSC also appreciates alternative approaches to including growth in the assessment model. However, the SSC cautions that a linear model is a strong assumption and a linear model is just one of many growth model alternatives. The SSC noted that model 19.2, in which growth was fixed to be linear, did not converge. However, model stability is not necessarily the most appropriate basis for choosing the functional form of growth models. Ultimately, new growth data will be needed to fully resolve the correct form of the growth function.

The SSC offers the following additional suggestions to the assessment author:

- Consider whether a higher natural mortality should be incorporated with a suitable prior or as a fixed parameter estimated outside the model.
- Consider the northern Bering Sea data to better understand the influence of snow crab in that area on the eastern Bering Sea assessment. A geospatial modeling approach (e.g. VAST) may be useful to determine whether the proportion of snow crab in the northern Bering Sea has been increasing.
- Examine whether snow crab in the northern Bering Sea and higher estimates of natural mortality are linked. Namely, does snow crab movement into the northern Bering Sea result in higher estimates of natural mortality as these crabs are not captured by the standard survey? Or does this affect estimates of survey catchability as crab move in and out of the standard eastern Bering Sea trawl survey region? Or are crab in the northern Bering Sea mainly young crab that primarily affect recruitment estimates, not mortality estimates?
- Ongoing considerations of catchability/selectivity within the survey area are also encouraged. The potential interplay of crab spatial distribution and habitat-specific catchability is intriguing. Examination of the effects of environmental conditions on snow crab spatial distribution and habitat-based catchability seems to be a potential fruitful avenue of research with existing data.

Effects of temperature and survey dates on catchability of yellowfin sole may be a useful case study for comparison.

### **Pribilof Islands red king crab**

The assessment author evaluated several approaches to assess Pribilof Islands red king crab (PIRKC). Prior to 2017, an inverse-variance weighted 3-year running average of male biomass ( $\geq 120$  mm) was used based on densities from the NMFS summer trawl survey. In 2017, a random effects model was applied to biomass of males  $\geq 120$  mm CW. No assessment was conducted in 2018, as PIRKC is now on a biennial cycle.

For September 2019, the assessment author proposed to present three assessment models:

- Running average, which is an inverse variance weighted 3-year running average of mature male biomass.
- Random effects model, which is fit to survey male biomass.
- An integrated assessment model, which fits male abundance and length composition data from the NMFS summer survey.

The CPT supports the choice of these models for September. With respect to the new integrated assessment model, the SSC noted that it may not be realistic to expect the integrated assessment to be accepted in September 2019, as new models are typically accepted at a meeting prior to its implementation and September/October would be the first time that the CPT/SSC will have seen this model for potential adoption. Nevertheless, the SSC appreciates the author's enthusiasm and excellent progress. Vastly different interpretations about stock status inferred from running average and random effects models versus the integrated assessment model (see below) for this stock elevate the priority for completing the integrated assessment to help vet these alternative interpretations, which have large management implications.

The author pointed out that neither the running average nor the random effects model incorporate survey length composition data, whereas the integrated assessment model does. As length composition data contain information on cohorts passing through the population, it might be expected that an integrated assessment would perform better. However, the SSC recognizes the assumptions about retained fishery selectivity and bycatch selectivity that must be made in the absence of PIRKC-specific data, resulting in a tradeoff between data and assumptions. The SSC looks forward to a more complete description of these tradeoffs in the September assessment. In addition, with respect to the random effects model, the preliminary assessment noted that many of the CVs were exactly equal to one, which suggests a truncation issue. This issue should be investigated for the September assessment.

The choice of model appears to lead to vastly different interpretations of the current status of this stock. Preliminary assessments based on the running average and random effects models indicate that MMB is very close to the minimum stock size threshold, whereas the integrated model output suggests that the stock is near  $B_{MSY}$ . The SSC requests the author to evaluate the credibility of each of these very different interpretations of the available data in the September assessment.

In addition to the choice of assessment model, the choice of years to include in the calculation of  $B_{MSY}$  is critical for this Tier 4 stock. In the Tier 4 harvest control rule, natural mortality is used as a proxy for  $F_{MSY}$  and target biomass is set by identifying a range of years over which the stock is thought to be near  $B_{MSY}$ . Unfortunately, as the fishery for PIRKC was only open for five of the last 27 years, it is difficult to identify a range of years when the stock may be near  $B_{MSY}$ . In 2017, the Tier 4  $B_{MSY}$  proxy for PIRKC was estimated as the average of the 1991/92 to the present year of observed survey data projected forward to February 15, removing the observed catch. The CPT recommends that the assessment author re-evaluate this assumption and propose alternatives for consideration in September 2019. The SSC agrees and requests justifications for the alternatives. An evaluation of alternatives and the ensuing discussion will be helpful to evaluate whether the stock is closer to the minimum stock size threshold, closer to  $B_{MSY}$ , or somewhere in between.

The SSC agrees with additional guidance provided by the CPT:

- Attempt to leverage information from the more data-rich BBRKC assessment. For instance, it may be reasonable to borrow information on molting probabilities, growth, maturity, and selectivity.
- Fit the model to biomass rather than total abundance.
- Thoroughly evaluate the relative weights given to different data components in the model, in particular the size composition data and survey biomass.

### **Bristol Bay red king crab**

The assessment of Bristol Bay red king crab (BBRKC) involved three model scenarios:

- rk18A.D18. Scenario 18.0a from September 2018 (base model).
- rk18A.D18a. Scenario rk18A.D18, except groundfish fishery bycatch data are updated for 1991–2017 and separated into trawl and fixed gear for 1996–2017 (base model with better bycatch data).
- rk18Aa.D18a. Scenario rk18A.D18a, but implemented using GMACS (base model with better bycatch data using GMACS).

The SSC expresses its appreciation to the authors for extra efforts to implement this rather complex assessment in GMACS. Results are very similar for the base model and for the base model with better bycatch data, which suggests that model results were affected little by updated groundfish fisheries bycatch data and their breakdown into trawl and fixed gear bycatches starting in 1996. These two models fit the NMFS survey biomass better than does the GMACS model. On the other hand, the model fits to the BSFRF survey data were better for GMACS than for the other models. The GMACS model with the better bycatch data resulted in somewhat higher biomass estimates after 2004 than do the other two models.

On the bottom of page 4 and top of page 5 of the assessment report, the authors identified seven areas for which the GMACS scenario needs some improvement or additional examination. One of these issues includes an unbelievably high estimate of fishing mortality in 1981. The SSC supports the authors' intentions to investigate these issues for the September assessment. Additionally, the SSC supports the CPT's recommendations to the authors to provide additional diagnostics to facilitate comparisons among the base model with better bycatch data and GMACS model so that outcomes can be better understood. It is important to understand what drives differences among these models, and such an evaluation is critical before GMACS can be accepted. Finally, the SSC reiterates its request that model names should follow approved conventions.

### **St. Matthew Island blue king crab rebuilding plan progress report**

The SSC received the CPT report on progress for the St. Matthew Island blue king crab (SMBKC) rebuilding plan, and an analysis to evaluate whether the stock may have experienced a change in productivity (breakpoint analysis). Katie Palof (ADF&G) provided an overview of rebuilding projections using results from the breakpoint analysis and the fall 2018 assessment model and specification. The analysis evaluated seven projection scenarios associated with recruitment and  $B_{MSY}$  proxy assumptions, and evaluated four variations on the treatment of bycatch mortality and whether the State of Alaska harvest strategy was included in the scenario.

The recruitment regime selected for the projections are those years that are randomly resampled for future stock productivity. This assumption, and the selection of the regime in which the estimate of  $B_{MSY}$  is derived, are critical in determining the time to rebuild in the projections. The SSC found both the breakpoint analysis

and projection method to be appropriate and appreciates the authors' work to provide a comprehensive analysis. The SSC notes the breakpoint analysis is new information that was not available last October, and certainly improves our understanding of potential regime changes in this stock. The currently specified  $B_{MSY}$  proxy period is the average mature male biomass (MMB) estimated during 1978-2017. The breakpoint analysis showed a statistical break for the 1989 brood year, which corresponds to a MMB break at 1996 (assuming a lag of seven years from the brood year to recruitment). The analysis suggests future recruitment conditions equal to the full period are unlikely, which may indicate a different recruitment regime is appropriate. **The SSC recommends this potential breakpoint in productivity be brought forward for the 2019 assessment.**

The breakpoint analysis could benefit from the inclusion of additional information to link the statistical results with the environmental and ecosystem information. The SSC recommends the authors consider appropriate information from the draft SMBKC Ecosystem and Socio-economic Profile (and specifically the ecosystem indices) that relates historical trends to the breakpoint analysis. An approach would be to evaluate the directional change each indicator may have on stock productivity. The authors should also consider differential impacts on crab life stages as appropriate; and to include any available information on red king crab biomass and historical trends in other important predators within the St. Matthew Island area (e.g., Pacific cod).

Specification of a different  $B_{MSY}$  proxy regime period than currently used in the assessment has important implications for the rebuilding projections and specifications, making the associated rebuilding analysis contingent on decisions made for the fall 2019 assessment. The rebuilding analysis will use the specification from October 2019, with the rebuilding plan to be implemented October 2020. However, given that tight time frame, work on potential rebuilding scenarios (even if not selected in October) would need to occur this summer for initial review in December 2019.

**Therefore, the SSC concurs with the CPT recommendation to evaluate Scenarios 1 and 5 for the rebuilding analysis.** These scenarios match the recruitment period with the  $B_{MSY}$  proxy, which is appropriate given the prevailing environmental conditions leading to the  $B_{MSY}$  proxy should be consistent with the stock's reproductive potential. Scenario 1 is consistent with the current model, and Scenario 5 presents an alternative regime period. The SSC also supports the assumption of random recruitment given it was consistent with the assessment, stock-recruitment fits for the Beverton-Holt or Ricker models were poor, and random recruitment provides a comparison between the two periods, particularly with regard to whether recruitments prior to 1989 are realistic under current conditions.

The SSC notes the rebuilding projections showed sensitivity to whether the State of Alaska harvest policy was included. At a 50% probability of rebuilding,  $T_{min}$  was 7.5 years for Scenario 1 and 10.5 years for Scenario 5. Rebuilding with directed fishing mortality allowed under the state harvest policy resulted in projected rebuilding to occur at 11.5 years under Scenario 1 and slightly more than 10 years in Scenario 5. The reason that the two rebuilding times under Scenario 5 are approximately equal is because the state harvest policy uses the average survey biomass for the full time period. It might be worth considering a projection scenario that uses a hypothetical state harvest policy that uses a survey biomass threshold for the same time period as the scenario. Thus, there is an interaction between allowing fishing under the state harvest policy, the specified  $B_{MSY}$  proxy period, and whether rebuilding under  $F=0$  ( $T_{min}$ ) occurs is 10 years or less. Staff indicated the  $T_{max}$  and  $T_{target}$  periods would be formally described in the analysis after the fall 2019 specification. The SSC noted that the projections are likely to change with the updated survey information, as well. Finally, the SSC had some discussion about when the stock should be considered rebuilt. **The SSC concurs with the CPT recommendation that the rebuilding analysis consider the stock rebuilt in the first year that the stock increases above  $B_{MSY}$ , which is consistent with the specification of  $T_{max}$  in the NS1 guidelines.**

## ***Groundfish***

Projections showed groundfish discard did not change projection timelines or trends. Staff noted that to groundfish and halibut fisheries can be closed (after the pot rule goes into effect, likely in 2020) using in-season management authority, based on crab PSC approaching an OFL. At this time, the SSC does not believe that further action is needed to limit PSC catch beyond the currently implemented measures for the following reasons:

- Results from preliminary projections show that recent average groundfish catch has no impact on the projections.
- Levels of historical groundfish discards are relatively stable.
- In-season management authority can be used to close groundfish and halibut fisheries if crab PSC approaches the OFL.
- Consideration that spatial closures could impact pot-cod catcher processors operating in the area, and an additional spatial closure would impact those operations without a clear benefit to the rebuilding timeline.
- The timeframe required by MSA to implement regulations, such as area closures, may be difficult given the current schedule.

The SMBKC OFL is currently higher than the historical groundfish catch and, as the stock biomass improves, the OFL will also increase. One concern is the potential for increased catch of crab before inseason action occurs given the room between the OFL and historical groundfish catch levels, particularly as the stock recovers. As groundfish species shift north in the Bering Sea, there is potential that fishing mortality on blue king crab could increase, but it is not clear at what point an increase in crab mortality will impact rebuilding projections in a meaningful way. **Therefore, the SSC recommends the rebuilding analysis investigate the sensitivity of the projections to increases in fishing mortality of blue king crab from groundfish fisheries. Additionally, a discussion on how the in-season closure authority would be used as it relates to the OFL and ABC should be provided in the analysis.**

## **EBS Tanner crab management strategy evaluation**

The SSC received a presentation from Madison Shipley (master's student at the University of Washington) on an ongoing Management Strategy Evaluation (MSE) to evaluate State of Alaska harvest policy options for Tanner crab. The SSC recognizes that state management of Tanner crab is outside the purview of the SSC and Council, but appreciates the opportunity to provide comments on the MSE, which may be helpful to the State of Alaska. Investigation into the Tanner crab model configuration and technical details of simulating Tanner crab dynamics are also relevant to the understanding and future development of the stock assessment model, on which annual status determinations are made and OFLs/ABCs are set. The stock assessment model and OFL/ABC setting fall within the Council process.

The SSC acknowledged the breadth of the MSE effort, which is especially extensive for an MS project, including a closed-loop simulation to compare 13 alternative harvest control rules (HCRs; including the *status quo*). The analysis is conditioned on the current stock assessment model, using it as both the basis for the operating model as well as the estimation model in the MSE.

The SSC noted several important aspects of the operating model that should differ from an assessment model. These features of the operating model include:

- Simulating survey data (point values and confidence intervals) with a lack of fit from the true dynamics consistent with both the observation error and the assessment model residuals (i.e., a predictive interval). This is particularly important in light of the direct use of survey data (including confidence intervals) in some of the HCRs including the *status quo*.

- Allowing for additional processes, such as a stock-recruitment relationship. The assessment has not included any relationship between female Tanner crab abundance/biomass and subsequent recruitment; however, testing a wide range of conditions may not be reasonable without precluding large recruitment events in the absence of female crab. Further, the performance of a HCR that uses the survey-based biomass estimate for female crab will depend on whether there is a stock-recruitment relationship.
- Alternative structural hypotheses, potentially including the known issue of over-predicting large crab abundance in the stock assessment models, could be important to include as part of the operating model for evaluation of relative HCR performance.

The SSC was also concerned that there was currently no propagation of parameter uncertainty included in the operating model. This may be important, as the performance of potential HCRs, particularly through metrics based on binary management responses such as “is the fishery open or closed?” may be sensitive to interactions among the range of conditions, the process (recruitment) error, and the estimation error in the simulations.

This MSE highlights inconsistencies between the state’s HCR and the stock assessment on which stock and fishery status determinations are based. These include the treatment of female crab; namely, there is no stock-recruitment relationship in the assessment but survey-based female biomass estimates and confidence intervals are included in the HCR.

The SSC encourages the MSE, noting that the work may help to illustrate the trade-off between yield and the likelihood of fishery closure, as well as allow for the relative ranking of HCRs based on a variety of performance metrics. Although extensive, the SSC cautions that the proposed work will not explore all important aspects that could be included in an MSE. It does not appear that objectives for the stock and fishery have been clearly identified. Performance metrics should index the degree to which stock and fishery objectives are met. An MSE generally consists of tuning management procedures to best meet objectives, rather than pre-specifying a small number of alternative HCRs and then selecting one based on the results. Thus, the SSC suggests that managers and fishery stakeholders should consider this to be an iterative process and further develop specific objectives for the stock and fishery as initial results become available. The State’s Policy on King and Tanner Crab Resource Management may serve as a starting point for the development of objectives for the stock and fishery.

Finally, the SSC also notes the following references that may provide helpful background on an earlier MSE analysis for Tanner crab in the eastern Bering Sea:

- Zheng, J., and G.H. Kruse. 1999. Overview of population dynamics and recommended harvest strategy for Tanner crabs in the eastern Bering Sea. Alaska Department of Fish and Game, Regional Information Report 5J99-04.
- Zheng, J., and G.H. Kruse. 1999. Evaluation of harvest strategies for Tanner crab stocks that exhibit periodic recruitment. *Journal of Shellfish Research* 18: 667-679.
- Zheng, J., and G.H. Kruse. 2000. Rebuilding probabilities under alternative rebuilding strategies for eastern Bering Sea Tanner crab. *Alaska Fishery Research Bulletin* 7: 1-10.

### **B<sub>MSY</sub> Basis**

The CPT discussed a range of issues associated with establishing appropriate time periods for determining reference points for Bering Sea crab stocks. There are a variety of approaches used and time periods selected that vary across stocks. For example, some authors have used breakpoint analysis to identify transitions

between productivity regimes, while other stocks rely on recommendations by the SSC and CPT. Further, there are different approaches among stocks with regard to whether the latest year in recruitment or spawning stock biomass is used for the reference period. The SSC supports the CPT's conclusion that a single prescriptive time period for all crab is not necessary, noting there is likely stock-specific variation in production. Additionally, the reference period should be well supported with available information. During discussion, the SSC generally supported the CPT recommendations, and indicated environmental information should also be used when possible to support existing quantitative breakpoint analysis. The SMBKC rebuilding analysis may provide a useful template from which to document changes in regimes, and to provide a consistent method for future evaluation of that and other crab stocks.

In addition, the SSC made the following request in February 2012:

"The SSC supports the previous recommendation of the Groundfish Plan Team ... to hold a workshop to develop guidelines on how to address environmental changes in the SR relationship into biological reference points and how to model environmental forcing in stock projection models.... The SSC believes it would be useful to have members from both the Groundfish and Crab Plan Teams present, because the issues are common to both groups."

This comment initiated a Joint meeting of the Crab and Groundfish Plan Teams where many of these issues were discussed (but not necessarily resolved). The SSC encourages authors to review the concepts discussed during the meeting in the August 2012 report (Report of the Joint Plan Team Working Group on Assessment/Management Issues Related to Recruitment, [https://www.afsc.noaa.gov/REFM/stocks/Plan\\_Team/2012/Sept/Recruitment\\_working\\_group.pdf](https://www.afsc.noaa.gov/REFM/stocks/Plan_Team/2012/Sept/Recruitment_working_group.pdf)).

The SSC requests that the authors and CPT provide a clear basis for the current regimes that are in place and clearly specify their objectives (i.e., target the current productivity regime or the range of potential productivity).

### **Economic and Community Reports**

The CPT received an overview of the 2018 crab SAFE economic status report. In response to past SSC recommendations, several updates to the economic SAFE are being developed, including creating a report card, making data available for public download, improvements to how ownership and quota harvest information are presented, and disaggregation of wage information. The SSC looks forward to seeing these improvements in the near future.

In addition, the SSC reiterates the importance of continuing work on providing data regarding community engagement in, and dependency on, the crab fishery for the purposes of tracking sustained participation of fishing communities (or the lack thereof), per National Standard 8. The SSC agrees with the CPT that the Norton Sound red king crab fishery would be a good candidate for a pilot socio-economic report as it would be particularly valuable for evaluating the efficacy of multiple community protection measures, as detailed on pages 10 and 11 of the February 2018 SSC Report. Further, this information will be useful for future development of environmental and socio-economic profiles.

### **Catch Sampling and Estimation**

A brief overview of the CPT discussion on catch sampling and estimation for crab fisheries was presented to the SSC. The SSC appreciates the work by ADF&G describing the estimation methodology, and supports the CPT recommendations. Additionally, the SSC highlights efforts to create a consistent methodology for estimating catch and to provide a "one-stop" shop using AKFIN services.

The SSC recommends a clear description of the accounting and estimation methodologies be written and,

if possible, associated with a data warehouse (e.g., AKFIN) where consistent data and estimates are accessed and used by assessment authors. In addition, the SSC notes the CPT minutes highlighted a potential Alaska Board of Fisheries proposal to raise the amount of incidental catch species allowed in a fishery. The CPT minutes note this may create problems with crab accounting. The SSC would appreciate an update on the accounting issues should this proposal move forward.

### **VAST Modeling**

The CPT received presentations related to use of the VAST model and had discussions about the use of this modeling technique for crab stocks. The SSC discussed issues associated with the use of VAST and how these issues relate to its adoption for use in crab assessments. The SSC supports continued exploration of VAST, noting there are a number of issues that need consideration prior to its adoption. Specifically, the SSC noted there are concerns about the smoothing aspects of VAST that greatly increase precision when compared to design-based estimators. The increase in precision can change the relative weighting among data sets included in a model (e.g., a survey index versus length compositions), resulting in more weight being applied to the VAST index than would otherwise be applied to a design-based index. A key question remains how to handle these weightings and consideration of when to add extra variation to VAST estimates. The SSC supports evaluation of the VAST model in assessments when appropriate, noting these important issues should be considered. The SSC noted the VAST model could be especially useful when spatially unbalanced data are used, the spatial or temporal extent of surveys change, combining different data sources, and assessing shifts in species distribution.

### **General Assessment**

The CPT had a discussion about the future direction of stock-specific ecosystem report cards for crabs, and supported including the report cards in the SAFE chapters and an appendix to the main document. The SSC will review these report cards once they become available.

### **C-3 Observer Program 2018 Annual Report**

Presentations were given by Elizabeth Figus (NPFMC), Jennifer Ferdinand (NMFS-AFSC; FMA Division Director), Craig Faunce (NMFS-AFSC), Phil Ganz (previously PSMFC, now NMFS-AKRO), and Special Agent Jaclyn Smith (NMFS-OLE) on the North Pacific Observer Program 2018 Annual Report (Annual Report). Public testimony was provided orally by Jon Warrenchuk (Oceana) and Julie Bonney (Alaska Groundfish Databank, and OAC and EM Trawl Workgroup member). Additional written public testimony was provided by Jon Warrenchuk (Oceana), Malcolm Milne (North Pacific Fisheries Association), and Dan Falvey (Alaska Longline Fishermen's Association).

The SSC received the sixth Annual Report of the restructured observer program, which provides details on sampling of fisheries during 2018. The SSC appreciates the dedication and tireless work of observer program staff, both in the field and office, to collect, summarize, and interpret this information. The sampling and estimation methods used by the North Pacific Fisheries Observer Program are well documented and vetted, and the program provides essential biological samples and fishery-dependent catch and effort information for sustainable fisheries management. The current EM program employs an innovative technological approach to collect data for catch estimation of most species; a substantial improvement to compliance-based logbook programs that provide catch only for a focused subset of species.

The Annual Report provides comprehensive information on implementation of the observer program in 2018, including detailed information on coverage categories and levels, fees and the budget for the partial coverage category, metrics and evaluation of the performance of the deployment plan, fishery information summaries, summaries of EM video review for select strata, compliance and enforcement statistics, outreach activities, and NMFS recommendations for the program. Analysts have been responsive to OAC

and SSC comments about the program provided during June and October meetings, and the SSC appreciates inclusion of section 7.2 in the report that provides a history of targeted responses to direct questions and concerns raised in prior years. Several substantial changes of note occurred in 2018, namely: implementation of a 15%+Optimization sampling design; inclusion of EM under regulation; merging of the HAL and HAL Tender strata; and use of HAL EM data for in-season management. The SSC found the report to be well written and rigorous in its evaluation of how well the program is conforming to the current deployment plan. Specific recommendations for streamlining and re-organizing some sections of the document for the sake of succinctness and clarity were provided directly to the authors.

The SSC focused primarily on the performance of the partial coverage category and notes the following:

- The program effectively used landings fees and NFWF funding to deploy staff in accordance with the 15%+Optimization hurdle model outlined in the Annual Deployment Plan and obtained largely representative data for most fishing areas and for most fleets.
- Stratification by gear and presence/absence of tendering for the partially observed trip selection strata is straightforward to interpret and allows for ready identification of strata for which catch and bycatch metrics affect management, versus those for which effort and catch are too low to have much impact. The analysis in Appendix A shows that, while pelagic and non-pelagic trawl fisheries differ substantially in many aspects of their catch, there are operational and statistical reasons to maintain them as a single gear-type stratum.
- The ODDS system largely worked as intended for trip planning and logging of trips, though trip inheritance continued to generate temporal bias (see below). However, plans to link ODDS with eLandings continue to progress very slowly. The report notes an ongoing effort to document the computer code that forms the basis of ODDS so that future improvements, including connection with eLandings, can occur when sufficient staff time and funding are allocated for this purpose.
- The EM selection pool continues to evolve and expand, demonstrating clear enthusiasm by several fishing sectors for use of this monitoring tool.
- The overall number of statements about poor/illegal behavior decreased nearly 25% during 2017, largely due to reductions in retention of salmon bycatch, mishandling of prohibited species, interference with observer duties, and improper record keeping. This can be attributed in part to extensive outreach efforts by the OLE the past several years. Appendix D reports the results of a new data exploration exercise to standardize incident occurrence rate under various conditions, moving away from statement counts, with the goal of focusing additional outreach efforts.

While the SSC acknowledges the achievements of the analysts in rapidly overhauling the program to its current, much-improved state, we also note that the program is not fully achieving an unbiased or representative sample of trips from the partially observed category, due in large part to the following:

- There are statistically significant differences between observed and unobserved trips for several characterization metrics, including fundamental attributes like catch weight and trip duration, for some sectors. While it is not clear whether these differences in metrics imply that the data are biased, it suggests that further investigations are warranted to determine why observations of certain fleets seem to be less representative than others, and whether those differences are meaningful.
- There are indications that funds to observe trips adequately in the current gear and tender-status strata under the 15%+ Optimization hurdle model are decreasing, with concomitant impacts on sampling rate. **Adequate funding of the observer program is critical to the ongoing success of in-season management, stock assessment, and specifications setting processes.**
- The behavior of the ODDS system with respect to inheritance of trip selection after a trip is

cancelled leads to temporally biased sampling of some strata, with many, or most, observed trips coming very late in the season. At the request of the SSC and NMFS a sub-group has been created to evaluate system behavior and identify ways to obtain broader, more representative observer coverage throughout the season but documentation of computer code for ODDS must occur first. The SSC agrees that these are high priority activities.

The SSC predominantly agrees with the recommendations made by the OSC and NMFS for the 2019 deployment year. However, based on the aforementioned successes and continuing challenges of the program, the SSC has the following recommendations with respect to the partially observed category:

- **The SSC supports the continued development and utilization of the optimized hurdle model** and looks forward to seeing results from its continued evaluation and use at our June meeting in 2020.
- The SSC reiterates that, while we recognize that development of variances for use in planning of deployments and stock assessment is ongoing, **we urge the analysts to initiate a comparison of the presence and magnitude of bias detected between observed and unobserved trips with the overall magnitude and precision of catch, discard, or PSC that is being monitored by management.** The analysts note in the report that further clarification and conversation with the SSC is needed and we look forward to this exchange. It may be that additional performance metrics must be considered to quantify specific management goals relative to data utility.
- Given the potential for future funding constraints, the SSC looks forward to the Council's review of the current fee structure of the observer program. We again note from our June 2010 report on this issue that the initial analysis of the revised observer program was based on the assumptions of a maximum 2% fee and a daily observer cost of \$450, and neither of these assumptions have been met in the current system (i.e., the fee is 1.25% and the daily observer cost is often >\$1000 annually). Fees are based on the often-volatile landed value of fish, which introduces uncertainty into the funding stream.
- EM offers flexibility with regard to the conditions under which catch and effort data can be obtained, but involves trade-offs relative to observer deployment. While it is clear that some tasks cannot be performed via EM (e.g., biological specimen collection), it is less clear how directly comparable data from EM are relative to those from observers, with regard to detectability and error rates. The current report states that a scoping document for analysis of this issue is forthcoming in October, but this means EM will be operationalized from 2018 to approximately 2021 before this assessment of data suitability is complete. As such, **the SSC recommends that this analysis be given a high priority and initiated now before dependency upon EM-derived data becomes further institutionalized.**
- The time necessary to review EM videos and extract useful data can be extensive and ensuring a temporally comprehensive sample for a given fishing year requires thoughtful sample selection. The report states that an analysis of post-selection methods for EM review is forthcoming. The SSC looks forward to reviewing this document.
- While the SSC recognizes the Council's need for EM research on trawl vessels, to the extent possible, the SSC also encourages consideration of coverage for the under-40'-no coverage fleet for 2020. This represents a large segment of the targeted halibut trips. Deployment options should be brought forward for discussion during the ADP review in October, if practicable.
- While recent outreach efforts have helped considerably, compliance and enforcement issues continue to be problems that contribute to bias, fluctuate substantially among years, and may be substantially underreported for a variety of social and safety reasons. The SSC continues to encourage training of captains, crews, and processing plant workers in all sectors on the necessity

of the observing program to proper fishery management and how crew members can contribute to the success of the program by interacting appropriately with observers.

- While the total predicted trip days overall was off by about 20% from the actual trip days in 2018, individual sectors were off by as much as 90%. The SSC requests further explanation and development of the prediction methods in future reports.

The SSC offers the following additional recommendations to the analysts:

- In 2018, EM video review was slowed by a number of factors, including a largely unsuccessful attempt to categorize hook damage to halibut purely from the video. In an effort to ensure EM video review occurs in time to provide data critical for inseason management and catch accounting each year, we recommend that the analysts develop clear guidelines for the thorough consideration of any and all secondary projects that might prolong video processing time.
- As detailed in the June 2016 and 2018 SSC reports, and IPHC public comments made at the June 2016 meeting, the SSC encourages additional progress toward resolving the calculation of mean weight of halibut discarded by the IFQ halibut fleet.

#### **C-4 Crab partial deliveries**

The SSC received a presentation from Sarah Marrinan (NPFMC) of the draft RIR document for the proposed actions that would remove the prohibition against continuing to fish in a Bering Sea/Aleutian Islands Crab Rationalization Program fishery after a partial delivery. Public testimony was provided by Lance Farr (ABSC/PNCIAC) and Frank Kelty (self).

Initially, the prohibition against fishing after partial deliveries was intended to address a concern over increased opportunities for illegal discarding activities after partial deliveries. Experience has shown, however, that illegal crab discards in the rationalized crab fisheries are unlikely. Thus, prohibiting fishing after partial deliveries may not be justified on that basis. However, the prohibition against fishing after partial deliveries has greatly simplified dockside sampling and catch accounting. Thus, the benefits of removing the prohibition against fishing after partial deliveries—i.e., increased flexibility in business operations—must be weighed against the potential costs of degraded data collections and/or the costs associated with changes to the data collection programs.

The SSC commends the analyst on an excellent presentation and analysis. The analysis assembles the available and relevant information on the crab rationalization fisheries, including the extent of deadloss realized and the frequency with which partial deliveries have occurred in recent years. The analysis also describes the crab delivery/offload process to better understand the circumstances in which a crab harvester may wish to exercise the option of fishing after a partial delivery. Data from recent years demonstrates that partial deliveries are not routine practice and that crab rationalization has reduced deadloss considerably. Anecdotal evidence suggests that fishing after a partial delivery is not anticipated to become a routine operating procedure. The analysis also describes how the proposed action would complicate the current data collection programs and provides a discussion of the potential costs associated with changes to the data collection programs.

The SSC finds the analysis to be comprehensive and sufficient for understanding the various costs and benefits of the proposed action. While the analyst was unable to quantify how often harvesters will exercise the option of fishing after partial deliveries, the analysis provides a nice description of the key mechanisms that likely determine the extent to which this option would be exercised if Alternative 2 is adopted. **The SSC recommends the analysis be released for public review once the following minor issue is addressed:**

- The analysis highlights potential areas in which this action *may* impact crab processors and the

communities in which they are located. These include a potential change in delivery patterns for B and C quota shares (neither of which need to be matched with IPQ) and the community tax revenue associated with these landings. The analysis should characterize the amount of B and C shares that are now landed with the cooperatives' processor to develop a better calibrated sense of how much of catch attributed to B and C shares could be expected to shift given existing cooperative arrangements.

The SSC acknowledges the possibility of a slight degradation in the quality of data in catch by area. However, this information is minimally used in current modeling, and the analysis suggests these effects can be mitigated through a number of measures. In addition, the SSC is concerned that the option to Alternative 2 does not completely fulfill its intended purpose. Without an additional restriction on adding crab to a partially filled tank containing crab from a previous trip, there is still potential for intermixing of sources to record on fish tickets.

### **C-5 Sculpins to ecosystem component (EC)**

The SSC received a presentation from Megan Mackey (NMFS-AFSC) regarding the classification of the sculpin species complex (48 spp.) in the GOA and BSAI. Written public comments were provided by Kawerak, Inc. No oral public testimony was received.

The SSC reviewed the Initial Review Draft of the Environmental Assessment (EA) and a Regulatory Impact Review (RIR) assessing two alternatives. Alternative 1 examined the *status quo*, where the council would continue to manage sculpins as target species in both the BSAI and GOA groundfish FMPs. As target species, assessments would be performed every four years, harvest reference points would be set, and sculpin TAC would continue to be factored into overall harvest levels in both regions. Alternative 2, the action alternative, would designate sculpins in both the BSAI and GOA FMPs as non-target ecosystem component species. As ecosystem component species OFL, ABC, and TAC for sculpins would no longer be required, regulations referring to sculpins as target species would be removed, and regulations prohibiting directed fishing for sculpins would be implemented. Further, a sculpin maximum retainable amount (MRA) would be selected. Three MRA options were evaluated: Option 1 MRA = 2%, Option 2 MRA = 10%, and Option 3 MRA = 20%. An MRA of 20% is currently in place for most basis fisheries, except those targeting arrowtooth and Kamchatka flounder for which the MRA is 3%.

The draft EA concluded that, because sculpins are not actively targeted, neither alternative would affect current fishing regulations in terms of seasons, gear types, or protections for habitat or important breeding areas. Further, no effects were expected on marine mammals, seabirds, habitat, or the ecosystem and, therefore, the analysts focused on potential effects on sculpins, groundfish, and on social and economic factors. Additionally, the analysts concluded that neither alternative would change fishing mortality nor spatiotemporal distribution of sculpins or other groundfish, and therefore the impacts of both alternatives are expected to be insignificant. It is notable that under Alternative 2 approximately 5,000 mt of TAC would become available under the 2 million mt OY limit for the BSAI. The Council would be able to allocate this additional TAC to any, presumably more economically valuable, species in the BSAI during the annual harvest specifications process. The analysts concluded that this relatively small amount of additional fishing under the OY limit would result in minimal changes to prohibited species catch. Further, they could not anticipate where this additional catch would be allocated but they noted that the Council would examine those potential impacts when considering harvest specifications.

In the draft RIR, the analysts noted that incidentally landed sculpins are used for fish meal, their value is routinely \$0.02 per pound or less, and there is currently no market, or interest in developing a market, for sculpins. The analysts concluded that both alternatives would directly regulate any vessel operator harvesting sculpins in federally managed groundfish fisheries in the BSAI and GOA, that the economic impacts of Alternative 1 would be neutral, and that the economic impacts of Alternative 2 would be

primarily beneficial or neutral due to the “freeing up” of approximately 5,000 mt of TAC. Three options for an MRA of 2%, 10%, or 20% were considered for Alternative 2. The analysts noted that retention of sculpins has been well below current MRA thresholds in recent years, and concluded there was no conservation benefit in reducing the MRA below 20% given there is little financial incentive for fishermen to top off on sculpins. Further, they concluded that reducing the MRA to 2% or 10% could increase operating costs for vessels by increasing handling time for regulatory discarding. Some management and enforcement issues were identified under Alternative 1, including: individual trip level catch monitoring to ensure that the sculpins MRA is not exceeded; cumulative catch monitoring to ensure that catch is not approaching the TAC; determination of unspecified reserves in the BSAI are available to be added to increase the TAC; placement of sculpins on prohibited species status when total TAC is exceeded or projected to be exceeded; the potential of directed fishing closures in the event harvest ever approached the OFL; and the challenge for enforcement to determine the appropriate penalty for sculpins MRA overages due to the low price of sculpins. The analysts concluded that the preliminary preferred alternative of a 20% MRA option under Alternative 2 would alleviate these management and enforcement issues.

The SSC finds that the draft EA/RIR document is adequate to allow the Council to understand the fishery and policy impacts of the alternatives. However, **the SSC recommends the items listed below be addressed prior to the release of this analysis for public review:**

1. Provide a summary of the sculpin discard mortality literature to better inform the assessment of potential increases in discards under the Alternative 2 MRA options.
2. Provide a table comparing historical annual sculpin catch relative to the MRAs to better inform the discussion of Alternative 2 MRA options. For example, is a 2% MRA likely to be constraining? Given that Table 3-7 shows that the percent of retained sculpins peaked at 19% in the GOA in 2007 and 9% in the BSAI in 2009, would different MRA values be appropriate in the BSAI and GOA? The SSC also notes that percent retained has been less than or equal to 3% in both areas since 2013.
3. Provide an analysis of the projected impact of increasing the sculpins MRA for arrowtooth and Kamchatka flounder from 3% to 20% under Alternative 2, Option 3. Though likely minor, given harvest levels of these species, this increase in MRA is not currently explicitly considered.
4. Summarize the available spatial fishery and survey data on sculpin catch by species to better inform the analysis of local stock structure and the potential for species-specific fishery impacts. Understanding disaggregated distribution and stock structure is critical to evaluating the appropriate level of conservation concern for species in the complex now and in the future regardless of their classification. Including this assessment for sculpins will bring the document into alignment with the analysis provided when squids were moved into the ecosystem component species category.
5. Outline the contents of the report to be provided every four years under Alternative 2. This document should contain the basic components of the Sculpin SAFE Report including survey and catch trends by species, and size composition information.
6. Provide a table summarizing sculpin species size ranges.
7. Revise the following economic, social, and community impact-related statements in the document:
  - a. Pg. 17 (Table 2-1): “*Sculpins are not considered important to...subsistence users...*” When modifying this statement (based input provided in written public comment), please note whether or not subsistence harvest and use of sculpins also show up in ADF&G subsistence data.
  - b. Pg. 24 (Section 3.1.2): “*Thus, the alternatives have the potential to affect...social and economic components.*” Please describe the mechanism of impact that would potentially

result in social and economic impacts (and describe those impacts) or remove this statement.

- c. Pg. 24 (Section 3.1.2): “...further analysis is included...for...social and economic components. Social and economic components are addressed in the Regulatory Impact Review in Section 4.” At present, this analysis is not included in Section 4. Please either add the analysis or delete these statements. If statements are deleted, please definitively state that social and economic impacts are not anticipated (if that is the case).
- d. Pg. 25 (Section 3.1.4): “Based on Table 3-1, the resources with potentially meaningful cumulative effects are...and social and economic components.” Please describe the mechanism of impact that would potentially result in cumulative social and economic impacts (and describe those impacts) or remove this statement.
- e. Pg. 55 (Section 5.2): “The effects on participants in the fisheries and fishing communities are analyzed in the RIR chapter of the analysis (Chapter 4).” At present, this analysis is not included in Section 4. Please either add the analysis or delete this statement. If this statement is deleted, please definitively state that adverse effects on participants in the fisheries and fishing communities are not anticipated.

## **D-1 Salmon bycatch**

The SSC received presentations on the genetic stock composition analysis for GOA and BSAI Chinook and chum salmon prohibited species catch (PSC) from Chris Kondzela (NMFS-AFSC) and Chuck Guthrie (NMFS-AFSC). Diana Stram (NPFMC) provided an overview of and recommendations from a salmon bycatch workshop, which was held on April 15th and 16th, 2019, with broad representation from AFSC, ADF&G, the industry, UAF, UW, and others. Public testimony was provided by Verner Wilson III (Friends of the Earth). Written comments were provided by Kawerak, Inc. and the Western Interior Alaska Subsistence Resource Advisory Council.

The SSC thanks the presenters and the authors of the stock composition reports, as well as the many analysts contributing to developing baselines and analyzing the data, for the **tremendous advances that have been made in our ability to quantify impacts of salmon bycatch on particular stocks of origin that may be of management concern**. The datasets that have been developed, provide a rich source of information to answer a variety of questions about not only stock composition of the bycatch, but also about what may be driving variations in bycatch rates, as well as about the marine ecology of salmon.

The SSC has received annual reports on the genetic stock composition of salmon bycatch in the Bering Sea and the Gulf of Alaska for a number of years. This year’s reports summarized the 2017 stock composition estimates for Chinook and chum salmon caught in the Bering Sea pollock fishery, the Bering Sea non-pollock CP trawl fishery, the GOA pollock fishery, and the GOA rockfish CV trawl fishery. Sampling protocols differ among fisheries. In the fully-observed Bering Sea pollock fishery, all salmon are enumerated and systematic samples of 1 in 10 Chinook salmon and 1 in 30 chum salmon have been collected for genetic analyses since 2011. In the GOA, Chinook and chum salmon on observed pollock trips are completely enumerated and sampled, whereas salmon are randomly sampled at-sea for observed non-pollock trips (excluding rockfish program CVs). The sampling of the GOA rockfish CV trawl fishery by industry is voluntary and is a census of Chinook salmon encountered. **The sampling design has matured and has largely succeeded in providing a representative sample of bycatch occurring in these fisheries.**

The current reports provide Bering Sea-wide and GOA-wide seasonal and interannual trends, as well as trends for several smaller regions in the Bering Sea that were provided in response to a request from the SSC. There are now sufficiently robust data to evaluate long-term trends and spatial patterns in specific

stock groups. For example, in the Bering Sea the proportion of Chinook salmon from the Coastal Western Alaska region has been decreasing since 2011, along with a corresponding increase in the proportion of southern stocks (BC and West Coast US), primarily in the B season. In contrast, the proportion of southern stock groups in the GOA bycatch has remained relatively stable or has decreased since 2015. There are also strong seasonal trends that likely reflect the migration of different stocks into and out of the region. Regional analyses for the 2017 A season in the Bering Sea suggest that bycatch from the Northwest region (west of approximately 168°W) had a higher proportion of salmon origination in rivers that drain into the Bering Sea, while bycatch in the Southeast region, as well as in two subregions (CVOA and Area 509 stratum), were dominated by Chinook salmon originating in the South (e.g., BC and West Coast US).

The workshop highlighted some current and possible future uses of the stock composition estimates. The composition of Chinook salmon caught in the BSAI pollock fishery is currently used in the Adult Equivalency Analyses (AEQ) to assess the impacts of the pollock fishery on stocks from western Alaska. The reports also provide important information for regulatory analyses and for research into the potential impacts of Prohibited Species Catch (PSC) at a regional level. Information about stock composition of chum salmon bycatch is used informally in the fishery to avoid areas and times that tend to have high bycatch of Western Alaska chum salmon. However, the use of the data for in-season management is limited by the long lag time between when data are collected and when stock composition estimates become available. The SSC was encouraged by the workshop discussions that focused on the potential for a much faster turn-around that could provide more useful information for in-season management. At this time, the rich dataset generated by the salmon bycatch sampling program clearly remains under-utilized. One of the main reasons for this under-utilization is the current management structure for Chinook salmon bycatch, which incentivizes the avoidance of all Chinook salmon, regardless of stock of origin. **The SSC therefore agrees with the workshop recommendation to conduct additional analyses to evaluate whether the current management is effective in reducing bycatch of Western Alaska Chinook stocks.**

The SSC notes that a lot of resources are going into producing stock composition estimates. While some specific objectives are currently being addressed with these data, there are many other possibilities and objectives that could be considered. **The SSC suggests that the management of salmon bycatch could benefit from clearly laying out the major possibilities afforded by leveraging the data and developing a clear set of management objectives that make optimal use of the data moving forward.**

The SSC supports other recommendations from the workshop, some of which are highlighted below, and had several additional recommendations:

- Given preliminary results from a sensitivity analysis that examined the impact of possible changes in salmon growth on results from the AEQ analyses for BSAI Chinook salmon, the SSC supports the workshop recommendation to update the age-length key. The key was developed several decades ago and processing the backlog of more recent Chinook salmon scales could considerably improve the AEQ analyses.
- Given concerns about some Chinook salmon stocks in the Gulf of Alaska, the SSC agrees with the workshop recommendation to pursue the development of an AEQ model for Chinook salmon in the GOA. This may require considerable development time both in terms of improving stock composition estimates for particular stocks of interest and in terms of obtaining biological parameters appropriate for the GOA, as there are important but poorly understood differences in size-at-age. Developing such a model now would put the Council in a better position to address potential future conservation concerns.
- The available data for both Chinook and chum salmon support stock composition estimates for specific regions, by age, by season, by sector, and for other subsets that have a sufficient sample size for mixture analyses. NOAA-AFSC analysts are developing an online tool (Shiny App) that

would allow for interactive exploration of the stock composition data by interested users. If this goes forward, the SSC suggests that it would be useful to provide ways to solicit feedback from users and/or track user statistics. This would help identify user needs or interests and future refinements to the tool to maximize its utility, as well as the utility of the data being collected.

- The SSC further suggests that efforts to use the available data to answer a variety of questions could benefit from the development of a more flexible, hierarchical modeling approach that can use shared single nucleotide polymorphism (SNP) DNA marker baselines (based on fewer SNPs) for estimating stock composition at broader spatial scales, while leveraging the regional SNP baselines (more SNPs) to refine stock composition estimates at finer regional scales that may be needed to answer specific questions. In this regard, the SSC was encouraged that analysts have adopted new modeling software that will offer more flexibility and speed than the previously used BAYES software.
- Clearly, there is a trade-off between the number of stock groupings that can be resolved and the associated costs (both in terms of number of samples needed & the number of SNPs to be developed). The workshop discussed these trade-offs and the SSC recommends that an analysis of trade-offs and associated costs should be considered when new applications for answering questions of interest are developed.
- The SSC notes that authors of the stock composition reports have started to combine stock composition information (proportions by stock of origin) with total bycatch to present the number of Chinook and chum salmon by stock of origin in addition to the proportions. The SSC encourages inclusion of both numbers and proportions in future reports.
- Regarding concerns about hatchery contributions to bycatch, the SSC notes that the State of Washington approved the proposed increase in hatchery production of Chinook salmon from current levels to support southern resident killer whales. However, to what extent this may affect bycatch in Alaska's fisheries will depend on the marine distribution of the stock(s) selected for propagation.
- Finally, we highlight the potential for shipside stock IDs that could provide a valuable tool for in-season management. A PCCRC-funded project is looking at the possibility of using a pocket sequencer that is accurate enough for distinguishing broad geographic stock groupings, such as distinguishing Alaskan from Asian chum stocks, as well as at the feasibility of a lab and analytical workflow for onboard sample and data processing.

## **D-2 BSAI Pacific cod allocation review**

The SSC received a presentation from Jon McCracken (NPFMC) on the Pacific cod allocation review. There was no oral public testimony. Written comments were received from Robert Hanson (FV Oracle), Craig Lowenberg (Bering Sea Pot Cod Cooperative), and Brett Veerrhusen and Hannah Heimbuch (Under Sixty Cod Harvesters).

This document represents the first independent allocation review for the NPFMC and the nation. Developing this review requires addressing a range of challenges in selecting and presenting indicators in ways that are useful and insightful about the way different fleets derive benefits from, and are dependent upon, Pacific cod. **The SSC commends the efforts of the analysts in making this complex characterization of diverse fleets approachable:** the measures and presentation formats capture a useful snapshot that depicts outcomes for each fleet in a straightforward and accessible way. This document is a very strong model for allocation reviews.

The SSC does not interpret the allocation review as a program review of Amendment 85; rather, it also draws on measures of objectives stated broadly in the FMP and incorporates measures of fleets, such as the

GHL fishery, that are not explicitly incorporated in Amendment 85’s objectives. **The SSC finds that this document fulfills the requirements of the periodic Pacific cod allocation review. It provides the information necessary to characterize how each fleet uses Pacific cod to advance the objectives of Amendment 85 and the broader FMP. It is sufficient to draw a conclusion about whether this review should trigger any allocative adjustments that would not otherwise arise through the normal Council action and amendment process.**

The dashboard format is very effective at succinctly presenting complex information about various fleets. The SSC has the following recommendations for adjusting the metrics and presentation to make the document even more effective:

- The current dashboard does not have a measure that reflects the value of Pacific cod to fleets that use it primarily to harvest other species. A measure such as the dollars of other fish caught on trips where Pacific cod is caught, per pound of Pacific cod, could be presented on a second Y axis on the lower left dashboard panel to reflect multispecies fishery considerations.
- Neither the aggregate Executive Summary nor the individual fleet profiles provide a sense of how much each fleet contributes to Pacific cod catch. This can be addressed by:
  - Using stacked area plots to reflect how each fleet contributes to the whole.
  - Replace the “Catch as % of allocation” series in the upper right dashboard panel with the fleet’s share of total catch.
  - Identify measures where it is possible to fix the scale of the Y axis across fleets on the dashboard.
  - Order the presentation of the fleets in the document by total average cod catch.
- The metric of BSAI Pacific cod (catcher vessel) deliveries aggregates all ports due to data confidentiality constraints. If, however, port calls before and after targeted BSAI Pacific cod trips were used instead, it should be possible to show fishery-specific changes in vessel-related activity by port over time using stacked bar (or stacked area) graphs. The number of active ports could be shown as a trend line on the same figure.
- Use stacked area plots to show trends over time in owner city within the lower right panel.

As a snapshot of performance metrics, the SSC does not see the allocation review as a forward-looking document that would predict the effect of changes in future conditions or behavior. As such, **the SSC recommends minimizing the discussion of recent or potential actions, or changes in conditions, whose effects are not yet known.** Specifically, the synopsis of the Plan Team recommendations in Section 3 and the detailed discussion of the shoreside set-aside in 4.1.6 could be condensed.

#### **D-6 Bering Sea Fishery Ecosystem Plan**

The SSC received a presentation on the EBS Fishery Ecosystem Plan (FEP) from Kerim Aydin (NOAA AFSC) and Diana Evans (NPFMC). Public testimony was given by Julie Raymond-Yakoubian (Kawerak, Inc.) and Raychelle Daniel (The Pew Charitable Trusts). In addition, written comments were provided by Julie Raymond-Yakoubian (Kawerak, Inc.), Rebecca Robbins Gisclair (Ocean Conservancy), and Amos Philemonoff, Sr. (Aleut Community of St. Paul Island).

Dr. Aydin gave a helpful overview of the FEP document and the two Action modules proposed for activation. The SSC previously reviewed the main body of the document in December 2018. Appendix 1 and Appendix 2 were also previously reviewed and are unchanged.

The concern was brought up that there may be duplication across various Council groups (e.g., Plan Teams,

ESR, FEP). The presentation provided by Dr. Aydin clarified that the FEP seeks to complement existing tactical products by providing strategic information. For example, the Team recommended identifying both available indicators and ideal indicators, with a view to informing future research needs, and particular consideration if a single indicator informs multiple objectives. There are a number of ways we think about ‘indicators’ at the Council. All are helpful and are incorporated into the Council process in nuanced ways. It will be important to clarify these nuances not just with staff and the Council family, but with the broader public through outreach. It was noted there are already story-maps on the BS FEP website (<https://www.npfmc.org/bsfep/>). While these are a good first step, they are passive outreach and may be difficult to access in some communities. **The SSC encourages further exploration into active outreach opportunities that promote two-way communication.** Specifically, we recommend considerable attention be given to communicating uncertainty in long-term modelling and how this is taken into account strategically.

**The SSC recommends that the Bering Sea FEP Draft Action Model Workplans and the two proposed Action Modules move forward, and that the Council issue a call for task force membership after issues and concerns noted below are addressed.** The Action Modules identified as high priorities include the Action Module to develop protocols for Local Knowledge (LK), Traditional Knowledge (TK), and subsistence, and the Action Module to evaluate short- to long-term effects of changing climate on fish, fisheries, and the Bering Sea Ecosystem, and develop management recommendations. The SSC suggests that the Council might develop Purpose and Needs Statements for both Action Modules. Purpose and Needs Statements could be useful to the Action Module teams for clarifying and emphasizing what the Council wishes to accomplish with these teams, and should provide guidance as to the timing of work on these priorities.

**The SSC recommends that the development of ESPs and ESRs continue to be done by assessment authors and ESR authors with review by the SSC, CPT and GPT.** Further, it would be useful to clarify that the authors, CPT and GPT, and SSC will be the leads for evaluation of proposed tactical use of ecosystem information in stock assessments, status determinations, and risk tables. The two modules will be discussed separately.

The Climate Change Action Module is well written, and thought out. The module mostly supports ongoing activities, in particular, large-scale, complex modeling at the AFSC. Edits to the first, second, and fourth bullets of the Medium Term Action Module Products and Results section are needed to clarify that the exploratory research conducted for this module will inform the NPFMC of potential adaptation options to address the impacts of changing climate. The module should emphasize that that adoption of alternative harvest strategies would be considered through the existing FMP process. The SSC notes that strong communication among the Climate Module Task Team and the assessment authors, Plan Teams, and ESR authors will be needed to ensure that emerging hypotheses about mechanistic relationships governing fish or crab responses to changing climate are included in the Climate Module. The SSC supports the Team’s plan to consider a full range of models of different levels of complexity. The SSC also suggested that the Action Plan Team consider inviting a scientist who works in a different system (e.g., the Barents Sea) to provide fresh ideas about approaches to assessing climate change impacts on a sub-Arctic marine ecosystem.

The LK and TK Action Module is well written, and well thought out, although it (deliberately) leaves a great deal to be fleshed out and decided by the individuals who will be appointed to the Action Module Team. This approach has both advantages and disadvantages. It could be helpful if the Council articulated a set of questions or Council actions that would benefit from inputs from TK and LK. The SSC recognizes that there will be challenges in populating this Action Module Team. There is a wide variety of expertise that is required, and many constituencies to be represented.

Page 5, paragraphs 2, 3, and 4 under the “Membership” heading should be edited for consistency with the membership size and composition described by Diana Evans in the presentation to the SSC. The first full paragraph on page 6 should be similarly edited.

An issue of particular importance is how the gathering and use of information obtained from or about human subjects is accomplished. The SSC noted that many of the locally-initiated TK/LK information collection efforts in Alaska are executed without Institutional Review Board (IRB) approval. Many institutions have strict rules that require an Institutional Research Board (IRB) review and vet data involving human subjects. Both ethical and legal issues may be involved. **The SSC recommends that the FEP Team develop clear guidelines and standards regarding the collection of TK and LK information for integration into the Council process.**

**The SSC recommends that proposed guidelines regarding how to evaluate LK and TK information/data in Council analyses (noted as a short-term action on page 10) be developed.** There are several management action analyses currently in the pipeline that could clearly benefit from the systematic and thoughtful incorporation of LK and TK (and subsistence) information.

#### **D-7 Social Science Planning Team report**

The SSC received a presentation from Steve Kasperski (NOAA-AFSC) on the minutes from the Social Science Planning Team’s (SSPT) three-day meeting. Public testimony and written comments were received from Julie Raymond-Yakoubian (Kawerak, Inc.) and written comments were received from Amos Philemonoff, Sr. (Aleut Community of St. Paul Island).

The focus of the SSPT meeting was discussion of programmatic research issues in social science related to the Council process. There were four major agenda items: identifying qualitative and quantitative data gaps that limit the ability of social science to support the Council; enhancing cross-disciplinary social science capacity among the Council family; developing a shared understanding of multidisciplinary issues in the use of social sciences in Council processes; and strategic approaches to modifying Economic Data Reports (EDRs).

The SSC appreciates that a high-level dialogue about data gaps and methodologies is occurring within an interdisciplinary context, with a focus on how different disciplines can bring their tools to move what is currently the best scientific information available toward an “information-rich” state. **The SSC recommends the SSPT continue to focus on these and other issues related to the cross-policy application of social sciences. The SSC also reminds the SSPT to remain aware of its mandate to push the frontiers of social science methodology, but understands that a systematic data foundation must first be constructed and consideration must be given to whether and when frontier methods are best suited to Council needs and resources.**

Much of the SSC discussion focused on providing the SSPT with guidance and advice about the data, analytical, and methodological approaches discussed. Across agenda items, the SSC recommends the SSPT remain strongly focused on the needs of its audience, the Council. The initial efforts of the BSAI Crab EDR to capture detailed cost data offer a cautionary tale of how science, whose burden is perceived as being disproportionate to its utility to the Council, can set back categories of baseline data collections and analyses for decades. Thus, there is a balance to be struck between framing up what SSPT members think are the most interesting research questions related to North Pacific federal fisheries, and data and methodologies from each field that addresses the Council’s identified policy and decision support needs. Specifically, the SSC suggests that:

- **The data gap analysis be organized to emphasize gaps around questions the Council has framed for past analysis, or that have been highlighted by the SSC, for which there is clear**

**need and potential for addressing uncertainty.** Additional important gaps might identify questions the Council could have framed (drawing the distinction), with a clear nexus with the federal fisheries.

- **The SSPT consider how the Council bodies usually use the scientific information presented to them.** The Council typically receives scientific information and analysis to help them understand the effects of implemented actions, or alternative proposed actions, so it may balance competing interests. It is also worth noting that, to fulfill this role, the economic work that provides this insight is not typically of publishable quality.
- **The SSPT consider the potential need to educate the Council bodies on standards and practices surrounding methods with which they are not familiar.** For example, relative to the natural science paradigm that supports most Council action, disciplines that use qualitative methods sometimes construct hypotheses differently, have different standards of evidence, and place differing emphasis on features such as external validity, representativeness and sampling, and replicability.
- **The SSPT frame methodological discussions with an awareness that, like natural science, social sciences are evolving,** with continuously improving models and methods.

The SSPT meeting identified several concrete steps to advance the use of social science. **The SSC encourages the following activities and approaches identified in the report:**

- Reorganizing the data gaps analysis around the scale of the unit of observation, individual; communities; entity (vessels, companies); national.
- Helping Council bodies understand the distinction between systematically collected and analyzed qualitative data and anecdotes.
- Reviewing how other resource management agencies, such as the US Forest Service, use qualitative data in their decision processes.
- Considering broadly a systematic, coordinated revision to the EDRs to reflect how the data can be broadly useful independent of specific management programs.
- Increasing interdisciplinary understanding and communication within the SSPT by sharing important new research relevant to the Council during SSPT meetings.

The SSPT also reported two ongoing strategic research coordination activities. First, **the SSC supports the SSPT recommendation of a technical workshop to focus on cross-program EDR revision and improvement.** Second, one instance of the SSPT's broader initiative to integrate qualitative data is being spearheaded through the LK/TK/Subsistence action module of the FEP. **The SSC recommends that the SSPT clarify the relationship between these two bodies, and work with the FEP team to avoid duplication of efforts.** After discussion, the SSC understands the role of the SSPT to be one of coordination: the LK/TK/Subsistence Task Force will assemble a team of holders of LK and TK to identify and conduct research on the impacts of federal fisheries policy on subsistence, while the SSPT will consider this among a broader suite of qualitative approaches that can inform Council analyses.

#### **D-9 Tracking research priorities funding**

The SSC received a report from Matt Baker (NPRB) and Jim Armstrong (NPFMC) on current North Pacific Research Board (NPRB) priorities and efforts of the NPRB to coordinate research funding with Council research priorities. Public comments were provided by Gerry Merrigan (representing himself) and a written comment was received from Julie Raymond-Yakoubian (Kawerak, Inc.). The SSC greatly appreciates the time and effort made by Dr. Baker to inform the SSC about the work of NPRB and feels that the presentation

and accompanying discussions were extremely valuable to the SSC as it tries to assess, refine, and track work on research priorities.

Dr. Baker presented an overview of the NPRB mission, and how NPRB's mission is to fund research that supports improved management of marine fisheries in waters off Alaska, as well as research that improves our understanding of the marine ecosystems off Alaska. The NPRB has multiple program emphases: a core program that supports individual or small-group research projects in various areas that the NPRB deems important and which varies from one year to the next; graduate student awards to support thesis work toward a degree; large-scale Integrated Ecosystem Research Programs (IERP); a long-term monitoring program; and the North Pacific Marine Research Institute. A recently revised Science Plan provides guidance for the structure of the NPRB and a set of research themes and approaches to research. The research themes are: oceanography and productivity; fishes and invertebrates; marine birds and mammals; human dimensions; and multispecies and ecosystem interactions. Issues of particular interest that the NPRB has identified for 2019 are: anomalous conditions and ecosystem impacts; population structure and movement of pollock and cod; automated image analysis; mortality events; community resilience to ecosystem change; and trends in resource access. Potential 2020 focus sections include: identifying existing data sets and conducting research on ecosystem processes in the Aleutian Islands; forecasting the frequency of cold pool anomalies in the northern Bering Sea and evaluating the impacts of warming on recruitment, abundance, distributions, and ecosystem interactions; and examining the effect of reduced survey effort on stock assessments, uncertainty on allocation, and impacts on related data collections. The SSC believes that these focus sections are highly relevant, but suggested that NPRB consider replacing "cold pool" with the broader theme of "sea ice retreat."

The SSC appreciates the NPRB outreach efforts and the new flexibility in accomplishing this important activity. There was public testimony supporting these outreach efforts, and the SSC finds the provision of additional funding to projects that will promote outreach valuable.

There was considerable discussion of how the NPRB uses the NPFMC list of research priorities. The lists were seen as helpful to the NPRB and useful to principal investigators planning research proposals. Another issue was how the NPRB and the NPFMC might track the results of funded proposals and feed this information back into the process of setting Council research priorities. Tracking the results of funded proposals is also important to the NPRB in their efforts to develop metrics for impact and the means to identify the impact of their funding decisions. The SSC discussed multiple ways that the NPRB might improve their tracking, including reaching out to agencies to get reports on how funding has impacted their work. The NPRB is working to develop an internal database to determine: where investments have been made, what has been developed or implemented based on these investments, which priorities were funded, and which priorities were not funded and why. The SSC was supportive of these efforts, as they will also be informative to the Council in developing research priorities. The SSC noted that they would appreciate information on what topics are funded and the associated principal investigators, starting with current funding moving forward, and adding historical information when possible. The SSC suggested that it is important in the funding process to allow room for innovative proposals that involve "thinking outside the box."

During the presentation and ensuing discussion several additional issues were raised. These included: NPRB funding of management-focused research is highly valued by industry, managers, and others, as the NPRB is seen as a neutral player; the Council's list of research priorities is valued by the NPRB and influences decisions about the allocation of funding resources; the SSC suggested that a rapid response funding system when unusual events of particular significance occur would be of great value; and it was suggested during public testimony that the **Council might provide two research priority lists, one focused on management and the other on ecosystem and other science issues. It was also suggested that the Council consider an evening event at the meeting when the SSC develops the lists of research**

**priorities at which stakeholders and the public could discuss research needs.**

### **SSC Member Agenda Associations**

At the beginning of each meeting, members of the SSC publicly acknowledge any direct associations with SSC agenda items. If an SSC member has a financial conflict of interest (defined in the 2003 Policy of the National Academies and discussed in Section 3), with an SSC agenda item, the member should recuse themselves from participating in SSC discussions on that subject, and such recusal should be documented in the SSC report. In cases where an SSC member is an author or coauthor of a report considered by the SSC, that individual should recuse themselves from discussion about SSC recommendations on this agenda item, however that SSC member may provide clarifications about the report to the SSC as necessary. If, on the other hand, a report is prepared by individuals under the line of supervision by an SSC member, then that SSC member should recuse themselves from leading the SSC recommendations for that agenda item, though they may otherwise participate fully in the SSC discussion after disclosing their affiliations with the authors. The SSC notes that there are no financial conflicts of interest between any SSC members and items on this meeting's agenda.

At this June 2019 meeting, multiple SSC members acknowledged associations with specific agenda items under SSC review. Matt Reimer and Mike Downs acknowledged their membership on the SSPT (D-7 SSPT Report). Jason Gasper noted that he contributed to the analysis and development of C-3 2018 Observer Annual Report. With respect to D-1 Salmon Bycatch, Andrew Munro acknowledged that he has provided previous reviews of the Gulf of Alaska Chinook bycatch reports as part of his role at ADF&G and has been part of the bycatch genetics working group, helping to organize the April workshop and contributing to writing sections of the workshop report. With respect to C-1 BSAI Crab, Anne Hollowed supervises Jim Ianelli who contributed to the development of GMACS for SMBKC and BBRKC, Buck Stockhausen who is the assessment author for EBS Tanner crab and Pribilof Islands blue king crab, Cody Szuwalski who is the assessment author for EBS snow crab and Pribilof Islands red king crab, and Martin Dorn who is the co-chair of the CPT. Brad Harris, Heather Renner, and Ian Stewart acknowledged their membership on the Bering Sea FEP Team (D-6 Bering Sea FEP Team Report) with Brad Harris noting that he did not contribute to the two modules being reviewed at this meeting.