



North Pacific Fishery Management Council

Simon Kinneen, Chair | David Witherell, Executive Director
1007 W. 3rd Avenue, Suite 400, Anchorage, AK 99501
Phone 907-271-2809 | www.npfmc.org

FINAL REPORT of the SCIENTIFIC AND STATISTICAL COMMITTEE to the NORTH PACIFIC FISHERY MANAGEMENT COUNCIL January 27th – 29th, 2020

The SSC met from January 27th through 29th at the Renaissance Hotel, Seattle, WA.

Members present were:

Anne Hollowed, Co-Chair
NOAA Fisheries—AFSC

Chris Anderson
University of Washington

Mike Downs
Wislow Research

Brad Harris
Alaska Pacific University

Dayv Lowry
Washington Dept. of Fish and Wildlife

Kate Reedy
Idaho State University Pocatello

Sherri Dressel, Co-Chair
Alaska Dept. of Fish and Game

Amy Bishop
Alaska Sea Life Center

Jason Gasper
NOAA Fisheries – Alaska Region

George Hunt
University of Washington

Franz Mueter
University of Alaska Fairbanks

Matt Reimer
University of Alaska Anchorage

Alison Whitman, Vice Chair
Oregon Dept. of Fish and Wildlife

Curry Cunningham
University of Alaska Fairbanks

Dana Hanselman
NOAA Fisheries—AFSC

Gordon Kruse
University of Alaska Fairbanks

Andrew Munro
Alaska Dept. of Fish and Game

Ian Stewart
Intl. Pacific Halibut Commission

SSC Election of Officers

The SSC elected Anne Hollowed (NOAA-AFSC) and Sherri Dressel (ADF&G) to serve as co-chairs for 2020. Dr. Hollowed will act as chair for the February, April, and December meetings, and Dr. Dressel will chair the June and October meetings. The SSC also elected Alison Whitman (ODFW) to serve as vice chair. The SSC extends gratitude to Gordon Kruse (UAF) for his service as SSC co-chair. We look forward to his continued guidance and thoughtful advice as an SSC member.

SSC Administrative Discussion

Diana Evans (NPFMC) reported on the status of the SSC Handbook. Some of the revisions previously recommended by the SSC awaited changes to the Council's Standard Operating Procedures (SOP). Diana reported that the Council approved the corresponding changes to their SOP so that all SSC recommended changes are now approved. Diana also reported that the Council's move to their new office has been completed and that an open house is being planned. Finally, Diana highlighted that the April 2020 SSC meeting will be a busy meeting as the SSC will be taking up research priorities, as well as other items including salmon genetics and essential fish habitat. A full 3-day meeting is being planned.

B-4 Alaska Fisheries Science Center Report

The SSC appreciates the comprehensive report from Dr. Robert Foy (Science and Research Director, NOAA-AFSC) on the Alaska Fishery Science Center's (AFSC) current budget challenges and operational

priorities. While decreasing operational funds are disappointing and challenging, we are encouraged that the AFSC has finally been able to increase staffing levels after years of declines. Dr. Foy highlighted the challenges faced by the AFSC associated with a changing climate, which have increased the complexity and scope of its monitoring and research needs. Maintaining the current assessments of fish, crab, and marine mammal stocks and supporting analyses and obligations of NOAA and the Council remain core priorities. However, given the reality of shrinking or flat budgets, meeting these challenges will require a reassessment of the appropriate balance among the needs for resource surveys, stock assessments, ecosystem and process research, the observer program, marine mammal research, and socio-economic research.

The SSC has long been on record advocating for prioritization of basic survey data collection and notes that assessment models and other analyses are only as good as the data supporting them. While data analyses can be refined when the need arises and as resources allow, data collection cannot be done retrospectively. Adequate data collection is essential to assessing the status and trends of biological resources, supporting both foreseeable and unanticipated analyses and management needs in the future, and dealing with surprises. While the SSC realizes the need for finding efficiencies in data collection, support for the core data requirements for management must be sustained.

It was noted that a recent ICES workshop on trade-offs associated with different survey designs and levels of survey effort may yield fruitful avenues for evaluating alternative sampling strategies. Three SSC members participated in this workshop (Anne Hollowed (NOAA-AFSC), Curry Cunningham (UAF) and Dayv Lowry (WDFW)). One of the challenges identified in the workshop was the trade-off associated with optimizing survey designs across different species, which will require choices about how to weight the importance of different species based on socio-economic, ecological, or other considerations.

Dr. Foy also highlighted the Center's investments in new and innovative approaches to monitoring and research. The SSC notes that in developing new approaches for monitoring populations (e.g., drones), catches (e.g., electronic monitoring), or biological parameters (e.g., new aging methodology), care needs to be taken not to compromise existing time series. Similar to balancing trade-offs among survey designs, the use of new technologies should be rigorously evaluated to assess the costs and benefits relative to established approaches, and to ensure the comparability of data time series. However, investment in innovative approaches to monitoring and basic research is clearly warranted, even if the benefits may not be immediately obvious, but if at all possible with current staffing, alternative funding sources and mechanisms should also be explored to support such work.

The SSC emphasizes that the Alaska region is facing unique challenges associated with climate change. Fish populations are expanding into new areas that: (a) have not had regular surveys in the past, such as the northern Bering Sea; (b) are currently closed to commercial fishing, such as the Chukchi Sea; and (c) extend across national borders, such as Russian waters. Examples of how the expanding geographic distribution of commercial stocks has impacted the AFSC's activities are the addition of the northern Bering Sea survey at the expense of the slope survey and the need for collaborating with Russian scientists to understand the changing distribution of shifting stocks (e.g., Pacific cod). Climate change is occurring faster in the Arctic than at more temperate latitudes. **The rapid rate of change in the Alaska region requires not only continuing survey efforts in current regions and expanding survey efforts into additional areas, but also expanding the amount of ecosystem and socio-economic research and monitoring necessary to understand the changes that are occurring and the impacts the changes are having. This is not possible under current funding levels. The SSC suggests that meeting the unique challenges facing federally managed fisheries off the coast of Alaska cannot be achieved through more efficient operations alone, but will require new funding, possibly from novel sources, for research and monitoring.**

Much of the work of the AFSC is achieved through collaborations and partnerships with the industry, other agencies, and universities. **The SSC encourages the AFSC to explore additional opportunities for**

collaborations between scientific researchers and industry, agencies, and academia. Further, the SSC noted that research set-aside programs for scallops, monkfish, and herring have been employed to support new and ongoing research and monitoring in New England.

The SSC appreciates receiving this report on the AFSC budget and priorities, as well as the AFSC's efforts to maintain delivery of high priority services to the Council under current strained federal budgets.

C-2 BSAI Crab

The SSC received a detailed report on the January 2020 Crab Plan Team (CPT) meeting from Jim Armstrong (NPFMC) and Martin Dorn (NOAA-AFSC). Public testimony was provided specifically for the Norton Sound Red King Crab stock assessment, which is characterized below. The SSC also provided comments on select CPT agenda items.

Norton Sound Red King Crab

The Norton Sound red king crab stock assessment was presented by Martin Dorn (NOAA-AFSC). Public testimony was provided by Adem Boeckmann (Norton Sound crab fisherman) and Scott Kent (Norton Sound Economic Development Corporation). Both expressed their concerns about the conservation of this stock. Low confidence in stock abundance estimates was noted, given the few crab caught in the NMFS and ADF&G trawl surveys and their relatively narrow spatial distribution. Mr. Boeckmann also presented data from Jenefer Bell (ADF&G) on clutch fullness from female crab caught during a tagging study, trawl surveys, and by fishery observers. According to the data tables and graphs presented, in 2019, approximately 50% of females had empty egg clutches, indicating reproductive failures associated with shortage of mature males. Changes in the spatial distribution of red king crab with stock increases (expansion) and decreases (contraction) were noted. In 2019, a sharp drop in fishery CPUE, associated with failure to find crab concentrations in adjacent areas, indicated low stock size. Based on these observations, Mr. Boeckmann did not feel that a fishery was advisable in 2020, whereas Mr. Kent supported an increase in the buffer between OFL and ABC from 20% to 25% as recommended by the CPT.

The Norton Sound red king crab stock assessment is a length-based model of male crab abundance involving data from four surveys: preseason summer pot, summer trawl, summer pot and winter pot. The stock assessment for 2020 was conducted with the following updated data: (1) commercial catch CPUE standardized over the full time period (1977-2019), rather than two separate time periods (1977-1993, 1994-2019); (2) recent winter and summer commercial fishery harvest, discards, and length compositions; size composition data were not collected for retained crab in the 2019 winter commercial fishery due to low harvest; (3) new tag recovery data from 14 crab for 2019; and (4) abundance estimates and associated data (e.g., length frequencies) from the 2019 ADF&G and NMFS trawl surveys. The SAFE provided supplementary information in four appendices: A – assessment model description, B – CPUE standardization, C – estimation of discards from the summer fishery, and D – plots (Q-Q plots, residuals, etc.) for base model 19.0 and alternatives 19.1-19.5.

The base model and five alternatives were examined:

- Model 19.0: Base (Model 18.2b)
- Model 19.1: Model 19.0 + Tag recovery data just for 1 year
- Model 19.2: Model 19.0 + NOAA trawl survey $q = 1.0$, estimate ADF&G survey q
- Model 19.3: Model 19.0 + Estimate survey q 's for both surveys
- Model 19.4: Model 19.0 + Estimate M equal for all lengths + dome-shape selectivity for trawl and summer commercial fishery (maximum selectivity 94-103 for trawl, 104-113 for commercial)
- Model 19.5: Model 19.0 + Estimate M equal for all lengths + dome-shape selectivity for trawl and summer commercial fishery (maximum selectivity 104-113 for trawl, 114-123 for commercial)

This assessment focused on the base model (Model 19.0) and the CPT continues to recommend adopting this model. The SSC agrees. Using Model 19.0, the estimated 2020 mature male biomass (MMB) is 1,660 t, which is near the all-time low estimated in 1982. **Based on Model 19.0, stock biomass is above MSST so the stock is not overfished, and retained catch during 2019 did not exceed the OFL for this stock so overfishing is not occurring.** However, in the 2019 fishery, commercial harvests were well below the 2019 ABC. Poor fishery performance was attributed to: (1) late ice buildup preventing winter fisheries; (2) reduced participation in the summer commercial fishery; and (3) low CPUE. One optimistic sign is that the most recent (2019) recruitment estimate from length-based analysis is the largest on record since 1976 (Table 13), driven by increased catches of small individuals in 2018-19 trawl surveys. However, the abundance of this year-class remains quite uncertain as it will be 2-3 years before these small crab grow enough to enter the fishery.

This stock has been managed under Tier 4. Tier 4 stocks are assumed to have reliable estimates of current survey biomass and instantaneous M . However, biomass estimates for Norton Sound red king crab are uncertain. As an example, in 2019 the abundance estimated by the ADF&G trawl survey was roughly double that estimated by the NMFS trawl survey. Both surveys encountered very high catches at individual stations but at different locations; in the case of the NMFS survey, the high-catch station was outside the standard ADF&G survey area. Also, a long-standing challenge for this assessment is a tendency for the model to project higher abundances of large-size males (>123 mm CL) than observed. Computationally, the issue was addressed by setting natural mortality M to be ~3-4 times higher for the largest size class relative to smaller size classes. It remains unclear whether such a sharp increase in M is real, owing to unknown causes, or whether there is another explanation, such as large crabs moving outside the survey area. Members of the public provided testimony that crab are not moving outside the survey area, based on wide-spread fishing effort and local knowledge shared by Mr. Boeckmann.

MMB is estimated to be below the B_{MSY} proxy, so this stock falls under Tier 4b. The resulting calculations provide a retained catch OFL of 0.287 million lb (0.13 thousand t) for 2020. The SSC endorses this OFL as recommended by the authors and CPT.

The CPT recommended increasing the buffer between OFL and ABC from 20% to 25% in 2020 on the basis of very low summer fishery CPUE and unusually large numbers of old-shell males in the fishery in 2019. However, the SSC is quite concerned about this stock and instead recommends a more conservative 30% buffer resulting in an ABC of 0.201 million lbs (0.09 thousand t) for 2020.

The SSC justifies a 30% buffer based on the following concerns:

- 1. Considerations of other stocks with similar levels of uncertainty**
- 2. Concerns with model specification in part indicated by a positive retrospective pattern, whereby successive assessments indicate increasingly pessimistic estimates of stock size for the same years. The full magnitude of the retrospective bias is unknown given that peels of the data go back only a few years. The cause(s) of the pattern are unknown**
- 3. Shortage of discard data and resultant inability to manage the stock based on total catch, which is the standard for federal fisheries**
- 4. Unresolved issues associated with the apparent high M for the largest size class**
- 5. Discrepancies in stock size estimates between ADF&G and NMFS surveys as well as concerns about the spatial distribution of crab relative to the survey footprint**
- 6. Very low fishery CPUE and inability of the fishery to attain the ABC in 2019**
- 7. Unusually large numbers of old-shell males in the fishery in 2018-2019**
- 8. High proportions of barren females in survey and fishery observations indicating some reproductive failures in 2019**

9. **Below-average numbers of prerecruits (<94 mm CL) in 2015-2018 suggesting that below-average recruitment to the fishery will be experienced for several more years**
10. **High uncertainty in the magnitude of the most recent year class (prerecruits in 2019), preliminarily estimated to be large. However, these small crab are several years away from recruiting to the fishery as legal crab and they are challenged by unprecedented recent increases in Pacific cod, a crab predator, in Norton Sound.**

The SSC appreciates the authors' attempts to address the previous CPT and SSC recommendations and provides the following further guidance for additional work. Many of these issues were topics of discussion at the CPT meeting. Among these, a leading concern is the continued use of retained catch OFLs and ABCs, rather than total catch OFLs and ABCs, which is the standard for federally managed fisheries. The SSC appreciates the authors' attempt to generate preliminary discard estimates in Appendix C of the assessment. However, as pointed out by the CPT, a more complete description of alternative methods to calculate discards is needed to evaluate a potential way forward. The SSC also reminds the authors of the SSC's suggestion from October 2019 in which the authors were encouraged to consider using dockside interviews as an approach to compare with analytical predictions of discards. The goal is to set OFLs and ABCs in terms of total removals (total fishing mortality). Accurate estimates of discards are even more important now, given low CPUE of legal males and the apparent very high abundance of sublegal crab. The SSC recommends that the assessment authors place top priority on working on this topic for next year's assessment and supports the CPT's recommendations in this regard.

Some previous SSC comments were not resolved. For example, the SSC suggested that a thorough examination of the spatial distribution of red king crab, in particular spatial differences in size composition, across the northern Bering Sea beyond Norton Sound would be helpful as it could provide insights into potential movement of large-size crab outside of the survey area. Also, the SSC had previously noted the number of crab caught per trawl appears to be very small in most cases with many zeros for both the ADF&G and NMFS surveys. In fact, in 2019, the NMFS trawl survey caught red king crab in only 10 of 16 stations and the ADF&G trawl survey caught king crab in only 27 of 52 stations. Based on such observations, the SSC had also earlier suggested that it might be useful to compare the ADF&G and NMFS surveys using appropriate methods for zero-inflated distributions, such as those offered in various R packages (e.g., pscl, gamlss, INLA, VAST, glmmfields). The authors responded that examination of the spatial distribution is a task more appropriate for NMFS and they also indicated lack of familiarity with the aforementioned packages for spatial modeling. The SSC suggests that treatment of survey data is critical to the Norton Sound red king crab stock assessment and encourages the assessment authors to pursue such spatial analyses through collaboration with experts in these techniques. The SSC highlights the portion of the NMFS survey that lies west of the ADF&G survey footprint, which contained crab not used in the abundance estimate, and suggests that methods directly estimating the spatial correlation structure among the data may provide a basis for estimating model-based indices that incorporate all available data and are robust to changes in survey footprint. These facts suggest that new field work may be needed to examine potential shifts in spatial distribution of the stock and raises questions whether a different survey design may be appropriate. Such concerns motivate the SSC's recommendations to conduct spatial analyses.

Previously, the SSC encouraged bringing local and traditional knowledge into the assessment. The authors sought clarification from the SSC about how to do this. The SSC reiterates its February 2019 recommendation regarding local and traditional knowledge. As stated in the minutes from that meeting:

Local and traditional knowledge: Both summer and winter fisheries for red king crab have been taking place in Norton Sound as well as in Kotzebue Sound for a long time and the SSC suggests that local commercial fishermen may have considerable knowledge about spatial patterns in size distributions, changes in spatial distribution, migratory behavior, and other aspects of red king crab dynamics in the region, as may local subsistence users of the resource, including elders. For instance, local users may possess valuable insights into the disposition of the "missing" large male

crab. We strongly encourage the authors, through collaborations at the local level, to consider these sources of knowledge.

Regarding the authors' question about how to do this, the SSC notes that there are individuals with this expertise within NMFS and ADF&G who could help facilitate those collaborations, as well as several entities within the region including, but not limited to, NSEDC and Kawerak, Inc.

Previously, the SSC noted that new maturity studies are needed to improve the assessment as current estimates are based on a proxy method by applying the ratio of male to female size at maturity from the Bristol Bay red king crab stock to female size at maturity for Norton Sound. The SSC appreciates the addition of new chela and carapace size data from 97 males collected in 2019, and agrees that no obvious break-point is indicated by these data. Lacking new maturity data from Norton Sound red king crab, the SSC had previously suggested that the authors explore availability of Russian data on maturity. It is not clear whether the authors have been successful in locating Russian data for red king crab in the western Bering Sea. The SSC believes that maturity data are available from Norwegian and Russian scientists on the Barents Sea stock of red king crab. The SSC further suggested that a potential relationship between maturity and temperature across all stocks that have maturity data should be explored for potential predictive capability for Norton Sound. The SSC suggests that a meta-analysis of available size at maturity across red king crab stocks with respect to temperature may have the potential to demonstrate a temperature effect that could then be used to predict mean size of maturity for Norton Sound using local temperatures.

The SSC appreciates the evaluation of retrospective model performance but reminds the authors that retrospective analyses should be extended to peel more than 4 years; typical retrospective analyses are conducted over ~10 years. The SSC joins the CPT in continuing to recommend an attempt to conduct 10-year peels for retrospective analyses. The SSC notes that, even with just four peels, there is a tendency for estimates of current-year biomass to become smaller each year with the addition of new data (Figure 18). Retrospective bias and its potential causes are important areas to explore more thoroughly.

The SSC supports the 13 bulleted CPT recommendations for the authors, as well as the CPT suggestion that a model run without shell condition data would address whether estimates of high terminal M is driven by inaccurate shell condition data. The SSC agrees that this is an interesting possibility that should be considered.

Finally, the SSC offers the following new recommendations:

1. For future model comparisons, please plot time-series for all models, including the base model on a single plot for the figures presenting biomass and recruitment estimates.
2. Provide additional information and clarification on the data-weighting approach for size-composition data in this assessment. Specifically, provide a justification for the arbitrary minimum sample sizes (10 or 20) applied to all but tag size-composition data, report the harmonic mean-implied sample size (the average is a biased estimate for the multinomial), and provide standardized (Pearson) residuals in the residual plot including a legend showing the scale of the reported residuals.
3. Explore widening the area used for the NOAA trawl survey biomass estimate and explore the effect on estimated catchability. The current catchability estimate is less than one and this may be related to the fact that crab are found outside of the standard area. In addition, please explore whether crab catches are also included from outside the assumed survey area.
4. Report time series of the proportion of barren females in the SAFE and address their utility to indicate reproductive concerns for the stock. Specifically, consider caveats to the interpretation of this proportion, address whether this proportion has changed over time, and compare these proportions to other managed red king crab stocks.

Under agenda item D7 Economic SAFE, the SSC requests the development of a quantitative baseline of annual community engagement and dependency for Norton Sound red king crab. There may be ways for the assessment authors to assist in this effort.

Fishery Update

It was reported that ADF&G is currently recalculating time series of total catch using standardized methods. The SSC supports this effort and supports the CPT recommendation to use the 1995 start date for revising the catch time series. This start date corresponds to the standardization of data collection and storage methods. Modeling efforts may still use catch data prior to 1995. **The SSC also supports the CPT recommendation that each assessment should evaluate the impact to the current base model of shifting to these new catch time series.** The SSC also supports the CPT recommendation to consider making raw data available to stock assessment authors through AKFIN or an alternative on-line application, highlighting that this has been very helpful for groundfish and economic data users. Length-weight relationships are based on the NMFS trawl survey which occurs in the summer, while the fishery occurs in the winter, so the SSC recommends examining the relationship for specimens collected in the fishery.

Ecosystem and Socioeconomic Profiles

The SSC commends the development of the ESP for St. Matthew BKC and was pleased to see continued discussion about crab ESPs. The SSC encourages the ESP team to carefully choose indicators that are relevant to specific crab stocks. Given recent NOAA research that points to increased concerns about the detrimental effects of ocean acidification (OA) on crab stocks, the SSC strongly encourages the development of OA indicators that are geographically appropriate for each stock. The SSC looks forward to an ESP for Bristol Bay RKC, but also would like to see ESPs conducted on other stocks before they become a conservation concern. Priorities for ESPs will likely be based on economic value, but ESPs may also be useful to develop for stocks with unique ecological niches such as Aleutian Islands GKC.

Regarding ESPs in general, the SSC recommends development of a method to aggregate indices into a score that could be estimated over time and compared to stock history. One potential pathway forward may be to normalize and use an unweighted sum of all the indicators where all time series overlap, or just assign +1 or -1 to each indicator so that a neutral environment would be zero.

St. Matthew BKC Rebuilding Plan Update

An update was presented on the current status of the SMBKC rebuilding plan, and the SSC supports the CPT recommendations for better documentation of the choices for recruitment time series selections, stock-recruit functions, and estimates of generation time that form the basis of rebuilding time estimates. The SSC also fully supports the CPT recommendation to fully quantify and incorporate uncertainty in stock projections.

Aleutian Islands GKC Proposed Model Runs

The SSC was presented with an update on CPT discussions regarding the development of the Aleutian Islands GKC stock assessment. The SSC supports expanded analysis of cooperative survey data and reaffirms its request for expanded documentation of cooperative survey design, including such things as the areas sampled, size composition, and expanded results. Specifically, the SSC supports exploration of treating pot number as a random effect nested within vessel, or possibly string, and encourages exploration of alternative mixed-effects model structures that align with assumptions of the survey design. To constrain model flexibility to an appropriate level, the SSC requests further evaluation of the knot structure for non-linear smoothers that is biologically realistic and consistent with survey design. The SSC reiterates its request for a brief description of the cooperative survey in the assessment document, including the area sampled and size composition. The SSC looks forward to evaluation of how inclusion of the cooperative survey influences model results.

The SSC appreciates the thorough examination of fishery CPUE models and the detailed appendix describing them. The SSC was curious about the advantage of including the year:area interaction term as that is not traditionally how standardizations are done, as the interaction makes the individual year effect no longer an easily used unbiased index of abundance. However, the cited paper by Campbell (2004) provides a number of reasons why the year:area interaction should be used, but notes that the interaction complicates the extraction of the index. The rationale for including the interaction would be that the spatial footprint of the fishery is contracting or expanding throughout the time series. The SSC would like to see what three or four individual models for an aggregation of like areas would compare when summed up to the year:area interaction model. In addition, the SSC requests that a time series of spatial fishery heatmaps of the fishery footprint would be useful in evaluating the rationale for the year:area interaction effects and differing area-sizes chosen. The SSC also recognizes that these details may have a very low impact on model results, so if other items are of higher priority, these analyses can be delayed.

The SSC also reiterates the CPT request on the rationale for the 0.7 sigma-R criterion for recruitments included in the estimation of reference points as this does not seem justified at this point. The specification of sigma-R is not necessarily related to the uncertainty of individual recruitment estimates.

The SSC agrees with the CPT that the maturity analyses did not yield any obvious sign of a good breakpoint in maturity that would support a change in the model. The SSC recommends continued analysis to validate maturity estimation including presentation of logistic parameter uncertainty, and the potential initiation of efforts to collect additional data from smaller individuals, recognizing that sampling these individuals is challenging.

The SSC supports the CPT's recommendation to explore models 19.1b, 19.1d, 19.2, and 19.2b for the May meeting that explore new recruitment time series, different formulations of CPUE standardization and the inclusion of cooperative survey CPUE.

Bering Sea Fishery Ecosystem Plan

The SSC shares the CPT's concern that these FEP Action Modules may inform changes to our Council process, therefore the Plan Teams and SSC should be included before any major recommendations or conclusions are finalized.

Projections

In October 2019, the SSC requested standardized projections for instances in which the entire OFL is not harvested:

The SSC requests that the CPT consider developing a standard approach for projecting the upcoming year's biomass that does not include removing the entire OFL for stocks where recent mortality has been substantially below the OFL. This may appreciably change the projected biomass levels for stocks such as Tanner crab, where actual catch mortality has been less than 10% of the OFL.

The CPT chair thought this might be too confusing to stakeholders, but the SSC notes this has been standard practice for groundfish for almost a decade and feels that tables could be properly labelled to avoid confusion. The CPT proposed to add a 5-10 year projection table in the SAFE based on catches under the state GHs. The SSC encourages the CPT to continue exploring the most appropriate method for providing this additional set of projections and bring their specific recommendation back to the SSC for review.

Economic SAFE

The SSC appreciates continued progress in responding to SSC requests to improve the Economic SAFE for crab stocks, and supports the development of report card indicators for key economic factors. Detailed SSC comments on the crab Economic SAFE are provided under agenda item D7.

ADF&G Crab Observer Program

The SSC was given an update on some of the challenges and development of the crab observer program conducted by the state of Alaska. One challenge is that having a large proportion of new observers each year causes issues with continuity and training. The SSC supports expanded research to identify the optimal ratio of measure to count pots to meet data needs for assessment. The SSC further supports looking at variance estimates for catch data from the program to help inform effort/resources to spend on it, and what sample sizes are necessary to achieve adequate precision. The SSC recommends that the program consult the catch accounting staff at the AKRO and the observer staff at AFSC who have years of experience analyzing catch variances.

GMACs

The SSC is very pleased with the progress on GMACs. The SSC continues to strongly support the development of a generalized framework for conducting crab stock assessments and looks forward to continued adoption for other crab stock assessments. Several extensions to accommodate features of existing analyses, including the addition of a terminal molt, are still under development and will be welcome additions given the potential to extend the framework to different life history types (e.g., snow and Tanner crab). The SSC commends the work of the development team with regard to newly implemented features and supports the plans for new features that were presented at the workshop. The SSC looks forward to continuing to review the framework after significant development milestones are achieved as well as review of specific management applications.

C-4 Initial Review - Economic Data Reporting Revisions

The SSC received a presentation from Scott Miller (NOAA-AKRO) on an RIR analysis of proposed amendments to the Economic Data Reporting (EDR) programs. There was no in-person public testimony, though written testimony was provided by Chris Woodley (Groundfish Forum).

The SSC commends the analyst on the care taken to capture NMFS and user costs in complying with various EDR regulations. **After moderate revisions, the SSC recommends the analysis can be advanced for final action.**

The SSC finds the first two components of Alternative 2 to be sensible regulatory cleanup, which will enhance the ability to do insightful regulatory analyses without reducing data quality, validity, or reliability within standard confidentiality practices for similar data.

The cost analysis for Component 1 is well done, and the analyst has identified the best information available to support the claim that incidents of intentional misreporting are unlikely to rise if current quality assurance/quality control practices are maintained. It is clear, however, that it would be beneficial for data integrity to maintain audits for non-compliant entities. The SSC suggests updating the cost estimates of the alternative to reflect the new interpretation of the status quo as authorizing, rather than requiring, third party audits so as not to overstate these savings to the public.

The cost analysis for Component 2 is clear, as are the analytic benefits for the Council of increasing the accessibility of EDR data by revising confidentiality practices to be consistent with those NMFS uses for other, similar data.

The SSC finds that the third component of Alternative 2 would eliminate a data program that has proven its utility in a number of key Council analyses, and that is central to complying with National Standard 2 in pursuit of National Standard 8, as well as human benefits expressed in optimum yield in National Standard 1. The SSC recommends modifying the analysis to highlight the value of this information as well as its costs.

This package lacked a specific EDR revision to analyze, and hence it provides only an analysis of the elimination of the GOA Trawl EDR program relative to the status quo. Against the alternative, the SSC notes that the utility of these data in Council analyses has proven itself; they allow a scientific portrait of the fishery for social and economic assessment and characterization of the footprint of employment,

including compensation to captains, crew and processing workers for multiple fisheries in the GOA. The SSC acknowledges this program was designed to capture a baseline economic status in anticipation of a catch share program that has been “suspended indefinitely.” However, **while this type of pre-implementation baseline information was identified as missing through review of past catch share programs (i.e., crab rationalization), it is also essential for evaluating any future Council action.** The GOA trawl fleet is experiencing changes in the availability of several key resources, which makes them likely to be subject to future Council actions directed at improving the social and economic resilience of this fishery. For these programs to be designed or evaluated, whether or not they involve a catch share program, data from the GOA trawl EDR effort provides crucial monitoring and baseline information. To strike a policy balance for this fishery, it is essential that the demonstrated value of these data is represented in the analysis to be weighed against the submitter reporting burden and unrecovered agency cost.

C-5 Initial Review - Removing processing restrictions for squid and sculpins

The SSC received a presentation from Steve MacLean (NPFMC) regarding the initial draft of a Regulatory Impact Review (RIR) dealing with processing restrictions for incidentally harvested squids and sculpins in the Bering Sea (BS) and Gulf of Alaska (GOA). In-person public testimony was received from Shannon Carroll (Trident Seafoods) and a comment letter was submitted through the online portal by Chris Woodley (Groundfish Forum).

Prior to 2017, squids (a complex of 15+ species) were managed in both the BSAI and GOA as Tier 6 species, due to high variability and uncertainty in estimates of their biomass. Harvest, however, was largely incidental to pollock fishing and landings were typically sold as bait, for human consumption, or ground into fishmeal. In June 2017, the Council took final action to move squids into the Ecosystem Component (EC) species category in both the BSAI and GOA Fishery Management Plans (FMPs). To prevent targeted fishing of this complex, a 20% of basis species maximum retainable amount (MRA) limit was put into place. Though landings of other EC species (e.g., forage fish and grenadiers) identified in the FMPs are required by regulation to be processed into fishmeal, the 2017 Council action and supporting analysis indicated that historical uses of squid for bait and human consumption would continue after re-classification as an EC species. Federal rulemaking to enact this action, however, applied the fishmeal-only processing limitation.

Sculpins are a diverse complex of species whose biomass is dominated by a handful of large species. Through 2019, sculpins were managed as Tier 5 species in both the BSAI and GOA, with abundance estimates coming from the respective bottom trawl surveys. Due to a lack of targeted fisheries and little interest in market development, however, the Council took action in October 2019 to reclassify sculpins as EC species in both FMPs, also with a 20% MRA threshold. Though this action is currently undergoing final rulemaking, which will apply the standard EC species provision requiring processing retained catch as fishmeal, the analysis indicates this would needlessly increase wastage via at-sea discard and limit flexibility of sculpin utilization.

This RIR evaluates two alternatives relative to the processing of squids and sculpins in the BSAI and GOA:

- Alternative 1. Status quo, with squids and sculpins defined as non-target EC species with a prohibition on processing them into anything other than fishmeal.
- Alternative 2. Retaining the definition of squids and sculpins as non-target EC species but with no processing limitations.

The analyst succinctly summarized the events leading up to the need for this action and, within confidentiality constraints and other data limitations, provided a compelling evaluation in support of Alternative 2. The SSC notes that the analysis also takes advantage of a limited natural experiment. In 2019, the first year that squid was classified as an EC species, many of the processors were unaware that squid could not be processed as anything but fishmeal. However, by the end of July, NMFS informed processors of this prohibition. Thus, there was a mid-season change in the (known) processing restrictions. If there

was an increase in the degree to which the industry attempted to avoid squid because of this change, the data would show a decrease in squid landings after the end of July, relative to other years when there were no restrictions on processing. Figures 4-3 and 4-4 show that there is no noticeable difference in the seasonal patterns in squid landings after the end of July 2019. In fact, there are actually more squid landings in the latter half of the year in 2019. This indicates that squid landings are likely being driven by factors other than sale as bait or for human consumption. While there is only one year of data from which to draw this conclusion, it provides some evidence to suggest that squid encounters (or landings) are not likely to increase if processing restrictions are lifted. The case for consideration of Alternative 2 for squids is stronger than for sculpins. Historically, squid have been processed for bait and sold and this product is still in demand as demonstrated in 2019. The case for sculpins hinges on the need to retain marketing flexibility for a species that has never been aggressively marketed. **The SSC feels that the RIR can be advanced to final action after several crucial revisions are made.** These include:

- The document presents data from the last full assessments for squid (2015 and 2016) and sculpins (2017). The SSC feels that it is important for the document to include the following updated data through 2019: BSAI squid catch, BSAI squid biomass estimates, and value of the catch including the actual (or estimated) value of the squid catch in 2019 (e.g., see Table 3-3). Tables 3-2 and 3-3, and Figures 3-1 and 3-2, should be updated with the most recent biomass estimates for squids and sculpins, respectively. Additionally, on Table 3-2 the column headers should be adjusted to better center regional labels over the squid species with which they are associated. This is especially true for the Aleutian Islands. Catch data and fishery value data should be updated in all appropriate locations to facilitate evaluation of recent fishery trends. **Of particular note is the abrupt increase in incidental catch in 2019. This updated information is critical for transparency for public review, especially with respect to squid.**
- The next version of the analysis should contain a qualitative discussion of the potential impacts on local catcher vessel operations/costs of the ability or inability of local processors to process squid for bait to capture more fully community impacts of continuing to prohibit (Alternative 1) or of allowing (Alternative 2) the processing of squid into products other than fishmeal.
- The next version of the analysis should contain a qualitative discussion of the potential for squid processing to foster expanded shore-based processing opportunities, in whatever product form, in Alaska communities.
- Additional discussion should be presented on the downstream markets for squids and sculpins, and how the actions under consideration would impact those markets. For example, the fixed-gear groundfish fleet in the North Pacific is a primary consumer of squid as bait, and thus, restrictions on processing squid would likely impact local bait markets.
- The document notes on page 37 that the main communities processing squid are Dutch Harbor/Unalaska and Kodiak. In Table 4-6, processing volume figures are presented for those two communities, while volumes processed in other communities are combined into an "other" category to address issues of confidentiality. This is appropriate for fishery volume or value data but prevents the determination of the universe of communities involved in the processing sector of the fishery, which is especially important given that the total processing volume of "other" communities often exceeds that of Dutch Harbor/Unalaska and/or Kodiak in any given year. The SSC recommends that the next version of the document include an additional table providing a simple count of shore-based processing entities active in squid processing by year and by community of operation 2009-18 (without confidential volume or value information) to allow for determination of sustained engagement of fishing communities in squid processing and trends of change in that engagement

(consistent with National Standard 8). This, in turn, will inform analysis of the potential distribution of anticipated beneficial community impacts under Alternative 2.

- The analysis should present details of the anticipated effects of Exempt Fishing Permit (EFP) 2019-03, which evaluates various aspects of electronic monitoring in BSAI and GOA pollock catcher vessels using pelagic trawl gear. This permit requires 100% retention of incidentally caught species and development of relevant performance metrics. The RIR should briefly describe this permit in section 4.5.1.2 Description of Current Management.

Finally, **the SSC would like to reiterate two concerns raised in our minutes from 2017 during the review of squid reclassification as EC species.** At that time, we noted that movement of a species into the EC classification was not necessarily a one-way ticket and that development of future markets could necessitate their reclassification as fishery target species. This may be especially pertinent now given recent declines in squid biomass off the eastern coast of Japan and China, in which market demand for these species is high. At this time, the SSC also raised concern about the continued need to document and report species within a complex to the species level during survey and, when practicable, fishery operations. With the potential for species-specific range shifts to occur in response to climate change, it is imperative to document species-specific abundance shifts as well, rather than aggregating to the complex level.

D-3 Bering Sea Fishery Ecosystem Plan Action Module Update

Climate Change Task Force

The SSC received an update from Diana Stram (NPFMC) on results from a one-day WebEx workshop held by the Climate Change Task Force (CCTF) to continue developing their work plan. The SSC commends the CCTF on their work so far, which was compromised by the inability of the task force to conduct a full, in-person meeting due to an unanticipated climate event (a winter snow storm in Seattle). We provide the following comments on the current draft work plan and look forward to an updated version from the full CCTF meeting, tentatively scheduled for late February.

The goal statement for the CCTF was expanded to “encourage transparent, effective, and dynamic communication and engagement of communities, fishers, managers and other stakeholders and the Council.” While this is a worthy goal, it is not specific to the CCTF and, if needed, could simply be highlighted as an operating principle for the task force, rather than an explicit goal.

Other, mostly minor changes were made to the previously reviewed goal statement. The SSC encourages the task force to carefully review and justify any changes to avoid language that may imply a prescriptive approach (e.g., ‘suggest’ was replaced with ‘facilitate’ - the SSC suggests ‘inform’; consider replacing ‘enable’ with ‘identify’).

The SSC appreciates the addition of a section on adaptation options and looks forward to the CCTF creating its own definition of what adaptation means in the context of the work plan.

The CCTF spent considerable time discussing potential interactions with the Local Knowledge, Traditional Knowledge, and Subsistence task force (LK/TK TF), which in part addresses the desire for a more open and inclusive process. However, the purpose of these interactions should be clarified in the context of the CCTF goals. The SSC suggests that joint efforts could be focused on a case study designed to address the primary goals of both the CCTF and LK/TK TF. One example may be a case study focused on Norton Sound red king crab. This case combines the need for long-term, strategic recommendations on how to adapt to climate change with a need to involve a variety of local stakeholders.

The CCTF should harmonize the objectives at the end of the ‘Module Goal’ section of the work plan:

“To achieve this, the climate change module will be used to [1] synthesize current knowledge regarding climate change effects on the Bering Sea ecosystem, [2] identify potential climate-resilient management measures that can improve adaptive capacity and avoid maladaptation, [3]

evaluate the risks, timescales, and probability of success of potential climate-resilient management policies under future scenarios of change; and [4] develop short-, medium-, and long-term options for consideration for future actions by the Plan Teams, SSC, AP and Council to help advance the goals and minimize the risks identified.”

with the detailed objectives as described in the document on pages 5 and 6. The SSC suggests retaining the brief, clear objectives in the above quote and re-formulating the objectives on pages 5 and 6 as specific actions and tasks under the above objectives.

The SSC has continued concerns about the apparent redundancies with ongoing efforts, in particular with the existing Ecosystem Status Report (ESR). While there is clearly value in adding to and enhancing the annual ESR process with respect to addressing long-term challenges associated with climate change, the work plan should further clarify how the proposed work by the CCTF would differ from, or add to, what the ESR already does. Some potential areas of concern are:

- The CCTF proposed the annual development of ‘Climate Knowledge Briefings’ and a synthesis report that largely parallels the ESR timeline. The proposed template for Climate Knowledge Briefings is reminiscent of the template for ESR contributions. Because of the similarity in approach and overlap in content, the SSC suggests that the CCTF could, on an annual basis, work closely with the ESR authors to enhance the ESR, rather than develop separate products. This could be done by reporting on climate-relevant indicators for inclusion in the ESR. In addition, the CCTF could periodically contribute a climate change synthesis to the ESR that focuses on new information most relevant to climate change adaptation and long-term strategic planning.
- In general, the SSC recommends re-focusing the work plan on those elements that are most relevant to long-term strategic planning. Task force members are engaged in climate change research and adaptation at local, regional, national, and international levels; the SSC suggests that using this expertise to inform the Council on long-term strategies based on multiple perspectives is more important than, for example, focusing on red flags or emergent issues that already receive much attention. An efficient process to identify and highlight relevant trends and surprises in the ecosystem is largely in place already; what is needed, and what the CCTF is well positioned to support, is identifying appropriate responses to both long-term trends and ecological surprises associated with climate change.

The SSC supports the development of a high-level synthesis of our current understanding of climate change effects on the Bering Sea ecosystem, including the underlying mechanisms, and recommendations about possible responses to the observed effects in terms of research, management and adaptation. This could be a stand-alone document or could be incorporated into the Bering Sea FEP, and should be updated periodically.

The SSC encourages the CCTF to review, and recommend, climate-relevant research priorities, which could be vetted by and funneled through the BSFEP Team and submitted to the SSC.

Finally, the SSC reiterates its recommendation from June 2019 that the Council consider the development of a Purpose and Needs Statement for the Action Module to clarify the Council’s vision for the task force.

Local Knowledge/Traditional Knowledge and Subsistence Task force

The SSC received an update from Kate Haapala (NPFMC) on the progress of the Local Knowledge, Traditional Knowledge, and Subsistence task force to further develop their work plan following a two-day meeting of the task force held January 16-17, 2020 in Anchorage. There was no public testimony.

The SSC commends the thoughtful efforts by the task force in moving this Bering Sea Fisheries Ecosystem Plan Action Module forward. This represents a positive step toward improving the Council’s ability to follow National Standard 2 guidance that relevant local knowledge (LK) and traditional knowledge (TK) should be obtained, where appropriate, and considered when evaluating the best scientific information

available to inform its decision-making process. At this early stage of the action module implementation, the SSC offers the following recommendations and comments:

- The SSC noted that the work plan outlined by the task force is particularly ambitious. In addition to the numerous individuals involved in the effort who are donating their personal time, it will undoubtedly require a substantial ongoing commitment of NPFMC and NMFS professional staff time to keep things moving forward. The SSC was encouraged by the expression of NPFMC and AFSC staff leadership support of this effort.
- The task force report noted that **the task force will “explore and synthesize a list of existing protocols and projects related to the solicitation and consideration of LK and TK, and the social science of LK and TK.” The SSC supports this effort** and notes that it could result in data applicable to ongoing Council analytic needs becoming available for use sooner rather than later.
- Deliverables envisioned by the task force are identified primarily as protocols and guidance documents, but there are also three types of “repositories” proposed: one is availability and current use of LK/TK; a second is subsistence data sources that go beyond the state and federal data collection efforts; and a third is human sources of LK/TK who have yet to share their knowledge. **The SSC recommends development of a specific plan for these repositories and their sustainability and access. Human subject issues of informed consent, confidentiality, and risk to participants need to be central to the formulation of each deliverable.**
- The draft work plan includes an implicit assumption that the development and production of LK, TK, and subsistence information will be an apolitical process and will result in internally consistent data agreed upon by all parties. The SSC cautions that issues such as experiential and generational differences, authority/spokespersons, and risk, among others, will inevitably be present and result in inconsistencies. **The SSC recommends that the task force explore the creation of protocols that could provide guidance when these issues are present.**
- **The SSC recommends that additional text on generating LK for non-subsistence fisheries be included in the task force documents going forward.** Specifically, the intention of this inclusion would be to inform Council decisions involving regulatory tradeoffs and indirect impacts to resources and fishing communities by also including LK held by those engaged in non-subsistence fisheries (e.g., commercial fishers, sport-charter owners, and recreational fishers). In addition, the SSC recommends that the task force consider bringing on an additional member with non-subsistence LK expertise.
- The SSC recognizes that in-person meetings are a high priority for the task force due to the inherent challenges in effective communication via teleconferences, which are only amplified in culturally diverse contexts. **The SSC supports funding for in-person meetings of the task force to the extent feasible**, recognizing that the inclusion of key persons from remote communities is indispensable, but also expensive and logistically challenging.
- The SSC notes that there is value for task force members to have access to shared workspace sites, such as Google Docs, and that varying government agency protocols can make the use of such sites difficult for their employees. The SSC encourages government agency support for employees engaged in this action module effort to access these sites wherever possible.
- As noted in the Climate Change task force discussion above, the SSC has suggested that a case study focused on Norton Sound red king crab may provide a useful opportunity for collaboration between the LK, TK, and Subsistence task force and the Climate Change task force. Additionally, the potential value of LK, TK, and subsistence information in the context of management of that fishery is noted and related previous SSC requests for the development of that information are referenced under agenda items C2 and D7 of these SSC minutes.

D-6 Social Science Planning Team Report

The SSC received a presentation from Sam Cunningham (NPFMC) and Steve Kasperski (NOAA-AFSC) on the Social Science Planning Team (SSPT) minutes from their November 2019 teleconference. That meeting focused on EDR program revisions, formulating a Data Gap Analysis, and a review of qualitative methods and analyses across disciplines and their utility for the Council process. The SSC agrees that the tier system proposed and debated for evaluating social science data quality requires further discussion for the tradeoffs of such an approach. Since the majority of social science data is not collected for informing Council analyses, but rather in numerous contexts with a variety of funding streams, a tier system could add more questions about data validity rather than increasing its usefulness for Council action.

The SSC appreciates the work that the subgroup will invest in developing a framework for evaluating utility of the EDR data, best practices, efficiencies, and burdens to those reporting the data. The SSC advises that achieving consistency across EDRs is not an ideal goal, since each data collection effort needs to respond to different fisheries and issues, but instead a framework for organizing data elements and justifying differences in their structure would be valuable. The SSC looks forward to reviewing the results of the subgroup's May workshop on prioritizing data collection and data gaps in June.

The SSC notes that the November SSPT meeting was limited in scope, focusing on essential tasks. The SSC recognizes that these are the necessary building blocks for future exploratory work. As the Council is leading our nation's efforts in incorporating social sciences into the management process, it is important that the SSPT keep a visionary eye on the exploration of human dimensions.

The SSPT also received a presentation on the various qualitative methods, analyses, data, and deliverables across social science disciplines, contrasted with natural scientific methods. We recommend a similar presentation be brought forward before the SSC to improve committee understanding of different data streams and approaches in what has largely been a strict natural science process.

D-7 Economic Stock Assessment and Fishery Evaluation

The SSC received a presentation from Steve Kasperski (NOAA-AFSC), Ben Fissel (NOAA-AFSC) and Brian Garber-Yonts (NOAA-AFSC). There was no public testimony.

The Groundfish Economic SAFE presentation provided an overview of the economic performance of the fishery in the 2018 data year, and some new initiatives. Across groundfish, catches were slightly down, but ex-vessel revenues increased due to higher prices.

The SSC appreciates how the Groundfish Economic SAFE has evolved over the last several years; it is a useful reference on the economic status of fisheries. The index-based report card makes it easy to quickly understand recent status and changes. The SSC recognizes the value of updated market profiles in understanding product flows and the distribution of fishery benefits along the supply chain. The SSC also appreciates continued refinement of price forecasts and suggests beginning to consider how these values might be useful in TAC specification. The SSC appreciates the inclusion of "now-casts" of the most recent year. The SSC suggests exploring the inclusion of projected size or age compositions from stock assessment models or examining cross-correlations among product types as ways to improve forecasts. Distributing data tables through the new AKFIN website improves accessibility.

The representation of community engagement is still evolving. The new annual community engagement and participation (ACEPO) sketches are elevating fisheries within the context of their dependent communities. However, **the SSC recommends the authors develop a consistent strategy for the presentation of different aspects and resolutions of fishing community engagement and dependency in various documents.** Specifically, consistent with December 2019 SSC comments, **the SSC requests clarification of the relationship between the type of human dimensions data for groundfish, crab, and**

other species that are contained in ESPs, ESRs, SAFEs, Economic SAFEs, and the new and to-be-fully-defined documents that will contain the fishing community information that was previously contained in the Groundfish Economic SAFE. This would provide clarity and consistency in meeting the data needs to address social and community focused management obligations under National Standard 2 and National Standard 8 while avoiding redundancy of effort.

The Crab Economic SAFE presentation provided an overview of the economic performance of the fishery in 2018, and some responses to previous SSC requests. Across component fisheries, catches are significantly down in the last few years, and price increases are not compensating sufficiently to maintain revenues or the same level of participation in the harvest or processing sectors.

The SSC appreciates the data overview provided in the Crab Economic SAFE, though it has fallen behind the Groundfish Economic SAFE in the presentation and accessibility of information. Fishery-specific, index-based report cards are being developed, but aggregating these across fisheries, and considering additional metrics, would improve accessibility of the SAFE. The SSC recognizes that efforts to identify net earnings, in pursuit of monitoring net benefits to the nation, are challenging. Confidentiality continues to limit our ability to monitor the fishery, because there are a limited number of processors and custom processing is a growing practice. The SSC suggests that the analyst explore ways to present indices or percentages to allow identification of trends, even when table cells cannot be displayed.

The SSC looks forward to completion of the quota ownership decomposition effort, which will allow better tracking of who is capturing the ownership benefits of the crab fishery. The SSC specifically notes that its recommendation regarding local and traditional knowledge relevant to the Norton Sound red king crab fishery, documented in the February 2019 SSC Report and additionally noted under Agenda item C2 in this current report, remains a relevant outstanding recommendation. Further, the SSC notes that its request for the development of a quantitative baseline of annual community engagement and dependency for the Norton Sound red king crab fishery, documented in the February 2018 SSC Report, remains an outstanding request. Given the ongoing evolution of the placement of human dimensions data in the various ESPs, ESRs, SAFEs, Economic SAFEs, and additional forms of documents under development noted above, it is not clear where the information generated under these two recommendations/requests would reside, but that the information would be potentially useful in informing management decision-making relevant to this fishery is clear.

D-8 Multi-Regional Social Accounting Matrix Model Review

The SSC received a presentation from Chang Seung (NOAA-AFSC) on the Multi-Regional Social Accounting Matrix (MRSAM) modeling tool designed to estimate regional economic effects of proposed fishery management actions. Also present was co-author Scott Miller (NOAA-AKRO). The authors noted that the 3-region version of the model (Alaska, West Coast, and Rest of U.S.) represented in the documentation provided to the SSC for review has recently evolved into a 10-region version of the model. The updated model includes six Southwest Alaska boroughs and census areas, an at-sea “region,” and three U.S. regions outside of Southwest Alaska. Public testimony was received from Brett Watson (University of Alaska - Anchorage).

The SSC is supportive of the MRSAM effort, which includes critical calibration through the use of surveys unique to Alaska. It holds the promise of allowing quantitative estimation of local multipliers and a range of borough-level community and regional impacts that may result from some types of Council management actions in a manner not possible at present.

The SSC notes that the authors no longer consider the 3-region model appropriate for use in Council analyses and requests the opportunity to review the 10-region version of the model before its use in analyses of Council actions. In the future presentation of the 10-region model, the SSC requests that the authors:

- Provide additional information on model assumptions.
- Discuss the challenges associated with model assumptions and parameterizations in a dynamic system (e.g., volatile world markets and rapid ecosystem change).
- Include details regarding how the MRSAM tool will be maintained and updated to reflect the best available information.
- Include details regarding how the MRSAM tool has been validated, including how it will be further validated and tuned going forward.
- Discuss how existing EDR data streams in the BSAI (crab and Amendment 80), Bering Sea (AFA pollock), and GOA (trawl) fisheries could provide information for updating and maintaining this tool, along with socioeconomic data streams that are being developed or managed for ongoing use in ESPs, ESRs, and Economic SAFEs and/or in response to the SSPT data gap analysis effort.
- Provide information on the appropriateness regional geographic units of analysis used in the model with geographic units commonly used by the public, affected communities, and in Council socioeconomic analyses (due to their reflection of established social, cultural, economic, and institutional relationships) and, where those geographies diverge, discuss the implications for use of the model in Council analyses.
- Provide information on how and when (and for what type of actions) this tool could be most usefully employed in Council analyses.

The SSC also requests that the analysts undertake and present a calibration exercise for the model using a retrospective event, such as the 2009 Pacific cod price collapse, where model results suggested a level of employment loss among vessel and processing crew that, with industry cooperation, could be ground-truthed against actual outcomes, at least on an order-of-magnitude level. The SSC further requests that the analysts also consider the potential for using the ongoing ISER effort to empirically determine local Alaska multipliers as a way to verify model assumptions and results as part of a validation plan to understand its limits of predictability. Finally, the SSC recommends that the analysts explore the potential for using ongoing natural resource modeling efforts with time-dependent parameterization to inform the updating of MRSAM assumptions that change over time.

D-9 Northern Fur Seal Update

The SSC received an update on northern fur seal status and trends from Jeremy Sterling (AFSC-MML), Carey Kuhn (AFSC-MML), and Elizabeth McHuron (University of Washington). No public testimony was given nor provided online via the meeting web portal.

This presentation was in response to a request from the SSC to receive annual updates on the status of marine mammals of conservation or fishery interaction interest. Due to staffing, the AFSC requested the full presentation be delayed to April; instead the SSC was only presented information on the status of the northern fur seal populations in the Bering Sea and two related ecological research projects.

Dr. Sterling reported that, across the entire Bering Sea, northern fur seal populations have experienced a decline in pup production since 1998. However, pup-production trajectories differed across the three main breeding islands (persistent declines at St. Paul, large increase in pup numbers at Bogoslof Island, and a slight increase at St. George after a long period of decline). Further differences in pup-production trajectories were reported for rookery complexes within and across islands. It is uncertain what is driving the different population trajectories among the colonies, as well as between rookery complexes. There are key differences in foraging habitats, pup weights in August, on-land pup survival, and maternal foraging trip durations between the islands and rookery complexes, but these differences alone are not enough to explain the variance in pup production. There is currently funding for population monitoring efforts in 2020. **The SSC recognizes and supports efforts to continue monitoring population demographics of**

northern fur seals, and commends the team for providing these data for inclusion in the Ecosystem Status Reports. Further, the SSC thanks the presenters for sharing the details underlying the information provided in the Ecosystem Status Reports in these annual briefings, as it provides additional, valuable context.

The SSC also received an update on two ongoing research projects. Dr. Kuhn first presented an update on a project seeking to improve knowledge of the numerical and functional relationships among fur seals, fisheries, and fish resources. Beginning in 2016, this work uses unmanned surface vehicles (saildrones) to map prey landscapes using hydroacoustics and elucidate northern fur seal behavioral responses to prey availability. This study tracked adult female fur seals during 2016-19, and a subset of animals were fitted with accelerometers and crittercams. Saildrones collected concurrent spatial data on age-0 and adult pollock backscatter. Trawling was used to validate the identity of acoustic targets. Preliminary results indicated associations between fur seal distributions and diving behaviors and pollock vertical distributions and abundance. The addition of the crittercams provided novel insights into capture efficiency, prey preference, and foraging effort associated with different prey species and prey size. The results demonstrate that northern fur seals are opportunistic foragers, that their diets vary spatiotemporally, and that individual preferences for various prey types and sizes also exist. Funding for this work has run out and no further activities are planned at this time. **The SSC recognizes the value gained from the project for addressing questions pertaining to interactions between northern fur seals and fisheries.** In particular, it was noted this work has the potential to provide data that can enable researchers to differentiate between encounter rate and population-level prey preferences. The SSC encourages this type of research that can help understand the impacts of changing ocean conditions on northern fur seals, population demographics, and survival.

Dr. McHuron reported on a large collaborative effort that combines a spatially explicit northern fur seal bioenergetic model with outputs from end-to-end ecosystem (FEAST) and multispecies stock assessment (CEATTLE) models. Results of a retrospective analysis exploring variation in field metabolic rates (FMR) for breeding female northern fur seals during a period of population decline suggested females had greater physiological costs in the fall relative to summer seasons (likely associated with molting energetics). A lack of relationship between FMR and mass gain, diet variation, or diving behavior further suggested that northern fur seals may have reached a metabolic ceiling early in the population decline (e.g., they are working as hard as they can to find prey and have limited physiological flexibility to respond to environmental change).

This information on FMR was then incorporated into bioenergetics models that have been developed for target years between 1991-2018 with the goal of estimating how much energy northern fur seals consume while in the Bering Sea during summer and fall. Model outputs indicated that, in the selected years (1995, 1996, 2004, 2006, and 2010), prey was primarily pollock, with some interannual variation. When compared to past efforts to estimate consumption (pre-1990s), the estimates from the current bioenergetics models were greater than all previous estimates, likely due to discrepancies in input data. By combining the data from these models with CEATTLE output, results further suggested that northern fur seals consume more age 3+ pollock, relative to other predators (e.g., arrowtooth flounder, Pacific cod). The SSC noted that these bioenergetics models primarily are informed by data on adult, breeding females—but in terms of estimating total consumption of the population, males account for 9% of the population by numbers and 20% by energy needs. **The SSC encourages further exploration of data for these segments of the population, as their contributions may be of importance for informing interactions with fisheries and council decision-making.**

The SSC notes this project is a particularly good example of how coupled biophysical models that link physics to fish and fisheries can be utilized in retrospective studies to understand interactions among species groups. The SSC commends the analysts on their contributions to understanding fur seal metabolics. SSC notes that inferences about fur seal diet composition remain challenging and should be approached cautiously given the potential for considerable bias in prey species and size information based on the

proportions of scat versus spew samples used, and the limited understanding of the foraging time scales that these samples represent. The SSC recommends further work to characterize these uncertainties. This work may provide estimates of annual consumption that could inform rates of natural mortality for some fish stocks. **The SSC encourages efforts to work with stock assessment authors to ensure the information is brought forward to potentially inform natural mortality rates for stock assessment.**

The SSC looks forward to continued updates on this and other marine mammal research covering a broad suite of species.

SSC Research Priorities Workshop

The SSC convened a workshop on Research Priorities on Wednesday afternoon. This workshop was an opportunity for the SSC to discuss the research priorities review process, and to hear from the Plan Teams' co-chairs and multiple NOAA scientists about survey, sampling, and research-related projects and concerns. The SSC greatly appreciates the presentations and discussions provided by all workshop participants and found the workshop to be informative regarding the breadth of research needed, as well as providing context to how the research priorities process could be improved. Public testimony was received from Brenden Raymond-Yakonbian (Kawerak Inc.).

At the end of the workshop, the SSC had a lengthy discussion regarding future methods for evaluating research priorities, and the need to develop a collective vision for the research priority process. The SSC noted the current process is cumbersome. Many of the research items in the database are broadly categorized and often only vaguely described, which makes the task of evaluating all research items for prioritization extremely difficult, time intensive, and unlikely to yield a clear prioritization among projects. The SSC also recognized that intensively evaluating all priorities without a clear strategic direction may not be a good use of SSC, Plan Team, and NPFMC staff resources.

The SSC is scheduled to take-up Research Priorities during its April 2020 meeting and intends to discuss a proposal for creating a strategic plan for evaluating research priorities. The SSC noted that tactical issues could be identified to achieve specific goals or objectives associated with the strategic plan. For example, one issue discussed at the workshop was how to consider tradeoffs between survey reductions and other research priorities that are needed to maintain a robust research portfolio. These tradeoffs were noted in the B4 AFSC Report agenda item as being a critical consideration in evaluating an overall research portfolio that must balance ongoing data needs with long-term strategic needs. The SSC will also consider in April whether to evaluate a top 10 list of research priorities as part of the planning discussion.

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 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 January 2020 meeting, a number of SSC members acknowledged associations with specific agenda items under SSC review. Matt Reimer is a co-author of the SSPT report. Mike Downs is also a member of the SSPT, but was not involved with the production of the current report. Anne Hollowed supervises three scientists who serve on the CPT and works for Dr. Robert Foy, who is the Science and Research Director

for AFSC. Dana Hanselman also works for Dr. Foy. Brad Harris and Ian Stewart are on the Bering Sea Fishery Ecosystem Plan team, but were not directly involved with the task force's reporting at this meeting. Andrew Munro supervises one of the authors of the Norton Sound red king crab assessment, Toshihide Hamazaki.