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

DRAFT REPORT
of the
SCIENTIFIC AND STATISTICAL COMMITTEE
to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
June 1st – 3rd, 2020

The SSC met remotely via Adobe Connect from June 1st through 3rd.

Members present were:

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

Chris Anderson
University of Washington

Mike Downs
Wislow Research

George Hunt
University of Washington

Franz Mueter
University of Alaska Fairbanks

Matt Reimer
University of California, Davis

Anne Hollowed, Co-Chair
NOAA Fisheries—AFSC

Amy Bishop
Alaska Sea Life Center

Jason Gasper
NOAA Fisheries – Alaska Region

Gordon Kruse
University of Alaska Fairbanks

Andrew Munro
Alaska Dept. of Fish and Game

Ian Stewart
Intl. Pacific Halibut Commission

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

Curry Cunningham
University of Alaska Fairbanks

Dana Hanselman
NOAA Fisheries—AFSC

Dayv Lowry
Washington Dept. of Fish and Wildlife

Kate Reedy
Idaho State University Pocatello

Members absent include:

Brad Harris
Alaska Pacific University

General SSC Comments

At the request of the Council Coordinating Committee, NMFS HQ is seeking a review of the new policy directive on stock status determination by the fishery councils. A subgroup of the SSC was formed to provide feedback on the document by late June. Volunteers for this subgroup include Curry Cunningham, Sherri Dressel, Jason Gasper, Dana Hanselman, Anne Hollowed, Franz Mueter, and Ian Stewart.

B-1 Crab and Social Science Planning Team Nominations

The SSC reviewed the nomination of Erin Fedewa (NOAA-AFSC) to the Bering Sea and Aleutian Islands (BSAI) Crab Plan Team (CPT) to fill the vacancy created with the departure of Robert Foy. **The SSC finds Ms. Fedewa to be well-qualified and recommends the Council approve her nomination.**

The SSC reviewed two nominations to the Social Science Planning Team. Specifically, the SSC reviewed the nominations of Kate Haapala (NPFMC), to fill the vacancy created with the departure of former NPFMC staffer Elizabeth Figus, and Scott Miller (NOAA-AKRO), to fill the vacancy created with the departure of Sally Bibb. **The SSC finds Dr. Haapala and Mr. Miller to be well-qualified and recommends the Council approve their nominations.**

B-3 Alaska Fisheries Science Center Report

Surveys

Dr. Robert Foy (NOAA-AFSC) provided the Alaska Fisheries Science Center (AFSC) report. Jamie Goen (Alaska Bering Sea Crabbers) provided public testimony expressing concerns about the loss of surveys for Bering Sea Aleutian Islands (BSAI) crab stocks, many of which are closed or approaching thresholds that would lead to closure.

For the past several years, the SSC has expressed concerns about funding needed to maintain stock assessment surveys in the Alaska Region, given budget cuts, loss of one-time funding sources, and the need for new routine assessments in the northern Bering Sea and Arctic. Unfortunately, COVID-19 has created a worst-case scenario for 2020, as five of six large-scale assessment surveys in federal waters off Alaska have been cancelled owing to uncertainties surrounding the pandemic, lack of vessel availability, logistical constraints, and a need to minimize health risks to staff, crew, and communities. Cancelled surveys include trawl surveys in the eastern Bering Sea (EBS), northern Bering Sea, and Aleutian Islands (AI), as well as the Bering Sea pollock acoustic survey, and the fall ecosystem survey. The annual Alaska longline survey in the Gulf of Alaska (GOA) and AI (primarily targeting sablefish) and the Southeast Alaska Coastal Monitoring survey (primarily targeting salmon and providing valuable environmental data) will proceed as planned.

The SSC notes that loss of surveys will likely increase uncertainty in stock status and projections and may necessitate larger buffers between overfishing limits (OFLs) and acceptable biological catches (ABCs). Groundfish and shellfish assessments in the BSAI, especially for short-lived species and species without an age-structured assessment, are likely to be most affected. Under C2 "Model Runs for September - General Advice", the SSC provides some advice to the crab stock assessment authors on how to address this uncertainty in upcoming assessments. The SSC co-chairs plan to discuss this issue further with groundfish and crab plan team chairs prior to the September Plan Team meetings. Dr. Foy pointed out that the lack of surveys would significantly affect uncertainty, particularly for the following stocks: Bristol Bay red king crab, EBS snow crab, EBS pollock, EBS Pacific cod, AI Pacific cod, BSAI Atka mackerel, BSAI blackspotted/rougheye rockfish, and BSAI Greenland turbot. Assessments for the GOA should not be affected (assuming a resumption of normal survey operations in 2021), as 2020 is a planned off-year for GOA surveys. A saildrone mission has been initiated to collect acoustic data on pollock abundance, which may be similar to historical data from vessels of opportunity but lacks biological sampling, in the eastern Bering Sea.

Dr. Foy raised questions that need to be answered to develop a survey plan for next year. For instance, if conditions allow, should the GOA or AI or both be surveyed in 2021? If the GOA is surveyed, should a third GOA vessel be included or should the northern Bering Sea be surveyed? In response to similar questions posed by then acting AFSC Science and Research Director, Jeremy Rusin, an SSC subcommittee provided advice on survey prioritization to NMFS in September 2018. This advice was approved by the full SSC and appears as an appendix to the October 2018 SSC report. In response to Mr. Rusin's question, "What are the ranked order of priorities for our present suite of bottom trawl surveys?", the SSC responded: 1) eastern Bering Sea shelf; 2) Gulf of Alaska; 3) Aleutian Islands; 4) northern Bering Sea; and 5) Bering Sea slope. However, the SSC pointed out at that time that, if large portions of the eastern Bering Sea pollock and Pacific cod stocks continue to occupy the northern Bering Sea, the survey of that area will rise in priority. On this basis, the northern Bering Sea survey might now be prioritized ahead of the Aleutian Islands. Given that conditions have changed since 2018, additional review and discussion on survey prioritization would be appropriate.

Dr. Foy expressed interest in SSC advice once again on survey prioritization. The SSC welcomed this opportunity. Following the protocol used in 2018, the SSC formed a survey prioritization subcommittee with the following members: Sherri Dressel, Dana Hanselman, Anne Hollowed, George Hunt, Dayv Lowry, Franz Mueter, Andrew Munro, and Ali Whitman. This meeting should be coordinated with the NPFMC

and should be open to the public. As was the case last time, it would be most helpful if Dr. Foy could provide some key motivating questions (and scenarios) about survey prioritization to be addressed. For example, it would be helpful to understand Dr. Foy's list of stocks most sensitive to uncertainty and the basis for their sensitivity. Appropriate NMFS survey staff should be included. In particular, the SSC recommends including Stan Kotwicki, who, at the 2018 meeting, outlined a suite of ongoing research projects designed to answer questions about survey prioritization, frequency, coverage, and so on. Likewise, an ICES Workshop on Unavoidable Survey Effort Reduction (WKUSER) was held in January 2020 (AFSC Seattle, WA), specifically addressing the topic of optimal survey design under alternative effort scenarios, and which included participation by several SSC members. It would be important to hear the results of these efforts. The SSC recommends holding the meeting in August so that the subcommittee report can be vetted through the full SSC and Council in October 2020.

Finally, the SSC recommends that NMFS reflect on their response to the COVID-19 situation. Did this experience reveal any weaknesses or vulnerabilities that can be improved in the future to strengthen agency resilience? NMFS might consider what information should be collected now so that the agency can benefit from this situation as a learning experience.

Ecosystem and Socioeconomic Profiles

The SSC received a presentation on ecosystem and socioeconomic profiles (ESPs) by Dr. Kalei Shotwell (NOAA-AFSC). There was no public testimony.

An ESP is a standardized framework that facilitates the integration of ecosystem and socioeconomic factors within the stock assessment process and acts as a proving ground for use in management advice. ESPs are reported as appendices to stock assessments in the SAFE reports. Key contributions of ESPs are metrics assessments and indicator assessments. Metrics include standard measures of stock attributes (e.g., recruitment variability, age at maturation), as well as processes and drivers associated with the ecosystem by life stage and socioeconomics. Indicators include time series for critical processes (identified by metrics assessment), as well as indicator assessment (i.e., three stages starting with a 'traffic light' style of ranking).

Two workshops have been conducted to develop and implement ESPs, and a third one focused on forecasting and management advice is planned for spring 2021. Three new ESP teams have been initiated (Pacific cod, crab, and data-limited stocks). Full ESPs are being developed for BSAI and GOA Pacific cod and Bristol Bay red king crab, and executive summaries for sablefish, GOA pollock and St. Matthew blue king crab.

Advice from ESPs is viewed to inform fishery management in three ways: (1) risk – contextual information about additional uncertainties not in the model, (2) rebuilding – evidence of time steps in productivity regimes for rebuilding plans, and (3) readiness – tools to evaluate and be prepared for unforeseen changes. Contextual ecosystem information appears in a risk table in the stock assessment that feeds information to complement the stock assessment model in Groundfish Plan Team review and ABC recommendations. ESPs provide valuable information for these risk tables. Social and economic information is more generally used to inform decisions regarding TACs, so it enters later in the management process. However, these indices should be vetted by the author, PTs and SSC as reliable indicators of relevant ecosystem processes if they are used for this purpose.

Successful implementation of ESPs requires teamwork. For instance, the CPT provided enthusiastic comprehensive review of a draft ESP for Bristol Bay red king crab at their May 2020 meeting. In addition, the CPT noted the utility of ESPs when an ecosystem report card was recently presented at an Alaska Board of Fisheries meeting during which the eastern Bering sea Tanner crab harvest strategy was revised.

The SSC expresses its thanks to Dr. Shotwell and all who have assisted in these efforts. **The SSC supports plans for further ESP development and evaluation. These efforts should enhance the future utility of indicators in stock assessments, including evaluations of uncertainty**. ESPs are a commitment to a process, not a static product. As such, consideration should be given to the regularity (and timing) of reviews

and revisions. Moreover, **this effort should not stop with ecosystem indicators, but continue until they are formally incorporated into SAFEs to achieve the goal of ecosystem-based fisheries management (EBFM).** In that light, the SSC acknowledges the thoughtful consideration that is going into defining the varying needs and uses of socioeconomic data in ESPs, ESRs, and SAFE documents. The SSC is well aware of the challenges involved in trying to close the EBFM loop. Tough decisions lay ahead about how exactly to do this.

C-1 Scallop SAFE

The SSC received a presentation on the 2020 scallop SAFE from Scallop Plan Team (SPT) co-chair Jim Armstrong (NPFMC), scallop biometrician Tyler Jackson (ADF&G), and economist Scott Miller (NMFS-AKRO). No public testimony was provided.

The SSC appreciates the efforts by the SPT and the authors of this year's scallop SAFE report. The report is well written and contains valuable new information on recent fishery independent surveys, fishery performance metrics, and management activities. As requested by the SSC in 2019, the appendix on socioeconomic considerations associated with the fishery (Appendix 2) added context on the development and current state of fleet composition, market drivers, and community engagement. Additional work is needed to: document the current limits of knowledge about crew share changes over time; better document changes in patterns of landings associated with cold storage availability and access to shipping routes; provide information on which taxes are applied to different types of landings or offloads/transfers; clarify what product forms are currently being landed and how the forms have varied over time; and elucidate changes in the frequency of landings over time by community. The SSC acknowledges the challenges associated with data confidentiality constraints inherent in the analysis of the scallop fishery as currently constituted. The SSC recommends, as it did in its April 2019 report, that the analysts explore ways to use qualitative information, potentially in combination with indices of relative change, to portray the sustained participation (or lack thereof) of fishing communities in the fishery. Appropriately sourced information on historic crew share levels and vessel haulout/repair locations provided in the presentation would also be useful additions to Appendix 2. Appendix 4, which provides a brief history of the fishery, should be merged with Appendix 2, as there is substantial redundancy between the two. References cited in both appendices should also be embedded within the final text.

The SSC supports the SPT's recommendation to set the OFL for the 2020/21 season equal to maximum OY (1.284 million lbs; 582 t) as defined in the Scallop FMP, which applies a 20% mortality rate to discards. The SSC also supports the Team's recommendation to set ABC for scallops in 2020/21 consistent with the maximum ABC control rule (90% of OFL), which is equal to 1.156 million lbs (524 t). Despite the status of scallop stocks being "unknown", recent harvest has been less than 20% of the identified OFL based on the best available science, justifying these identified harvest maxima. In the interest of administrative efficiency and maximization of analyst time, **the SSC also endorses the concept of scallop updates occurring as executive summaries in alternate years.**

Given the reliance on fishery CPUE, **the SSC requests further documentation of the methods used to standardize the time series that are used to inform Minimum Performance Standards and to infer relative stock trends.** Consideration should be given to the fraction of the beds actually accessed by the fishery each year, including potential thresholds for when CPUE data may be informative about the abundance/density on that bed versus simply reflecting fishery conditions and practices in light of current low levels of fishery participation.

Region-specific size and age data seem to tell contradictory stories in 2019 when the survey and fishery data are compared. The SSC requests that the analysts further explore this apparent discrepancy to determine if it is the result of cohort-specific variation in growth, differences in selectivity between fishery and survey gear, or other factors.

The SSC appreciates the responses to previous SSC comments since 2017, but notes that several of

these requests remain outstanding and should be addressed in subsequent analyses. As progress on these requests has been hampered by staffing and funding shortfalls, the SSC looks forward to further progress now that the ADF&G Scallop Biometrician position has been filled. These specific requests include:

- Provide details for bootstrapping methods used to generate confidence intervals for abundance and biomass.
- Provide details on how the two-stage estimator for calculating meat biomass differs from that used by Williams et al. (2017).
- Add a single summary table to the SAFE showing region-specific survey results next to region-specific harvest totals and long-term averages in the same units (e.g., round weight).

For many years the SSC has been requesting that an age-structured model be produced. However, challenges include validation of scallop aging and the short time series of fishery-independent surveys. The SSC is heartened to hear efforts at age validation continue and that an age-structured model has been developed for Kamishak Bay. The SSC would appreciate having an opportunity to review this model and also looks forward to seeing such models extended to major fishing areas, such as Kodiak and Yakutat.

Additional comments include:

- Calling the current assessment "statewide" is a misnomer given that the current plan is to alternate annual surveys between only two of the nine fished regions. In future SAFEs, consider using the term "state" or "ADF&G" survey.
- The SAFE raises the issue of meats being small in 2019 and implicates temperature, or possibly pH, as the putative cause. The GOA ecosystem report is mentioned as containing information that might inform this assertion, but no attempt at making a more formal linkage is made. In future SAFEs, please explore such linkages and bring what data are available to bear to better understand biological variation that affects fishery performance.
- "Clapper" isn't defined anywhere and is conflated in Table 2-5 with weak meat. This table effectively shows "unharvestable scallops" not just those with weak meat. Please separate these data.
- The SSC supports the initiative to update scallop Essential Fish Habitat (EFH) information, which is overdue, given new available information and improved modeling approaches.
- Patterns of changing abundances and biomass in the survey data from the Yakutat region implies an increase in average size and weight in recent years. However, the length-frequency distribution in the fishery does not show an increase in the size of landed or discarded scallops over the same period. This apparent discrepancy should be explored.

C-2 BSAI Crab

The SSC received a detailed report on the May 2020 Crab Plan Team (CPT) meeting from Jim Armstrong (NPFMC) and the CPT co-chairs, Martin Dorn (NOAA-AFSC) and Katie Palof (ADF&G). No public testimony was provided.

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

The Aleutian Islands Golden King Crab (AIGKC) stock assessment fits separate models to two subareas of the Aleutian Islands, the eastern area (east of 174 W, EAG), and the western area (west of 174 W,

WAG). These model results are combined into a single ABC and OFL for the Aleutian Islands. The SSC appreciates the CPT chairs' presentation and the authors' extensive explorations in response to previous SSC comments.

Alternative models
The assessment authors examined six model scenarios for the EAG and three model scenarios for the WAG.

- Model 20.1 was the base model last year.
- Model 20.1b is the same as Model 19.1, except that the standardization of the Fish Ticket CPUE is based on a negative binomial error model.
- Model 20.1c is the same as Model 20.1b, except that the assessment for the EAG adds[f1] the CPUE index from the cooperative survey.
- Model 20.1d is the same as Model 20.1c, except that the value from the cooperative survey for 2019 is excluded from the assessment.
- Model 20.2 is the same as Model 20.1b, except that the observer CPUE is based on a standardization model with year*area interactions.
- Model 20.2b is the same as Model 20.2, except that the assessment for the EAG adds the CPUE index from the cooperative survey.

Under SSC recommended model naming conventions, all models named 20.x should probably be considered to be named variants of 19.1 with perhaps the two models that include a new data source, the cooperative survey being considered a new series, 20.x.

The SSC agrees that the use of the negative binomial for fish ticket CPUE is appropriate and an improvement to the base model to account for the typical overdispersion in CPUE data. The SSC thus agrees with the CPT recommendation to use Model 20.1b for specifications, with some concerns highlighted below:

CPUE standardization
The annual fishery CPUE index is estimated by combining estimates from one model (model with year:area interaction) that was fit to all year-area combinations that had any fishing effort, and another model (without a year:area interaction) to estimate mean CPUE in those year-area combinations that did not have any fishing effort. These estimates are then combined to compute a mean CPUE by year, weighted by the overall "footprint" of the fishery. Because the two models (with or without interaction) include different covariates, the estimated annual CPUE indices may not be directly comparable across all year-area combinations. For example, the best model for EAG with a year:area interaction term also includes soak time and mean CPUEs may be standardized to the median or mean soak time, which was not described in the SAFE, whereas the model without the interaction term does not include soak time, so the resulting estimate is over all observed soak times. How these different models are combined, and how the year:area effect is appropriately dealt with was unclear. **The SSC requests more detailed documentation on how these methods are justified and implemented.**

Cooperative Survey
The SSC appreciates continued exploration of the cooperative survey data, but agrees that its inclusion is not aiding in the interpretation of model results at this time. Last year the CPT suggested a possible model with several random effects that was adopted by the authors, but it is unclear whether this structure is indeed the best random effects structure for the data. The SSC recommends consideration of alternative random effects structures that may reflect the sampling design and variability in CPUE as well or better. For example, a model with a fixed 'Area' (= 'block') effect and a 3-level random effect that nests pot within strings within vessels and other structures could be considered [e.g. Catch = Year + Area + s(soak) + s(depth) + (1 | vessel/string/pot)]. **The SSC recommends that the authors reexamine and justify the**

random effects structure in the model for the cooperative survey data if it is included in models next year.

Modeling recommendations
The model was first introduced in 2016 and has always been fit separately to two areas. The assessment based the two areas primarily on management boundaries and some tagging work that was done in the center of the EAG, from which few recoveries indicated westward movement. The SSC recommends that the authors consider the advantages and disadvantages of combining the two areas since we are setting a single OFL/ABC. Rationale for considering a single model includes:

- The overall trend in biomass is fairly similar and there may be movement between the areas that we are not aware of from the limited tagging work
- There is NOT a strong justification for an oceanographic break at 174 (just east of Atka). Even the larger passes to the East (Seguam / Amukta between 170 and 172 W) are relatively shallow (< 400 m) for GKC, which live at a depth of 300-1,000 m and are unlikely to be limited in their movement by the passes
- There is no evidence that life history parameters differ between EAG and WAG
- A combined model might help with the strong positive retrospective bias in EAG if there is demographic leakage from the WAG that makes that area's population look larger than it is
- Residual patterns are very similar between the two regions
- The CPT chair suggested that research showed there was likely little genetic differentiation between the areas

One possible drawback of the combined model is that the survey is limited to the eastern area. **Despite the cancellation of the AI bottom trawl survey for 2020, the SSC requests examining the data to see if abundance/biomass estimates can be utilized for either the two-model approach or a single area model. The SSC recommends near-term exploration of a one-area model. A long-term research goal would be to see if it is possible to construct a spatially explicit 2-box model that estimates movement between EAG and WAG but shares other parameters like vital rates and selectivities.**

In last year's assessment (Model 19.1), the years used to determine the mean recruitment corresponding to MSY (and the mean recruitment in the first year of the model) were set to those for which the standard error of log-recruitment was less than 70% of R-sigma (the assumed standard error of log-recruitment). The SSC pointed out that R-sigma is not necessarily related to the standard error of the individual recruitment estimates, but is a control over the inter-annual variability of recruitment estimates. The CPT and SSC questioned this subjective choice, so the authors tried to make it non-subjective by setting the cutoff recruit deviation value at the 90th percentile of the model-estimated recruitment standard deviations for the whole time series. Recruitments with standard deviations less than the cutoff value are included for reference point estimation. **The SSC recommends that, if this approach was used, the CV would be a better choice. This is because the standard deviations of high recruitments with the same CV might be higher than a cutoff and would result in reference points that are biased lower. The SSC also recommends exploring choosing a reasonable lag from the current year that would include most crabs that have recruited into the fishery. For example, if most crabs are observed by age 6, the 2020 assessment would use recruitments from 1987-2014, and the 2021 assessment would use 1987 – 2015, and so on.**

Jitter runs/model stability
In the two WAG jitter runs for models 20.1 and 20.1b, there are runs that have lower objective function values (e.g., runs 15 and 78 in 20.1b). Typically, these runs would become the new global minimum and be the starting points for new jitter runs for a final model. The OFL for the WAG would be about 1,900 t instead of 1,800 t under these scenarios. Considering that the final gradients for these runs are also very

small, the SSC requests an explanation as to why these model runs were not used. These patterns also point to potential instability in the recommended model. Figure 41 further illustrates the instability in the WAG model, as the model fits suggest that simply calculating the reference points based on a different set of recruitments (20.1b CPT version) adds instability at the beginning of the retrospective time series. The strong retrospective pattern in the EAG persists from the 2019 model and led to some of the above modeling recommendations.

Because of discomfort with the new method for inclusion of recruitment, the CPT asked the author to re-run Model 20.1b with $MMB_{35\%}$ based on the years 1987-2012 and selected this model as the preferred model. **The SSC agrees with the CPT to use the modified Model 20.1b for 2020/21 specifications but looks forward to alternatives for the next assessment. We continue to recommend the 25% buffer because of uncertainties highlighted in the 2017-2019 minutes as well as issues with retrospective patterns, jitter runs, and reference point calculations highlighted in this report. The recommended total OFL and ABC for 2020/2021 are 4,798 t (10.579 million lbs) and 3,599 t (7.934 million lbs), respectively. AIGKC was not subject to overfishing in 2019/2020 and was not overfished.**

Pribilof Islands Golden King Crab

Pribilof Islands Golden King Crab (PIGKC) has been managed as a Tier 5 stock that is assessed on a triennial basis. The last full assessment was completed in 2017. The SSC appreciates the authors' efforts to develop a random effects (RE) model and diligence in addressing past SSC comments in the assessment. Development of the RE model has been ongoing since 2015. For this iteration, the authors applied six variants of the RE model to the EBS slope survey MMB biomass. The RE models varied depending on EBS slope survey years used to fit the model (2002 – 2016 or 2008 – 2016), the spatial extent of survey stations used in the analysis (defined by survey sub-areas and the Pribilof District stock area), and the post-stratification method used to expand sampled stations to the stock area. The authors used survey length composition and sex composition from the 2008 – 2016 surveys to estimate MMB for the 2002 and 2004 surveys since length and sex composition data were unavailable for those years.

For the 2020/21, 2021/22, and 2022/23 specifications, the SSC agrees with the CPT's recommended Tier 5 procedure to calculate the OFL (93t; 0.20 million lbs) and apply a 25% ABC buffer (70t; 0.15 million lbs), which is consistent with recent specifications for this stock. Total catch for 2017 - 2019 was confidential in the SAFE; however, the authors indicate **overfishing did not occur on this stock**. **Evaluation of an overfished condition could not be made since PIGKC is a Tier 5 stock**.

The CPT recommended that RE models be evaluated during their January 2021 modeling workshop, and notes that the CPT would consider a Tier 4 assessment during its May 2021 meeting. The SSC has consistently supported development of the RE model using EBS slope survey data, and notes continuation of this survey would provide a fishery independent source of information on stock trends. **The SSC does not recommend reviewing a full assessment in June 2021 outside of the stock prioritization schedule. The next assessment is scheduled for 2023, at which time additional information about the status of the EBS slope survey will be available.** The SSC notes that there is not a pressing need for the RE modeling to be included in the January 2021 workshop given the triennial assessment schedule, but would appreciate an update on model development as appropriate.

For the next full assessment, the SSC requests the authors provide three assessment alternatives:

- The current Tier 5 assessment methodology.
- A Tier 4 assessment. A key issue with the Tier 4 approach will be selecting an appropriate B_{MSY} proxy and determining whether the estimates of biomass are sufficiently reliable to warrant a Tier 4 status for the stock. The SSC notes that estimates of MMB from the slope survey may only be sporadically available in the future, which complicates status determination under Tier 4 (i.e., stock status relative to MSST).
- A Tier 5 methodology that uses Tier 4 methods for calculating the OFL/ABC. This approach would

use the historical EBS slope survey estimates (based on a reference period) and use F=M for OFL calculation (or perhaps a different F value). An example of this approach was used for spiny dogfish (see October 2010 SSC report).

Finally, the SSC offers the following recommendations:

- The SSC notes that assessing trends in catch is not currently possible because of confidential data. The SSC recommends that the authors consider rescaling catch across years (e.g., min/max or z-score) such that relative catch trends could potentially be displayed without violating confidentiality rules.
- For the assessment alternatives using a survey reference period, the SSC recommends the authors and CPT provide a rationale for the preferred reference period, and clearly specify the objective associated with the chosen period (e.g., target the current productivity regime or the range of potential productivity).
- The SSC supports the CPT recommendation to evaluate EBS slope survey variance for the early survey years (2002 and 2004) and to continue investigating whether additional length and sex composition data are available for 2004.
- The SSC supports continued efforts by ADF&G to coordinate with industry to conduct a pot survey, and reiterates its past recommendation to explore VAST model fits to the EBS slope survey data, recognizing that this method may not be successful given the spatial characteristics of the survey.
- The SSC recommends the authors and CPT consider whether the Aleutians Islands estimate of M (0.21) is appropriate for the Pribilof Island Golden King Crab stock (M=0.18).

Western Aleutian Islands Red King Crab

The Western Aleutian Islands Red King Crab (WAIRKC) stock is managed as a Tier 5 stock whereby total catch OFL is calculated using retained catch, non-directed crab discard mortality, and groundfish discard mortality averaged over 1995/96 – 2007/08. In recent years, the ABC has been calculated with a 75% buffer below OFL to reflect the depressed status of the stock and the lack of stock information.

The SSC appreciates the responsiveness of the assessment author to SSC and CPT requests regarding bycatch in the groundfish fisheries, as well as the fishery management and fishery independent survey descriptions in the assessment report. The SSC, however, encourages the author to provide additional context for the two most recent surveys in Adak and Petrel Bank in the next assessment report. For example, how do the CPUEs for these surveys compare to older surveys or the fishery dependent information?

WAIRKC assessments are conducted on a triennial schedule and current harvest specifications will be for 2020/21, 2021/22, and 2022/23. The author and CPT recommended calculation of OFL under Tier 5 using status quo methods and continued use of the 75% buffer for the ABC, given the presumed condition of the stock. **The SSC supports these OFL and ABC recommendations, resulting in OFL = 56t (123,867 lbs) and an ABC = 14t (30,967 lbs).** The SSC also reiterates that any data that could provide additional information on the status of the stock would be valuable, and encourages the author to explore any potential sources.

Overfishing did not occur during 2017/18, 2018/19 or 2019/20 because the estimated total catch did not exceed the Tier 5 OFL. **Evaluation of an overfished condition could not be made since WAIRKC is a Tier 5 stock**.

Model Runs for September - General Advice

There was considerable discussion about whether the cancellation of major surveys should prompt changes in the overall 2020 assessment tactical plan. For example, whether it might be most useful to conduct analysis on the effect of the loss of survey data rather than, or in addition to, presenting new assessment models. Specific advice for crab model runs is provided below. In addition, the SSC co-chairs will discuss

this issue with crab and groundfish plan team co-chairs to determine whether specific tactical advice might be provided to stock assessment authors in time for the fall assessments. This advice could apply to both crab and groundfish and may provide further guidance in addition to the following minutes that are specific to crab.

During the CPT meeting in May 2020, the fate of NMFS assessment surveys was unknown. Most scenarios involved delayed surveys, which would have greatly shortened the time frame between survey completion and stock assessment modeling. Given this expectation, the CPT took a minimalist approach by recommending that stock assessment authors only run last year's base model plus just one new preferred alternative model. Now that we know that NMFS surveys are cancelled for 2020, assessment scientists actually have more (not less) time available to conduct their stock assessments. Given the survey cancellations, CPT co-chair, Martin Dorn, provided some advice on model options. Based on his suggestions, the **SSC provides the following general advice to the crab stock assessment authors regarding models to run in fall 2020**.

- **Base model.** The base model for 2020 should be last year's base model (same configuration) updated with available new data inputs (catch, fishery size compositions, bycatch).
- **Base model with evaluation of sensitivity to new data.** It may be informative to run the 2020 model (with same configuration as 2019 model) with either just catch or just size compositions separately to evaluate sensitivity to new (2020) data.
- **Base model with evaluation of sensitivity to loss of 2020 survey.** An additional run with mock 2020 survey data may provide insights into the consequences of the missing survey data. For instance, Dr. Dorn recommended using proxy 2020 survey data estimates with large CVs to get an expected value for the 2020 survey, then put that back into the model assuming typical CV (this is intended as a sensitivity run to evaluate the loss of survey data). One SSC member suggested that, rather than use "expected" survey data consistent with model predictions, it may be preferable to sample from the historical survey residuals to select high and low results to better bracket the uncertainty due to the lack of a survey. This may be particularly important where some conflict and/or systematic lack of fit to survey indices is present in the assessment model. The SSC considers advice on this model run as a "placeholder" pending emerging advice on the best approach to evaluate uncertainty owing to the loss of 2020 survey data. As mentioned above, the SSC co-chairs will discuss this issue with crab and groundfish plan team co-chairs to determine whether specific advice might be provided to stock assessment authors in time for the fall assessments.
- **CPT's preferred model from May meeting.** Described in CPT report and below. The SSC agreed with the CPT's preferred model recommendations in all instances this year.
- **Another alternative model that shows promise.** Given more time for stock assessment modeling than originally thought, the assessment authors should have latitude, if they wish, to select an additional model on which they have already made progress (reported at the CPT meeting in May) or based on previous SSC and CPT requests as another alternative.

To support the OFL/ABC recommendations in fall 2020, the SSC requests:

- Usual diagnostics for base and alternative model runs
- Authors' and CPT's recommendations for model choice including justification
- Careful consideration of the effect of additional uncertainty associated with the loss of the 2020 survey on the harvest specification process including size of buffer between OFL and ABC.

Specific SSC comments on model runs for four crab stocks follow.

Bristol Bay Red King Crab model runs

The SSC appreciates the responsiveness of the assessment scientists to previous comments by the CPT and SSC. Eight scenarios for the Bristol Bay red king crab (BBRKC) assessment were considered that address

the way that natural mortality, selectivity, catchability, and the use of VAST are modeled. Models 19.1 and 19.2 fit the data poorly. Based on model fit to data, the assessors picked Model 19.4 in which size-based survey selectivity was treated the same for both males and females in response to a suggestion by the SSC. However, the CPT selected Model 19.3 as the priority model (in addition to the status quo Model 19.0a) for presentation in September.

Model 19.3 estimates male natural mortality in an early block (1980-1984) and then specifies M=0.18 thereafter. Female natural mortality is estimated as an offset from males in both periods. Survey selectivity is estimated separately for sexes, but a single catchability is estimated (still with a strong prior). The CPT favored Model 19.3 (estimating sex-specific survey selectivity) over Model 19.4 given potential behavioral differences between the sexes, slight sexual dimorphism, consistency with other assessments, better fits to survey composition data, and the relatively small number of parameters required. The team recommended that, if time allows, an additional model building from 19.3 in which the prior on catchability is relaxed and estimated separately by sex (and revisited in light of the catchability implied by the BSFRF data) should be generated for comparison. Models 19.4a and 19.4b in which VAST indices of abundance were not considered for September owing to poor diagnostics (e.g., Q-Q plots) and an identified need for examples of acceptable versus unacceptable diagnostics that would inform decisions to adopt VAST indices of abundance.

The SSC agrees with the CPT's model recommendations for September. Though promising, it is advisable to postpone the use of VAST estimates for this stock assessment until diagnostics for VAST can be more fully analyzed and better-fitting error distributions identified. The SSC also supports the other recommendations on this assessment offered by the CPT.

EBS Tanner Crab model runs

The stock assessment author noted a persistent residual pattern in the length-weight relationship used in the assessment for male Tanner crab. Old shell crab tended to weigh more at length than estimated by a length-weight regression. The author indicated that the NMFS-RACE division intends to look into the data and analyses used to develop the regression. The SSC looks forward to resolution of this issue.

The SSC appreciates the assessment author's responses to CPT and SSC comments. However, several issues have not been addressed. In particular, from the SSC's December 2019 minutes:

- The SSC requested that for the next assessment, models be reparameterized, simplified, or have parameter bounds adjusted such that no parameters remain at the bounds after estimation.
- Provide additional information on data weighting. Specifically, identify standardized residuals appreciably greater than would be expected by chance (e.g., values of four and larger), report mean input and harmonic mean effective sample sizes by source for evaluation of model fit, and consider basing input sample sizes on the number of trips/hauls sampled rather than the number of individual crab measured.

Another issue that was not addressed was an SSC request to develop a standard approach for projecting the upcoming year's biomass that does not include removing the entire OFL for stocks in cases where recent mortality has been substantially below the OFL. This is an issue for all crab assessments. The CPT report indicated that team members expressed reservations about how dependable such projections would be. However, the SSC points out that, if harvests are far below OFLs, then projections assuming that harvest occurs at OFL will be biased and unreliable. The SSC noted that it is standard for groundfish assessments to report two projections one using the OFL and a second with more realistic catch levels. The CPT is exploring options. One option is to project stock dynamics when the catch is set to some fraction of OFL based on recent history. The SSC appreciates that the team will form an ad hoc working group including assessment authors to consider options and to make recommendations for evaluation at the January modeling workshop.

Nine model scenarios were explored including alternatives that consider dropping pre-1982 biomass and size composition, use of cubic splines, use of VAST estimates, and exploration of different ways to include BSFRF side-by-side survey data. Models involving VAST estimates were not recommended at this time owing to the same reasons as for BBRKC and EBS snow crab.

Among the models that use the BSFRF side-by-side data, the CPT determined that model 20.07 was the most robust and makes best use of available data. Thus, the CPT recommended bringing forward the base Model (19.03) and Model 20.07 for September. If possible, instead of Model 20.07, the CPT recommended bringing forward a modification to Model 20.07 (denoted Model 20.07b) in which the empirical availability curves are input as data vectors with specified uncertainty rather than assumed to be known.

The SSC reiterated its previous recommendation on analysis of the BSFRF data. The SSC encouraged authors to work together to create a standard approach for creating priors on selectivity and catchability from these data for use in the respective assessments. A hierarchical comparison of all species pooled, separated species, and separated sexes may be helpful for understanding where statistically supported differences exist. Where sample sizes are modest (e.g., snow crab), bootstrapping, or a sample size-weighted estimate rather than a raw average may be useful for aggregating across years.

The SSC supports the CPT's recommendation to bring forward Model 19.03 (base model) and either Model 20.07b (if easy to implement) or Model 20.07 (if Model 20.07b is difficult to implement).

EBS Snow Crab model runs

The SSC is very pleased with the author's efforts to transition the snow crab assessment to GMACS. A recent significant advancement is the addition of an option for terminal molt, which is critical to describe the population dynamics for both Tanner and snow crabs. Another significant advancement is that the GMACS models are able to produce converged fits to the growth data using a linear fit between pre- and post-molt sizes. Despite gallant previous efforts, this is something that had not been achieved with the status quo model.

The stock assessment author recommended bringing forward three model variants for consideration this fall: status quo, "free q" GMACS, and "prior q" GMACS models. The CPT agreed, and the SSC concurs. The GMACS models fit both NMFS and BSFRF survey data better than the status quo model. Both the stock assessment author and the CPT recommended postponing the use of VAST estimates for assessment until diagnostics could be more fully analyzed. The team offered other suggestions about the assessment, with which the SSC agrees.

St. Matthew Blue King Crab model runs

A three-stage, length-based, male-only model has been used to assess St. Matthew blue king crab (SMBKC) since 2012. It has been modeled in GMACS since 2016. The model estimates population abundance and biomass by fitting a variety of data on commercial catch, groundfish trawl and fixed-gear bycatch, observer size composition, and trawl and pot surveys.

The authors investigated five model scenarios with mixed results. For instance, two models fit the NMFS trawl survey better, and the ADF&G pot survey worse, than the base model.

The SSC agrees with the CPT's advice to bring forward the following models for September:

- **Model 16.0 (2019 reference model) updated with January 2020 revisions to GMACS**
- **Three exploratory (research) models:**
  - **Model 19.1 (using VAST estimates)**
  - **A model with a random walk in pot survey catchability**
  - **Model 16.0 without ADF&G pot survey data**

Although VAST estimates were not deemed ready for use in other stock assessments at this time, they nonetheless may have value to this assessment where one NMFS trawl survey station often accounts for

most of the catch of SMBKC. The SSC encourages further exploration of alternative error distributions in the VAST model for SMBKC, noting that a single 'one-size-fits-all' approach to modelling survey data is unlikely to produce acceptable residuals for all species given differences in distribution and patchiness. If a model based on VAST survey estimates is brought forward in 2020, the SSC requests an appendix containing a report of VAST diagnostics for consideration. The CPT noted that the model with VAST generally estimates higher mature male biomass since the early 1990s but the stock nonetheless remains overfished under this model. Finally, the CPT noted that development of the proposed model with a random walk in pot survey catchability depends on upcoming modifications of GMACS.

Summer Trawl Survey

The CPT received a report on the status of the 2020 NMFS summer trawl surveys in the EBS, northern Bering Sea, and AI at their May 2020 meeting. Several scenarios were presented, and the CPT discussed the effect of these different scenarios on the timing of data availability and the potential for delaying assessments and harvest specifications for various crab stocks. It was noted that the scenario of "No Surveys", which was the eventual outcome, was not extensively discussed by the CPT.

The SSC discussed options for crab stock assessments this fall and a general approach is outlined in the "Model Runs for September - General Advice" section of this agenda item. Included in these recommendations are models that explore the impact of the missing survey data on the resulting uncertainty in the stock assessments, as suggested by the CPT in their presentation. The SSC requests authors report how assessments might be affected by missing data, including Tier status and buffer recommendations. The SSC also discussed the need to plan and prioritize updating upcoming assessments in the case of possible future reductions in surveys because of health and safety concerns related to the pandemic. Please reference the "B3 AFSC Report" section of this report for further details.

GMACS

The SSC continues to be very pleased with the progress on GMACS. Improvements to the platform have included standardization of input file headings, error checks for specific model components, and advancement of the GMR package for standardized reporting of model outputs. Extensions such as implementation of terminal molt capabilities to accommodate the snow (and Tanner) crab stock assessments have been successfully accomplished but are not yet part of the common repository. Several other features are at various stages of development. The SSC supports the CPT's high-priority development targets (e.g., inclusion of retrospective analysis, estimating a stock-recruit relationship internally, etc.). The SSC recommends that side-by-side comparison of GMACS with current assessment models continue to be reported as GMACS is explored and adopted for other crab stock assessments. The SSC looks forward to reviewing the framework after significant development milestones are achieved as well as reviewing specific management applications.

VAST model

VAST continues to be explored by the analysts and CPT as a method for modeling survey data for crab stocks. The CPT reported that a standard approach was developed for producing VAST estimates for the EBS trawl survey and all draft assessments included exploratory model runs that incorporated VAST estimates. None of these models, other than exploratory models for SMBKC, were recommended by the analysts or CPT to move forward for final analysis in September 2020. While VAST estimates tracked well with design-based estimates, the CPT noted it was not clear what level of diagnostic fit would indicate a reasonable model as opposed to those that would lead to model rejection. As standards have not yet been developed regarding for what diagnostics to examine and what level of diagnostic fits would result in rejecting VAST model output for operational use, the CPT determined that VAST estimates were not ready for inclusion in assessment models at this time.

While a clearly documented approach is necessary, the SSC noted the reluctance of accepting VAST estimates and questioned if VAST modeling is being held to a higher standard than other approaches as far

as meeting assumptions. The SSC also suggested that a single standard VAST model specification might not be appropriate for all stocks and recommended exploring alternative distributions for the positive catch rate component of the model to potentially improve model fits among different stocks. Once an appropriate approach is developed for a given stock, it should then be relatively easy to update in the future, and may allow inclusion of partial or sparse survey designs. In addition, when the VAST model tracks the design-based estimates closely, the SSC questions whether the added complexity of the approach is something to commit analytical resources to as opposed to other modeling issues. The SSC received comments during the meeting indicating that a new feature in VAST is in development by NOAA-AFSC analysts that addresses the "barrier effect for islands" that eliminates correlations across land. There are plans to explore this extension for the Aleutian Islands this summer, and the SSC encourages stock assessment authors to discuss these developments with NOAA-AFSC analysts when possible. The CPT report described that it was necessary to not estimate spatio-temporal random effects for the positive catch rate component of the VAST model for BBRKC abundance explored by analysts. The SSC recommends that analysts explore the distribution of survey abundance observations across years to determine if the implied temporal stationarity in the spatial distribution of abundance is consistent with observations.

The SSC supports the continued work on VAST, including addressing modeling issues such as dealing with land barriers and reporting of standard VAST model diagnostics in SAFE chapters, if proposed for inclusion. **The SSC further recommends the CPT develop a standardized reporting format for VAST model specification in future SAFE chapters.** The SSC also recommends that crab stock assessment authors and CPT continue to collaborate with appropriate AFSC staff as they develop approaches for including VAST estimates in stock assessment models.

BSFRF survey selectivity

The Bering Sea Fisheries Research Foundation (BSFRF) conducted side-by-side tows in conjunction with the NMFS EBS bottom trawl survey in Bristol Bay in 2013-2016 and further west on the EBS shelf in 2017 and 2018. The results have provided a valuable dataset with which to estimate NMFS trawl survey selectivity and catchability relative to a more efficient gear type. The BSFRF survey selectivity data have been incorporated into selected crab assessments.

The SSC supports the CPT recommendations for continued analysis of these data and looks forward to reviewing future results, such as the bootstrapping analysis to define catchability and availability priors. The SSC also encourages the exploration of a hierarchical comparison of all species pooled, species individually, and sexes individually, as recommended in the June 2019 SSC report. Finally, the SSC received comments during the meeting indicating that scientists at NOAA-AFSC are developing standard tools for analyzing size-selectivity experiments that might be of use in this effort.

Ecosystem and Socioeconomic Profiles

The CPT received a progress update on the ESP for BBRKC and shared details with the SSC. The ESP has seen significant progress and will be included as an appendix to the SAFE at the September CPT meeting and the October SSC meeting. This is only the second crab stock to have an ESP completed, after SMBKC, though all crab stocks have had report cards developed for them.

The CPT had a thorough discussion of metrics to include in the ESP and noted that, regardless of being quantitative or qualitative, all metrics used should be measurable and responsive to changes in the system. Metrics currently being used have been grouped into climate, life history, and spatial distribution categories in an effort to help conceptualize critical variables. For some of these metrics it is crucial to include a lag factor to account for temporal delays in the response. Current socioeconomic indicators are broken into two groups: those related to commercial value of and demand for fishery products, and those related to fishing effort. The CPT determined that incorporation of socioeconomic indicators into the ESP needs refinement to provide the needed utility for TAC setting, but noted that TAC is set by the State of Alaska for crab fisheries.

The SSC joins the CPT in thanking the authors for their extensive work on the ESP and looks forward to seeing it as an appendix to the full SAFE in October. The SSC specifically noted the thoughtful consideration of socioeconomic indicators and their potential uses that has gone into the development of this ESP. The SSC recommends that, prior to finalizing the document, a thorough review of the economic SAFE and relevant ESR be conducted to ensure that complementary socioeconomic information is being provided in each document. The SSC further recommends that clear lines be designated regarding which type of socioeconomic information will be routinely provided in each of these types of documents.

Crab PSC

In response to a Council motion, Council staff briefed the CPT on an initial review analysis being prepared for the October meeting that would reduce crab PSC in all fisheries to the lowest currently identified level when directed crab fisheries are closed. This conservative approach is meant to enhance recovery potential by minimizing fishing impacts from all sources. While area-specific PSC limits currently exist for many crab stocks, they are rarely exceeded and even at the lowest currently identified levels are not anticipated to constrain other fisheries.

In order to ensure maximum utility of the initial review, the CPT recommended that analysts bring forward a thorough review of how current PSC limits were developed; a summary of the rationale behind the stair-step approach currently used to set PSC; detailed analyses of spatiotemporal patterns of crab bycatch; and an analysis of the potential impacts of unobserved mortality (i.e., mortality due to injury by fishing gear when the crab are not brought to the surface).

The SSC supports the recommendations of the CPT and looks forward to seeing the initial review document in October.

Board of Fisheries update

The SSC received an informational summary on a recent action taken by the Alaska Board of Fisheries to revise the harvest strategy for EBS Tanner crab. Specifically, Proposal 261 sought to simplify the overall harvest strategy, reconsider application of a female-based control rule, and improve the economic outlook of the fishery. To achieve these goals, a coalition of partners at the ADF&G, University of Washington, Natural Resource Consultants, BSFRF, and NMFS conducted a management strategy evaluation (MSE) for 15 different harvest regimes and projected the results 100 years into the future. Conservation, catch, and catch stability were the major factors considered via diverse metrics, and in the end a "female dimmer" control rule was developed whereby female biomass is used to set the scale of the sloping male biomass control rule. This approach helps to account for reproductive capacity of the stock rather than simply harvest output.

The CPT supported the collaborative, thorough approach taken to accomplish this MSE and identified snow crab as the next appropriate stock to receive such treatment. **The SSC concurs with the CPT that this MSE process was broadly effective and supports similar efforts in the future for other crab stocks, beginning with snow crab.**

Climate change and LT/TK for Norton Sound Red King Crab

At the February 2018 and February 2019 meetings the SSC recommended that the Norton Sound red king crab (NSRKC) fishery would benefit from the inclusion of local knowledge (LK), traditional knowledge (TK) and additional subsistence information in the management process. Further, the SSC has recommended that the fishery would serve as a valuable test case for focused efforts of the Climate Change Taskforce and the Local Knowledge, Traditional Knowledge, and Subsistence (LKTKS) Taskforce. In January of 2020 both taskforces confirmed their interest in the undertaking, but efforts toward initiating work in support of that interest were soon delayed by the COVID-19 pandemic. Given regional and local travel restrictions that continue to impede the face-to-face interactions and community support considered

essential for the success of the effort, both taskforces concluded that without the opportunity to lay additional groundwork, additional efforts to seek information beyond already established, routine stakeholder involvement processes would be ill advised. As such, Council and NMFS staff have recommended using 2020 to cultivate relationships, identify regionally appropriate LK and TK pathways, and align the information needs of the CPT and the Council with local expertise for long-term enduring collaboration.

After receiving the briefing on taskforce progress from Council staff, the CPT deliberated on how to make progress on the SSC request for inclusion of LK/TK information in NSRKC stock and climate change analyses without jeopardizing community support or potentially compromising the health of individuals in the community by increasing coronavirus exposure risk. The CPT suggested that formation of a committee of local volunteers could move forward in 2020 and that information from this committee, though acknowledged as less comprehensive than what the taskforces would eventually produce, could be useful and responsive to the SSC request.

The SSC applauds the CPT recognition of the potential utility of LK/TK/Subsistence information and climate change data needs to stock assessment and its desire to move forward as quickly as possible. However, the SSC also recognizes that the extraordinary circumstances of the COVID-19 pandemic must be acknowledged. As such, the SSC concurs with the Local Knowledge, Traditional Knowledge, and Subsistence Taskforce and recommends that 2020 be used as a relationship-building year, working toward a comprehensive, coordinated LK/TK and climate change oriented outreach and community engagement effort beginning in 2021.

C-4 Cook Inlet Salmon FMP Amendment

The SSC received reports from Jim Armstrong (NPFMC), Doug Duncan (NOAA-AKRO), Marcus Hartley (Northern Economics) and Mike Downs (Wislow Research) on a preliminary review draft of the Environmental Assessment/Regulatory Impact Review (EA/RIR) for a proposed amendment to the Fishery Management Plan (FMP) for salmon fisheries in the Exclusive Economic Zone (EEZ) off Alaska. These revisions are needed to comply with the Ninth Circuit Court's ruling that the Cook Inlet portion of the salmon fishery must be included in the federal FMP. The SSC appreciates the opportunity to review the preliminary documents to help the Council meet the court-ordered December 31, 2020 deadline for this action. Public testimony was provided by United Cook Inlet Drift Association (UCIDA, written testimony), Samuel Kelley (Veteran Internships Providing Employment Readiness, VIPER), Eric Huebsch (UCIDA), Jeff Fox (self) and Roland Maw (self).

To bring the salmon FMP in compliance with the MSA, consistent with the court ruling, the Council appointed a Cook Inlet Salmon Committee of stakeholders and solicited proposals from the public to help develop alternatives and options for the FMP amendment. This led to the adoption of three alternatives in December 2019, including Alternative 1: No Action, Alternative 2: Federal management with specific management measures delegated to the State, and Alternative 3: Federal Management (of those portions of the fishery that occur in the EEZ).

However, additional stakeholder review of the alternatives and proposed modifications have been received since December and the Council may amend the alternatives under consideration. While this will require revisions to the descriptions of the alternatives and will affect the analyses of impacts, most of the completed EA/RIR sections provide the necessary foundations for the impact analyses and would not be affected by modifications to the alternatives.

The SSC commends all of the authors that contributed to this EA/RIR draft for the comprehensive documentation of the current status of affected Cook Inlet marine resources and the Upper Cook Inlet (UCI) driftnet salmon fishery. **The information contained in the EA/RIR sufficiently summarizes the marine environment, the UCI salmon fishery, other affected fisheries, and the communities that could be impacted by the FMP amendments under consideration.**

The SSC notes that the analysis of the impacts of the alternatives is not yet complete, which is to be expected at this point given that the alternatives have not yet been fully determined by the Council. The SSC believes that the baseline information provided in the current document is an excellent starting point and will facilitate the analysis of impacts once the details of the alternatives under consideration have been settled.

The SSC previously reviewed the proposed escapement-based status determination criteria (SDC) and options for determining Annual Catch Limits (ACLs) in April 2019. The description of the SDC and ACL determinations is much improved and supported by helpful examples. **However, the presentation of the different elements of each alternative, once these are finalized, need to be clarified in the document to make it easier for the public to understand and compare elements between alternatives.**

The SSC offers the following recommendations to improve the document:

Description of Alternatives (Chapter 2)

To address MSA provisions, Alternatives 2 and 3 propose new management measures including SDC, a mechanism for specifying ACLs, and a mechanism for standardized bycatch reporting. Additionally, Federal requirements may also be applied to vessels commercially fishing for salmon in the Cook Inlet EEZ, such as electronic monitoring requirements, recordkeeping and reporting requirements, or vessel monitoring systems.

Under both Alternatives 2 and 3, salmon stocks caught in Cook Inlet are annually assigned to one of three tiers based on the best scientific information available for the purposes of applying status determination criteria and setting annual catch limits:

Tier 1: salmon stocks with escapement goals and stock-specific catches

Tier 2: salmon stocks managed as a complex, with specific salmon stocks as indicator stocks

Tier 3: salmon stocks with no reliable estimates of escapement

The April 2019 SSC minutes provide a concise summary of the proposed tier structure; an updated version of this summary would be a useful addition to include in Chapter 2. Currently, three stocks would be placed in Tier 1 (Kenai and Kasilof River sockeye salmon, Kenai River late Chinook salmon), two stock complexes would be placed in Tier 2 and two stock complexes would be placed in Tier 3. The document describes how SDCs and ACL would be determined for each tier and the SSC offers the following suggestions for improving these descriptions:

- Alternatives 2 and 3 are difficult to compare in the current document. Each alternative has a number of elements and options and the presentation of these is somewhat inconsistent between alternatives. **The document would greatly benefit from an overview table that compares the main features of each alternative**. The overview table in the presentation or this draft table prepared for the most recent salmon committee meeting would serve as a good starting point.
- There are many similarities between Alternatives 2 and 3, leading to much redundancy in the document. Perhaps these redundancies could be reduced by describing these common elements under Alternative 2 (section 2.4) and simply referring to the relevant sections as appropriate when describing Alternative 3 (section 2.5), with a focus on highlighting the differences. For example, Alternative 2 does not provide a description of approaching an overfished condition, whereas Alternative 3 provides a description.
- To help the public better understand the annual decision processes as they relate to the alternatives, **the SSC suggests including an info-graphic that shows the overall process, with key decision points tied to the management body making the decision.** This graphic should also highlight the type of information being used in the decision (e.g., pre-season forecast versus post-season, SAFE document, ADF&G action, etc.).
- **The document defines MSY for salmon stocks based on the lower limit of the escapement goal ranges. As the SSC noted in April 2019, this does not appear to be very conservative and**

results in a higher MSY than the MSY currently defined by ADF&G for stocks with Biological Escapement Goals (BEG). It could be argued that MSY can be achieved over a range of escapements, therefore defining MSY as the potential yield that can be taken while maintaining escapement at the lower bound would result in the optimum yield (OY). This is indeed the definition used in the document. However, this appears to be a much less conservative control rule than other control rules used by the Council and **highlights the critical importance of selecting and justifying the lower bound for the escapement range.** The desire for a less conservative control rule is understandable as the lags in the salmon management system typically results in much larger escapements than the lower limit of the range and a more restrictive ACL could lead to unnecessary closures of the EEZ fishery. If that is part of the rationale, it could be used as part of the justification for the MSY control rule. As a possible alternative, the SSC encourages the analysts to consider using 'MSY' more generally in the FMP rather than fixing it at the lower bound, and to let the annual Salmon Plan Team process specify an appropriate value using best available science, noting that ADF&G generally reviews escapement goals on a 3-year cycle.

- The document appears to use MSY inconsistently in that it may refer to either the yield corresponding to the lower bound of the escapement goal or to the "true MSY" based on a BEG. Similarly, S_{MSY} in section 2.5.3 is used without an explicit definition. It is not clear whether S_{MSY} refers to the spawning biomass at which MSY is maximized (if a BEG is estimated), the spawning biomass at the lower limit of an escapement range, or something else. The potential inconsistencies in the use of both terms should be addressed, perhaps by distinguishing the different meanings using appropriate terminology that is clearly defined in the text.
- A prominent table with definitions of all quantities used in Chapter 2 would be very helpful in addressing some of the confusion.
- The use of OFL, ABC and ACL in the document should be checked carefully and should be consistent with their definitions under the MSA. Conceptually, the process first determines an OFL as in equation 6 (p.62), which should use OFL rather than ACL on the left-hand side. Maximum ABC is then determined as X% * OFL and ACL = ABC.
- While ACLs are defined as cumulative values over a generation (T years), the ACL appears to be used in an annual sense in some cases (for example, formula for ABC on p. 89). There may be some benefits to defining it as an annual value, but it should be used consistently and a different notation should be used for annual limits, if needed. While the conversion from a cumulative limit as defined in the document to an annual limit for the current year might be trivial, an annual limit (as implied by the term 'ACL') would likely be more transparent to the public.
- The same formula (p. 89) also includes several previously undefined quantities, R_hat and F_bar, presumably the estimated run size in year t and the average exploitation rate in the non-EEZ fisheries. These should be clearly defined.
- An apparent difference between the alternatives is that MFMT and MSST are defined in terms of total catch (EEZ + State water catches) in the equations for Alternative 2 and in terms of EEZ catches under Alternative 3. This needs to be clarified as the example in Table 2-2 (Alternative 2) defines catches and a fishing mortality estimate for the EEZ only, similar to the definition under Alternative 3.
- With respect to accountability measures (AM), the SSC has these suggestions
    - In the statement (p. 90) "if realized escapement is below the post-season S_{ACL} value, …" it is not clear if S_{ACL} is realized escapement in a given year or the cumulative escapement over a generation. S_{ACL} is not explicitly defined anywhere.
    - The SSC recommends that the authors further develop section 2.4.5 (p. 69) by broadening the description of AM to include a discussion of State management measures.
    - The SSC requests that the authors consider the use of annual catch targets as part of the system of AM measures for Alternative 2.
- If salmon stocks in UCI are managed with Council oversight, it will be important for the SSC to

gain a better understanding of current State management and how escapement goal ranges are determined for different stocks. **We reiterate our request from April 2019 for a brief overview of state management and escapement goal determinations prior to setting ABCs for salmon under a new process.** Public testimony suggests that there is some concern regarding the basis for the escapement goal ranges.

- The authors should clarify the purpose of Objective 5 (Alternative 2). As currently worded the objective provides for the protection of wild stocks while also fully utilizing hatchery production. These actions are in conflict should harvest reduction be required to protect wild stocks because wild stocks are mixed with hatchery stocks.
- Under both Alternatives 2 and 3, catch within the EEZ needs to be estimated separately from those within State waters. However, it is unclear what the required level of precision is under the two alternatives. The document implies that less precise estimates are needed under Alternative 2. **The document should clarify the level of catch accounting required under each Alternative to meet minimum MSA requirements.** The SSC suggests that eLandings, with modifications to the statistical areas, may be a way to accomplish this need under Alternative 2.
- The SSC recommends characterizing the types of processing operations not currently using eLandings, and clarifying in the analysis how reporting is occurring for those operations.
- The formatting of Chapter 2 should be improved to better distinguish sub-sections in a logical hierarchy. Currently, headings for minor subsections are often more prominent than higher-level headings, which is confusing for readers.
- On p. 85, last line (equation), $C_{total,t}$ on the right-hand side should be replaced with $C_{State,t}$
- Section 2.5.5, first sentence: 'post-harvest run size' should be replaced with 'post-harvest escapement' in the sentence that reads: "…results in a post-harvest run size equal to the MSY escapement goal…".

Environmental Assessment (Chapter 3)

The SSC found the EA to be well written and well developed at this stage and it appears that only minor updates will be required once the alternatives are finalized. Two suggestions for improvement are:

- A short discussion on the Alaska Marine Mammal Observer Program, its current status, and the type of information this program could provide should be included in the Marine Mammal section.
- The climate change impacts section should be updated with more recent literature, specifically literature most relevant to the Cook Inlet region. A good starting point is Schoen et al., 2017, Future of Pacific Salmon in the Face of Environmental Change: Lessons from One of the World's Remaining Productive Salmon Regions. Fisheries 42, 538-553. doi: 10.1080/03632415.2017.1374251.

Regulatory Impact Review (Chapter 4)

Like the EA, the SSC found this section to be well written and well developed at this early stage. The detailed information on catch composition, value of landings, etc., and the advances in the analysis of community fishery engagement (including the new principal components factor analysis) provide an unprecedented level of resolution that will be extremely helpful in evaluating the alternatives under this action and for future analyses. **The SSC notes that the analysis of impacts from the alternatives will be challenging, as it is hard to predict how they will impact the regulatory operations of the fishery in the EEZ, and in turn, how the industry, Alaska Board of Fisheries, and ADF&G will respond to these changes.** For example, consider an ACL in the EEZ for a particular salmon species, and suppose that this ACL is smaller than the amount of salmon that would have been caught without the ACL. What is the impact on the industry? A revenues-at-risk approach would assess the impact by calculating the difference between what would have been earned with and without the ACL in the EEZ. But this likely provides an upper bound on the impact to the industry since industry could presumably make up much (if not all) of

this catch in State waters. Further complicating this is the fact that there are other fisheries (set net, sport, and personal use) and other stocks that will likely be differentially affected by a binding ACL in the EEZ. This example illustrates that the impacts of some form of federal management of the UCI salmon fishery in the EEZ will be hard to estimate. Analysts are encouraged to do their best to describe the range of possible responses by the industry, Alaska Board of Fisheries, and ADF&G, and to be clear about the underlying assumptions used to come up with estimated impacts.

The SSC provides the following specific recommendations on the current RIR draft:

- Regarding the eLogbook, cost references are for the crab program logbook, which was still very much in development for a fairly complicated fishery and situation. The logbook requirements for the salmon fishery could be much simpler with a focus on groundfish bycatch only. The SSC requests the RIR provide a description of whether costs could be scaled down by modifying the existing groundfish eLogbook program for the salmon fishery.
- Regarding the Vessel Monitoring System section, the SSC had the following suggestions:
    - The document notes that federal funds may be available to qualified vessel owners or operators for reimbursement of the cost of purchasing type-approved VMS units. The SSC requests the analysts to provide details about the requirements for the reimbursement program and a general description of the availability of funds to offset VMS costs for this fishery.
    - As noted in the document, breakdown rates for VMS units may be higher for smaller vessels than for larger ones. Given this fleet is primarily composed of small vessels, and an inoperable VMS unit can prevent fishing in a high paced fishery, the SSC requests information on breakdown rates. If these rates are high, VMS may be infeasible for this fishery.
    - ADF&G currently manages and enforces area closures/special management areas. The RIR should describe status quo measures, and provide a rationale for why the additional requirement of VMS would be needed to manage the State/EEZ line.
- Under both State and Federal management (Alternatives 2 and 3), inseason stock identification will be necessary if evaluating stock specific harvests against stock-specific ACLs. Some information on the status of identifying individual stocks or stock complexes and the ability to do so inseason should be provided.
- The SSC recommends that the RIR include a discussion about potential impacts on processors under the 'Full Retention of Groundfish' option.
- In Alternative 3, a revenue at risk analysis in case of an EEZ closure needs to consider choke species regulating catch in State waters, which may encourage fishing in the EEZ. The authors should consider discussing some likely management scenarios under Alternative 3 and behavioral incentives associated with those scenarios.

D-1 Observer program update

The SSC received an update on the Observer Program from Jennifer Ferdinand (NOAA-AFSC). Public testimony was received from Julie Bonney (Alaska Groundfish Data Bank).

Under normal circumstances, the SSC would have discussed the 2019 Annual Report at this June meeting, however completion of this report was delayed to allow time to plan and respond to the COVID-19 global pandemic. The SSC received an update of the Fisheries Monitoring and Analysis responses to the global health emergency and a summary of the potential impacts of these changes on fishery-dependent data. **The SSC appreciates and supports the agency approach to the protection of lives and livelihoods. We thank all who have worked to adapt the fishery-dependent data collection enterprise to these unprecedented conditions**.

Several changes to the training, briefing, and debriefing protocols were adopted. These included measures

to reduce agency-observer interaction such as the use of virtual meetings for training, briefing and debriefing. Fish and crab species identification training and testing was suspended and it was noted that this may result in an increased incidence of species identifications being recorded at a higher taxonomic level. **The SSC recommends that the costs and benefits of remote training should be documented in the Annual Report to inform options for future training approaches.**

Several other logistical changes to observer deployment were also implemented. For example, to the extent possible, efforts were made to ensure that observers disembarked back into ports from which they embarked. In addition, the agency modified trip selection criteria to extend observer deployments for longer periods of time to facilitate assignments of one observer to one boat and to minimize air travel.

The SSC was encouraged to hear that major disruptions in the full coverage fisheries did not occur. The full coverage fisheries represent approximately 90% of the total coverage days. The largest disruption to data collection for the full coverage fleet was a change in the coverage of catcher vessels. The primary change was that observers were not allowed to enter the plants which disrupted their ability to collect data shore-side.

Disruptions in the partial coverage fleet were more substantial than full coverage. The partial coverage fleet represents about 10% of the coverage days. Waivers to deployment durations were allowed to minimize air travel and facilitate, to the extent practicable, deployment of one observer to one boat. In addition, when travel restrictions interrupted transportation of observers to Alaska, or training constraints limited the number of available trained observers, then observer coverage for partial coverage vessels was waived. These changes are expected to reduce deployment rates. Operators are continuing to report the number of trips that were not covered in 2020 so this impact can be tracked. The greatest loss of data from this decrease in coverage will be a decline in biological collections.

To mitigate the loss of data used for discard estimation and to more closely match the modified multiple trip selection plan, options for increasing fixed gear EM coverage from 30% to full coverage are being considered by NMFS. The SSC notes that participation in the EM pool is voluntary and shifting coverage to full coverage may result in some participants opting out of the EM pool in the future (e.g., 2021 ADP). In addition, the SSC notes that there are seasonal differences in catch composition and thus, increasing EM coverage will not mitigate reduced biological data collection and average weight information that would have otherwise been collected on non-EM trips.

The SSC recognizes that many of these changes to observer and EM coverage could impact the data used in stock assessments and in-season management. The SSC recommends that a high priority is placed on quantifying these impacts and communicating the potential impacts on key data streams to assessment authors and fisheries managers.

D-2 Sablefish apportionment workshop report

The SSC received a presentation from Kari Fenske (NOAA-AFSC) on the methods and preliminary analysis for evaluating ABC apportionment alternatives for the sablefish stock in the waters of Alaska. The purpose of this update was for the SSC to provide a review of the proposed methods as well as suggestions for structuring the discussion of apportionment alternatives to be brought forward in October. The SSC appreciates this opportunity to provide guidance prior to the final results, and to clarify the Council's needs with regard to future apportionment consideration. The SSC noted public testimony from John Gauvin (Alaska Seafood Coop) and Dan Falvey (Alaska Longline Fishermen's Association; written).

Sablefish apportionment among management areas has been frozen at the 2013 distribution due to concerns that the status quo method at that time (a mix of survey and fishery trend information) was not meeting fishery objectives, primarily due to large interannual changes in the results. Since then, there has been ongoing work to create a spatially explicit simulation framework with which to evaluate alternative apportionment approaches. The SSC thanks the authors for their work implementing a complicated technical problem in a relatively simple simulation study framework to explore the relative performance of

a range of alternative apportionment approaches. A limited set of preliminary results (not including sensitivity analyses) were available for SSC review, and the SSC noted that there had been some updates (noted during the presentations) to those results since the review documents had been produced.

The SSC considered the conditioning of the operating model and the degree to which the 'base case' analysis adequately represented the best current information on sablefish biology, stock assessment and management. **The SSC recommended that the analysis could benefit from an extended discussion regarding the conditioning of the operating model,** specifically addressing whether the model is able to recreate the historical biomass trends by area, and whether the age-independent movement rates applied adequately reflect the most recent analysis of historical sablefish tagging (Hanselman, D.H., Heifetz, J., Echave, K.B., Dressel, S.C., and Jech, J.M. 2014. Move it or lose it: movement and mortality of sablefish tagged in Alaska. Can. J. Fish. Aquat. Sci.: 1-14).

The SSC's consideration of the current state of sablefish scientific understanding highlighted several important research needs:

- Individual based modelling to identify the relative potential recruitment contributions from different spawning locations (as is being explored in association with the EFH analysis), and therefore the potential biological importance of maintaining a well-distributed spawning biomass.
- Continued tagging efforts to determine movement variability over time and/or size/age.
- Evaluation of potential maternal effects (differential reproductive success of larger/older females) within the sablefish spawning biomass.

The SSC noted that the sources of variability included in the simulation framework were limited to future recruitment magnitude and distribution, and the estimation error associated with determining the following year's ABC and the ABC distribution (for those options where the distribution was based on estimates or simulated data). The SSC suggest that a large number of additional sources of variability could be important contributors to variability in realized apportionment, including: parameter uncertainty and process error in the operating model (such as time-varying movement rates, mortality, catchability, and selectivity), mismatch between the specified ABC and actual catches, particularly in western areas where this has been historically common, and precautionary adjustments to the coastwide ABC. These additional sources of variability could interact to create additional variability in realized apportionment results relative to those observed from simulations. **The SSC recommends that the analysts consider incorporating additional sources of variability as part of the simulation where appropriate, if possible.** Where this cannot be done, sensitivity analyses should be used to provide additional insight into these factors, noting that sensitivity analyses will not capture the cumulative and interactive effects of multiple sources.

The SSC further recommends that a 'base case' simulation should include more realistic catch vs. ABC ratios where appropriate, perhaps limited to historically observed levels of effort by area.

The SSC also recommends consideration of the adjustment to the coastwide ABC to reduce harvest (implementing a larger OFL-ABC buffer) when abundance of older spawners is low, such as was applied in 2019 and 2020, and whether this should be included.

The SSC requests a model check be performed based on one apportionment approach and an estimation model provided with very precise data from the operating model, (and perhaps extended farther into the future) to evaluate the implementation of the Council's harvest control rule; the expectation being that the stock should equilibrate at or above B_{40}.

The SSC recommended adding two additional performance metrics: the effort required to achieve the ABC in each area and the variance in apportionment in each management area, displaying the latter metric as a mean-variance plot for each of the approaches.

As time permits, it may be preferable to include more than the 200 simulation iterations completed in the

preliminary analysis. The SSC suggests that evaluation of Monte-Carlo error over increasing sample sizes for several performance metrics could guide selection of the appropriate number of iterations for the final results.

The SSC concluded that the range of apportionment alternatives (nine in the revised results) appeared to be adequate to compare and contrast different outcomes and performance. The SSC did note that the 'equilibrium' and 'blended' approaches would not be responsive to long-term directional changes in stock distribution (for example, due to climate change), where even long-term running averages would be.

The SSC recognized that most important biological and fishery aspects of the sablefish stock are the very high rate of non-directional movement and relatively low level of fishing mortality. In tandem, these properties result in little chance that either localized depletion or 'downstream effects' are propagated from one area to the next. This somewhat circular result is consistent with the conclusions of the most recent sablefish CIE review, as well as the SSC's recommendation to combine the OFL into a single coastwide value for 2020. **However, these properties do not necessarily equate to a lack of biological importance for maintaining spawning biomass across the full extent of the species range. Therefore, the SSC highlights the ongoing research needs identified above.**

The SSC may find that multiple approaches to apportionment acceptably meet biological conservation objectives of maintaining a healthy coastwide spawning biomass with sufficient spatial distribution to provide for successful recruitment across a range of environmental conditions. However, since different vessels, fleets, processors and communities are engaged with the fishery differentially across areas, the decision has distributional implications requiring analysis prior to a policy decision. The apportionment modelling effort has yet-unrealized potential to support evaluation of social and economic impacts through analysis and development of additional social and economic performance metrics. These could support the Council in ensuring the chosen apportionments comply with National Standard 8, specifically ensuring that changes in apportionment do not compromise sustaining historical participation.

As supporting information for the policy decision, the SSC suggests the Council consider requesting a complementary social and economic analysis that would map area-based apportionment to the vessels, processors and communities that participate in the fishery in different areas, and calculate the mean and variance of business-level indicators. This analysis could consider:

- Effects on catch from vessels (which may hold quota in multiple areas) in different fleets, or that use different gear types
- Effects on vessels that do not target sablefish
- Effects on the communities in which participating vessels are registered
- Effects on processors and communities that receive landings based on which fleets harvest in which subareas

The SSC requests guidance from the Council on its goals, such that the SSC may guide the analysts in developing the appropriate scope of information to support subsequent results and discussion on sablefish subarea ABC apportionment.

D-3 Essential Fish Habitat 5-year review modeling workplan

The SSC received a presentation by Steve MacLean (NPFMC), Jim Thorson (NOAA-AFSC) and Jodi Pirtle (NOAA-AFSC) on the development of modeling efforts to support the description and designation of Essential Fish Habitat (EFH). Public testimony was provided by John Gauvin (Alaska Seafood Cooperative), Jon Warrenchuk (Oceana), Craig Rose (self), and Stephanie Madsen (At-Sea Processors Association). The SSC thanks the co-authors and contributors for a clear, comprehensive, and detailed presentation of new analyses and proposed changes to methodology following the last 5-year EFH review in 2017.

The presentation reviewed analyses under development to define Essential Fish Habitat (EFH) in the GOA, BSAI, and Alaskan Arctic regions, in preparation for the upcoming 2022 5-year EFH review. The range of proposed methods are intended to define Level 1 EFH (distribution), and advance methods for delineating Level 2 EFH (habitat-related densities and abundance) and Level 3 EFH (vital rates including habitat-related growth, reproduction and survival). Specifically, the discussion paper presented new research from four in-progress studies: (1) use of species distribution models (SDM) to define groundfish EFH in GOA and BSAI regions by Laman *et al.*, (2) SDM for defining EFH in the Arctic region for Arctic and saffron cods and snow crab by Marsh *et al.*, (3) identification of optimal thermal habitats for juvenile walleye pollock (Level 3 EFH) in the GOA based on a combination of laboratory studies of temperature-dependent vital rates and SDM by Laurel *et al.*, and (4) exploration of biophysical life-stage integrated individual-based models (IBM) for defining Level 3 EFH for the early life-history stages of Pacific cod and sablefish. In preparation for the upcoming 5-year EFH review, NMFS requested SSC review of proposed methods and products, and progress to date.

The SSC noted that there was a link in the action memo to the Council's *Proposed approach to reviewing Essential Fish Habitat for the 2022 EFH 5- Year Review*. The SSC looks forward to providing review and comments on this document in the future.

Current SDM analyses are based on survey data alone and by necessity only describe summertime habitat use, given the timing of survey efforts. It was noted that there may be potential utility of including fishery-dependent information and local and traditional knowledge to inform EFH efforts for seasons, areas, or habitats that are not sampled by fishery-independent surveys.

Finally, testimony highlighted appreciation for this work in advancing EFH for finer-scale life stages and the estimation of habitat quality metrics on a continuous basis across the entire region, but suggested consideration of defining EFH not based on the top 95% of locations, but instead based on regions containing the top 95% of abundance observations.

The SSC supports the continued exploration of alternative SDM approaches across species, regions, and life stages using generalized additive models (GAMs) describing abundance, presence-absence, and simultaneously with hurdle GAMs, in addition to maximum entropy models for presence-only data. Regarding proposed changes to SDM methods, the SSC supports:

- Modeling abundance with area swept (effort) as an offset where possible, as a replacement for the 4th root transform of catch per unit effort (CPUE)
- Use of out-of-sample skill testing for arbitrating among candidate SDM approaches, and inclusion of repeated sampling of testing and training datasets
- Use of the complementary log-log link in analyses of presence-absence and presence-only data, given its utility in directly relating abundance to occurrence thereby permitting skill testing across a broader suite of models, and given its extensive application in aquatic and terrestrial SDM efforts
- Continued exploration of static and dynamic habitat or physical environmental variables as predictors in SDM

The SSC further recommends consideration of error distributions that are better suited to over-dispersed counts, including the negative binomial. While these were not described in the discussion paper, the presentation explained that exploration of over-dispersed models is planned.

With respect to the selection of specific SDM approaches based on skill testing, the SSC suggests consideration of ensemble methods that weight EFH prediction across candidate SDM with similar out-of-sample predictive performance. While there are many ways to weight ensemble members, weighting based on out-of-sample predictive skill may be most applicable. In defining the spatial extent of EFH, the SSC discussed the question of uncertainty in model predictions due to limited observations in particular regions, or at particular values of predictor variables. The SSC recommends that analysts define thresholds for

excluding or denoting areas where uncertainty is high, perhaps based on the ratio of the estimated response to uncertainty. The SSC recognizes the value of using a metric such as root mean square error (RMSE) for selection of specific SDM approaches. At present, the analysts have identified the model with the lowest RMSE value as the 'best'; however, it was noted that in several cases, alternate models had limited differences in RMSE values but substantial differences in the areal extent of EFH. The SSC requests justification for selection of the 'best' model based on RMSE moving forward, and for defining thresholds for final model selection.

The SSC notes that analysts should be cautious in the interpretation of habitat as the most essential for a species' life stage when surveys have not sampled some of their preferred habitats. For example, the SDM results for sub-adult Pacific ocean perch (POP) show a peak depth of about 250 meters, which is roughly the adult POP peak depth. Without considerations for the amount of shallower and untrawlable survey grid cells that are likely to contain higher abundances of sub-adult POP, SDM may fail to identify suitable habitat for younger POP.

The SSC encourages expanded efforts to include additional sources of information to describe and define EFH, potentially including additional fishery-independent survey information (acoustic data), careful consideration of fishery-dependent data, and local and traditional knowledge. However, the SSC acknowledges that additional efforts would be necessary to account for differences in survey design and gear type when including data from multiple surveys in SDM, given differences in selectivity and catchability (e.g., EBS slope and EBS shelf surveys use different gear, but are combined in the sablefish EFH analyses). Exploring other data sources for species groups such as rockfish (or juvenile life stages) that occupy unsampled habitats may prove fruitful. Exploring fishery-dependent data from pelagic gear or with rugged tire gear modifications and fishery-independent video and acoustic data could provide valuable insight.

Below are comments specific to the four in-progress analyses presented in the discussion paper. Pertaining to EFH analyses for the Arctic region (Marsh *et al.*), the SSC supports inclusion of additional survey data if possible, continued consideration and development of alternative habitat covariates (e.g. bathymetry-derived seafloor terrain metrics, biogenic habitat, or occurrence of prey), and encourages the exploration of alternative SDM approaches including GAMs and out-of-sample skill testing to arbitrate among model alternatives.

With respect to efforts by Laurel *et al.* to develop Level 3 EFH products, the SSC commends researchers on efforts to fill the "winter knowledge gap" by providing greater understanding of habitats critical to age-0 pollock overwinter survival, and encourages extension of the mechanistic approach described to other species or life stages for which environment-linked vital rates have been identified. The SSC supports the continued development of the products proposed by Laurel *et al.* (i.e. metrics for regional habitat quality, regional survival likelihood estimates for age-0 fish emerging from overwintering habitats, regional maps of habitat quality and habitat-linked survival metrics), and next steps including completion of juvenile pollock laboratory experiments, updates to juvenile pollock SDM and continued exploration of SDM-integrated Level 3 EFH mapping approaches, and development of Level 3 EFH maps for summer and winter seasons from updated ROMS data.

Pertaining to research by Shotwell *et al.* in defining Level 1-3 EFH based on IBM, the SSC supports continued efforts to explore the regions and conditions fostering successful survival of early life history stages (ELHS). Given the observed sensitivity of successful transport and settlement of ELHS to the assumed spawning location (start location within the IBM), the SSC encourages exploration of multiple spawning areas based on fishery-independent and fishery-dependent data, or other sources of information. One possibility discussed was "reverse" engineering where spawning areas are inferred by working backward in their life history from where juveniles are encountered. The SSC further encourages extension of IBM-based methods for defining ELHS EFH, to other species for which IBM have already been developed.

Some SSC discussion pertained to efforts at defining EFH for a broader suite of species in the Arctic region as climate-mediated shifts in distribution are currently being observed. NPFMC staff (Steve McLean) clarified that Arctic EFH description is only required for species included in the FMP. The SSC generally agreed that, while not required, additional SDM research for other species more recently occupying the Arctic should be supported, noting that it may be most appropriate to extend SDM for the Bering Sea region northward for those species most likely to expand, rather than extending existing Arctic EFH efforts.

The SSC also discussed the need to move to a more dynamic definition of EFH given recent and rapid changes observed in the environment and species distributions. The SSC supports research permitting description of Level 3 EFH, given that vital rates may be responding to temperature variation, and encourages consideration of EFH in time blocks. The SSC further commended authors for progress toward Level 3 EFH definitions but encourages consideration of whether co-mapping or directly incorporating vital rates within SDM is the best approach, highlighting that it ultimately depends upon the underlying assumptions and questions.

The SSC supports these ongoing research efforts to refine existing EFH designations, explore new SDM methods for defining Level 1-2 EFH, and the integration of laboratory and field studies with data describing physical environmental conditions, SDM, and IBM, as a means for describing Level 3 EFH. The SSC notes the immense progress in EFH modeling and hopes that these analyses will be considered in stock assessments and analyses supporting stock assessments, particularly habitat suitability and how it may pertain to recruitment and spawning locations. At a minimum, these efforts should be able to contribute to the stock assessment process and ongoing EBFM efforts, including through the ESPs.

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 2020 meeting, multiple SSC members acknowledged associations with specific agenda items under SSC review. Mike Downs and Andrew Munro are contributing authors to the Cook Inlet Salmon FMP Amendment (C-4). Curry Cunningham acknowledged that he is an PhD advisor to Kari Fenske, the lead author for the D-2 Sablefish workshop materials, and is a contributing author for the sablefish workshop materials and the Cook Inlet Salmon FMP Amendment analysis. Dana Hanselman is a contributing author on the sablefish workshop materials, and indirectly supervises Ms. Fenske and Jordan Watson, who is a contributing author to the Cook Inlet Salmon FMP Amendment analysis. Dr. Hanselman also acknowledged that his wife, S. Kalei Shotwell, is the lead author on a chapter of the Essential Fish Habitat discussion paper (D-3), and also gave a presentation on the Ecosystem and Socioeconomic Profiles in the AFSC report (B-3). Franz Mueter supervises Jen Marsh, who is a lead author of a chapter in the EFH discussion paper. Dr. Mueter is also a contributing author to a chapter of the EFH discussion paper as a result of his supervision of Dr. Marsh. Dana Hanselman and Anne Hollowed noted both work for Dr. Robert Foy, Science Director of the Alaska Fishery Science Center. Dr. Hollowed also supervises the lead authors for the EBS Tanner and snow crab assessments (Buck Stockhausen and Cody Szuwalski), the CPT co-chair (Martin Dorn), and is the second lead supervisor for Dr. Shotwell. Finally, Jason Gasper provided input on the FMA Observer Program COVID-19 response (detailed in Agenda item D-1).