

**DRAFT REPORT OF THE
SCIENTIFIC AND STATISTICAL COMMITTEE
TO THE
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
February 1st – 5th, 2021**

The SSC met remotely from February 1st to 5th, 2021.

Members present were:

Sherri Dressel, Co-Chair <i>Alaska Dept. of Fish and Game</i>	Anne Hollowed, Co-Chair <i>NOAA Fisheries – AFSC</i>	Alison Whitman, Vice Chair <i>Oregon Dept. of Fish and Wildlife</i>
Milo Adkison <i>University of Alaska Fairbanks</i>	Chris Anderson <i>University of Washington</i>	Amy Bishop <i>University of Alaska Fairbanks</i>
Curry Cunningham <i>University of Alaska Fairbanks</i>	Mike Downs <i>Wislow Research</i>	Jason Gasper <i>NOAA Fisheries–Alaska Region</i>
Dana Hanselman <i>NOAA Fisheries—AFSC</i>	Brad Harris <i>Alaska Pacific University</i>	George Hunt <i>University of Washington</i>
Andrew Munro <i>Alaska Dept. of Fish and Game</i>	Matt Reimer <i>University of California, Davis</i>	Chris Siddon <i>Alaska Dept. of Fish and Game</i>
Ian Stewart <i>Intl. Pacific Halibut Commission</i>	Patrick Sullivan <i>Cornell University</i>	

Members absent were:

Tien-Shui Tsou
*Washington Dept. of Fish and
Wildlife*

SSC Election of Officers

The SSC re-elected Anne Hollowed (NOAA-AFSC) and Sherri Dressel (ADF&G) to serve as co-chairs for 2021. Dr. Hollowed will act as chair for the April and December meetings, and Dr. Dressel will chair the February, June and October meetings. The SSC also re-elected Alison Whitman (ODFW) to serve as vice chair.

General SSC Comments

The SSC extends a warm welcome to new members Patrick Sullivan and Chris Siddon and returning member Milo Adkison (alternate for Franz Mueter). The SSC is grateful for their offering of time and expertise and the SSC is appreciative to the Council for their appointments.

The SSC congratulates Dr. James Ianelli who was selected by the Council to be the second recipient of the Terry Quinn II Distinguished Scientist Award and Chris Oliver who was awarded the Bob Mace award. Dr.

Ianelli and Chris Oliver have contributed greatly to the Council process and to sustainable fisheries and the SSC has greatly appreciated working with them both.

SSC Administrative Discussion

The SSC reviewed proposed changes to the SSC handbook. The SSC thanks Council staff for their work to continually update and revise the SSC handbook. Significant proposed revisions presented to the SSC included:

- Language added to clarify that the SSC shall consist of no more than 20 members (pg. 4)
- Note that the SSC may choose to hold a special-topic meeting during summer months (pg. 8)
- Multiple additions and clarifications related to virtual meetings, including:
 - Timing of SSC meetings in virtual mode only (pg. 7–14)
 - Reimbursement of costs related to virtual meetings (pg. 14)
- Clarifications and updates to the Council’s travel compensation policy (pgs. 12 – 13).
- Additional text in Section 6.1 describing the six Fishery Management Plans for fisheries off of Alaska (pg. 15)
- The addition of a section (Section 6.3) describing a typical annual cycle of Council issues (pg. 17 – 18)

The SSC is supportive of these changes and additions and has a few additional suggested changes. The first is regarding the description of SSC membership from the Statement of Organization, Practices, and Procedures for the North Pacific Fishery Management Council (Council SOPPs) as cited in Section 3 of the SSC handbook (pg. 4). The SSC suggests changing “sociology” to “anthropology/sociology” to reflect both the accepted distinction among social scientists between an economic and non-economic focus and the particular value of anthropological methodologies and perspectives for SSC review of community/social impact assessments and work related to the Council’s stated commitment to the incorporation of LK/TK to the Council process. The SSC is currently reviewing its process for reviewing research priorities and suggests the language referencing the SSC reviewing research priorities annually at their June meeting be made more general (pg. 20), such as ‘annual or multiyear review’ and not specifying a specific meeting. The SSC suggests clarifying that the language the SSC uses during review of initial review items has changed from ‘released for public review’ to “sufficient to be advanced to final action” (pg. 19). Finally, it would be helpful if the hyperlinks in the document be verified and updated if no longer functional or accurate.

SSC Prioritization and Planning

The SSC held a discussion of meeting scheduling, subject matter expertise of SSC members, topics for review and time management during virtual meetings. Stephanie Madsen (At-Sea Processors Association) provided public testimony.

The SSC was notified that the June NPFMC meeting will be virtual. To accommodate the need for extended time during the virtual meetings and observance of Memorial Day, the NPFMC administrative staff shared that the Council is considering a four-day SSC meeting starting on Tuesday June 1st. The SSC noted that the SSC’s experience with virtual meetings has revealed that five days have been necessary to complete all topics and recognizes that a shorter agenda will be necessary if a four-day meeting is planned. The SSC recognizes the difficulty of scheduling virtual meetings and agreed that the starting the meeting on Tuesday June 1st would work for SSC members.

The SSC appreciated the NPFMC's recent action to appoint new SSC members with strong stock assessment backgrounds. The addition of Drs. Sullivan and Siddon with strong backgrounds in this area are greatly appreciated by the SSC. The SSC acknowledges the large number of items coming before the SSC that benefit from including non-economic social science expertise and perspective in the review process. Therefore, for future appointments, the SSC recommends that the Council consider appointing another social scientist with a background in anthropology, sociology, human geography, or a related field.

With respect to prioritization, the SSC discussion focused on making sure that the SSC did not miss or delay a scientific review that would have implications for Council actions in the near future. The SSC discussed two categories of items: key issues that the SSC recommends be scheduled or considered and informational issues that are important but are not currently associated with a Council action. With respect to key issues that the SSC recommends be scheduled or considered, the SSC identified six issues:

1. A stock structure white paper and workshop in response to Step 2/3 of the NPFMC spatial management policy. In December 2020, the SSC recommended reconstituting the spatial management working group to develop a white paper updating knowledge of BSAI blackspotted/rougeye (BS/RE) rockfish spatial distribution, stock structure, and ontogenetic spatial shifts in depth. This would provide the basis for discussions of how the NPFMC spatial management policy could be utilized to identify and evaluate a suite of possible actions (e.g., gear, time, area, triggered closures) that could be applied to enhance the efficacy of the Maximum Subarea Species Catch or similar tools to address conservation and management concerns for BS/RE, as well as identifying priority areas for further research. **The SSC continues to recommend this white paper and workshop as soon as possible.**
2. In June 2020, the SSC reviewed species distribution modeling efforts that included new approaches and information sources relevant to mapping EFH by species and life-stage. The SSC notes that the species distributions are only one component of the 5-year EFH review and that other elements will be needed, in particular the fishing effects analyses. **The SSC requests a briefing on the EFH 5-year review work plan (e.g., Council's EFH Roadmap) and timeline.**
3. In December 2020, the SSC noted that mainlining reliable information on the size, sex and age of the catch is a critical component to sustainable management of marine resources off the coast of Alaska. The adoption of electronic monitoring (EM) must not degrade the quality of the fishery dependent biological information. **The SSC looks forward to hearing how the biological sampling plans have performed relative to this goal** in the EM Observer report (June), Observer Program Annual report (June), the upcoming Trawl EM analysis (October), and possibly also in the AFSC Director report (April and/or June) or a separate update.
4. As noted in the SSC comments on the Climate Change taskforce (CCTF) work plan (Agenda Item D-3), workshops to inform the Council of the emerging risks of climate change and extreme events (marine heatwaves) and to initiate planning for reviewing alternative management approaches to respond to these changes are needed. **It was noted that the Intergovernmental Panel on Climate Change 6th Assessment Report will be finalized this fall and perhaps a briefing on the key findings from that group with respect to impacts and management of marine resources in the Arctic, Bering Sea and Gulf of Alaska (GOA) would be useful.**
5. The SSC anticipates that the Alaska Climate Integrated Modeling Phase 2 modeling effort will initiate workshops to identify a new suite of potential management responses that include spatial and temporal management. These workshops are not expected to interfere with scheduled SSC meetings. However, some **SSC participation will be needed** for these workshops.
6. **The SSC requests an informational update on seabird status.** The SSC noted the need to receive an informational presentation on seabird status, beyond (and not duplicative of) that presented in the ESRs. Council staff shared that the NMFS seabird working group is scheduled to meet in March

and can provide a short informational presentation to the SSC following that meeting. The SSC would appreciate this update.

The SSC discussed the benefits of receiving informational updates on emerging science and how to balance those within the time constraints of SSC meetings. The SSC greatly values these briefings, especially when focused on key emerging issues that may require Council action in the future. **During this time of virtual meetings, the SSC recommended that the briefings be shortened to the extent practicable to focus on the most pressing emerging issues.**

The SSC discussed the timing of receiving documents and presentations. **The SSC highlights that sufficient time to review documents is essential for SSC to provide the Council with a thorough review.** The SSC extends appreciation for documents that are posted in time to allow sufficient review (e.g., 2/3 weeks before the meeting for Initial Review of Analysis, Section 6.2 SSC handbook) and acknowledges that there are situations in which a short review time will be required (e.g., assessments that incorporate survey data that only becomes available close to meeting time). The SSC is particularly concerned, however, about documents that become available only days before the meeting and notes that the SSC's ability to provide a thorough review is compromised when this occurs. **The SSC has appreciated that presentations are now posted on the SSC agenda** and noted that having access to these as reference is extremely helpful. The SSC also indicated, and received public testimony at this meeting, that **it would be helpful to have presentations posted at least a few days before the presentation to allow for SSC review and public review and comment.**

C-3 IFQ Sablefish Release Analysis

The SSC received a presentation from Jim Armstrong (NPFMC) and Joe Krieger (NOAA-AKRO), with additional information from Jane Sullivan (NOAA-AFSC) and Jen Calahan (PSMFC). Public testimony was received from Paul Clampitt (Sablefish and Halibut Pot Association), Bernie Burkholder (Sablefish and Halibut Pot Association), Bob Alverson (Fishing Vessel Owners Association), Shawn McManus (Deep Sea Fishermen's Union), Linda Behnken (Alaska Longline Fishermen's Association), Alexander Stubbs (Stubbs Marine/CodCoil pots), and Stephen Rhoads (Seafood Producers Cooperative).

The SSC thanks the analysts for a document that comprehensively identifies dynamics that may influence the outcomes arising from this measure. In the absence of information or data about this fishery, they did well to draw on information from other fisheries for information that sensibly scopes reactions and bounds effects, for example, about selectivity and discarding behavior.

The SSC acknowledges the proposed amendment is designed to address an immediate problem brought about by recent large year classes leading to an abnormal abundance of sablefish below optimal market size. The analysis addresses three primary issues: 1) difficulties in estimating the size or age distribution of discards and thus enumerating discard mortality, 2) risk to future productivity, and 3) risk to future yield. While the difficulties associated with the estimation of size or age distribution of discards are thoroughly considered, **the SSC feels there are two unresolved questions that are central to understanding the effects of the proposed amendment:**

1. What is the impact on the age structure and overall productivity of the stock under different rates of discard mortality and for different gear and discard selectivity profiles?
2. What is the impact on the uncertainties in the stock assessment, and the required buffers in setting ABC, arising from knowledge gaps introduced by not knowing gear selectivity or discard selectivity and mortality in a mostly unobserved fishery?

The SSC recognizes that this analysis provides the basis for a time-sensitive action, but the SSC concluded that the analysis does not fully address these questions and recommends that the draft amendment is not ready for final action.

Age Structure and Productivity

Under Alternative 1, it is assumed that all small fish captured in the fixed gear fishery are retained. Under Alternative 2, an unknown quantity of small fish would be released with the expectation that a relatively large percentage of them survive. The result would be to shift the retained selectivity curve to favor larger fish (as is shown when comparing the logistic selectivity curve in the draft amendment to Figure 3.40 in the 2020 SAFE). The effect of shifting the retained selectivity curve towards mature fish will change $F_{40\%}$, increase the fraction of the population entering the spawning population, and change the value of the landed catch. Depending on how selectivity is changed, this could result in a higher ABC or lower ABC. The key is whether the lost yield of young fish would be offset by the benefits of increases in the recruitment of fish to the spawning population and the associated harvest of larger fish. Allowing releases of small sablefish could make ecological sense and, if these lead to increased value of total landed fish, then allowing releases of small sablefish could also make economic sense. The investment of time in carefully releasing small fish is potentially well suited for a slow maturing stock like sablefish, if the amount of released fish can be reliably monitored. The potential value of this action, however, is not demonstrated by the yield per recruit (YPR) analysis, which focuses on maximizing yield rather than maintaining reproductive potential. **The SSC recommends that projections be developed to assess where the trade-off in lost yield of younger fish balances with preserving spawning biomass and future value of the catch.**

Uncertainty

The challenges associated with data collection are laid out in the analysis and represent a serious concern for the proposed amendment. The authors highlight that in the absence of paired at-sea and onshore sampling programs for age or length composition, retention selectivity cannot be estimated and will result in an increase in uncertainty for quantities of interest estimated by the assessment (Table 2-9). However, **the SSC encourages the authors to consider whether additional exploration of the impact of poorly-informed IFQ fishery selectivity on stock assessment model reference points is warranted to fully evaluate the impacts of this proposed management measure**, potentially in conjunction with the age or length structured simulations described below.

An additional consideration for modeling the impacts of discards is whether under Alternative 2, fishermen will continue to fish in the same areas, at the same time, and with similar gear configurations or if fishing strategies would alter. Under Alternative 1, harvesters have an individual incentive to avoid small sablefish to use IFQ on more valuable, larger fish; under Alternative 2, harvesters are only collectively accountable for small fish mortality through the DMR. Estimates of the size distribution of released fish captured with new fishing strategies will be uncertain. If the IFQ fleet moves into new fishing grounds, the expected encounter rates with small fish will be difficult to project within the model. **Thus, if Alternative 2 is selected, monitoring the released catch would be critical.**

Recommendations

To address questions about the impact of discards on future yield (section 2.2.3.4), **the SSC recommends that the authors replace the YPR analysis with a spawner per recruit (SPR) analysis.** The SSC requests that this include a 50 - 100 year projection. The specifics of this projection can be adjusted based on the authors' best judgement. We provide the following as an example. Use the 2020 age or size composition by sex of the population as a starting point. Project future yield over a 50 to 100-year time horizon using random draws from observed recruitment (1977 to present), and using a sex specific age or size-based model with all parameters fixed at the values of the last approved stock assessment except for IFQ selectivity. Adjust IFQ selectivity to the three scenarios based on perceived fishermen's responses, as described in the amendment package. Run simulations that include the sloping control rule using a recalculated $F_{35\%}$, $F_{40\%}$, $B_{35\%}$, and $B_{40\%}$ based on the relevant IFQ selectivity, and estimate future total ABC. Estimate released catch based on the difference between current sex-specific selectivity for IFQ fisheries in the SAFE and the 3 scenarios in the amendment package. Run separate simulations using a wide range

of DMRs, including at least those presented in the draft analysis (5, 12, 16, 20%) and 100%, to the released catch and impose this additional mortality to the population model by age or size and sex. Authors may also consider whether to include simulations with a range of retention curves to explore uncertainty in retention by size or age in addition to uncertainty in DMRs. Compare results to the full retention scenario. Partition the ABC to approximate historical sector allocations of the TAC and assume that the sectors maintain catch below the TAC. Report on IFQ landings, CV of IFQ landings, IFQ discard mortality, CV of IFQ discard mortality, the age composition of the IFQ catch, spawning biomass, total yield, IFQ landings, and the number of times the fishery drops below $B_{40\%}$.

In analyzing projection results, the SSC recommends that the discussion emphasize how episodic recruitment impacts age structure as strong year-classes move through the fishery and how the proposed amendment performs when there are sequences of low recruitment years, in addition to the current situation of streaks of high recruitment.

In discussing the risk to future productivity (page 34), the SSC notes that growth overfishing would only occur if the stock assessment author failed to model the population correctly and the SSC failed to follow the FMP guidelines for setting the ABC and OFL. The NPFMC harvest policy is specifically designed to prevent overfishing and avoiding falling into an overfished state. Therefore, the harvest control rule considers the fishing mortality that on average will produce MSY or its proxy and preserves the reproductive potential of the stock (typically spawning biomass) to be managed to achieve MSY or its proxy. In the absence of a reliable spawner-recruit relationship, the proxies for F_{MSY} and F_{ABC} are based on SPR estimates $F_{35\%}$ and $F_{40\%}$ respectively. The harvest control rule includes a precautionary adjustment such that fishing mortality is reduced when the stock drops below $B_{40\%}$ (the sloping control rule). This adjustment acts to expedite rebuilding the spawning stock to $B_{35\%}$. In the case of sablefish and other Tier 3 stocks, the stock assessment authors include fishery selectivity and maturation schedules in their estimate of $F_{35\%}$ and $F_{40\%}$. This approach takes into account the impact of harvesting immature fish. The inclusion of selectivity in the estimation of biological reference points for this stock and the sloping control rule adopted by the NPFMC both act as safeguards against growth overfishing. The SSC requests that this section of the document be edited to address these precautions.

The SSC requests that, if the data are available, the authors compare processor size grade composition of observed versus unobserved IFQ trips (as done with the comparison between the IFQ and Chatham Strait fisheries in Figure 2-8) to investigate whether any observer effect currently exists under Alternative 1.

Comments on RIR

Given that smaller sablefish are more prevalent in the Western GOA, Aleutian Islands (AI), and Bering Sea, the proposed amendment is likely to affect communities differently, although those northern communities are in general less dependent upon sablefish. The SSC requests that reporting of simulation results identify differential impacts across communities or regions, and especially any communities that are of particular concern for positive or adverse impacts.

General editorial comments

Please use metric as the units throughout this document. If reporting catch weight in pounds is informative, please include this as a parenthetical to the value in metric units.

C-4 Crab PSC Limits

The SSC received reports from Sarah Marrinan (NPFMC), Angela Forristall (NPFMC), and Sara Cleaver (NPFMC) on the Preliminary/Initial Review Draft of the Environmental Assessment/Regulatory Impact Review (EA/RIR) for a proposed amendment to the Fishery Management Plan (FMP) for the Bering Sea Groundfish Fishery. The proposed action alternative would change the method of managing the existing stairstep procedure used to manage crab prohibited species catch (PSC) limits for the trawl fishery. The

SSC appreciates the public testimony from John Gauvin (Alaska Seafood Cooperative), Scott Goodman (Bering Sea Fisheries Research Foundation), Jamie Goen and Cory Lescher (Alaska Bering Sea Crabbers), and Lance Farr (self).

This action would apply to crab PSC limits for Bristol Bay red king crab (BBRKC, *Paralithodes camtschaticus*), Eastern Bering Sea (EBS) Tanner crab (*Chionoecetes bairdi*), and EBS snow crab (*Chionoecetes opilio*). The Council's purpose and need for the action is: "*At present, most Bering Sea crab stocks are experiencing low productivity and small population sizes, leading to reductions in directed harvest levels. These problems appear to be ongoing and lead the council to examine existing PSC limits to determine whether both directed harvest and bycatch measures are responsive to these adverse conditions.*" There are several objectives that this action is intended to address (as described in the purpose and need statement):

- Increase the linkage between controls on crab bycatch in groundfish fisheries and the harvest controls on directed crab fishery by establishing explicit reductions in allowable bycatch levels when the directed fishery is closed;
- Ensure consistency in management measures between the directed fisheries and bycatch in groundfish fisheries;
- Make explicit the balance of impacts to all fisheries and communities that are affected by the status of all stocks.

The analysis considers two alternatives: Alternative 1, status quo, which would not change regulations governing crab closure limits; and Alternative 2, which would change federal regulations to automatically set crab PSC limits to their lowest abundance-based level in the BSAI trawl CDQ and non-CDQ groundfish fisheries when the corresponding crab directed fishery (BBRKC, EBS Tanner, or EBS snow crab) is closed. The PSC limits specified under Alternative 2 would be as follows: BBRKC in Zone 1 would be 32,000 animals if the directed BBRKC fishery is closed; for EBS snow crab, the PSC limit in the COLBZ would be 4.350 million animals if the directed crab fishery is closed; and for EBS Tanner crab, the analysts are assuming that the Council intended for the PSC limits to be set at a fixed 730,000 animals in Zone 1 and 2.07 million animals in Zone 2, unless Tanner crab abundance dictated a lower PSC limit. The authors note these limits are not the lowest tier of Tanner crab PSC currently specified in regulation, but are the lowest fixed amount as there is no minimum threshold.

The SSC appreciates the work done by the authors, CPT, and stakeholders who provided input. The evaluation provides an excellent overview of current management and history, and provides analysis that adequately evaluates the alternatives against the purpose and need for the action. **The SSC finds the preliminary/initial review document to be adequate for advancing to final action after addressing the SSC comments described below.**

In general, the SSC agrees with the authors' assertion that this action is largely a matter of policy rather than addressing a specific conservation issue. As described in Appendix 4, this action is unlikely to increase the amount of crab available for the directed crab fishery, based on recent PSC levels, nor substantially improve conservation of declining stocks. Only with unprecedented increases in PSC would the stock dynamics and biomass trajectories across the entire time series show meaningful changes. The analysis finds that snow and Tanner crab PSC is typically well below lower limits and thus reaching the PSC limit is likely to be uncommon. With few exceptions, current PSC management for BBRKC aligns with the thresholds used in the State of Alaska harvest strategy and is expected to constrain the Amendment 80 sector under either alternative, which may result in foregone revenue (Section 4.6.1.1 of the analysis).

Alignment with the Purpose and Need

The purpose and need statement indicates this action is “*intended to ensure there is consistency in management measures between directed fisheries and bycatch in groundfish fisheries*”. The SSC notes that while this action would certainly link the State of Alaska management control rule with the lowest PSC stairstep, inconsistency will remain between the composition of PSC and the linkage of PSC to MMB in the State of Alaska harvest policy (for Tanner and snow crab), and whether PSC stairsteps follow biomass trends in the federal assessment. The analysis would benefit from a clearer evaluation of the composition of PSC (i.e., MMB, sublegal males, and female crab). **The SSC recommends that the line graphs in Appendix 3 be replaced by bar or density plots and/or tables that provide detail on the compositional information as it relates to legal size and sex composition of PSC catch.**

The SSC had extensive discussion about its concerns that current PSC stairstep management may not align with overall stock trends and management quantities. The SSC discussed a number of different methods that may improve consistency in the future. For example, better alignment with the assessment may be achieved by changing PSC management such that limits are integrated with the ABC determination, such as fishing mortality rate (F) based approaches. Findings outlined for ABC setting that came out of the National Research Council report on the effectiveness of stock rebuilding plans may be a useful future reference (National Research Council 2014. Evaluating the Effectiveness of Fish Stock Rebuilding Plans in the United States. Washington, DC: The National Academies Press. <https://doi.org/10.17226/18488>). The SSC is concerned that a focus on area-swept methods may not adequately capture population trends and would create confusion regarding appropriate values for selectivity and catchability. However, the SSC notes that using model-based estimates is more complex, less transparent, and abundance may change as assessment models change. Additionally, it was noted that abundance-based PSC limits have desirable incentives that reduce bycatch for the limited species, but may also impact on other limiting species (e.g., halibut and salmon) as the fleet works to avoid the capture of constraining species. These issues are always important to consider when evaluating new management measures.

The SSC recognizes that aligning current PSC management with overall stock trends and management quantities will require considerable time and development. The SSC is not requesting that the authors develop methods to improve consistency between the current PSC stairstep management and overall stock trends and management quantities prior to advancing to final action. Instead, the SSC recommends a white paper be prepared in response to the CPT review of this agenda item (see the C-5 agenda item) as a first step. The white paper would provide information on current and past methods, and explore flexibility under current regulations for changing the PSC calculation methods in the future if necessary. Should the Council want to explore different options for determining PSC, future iterations of the white paper could be used to explore methods that better relate PSC to the biological and management quantities from the stock assessments.

The purpose and need statement for the action has an objective of “*making explicit the balance of impacts to all fisheries and communities that are affected by the status of all stocks.*” **The SSC recommends the analysis clarify the linkage between the communities and fisheries potentially impacted by this action.** This could be accomplished by the addition of a community summary to the Alternative 1 analysis that uses a common set of community engagement and dependency indicators to identify potentially affected communities associated with the relevant groundfish fisheries, crab fisheries, or both, and the varying levels of engagement and dependency on each. This addition would make the differential distribution or balance of potential impacts across communities more explicit, but the SSC does not anticipate changes in the magnitude of impacts already described in the analysis.

PSC Crab Accounting

The analysis notes the stock areas used in the assessment do not align with the crab PSC management areas. The implication is that crab caught as bycatch from outside of the stock area (area used in the stock

assessment) would accrue towards the PSC limit, but would not explicitly be included in total removals in the assessment. These amounts are likely small and are likely more of an issue for BBRKC than Tanner or snow crab, given the smaller stock area relative to the fishery footprint. **To clarify this issue, the SSC recommends a map that overlays the stock areas used in the assessment, crab PSC areas, and state management areas. A table summary could also be provided that would show the amount of PSC (by weight and/or numbers) not included in the stock assessment areas.**

An underlying assumption with abundance-based PSC management is that there is a relationship between PSC and crab abundance. Under this assumption, changes in abundance will govern whether PSC is constraining the fleet. **To better understand this issue relative to crab PSC, the SSC recommends a correlation graph/evaluation of PSC use relative to abundance (used for estimating the stairstep) be added to the analysis, with the caveat that fleet response is tied to the degree to which PSC is constraining in the historical data.** The SSC suggests using the abundance estimates in Table 3 of the analysis for the correlation evaluation.

Unobserved (Crushed) Crab Mortality

The SSC heard public testimony about concerns regarding the mortality of crab due to contact with trawl gear but not captured, and concerns that this mortality is unaccounted for in the PSC limits or assessments. The analysis references the best available science on the issue, which is currently limited because there is not a reliable method to estimate the amount of crab mortality due to injury across all fishing operations (groundfish and the directed crab fishery). The SSC notes that careful evaluation would be required to understand assessment responses should such mortality be explicitly included. Mortality that is not explicitly calculated could interact with current assessment parameterization of catchability, natural mortality, and reference limits. In addition, the SSC notes that unobserved mortality is a source of both assessed and unassessed uncertainty throughout the history of the assessments (e.g., currently attributed to natural mortality), and that the ABC/TAC buffers in place are an appropriate process to account for sources of uncertainty that cannot be explicitly described in the assessment. The SSC encourages consideration of this uncertainty when setting the buffers as appropriate and supports industry and agency efforts to research and estimate unaccounted for mortality to the degree it is consistent with other priorities. The SSC acknowledges that this issue will require substantial resources on an already fully-tasked agency staff. Thus, careful consideration will need to be given in prioritizing these mortality projects relative to other agency research and staff tasks.

C-5 BSAI Crab

The SSC received a report on the January 2021 Crab Plan Team (CPT) meeting from Jim Armstrong (NPFMC), Katie Palof (ADF&G), and Martin Dorn (NOAA-AFSC). Cody Szuwalski (NOAA-AFSC) presented on the impacts of climate change to crab management. There was no public testimony for BSAI CPT agenda items, except for the Norton Sound red king crab (NSRKC) assessment.

BSAI Crab SAFE and Harvest Specifications

The SSC reviewed the NSRKC SAFE chapter and information provided by the CPT with respect to the stock status information from 2020/2021 relative to total catch during the 2020/2021 season (Table 1). In addition, Table 2 contains the SSC recommendations for 2021/2022 catch specifications, with maximum permissible ABCs for 2021/2022 shown in Table 3. The remaining crab SAFEs will be reviewed, and harvest specifications set, at the June and October SSC meetings.

Table 1. Stock status for Norton Sound red king crab in relation to status determination criteria for 2020/21 as estimated in February 2021. Hatched areas indicate parameters not applicable for that tier. Values are in thousands of metric tons (kt).

Chapter	Stock	Tier	MSST ^[1]	B _{MSY} or B _{MSYproxy}	2020/21 ^[2] MMB	2020/21 MMB/ MMB _{MSY}	2020/21 OFL	2020/21 Total Catch	Rebuilding Status
1	EBS snow crab	3							
2	BB red king crab	3							
3	EBS Tanner crab	3							
4	Pribilof Islands red king crab	4							
5	Pribilof Islands blue king crab	4							
6	St. Matthew Island blue king crab	4							
7	Norton Sound red king crab	4	1.03	2.05	2.27	1.11	0.13	0.09	
8	AI golden king crab	3							
9	Pribilof Islands golden king crab	5							
10	Western AI red king crab	5							

^[1] As estimated in the 2021 assessment. ^[2] For Norton Sound red king crab, MMB on 2/1/2021 is estimated using the current assessment in January 2021.

Table 2. SSC recommendations from the final 2021 SAFE for Norton Sound red king crab in February 2021. Stocks for which specifications are rolled over between assessments (Pribilof Islands golden king crab and Western Aleutian Islands red king crab) are also included. Biomass values are in thousand metric tons (kt). Stocks for which the SSC recommended different harvest specifications from the CPT are bolded. Harvest specifications for SAFE Chapters 1 – 4 and 6 are set in October and Chapters 5 and 8 – 10 are set in June, in the year according to the assessment frequency cycle (see current SAFE Introduction for assessment cycle).

SAFE Ch.	Stock	Tier	F _{OFL}	B _{MSY} or B _{MSYproxy}	B _{MSY} basis years ¹	2020/21 ² MMB	2020/21 MMB / MMB _{MSY}	γ	Natural Mortality (M)	2021/22 OFL	2021/22 ABC	ABC Buffer
1	E. Bering Sea snow crab	3										
2	Bristol Bay red king crab	3										
3	E. Bering Sea Tanner crab	3										
4	Pribilof Is. red king crab	4										
5	Pribilof Is. blue king crab	4										
6	St. Matthew blue king crab	4										
7	Norton Sound red king crab	4a	0.18	2.05	1980-2021 [MMB]	2.27	1.11	1	0.18 (0.58 >124 mm)	0.29	0.17	40%
8	Aleutian Is. golden king crab	3										
9	Pribilof Is. golden king crab	5	-	-	See intro chapter	-	-	-	-	0.093	0.070	25%
10	W. Aleutian Is. red king crab	5	-	-	1995/96-2007/08	-	-	-	-	0.056	0.014	75%

¹ For Tiers 3, 4 where B_{MSY} proxy is estimable, the years refer to the time period over which the estimate is made. For Tier 5 stocks it is the years upon which the catch average for OFL is obtained.

² MMB on 2/1/21 as estimated using the current assessment for Norton Sound red king crab.

Table 3. Maximum permissible ABCs for 2021/22 and SSC recommended ABCs for three stocks where the SSC recommendation is below the maximum permissible ABC, as defined by Amendment 38 to the Crab FMP. Stocks for which specifications are rolled over between assessments (Pribilof Islands GKC and Western Aleutian Islands RKC) are included. Values are in thousand metric tons (kt). Harvest specifications for SAFE Chapters 1 – 4 and 6 are set in October, and Chapters 5 and 8 – 10 are set in June, in the year according to the assessment frequency cycle (see current SAFE Introduction for assessment cycle).

SAFE Ch.	Stock	Tier	2021/22 Max. ABC	2021/22 ABC
1	EBS Snow Crab	3		
2	Bristol Bay RKC	3		
3	Tanner Crab	3		
4	Pribilof Islands RKC	4		
5	Pribilof Islands BKC	4		
6	Saint Matthew BKC	4		
7	Norton Sound RKC ¹	4	0.288	0.17
8	Aleutian Islands GKC	3		
9	Pribilof Islands GKC	5	0.084	0.070
10	Western Aleutian Islands RKC	5	0.050	0.014

¹Basis for P* calculation of max ABC is the CV on OFL

²For Tier 5 stocks, max ABC is 0.90 of the OFL

Norton Sound Red King Crab

Martin Dorn (NOAA-AFSC) presented the 2021 assessment for NSRKC. Several members of the public also contributed testimony concerning model uncertainty, observations from the grounds, and historical perspectives in oral testimony. Public oral testimony is summarized below. There was also written testimony provided.

Wes Jones (Norton Sound Economic Development Corporation; NSEDC) testified about his concerns regarding the model and the current state of the stock. He clarified a point in the presentation, indicating that there was no market because the Alaska Board of Fisheries had closed the Norton Sound district to summer crab fishing. Mr. Jones clarified that if there were crab to buy, there may have been a market. Mr. Jones stated concerns about the low amount of NSRKC caught in the trawl survey and that the subsistence catch was the lowest on record. Current reports from this winter are revealing that the majority of the catch is sublegal, with very few crab of market size. Testimony was provided that the model has been overestimating growth, so the recruitment pulse seems to be a year ahead in the model rather than what the fishery is seeing on the grounds, and that the model is predicting a quicker recovery than reality. Therefore, a large buffer is warranted.

Charles Lean (Norton Sound Fishery Advisory Committee) testified that the current abundance indicates that the stock was still in rebuilding mode after taking large catches prior to 2018. He had concerns about the model producing too high a biomass estimate. His testimony referred to “passive management”, and that State regulations and the management strategy were being disregarded. Mr. Lean also believes that pot loss rate is severely underestimated because, at the end of the season, there is no requirement to report lost pots. He has observed that when the ice is thinner, the pots drop quicker and closer to Nome, while in years of thicker ice, they may be transported in the ice all the way to the Chukchi Sea. Since females reach sexual maturity about a year before males, there was a lull in clutch fullness because the pulse of young males was not mature yet. He noted that every time there have been clutch fullness issues, it coincided with heavy male harvest. He also described that handling mortality in the winter is much higher than the summer, so there is a need to establish two seasonal discard mortality estimates.

Scott Kent (NSEDC) described his experience as a fishery manager and developer of the harvest strategy. He noted that the harvest strategy was developed around the notion that the stock was rebuilt and that the local small boat fishery would not harm the stock. Initially, it was going to be a typical ramp harvest strategy, but there was a desire for more flexibility for managers to be able to apply a more conservative harvest rate. Mr. Kent stated that since then, the harvest rate has been set so that the GHF has been pretty close to the ABC every year. This seemed to be working early on, but now greater conservation is warranted. He suggested that the SSC should consider a larger buffer.

The SSC appreciates the NSRKC presentation and the work of the CPT and assessment authors. Responses to past SSC comments presented at the beginning of the document were thorough. The SSC also thanks the public for their useful testimony and observations from the grounds and the fishery. The NSRKC stock supports three fisheries: summer commercial, winter commercial, and subsistence. The summer commercial fishery, which accounts for most of the catch, reached a peak in the late 1970s, but catches have averaged around 10% of that peak recently. The commercial crab fisheries did not operate in 2020 and only winter subsistence catch occurred.

A single model was presented (19.0) as a viable model for setting specifications. A GMACS model was developed to mirror the existing model, but was not ready for full consideration. **The SSC supports the CPT recommendation to use Model 19.0 for specifications. Based on Model 19.0, stock biomass is above MSST so the stock is not overfished, and retained catch during 2020 did not exceed the OFL for this stock so overfishing is not occurring.** The SSC commends the state of Alaska for conducting their trawl survey during a pandemic. The 2020 survey biomass estimate was very low compared to 2019, yet the model does not follow that data point, and instead continues to predict an increase. Fishery CPUE had

declined precipitously until 2019, and there is no CPUE value for 2020. Without these data, a valuable indicator of abundance and fishery performance is missing in this year's assessment. In addition, there was no NMFS 2020 trawl survey. The recommended ABC is more than double the 2020 ABC despite many indications that the stock may not be that healthy.

Some of the SSC's previous concerns were alleviated, such as the majority of the crab catch is occurring inside the survey area (>95% in nearly all years). The work on barren females was appreciated and seemed to be of lesser concern this year. The SSC thanks the authors for the information on pot loss and the potential impact of ghost fishing mortality. The information on using electronic trackers on the ice to consider where lost pots may end up was interesting and the SSC encourages further exploration. The authors report trouble with implementing the VAST model for NSRKC survey data and the CPT reported that Jon Richar's analyses suggest the NSRKC was not a very good candidate compared to other crab stocks. The successful tagging work showed fairly strong westward movement and the SSC encourages the upcoming efforts to increase tagging in 2021. The SSC notes that the tagging work might shed light on how closed the population is, and that future tagging work should include random releases to better understand whether crabs tagged offshore behave similarly to those tagged close to shore.

The most significant past CPT and SSC request was to shift to total catch harvest specifications. The author provided additional details on methodology to estimate discards in Appendix G. **The move to a total catch OFL and ABC in this assessment represents the best available science and the SSC supports this change to be consistent with other assessments and national standards for federal fisheries.** As the CPT stated, an uncertain estimate is better than ignoring discard mortality altogether. The method recommended by the CPT and the SSC produces similar OFL estimates as the other methods of estimating total catch OFL and ABC. It also included a correction factor for the observer effect. The SSC believes that this is the best method at this time, but recommends the author continue to explore ways to improve discard estimation, either through refinement of the currently selected method, or through alternative data sources. The SSC has several clarifications and requests related to this methodology described in Appendix G.

- The CPUE methods use a denominator of pot lifts. Please describe whether soak time was relatively consistent, variable, or is completely unknown.
- The information presented in the Appendix G discussion was confusing and the SSC requests some clarification on the comparison among methods.
- Also, justification for not using the model estimated discards might be helpful to provide some context.

The SSC appreciates the CPT table documenting previous concerns expressed by the SSC when adopting the 30% buffer for NSRKC in 2020/2021 and whether they still represent major concerns. As stated above, some of these issues may have lessened slightly. However, in addition to those ongoing concerns, there are now some additional considerations listed below:

1. The ADF&G survey abundance is much lower in 2020 than 2019, and the model is not fitting this new observation very well.
2. The retrospective bias was 0.18 for the 10-year peel, but the SSC is unsure how confident to be in that estimate because of the different data streams and fixed retention probabilities. The Mohn's rho of 0.26 in the recent 5-year peel presented is somewhat more substantial and is positive. In other words, the model is overestimating MMB by 26% each year on average. The overestimation of growth may be contributing to this retrospective pattern.
3. One of the selectivity parameters is on a bound, and it appears to be survey selectivity which could contribute to the poor fit to the recent ADF&G survey data point. This also raises questions about if the model has properly converged.

4. The recommended ABC is increasing when the only available 2020 survey estimate is low, and fishery CPUE has steeply declined in past years. Since there was no commercial fishery in 2020, there is no fishery CPUE estimate which increases uncertainty. The fit to recent low commercial CPUE values is poor, similar to the trawl survey. There also were no NMFS trawl survey data to evaluate.
5. While an improvement, the minimal data informing the estimate of total catch OFL further emphasizes the uncertainty in the estimation of discards.
6. The high recruitment discussed last year was supported by a high survey biomass estimate. The low biomass estimate in 2020 lowers confidence in the magnitude of this recruitment pulse. This potential large recruitment is still mostly below the preferred commercial size.

The CPT recommended continuing with the 30% buffer recommended by the SSC last year. However, for the above reasons, and previous concerns identified last year that remain unresolved, the SSC recommends increasing the buffer from 30% to 40% this year (Table 2).

Overall, there has been a great deal of work that has been done for this stock and the SSC recognizes the effort by the assessment authors to address some long-standing and complex issues associated with this assessment. The SSC supports the CPT's list of suggestions and looks forward to considering a GMACS version of the model next year.

Beyond the concerns listed above, the SSC encourages continued progress on the following priorities:

General:

- Investigations into size at maturity for this stock, referencing that of other red king crab stocks if useful.
- The inclusion of local, traditional and subsistence knowledge (LTKTS) information in the assessment, an effort the SSC understands cannot be fully pursued until appropriate protocols are developed and pandemic conditions ease. This particular issue is also discussed further in the SSC comments on the progress report from the LTKTS Taskforce (Agenda Item D-2).
- Reporting on pot loss, especially in regard to potential pot losses at the end of the season as noted in public testimony.
- Continue exploration of data-weighting assumptions. Provide clarification and justification for the current data weighting scheme utilized in the model.

Assessment document:

- The authors' responses to CPT and SSC comments could be reorganized by topic, as opposed to review body, to reduce redundancy and clarify the authors' responses.
- In the Analytic approach, more descriptive text should be included in the sections describing the model and its assumptions, to reduce referring to Appendix A.
- Furthermore, a thorough description of the model selection and evaluation criteria, and most particularly, the results of the author's recommended models (and the base model, if they differ) is a basic requirement for a complete assessment document. A list of figures and tables is not an acceptable description of results.
- Finally, the figures should be reviewed with respect to the caption descriptions and legends. There were some inaccuracies or conflicting statements found.

- Please explain how the SD was determined for the CPUE as it is the same from 2000 - 2019. Is this a fixed SD? If so shouldn't the CV be fixed rather than the SD?

Aleutian Islands Golden King Crab model runs

The SSC reviewed the proposed models to be brought forward for annual assessment of the Aleutian Islands golden king crab stock for the May 2021 CPT meeting. A total of seven models were proposed to the CPT for assessment of the Aleutian Islands east (EAG) portion of the stock, and four models for the Aleutian Islands west (WAG) portion. Of these models, four were recommended by the CPT:

- Model 19.1 – Prior accepted model with updated input data.
- Model 21.1a – Same structure and data inputs as M19.1, but with the period of reference for defining mean recruitment set to 1987-2017.
- Model 21.1b – Same structure and data inputs as M21.1a, but with three time blocks for selectivity (1960-2004, 2005-2015, and 2016+).
- Model 21.1c – Same structure and data inputs as M21.1a, but with observer CPUE standardization including Year:Area interactions.

The SSC endorses these four assessment model alternatives as recommended by the CPT to be brought forward in May 2021, as well as suggestions for further model development and exploration. With respect to Model 21.1b, the SSC agrees that justification will need to be provided as to why allowing time-varying selectivity based on these time blocks is appropriate, relative to other time-varying parameterizations. The SSC also supports the CPT recommendation to include two additional models as appendices to the upcoming SAFE document, including:

- The GMACS model under parallel development. The SSC supports continued efforts to recreate existing operational model structures and explore novel structures, within the standardized GMACS platform.
- An exploratory model in which M21.1a ignores 2015 observer CPUE data, but incorporates estimates from the cooperative survey for EAG. The SSC encourages exploration of whether overlapping these indices may help in estimating catchability.

The SSC would also like to reiterate its support for several previous suggestions:

- Exploration of a single-area model, or possibly a two-area model with larval connectivity, for the AIGKC crab stock.
- Evaluation of whether catches of AIGKC caught in the NMFS Aleutian Island trawl survey could be utilized as an additional index of abundance.
- Continued exploration of the Year:Area effect in the CPUE standardization, specifically by fitting two area models and combining the results and comparing to the Year:Area model. Diagnostic plots of the data and model predictions of time trends by area (holding all other predictors at their median or mean value) might shed light on the nature of the interaction and aid interpretation.

Crab Survey Planning

The SSC is pleased that, at present, the AFSC is planning to conduct a full complement of surveys in the northern and EBS in 2021, but realizes that due to the dynamic nature of the COVID-19 pandemic, staffing plans are subject to change prior to the season and final decisions are forthcoming. As noted in the CPT minutes and the presentation, there has been some discussion of contingency plans in the event staffing needs are not met for the 2021 survey, including bringing observers or industry members onboard to fill in

as alternates or dropping the St. Matthew Island and Pribilof Island corner survey stations. Mike Litzow (NOAA-AFSC) responded to SSC questions, indicating that there was a low probability that stations would need to be dropped during the 2021 survey and this proposal was brought forward solely as a contingency plan. The SSC concurs with the CPT recommendation to prioritize survey stations based on their influence on the resulting abundance indices and their uncertainty. The SSC further suggests that retrospective simulations wherein indices are recalculated with and without candidate stations should be used to identify stations of lowest priority, in the event a reduction in effort is necessary. The SSC requests further details on how the corner stations are used in abundance estimation, and whether treating those stations as independent from the primary stations could introduce bias.

Draft Risk Tables for Crab Stocks

The SSC reviewed the CPT plan for development and inclusion of risk tables within SAFE documents for BSAI crab stocks. **The SSC endorses development of risk tables for BSAI crab stocks**, and is pleased that the authors of the snow crab and SMBKC assessment have volunteered to develop risk tables for review in May. The SSC looks forward to reviewing risk tables for other BSAI crab stocks as they become available in coming assessment cycles, and suggests that NSRKC may be a good candidate for near-term risk table development. As highlighted in the CPT minutes, one of the major benefits of the risk table development process for Alaska groundfish stocks has been increased conversation, coordination, and collaboration between assessment authors and ecosystem scientists, in addition to greater transparency about the sources of risk that are external to the assessment model and input data.

The SSC also reiterates that the objective of risk tables is to clearly articulate sources of uncertainty that should be considered and provide greater transparency in the justification for any reduction from maxABC, rather than to develop an overall risk score or to increase the frequency of ABC reductions. However, based on the outcome of the Risk Table Workshop, the SSC acknowledges that the objectives and design for risk tables may be updated in the future.

Industry Fishery Questionnaires

The SSC received a presentation on an industry survey developed by the Alaska Bering Sea Crabbers (ABSC), which elicits information on fishery performance from skippers and a pilot survey that occurred following the 2020/21 BBRKC fishery. **The SSC concurs with the CPT that this industry survey provides an excellent opportunity to collect useful information from fishery participants, and that this information may provide the basis for contributions to risk tables and the socio-economic component of the Ecosystem and Socioeconomic Profiles associated with each SAFE chapter.** However, the SSC highlights that the ABSC survey development team may benefit from consultation with experts in the well-established field of expert elicitation and recommends that developers of this survey consult with the Local Knowledge, Traditional Knowledge, and Subsistence (LKTKS) taskforce. The SSC further highlights the potential need for formal review of survey methodologies, to ensure data confidentiality is protected. Finally, the SSC suggests that the survey development team consider whether it may be valuable to provide alternative answers to questions regarding effort or stock trends such as “NA” or “I don’t know,” and if more quantitative response options may be useful. Consultation with the Economics and Social Sciences Research program at the AFSC is also encouraged. However, the SSC recognizes that survey length and complexity must be balanced against the willingness of survey participants to contribute their knowledge repeatedly across seasons.

Climate Change and Crab Management Considerations

The SSC received a presentation from Cody Szuwalski (NOAA-AFSC) summarizing recent research quantifying past responses by crab stocks to climate variability in terms of recruitment, distribution, and aggregation, among other metrics, and predicting future responses to temperature change. In addition, Dr. Szuwalski summarized results from simulations exploring the efficacy of dynamic or non-stationary

reference points for BSAI crab stocks, finding what he has termed the “productivity paradox” wherein climate-adaptive harvest control rules (HCR) may actually result in higher than optimal exploitation rates rather than more conservative management, whereas the status quo HCR could lead to both higher long-term biomass and yield. The consideration of dynamic reference points in response to observed shifts in stock productivity are a very real consideration for crab and groundfish stocks, given the potential responses to previously unobserved climate regimes. As highlighted in the CPT minutes, the rebuilding plan for SMBKC provides a direct example of a situation in which the recent recruitment time series differs greatly from the historical reference period and rebuilding targets reflect the complete production history for the stock. The CPT minutes clearly indicate that the CPT does not express a preference for a single approach to establishing reference points with respect to their static or dynamic nature, or period of reference, and instead recommends a flexible case-specific approach.

The SSC would like to thank Dr. Szuwalski for his excellent presentation and this research to explore and quantify potential responses of BSAI crab stocks to future climate change, and simulation analyses to evaluate the efficacy of alternative potential management responses to future climate-driven changes in stock dynamics. **The SSC highlights that consideration of time-varying or climate-driven changes in stock production dynamics and species distribution are important areas of further research, as is exploration of candidate management strategies in response to these observed and predicted changes.** Specific consideration might be given to the possibility that a change in management (i.e. changing the reference points) might result in a one-way street for some species where higher exploitation under a revised reference point might result in permanently lower stock sizes even if climate conditions return to “normal.”

Crab PSC Limits

The SSC received the CPT report on C-5 Preliminary/Initial Review of Crab PSC Limits in the BSAI Groundfish Trawl Fisheries. No public testimony on this topic was provided under the CPT report, but testimony related to this topic is provided under the SSC’s comments for C-4 in this report. The CPT recommended that if catchability (q) is to be used for PSC calculations, then the current threshold calculations should be revisited with an analysis. Related to this, the CPT requested feedback from the SSC on the inclusion of q in PSC calculations; clarification about how to incorporate selectivity and q in PSC calculations as selectivity and q are estimated in the model and thus change each time the assessment is updated; and whether PSC calculations could be defined to be based on specific components of the population (e.g., a % of mature male abundance).

The CPT noted that inclusion of q in PSC stairstep calculation of total abundance for Tanner and snow crab can make large differences in interpretation of the trawl survey index relative to the stock abundance and the PSC stairstep. Catchability for the Tanner and snow crab stocks is estimated to be well below one, and research on the NMFS bottom trawl survey gear efficiency has been an ongoing research topic since its estimation is uncertain and variable among years.

During the SSC discussion, it was noted that multiple methods to calculate crab abundance for the PSC stairstep policy likely exist. However, because PSC management for the trawl fishery is a regulatory policy, understanding the historical framework associated with the methods is important both for context and transparency. The Preliminary/Initial Review draft analysis for the C-4 PSC action provided a good high-level overview of the history of PSC limits but was not intended as a detailed description of historical calculation methods. **To better inform decisions about the abundance calculation for PSC limits, the SSC recommends that a white paper be prepared that provides information on the regulatory intent and historical methods used to calculate abundances associated with the PSC stairstep procedures. The paper should also describe potential options for calculating abundance under existing regulations.** As described in the SSC C-4 minutes, the SSC also discussed methods that would change current management methods for trawl PSC. Future versions of the white paper could also explore alternative methods for managing crab PSC limits, should the Council wish to explore these. The SSC

acknowledges that this white paper will require staff resources and its priority should be considered along with other tasks.

The CPT also asked for clarification about whether the PSC stairsteps could be defined as a specific component of the crab population (e.g., mature male biomass). For BBRKC, this question seems moot since BBRKC is narrowly defined in regulation as mature female red king crab; however, for snow and Tanner crab, the stairstep is defined as total abundance, which could include males, females, and juvenile crabs. **The SSC recommends the white paper address this question relative to regulatory intent.**

Finally, the SSC recommends using current methods for calculating the PSC limits until different processes are identified. In addition, the SSC reiterates its past recommendation (October 2020) to provide a PSC values in the SAFE report and also requests a brief explanation of how the PSC values were calculated.

VAST Updates

The CPT minutes provided an update on the ongoing efforts by Jon Richar (NOAA-AFSC) to explore application of Vector-Autoregressive Spatio-Temporal (VAST) models to NMFS EBS survey data for BSAI crab stocks. **The SSC is appreciative of continued research to evaluate model-based index standardization methods, and efforts to align diagnostics for VAST model fits for crab data with the evolving guidelines for groundfish.** The SSC has previously commented on the need to provide analysts with discretion in identifying and justifying the most appropriate VAST model specification for a given stock. The SSC further highlights past recommendations for groundfish assessments incorporating VAST model estimates, to develop a standard format for documenting VAST model specifications, visualizing model outputs, and describing model fit diagnostics. The SSC encourages continued collaboration between Dr. Richar, NOAA VAST GAP personnel, and Drs. Thorson, Monnahan, and Havron, in the development of standard diagnostics and acceptance criteria for VAST models applied to data for BSAI crab stocks.

Updating TORs in Crab SAFEs

The SSC supports the CPT proposed changes to the terms of reference for SAFE chapters for BSAI crab stocks, specifically efforts to align the structure of tables, order of the document, and description of methods, to provide greater consistency with groundfish SAFE chapters. Specifically, the SSC highlights the utility in standardizing model naming conventions, improved documentation of maxABC calculations and resulting values, and revision of harvest specification tables to match SSC and Council needs. The SSC further supports the inclusion of a detailed history of OFL-ABC buffers applied to each stock as a formal part of the SAFE document. The SSC looks forward to reviewing the updated terms of reference for crab stock assessments following the May 2021 CPT meeting.

Stock Prioritization and Frequency Review

The CPT is recommending two changes to the assessment cycle for BSAI crab stocks. The first would reduce the assessment frequency for SMBKC from an annual to a biennial cycle. The second change would reduce the assessment frequency for Pribilof Islands red king crab from a biennial to a triennial cycle. **The SSC supports the proposed priority schedule,** recognizing that this provides greater balance between analyst effort, survey data availability, risk associated with responsiveness to short term population fluctuations, and potential impacts on fishery prosecution. The SSC encourages the CPT to consider additional assessments that might benefit from reducing the frequency of full assessments to allow more time for model development (e.g., GMACS implementation). This could result in greater fishery stability and increased CPT and SSC review capacity for other crab assessments. Abbreviated and partial assessments that only update catch or data should be considered. The SSC appreciates the opportunity to review these and any other proposed changes in crab stock prioritization and assessment frequency.

Modeling Workshop

The SSC did not receive a presentation on the modelling workshop held at the conclusion of the CPT meeting but provided feedback in response to the summary in the CPT report. The SSC appreciates the efforts by the CPT and the workshop leads to address both common and assessment-specific concerns, and the influence of decisions regarding model specification. **The SSC commends the participants on the stepwise transition analyses from status quo models to the GMACS platform, and the provision of assistance from experienced users to new ones.**

The SSC noted that these transitions represent an excellent opportunity to go beyond just matching status quo model assumptions and to consider their scientific justification, exploring new approaches as available in the platform.

The SSC supports future workshops with a similar agenda.

D-2 Experimental Fishing Permit Application and Report

Halibut Excluder EFP Application

The SSC received a presentation from John Gauvin (Alaska Seafood Cooperative) outlining the proposed Experimental Fishing Permit (EFP) to test ‘hallway’ style excluders in the Bering Sea flatfish trawl fisheries. Non-experimental data from the fishery using a diverse set of excluder designs show that excluders reduce catch of both halibut and of the target species, and that the effect on the ratio of bycatch to target is variable. If the use of an excluder does not reduce the ratio of bycatch to target, excluders would not reduce the total bycatch, while increasing the costs of harvesting the quota. These data may be biased in that captains choose when to use nets with excluders and when not to, in part due to the expected bycatch.

Accordingly, an experiment using paired nets in a twin trawl configuration is proposed. The plan is to conduct 60–70 trawls on a 3–4 week cruise by a new trawler suited for twin-trawling. Results from a power analysis indicate that anywhere from 29–310 tows are required for a power of 80% at $\alpha=0.05$ (but over 100 for the crucial ratio of bycatch to target). This analysis could be conservative because the biases may lead existing data to underestimate the effectiveness of excluders. The experiment will improve the measurement of the halibut bycatch that are not deck sorted.

Additionally, the experiment will look at the effect of the excluder on the size distribution of the halibut bycatch and will include collection of opportunistic tissue samples for a pilot study on estimating sex ratios of bycaught halibut. The SSC understands that the trial of the methodology for ascertaining the effects on sex ratios is simply a feasibility trial, and that the data themselves will not be representative of the true sex ratio. The size distribution and sex ratio aspects of the study did not have power analyses but would provide valuable data.

The SSC believes that this experiment could be quite valuable and is well-designed, and **recommends proceeding with the proposed work.** The twin trawl approach is quite powerful, and the SSC appreciates the industry’s willingness to undertake it at their own expense. There is some concern about whether the experiment will be sufficiently powerful, but the paired trawl design, the power analysis, and the possibility that the power analysis was conservative are reassuring. As the summary of the power analysis indicates, this EFP could be considered a pilot study that will generate methodology and data that will be useful to inform future work.

The SSC understands the logistical constraints involved, but would recommend that the experiment consider switching sides on the excluder more frequently. A systematic design for which side of the boat the excluder gear is on for a particular tow may help with this, for example an ABBA followed by BAAB design (e.g. left, right, right, left, then right, left, left, right) for morning and afternoon tows.

While the SSC understands that it may not be successful, the SSC endorses attempting to collect data from captains that would help interpret the previously-collected non-experimental data; i.e., ask the captain prior to a tow whether they would normally use a net with an excluder under current conditions, or survey other captains about the circumstances that determine their decision to use an excluder. The SSC also agrees with the suggestion to try to obtain data from vessels outside of the experiment that are using the same excluder contemporaneously.

Report on AI Pollock EFP

George Pollock (Aleut Corporation) and Dave Fraser (Adak Community Development Corporation) presented the result of experimental fishing by three vessels seeking to identify factors that were associated with Pacific Ocean perch (POP) bycatch during pollock trawling. Although there were some logistical problems, 28 tows were made that were examined for any relationship between bycatch and a suite of potential predictors. No reliable indicator was identified, unfortunately.

The SSC agreed that the experiment did not appear to show any relationship between the variables examined and bycatch of POP. There is a slight chance that some multivariate combination of variables could show a stronger relationship, but the likelihood is low given the weak univariate relationships seen. There were indications that captains had some ability to predict the amount of bycatch, particularly once a tow had started. Interviews indicated that several captains believed that when fish schools were far from the bottom that POP bycatch was minimized. NOAA personnel indicated that work on using hydroacoustic signatures to distinguish pollock from POP has continued.

D-3 Bering Sea Fishery Ecosystem Plan

The SSC received a presentation from Diana Evans (NPFMC) and Kerim Aydin (NOAA-AFSC) on the Bering Sea Fishery Ecosystem Plan (FEP) Team Report from the March 2020 meeting. There was no public testimony.

Bering Sea FEP Action Modules

The SSC noted comments in the March 2020 Bering Sea FEP Team Report that several members of the public had been concerned about the removal of language from the LKTKS Taskforce’s list of objectives, that language including “impacts” and “mitigation” had been removed and that Objective 6, “intended to identify measures and opportunities to mitigate impacts to subsistence resources and users,” was no longer listed as an objective. The LKTKS Taskforce also commented on this change in their report to the SSC. **The SSC is concerned that these changes may be perceived by those who harvest, share, and use subsistence resources as an indication that the Council is not sensitive to the vulnerability of subsistence-dependent communities to climate change.** These communities may be less willing to share information with the Council if they perceive that they will get little in return. **The SSC suggests that it may be appropriate for the Bering Sea FEP Team and associated taskforces to continue to explore ways in which their interactions with subsistence communities can be mutually beneficial.**

Ecosystem Health Report Card

The Team presented updated information on the progress toward developing an Ecosystem Health Report Card (EHRC). The EHRC would fill a current gap by providing longer-term indicators of change in ecosystems, and would include hindcasts and forecasts (stemming from the CCTF) that currently are not captured in the ecosystem status report (ESR) or ecosystem socioeconomic profile (ESP) products. The EHRC could also expand to include international indicators that are less appropriate to cover in the ESR. The Team noted that in addition to adding new indicators, some indicators already in the ESR could be moved to the EHRC (e.g., mean length of the groundfish community) to avoid unnecessary duplication between ESPs, ESRs, and the EHRC, and to tailor each product to a specific objective. **The SSC**

emphasized the importance of these products and encourages the Team's continued coordination across these groups producing them to avoid unnecessarily duplicative efforts. The SSC also supported the Team's suggestion to develop a single page handout, once the EHRC product is finalized, that consistently explains the differences in content between the ESRs, ESPs and EHRC, and when the ESR, ESP, EHRC products are used by Council. This would help identify the best place for new data sources and contributions (for example, it was noted that some types of TK might fit well into the longer-term timeframe of the EHRC).

At present, the Team has identified over 90 indicators that could be included in the EHRC. The SSC suggests that in addition to the included indicators, the Team consider looking at a suite of indicators that are not typically included, including those associated with external forces impacting the ecosystem such as pollution, mining, coastal development, shipping, and wetland inundation. The SSC also recommended including the community of stock assessment scientists in developing the indicators to ensure two-way communication and the applicability of these products.

The SSC discussed the appropriateness of the word "health" in the context of ecosystem functioning due to the varying interpretations and reference points, and **recommends that future iterations of the Team's report consider removing the word "health" from the product's name.** The SSC also recommends that, where possible, as the design of the EHRC is further developed and refined, the Team keep in mind the potential for this type of product to scale to other regions (GOA, AI).

A subgroup consisting of Elizabeth Siddon, Kerim Aydin, Stephanie Zador and Jim Ianelli will continue to develop the EHRC in coordination with the CCTF and LKTKS Taskforces. The SSC looks forward to hearing updates from the Team on these developments.

Research Priorities

The Team offered the following research priorities that broadly address the main goals of the FEP:

- **LK and TK data collection:** This research priority would support more structured and consistent sources of ecosystem information for use in annual reports (such as ESRs), specific fishery management actions, or future development of conceptual models, especially as there are some areas that are data poor. Ultimately, the LKTKS taskforce wants to build systematic on-ramps into the Council process, but they also need data to be able to populate those on-ramps.
- **Climate change:** Develop predictive tools to inform management options related to resilience and adaptation. This research priority supports the work of the CCTF to inform the NPFMC of emerging decision support tools that identify, forecast and project climate and environment change drivers and assess responses of living marine resources and the communities that depend on them within a coupled socio-ecological management system. The CCTF includes an outreach plan to identify climate-ready management responses and adaptation strategies. The products of the CCTF may also support groundfish specifications through the provision of climate indices. As ecosystem-enhanced assessments come online, climate model hindcasts and short-term forecasts can be used to evaluate the potential risk of extreme events (e.g., marine heatwaves).
- Conduct an assessment of the Council's Bering Sea management with respect to EBFM best practices. This research priority could be useful to help identify future needs and research.

The SSC looks forward to discussing these recommendations in April 2021.

Outreach and Communication

Several products exist or are being developed to share summaries of the FEP with the public. Specific products for dissemination will reflect ideas contributed by members of the public (e.g., Facebook, regional newsletters) and the Team will review recommendations from the Council's Community Engagement

Committee once their report is finalized. The SSC commends the efforts to identify and implement a diverse portfolio of appropriate and engaging products, and noted that future reports would be strengthened by assessments of the efficacy of each of these products, and the range of products holistically, in reaching the public. These assessments could include metrics of views, visits, or other social media insight reports.

FEP Taskforce on Climate Change

Diana Stram (NPFMC) and Kirstin Holsman (NOAA-AFSC) provided an overview of the CCTF of the Bering Sea FEP 5-year work plans. There was no public testimony.

The SSC thanks the authors for their work on an ambitious and important implementation plan for the CCTF. The SSC was encouraged by the taskforce's effort to effectively contribute CCTF products for use in existing Council bodies. This approach is consistent with the vision for the CCTF to be an action informing but not decision support body. Thus, it will build bridges between the science of the FEP (action informing) and the FMP (actionable decision support). The SSC appreciated the clarity of deliverables and progress tracking milestones included in the document. The when, who, and what headers were useful to map how information products will be used within the existing management system.

The CCTF contributions to tactical management are correctly aligned to deliver climate informed ecosystem landscapes for context setting and index delivery for use in ecosystem and stock assessments. In this regard, the taskforce does a good job of recognizing the need to augment and enhance the existing tactical systems (ESPs and ESRs) rather than attempting to create a new information flow within the NPFMC. The SSC notes that there will likely be two-way feedback between the developers for the ESPs and the CCTF.

The primary contribution of the CCTF will be in advancing strategic planning with a focus on the delivery of coupled social-ecological decision-informing tools and risk profiles based on a range of future climate change scenarios. As the Council faces future choices regarding how and when to respond to climate change, the Council will need to establish and maintain rigorous scientific review of climate information. Coupled social-ecological climate models should be based on the best available scientific information (BASI) regarding fisher and ecosystem response to climate change scenarios within a coupled social-ecological system. In this respect, the lines pointing to the SSC are useful as this would allow the SSC an opportunity to review the scientific basis for the modeling products. The revised Figure 6 indicates that, once the SSC approves the current model(s) and acknowledges that they are providing a reliable science-based basis for informing decision makers that: **1) the SSC would participate in workshops seeking input for scenario planning, 2) the SSC should review model development and model skill testing (based on hindcasts and short-term projections) and 3) the SSC would provide input regarding performance diagnostics.** It was noted that the Center for Independent Experts could provide additional review of current and proposed models.

The SSC was pleased to see the thoughtful delineation of points of entry for LKTKS information to inform scenarios of resource dependent community responses to climate change. Close coordination with the LKTKS taskforce is recommended.

Developing and testing climate-ready management actions will be iterative, and the outreach and communication plans will assist the CCTF in seeking input from the Council, resource-dependent communities and the SSC. This approach will help the CCTF to continue to keep current with the evolving nature of sustainable development goals and the associated landscape of potential management responses. **The SSC notes that scenarios for proposed changes to time-area management, allocation (including bycatch management), and harvest control rules will need to be constructed in very close collaboration with the stock assessment scientists, plan teams, the AP, SSC and Council.** Efforts to independently develop these proposed changes is not recommended.

The SSC noted that the CCTF has outlined a big task and considerable investments of time and effort will

be needed to sustain the delivery of this effort into the future. The SSC encourages the CCTF to communicate the urgency of this research. The abrupt impact of the recent marine heatwave serves as a reminder of the need for sound planning to avoid reactive management. In this regard, the CCTF might consider developing flexible adaptive management approaches that can adjust for extreme events.

FEP Taskforce on Local Knowledge/Traditional Knowledge/Subsistence

The SSC received a presentation from Kate Haapala (NPFMC) on the progress of the LKTKS taskforce in 2020. Sarah Wise (NOAA-AFSC) was also present to answer questions. A report of the LKTKS November 9-10, 2020 meeting was provided as an agenda item attachment, as was the most recent version of the LKTKS workplan. No public testimony was received on this agenda item.

The SSC commends the thoughtful efforts by the taskforce in moving the LKTKS action module forward, particularly given the difficult last year. This represents another positive step toward improving the Council's ability to follow National Standard 2 guidance that relevant LK and TK should be obtained, where appropriate, and considered when evaluating the best scientific information available to inform its decision-making process. The Taskforce has collectively determined five specific objectives in the service of achieving its two overarching goals related to TK/LK and subsistence, respectively. The SSC notes that progress made during 2020 in the form of development of work streams and products consistent with these goals and objectives has also been consistent with the Council's action at its February 2020 meeting regarding taskforce work product tasking. Products completed during the year include an authorized workplan and a glossary of terms.

The SSC commends the Taskforce on the progress that has been made on consideration of “onramps” for accessing LKTKS in the Council’s process and, consistent with recommendations to the CCTF, the **SSC recommends that the LKTKS Taskforce coordinate closely with the CCTF, which has identified onramps for LKTKS information in their workflow processes.** The CCTF has specifically noted where LKTKS information has the potential to substantially inform ESP, ESR, and SAFE data needs on an ongoing basis.

The SSC is also encouraged by the LKTKS Taskforce progress on protocol development, which is recognized as a critical element in the overall development of LKTKS data specific to informing a range of management decision making applications. The SSC notes that the 12 initial, high-level guidelines included in the draft protocol reflect a thoughtful effort and represent a solid foundation for what is recognized as an ongoing effort. **The SSC concurs with the LKTKS Taskforce in its continuing support of utility of the Norton Sound red king crab fishery as a case study** once adequate protocols are developed and conditions relative to COVID concerns are otherwise appropriate for in-person interactions in the relevant communities.

The SSC also recognizes the importance of the development of a catalogue of sources and an accompanying search engine for identifying and soliciting LKTKS information. This effort has the potential to improve the ability of those working on Council analyses to better incorporate existing sources of LKTKS information into their work in the relatively near future while more robust capabilities are built out through other processes currently constrained due to pandemic conditions. **The SSC also recognizes the importance of the LKTKS Taskforce work on a conceptual model for Tribal engagement,** especially given that as the Taskforce notes, LK and TK are living sources of knowledge that reside in individuals and communities, meaning that building relationships are key to fully bringing LKTKS into the Council process. **The SSC further recognizes that full Tribal engagement in the Council process requires a systemic approach that is larger than any one agenda item.**

D-4 Economic SAFEs

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

The SSC received an overview of the different sources of human dimensions data for groundfish, crab, and other species, and where summaries and descriptions of these data are located (e.g., ESPs, ESRs, SAFEs, Economic SAFEs, annual community engagement and participation overview (ACEPO), etc.). **The SSC found this presentation to be very useful in providing clarity and consistency in meeting the data needs to address social- and community-focused management obligations under National Standard 2 and National Standard 8.** The SSC is particularly excited about the development of a new ACEPO document and is looking forward to seeing its presentation in April 2021.

Groundfish Economic SAFE

The Groundfish Economic SAFE presentation provided a broad overview of the economic performance of the groundfish fisheries in the 2019 data year, and some new initiatives for the presentation and accessibility of the economic data for these fisheries. **The SSC appreciates how the Groundfish Economic SAFE has evolved over the last several years. It continues to be a useful reference on the economic status of fisheries, and has become more useful, organized, and accessible to the public over time.** The SSC is especially appreciative of the continued development of the data webtool, as well as other new initiatives—such as the in-season nowcasts and the new graphical displays of the Amendment 80 Economic Data Report (EDR) data. The SSC also appreciates the decomposition of first-wholesale revenues into their respective price and quantity effects (Figures 3.6 and 3.7, Figures 5.2-5.11), and thought these figures would be useful for the Bering Sea FEP. Finally, the SSC also appreciates the report card in the Groundfish Economic SAFE, and believes it provides an excellent overview of general trends in the groundfish fisheries. Unfortunately, due to time limitations in the remote-meeting format, the SSC did not receive a presentation of the report card metrics. The SSC requests a presentation of the report card metrics in February 2022.

Crab Economic SAFE

The Crab Economic SAFE presentation provided an overview of the economic performance of the fishery in 2019, as well as a list of “things-to-do” for future iterations of the document, some of which are responses to previous SSC requests. A particularly appreciated aspect of this analysis is the tracking of quota lease rates to identify who is benefitting from the fishery. The SSC continues to look forward to completion of the quota ownership decomposition effort, which will allow better tracking of what communities are capturing the ownership benefits of the crab fishery. The SSC also finds the presentation of net revenues in the rationalized crab fisheries to be very useful, as well as how these net revenues can be decomposed into different sources of revenues and costs. **The SSC recommends the development of a report card for the Crab Economic SAFE, similar to the Groundfish Economic SAFE, which reflects both the needs and opportunities in the fisheries.** The Groundfish SAFE and the fishery-specific ESRs provide a starting point for report card measures, and specific variables to measure them. The SSC invites the analyst’s recommendations about what to measure, and suggests considering: catch (kg); catch per unit effort (kg/haul or kg/day); ex-vessel value; wholesale value; weighted price index; measure of amount of harvest labor (crew days or pot lifts); labor share of revenue; crew wages per day; quota holder share of ex-vessel revenue; lease payments as a fraction of ex-vessel revenue; and processing crew days.

Finally, the SSC notes that the rationalized crab fisheries offer a unique opportunity to track the economic health of the fisheries thanks to the comprehensive economic data collected under the crab EDR program. This is one of a few examples (along with the Amendment 80 fisheries) where the Council is collecting this type of detailed economic information, which has proven useful in helping to fulfill its obligations under the National Standards of the MSA, and should be kept in mind when the Council considers any potential revisions to the current EDR programs.

Annual Community Engagement and Participation Overview

Previously scheduled for this meeting, the presentation of the new Annual Community Engagement and Participation Overview (ACEPO) to the SSC was rescheduled for the April 2021 meeting.

D-5 Marine Mammal Conservation Status

The SSC received presentations from John Bengtson (NOAA-AFSC), Jeremy Sterling (NOAA-AFSC), Michael Williams (NOAA-PRD), Lauren Devine (Aleut Community of St. Paul Island, Ecosystem Conservation Office), Tom Gelatt (NOAA-AFSC), Josh London (NOAA-AFSC), Paul Wade (NOAA-AFSC), and Catherine Berchok (NOAA-AFSC). Public testimony was provided by Austin Ahmasuk (self).

The presentations were in response to a request from the SSC to receive annual updates on the status of marine mammals of conservation and fishery-interaction interest. Due to the COVID-19 pandemic, the 2020 full presentation had been postponed. **The SSC greatly appreciated the presentations on marine mammals and was impressed with the breadth and depth of the information provided. The SSC supports continuing to receive annual updates and new findings that are not captured through other Council pathways, and will work with Council staff to identify particular topics of interest.**

While covering a wide variety of topics, species, and regions, several common themes arose that are related to fisheries management and of interest for the Council: (1) population trends, (2) integrated research projects and bioenergetics, (3) changes in the Bering Sea, and (4) co-management and LKTK.

Population Trends

Information on population trajectories for northern fur seals, Steller sea lions, harbor seals, and Cook Inlet Belugas were provided. Polar Ecosystem Program staff (NOAA-AFSC) are working on population assessments for ice seals.

- *Northern fur seals*: There was no 2020 pup production survey on the Pribilof Islands due to COVID-19. Population trajectories up to 2019 indicated that the eastern stock as a whole experienced a -0.55% /yr decline (2009-2019). This is inclusive of contrasting trends at the three main breeding colonies (St. George Island +2.5%/yr, Bogoslof Island + 6.1%/yr, St. Paul Island - 3.0%/yr). On-going VHF studies are being conducted to assess immigration between rookeries.
- *Steller sea lions*: No sea lion surveys were conducted in 2020 due to COVID-19. **The SSC looks forward to updates on population trends for Steller sea lions, particularly in the Gulf of Alaska, where 2019 data suggested a decline in non-pup abundance relative to 2017 counts.**
- *Harbor seals*: Abundance estimates are available for all stocks between 1995 and 2019, though the precision or confidence varies by stock. **The SSC supports the author's plans to include these trends in the ESR as an indicator of the nearshore ecosystem, but suggests that the data should not be aggregated, as this could mask important spatial variability in trends.** For example, it appeared from the data presented that populations in Glacier Bay/Icy Strait have been declining since 2014, while the trend from N. Kodiak has been stable or increasing during that same period.
- *Cook Inlet beluga whales*: Aerial surveys were flown annually from 1994 to 2018. The population appeared to be increasing from 2004-2010, but there was a negative trend from 2010-2018. The current total population estimate is 279 individuals.

Integrated Research and Bioenergetics

The SSC received updates on several projects seeking to improve knowledge of the numerical and functional relationships between marine mammals, fisheries, fish resources, and/or the physical environment.

- Dr. Sterling updated the SSC on the on-going efforts to identify northern fur seal prey capture and size selection through the combination of animal-borne cameras and sail drones. New results from this work indicate that adult females can capture multiple large fish (primarily pollock) on a single dive. The patterns of prey size selection (small fish at surface, larger fish mid-water or at the bottom) appears to be related to the strength of the pollock year class in the preceding year (e.g., if there is a successful year class of age-0 pollock in the previous year, females spend more time at the surface and target age-1 fish).
- Dr. Sterling also provided an update on a large, collaborative Lenfest project that combines a spatially-explicit northern fur seal bio-energetics model with outputs from the end-to-end ecosystem (FEAST) and multispecies stock assessment (CEATTLE) models. In 2020, two new papers were published on factors affecting energy expenditure of fur seals and the practical application of a bioenergetics model to inform management of fur seal populations and their commercially important prey. The SSC was encouraged to see that the project team has explored assumptions in the bioenergetic models surrounding the lack of data from adult male northern fur seals. While only 9% of the population, this sex and age group is estimated to represent 20-30% of the consumption. The project is currently in phase 3, linking the fur seal bioenergetic model to the FEAST and CEATTLE models, and will move into phase 4, evaluating potential future availability of pollock under different scenarios of climate change and fishing, which is anticipated to be completed by the end of 2021.
- Dr. Wade presented information on the seasonal prey consumption of Cook Inlet beluga whales. He noted that because belugas do not chew their prey, stomach content analysis provides the opportunity to assess weight and length of fish consumed. This information, combined with the efforts of collaborators to quantify metabolic rates and other parameters, could be integrated into a bioenergetics model.

The SSC recognizes the value of these integrated bioenergetic models in assessing the importance of commercial fish resources for marine mammals, and also the impact of marine mammals on commercial fish populations. **The SSC encourages continued efforts to collect diet data—for all marine mammals—as this is essential for integrating marine mammals into ecosystem models, and for identifying the mechanistic links between observed population trajectories and changes in the coupled social-ecological system. The SSC also suggests that, where possible, researchers include quality of prey (e.g. lipid content, condition) in addition to size and quantity of species.**

Changes in the Bering Sea

Several presentations noted changes in the distribution, timing of migration, or body condition of marine mammals in the Bering Sea. Changes and anomalies in the physical environment (e.g., sea ice distribution and timing, wind direction, wind speed, snow, temperature) and/or associated shifts in prey resources were suggested as potential drivers of the marine mammal observations. In brief:

- Steller sea lions have not historically maintained a presence in the NBS. Observations from communities and MML researchers noted that male Steller sea lions are now consistently present in the NBS (e.g. St. Lawrence Island) and are remaining for longer; however, no known breeding is occurring.
- Dr. London presented the results of a recently published study quantifying declines in body

condition for two ice-associated seal species (ribbon and spotted seals). An unusual mortality event was also declared for ringed, spotted, and bearded seals from 2018-2019. These both coincided with a decline of 47,000 km² in April sea-ice extent in the Bering Sea. It was noted that the rate of strandings returned to ‘normal’ in 2020, when sea ice also returned to long-term average patterns. A decline in body condition was also observed in harbor seals from the Aleutian Islands during the prior marine heatwave (2014-2016). **The SSC supports continued investigations to identify the linkages between the observed changes in phocid body condition and sea ice loss, bioenergetics, and prey availability.**

- Dr. Sterling presented information on a study investigating the linkages between physical conditions in the Bering Sea and the migration of northern fur seals, specifically exploring age-sex differences. There was strong evidence for an influence of surface winds on pup movement.
- Dr. Berchok presented new information derived from passive acoustic monitoring stations distributed North-South along the 50 and 70m isobaths from the Bering Sea to the Chukchi and Beaufort Seas (2007-present). Both ice-associated and ice-avoiding whale species exhibited changes in detection patterns with a general trend of northward expansion since 2014. The SSC was very pleased to see the acoustic research including the Beaufort and Chukchi Seas and noted the value of establishing baselines in these and other areas. **At present, the mooring configuration facilitates north-south assessments, and the SSC encourages deployment of additional moorings to look at potential changes in east-west migratory patterns.** The SSC also suggested exploring automation and machine-learning applications for processing the large quantity of acoustic data gathered through this system. Additionally, some of the techniques used for the study of bird communication may be of value.

The SSC appreciates the challenges in establishing more direct mechanistic linkages between marine mammal body condition or population dynamics and shifts in the physical environment and/or fisheries interactions. **The SSC encourages continued efforts to monitor marine mammal populations in the Eastern and Northern Bering Sea, and the integration of relevant time-series into the ESRs when possible.**

Co-management, Local Knowledge and Traditional Knowledge

This was the first year the SSC received presentations from a marine mammal Co-management organization as part of the marine mammal status updates. Dr. Devine and Mr. Williams provided an excellent background on the history of Co-management on the Pribilof Islands and how ‘co-management’—the informal participation of communities in marine mammal research and management—evolved into “Co-management” as formalized under the Marine Mammal Protection Act, and the amended Co-management Agreement signed Jan 2020.

At present, the Ecosystem Conservation Office on St. Paul Island implements numerous research and management programs locally on St. Paul Island, including Co-management with NMFS. These include marine debris and fur seal entanglement monitoring and response, coordinated dual-collection of data for Co-management (e.g. hunter and researcher disturbance) and on-going immigration studies, length at age estimates from subsistence and commercial harvests, and observations of female and pup departures. **The SSC recognizes the informative synergies of these projects, in particular, the ability to provide context between observed and modelled datasets, and the importance of evaluating potential bias in long-term datasets.**

Following the presentations, public comment expressed disappointment that the SSC did not hear from other marine mammal Co-management groups or from communities in the region with local knowledge or traditional knowledge as it relates to marine mammals and fisheries interactions. Examples of the types of information that would be important for the Council to know include the impacts of large-scale commercial

fisheries on bowhead whale entanglement and concerns of northward progression of catcher-processors that could result in increased hook interactions and entanglements. **The SSC recognizes that, at present, the on-ramps for this valuable information to the Council are not clear or consistent, and rectifying this is of critical importance for relationship building. Efforts are being made to improve these efforts. In the SSC's comments for D3, the BS FEP LKTKS Taskforce noted that the protocols they are developing will help to operationalize the on-ramps for LKTKS information (including information on marine mammals) into the Council process.**

Other Topics and Minor Comments

The SSC received an update from Dr. Bengtson on the proposed Critical Habitat Designation under the Endangered Species Act for the listed ringed seal and bearded seal that was recently published. It was noted that designation of Critical Habitat does not in and of itself prohibit any activities nor does it affect subsistence use. For questions or additional information on this topic, Dr. Bengtson encouraged contacting the Protected Resources Division. Public hearings will take place at the end of February and public comments may be submitted through early March.

The SSC also suggests in general to all presenters to distinguish whether plots are presenting observed zeros and no-data.

SSC Risk Table Workshop

The SSC convened a workshop on Risk Tables for ABC advice to the Council. The workshop was motivated by feedback from stock assessment authors and Plan Teams, as well as the SSC's plan to assess risk table performance after they had been presented for groundfish stocks. The primary goals of the workshop were to:

1. Evaluate how the risk table process is working;
2. Address consistency issues with the risk tables as identified by the Groundfish Plan Teams, assessment authors, and SSC;
3. Provide guidance for moving forward through an open discussion between stock assessment authors, Plan Teams and SSC members.

The workshop opened with an overview of the risk table development background and a summary of case studies for risk table adjustments with presentations by K. Shotwell, S. Zador and M. Dorn (NOAA-AFSC). This was followed by a group discussion focused on risk table issues, challenges and concerns facilitated by Anne Hollowed. Next, participants selected one of two concurrent breakout sessions. In Session 1, A. Haynie, J. Ianelli, and S. Kasperski led a discussion of tangible steps toward quantifying the importance of external changes in fishery performance in stock assessments, and G. Thompson led a discussion of tangible steps toward quantifying the importance of assessment risk. In Session 2, P. Spencer and D. Goethel led a discussion of tangible steps towards quantifying the risk of external changes in population conditions, and K. Shotwell, B. Ferriss, E. Siddon, and S. Zador led a discussion of tangible steps towards quantifying risk of external changes in ecosystem conditions. The key session outcomes were discussed in a plenary session followed by presentations from M. Dorn and G. Thompson on frameworks for addressing scientific uncertainty. Public testimony was provided by Gerry Merrigan (Freezer Longline Coalition). The workshop concluded with an SSC discussion.

The SSC thanks the workshop session leads for their excellent presentations and the participants for contributing to the thoughtful discussions. The workshop highlighted the value of the risk tables in fostering increased transparency and communication between ecosystem/process researchers and stock assessment scientists, providing a venue for authors to capture concerns about whether additional precaution is necessary with respect to ABC, and a space to articulate concerns and areas for additional consideration.

The workshop also showed that there is a mix of opinions amongst participants regarding the purpose of the risk tables and the definition of risk. There were productive discussions about whether and how to develop risk tables for non-target species, Tier 5/6 stocks, and stock complexes and a range of perspectives on whether the tables should continue to be implemented on a qualitative case-by-case basis or be transitioned to support a more prescriptive quantitative approach for ABC reduction.

The SSC recommends the workshop proceedings be captured in a written report for discussion by the SSC at an upcoming meeting; ideally prior to the fall GPT meetings. The SSC offers the following suggested topics and questions, in addition to those highlighted above, for consideration in the report:

- Clearly define the objective of the risk tables.
- Summarize what has worked well so far and what has not.
- Develop a working definition of “risk” that is appropriate to the context and intent of the risk table exercise.
- Standardize terms and explore whether an alternative name for the ‘risk’ table should be considered. This should include (re)defining an objective for the table and perhaps a glossary of key terms.
- Decide if the SSC wants a qualitative or quantitative method for defining ABC reductions once table scores are assigned, including a review of the benefits and drawbacks of each. A quantitative method could be based on modelled estimates of uncertainty (e.g., method presented by G. Thompson) or be independent of model outputs.
- Are assessments of risk across species, with differing fisheries and connections to the broader ecosystem, sufficiently comparable to fit within a common framework for recommending ABC reductions?
- Provide guidelines to avoid double-counting information, within the assessment and risk table, or among multiple columns of the risk table.
- Potentially revise the category levels: from the existing four (normal, increased, major, extreme) to a new four (unknown, normal, increased, extreme).
- Continue to summarize the SSC’s ABC reductions to aid in consistency and characterize the reductions that have been made in previous assessment cycles.
- For which species should risk tables be provided? For example, should species with catch significantly less than ABC be excluded?
- Should the relationship between catch and ABC be a consideration in the assignment of risk level?
- Consider when and how TK/LK can help with data lags in potential community engagement/dependency fishery performance change indicators and/or missing survey observations within the context of risk tables.
- Reemphasize that reductions are only warranted for exceptional circumstances.
- Address the trade-off between transparency and complexity.

SSC Member Associations

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

At this February 2021 meeting, a number of SSC members acknowledged associations with specific agenda items under SSC review. Brad Harris is a member of the BS-FEP team, assisted with D2 EFP application power analyses, supervises Robert Murphy (D3 LKTKS Taskforce member), and is the M.Sc. major professor for Cory Lescher (Alaska Bering Sea Crabbers and contributor to the written public testimony ABSC white paper provided for C4 Crab PSC Limits). Andrew Munro supervises Toshihide Hamazaki, the lead author of the C5 NSRKC assessment. Jason Gasper contributed to C3 IFQ Sablefish release analysis. Ian Stewart provided background information for C3, in addition to being a member of the BS-FEP. Patrick Sullivan is on the Ph.D. committee of Scott Smeltz, who contributed to D2 Halibut excluder EFP application. Anne Hollowed supervises Martin Dorn (CPT co-chair and contributor to C4 Crab PSC analysis), William Stockhausen (CPT member and contributor to C4 Crab PSC analysis), and Cody Szuwalski (CPT member, presenter for C5 Crab Plan Team report, and contributor to C4 Crab PSC analysis). Dana Hanselman supervises the supervisor of Elizabeth Siddon (BS-FEP team member) and Jane Sullivan (contributor to C3 IFQ Sablefish release analysis). Chris Siddon supervises Katie Palof (CPT co-chair and contributor to C5 Crab PSC analysis), Jie Zheng (co-author for C5 NSRKC assessment), second level supervisor for Shareef Siddeek (C5 AIGKC model runs and CPT member) and is married to Elizabeth Siddon (BS-FEP team member). Numerous SSC members had associations with contributors to and participants in the Risk Table Workshop but, because the goal of the workshop was risk table development and not formal recommendations for Council action, all SSC members participated fully in the workshop.