SCIENTIFIC AND STATISTICAL COMMITTEE
REPORT TO THE
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
September 30th – October 2nd, 2019

The SSC met from September 30th through October 2nd at the Land's End Resort, Homer, AK.

Members present were:

Anne Hollowed, Co-Chair
NOAA Fisheries—AFSC

Gordon Kruse, Co-Chair
University of Alaska Fairbanks

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

Milo Adkison
University of Alaska Fairbanks

Chris Anderson
University of Washington

Amy Bishop
Alaska Sea Life Center

Mike Downs
Wislow Research

Jason Gasper
NOAA Fisheries – Alaska Region

Dana Hanselman
NOAA Fisheries—AFSC

Brad Harris
Alaska Pacific University

George Hunt
University of Washington

Dayv Lowry
Washington Dept. of Fish and Wildlife

Franz Mueter
University of Alaska Fairbanks

Andrew Munro
Alaska Dept. of Fish and Game

Matt Reimer
University of Alaska Anchorage

Heather Renner
U.S. Fish and Wildlife Service

Kate Reedy
Idaho State University Pocatello

Ian Stewart
Intl. Pacific Halibut Commission

Alison Whitman
Oregon Dept. of Fish and Wildlife

B-1 Plan Team

The SSC reviewed the Gulf of Alaska Groundfish Plan Team (GPT) nomination of Marysia Szymkowiak (NOAA-AFSC). The SSC finds this nominee to be well qualified, with appropriate expertise that will assist the Plan Team. **The SSC recommends that the Council approve this nomination.**

B-4 Alaska Fisheries Science Center Report

Dr. Robert Foy (Science and Research Director, NOAA-AFSC) provided an update on the Alaska Fisheries Science Center (AFSC) survey funding expectations and 2020 priorities. The presentation was greatly abbreviated due to time constraints. There was no public testimony.

By using forward funding, the AFSC expects to contract four vessels in 2020 for bottom trawl surveys: two in the Aleutian Islands and two in the Bering Sea, including a northern Bering Sea survey. Funds are not available for a slope survey in 2020. Moreover, staff are limited and deployed in other surveys.

Dr. Foy updated the SSC on progress towards addressing a June 2019 Council request to process a backlog of scales from Chinook salmon bycatch samples. These are needed to update the length-at-age key used in the adult equivalency (AEQ) model for Chinook in the Bering Sea pollock fishery and to develop a length-at-age key, estimate age-specific stock composition, and estimate age-specific bycatch for the Gulf of Alaska fishery. Progress has begun (30% have been read) with expected completion by the end of October 2019.

Dr. Foy also updated the SSC about an Alaska Geographic Strategic Plan, with a draft to be submitted to NMFS headquarters on 15 October. Goals of the plan are to describe the landscape unique to Alaska, and to describe how the AFSC, Alaska Regional Office (AKR), and the North Pacific Fisheries Management Council (NPFMC) work together to accomplish NOAA Fisheries strategic goals. The official roll-out will

be in Spring 2020 and will include a presentation to the Council. This plan constitutes part of a national initiative.

The SSC appreciates receiving this update from the AFSC and appreciates their efforts to maintain delivery of top priority services to the Council under current strained federal budgets. This includes finding a balance between stock assessments, ecosystem assessments, and economic studies. The SSC is pleased that at least four trawl survey vessels were able to be funded for 2020 but continues to be disappointed in the loss of the slope survey, which covers an important part of the ecosystem and supports important fisheries. The SSC strongly values the opportunity to hear updates from the AFSC and gives high priority to making time to hear the full presentation in the future. Specifically, the SSC hopes to understand the long-term priorities of the AFSC given budget constraints, especially related to surveys in the northern Bering and Chukchi Seas.

Technical Memorandum on NS1 Guidelines

NMFS Headquarters has asked the regional councils and SSCs to review a draft Technical Memorandum on "National Standard 1 Technical Guidance for Designing, Evaluating, and Implementing Carry-over and Phase-in Provisions within ABC Control Rules." To lead this effort the SSC formed a working group composed of Anne Hollowed, Gordon Kruse, and Alison Whitman. Their efforts will be brought forward for review at the December Council meeting to meet the review deadline of January 15.

C-1 BSAI Halibut Abundance-based Management PSC Limits

The SSC received an overview of the Draft Environmental Impact Statement (DEIS) for abundance-based management (ABM) of PSC limits from Diana Stram (NPFMC), with presentations from: Carey McGilliard (NOAA-AFSC) and Jim Ianelli (NOAA-AFSC) on the simulation model; Sam Cunningham (NPFMC) and Anna Henry (NPFMC) on the draft economic impact analyses (EIA); and Mike Downs (Wislow Research Associates LLC) on the Social Impact Assessment (SIA). Public testimony was received from Bob Alverson (Fishing Vessel Owners Association), Gerry Merrigan (Freezer Longline Coalition), Mateo Paz-Soldan and Simeon and Phyllis Swetzof (City of St. Paul), Linda Behnken (Alaska Longline Fishermen's Association), John Gauvin (Alaska Seafood Cooperative), Heather McCarty (Central Bering Sea Fishermen's Association), Arne Fuglvog (Northstar Fishing Company), Chris Woodley (Groundfish Forum), and Steve Martell (Sea State Inc.). Additional written comments were received from the Halibut Association of America, the Alaska Marine Conservation Council, the Aleut Community of St. Paul, the North Pacific Fisheries Organization, Peter Thompson (Kodiak), and Hailey Thompson (Kodiak).

The SSC commends the efforts of the ABM working group to produce a DEIS that includes an exceptionally clear background in the Executive Summary to help readers understand the alternatives and options, a helpful history of the action since the Council first considered linking halibut PSC to measures of halibut abundance, and extensive backgrounds on the affected groundfish and halibut fisheries. The analytical team has done an enormous amount of work to a high standard and has done it very quickly to provide timely advice. The analysis does an excellent job of fulfilling the SSC's request to select a baseline biological and an IPHC simulation model, and to focus on contrasts among alternatives, both those proposed by stakeholders and those designed to bookend potential effects. The economic analysis is thoughtful regarding the types of costs and benefits that each fleet experiences through halibut, either as PSC or directed catch. The SIA is exceptionally thorough at illuminating the geographic distribution of fisheries that are engaged with halibut and the form of each community's engagement. The resulting report provides a scientific basis for designing ABM alternatives that strike a balance between benefits to fleets and communities that interact with halibut as PSC, and the directed fishery.

Importantly, the report highlights two limitations of the current alternatives in achieving the Council's goals. First, the analysis concludes that the spawning stock biomass (SSB) displays "low variation amongst alternatives" (Table ES-4). This arises because decreases in PSC mortality lead to corresponding increases in directed fishery mortality. **The SSC emphasizes that, within the range of plausible alternatives, any differences in the age/size profile between PSC mortality and directed fishery mortality do not result in appreciable differences in halibut SSB when halibut mortality is shifted from PSC to the directed fishery.** Importantly, this is a property of the system that is robust across the range of plausible alternatives. **As such, the SSC concurs with the analysts' conclusion that "implementation of an abundance-based management of halibut PSC is an allocation decision rather than a conservation decision"** (p. 250).

Second, the analysis shows that the relationship between halibut PSC per-unit groundfish in the trawl fishery and the trawl survey halibut biomass ranges from moderate to nonexistent and is highly variable (e.g., p. 150). This finding was also supported by public testimony to the SSC. Therefore, there is limited empirical support that the trawl survey biomass index reflects what halibut encounter rates will be in the groundfish trawl fishery. Rather, the realized halibut encounter rates, and the associated likelihood of PSC-dependent fisheries foregoing considerable groundfish catch, are highly variable year-to-year. **The SSC emphasizes that a result of the analysis is that the groundfish fleet's ability to avoid halibut is poorly related to indices of abundance.**

The primary differences among the alternatives are likely in economic and social performance metrics, which are not yet developed and calculated on an alternative-specific basis. Because of this limitation, in addition to some shortcomings of the simulation model and performance metrics (as detailed below), **the SSC finds that the document in its present form is not yet ready for release for public review and would like an opportunity to review a revised DEIS prior to release.** Moreover, this delay allows time for the Council and the workgroup to review the present set of alternatives and assess whether additions are needed to achieve the Council's goals. If the Council continues analysis of these alternatives, or a modified set of alternatives, the SSC has the following recommendations for the simulations, alternatives, and associated performance metrics.

Potential improvements to the simulation model

This simulation model has been valuable in establishing a scientific understanding of the dynamics of the halibut population, management, and fleet benefits and costs while also demonstrating substantial information gaps in halibut demography. Despite the lack of effects on spawning stock biomass across alternatives, the simulation model is an appropriate tool to evaluate trade-offs associated with allocating different portions of the total simulated mortality between PSC and the directed fishery. However, the SSC had some concerns and recommendations about the current implementation of the simulation model:

- A critical feature of the model is the process that simulates IPHC management with regard to setting TCEY. The resulting portion of the TCEY that is allocated to the BSAI region determines the amount of halibut available to the directed fishery, which is obtained by subtracting the previous year's O26 PSC usage from the specified BSAI TCEY. Rather than simulating the full specification process, the analysts adopted a shortcut that predicts the total annual halibut mortality (a proxy for TCEY) that might be specified by the IPHC based on a simple linear relationship between SSB and total mortality estimated over recent years (2007-2018). While an approximation based on recent history may be adequate for examining small changes in SSB from the status quo, the SSC had a few concerns and comments about the approach as implemented:

  o The linear relationship between SSB and total mortality is simply extrapolated for simulated SSB values below or above the range observed over the recent period. This becomes particularly important at low stock abundances, when a decreasing portion of total

mortality/TCEY is allocated to the directed fishery. **Therefore, the SSC recommends that the analysts implement a simple version of the "30:20 control rule" to further reduce TCEY at very low levels of stock abundance as it better approximates the current IPHC management approach.** While this is unlikely to lead to SSB differences among alternatives, it will likely provide larger contrast in economic and social metrics among fisheries.

- o The analysts also noted that the model could be extended to simulate some form of the IPHC assessment and the control rule within the simulation model, but that this would require considerable effort. The SSC suggests that this additional effort is unlikely to add much benefit for the purpose of comparing alternatives.

- o The time period of the linear relationship encompasses an earlier period of relatively high (and variable) SSB and a more recent period of lower SSB, reflecting strong temporal autocorrelation. The SSC suggests that, in addition to implementing a 30:20 rule, the analysts should consider: (1) using alternative time periods or better justifying the relatively arbitrary time period (2007-2018) in the document, (2) allowing for temporal autocorrelation in the regression and/or different variances at low and high stock abundance, and (3) down-weighting earlier years, as halibut management has changed considerably over time. Giving more weight to recent years may better reflect future management. These changes may or may not affect the relative performance of different alternatives with respect to Council objectives and are offered as suggestions without being prescriptive.

- The current analysis assumes that PSC usage is a constant proportion of the PSC limits (Fig. 6-20), which is fixed at recent (2016-2018) average usage, thereby omitting critical dynamics and uncertainties that are described in the fleet operations background. This assumption cannot be validated with the available data and any behavioral changes to avoid PSC cannot be predicted. An obvious flaw of this approach is that it precludes the use of a performance metric that captures the risk of reaching or exceeding PSC limits. **Therefore, the SSC recommends incorporating interseason variability in halibut encounters and corresponding PSC usage rates, along with a performance metric related to foregone groundfish catch.** While this will not forecast the frontier of the fleet's halibut avoidance efforts, it is a critical bookending to contrast with the current assumption of constant proportional usage. Forward simulations could account for the effects of deck sorting by drawing from historically observed halibut bycatch rates in each fleet and applying recent discard mortality rates to determine PSC usage. A simpler approach may be to simulate PSC usage with some associated uncertainty to quantify (in a relative sense, for comparisons among alternatives), the probability that PSC usage in the groundfish fishery is below the PSC limit in any given year.

- Based on a previous SSC recommendation, the analysts simulated future abundances under a plausible range of variability in recruitment (and other parameters) over a long timeframe (April 2019 SSC minutes). The analysts chose a time horizon of 20 years, resulting in a limited range of spawner abundances and, in many cases, the simulations had not reached equilibrium (Appendix 4). The SSC suggests two enhancements to (1) **consider a wider range of recruitment variability, specifically a low recruitment scenario to evaluate the performance of the rules at low abundances** (see previous point) and (2) **consider some model runs over a longer time frame** to examine if the relative rankings among alternatives are sensitive to adopting a longer simulation period. Consideration of changes to weight-at-age would become more critical as the timeframe for model simulation increases.

The SSC offers some additional minor comments regarding possible improvements to the model and presentation of results:

- The estimated SSB (in the assessment portion of the ABM model) is currently simulated with random noise (independent random draws from a log-normal distribution) with an option to let the error follow a first-order autocorrelated process. This option was not implemented in the current model runs. The SSC suggests that the analysts consider implementing this option in future model runs.

- Forward simulations in the model use weight-at-age values for halibut from the 2018 stock assessment that include an unrealistic "spike" in weight-at-age at around age 23 that may reflect small sample sizes. For these forward simulations, it would be preferable to use a more realistic weight-at-age scenario, perhaps by combining weight-at-age over several recent years or smoothing the relationship.

- In Figure 6-2, the violin plot shows a lower value for the maximum usage than other, comparable alternatives (e.g., 3-1a, b). These values should be checked.

- To evaluate the Council objective that PSC limits should be indexed to halibut abundance, the analysts correlated PSC limits for the trawl fishery (which tends to catch smaller halibut) with current SSB. Because any benefits from these PSC limits affect SSB at a future date, the SSC suggests that trawl fishery CPUE should be correlated to future SSB (see Figures 6-9 and 6-10), reflecting the lag between the reduction in PSC and potential benefits to SSB in the future.

- It was difficult to track the differences in the subset of alternatives (Table 2.4). Visual aids, such as shading or color coding, might be helpful to track the effects of the various elements. Additionally, connections between the elements and options of each of the alternatives and the results of the model simulations could be enhanced, potentially through an expansion of section 6.1.5.

Further evaluating present or new alternatives

The current analysis represents a considerable investment in a framework for understanding the tradeoffs among fleets, and the SSC has the following recommendations to extend this tool to better assess current and new alternatives:

- The value of abundance-based PSC limits would be brought out better if they could be more explicitly contrasted with fixed PSC limit policies.

  o Clarify the representation of SSB performance in Table ES-4 to establish that the SSB is not different among the alternatives.

  o Throughout the document, consistently compare Alternatives 2 and 3 with the appropriate options under Alternative 1, to highlight the additional value of the abundance-based system rather than simply lower PSC limits. In particular, Alternative 1.c (zero PSC) provides an important upper bound on the potential stock effect of abundance-based PSC.

- **The SSC recommends including an alternative, for comparison purposes, that allows regulatory flexibility for in-season adjustments/transfers between sectors, after seasonal halibut PSC encounter rates are observed.**

- The SSC supports implementing the stakeholder-proposed alternatives in a way that is consistent with the intent of the proposal (i.e., update Alternatives 3.3a and 2.4)

- Stakeholders have expressed concern about the complexity of some of the alternatives, specifically those that use a primary and secondary index for determining PSC. To consider

model complexity explicitly, the SSC suggests that the analysts, with input from management, rank the complexity of different alternatives based on challenges in both communicating and implementing the alternatives in management.

- The SSC found the metric used to assess flexibility (the average ratio of PSC limits to 'trawl selected biomass' over 20 years) to be problematic. If PSC reflects abundance, the ratio will tend to be highest at the lowest levels of abundance in the presence of a floor, and it will decrease as abundance increases in the presence of a fixed PSC limit or ceiling. Given the high variability in PSC usage, it is not clear if a higher value for the ratio implies higher 'flexibility' for the fleet at high abundances.

- In Figure 6-15, the distribution of relative changes in PSC usage may be more usefully shown as an absolute change (i.e., the magnitude of change without the sign) to better evaluate the relative performance of alternatives.

Beyond Abundance-Based Management

The SIA demonstrates the critical role that directed halibut catch plays in numerous communities throughout Alaska. The SSC sees that these communities have borne the bulk of the burden associated with declining halibut biomass, and that there is currently no assurance that the burden of future reductions in TCEY will be shared among stakeholders. At the same time, the PSC fleets face highly variable encounter rates, and in a high encounter year, face a very costly avoidance problem, against which higher PSC limits provide insurance. In the absence of a strong relationship between halibut PSC mortality and measures of abundance, **the SSC encourages the Council to consider allocation approaches that allow for inseason flexibility**. For example, the Council currently relies on inseason management to reallocate groundfish apportionments across sectors to facilitate full utilization of groundfish TACs. One option for managing halibut allocation would be an inseason, intersector rollover provision whereby PSC limits could be transferred between groundfish sectors or from the groundfish sector to the directed halibut fishery. Another option would be a within-sector interseason rollover provision comparable to the salmon savings plans used to provide individual incentives to avoid salmon PSC in the pollock fishery.

C-3 Observer 2020 Annual Deployment Plan

The SSC heard a presentation from Craig Faunce (NMFS-AFSC) and Geoff Mayhew (PSMFC) providing an overview of the draft 2020 Annual Deployment Plan (ADP) for observers in the BSAI and GOA to support estimation of groundfish catches, discards, PSC, and related biological attributes. Oral testimony was provided by Molly Zaleski (Oceana). Written testimony was provided by Ernie Weiss (Aleutians East Borough), Beth Stewart (Peninsula Fisherman's Coalition), and Susan Murray (Oceana).

The SSC thanks the analysts and authors of the draft 2020 ADP for their work in preparing the report. The report is well written and conveys a tremendous amount of technical information in a concise and largely accessible way. The SSC appreciates not only the forward-looking analyses done by the authors, but their ability to convey key findings through their writing. The appendices, particularly B and C, were very helpful in providing technical background for the analyses and recommendations made in the report. Since initiation of the restructured Observer Program in 2013, the analysts have been responsive to SSC comments and recommendations for improving the ADP and the Observer Program. The SSC greatly appreciates the work that has been done to develop and implement these improvements. The newly revised program has matured significantly in the last few years with respect to current use of trip-based selection, gear-based stratification, and standardized methods of ADP development and Observer Program performance evaluation. The SSC found the gap analysis in Appendix C to be a valuable addition to the document and commends the authors on addressing the critical trade-off between adding vessels to the EM pool and the gaps in estimates of average weight, and collection of various biosamples, that result. These

enormous improvements reflect the hard work and dedication of the analysts, observers and their supervisors, and reviewers of the program.

Recognizing that approval of the pollock trawl EFP currently before the Council for consideration has the potential to substantially impact the deployment levels and funding needs detailed in this draft version of the ADP, the SSC has the following comments and recommendations concerning the draft 2020 ADP:

- In the partial coverage category, NMFS recommended deploying into a fixed gear EM stratum and into three observer strata based on gear type (trawl, pot, and longline), discontinuing separate strata for tendered trawl and tendered pot. The agency plans to use poststratification as an analysis tool to separate the effects of tender trips and untendered trips after sampling is completed. Appendix B of the ADP clarified that a decrease in the rates of coverage for tendered trips is unlikely to result from this change and the SSC agrees with this assessment. **The SSC agrees with the recommendation for use of three gear-specific observer strata (trawl, pot, and longline) and a fixed gear EM stratum for partially observed fleets and, like the FMAC, the SSC requests that NMFS continue to evaluate coverage levels achieved on vessels delivering to tenders in the Annual Report.**

- **The SSC supports the use of the 15% minimum coverage plus optimization method that was recommended by the authors in the 2020 ADP report.**

- **The SSC agrees with the authors' recommendation to support the addition of 30 vessels to the fixed gear EM stratum if there is funding, but the SSC looks forward to an analysis of the optimal number of vessels in EM, the amount of video coverage in EM, and the impacts to gaps in information on average weights, biological samples, and discard estimation.** Without a careful strategic assessment of short- and long-term impacts of this fundamental change in how fisheries are monitored, there is a risk of degrading the capacity to collect data fundamental for inseason quota management, catch estimation, stock assessment, and management of protected resources.

- The ADP report addressed the potential cost of dropping stratification in terms of possible lack of coverage for small groups (in this case tender landings) and found that it likely wouldn't be an issue. However, there was no mention of the cost of post-stratification relative to stratification in terms of increased variance of discard estimates (the cost of post-stratification is the additional variance term on estimates that accounts for setting strata boundaries after sampling has been conducted). The SSC requests a mention of this cost and a discussion of why this cost is outweighed by the other benefits.

- The SSC remains concerned about funding levels for the Observer Program as these data are foundational to stock assessments, inseason management, and PSC analyses, as well as Council decision making. As the optimization of trip allocation is based both on the cost of an observed trip in each stratum and variance of discarded groundfish, Pacific halibut and Chinook PSC, the limited and decreasing funding for the Observer Program means that available funds in 2020 may be entirely expended to obtain the 15% sample rate across all strata, leaving no funds to optimize sampling beyond this rate. **The SSC supports the Teams' recommendation that resources be allocated to fund this shortfall and that efficiency measures to deploy observers and EM systems continue to be pursued.**

- The document clearly laid out the allocation strategy for observers in the partial coverage category, but there was no mention of how and why the level of EM coverage was set at 30% of trips. Now that the source of EM funding is the same as observer coverage, **the SSC recommends an analysis**

of the 30% trip selection value should be re-evaluated and discussed in further ADPs. The SSC supports the FMAC recommendation that the Council request the agency consider how to integrate the results of EM and observer coverage in the fixed gear sector to present an aggregate view of monitoring (e.g., is the 15% hurdle still appropriate baseline level for observer coverage in combination with EM coverage?).

- For fixed gear, boats are permitted to "opt-in" or "opt-out" of the fixed gear EM program at the start of the year but must submit a monitoring plan to NMFS. The fixed gear EM is used for catch enumeration at less than 100% coverage. Because of the program implementation (opting in or out), designing an efficient and optimal program is impossible because the number and kind of sampling units is unknown in advance (vessels are not required to carry/use EM). **The SSC supports the authors', Crab Plan Team (CPT), and Joint Groundfish Plan Teams' (JGPT) recommendation for a reevaluation of the fixed gear EM vessel selection process to improve the efficiency of funds relative to reducing potential biases and estimation of uncertainty.**

- The SSC heard in this meeting, and the June 2019 meeting, that videos from fixed gear EM fishing towards the end of the year were not reviewed because of the lag between when the hard drives were received and when the drives could be reviewed. The SSC acknowledges that not reviewing videos from end-of-year fishing could lead to temporal bias and is glad to hear that it should be less of an issue in future years because more reviewers can be hired during busy periods. **The SSC supports the authors', CPT, and JGPT suggestion to evaluate the impact of non-review of end-of-year fixed gear EM video and develop measures to avoid this problem.**

- The SSC notes that when a trip is designated to be observed via ODDS, but is then canceled, the subsequent trip for that vessel inherits the "observed" status. This systematically shifts sampling effort later in the season, generating temporal bias. The SSC noted in its June 2019 report that linking ODDS with eLandings is required before the Trip Inheritance Group can make recommendations to resolve this issue and linking ODDS with eLandings first requires documenting of the computer code that forms the basis of ODDS. The SSC looks forward to seeing this addressed when sufficient staff time and funding are allocated for this purpose.

- The last couple of years the **SSC has recommended the addition of vessels under 40 feet to the EM pool and have requested to see some deployment options brought forward for discussion**. The under-40'-no coverage fleet represents a large segment of the targeted halibut trips so the impact of non-coverage could be substantial. The SSC would like to continue to highlight this as a sampling gap and hopes to see further discussions in the future.

- In June 2018, the SSC requested a fleet-wide training of crew on the necessity of the Observer Program, noting that compliance and enforcement issues have been a problem within the Observer Program and have contributed to bias. This was highlighted as a critical need to be addressed immediately. In June 2019, the SSC reported that extensive outreach efforts have been conducted by the Office of Law Enforcement (OLE) the past several years and that the overall number of statements about poor/illegal behavior decreased nearly 25% during 2017. **The SSC is grateful for the outreach efforts of the OLE and supports the goal of focusing on additional outreach efforts.**

- The SSC requests that abbreviations in the document be defined the first time they are used and in figure captions to provide clarity for readers (e.g., T and t in Table B-3; FN, FY and TYFY in Appendix C text; scenario name abbreviations in Table C-1; OBNO in Table C-2)

- Figures C-2 through C-5 were critical for understanding the conclusions in Appendix C but were difficult to digest. An example of how to read and interpret the plots (as provided in slide 24 of the presentation) would be extremely helpful.

Ecosystem Status Report Preview

The SSC received a presentation by Drs. Stephani Zador and Elizabeth Siddon (NOAA-AFSC) on preliminary data concerning aspects of the marine ecosystems of the Gulf of Alaska and the Bering Sea. This will provide important context for the December groundfish assessments. There was no public testimony.

The SSC appreciated this excellent, informative report. When appropriate, the **SSC supports continuing efforts to provide information on early warning signs in October**, recognizing this timeframe is VERY early for data providers and a tremendous, rushed effort for the authors.

The SSC found the EBS "Implications" slide helpful for interpretation of the findings and to highlight for the Council mechanistic or relevant indicators of impacts to fish stocks. The SSC notes that this slide addresses a suggestion made in December 2018 that the authors attempt to pull together a prominent, succinct summary of the most relevant indicators to aid the Council in evaluating likely impacts on fish stocks. The **SSC suggests that the October preview might also contain implications of ecosystem considerations relevant to crab assessments that are conducted in October**.

Given new information on major changes in the distribution and abundance of stocks of pollock and cod in the Bering Sea, the SSC requests information on the diets of both juveniles and adults of these species. These are needed to evaluate the likely impacts of the observed demographic changes on future recruitment. As the SSC noted in October 2018, there is likely to be a reorganization of the northern Bering Sea (NBS) food webs due to the increase in predator biomass. It is important to know how this increase is affecting crab, forage fish, and salmon stocks, as well as seabirds and marine mammals. If possible, it would be useful to receive output from Ecopath models based on past and present food habits to assess whether structural changes in the food web or shifts in carrying capacity have occurred. For example, the last time there was an Unusual Mortality Event (UME) for ice seals, there were significant pathologies associated with the deaths (e.g., hair-loss and coat condition issues) that are not yet apparent this time. The current UME is associated with young and emaciated seals, which, in addition to an UME for gray whales, suggests that the food web structure in the NBS may be changing. **The SSC notes the importance of continuing to do regular surveys in the NBS, as this system appears to be changing rapidly and the effects are largely unknown.**

The **SSC supports efforts to get input from communities on seabird reproductive timing, reproductive success, and observations of UMEs involving seabirds and marine mammals**, as this additional information improves the breadth of our understanding of ecosystem status. We note that agencies are receiving regular feedback from communities indicating that they want more information shared back to them. To that end, **the SSC strongly supports the continuation of the public summary begun last year. Wide distribution would be helpful.**

The seabird and marine mammal die-off maps reflect expanded efforts to obtain input from communities and the public, and to make reporting opportunities available for strandings and die-offs. These data are useful but present an interpretation challenge because time series are not available. For the long-term use of these data**, there is a need to develop a metric that defines a "die-off"** as distinct from increases in reports of dead birds due to increased reporting and active search for beach-cast birds. The COASST program has looked into quantifying this issue for their systematic surveys.

Likewise, there is increased reporting of Harmful Algal Blooms (HABs). It is unclear at this point if these are mostly isolated events – like the findings of saxitoxin poisoning of terns in SE Alaska – and what is a "normal" frequency for such events. Looking forward to December, the SSC suggests that it would be helpful to develop context for these events, such as a broad-scale summary of what is normal and what is unusual for HABs.

In the southeastern Bering Sea, there were mixed signals from seabirds about prey availability in 2019. There was a major die-off of euphausiid-eating short-tailed shearwaters, yet many of the fish-eating seabirds, both surface feeders and divers, were able to successfully raise chicks. Likewise, in the GOA, seabird reproductive success was mostly normal, yet the AFSC surveys of larval fish showed that for many species, larval abundance was low. These observations differ from those in the last GOA marine heat wave. **The SSC recognizes that there is a need to refine our assessments of which environmental metrics are most useful to fisheries managers for understanding and forecasting year-class strength of commercially important species and ecosystem carrying capacity.**

C-4 BSAI Crab

General SSC Comments to Crab Plan Team

The SSC reminds authors to use the model numbering protocols that allows the SSC to understand the year in which a particular version of the model was first introduced. Also, when reporting bycatch in tables in each SAFE chapter, the SSC requests authors to be clear whether they report bycatch or bycatch mortality (DMRs have been applied). Further, when reporting bycatch mortality, it would be helpful to report the DMR values used.

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

The Bering Sea Fisheries Research Foundation (BSFRF)/NMFS side-by-side trawl results from 2010 through 2018 have provided a valuable dataset with which to estimate NMFS trawl survey selectivity and catchability relative to a more efficient gear type. The SSC saw raw comparisons from both Tanner (Figure 66 in the SAFE document) and snow crab (Figure 21 in the SAFE document), which appeared functionally similar: both showed increasing selectivity over smaller sizes and much lower catchability across all sizes for the NMFS gear. The SSC encouraged authors to work together to create a standard approach for creating priors on selectivity and catchability from these data for use in the respective assessments. A hierarchical comparison of all species pooled, separated species, and separated sexes may be helpful for understanding where statistically supported differences exist. Where sample sizes are modest (e.g., snow crab), bootstrapping, or a sample size-weighted estimate rather than a raw average may be useful for aggregating across years.

Although listed on the agenda, the SSC did not receive presentations on the Tanner crab MSE, *Chionoecetes* mating dynamics, nor *Chionoecetes* skip molting.

Bering Sea Crab Survey

Jon Richar (NOAA-AFSC) presented an overview of the results of the 2019 eastern Bering Sea (EBS) trawl survey. There was no public testimony. The survey extended into the northern Bering Sea (NBS). Overall, the survey estimated the second lowest mature male crab biomass across all species on record. Bristol Bay red king crab continued its decline over the last two decades. Recruitment has remained poor since the early

2000s. There is a history of volatile recruitment for Pribilof Islands red king crab. This stock exhibited some improvement since 2018. Red king crab in Norton Sound experienced a sharp decline in mature males and legal males since 2017. Blue king crab in the Pribilof Islands remain low, whereas there was some improvement in most stock components for St. Matthew Island. The latter experienced a notable shift in geographic distribution, with a broader distribution of crab to the south and lack of crab at one station to the north that typically has high densities. EBS Tanner crab experienced downward trends in most stock components, with notable declines in mature male biomass both east and west of 166º W. Mature males and females are concentrated near the Pribilof Islands with continued low abundances in the eastern district. EBS snow crab experienced increases in some stock components. Mature females declined. Interestingly, when the NBS and EBS were considered together, there were more mature males in the NBS than EBS, whereas the reverse was true for mature females. Contiguous geographic distributions of snow crab throughout the area suggest that the EBS-NBS boundary lacks biological meaning for snow crab.

SAFE Updates

Pribilof Islands Blue King Crab

The SSC received an update to the PIBKC SAFE produced in May 2019, at which time the mortality estimates for 2018/2019 were incomplete. The stock remains in an overfished condition, the directed fishery remained closed in 2018/2019, and bycatch mortality in crab and groundfish fisheries was estimated to be 0.41 tons, approximately 35% of the OFL. Therefore, it was determined that overfishing did not occur in 2018/2019.

Pribilof Islands Golden King Crab

Although the 2018 estimates of mortality were confidential (only one vessel participating), it was determined that overfishing did not occur for the PIGKC stock.

Western Aleutian Islands Red King Crab

Based on final mortality estimates for 2018/2019, it was determined that overfishing did not occur for the WAIRKC stock.

Pribilof Islands Golden King Crab Assessment Plan

Due to increasing interest in participation in this fishery, the CPT will be re-evaluating the current analytical approach. Efforts to create a Tier 4 analysis by fitting a random effects (RE) model to the NMFS slope survey data by subarea have proven challenging. The SSC encourages further efforts to move this analysis to Tier 4 and encourages the CPT to also consider VAST models in addition to RE modelling. The SSC was concerned that the slope survey does not appear likely to be conducted again through at least 2020; this survey has been the primary source of information for this stock. T**he SSC strongly supports continued efforts to provide a fishery independent index of abundance for crab and groundfish species on the Bering Sea continental slope.** The SSC supports the development of a collaborative industry-based survey to provide data in the absence of the NMFS slope survey.

Norton Sound Red King Crab Modelling

The SSC received a summary of modelling efforts to improve the NSRKC assessment model. The work included estimating discard mortality, investigating maturity via chela height measurements, standardizing CPUE, and addressing the absence of large crab in the observed data. The SSC appreciates the work on these issues, recognizing that none were fully completed at this time. Noting the challenges in predicting discards for unobserved fishing activity, the SSC encourages the authors to utilize dockside interviews to compare with analytical predictions of discards.

Aleutian Islands Golden King Crab Survey

The SSC received an update on the cooperative industry-based survey efforts for AIGKC conducted over the last five years. The SSC noted that the design parameters have developed over time, and that efforts to standardize gear configuration and add small-mesh pots to better index incoming recruitment remain ongoing. As in the past, the SSC strongly supports this cooperative approach, and looks forward to the inclusion of these data in the assessment. The SSC looks forward to a presentation on the design stratification and potential for refinements in light of the data that have been collected to date.

Bering Sea Fisheries Research Foundation report

The SSC received public comment from Scott Goodman (Bering Sea Fisheries Research Foundation), and written comment from Jamie Goen (Alaska Bering Sea Crabbers). These comments highlighted ongoing research topics including saildrone-based acoustic tag monitoring for description of RKC movement patterns, bycatch reduction technology, the effects of climate change, as well as growth and maturity studies. The **SSC strongly supports these industry-funded efforts to address important research gaps** for crab stocks and encourages such collaborations with crab research programs. As with the BSFRF comparative trawl survey, the SSC is very appreciative of these industry efforts and looks forward to the inclusion of the data from these research projects into future crab assessments.

Ecosystem and Socioeconomic Profile (ESP)

The SSC is very pleased to see the Ecosystem and Socioeconomic Profile for SMBKC. The conceptual model was appreciated especially by those that are less familiar with crab life history characteristics. The introduction of some new ecosystem indicators was a good start. It was noted that the stock showed a high vulnerability to ocean acidification (OA), so if there is a way to index OA in the ESP that might be a good addition. Because SMBKC is currently undergoing the development of a rebuilding plan, there are questions about the recruitment regime. The ESP can provide immediate impact by aiding this decision. For example, the pre-recruit index shows good support for the regime shift in 1996.

The SMBKC ESP provides a tool to track, for the first time, the socioeconomic context of a fishery that has not successfully provided for the continuous, sustained participation of fishing communities over time. The SSC recommends that the ESP be augmented to track indices of community engagement and dependency, by community or aggregations of communities, across the relevant vessel and processing sectors and, for the years following rationalization, quota share ownership by community by share type. Where data confidentiality constraints dictate, the analysts should consider the use of regional as well as local quotient indicators.

It is understood that continuous time series data are not available for a fishery that been open only episodically, but there is substantial value in understanding changes in community engagement and dependency patterns seen in pre- and post-closure years that may be attributed in whole or in part to the periods of extended closure (as well as to identified management regime changes that over the same period, including creation of a CDQ program and implementation of crab rationalization). The SMBKC fishery is not unique in having periods of relative abundance and closures, but the ESP provides a rare and valuable opportunity to better understand the socioeconomic dimensions of this set of circumstances. Within the Bering Sea ecosystem context, the ESP could explore spatial, temporal, and intensity dimensions of the human component of the fishery through changes in patterns of community involvement, seasonal shifts within annual rounds, and changes in harvest and processing diversity as fishing portfolios, fleet sizes, and utilization rates have changed.

Rebuilding analysis

A brief update on the progress on the overfished rebuilding plan for SMBKC was provided as an appendix. The SSC was uncertain as to whether they were being asked to choose either a recruitment regime for reference points and future projections, or maximum rebuilding time frame (t_max). It was clarified that the SSC was not making a final decision about either at this meeting. The CPT reversed their previous recommendation on which time series to use for the reference point and now recommend the full time series (1978 – 2018) for the reference point (the point to rebuild to B_{MSY} proxy) and the recent recruitment time series (1996 – 2018) for projections of future recruitment.

The SSC noted that crab stock analysts have chosen a number of different recruitment regimes based on breakpoint analyses or other rationale in the past. In general, stock assessments in Alaska would match a recruitment period with the timeframe for the reference point, and the recruitment time series then used for projections that would achieve that reference point at equilibrium. If the recruitment time series is from a period of higher or lower recruitment than the reference point, then projections will either exceed the reference point in an unrealistically short period of time or may never reach the rebuilt status. This stock might be a place to deviate again because, although using the longer time period for both the reference point and recruitment projections reduces the potential for an unachievable recovery target based on a possibly temporary period of low stock productivity, this low productivity may continue for some time and, assuming that recruitments from the productive regime were likely in the near future, might give an overly optimistic estimate of time to recovery.

The SSC did not have a consensus recommendation about the best strategy for modeling recruitment, except noting that the CPT recommendation might result in an unrealistically long rebuilding period. An alternative method might be to use some combination of the two. For instance, the full time series of recruitment could be used for the reference point, projections could be started with the most recent recruitments and then after some period of time, allow for a random walk toward the full recruitment time series. **The SSC recommends further exploration of different strategies for rebuilding projections.**

Based on a comment from the public, the SSC agreed there was some potential for considering multi-stock dynamics such as migration or genetic exchange between stocks in these rebuilding plans, such as king crab stocks from the Pribilof Islands and St. Matthew Island.

BSAI Crab SAFE and Harvest Specifications

The SSC reviewed the SAFE chapters and information provided by the CPT with respect to the stock status information from 2018/2019 and relative to total catch during the 2018-2019 season (Table 1). In addition, Table 2 contains the SSC recommendations for 2019/2020 catch specifications, with maximum permissible ABCs for 2019/2020 shown in Table 3. **The SSC endorsed all OFL and ABC recommendations of the CPT.** St. Matthew Island blue king crab and Pribilof Islands blue king crab are overfished; none of the other crab stocks were overfished or approaching overfished status. None of the crab stocks were subject to overfishing.

Table 1. Stock status of BSAI crab stocks in relation to status determination criteria for 2018/19 as estimated in May and September 2019. Values are in thousand metric tons (kt). Note, diagonal fill indicates parameters not applicable for that tier level.

Chapter	Stock	Tier	MSST[1]	B_{MSY} or $B_{MSYproxy}$	2018/19[2] MMB	2018/19 MMB / MMB$_{MSY}$	2018/19 OFL	2018/19 Total catch	Rebuilding Status
1	EBS snow crab	3	63.00	142.80	123.10	0.86	29.70	15.40	
2	BB red king crab	3	10.62	25.50	16.92	0.66	5.34	2.65	
3	EBS Tanner crab	3	20.54	21.87	23.53	1.08	20.87	1.9	
4	Pribilof Islands red king crab	4	0.87	1.73	4.192	2.42	0.404	0.00722	
5	Pribilof Islands blue king crab	4	2.05	4.11	0.23	**0.06**	0.00116	0.00043	**overfished**
6	St. Matthew Island blue king crab	4	1.74	3.48	1.15	**0.33**	0.04	0.001	**overfished**
7	Norton Sound red king crab	4	1.09	2.18	1.85	0.85	0.20	0.16	
8	AI golden king crab	3	5.88	11.76	17.848	1.52	5.514	3.36	
9	Pribilof Islands golden king crab	5					0.09	Conf.	
10	Western AI red king crab	5					0.06	< 0.001	

[1] As estimated in the 2019 Assessment
[2] For stocks 1-6 MMB on 2/15/2018 is estimated using the current assessment in September 2019. For Norton Sound red king crab MMB on 2/1/2018 is estimated using the current assessment in January 2018.

Table 2. SSC recommendations for October 2019. Note that recommendations for stocks 7, 8 represent those final values from the SSC in February and June 2019 while 4, 5, 9 and 10 represent the October 2019 assessment. Hatched areas indicate parameters not applicable for that tier. SSC concurred with all Crab Plan Team recommendations. Values are in thousand metric tons (kt).

Chapter	Stock	Tier	Status (a,b,c)	F_{OFL}	B_{MSY} or $B_{MSYproxy}$	Years[1] (biomass or catch)	2019/20[2] MMB	2019/20 MMB / MMB_{MSY}	γ	Mortality (M)	2019/20[3] OFL	2019/20 ABC	ABC Buffer
1	EBS snow crab	3	a	1.93	126.10	1982-2018 [recruitment]	167.3	1.33		0.41 (females) 0.31 (imm) 0.30 (mat males)	54.90	43.90	20%
2	BB red king crab	3	b	0.22	21.35	1984-2018 [recruitment]	15.96	0.75		0.18	3.40	2.72	20%
3	EBS Tanner crab	3	b	1.08	41.07	1982-current [recruitment]	39.55	0.96		0.30 (females) 0.23 (imm) 0.30 (mat males)	28.86	23.09	20%
4	Pribilof Islands red king crab	4	a	0.21	1.73	2001-present [MMB]	5.37	3.10	1	0.21	0.86	0.65	25%
5	Pribilof Islands blue king crab	4	c		4.11	1980/81-1984/85 & 1990/91-1997/98	0.175	0.04	1	0.18	0.00116	0.00087	25%
6	St. Matthew Island blue king crab	4	c	0.04	3.48	1978-2018 [MMB]	1.08	0.31	1	0.18	0.44	0.35	20%
7	Norton Sound red king crab	4	b	0.12	2.06	1980-2018 [MMB]	1.41	0.68	1	0.18	0.11	0.09	20%
8	AI golden king crab	3	a	EAG (0.66) WAG (0.60)	11.76	1987/88-2012/13	15.94	1.36		0.21	5.25	3.94	25%
9	Pribilof Islands golden king crab	5				See intro chapter					0.09	0.07	25%
10	Western AI red king crab	5				1995/96-2007/08					0.06	0.01	75%

[1] For Tiers 3 and 4 where B_{MSY} or $B_{MSYproxy}$ is estimable, the years refer to the time period over which the estimate is made. For Tier 5 stocks it is the years upon which the catch average for OFL is obtained.
[2] MMB as projected for 2/1/2019 for Norton Sound red king crab, 2/15/2019 for AIGKC, and 2/15/2020 for other stocks.
[3] AIGKC OFL and ABC calculated by author outside the chapter for using the Approach 2 combination of EAG and WAG and 25% buffer between OFL and ABC.

Table 3. Maximum permissible ABCs for 2019/20 and SSC recommended ABCs for stocks where the SSC recommendation is below the maximum permissible ABC, as defined by Amendment 38 to the Crab FMP. SSC concurred with all Crab Plan Team recommendations. Values are in thousand metric tons (kt).

Stock	Tier	2019/20 *Max* ABC[2]	2019/20 ABC
EBS Snow Crab	3	54.777	43.90
Bristol Bay RKC	3	3.37	2.72
Tanner Crab	3	28.79	23.09
Pribilof Islands RKC	4	0.853	0.65
Pribilof Islands BKC	4	0.00104	0.00087
Saint Matthew BKC	4	0.0438	0.035
Norton Sound RKC	4	0.11	0.09
Aleutian Islands GKC	3	5.224	3.94
Pribilof Islands GKC[1]	5	0.081	0.07
Western Aleutian Islands RKC	5	0.054	0.01

[1] For Pribilof Islands golden king crab, this is for the 2019 calendar year instead of the 2018–2019 crab fishing year.
[2] For Tier 5 stocks this is 0.90 while all other stocks P*.

EBS Snow Crab

The Bering Sea snow crab assessment was presented by Cody Szuwalski (NOAA-AFSC). Alaska Bering Sea Crabbers submitted a letter commenting on snow crab prohibited species catch. The EBS snow crab stock has undergone volatile fluctuations. Observed mature male biomass (MMB) at the time of the survey increased from lows in the early 1980s to historical highs in the early and mid-1990s and then plummeted. The stock was declared overfished in 1999. Subsequently, MMB slowly increased and the stock was declared rebuilt in 2011. Thereafter, the stock declined to an all-time low in 2017 but since then MMB has been increasing as a large strong year class has matured.

The snow crab stock assessment model tracks numbers of crab by size, sex, shell condition, and maturity by year. Model structure is virtually the same as in 2018. This year's model incorporates updated data on trawl survey biomass and length composition, retained and discarded catch for the directed fishery, length composition for retained and discarded catch, groundfish discards and discard length frequency, and four new growth observations. Jittering was used to identify stable model configurations and retrospective analyses were performed for some model configurations. Models were evaluated based on their fit to the data, credibility of the estimated population processes, model stability, size of the retrospective patterns, and the degree to which model assumptions influence assessment outcomes.

Eight alternative models were evaluated in this year's assessment:

- 18.1 – Last year's accepted model fit to last year's data

- 19.1 – Last year's accepted model fit to this year's data

- 19.2 – 19.1 + Hamel's prior on M (0.27/yr)

- 19.3 – 19.1 + Then's prior on M (0.315/yr)

- 19.4 – 19.1 + linear growth for females

- 19.5 – 19.1 + linear growth for males

- 19.6 – 19.1 + sex-specific recruitment distributions

- 19.7 – 19.2 + linear growth for males

These alternative models are intended to address previous comments by the CPT and SSC. Specifically, alternatives focus on uncertainties involving growth, natural mortality, and potential different size distributions for male and female recruitment. Last year's accepted model used kinked growth curves for both males and females, a median prior for M of 0.23, and specified equal size distributions of female and male recruitment. This year, model alternatives impose linear models for growth on females or males but not both. A scenario based on imposing linear fits to growth data for both sexes at the same time failed to converge and was not considered further. The base model assumes a natural mortality of 0.23 using Hoenig's method and the assumption that snow crab can live at least 20 years in a virgin population. Recent empirical analyses by Then et al. (2015) and Hamel (2015) produce natural mortalities larger than 0.23 when using the same assumed maximum ages. Using state-space models, Murphy et al. (2018) estimated a mean M of 0.49 for females and 0.36 for males. Moreover, inspection of survey data also suggests that natural mortality for mature crab is higher than currently assumed. So, information from multiple new sources indicate that M is larger than the value of 0.23 used in recent assessments. Models 19.2, 19.3 and 19.7 explore the effects of alternative Ms on the assessment.

Observed mature male biomass was fit similarly by all models for most years, except that model 19.4 fit the survey biomass data somewhat better than other models. Model 19.3, which used the highest M prior, provided the best fits to female growth data, perhaps because larger females were killed more quickly. However, the stock assessment author noted that much of the improved 'fit' is to data that are outside of the size range modeled by the assessment. All models fit the following data reasonably well: retained catch, female and male discards, trawl data, and size composition of retained catch and survey catches. Fits to size composition data for the BSFRF survey selectivity experiments resulted in some large residuals. In 2009 numbers of males were generally underestimated by the industry survey and overestimated by the NMFS survey, while an opposite pattern existed for females.

Considerations of overall fit, retrospective patterns and stability of the model under jittering did not lead to a clear model choice. For instance, model 19.3 fit the data best, model 19.7 had the smallest retrospective patterns for males, and model 19.5 was the most stable under jittering. Both the assessment author and CPT preferred model 19.7 to determine stock status and catch specifications for 2019/20. This model provides for a slightly higher value of M than the base model (19.1), describes male growth as linear, exhibits the smallest retrospective pattern for males, and estimates fully-selected NMFS survey catchability near that implied from the BSFRF survey. Higher values of M are supported by assessment results as well as new independent information. While the issue of a linear or kinked growth curve remains an open question, models in this year's assessment with kinked growth curves were unstable. Regarding other models, model 19.2 exhibited the worst retrospective patterns, model 19.3 was unstable and also yielded unreasonably high

values of $F_{35\%}$ and F_{OFL}, and models 19.1, 19.4, 19.5, and 19.6 estimated lower values of M, which are no longer supported.

The SSC compliments the assessment author for this year's assessment, which makes very good progress on requests by the CPT and SSC. **The SSC concurs with the author's and CPT's recommendations to use model 19.7 to determine stock status and to set OFL and ABC for 2019/2020, under Tier 3 based on average recruitment over 1982-2018. Further, the SSC agrees with the CPT to continue using a buffer of 20% for setting the 2019/20 ABC** as used in recent assessments owing to ongoing concerns about model misspecification concerning growth, parameter confounding, ongoing retrospective patterns, and the uncertainty in M.

Projected MMB for 2019/20 is above the MSST, so the stock is not overfished. However, the apparent slight decline in MMB since 2018 should be reconciled with the observations from the 2019 trawl survey. When the eastern (EBS) and northern Bering Sea (NBS) areas are considered together, the largest aggregations of mature males occur north of the EBS-NBS boundary. While mature females extend into the NBS, as well, the largest female aggregations occur south of the EBS-NBS divide. These observations raise questions about connectivity, unit stock, and utility and placement of the EBS-NBS boundary. A caveat is that different criteria are used to determine male maturity. In the NBS males are classified as mature based on chela height data, whereas in the EBS classification is based on crab size.

- The SSC agrees with the author's and CPT's set of research priorities for snow crab and offers the following additional comment.

- The SSC agrees that moving the stock assessment into the GMACS modeling framework should be the highest priority.

- The SSC supports efforts to include additional relevant datasets into the assessment to the extent possible.

- Ideally, the assessment should be conducted on the unit stock over its geographic range. In this regard, next year's assessment should consider EBS-NBS boundary issues on the snow crab assessment. It may be prudent to fit the NBS data with VAST to facilitate inclusion in the assessment. Differences in maturity schedules between the two areas should be explored. Over the long term, tagging studies may be needed to determine crab in the NBS that may join those in the EBS in subsequent seasons or years, as well as the merits of the EBS-NBS boundary line.

- The SSC notes that the empirical results for BSFRF/NMFS side-by-side data (Fig. 21) were similar to those for Tanner crab, suggesting survey catchability much lower than 1.0. The SSC suggests using these data to develop priors for NMFS survey selectivity and catchability for use in the next assessment (see general CPT comments).

- Resolution of ongoing questions surrounding growth curves appear to be dependent upon collection of new growth data for larger crab.

- Additional work on M is warranted. Specifically, recent empirical studies on M all use the previous assumptions about maximum age of 20 yr. The SSC recommends looking into the veracity of this assumption, based on reinterpretation of existing radiometric data, as well as potentially conducting new radiometric studies. While investigating M, confounding with other parameters (e.g., q) should be explored.

- Finally, the SSC supports the author's ongoing work on potential relationships between snow crab recruitment and the Pacific Decadal Oscillation and Arctic Oscillation. Further progress may provide valuable insights into the estimation of biological reference points for this stock.

Bristol Bay Red King Crab

The CPT chairs presented the Bristol Bay Red King Crab (BBRKC) assessment.

Prior to the presentation of BBRKC, there was some information presented on fishery performance. Most of the catch was in the southeast Bering Sea and CPUE remains stable even though harvest is decreasing. The quota was taken in about three weeks. There has been a continued increase in average weight since 2016/2017.

The fixed gear bycatch of BBRKC has increased in the last three years. These increases were reported in numbers of crab, so if pot bycatch is increasing as opposed to trawl, the actual mortality may not be going up nearly as fast.

The trawl survey biomass estimates were quite low in 2019, but similar to 2018.

Three assessment model options were considered:

1) Model 18.0d, the accepted model from 2018 updated with 2019 data, and the groundfish fisheries bycatch data is separated into trawl and fixed gear for the full time period

2) Model 18.0e, changes the length compositions of bycatch in the Tanner crab fishery sum to 1.0 for both sexes combined

3) Model 19.0, this model is the closest approximation to 18.0e implemented in GMACS.

The authors did an outstanding job investigating the differences between the new framework and the former model. To do this, some of the likelihoods were adjusted (e.g., adding or removing constants) to be comparable. They also tested a number of sensitivities to the prior and penalty assumptions that are standard in GMACS but were not contained in the earlier model and showed that these had little effect on results.

Trawl survey selectivity is also different between model 18.0e and GMACS, where model 18.0e used three parameters (males and females shared one) and model 19.0 estimated all four parameters for male and female logistic curves. **The SSC recommends evaluating the use of one selectivity curve for both sexes, since the selectivity is length based and the gear is the same. If the authors believe that one sex is less available to the survey, please provide evidence. If evidence exists, consider using two catchabilities (as recommended by the CPT) with one selectivity curve.**

The fit to the length compositions for discards for model 19.0 in Figure 24 is poor, particularly for the early years and the plus group. It is puzzling how little the likelihoods for length compositions between the models differ despite this lack of fit in 19.0. **The SSC requests that these large differences in length predictions between the models be investigated, given what appear to be similar selectivities.**

The SSC appreciates the authors' responses to our comments and requests. The authors recommended either the 18.0e or the new 19.0 GMACS model and the CPT recommended model 19.0. **The SSC concurs with the CPT and supports the use of the GMACS model (19.0) for recommending ABC and OFL.** This represents a 30%+ reduction in the ABC from last year, similar to the other two model alternatives because

the stock is still declining. We support the CPT recommendation of continuing to use the 20% buffer as there still are a few outstanding issues such as the poor fit to the length comps and the two consecutive low survey biomass estimates which the models do not capture.

The SSC is pleased to see the GMACS framework moving forward and its continued development. It was pointed out that the way the reference points were calculated was slightly different than standard practice by using the estimate of the terminal year sex ratio to estimate MMB in GMACS. This was discovered late in the meeting and it was not adjusted for. **The SSC recommends that details on the reference point calculations should be investigated and reported on for the next assessment.** The SSC also requests that the addition of new data be consistently evaluated by comparing the results from the preceding year to the same model with the addition of new data. Note, these models will retain the same model number (e.g., Model 19.0 with 2019 data and Model 19.0 with 2020 data).

Tanner Crab

The SSC received an overview of the Tanner crab stock assessment from William Stockhausen (NOAA-AFSC) and CPT comments on the assessment from Martin Dorn (NOAA-AFSC) and Katie Palof (ADF&G).

This assessment reported the results from seven models, built sequentially starting with the 2018 assessment model (M19F00), to provide for evaluation of the incremental effect of each proposed change. Models M19F00a through model M19F03 added new 2019 data and explored alternative maturity information; the final two models used the BSFRF/NMFS side-by-side data (M19F04 and M19F05). Although all models were evaluated, only M19F03 was seriously considered for use as the basis for the assessment.

The SSC supports the author's and CPT's recommendation to use model M19F03 as the basis for this year's assessment and the OFL/ABC (using a 20% buffer) for the 2019/2020 fishery; the results place this stock in Tier 3b. The SSC highlights that the change in *scale* of the assessment biomass (up from previous assessments) was a function of changes to the historical mortality estimates (both in the directed Tanner crab fishery and as discard mortality in the snow crab fishery), male maturity and molt data, and simultaneous updating of estimated selectivity and catchability parameters. In particular, the catchability estimated for the NMFS trawl survey was lower than in previous assessments. In contrast, there was little difference in *trend* in biomass estimates (strongly down) from previous assessments or among alternative models. These trends are consistent with large decreases in survey biomass over the last several years, which are fit reasonably well by all model alternatives.

The sensitivity of the estimated scale of the Tanner crab assessment, highlighted by the changes for 2019, remains a subject of concern for the SSC. This assessment has shown poor convergence behavior in past and present models. Specifically, the SSC was concerned that many model parameters, including scaling parameters, such as the early time-series survey catchability, were constrained by arbitrary bounds at the maximum likelihood estimates. These concerns provide a basis for the application of a 20% buffer from the OFL to ABC. **The SSC requested that for the next assessment, models be reparameterized, simplified, or have parameter bounds adjusted such that no parameters remain at the bounds after estimation.** Ideally, models should utilize a set of initial parameter values and phasing of those parameters such that jittering is not required to find the maximum likelihood estimate but is used only as a test of convergence.

Models M19F04 and M19F05 added considerable complexity to model the BSFRF/NMFS side-by-side data directly. However, both models were ultimately deemed to be too unstable for further use. The SSC

recommended a much simpler approach of creating priors on selectivity and catchability based on analysis of the BSFRF/NMFS side-by-side data outside the model (see general CPT comments). The SSC highlighted the value of this comparative gear experiment and looks forward to a more robust approach to include the information in the appropriate crab models.

The SSC supported both the CPT's recommendations for Tanner crab and the author's stated plans for future work; in particular, exploring whether there is a biological basis for separating the fishery data into East/West strata at 166 °W, or combining these for the purposes of the assessment.

- **The SSC had a number of additional recommendations for the assessment author:**

- Use the standard model numbering approach.

- In next year's assessment, project biomass using a mortality level consistent with recent years, rather than the full OFL (see general CPT comments).

- Provide a retrospective analysis for future assessments.

- Add the 2018 BSFRF/NMFS side-by-side data for all future analyses of that time-series.

- Report the values for natural mortality actually used for calculation of reference points in the appropriate table(s).

- Provide additional information on data weighting. Specifically, identify standardized residuals appreciably greater than would be expected by chance (e.g., values of 4 and larger), report mean input and harmonic mean effective sample sizes by source for evaluation of model fit, and consider basing input sample sizes on the number of trips/hauls sampled rather than number of individual crab measured.

Pribilof Islands Red King Crab

The Pribilof Islands red king crab assessment was presented by Cody Szuwalski (NOAA-AFSC). There was no public comment. The Pribilof Islands red king crab stock was last assessed in 2017 and is now on a biennial assessment cycle. The data-limited assessment suffers from small sample sizes. About 100 crabs have been sampled annually from just 4 of 14 stations since the mid-2000s. Red king crab were not detected in early surveys, but the stock grew and peaked in 2015 and has since declined. A fishery targeted red king crab between 1993/1994 and 1998/1999. No fishery has occurred since 1999 and bycatch is a small fraction of OFL. Recruitment to this stock is episodic.

Seven alternative models were considered in this assessment:

- 19.01: Inverse variance weighted, 3-year running average of mature male biomass (MMB)

- 19.02: Random effects model fit to survey MMB

- 19.1: GMACS (length-based model) fit to biomass with assumptions borrowed from BBRKC

- 19.2: 19.1 + sensitivity run with more of the population selected in the trawl bycatch

- 19.3: 19.1 + sensitivity run with molting probability shifted to the left

- 19.4: 19.1 + increased M (Hamel 2015)

- 19.5: 19.1 + increased M (Then et al. 2015)

Models 19.01 and 19.02 were presented in 2017. The other five models represent variants of integrated assessments using GMACS. GMACS was fit to MMB (male biomass >120 mm CW), survey size composition, fishery retained catch, and bycatch.

The SSC agrees with the assessment author that the use of GMACS is preferable to the running average and random effects models, because it incorporates length composition data from the survey, which provide information on the population dynamics. Although survey biomass data are very noisy with large confidence intervals in many years, the length composition data clearly show cohorts moving through the stock, which provide valuable information on stock trends.

Model 19.1 does not fit a newly established cohort, whereas models 19.2, 19.3, and 19.4 do. Trends in estimated mature male biomass at the time of mating were similar across models, except for model 19.5, which diverged in a number of years in the 2000s. Model 19.4 has the best fit based on log-likelihood. The author preferred model 19.4 because GMACS made more complete use of all available data, it uses a more defensible prior for M, and provided a plausible fit to survey MMB. The CPT agreed with the author's recommendation of using model 19.4 and noted that this model struck a good balance between parsimony and complexity, and they further noted that the use of the Hamel prior for natural mortality corresponds with current practice. **The SSC agrees with the author and CPT to select Model 19.4 as the preferred model for setting catch specifications**.

Tier 4 control rules use natural mortality as a proxy for F_{MSY} and calculate a proxy for B_{MSY} by averaging the biomass over a period of time when the stock is thought to have been at B_{MSY}. The B_{MSY} proxy is estimated as 35% of that unfished biomass. The assessment author calculated two different estimates of B_{MSY}. The status quo (average mature male biomass over 1991-present) and an alternative in which the average MMB from 2000-present is used as an 'unfished' biomass. The year 2000 was selected as the beginning of the 'unfished' period because fishing ceased in the 1998/1999 season. The CPT agreed that the author's approach was the most acceptable alternative. Among the alternatives presented, the SSC agrees with this choice. However, for the next assessment, the SSC requests the author to consider the appropriateness of incorporating a time lag that would serve to diminish the effects of previous fishing on the stock status. While the crab stock in 2000 would have partly been a function of fishing in the immediately preceding years, the SSC appreciates that selecting a range of years over which the population is unfished is difficult, particularly for a population like this that is driven by episodic recruitment.

The CPT continues to support 25% buffer on OFL for ABC estimation to be consistent with other Tier 4 stocks and the SSC agrees.

- The SSC thanks the assessment author for moving this assessment to GMACS and compliments him for a thorough analysis. The SSC offers the following comments:

- The assessment should consider all relevant datasets. Available ADF&G pot survey data should be included.

- The SSC also raises the question whether Pribilof Islands red king crab are a separate stock. Reasons to raise this question include: (1) apparent lack of red king crab in the area in the 1970s and 1980s, (2) increases in stock abundance that do not seem biologically plausible, and (3) distribution of red king crab outside both the Bristol Bay and Pribilof Islands areas. Comparisons of size distributions may shed light on the sudden appearance of cohorts in the survey area. The possibility that red king crab exist as a metapopulation in the EBS should be considered.

St. Matthew Island Blue King Crab

Katie Palof presented the St. Matthew blue king crab assessment, a draft Ecosystem and Socioeconomic Profile (ESP) and a rebuilding plan update to the SSC. Gerry Merrigan and Chad See provided public testimony. The assessment is conducted in the GMACS framework and the model is similar to the one adopted in 2016. The assessment uses the same model configuration as last year, in which the male population is divided into three length categories, and five discrete seasons. The stock assessment examines three model configurations:

1) Model 19.0 – last year's accepted model updated with new data;

2) Model 19.1, which puts more weight on the NMFS trawl and the ADF&G pot surveys;

3) Model 19.2, which estimates an additional CV for the ADF&G pot survey.

There is also a model that calculates a reference point (19.0a) that is for illustrative purposes for the rebuilding analysis. Because of the way that the exploratory models weighted the contradictory time trends in the NMFS trawl survey and the ADF&G pot survey data, the various models gave an extremely large range of outcomes in terms of OFL, but still did not fit the most recent survey points very well. Based on the above considerations and in agreement with the CPT, **the SSC agrees with the authors' recommendation to use the reference model 19.0 for the 2019/20 crab year. The SSC also agreed with the authors' recommendation of a 20% buffer on the OFL for the ABC.** The SSC finds little utility in the CPT recommendation for estimating additional CV for the two surveys, given that this will only provide a poorer fit to the survey data, which we currently view as an issue. The SSC agrees with the remainder of the CPT recommendations and offers these additional requests:

1) **Please provide a retrospective analysis in the next assessment.**

2) **In Table 12, a number of selectivity estimates are at 0. Please investigate whether these are not estimated or not able to be estimated.**

3) **The catchability on the pot survey has a huge range in the alternate model runs. Consider some kind of prior or penalty on the catchability parameter for the survey catchabilities, including estimating the trawl survey catchability instead of the pot survey, or both.**

4) **Please use the correct model number (e.g., if 19.0 is the same model as was first adopted in 16.0 then it is still 16.0.)**

5) **Explore potential explanations for the discrepancy in the time trends of the two types of survey data, including movement hypotheses using spatial models (not necessarily VAST)**

6) **In Table 6 (p. 15), please clarify whether this table shows bycatch or bycatch mortality (with DMRs applied). Also, it would be helpful if the table heading reported the DMR values that are used.**

C-5 BSAI Groundfish

The SSC received a series of presentations from Grant Thompson (NOAA-AFSC), and Jim Ianelli (NOAA-AFSC) that included items from the September 2019 Joint Groundfish and Crab Plan Teams, Joint Groundfish Plan Teams, BSAI Groundfish Plan Team (BSAI GPT), and GOA Groundfish Plan Team (GOA GPT) meetings.

BSAI Groundfish Specifications

The SSC recommends approval of the preliminary 2020/2021 BSAI groundfish specifications as provided by the BSAI GPT with a change to the sablefish specification. The SSC recommends the sablefish OFL be apportioned into three areas for the preliminary 2020/21 specifications: AI, BS, and GOA (as specified for 2019). The SSC plans to discuss further OFL apportionment for final specifications at the December meeting. Items where the SSC had comments or recommendations in addition to, or different from the Plan Teams are listed below.

Sablefish

The SSC received a presentation on the PT report and update on the sablefish assessment from Dr. Grant Thompson (NOAA-AFSC). Gerry Merrigan and Chad See (Freezer Longline Coalition), and Jon Warrenchuk (Oceana) provided public testimony.

Survey indices from 2019 longline survey show continued high levels of sablefish abundance, with an RPN index increase of 48% from 2018, which is the largest in the time series since 1990. Much of this increase is attributed to the BS and AI, while the GOA is increasing and is above the long-term mean. The 2018 longline survey and fishery age compositions were dominated by fish under age 5 (50-60%). Small fish were also abundant in the GOA trawl survey, which also had an increase in biomass. The abundance of fish has resulted in higher levels of bycatch than has historically occurred in the Bering Sea.

Sablefish are currently managed with three area specific OFLs that are apportioned from an Alaska-wide OFL: Bering Sea, Aleutian Islands, and GOA. The Alaska-wide OFL is currently the measurable and objective criteria used to monitor and assess the status of the sablefish stock to prevent overfishing and to determine whether overfishing has occurred or the stock is overfished. Sablefish are characterized by having high movement rates, and the 2018 sablefish SAFE highlights that significant stock structure among the federal Alaska population is unlikely. The ABC is apportioned among six subareas.

At the PT, the assessment author presented an illustration of combining the BS and AI OFLs and the PT asked whether it should be combined at the entire Alaska-wide OFL level. The PT recommended that the authors bring forward two alternatives to OFLs in November: (1) combine the BS and AI OFLs and (2) combine OFL Alaska-wide. The PT noted this way of apportioning OFL was a hold-over from the 1990s when sablefish were assessed separately in the BSAI and GOA and was possibly never changed even though the assessment went to Alaska-wide. However, the exact history of this was not certain during the PT meeting. The PT also noted that the sablefish assessment is the only Alaska-wide assessment, and only some assessments in the BSAI set OFL at FMP subarea levels. The PT was clear that there didn't appear to be a conservation concern that warranted sub-area OFLs, particularly since the ABC apportionment is designed to spread harvest across areas and prevent any localized depletion.

The SSC had extensive discussion about the appropriate process for considering a combined OFL. There was concern that the option had only been raised as a possibility, not a proposal and there was no documentation to evaluate. Specific concerns raised were the uncertainty surrounding the history of the sub-area OFL and transition to an Alaska-wide stock assessment, the lack of a specific evaluation presented concerning conservation issues associated with the changing the OFL structure, and ambiguity with how bycatch limits are managed. However, the SSC also discussed that, based on the PT comments and information in the SAFE, that combining the OFL is a viable option to consider during the December meeting.

The SSC recommends that the authors bring forward three OFL options for the November PT and December SSC meeting: 1) Status quo; 2) combine the BS and AI; 3) an Alaska-wide specification. The SSC requests that the authors describe the history of the area-OFLs and assessment, a description of the conservation concerns as they relate to the need for sub-area OFLs versus those addressed with ABC apportionment, and whether some concerns could be addressed through management or policy measures outside of the specification process (this may need to be a separate request to NMFS management). The ongoing work on spatial management and stock structure could be informative as to whether the current spatial scales of the OFLs are appropriate.

The SSC notes that the proposed harvest specifications provide notice to the public about potential changes that are being considered for the final specifications. As described above, the SSC will consider a possible change to the current OFL structure (a BSAI or Alaska-wide OFL) during the December meeting.

Risk Table

At its December 2018 meeting, the SSC requested that all authors fill out the Risk Table for the 2019 assessment cycle, and that the PTs provide comment on the authors' results in any cases where a reduction from maxABC may be warranted. The SSC emphasized that the Risk Table should be used to determine whether an ABC reduction is warranted, rather than to justify a decision already made by the author. The SSC also indicated that the intent of the risk assessment is to have a qualitative evaluation done by the authors. The SSC notes the Risk Table was also reviewed by the Council at the December 2018 meeting.

The SSC appreciates the work done by Dr. Thompson to provide a framework to help authors complete the Risk Table assessment. His suggestion is informative as to how elements in the Risk Table could be restated and measured. However, the SSC is concerned that new guidance prior to the November PT may create confusion rather than enlightenment. The SSC prefers that the authors gain experience using the existing Risk Table, and issues associated with the use of the Risk Table be identified by the authors and the PT. Through this process, the table can be iteratively improved as necessary, once a baseline of risk tables can be evaluated. **The SSC recommends the authors complete the risk table and note important concerns or issues associated with completing the table**.

Halibut Discard Mortality Rates

The SSC received a report from Jim Armstrong (NPFMC) on proposed halibut DMRs for 2020/2021. No changes in methodology were proposed. **The SSC concurs with the PT recommendations to maintain current methods and to use the two-year reference period (2017-2018) for producing the 2020 and 2021 DMRs**

VAST Modeling

The SSC received a report from Dr. Grant Thompson (NOAA-AFSC) on the PT discussion on VAST modeling efforts. The SSC supported the PT recommendations, and notes that development of the VAST model in the Aleutian Islands is a priority for several stocks and should be considered in prioritizing development. **The SSC also recommends continuing to evaluate using the VAST model as an apportionment alternative.** The SSC also appreciates the PT and Dr. Jim Thorson's effort to develop criteria and considerations for implementing VAST, as this will be important for authors to consider as they decide whether or not to incorporate this index into their assessment. The SSC also is pleased that the survey group is willing to consider a production mode for VAST estimates.

Research Priorities

Dr. Thompson (NOAA-AFSC) reported that the JGPT plans to provide the top seven priorities in the Urgent and Immediate categories to the SSC for their February meeting and plans to initiate a process for taking categories off the full Research Priority list. Because one requirement for inclusion in the "urgent" category is an expectation that "a one- or two-year project would meet the information need," the Teams recommend that any project that has been ongoing for more than two years be removed from the "urgent" category. The JGPT also plans to raise a number of concerns about the Research Priorities process in their report to the SSC in February.

Ensemble Modeling

Dr. Thompson (NOAA-AFSC) summarized the cross-conditional decision analysis (CCDA) and PT discussion about the potential new method he is developing to systematically weight models in an ensemble. He noted that the PT and the SSC have expressed different goals regarding model averaging: the PT has favored justifiability whereas the SSC has favored plausibility. The CCDA method is an attempt at balancing subjective versus objective goals through a decision theoretic approach.

The SSC thanks Dr. Thompson for his work on developing the CCDA and supports continued efforts to explore this method. An important feature of this work will be how this method interacts with existing FMP control rules, and specifically how the level of risk aversion chosen ("ra" term in the loss function) maps onto existing control rule policies.

Bering Sea Pacific Cod

The SSC received a presentation on the PT report and summary of the preliminary Bering Sea Pacific Cod assessment from Dr. Grant Thompson (NOAA-AFSC). Gerry Merrigan and Chad See (Freezer Longline Coalition) provided public testimony.

The SSC thanks Dr. Thompson for his extensive work in evaluating a range of new models within the framework of testing area-specific hypothesis about Pacific cod distribution in the Bering Sea. This additional work has provided a structure to help the PT and SSC in selecting models for evaluation in November and December.

The focus of the presented modeling efforts is part of ongoing work to incorporate apparent changes in the distribution of Pacific cod between the EBS/NBS. The preliminary assessment focused on both the treatment of data prior to adding it to the assessment and evaluating new model formulations. Model evaluation is framed by three hypotheses about Pacific cod distribution:

1) Pacific cod in the NBS are insignificant to the managed stock, so the assessment should include data from the EBS only

2) Pacific cod in the EBS and NBS comprise a single stock, and the EBS and NBS surveys can be modeled in combination

3) Pacific cod in the EBS and NBS comprise a single stock, but the EBS and NBS surveys should be modeled separately

Two models were evaluated for each of the three hypotheses (total of 6 models).

1) Models 19.1, 19.3, and 19.5 are labeled "simple" in the document: The structural changes relative to the base model incorporate available fishery age composition information, age-based double-normal selectivity rather than logistic survey for both survey and fishery, tuning of the

recruitment deviations, use of size-based maturity, and setting input sample size equal to the number of hauls sampled.

2) Models 19.2, 19.4, and 19.6: These are labeled "complex" in the document and incorporate the following structural features: reweighting of the compositional data, size-based double normal selectivity (asymptotic survey selectivity), creation of two aging bias periods (2008 breakpoint), yearly-varying survey selectivity and mean length at age 1.5, and time varying in fishery selectivity.

The models also included important changes to the input data. All models included changes to input sample size for compositional data, using either rescaled number of hauls (simple models), or raw number of hauls (complex hauls) In addition, design-based estimates for survey estimates were used for models 19.1,19.2, 19.5, and 19.6; whereas VAST estimates were used for the combined survey indices in models 19.3 and 19.4 (hypothesis 2).

The SSC appreciated the author's detailed bridging analysis between the base model (16.6i) and the new model sets. The author also noted other models were considered but not brought forward.

The SSC generally supports the PT recommendations to bring forward the six models and hypothesis testing framework for PT and SSC evaluation in November/December. However, the SSC requests that the PT strongly consider not carrying forward hypothesis 1 given many indicators are certainly pointing to strong interaction between the NBS and EBS. Genetic information shows the NBS and EBS to be a single stock. Additionally, the 2019 trawl survey showed evidence of younger fish in the NBS and EBS, and recent trawl surveys have consistently shown higher aggregations on the northern edge of the EBS. Tagging information will further help inform the relationship of the cod stock between the EBS and NBS.

The SSC had a discussion about approaches for comparing among the hypothesis. The simple models provide a method to test specific structural hypothesis (e.g., biological hypothesis). These can be useful to test structural modifications and how those modifications compare across hypothesis.

Dr. Thompson discussed last year's SSC comments which recommended that "future efforts focus on the treatment of NBS data and how to include them" and "explicit hypotheses that explain model changes." With that in mind, the SSC noted that the bridging analysis, despite the drawbacks of order of changes perhaps yielding differing magnitudes of results, showed that there were many changes to the "simple model" from last year's accepted model. **The SSC suggests that the "simple model" should only compare the three biological hypotheses with the accepted model (but with the VAST estimated indices) and allow the "complex models" to incorporate the additional structural and statistical changes of interest. Thus, at the authors' discretion, models that are similar to 16.6i from last year that use the VAST indices testing the three biological hypotheses could be substituted for models 19.1, 19.3, 19.5 and would be preferable to the SSC.** However, if time constraints permit fewer models, a model that only examines hypothesis 2 (combined EBS and NBS) that is the same as model 16.6i with the VAST estimates would be satisfactory as well.

The GPT suggested that Mohn's rho may not be a useful statistic given the different hypotheses and data. The SSC disagrees with this statement because one of the main reasons retrospective analysis is conducted is to identify model misspecification, of which ignoring population closure is an important one. Thus, the SSC is concerned about the high values of Mohn's rho in some of the proposed set of models.

The GPT suggested that cross validating the VAST results by selectively removing different strata from the data and considering the results would be a useful exercise to test the model's ability to fill in missing data.

The SSC agrees with this recommendation but suggests that this may not be in the purview of the assessment author, but better suited for the survey analysis team.

Dr. Thompson requested that the SSC affirm their general statements on how the EBS Pacific cod assessment should proceed in terms of modeling guidelines, including such things as avoiding "complexity creep" and the SSC reiterates their recommendations that spanned between 2013 and the present.

Finally, the SSC remains concerned about doing ensemble "on the fly" during the PT meeting. Time allowing, the SSC requests the authors bring forward an ensemble set for the PT to evaluate. However, should the PT do an ensemble analysis, the SSC recommends they use the standardized code that the PT discussed to work from.

AI Pacific Cod

The SSC received a presentation on the PT report and summary of the preliminary Aleutian Islands Pacific Cod assessment from Dr. Grant Thompson (NOAA-AFSC). No public testimony was provided.

The SSC recommended at its December 2018 meeting that an age-structured model for Aleutian Islands Pacific Cod be developed. The stock is currently being managed as a Tier 5 stock. The preliminary age-structured model builds on modeling efforts conducted in 2012. The data used in this preliminary model include fishery catch and size compositions, survey biomass and standard error, and age compositions from survey data. The model presented here is very similar to previously developed models, with the following differences:

- logistic fishery (and survey) selectivity,
- fishery (and survey) selectivity constant over time,
- estimated ageing bias,
- survey q freely estimated (with a prior) and fishery q fixed at 1.

The data contained in the model include fishing catch biomass, size composition, the AI bottom trawl survey biomass and age composition.

The SSC notes there has been a long history of development for the model, but this is the first presentation of the latest version. The SSC expresses its appreciation to the assessment authors for continued work on developing an age-structure model.

The SSC endorses the PT recommendations. In addition, the SSC noted the wide variety of otolith sampling strategies that have been employed over time. **The SSC requests that the authors elaborate on important changes in otolith sampling strategies and provide detail on how different otolith sampling strategies were combined into one length-at-age curve. Finally, retrospective analysis should have peels annually, not every two years, which is likely to result in a lower Mohn's rho value.**

Atka Mackerel

The SSC received a presentation on the PT report and summary of the preliminary Atka mackerel assessment from Dr. Grant Thompson (NOAA-AFSC). There was no public comment.

The preliminary assessment highlights the large decline in trawl survey biomass for the Central AI in 2019, resulting in a change in apportionment for the Central AI under the 2018 assessment method. The change

in apportionment would result in a 71% decrease for the Central AI area (34.78% in 2018, to 10% for 2019). The authors investigated potential causes for this decline by evaluating the survey and fishery data and no apparent reasons were discovered. During this same period the fishery CPUE trend was stable.

The authors investigated combining the fishery and trawl survey indices using random effect methods developed by Hulson et al. (in prep). Five alternative weightings on the fishery data, relative to the survey data, were explored: 1) a zero weight, 2) half the weight of the survey index, 3) equal weight to the survey index, 4) double the weight of the survey index, and 5) all the weight given to the fishery CPUE data. In all cases with positive weights, fishery data stabilized variability in temporal trends.

The PT recommended that the authors investigate the application of median smoothers, whether hyperstability in the Atka mackerel fishery would impact this method, the available trip length data, and the potential to develop an objective weighting for the new approach. **The SSC generally supports these recommendations; however, highlights that VAST should be a priority for future development as well.** The SSC notes that information on length compositions for comparison between the trawl survey and fishery might also be an informative comparison. Hyperstability of the fishery CPUE might be considered a feature, rather than a drawback of the fishery CPUE index as the hyperstability is likely similar across areas and will help achieve the objective of stabilizing the apportionment.

The trawl survey indices in the AI have high variability and likely do a poor job of tracking trends in Atka mackerel abundance. Combining the fishery CPUE and trawl survey indices using random effects is a new method that may also offer stability in apportionment until the VAST indices can be evaluated. **The SSC recommends that the combined indices be brought forward for consideration in December.** The choice of weightings between the indices is likely to be a subjective decision, but perhaps a method similar to that used for the thornyhead assessment would be useful in the selection of weighting.

Northern Rockfish

The SSC received a presentation on the PT report and summary of the assessment activities from Dr. Grant Thompson (NOAA-AFSC).

The assessment presented methods for calculating length at age for Northern Rockfish. The author investigated a method to weight otolith information by abundance (rather than sample size) given differences in size-at-age and population abundance. The author did not find large differences for length-at-age or length-weight relationships. Although differences were small, abundance at age likely better represents differences in the population than using sample size derived weights. **The SSC supports the PT recommendation to use abundance-weighted length at age but requests the author reports on the difference between how the survey group produces mean length at age compared to this method.**

C-6 Gulf of Alaska Groundfish

The SSC received a presentation from Dr. Grant Thompson (NOAA-AFSC) on the meeting of the Joint Groundfish Plan Team and from Jim Ianelli (NOAA-AFSC) and Sara Cleaver (NPFMC) on the meeting of the GOA Groundfish Plan Team. Jon Warrenchuk (Oceana) provided public testimony. **In general, the SSC supports the PT recommendations detailed in the reports.** Items for which the SSC provides additional comments are below.

GOA Groundfish Specifications

In agreement with the PT, the SSC recommends approval of last year's projected 2020 harvest specifications for preliminary GOA harvest specifications in 2020 and 2021

Recruitment Process Alliance surveys in GOA

The PT received a presentation detailing the results of 2019 surveys from the Recruitment Process Alliance. In reference to the GOA, surveys conducted include beach seine, Southeast Alaska Coastal Monitoring, spring larval and young-of-the-year (YOY) groundfish. The SSC greatly appreciates the summary of information from these surveys. Noteworthy items include:

- Low larval fish abundance from multiple surveys, particularly for Pacific cod and pollock
- Warm temperatures observed throughout the water column and broadly distributed across the GOA
- Low summer catch-per-unit-effort for age-0 pollock
- Small numbers of large copepods from the Rapid Zooplankton Assessment

GOA bottom trawl survey

The SSC continues to be concerned about the lack of a full trawl survey of the GOA. As in recent years, the GOA bottom trawl survey was conducted with only two boats, which precluded surveying in deep strata. The lack of data from these stations will likely impact assessments for multiple groundfish species. **The SSC reiterates that complete biennial surveys of the GOA are a minimum sampling requirement that needs to be met. The SSC further suggests that annual surveys (SSC October 2017 minutes) might be necessary in the future**, particularly given the current status of Pacific cod. A biennial survey on even years also fails to provide information on Russian pink salmon, which are in high abundance in the GOA in odd years and are likely a significant competitor with Pacific cod. However, the SSC notes that the AFSC at this meeting indicated that a four-boat scenario will be continuing into 2020 and may, unfortunately, be a new normal. The SSC acknowledges that the AFSC is working diligently to try to address this issue, yet budgetary issues persist.

Results from the GOA bottom trawl survey are mixed. Large single-tow catches were uncommon in 2019 but overall, species composition was similar to previous years. Pacific cod biomass increased somewhat from 2017, including some noteworthy large catches near Prince William Sound, but 2019 is still the second lowest on record. The strong 2014 year class is supporting the largest estimate of sablefish biomass in 20 years.

AFSC longline survey

Preliminary results from the longline survey in the GOA include continued warm temperatures, declines of Pacific cod, the continued presence of the incoming large year class of sablefish, and a large increase in blackspotted/rougheye rockfish.

Dover sole/CIE review

The SSC thanks the author's responsiveness to the concerns brought forward by the CIE review and looks forward to seeing the improved models for Dover sole, rex sole, and flathead sole in December. The SSC suggests that a critical look at survey data, which was a focus of this CIE review, might also be beneficial for other GOA stocks.

GOA shortraker rockfish random effects (RE) model

The SSC endorses bringing this RE model forward as an option in November, in agreement with the PT. However, the SSC requests clarification on the method used to determine the weighting of the survey indices (i.e., justification for the 0.5 weighting).

GOA pollock

The SSC notes that the 2018/2019 government shutdown precluded the winter acoustic survey going to the Shumagins or Prince William Sound, and the survey was only able to sample in the Shelikof, Marmot Bay and Chirikof areas. The SSC would like to commend the staff for their efforts to survey this winter and would note that PWS will not be surveyed again until 2021, as Bogoslof will be surveyed in 2020. Biomass estimates from Shelikof was 1.28 million metric tons, similar to 2018. Size compositions suggest a relatively large year class of age-1 pollock observed in the 2019 survey, potentially alleviating some concerns with the reliance of the estimated population biomass on a single year class.

The SSC commends authors for the development of draft ESP for GOA pollock and looks forward to reviewing this in detail at the December meeting. The SSC additionally endorses the PT recommendation to see the conceptual model in the ESP in November.

GOA Pacific cod

The GOA Pacific cod assessment author brought forward a series of models with a long list of adjustments and explorations, and the SSC commends the author on this effort prior to developing the final models for harvest specifications this year. Most of these refinements to last year's accepted model (18.10.44) directly address the concerns expressed by the SSC and PT, and most result in minimal changes to key parameters or model fits. The most apparent differences are seen in estimates of biomass around the 1980s in some models. The assessment author provided a comprehensive and detailed evaluation of these changes. **In agreement with the author and the PT, the SSC would like to have models addressing aging bias and error, a change to the maximum age bin, and asymptotic age selectivity brought forward in November.**

Additionally, the use of the IPHC survey data should continue to be explored, as there are a number of benefits to including this survey, both as an index and a source of compositional data. This survey might be a new source of information on young Pacific cod, given that this survey samples in a relatively shallow depth range over the entire shelf annually. The SSC appreciates the efforts to again include age data prior to 2007, which were excluded from the 2018 model. However, it might also be advantageous to re-age some samples from this time period to confirm the magnitude and direction of the bias, recognizing that aging has typically been constrained by staffing issues.

Further, the assessment author explored a number of models linking Pacific cod population dynamics to climate processes. Last year's assessment model included a connection between survey catchability and bottom temperatures, in addition to a separate natural mortality modeled during the 2014-2016 marine heatwave. As shown in the preliminary Ecosystem presentation at this meeting, the GOA is again experiencing a marine heatwave, which is anticipated to continue through 2020. Two exploratory models (19.14.49 and 19.14.50) linked the marine heatwave index to recruitment and to several age-specific natural mortality schemes. Finally, the author also introduced a model (19.14.51) that included temperature-dependent growth.

The SSC commends the author on these efforts and, anticipating continued warm conditions and potential changes to Pacific cod population dynamics, recommends continued exploration on this front. **Specifically, the SSC supports bringing forward a model or models that include these climate connections for**

review at the November/December meetings, at the author's discretion. Documentation and model vetting will need to be extensive and thorough, given the rapid development and the dramatic change in the scale of the population seen in some of the climate-enhanced models.

The SSC notes that any model brought forward this year will show a stock that has declined precipitously over recent years, which continues to have substantial management implications. In particular, if Pacific cod falls below the $B_{17.5\%}$ level, a rebuilding plan will be required. Steller sea lion protections, which are implemented when the population falls to or below $B_{20\%}$, may be necessary, as well. **The SSC emphasizes that both of these scenarios are possible, given the results from the preliminary September models.**

As the author notes, biological reference points estimated from equilibrium conditions from 1977 – 2015 may no longer be relevant. While biomass estimates from the GOA bottom trawl survey increased in 2019, there remain several indicators that recruitment continues to be poor, as seen in multiple GOA surveys that sample young Pacific cod. This climate-enhanced modeling approach may improve understanding of population responses to warming conditions and may provide additional information to better assess Pacific cod into the future. Incorporating climate process in the assessment and projecting outcomes is complicated and the SSC recommends the author clearly indicate assumptions associated with resulting projections. For example, assuming a constant temperature anomaly in the projections may not capture shorter periods of cooling, or spikes in temperature.

The SSC suggests that coordination among the regional Pacific cod assessments might be beneficial, as biological processes influenced by a changing climate might be relevant for more than one region, though the SSC notes that Pacific cod are subject to regionally-specific ecosystem dynamics. Regardless of whether the observed connections between Pacific cod dynamics and the GOA oceanographic conditions are a regime shift or a short period of low productivity, it is worth considering the predator dynamics in the GOA within the assessment. The SSC suggests that the staff from the Ecosystem Status Reports might be able to provide insightful input. The SSC looks forward to considerations of the effects of declines in Pacific cod on their predators, to the extent possible, in the assessment. With respect to the concept of changing baselines, which was brought up in public testimony, the SSC strongly emphasizes that there would need to be considerable review and thought prior to any substantive changes being made to biological reference points, particularly given Pacific cod's role in the ecosystem, including its significance to ESA listed species, such as the Steller sea lion.

Pacific Ocean Perch

The SSC commends the assessment authors for their responsiveness to PT and SSC concerns and appreciates the investigations into natural mortality, an appropriate plus group, compositional data weighting, the use of VAST, and the addition of acoustic survey data to the model. The SSC believes that the move to VAST has a great deal of potential. Further, the SSC suggests new empirical information be included, such as the acoustic survey, to better understand survey catchability, particularly data that speak to trawlable vs. untrawlable habitats.

C-8 BSAI Parallel Waters

The SSC received a presentation from Jon McCracken (NPFMC) on an RIR analyzing a proposed amendment to limit entry in the BSAI parallel waters groundfish fisheries to those with an FEP and an LLP with correct LLP endorsements. Written public comments were submitted by the Under Sixty Cod Harvesters. There was no oral public testimony.

Alternative 2 is designed to limit access to the parallel fishery for Federal fishery participants by requiring HAL, pot, jig, and trawl gear vessels to have appropriate Pacific cod and area endorsements on the LLP, and appropriate area and gear type designations on the FFP; require these vessels fishing in parallel waters to adhere to Federal seasonal closures of the same sector in the BSAI; prevent these vessels from removing these designations from the FFP; and only allow participants to surrender and reactivate the FFP once every three years. This is largely a housekeeping proposal designed to close loopholes in the Council's previous actions on the BSAI Pacific cod parallel fisheries.

The SSC finds the analysis to be relatively complete in addressing impacts to the various sectors, communities, and processors. Particularly useful is the categorization of directly affected vessels based on different combinations of compliance criteria shortfall combinations, and the inclusion of time series data on engagement and dependency by sector by community, which to date have typically been utilized only in the analysis of more comprehensive or wide-ranging proposed management actions. In this analysis, this approach highlighted a concentration of risk in the local Unalaska fleet that would not have been as obvious in its absence. **The SSC recommends that the analysis be released for public review with the following additions and minor edits:**

- Include an analysis of the costs and benefits of vessels that choose to come into compliance with this amendment based on the categories of compliance shortfall combinations already developed. This should include likely costs of the LLPs based on data of recent transfers to the extent feasible, the availability of latent LLPs, and an order of magnitude impact analysis of the sectors by community.

- Include a qualitative/order of magnitude discussion of the costs and benefits of alternative fishing opportunities open to non-compliant vessels that choose, or are otherwise unable to come into compliance (e.g., focusing Pacific cod efforts exclusively on the state managed fishery), to allow a more complete understanding of likely impacts to local fleets.

- Consider the downstream impacts of the transfer of TAC to the compliant vessels in other sectors. Expand the harvester impacts from Alternative 2 beyond revenue at risk to examine revenue that can be reallocated and the order of magnitude of impacts on the various sectors, processors, and communities.

- Include a discussion of the 40 vessels at risk in light of their potential status as affected Small Entities.

- Data for this analysis are exclusively from the Catch Accounting System. However, qualitative assessments of the anticipated impacts from the different sectors should be included where possible to understand the broader effects of these changes.

- The analysis and tables should be carefully reviewed for clarity and errors (e.g. Table 2-18 contains errors in column 1).

D-1 Trawl Exempted Fishing Permit

The SSC received a presentation from the EFP applicants: Ruth Christiansen (United Catcher Boats), Julie Bonney (Alaska Groundfish Data Bank, Inc., Peninsula Fishermen's Coalition), and Charlotte Levy (Aleutians East Borough).

The documents provided to the SSC included the Trawl EM Committee Report, and the EFP Application with associated Alaska Regional Office (AKRO) and Alaska Fisheries Science Center (AFSC) reviews. The AK Regional Office concluded that the EFP application constituted a valid study per the specifications

set out in Federal Regulations. The AFSC provided eight specific requests for further information and clarification to be added to the application and indicated pending the addition of this information it would recommend approval of this EFP application. No in-person public comment was received, but one letter from Molly Zaleski (Oceana) was received online.

The EFP application includes a proposal for pollock CVs using pelagic trawl gear in the eastern BS and GOA (NMFS Areas 610, 620, 630, and 640) to evaluate the efficacy of EM systems in lieu of observers for at-sea monitoring of vessels for compliance with fishery management regulations. CVs delivering to motherships and catcher-processors are not eligible to participate. The EFP would exempt the participants from regulations that currently prevent full or maximized retention of all catch and observer coverage requirements. The objective of the EFP is to determine whether utilizing camera systems in lieu of onboard observers leads to cost reductions and is operationally effective for monitoring of catch and discards.

EFP General Objectives:

1. Improve salmon accounting.

2. Reduce monitoring costs.

3. Improve overall monitoring data for catch accounting and compliance.

4. Examine current regulatory retention and discard requirements as necessary to achieve Objectives 1-3.

Specific EFP objectives derived from the Council's EM Cooperative Research Plan objectives:

1. Demonstrate that maximized retention can be achieved in pollock trawl CV fisheries.

2. Demonstrate that at-sea observers can be replaced with observers at shoreside processing plants such that data needs and data streams for effective fisheries management are maintained.

3. Demonstrate that EM camera systems can adequately capture discard events and that video data can be used to verify vessel logbook discard information for compliance monitoring purposes.

4. Demonstrate that EM can be more cost effective than human observers.

5. Improve salmon bycatch accounting for CVs, especially for those delivering to tender vessels, through the use of EM camera systems that will enable shoreside observers to collect salmon bycatch census data.

The regulatory exemptions requested include:

- Regulations that require a vessel to discard specific species after an MRA has been reached in the BS and GOA.

- Regulations that require a catcher vessel to discard pollock after the vessel has reached the 300,000 lbs. trip limit.

- Regulations that prohibit retention of a species when they are placed on PSC status (for the fisheries with incidental take) such that any catch must be discarded at sea.

- Regulations prohibiting the retention of incidental species in an amount that exceeds the MRA when directed fishing for that species is prohibited.

- Regulations that require a vessel operator engaged in directed fishing for groundfish, including pelagic pollock, in the GOA or BSAI to minimize catch of prohibited species and, with the

exception of salmon which has a 100% retention requirement, discard all PSC at sea with a minimum of injury (note that halibut would already be exempt due to the PSDP).

- Regulations that require a catcher vessel engaged in directed fishing for pollock in the BS to carry an observer at all times.

- Regulations limiting the time required for an observer to complete sampling, data recording, and data communication duties to 12 consecutive hours in each 24-hour period.

Results from this EFP are intended to inform the Council's EM Trawl Committee and future Council analyses in consideration of implementing EM aboard pelagic pollock CVs in the BS and GOA as a compliance monitoring tool in these fisheries. The EFP application states that EM will not be directly utilized for catch accounting purposes; accounting of a vessel's catch will be done via fish tickets (eLandings reports), and a census of the Chinook salmon PSC will be done at the shoreside processing facility via a shoreside plant observer, both of which will be provided to NMFS.

The requested dates for the permit are the 2020 and 2021 pollock fishing years (both A and B seasons in the BS and NB and CID seasons in the GOA). The EFP applications indicated that for 2020, 49 pollock CVs (28 BS/GOA component and 21 western GOA component) and nine tender vessels are expected to participate. However, they noted that these numbers are subject to change and will be confirmed prior to final issuance of the EFP. An expansion of participating vessels will be considered for 2021 based upon information learned during the first year of the proposed EFP.

The SSC found the EFP application to be very thorough and appreciated the substantial collaborative and adaptive efforts of the EFP Team with Observer Program and AFSC staff, especially given the scope of this multi-area and multi-fleet effort, to ensure that the EFP achieves its stated goals while complying with catch accounting requirements.

The SSC notes that the EFP application benefits from lessons learned in the fixed gear sector, the Pacific whiting fishery EM program, and from the two ongoing projects funded through the National Fish and Wildlife Foundation (NFWF) in which EM systems were deployed on pelagic pollock fisheries' shoreside catcher vessels, crossover catcher vessels, catcher vessels delivering to tenders and processing plants, and tender vessels in the BS, GOA, and WGOA.

The SSC appreciates the efforts of the EFP applicants to conduct outreach to the EFP fishery participants to ensure project compliance, including timely transfer of hard drives to the video review service providers. Further, the team has developed a robust feedback processes to ensure any operational or compliance issues are addressed in real or near-real time, which will facilitate stakeholder buy-in as efforts continue to move toward full operationalization of EM.

The SSC notes that the video service providers (PSMFC and Saltwater Inc.) are experienced and will work with the EFP team to develop and refine the video processing protocols. **Given that EM review reported higher at-sea discards than did onboard observers in previous work, the SSC recommends that the EFP applicants work with these entities to get to the root of when, where, and why this discrepancy arose. Further, the SSC suggests working with these entities to include a fish identification confidence rating data field to be populated during the video review process to ensure identifications are sound, as well as initiating a cross-company video review comparison study to ensure data are comparable.** As review protocols and record-keeping forms/documents evolve it will be important to ensure a mechanism exists to track when and where specific versions of these documents were utilized.

The SSC appreciated the inclusion of specific evaluation metrics to assess specific hypotheses and characterize the performance of the proposed work relative to the stated EFP objectives.

Finally, the SSC recommends that, while it is beyond the scope of this EFP, as the Council moves forward with operationalization of EM, consideration should be given to privacy issues associated with the use of video recordings for purposes other than bycatch enumeration. If video can/will be used to enforce safety violations and fishery statute infractions it will be important to communicate this to vessel captains and crews.

The SSC highlights that haul-specific information is important for assessing at-sea fishing activities. Under the EFP, haul locations and associated attributes will be available via a logbook rather than at-sea observer data. The applicants indicated this information would be used to audit EM compliance, and should be available to assessment authors. The SSC encourages the applicants to work with agency staff to ensure this information is stored in a database (e.g., AFSC/AKRO/AKFIN) that authors can easily access.

The SSC also requests the authors report on the amount of shoreside sampling of biological information and implantation issues.

The SSC concurs with the AFSC's information request and notes that the analysts have addressed the information requests in the updated EFP and have provided a list of the specific changes made to facilitate tracking of this feedback. **The SSC recommends the EFP application be approved and looks forward to receiving annual reports on EFP development and results**

SSC Member Agenda Associations

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

At this October 2019 meeting, three SSC members acknowledged associations with specific agenda items under SSC review. Mike Downs acknowledged his authorship of the C-1 Halibut ABM Draft Social Impact Assessment. Anne Hollowed supervises Steve Barbeaux (GOA Pacific cod assessment author), Martin Dorn (GOA walleye pollock assessment author, GOA walleye pollock ESP author, CPT co-chair, and risk table contributor), James Ianelli (EBS walleye pollock assessment author, BSAI Halibut ABM author, and GOA GPT co-chair), William Stockhausen (Tanner crab author, Pribilof Islands blue king crab author), Cody Szuwalski (EBS snow crab author and Pribilof Islands red king crab author), and the supervisor of Sandra Lowe (BSAI Atka mackerel assessment author and supervisor of Carey McGilliard who is an author of BSAI Halibut ABM). Finally, Dana Hanselman is an author or coauthor on the Sablefish assessment, Gulf of Alaska Pacific ocean perch stock assessment, Gulf of Alaska blackspotted and rougheye rockfish stock assessment, a contributor to the BSAI halibut ABM initial review and supervises Chris Lunsford who supervises the stock assessment authors at Auke Bay Laboratories.