

North Pacific Fishery Management Council

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SCIENTIFIC AND STATISTICAL COMMITTEE Report to the NORTH PACIFIC FISHERY MANAGEMENT COUNCIL June 5th – 7th, 2017

The SSC met from June 5th through 7th at Centennial Hall, Juneau, AK.

Members present were:

Farron Wallace, Chair <i>NOAA Fisheries—AFSC</i>	Sherri Dressel, Vice Chair <i>Alaska Dept. of Fish and Game</i>	Milo Adkison <i>University of Alaska Fairbanks</i>
Chris Anderson <i>University of Washington</i>	Jennifer Burns <i>University of Alaska Anchorage</i>	Robert Clark <i>Alaska Dept. of Fish and Game</i>
Brad Harris <i>Alaska Pacific University</i>	Anne Hollowed <i>NOAA Fisheries—AFSC</i>	Gordon Kruse <i>University of Alaska Fairbanks</i>
Dayv Lowry <i>Washington Dept. of Fish and Wildlife</i>	Kate Reedy <i>Idaho State University Pocatello</i>	Matt Reimer <i>University of Alaska Anchorage</i>
Ian Stewart <i>Intl. Pacific Halibut Commission</i>		

B-1 Plan Team Nominations

The SSC reviewed the Plan Team nominations of Teresa A'mar and Nathaniel Nichols to the GOA Groundfish Plan Team, John Olson and Mike Byerly to the Scallop Plan Team, and Krista Milani to the Crab Plan Team. The SSC finds all of these nominees to be well qualified, with appropriate expertise that will assist the respective Plan Teams. The SSC recommends that the Council approve these nominations.

B-1 Social Science Planning Team (SSPT): Proposed Purpose and Organization

The SSC received a presentation from Sam Cunningham (NPFMC) on the Executive Director's Report on a Proposed Purpose and Organization of a Social Science Planning Team (SSPT). Public testimony was heard from Verner Wilson III (Bristol Bay Native Association) and Jon Warrenchuk (Oceana).

The proposal was developed in response to needs expressed by multiple groups. First, the SSC identified numerous gaps in social science data needed to meet statutory requirements for evaluating LAPP programs during recent reviews of Amendment 80, Bering Sea and Aleutian Islands (BSAI) crab rationalization, and the Halibut/Sablefish IFQ program. Second, the Human Dimensions Workshop hosted in July 2016 by AFSC identified value in having an advisory body dedicated to longer-term strategic planning for social science. Finally, Council staff, NMFS AKRO, and the AFSC social scientists also seek to coordinate their research programs to ensure responsive and broadly applicable social science products.

The proposed SSPT is designed to ensure the best available data and methods are applied in the scientific analyses that support Council decisions. Many of the persistent gaps in social science data span fisheries

and management programs, and are thus most efficiently addressed through strategic, coordinated, long-view efforts that do not fit well within the cycle of Council meetings and Council action analyses. The SSPT will improve structural support for social science, particularly in providing a venue for the types of incremental and iterative refinement that have benefitted stock assessments, while identifying ways to focus resources to meet statutory requirements.

The SSC strongly recommends establishing a Social Science Planning Team in order to support the Council in its efforts to manage fisheries under the MSA, and especially to satisfy National Standard 8. The SSC endorses the mission, scope, organization and initial membership outlined in the proposal.

The proposed scope of the SSPT emphasizes long-term strategic initiatives that span management programs and Council actions. The scope explicitly excludes annual reports (e.g., the Crab and Groundfish Economic SAFE reports) and the regulatory review of most individual management actions. The SSC supports this prioritization, while also allowing the SSPT to serve as a resource for staff who seek advice or feedback on analytical strategies and methods during the planning stages of especially complex projects and LAPP reviews.

The proposal included some details on the operation of the SSPT. The SSC concurs with the proposal's recommendation that the team meet in person annually, recognizing the depth of interaction, cooperation, networking and brainstorming that will be required to meet the SSPT mission. The SSC recommends items for the agenda be identified by SSPT members, representing their respective bodies (i.e., Council staff, AKRO, AFSC, SSC). The agenda will be set by the SSPT chair, with approval by the Executive Director and Council Chair. Based on framing discussions, the SSC anticipates that the initial meeting will focus on identifying cross-cutting data gaps and analytical issues that arose in the wave of recent LAPP reviews, with an eye toward improving all of them in their next iteration.

The proposal presents an excellent vision for the SSPT. However, the membership, organization and operations of the SSPT will likely evolve and be refined over time to better fulfill its mission. The SSC finds that the proposed membership includes the organizations and individuals who are most familiar with the circumstances that demonstrated the need for the SSPT; other individuals and groups can participate through the public meetings. Looking forward, the SSPT will improve the translation and integration of research from across the social sciences, and potentially enhance participation in the Council process by providing a more accessible avenue for impacted populations.

B-2 Stock Assessment Improvement Plan and Best Available Science

Stock Assessment Improvement Plan (SAIP)

Drs. Francisco Werner (NMFS Acting Chief Scientist) and Patrick Lynch (NMFS, National Stock Assessment Program Leader) provided an overview of the revised SAIP.

The SAIP updates and expands the original SAIP that was published in 2001. The 2001 SAIP was successful in expanding the stock assessment enterprise nationwide, and effective at both reducing cases of overfishing and rebuilding of overfished stocks. The SAIP improved the quality of many of our nation's stock assessments, and each of the regional fishery management councils adopted a rigorous peer review process. This revised SAIP builds on the previous successes of the original SAIP. It provides a comprehensive summary of the stock assessment enterprise, as well as the challenges that NMFS faces to provide the scientific information necessary to support sustainable management of our nation's marine resources.

The document lays out the steps needed to produce the holistic ecosystem-linked assessments needed to implement an ecosystem approach to fisheries management. **The NPFMC's stock assessment enterprise**

stands at the forefront of this effort. Tangible evidence of our readiness lies in the recent release of a multi-species stock assessment (CEATTLE) as an appendix to the EBS pollock SAFE. The new Species Profiles and Ecosystem Considerations (SPEC) sections at the end of each NPFMC groundfish SAFE chapter will provide a roadmap to the future implementation of climate enhanced stock assessments and stock projection models. The Alaska Climate Integrated Modeling (ACLIM) team's focus on evaluating the performance of alternative harvest strategies under changing climate and the recent formation of the Bering Sea Fisheries Ecosystem Plan Team should deliver climate-ready Management Strategy evaluations to the NPFMC.

The SAIP tasks the Science Centers with the development of timely, efficient and effective stock assessment advice. The Agency recognizes that the great demand for high quality stock assessments necessitates some prioritization of how frequently assessments are conducted and what level of complexity is needed to inform managers of their options for sustaining fisheries into the future. **The NPFMC's recent completion of the stock assessment prioritization exercise illustrates that our region is carefully adhering to the goals of timely, efficient, and effective assessments.**

The SAIP describes a vision of the future that focuses on four Ts: Throughput, Timeliness, Thoroughness, and Transparency. The guidelines recognize that the system adopted by the NPFMC provides efficient throughput.

The document's discussion of peer review notes that the NPFMC/AFSC approach to reviewing research assessments allows the authors to seek comment and advice on their models prior to use for stock assessments. The SAIP is designed as a guide for each region and the SSC was assured that the NPFMC's approach to peer review was consistent with the goals of the SAIP.

The document describes a future that embraces technological innovation in modeling. Again, the AFSC continues to play a leadership role in this arena. Emerging avenues for technological innovation are expected to include: expanded use of ADMB/TMB in stock assessments, use of distributed assessment model development environments such as cloud-based systems, and continued efforts to accelerate sharing innovations through national working groups/task teams and workshops. The development of the GMACS model for Alaskan crab stocks is a good example of a distributed model development environment.

Throughout the document there is a strong emphasis on the importance of continued data collection to support stock assessments and identifies the challenges associated with data poor stocks. It identifies opportunities for expanded use of advanced technology including innovative ways to collect data from ships of opportunity. The AFSC and ADF&G, together with North Pacific Research Board (NPRB) and Saltonstall-Kennedy funding, continue to ensure that the NPFMC's stock assessment enterprise incorporates new technological advancements when they become available that make for more efficient data collection.

Finally, AFSC's efforts to improve communication of results in a standardized manner are well aligned with the updated SAIP. The groundfish and crab plan teams have endeavored to standardize the formats for outputs through the use of R-interfaces for the production of a common suite of tables and figures and R-markdown for document development.

In summary, the SAIP outlines a national status and vision for stock assessments that align well with NPFMC existing regional practices and directions. Moreover, the presenters indicated that, rather than "top-down" rules, the document outlines NMFS recommendations that can be discussed and tailored to each region as required.

Best Scientific Information Available

Drs. Francisco Werner (NMFS Acting Chief Scientist) and Patrick Lynch (NMFS, National Stock Assessment Program Leader) provided an overview of the proposal for treatment of Best Scientific Information Available (BSIA). The SSC notes that, in general, the NPFMC's review process conforms to the proposed BSIA. Figure 11 of the presentation suggested that the SSC will review the Final SAFE chapters at one meeting and set the OFLs and ABCs at another meeting. Likewise, the figure suggests that the Council will set the ACLs at a different meeting. In the NPFMC system the final review of SAFE documents and setting of biological reference points and ACLs all occur during the same meeting for relevant crab and groundfish stocks. The SSC inquired about this issue and was assured that our system was acceptable under the BSIA. The SSC looks forward to reviewing the full BSIA report when it becomes available.

C-1 Observer Program Annual Report

Presentations were given by Diana Evans (NPFMC), Chris Rilling (NMFS-AFSC), Craig Faunce (NMFS-AFSC), Jane Sullivan (Alaska Sea Grant Fellow, NMFS-AKRO), and Jennifer Mondragon (NMFS-AKRO) on the North Pacific Observer Program 2016 Annual Report (Annual Report). Public testimony was provided by Molly Zaleski and Jon Warrenchuk (both from Oceana), and Julie Bonney (Alaska Groundfish Databank).

The SSC received the fourth Annual Report of the restructured observer program, which pertains to trips observed during 2016. We appreciate the dedication and tireless work of the observer program staff to provide this information. The North Pacific Fisheries Observer program is not only the largest observer program in the world, it is also the best documented and vetted program, which includes elaborate in-season QA/QC and annual in-depth analytical review. Likewise, the developing EM program is a first in establishing a data collection program that uses video to collect data for catch estimation, compared to other compliance-based logbook programs that only provide catch for a focused set of species that does not support ecosystem based assessment and management.

The Annual Report provides comprehensive information on the implementation of the restructured observer program in 2016, as well as briefly discussing changes to the program in 2017. Analysts have been responsive to SSC comments about the program provided during our June and October 2016 meetings. Observer-collected data provide essential biological samples and fishery-dependent catch and effort information for management of sustainable fisheries in waters off Alaska. The Annual Report provides an overview of the program with detailed information on coverage categories and levels, fees and the budget for the partial coverage category, metrics and evaluation of performance of the deployment plan, fishery information summaries such as the proportion of catch observed, summaries of EM video review, compliance and enforcement statistics, outreach activities, and NMFS recommendations for the program. The SSC greatly appreciates the analysis of selection and observer effects that can cause bias with respect to differences between observed and unobserved trips, as well as tendered and non-tendered trips. A comprehensive suite of performance metrics was used to evaluate deployment rates, representativeness of the samples, and adequacy of the samples. The SSC found the report to be well written and synthetic in its reporting of all operational aspects of the observing system, and to be rigorous in its evaluation of how well the program is conforming to the current deployment plan. The SSC focused primarily on the performance of the partially observed coverage category and note the following successes:

- The observer program in 2016 can be deemed successful based on efficient use of fees collected, as well as effective deployment and performance based on the reported metrics.
- Changes made between 2015 and 2016 deployments were effective at reducing bias in the sample of observed trips and increasing efficiency of obtaining an unbiased sample of observed trips.

- Stratification by gear for the partially observed trip selection strata appears straightforward to interpret and is more effective at obtaining representative trips in these strata than stratification schemes used in past deployments (except when tenders are involved, see below).
- The ODDS system largely works as intended for trip planning and logging of trips, although plans to link ODDS with eLandings are progressing very slowly.
- The EM selection pool continues to evolve and expand numbers as intended in the pre-implementation phase, though the expansion rate is lower than anticipated.
- The analysts were very responsive to past SSC comments and recommendations on the program, with a separate section of the report dedicated to details of their responses.

While the SSC acknowledges the achievements of the analysts in evolving and improving the program to its current state in just four short years since initial implementation, we also acknowledge that there remain indications that the program is not fully achieving an unbiased sample of trips from the partially observed category, due in large part to the following:

- There are statistically significant differences in the characteristics between observed and unobserved trips. Many of the differences were detected in the hook-and-line and especially the trawl gear strata. There also continues to be problems with sampling of tendered trips. For instance, observed tendered trawl trips did not exceed 5 days; however, unobserved vessels sometimes made many deliveries as part of a single, multi-leg trip..
- There are also indications that funds to adequately observe trips in these same strata are decreasing and this situation will likely continue to decrease the rate of sampling. A 15% minimum sampling rate is recommended as necessary for adequate spatial coverage of observed trips among the gear strata. **The SSC supports the minimum sampling rate of 15% across strata and encourages sampling rates higher than the minimum.** Moreover, the SSC foresees that funds to keep sampling at this minimum level of coverage may not be available in the near future as the contract for observing services is renegotiated for 2019. **Adequate funding of this program is critical to the success of the in-season management, stock assessment, and specifications setting processes that depend on these data.**

The SSC agrees in large part with the recommendations made by the OSC and NMFS for the 2018 deployment year. However, based on the aforementioned successes and continuing challenges of the program, the SSC has the following recommendations with respect to the partially observed category:

- Sampling of Chinook salmon in the GOA pollock trawl fishery should focus on estimating the actual amount of salmon PSC taken in portions of this fishery, rather than collecting an unbiased sample of tissues for genetics. Even if the genetic stock composition of Chinook is biased, the sample may still be an unbiased representation of the stock composition of the entire PSC due to overlap in areas fished and/or complete mixing of Chinook stocks over large areas of the GOA. **The SSC agrees with the NMFS longer-term recommendation to explore plant monitoring of offloads, including tender offloads, combined with EM for compliance monitoring to address the issue of PSC estimation and tissue sampling.**
- Although there is strong evidence of bias in unobserved trips relative to observed trips, and some vessels conducting an entire fishing season without carrying an observer the NMFS longer-term recommendation for 100% coverage of trawl vessels delivering to tenders may be impractical and may not be necessary. Beyond longer-term improvement of methods to monitor offloads of tenders, a shorter-term analysis should be conducted to examine the magnitude of bias caused by tendering

activities relative to the overall magnitude and precision of discard or PSC that is being monitored for compliance by management.

- While the SSC greatly appreciates that the development of variances for use in planning of deployments and stock assessment is ongoing, **we strongly urge the analysts to initiate a comparison of the likely magnitude of bias that has been detected between observed and unobserved trips with the overall magnitude and precision of discard or PSC that is being monitored for compliance by management.** This comparison can be used to determine if remaining trip-related bias is worth addressing through changes to the observing system, or is small enough in magnitude to be deemed “good enough” relative to management objectives. The SSC also notes that these types of comparisons will be necessary given the nature of current constraints on observer deployment (e.g., funding of higher sampling rates and practical need for further stratification). It may be helpful to perform these analyses at the post-stratified levels used for catch accounting (e.g., pelagic and non-pelagic trawl) in order to better identify specific sources of bias.
- The SSC notes that there are additional dimensions of optimization that should be considered beyond providing complete spatial coverage (e.g., estimation of salmon PSC in hard-capped fisheries). While we are cognizant of the funding constraints and possible tradeoffs between the minimum 15% sampling rate needed to provide adequate spatial coverage, and a focus on specific management quantities, we are also cognizant that these types of optimizations should be brought forward and compared with the currently recommended equal effort approach to allocating observed trips, making it possible to fully understand the magnitude and consequence of these potential tradeoffs.
- Given the current and impending funding constraints, the SSC encourages the Council to review the current fee structure of the observer program relative to the recent decrease in funding available to deploy sufficient observer days. We note from our June 2010 report on this issue that the initial analysis of the revised observer program was based on the assumptions of a maximum 2% fee and a daily observer cost of \$450, and neither of these assumptions have been met in the current system (i.e., the fee is 1.25% and the daily observer cost is \$1,049). We also note that there will likely be a 2-year delay in receiving funds following a change in the fee structure, so resolving this critical funding shortfall must be made without delay.
- Without a clear evaluation of these trade-offs, the SSC recommends that the current footprint of the EM voluntary fleet not be expanded as it is not known how this will impact catch estimation.
- The SSC does encourage consideration of the under 40’ no coverage fleet for 2018 as this represents a large segment of the targeted halibut trips, and in fact, some vessels have significant landings. Deployment options should be brought forward for discussion during our ADP review in October.
- Another potential area for expanding testing of EM would be compliance monitoring for full retention of salmon in the pollock fleet.
- Compliance and enforcement issues remain a problem within the observer program that are contributing to bias, and in fact, seem to be getting worse. The SSC encourages the training of crew fleetwide on the necessity of the observing program to proper fishery management and how crew can contribute to the success of the program by interacting appropriately with observers. It is critical that these issues be addressed immediately.

The SSC offers the following additional recommendations to the Analysts:

- Linkage between information provided on the performance review in chapter 3 and the fishery information provided in chapter 4 is unclear. Additional explanation of this linkage (i.e., how does performance relate to the estimated quantities in each fishery) should be provided in the

introduction to chapter 4.

- The SSC is concerned that there may be inadequate time to fully evaluate performance metrics from EM pre-implementation prior to full implementation of EM in the observer program. We look forward to seeing a full evaluation of this program as soon as is practical, as well as an evaluation of the tradeoffs between use of EM and the current partially observed coverage category. The Council's emphasis on continued growth of the EM program ensures EM costs greater than in-person costs is concerning given the budget constraints and absence of data with which the EM program can be evaluated relative to program needs.
- The SSC is unclear about the statement that "some video" was used as the hurdle in assessing whether video from a trip could be used in estimation and evaluation of the EM program. We encourage use of a specific, justifiable quantity to judge adequacy of video data for use in directed harvest and PSC estimation.
- As identified in previous reports, the SSC encourages additional progress toward resolving the calculation of mean weight of halibut discarded by the IFQ halibut fleet.

The SSC requests that the list of observer program analytical tasks continue to include addressing issues with estimation of discards in the directed halibut fishery as detailed in our June 2016 report and IPHC public comments made at that meeting. We also ask that a table of the prevalent PSC species contributing to discards be included in the next Annual Report.

C-5 Halibut Abundance-based PSC Limits

A short discussion paper on halibut prohibited species catch (PSC) abundance-based management (ABM) was presented by an inter-agency workgroup with members Diana Stram (NPFMC), Jim Ianelli (AFSC), Allan Hicks (IPHC), Carey McGilliard (AFSC), Dana Hanselman (AFSC), and Rachel Baker (NMFS Alaska Region). Public testimony was given by Mark Fina (US Seafoods), Gerry Merrigan (advisor to FLC), Steve Martell (Sea State), Chris Woodley (GFF), Heather McCarty (CBSFA), and Linda Behnken (ALFA).

The workgroup developed this document to provide a draft outline of the information to be included in a discussion paper that will be presented at the October 2017 Council meeting. The workgroup also provided a preliminary response to the Council's and SSC's request from the April 2017 meeting for additional description of the Pacific halibut abundance indices and their properties, as well as a revised draft of performance metrics to be used to evaluate whether (or the extent to which) ABM alternatives meet the Council's objectives. The workgroup was specifically seeking advice from the SSC in regards to what information should be brought forward in October 2017 to facilitate decision-making on a range of ABM alternatives. In addition, the workgroup also requested suggestions of a subset of abundance indices to help draft a suite of ABM alternatives to be considered in October, as well as feedback on the performance metrics and measurable objectives to help evaluate which indices and elements of the control rule will most likely achieve the Council's objectives.

The SSC recommends that the following elements be included in the October 2017 discussion paper:

- A full description of each abundance index that has been considered to date. For each index, the description should include the segment of the halibut population it is meant to represent, a discussion of the characteristics of the index, a qualitative evaluation of the index, and a recommendation for or against using the index to form ABM alternatives.
- A discussion of control rules that is not limited to sloping control rules with floors and ceilings, but also considers other control rules, such as those suggested by the SSC in the October 2016 meeting:

- e.g., a decision table with low, medium, or high levels of PSC in response to low, medium, or high levels of coastwide SSB and/or EBS exploitable biomass;
- e.g., a control rule that combines multiple indices by setting PSC to the value of the abundance index that is most constraining at a given combination of index levels.
- A discussion of the incentives corresponding to different control rules and abundance indices. This section should include the discussion of incentives in the April 2017 document and the December 2015 discussion paper, and should be extended to discuss how options for incentivizing halibut PSC avoidance can be explicitly incorporated into ABM alternatives.

The SSC recommends that the workgroup limit the set of abundance indices for initial development of single- and multi-dimensional ABM alternatives to those which reflect: (1) halibut encountered by the groundfish fishery; and (2) halibut abundance in Area 4CDE. The SSC has the following recommendations:

- The EBS Shelf trawl index in biomass is the best index for representing halibut encountered by the groundfish fishery. The SSC notes, however, that there are several reasons why observed bycatch (or even encounter rates) may not correlate to abundance due to halibut avoidance activities by the groundfish fleet. Although the workgroup recommends that numbers, as opposed to biomass, should be used to represent this component of the population, the SSC disagrees since PSC is measured in biomass, not numbers.
- Given the high correlations between the IPHC estimate of halibut spawning biomass, the coastwide setline survey biomass, and the Area 4CDE setline survey biomass, either of the survey indices would be adequate for representing halibut encountered by the directed fishery in the Bering Sea.
- To date, there is no evidence that a good index exists for representing halibut recruitment. Therefore, noU12, AI, and GOA indices should be considered in the initial development of ABM alternatives. If AI and GOA indices are included in ABM alternatives, a Random Effects model should be used to interpolate for years with missing observations.
- The coastwide halibut stock status may not be appropriate for inclusion in an index for halibut abundance; however, it could be useful as a trigger or switch in the control rule to reduce PSC limits when coastwide stock status is low. The SSC notes, however, that the coastwide stock status depends on IPHC's harvest control rule, which is currently under evaluation.

The SSC recognizes the importance of measurable objectives and the development of performance metrics for the future evaluation of ABM alternatives; however, it may be premature to settle on a set of performance metrics at this time. The measurable objectives and performance metrics will ultimately need to be consistent with the ABM alternatives and the overall objectives of the Council. The workgroup should continue to solicit feedback from stakeholders on potential measurable objectives, particularly once the Council has settled on a set of initial ABM alternatives.

The SSC also has the following recommendations:

- The starting point (Element 5) is fundamental to any control rule, regardless of whether it is a sloping control rule or not. It will be important at the October meeting for the Council to select a range of starting values for consideration so that the workgroup can move forward with developing a set of reasonable ABM alternatives. If the Council does not have guidance on the range of starting values, the values listed in the current document (i.e., Element 4, Options 1-3) will likely be used to create ABM alternatives. If these values are not within the Council's preferred range, then this could significantly delay the Council process.
- Although adult or yield equivalents are appealing concepts for understanding how one ton of

bycatch is equivalent to some fraction of directed halibut catch, including it in further investigations is challenging because the equivalency depends on the allocation among fisheries, selectivity, discard mortality rate, overall fishing rate, and biology. The workgroup should instead use the “fishery footprint” calculation proposed in the December 2015 discussion paper.

C-7 BSAI Crab Plan Team Report

The Crab Plan Team (CPT) report was presented by Bob Foy (NMFS-AFSC). Shareef Siddeek (ADF&G) presented the stock assessment for Aleutian Islands Golden King Crab, and Jie Zheng (ADF&G) presented the stock assessment for Bristol Bay Red King Crab. Buck Stockhausen (NMFS-AFSC) gave a presentation on the Tanner crab stock assessment. There was no public testimony.

General recommendations

Model Numbering Guidelines

The SSC previously requested the CPT discuss the model numbering guidelines presented in the Guide to the Preparation of Alaska Groundfish SAFE Report Chapters (July 25, 2016) and to provide a recommendation as to whether that would work for crab stock assessment documents and, if not, to provide a recommendation for standardized model numbering. The CPT discussed model naming conventions for crab assessments during their May meeting. The CPT developed two workable options, but unfortunately there was insufficient time during the CPT meeting to produce a recommendation about which option would be preferable. The first option would be to use the naming conventions as described in the groundfish SAFE guidelines. Specifically, they recommended an option C, where major and minor changes are distinguished based on logical but non-quantitative criteria. The second option considered by the CPT was a naming convention specific to crab stock assessments. The SSC asks the CPT to finish their discussions on this matter at their next CPT meeting so that their recommendation can be made to the SSC. It is appealing to the SSC to use a model naming convention most similar to that used by the Groundfish Plan Teams, barring some compelling reasons to name models with a different convention for crab than groundfish.

Data Weighting

The SSC also previously recommended that the CPT encourage assessment authors to continue the use of multiple approaches to data weighting (not just the Francis (2011) method, but also including the harmonic mean and others). The CPT requested the SSC outline the criteria that should be used to select between alternative weighting methods. The SSC response is that it encourages stock assessment authors and the CPT to continue to consider alternative approaches, as data weighting is not a ‘one-size-fits-all’ problem. The best method for data weighting depends on the quality of the data, the time-series length, the conflict among data sources and other factors unique to a specific assessment. Authors should retain sufficient latitude to use a method appropriate for their particular assessment, noting that internal consistency is more important than blanket consistency across assessments dealing with a variety of unique data configurations and estimation issues. Moreover, evaluation of alternative data weighting approaches can be a useful diagnostic tool to better understand conflicts among data sources.

Years to Include in Reference Point Calculations

The SSC encourages the CPT to provide guidance for authors to objectively define the terminal year of recruitment to include in reference point calculations in each assessment. For instance, for Bristol Bay Red King Crab (BBRKC), where all recent recruitment years have been used in the past, dropping one or more years at the end of the time-series might be warranted based on considerations about when recruitment is adequately determined by the trawl survey. For Aleutian Islands Golden King Crab (AIGKC), it might be warranted to drop even more terminal years, based on a greater time lag of recruitment to the fishery (CPUE-based assessment). A general rule could be based on the variance of the estimated recruitments and/or the youngest ages of crabs sampled by the fishing gear and/or survey gear included in the model.

Model Convergence Diagnostics

The SSC appreciates the discussion of Bayesian diagnostics provided for the snow crab assessment. This is an important effort that is generally applicable to several crab assessments. Issues of poor parameter convergence, and parameters estimated at or very near bounds, are a problem for maximum likelihood estimation as well as Bayesian analysis and should be addressed regardless of approach. Potential solutions to poor model behavior (often partially addressed through jittering) include: re-parameterization, simplification, and addition of informative priors where mechanistic hypotheses are required, but not fully supported by data. This is likely to be a difficult and iterative process for some assessments; however, the SSC encourages future work on this topic by the CPT and assessment authors identifying convergence issues in their models.

Pribilof Islands Golden King Crab (PIGKC)

PIGKC has been managed as a Tier 5 stock. A Tier 4 assessment based on a random effects model was first attempted in 2015. The model used data from the Eastern Bering Sea (EBS) upper continental slope survey from a few recent years that include information on size and sex, allowing estimation of mature and legal biomass. However, this model was unable to estimate process error. An updated random effects model was developed incorporating the 2016 survey. It was fit to data for Subareas 2, 3 and 4 and for Subarea 2 only (where GKC catches are concentrated). However, in both cases the model fit poorly due to high variance and a low number of data points. The SSC notes that, while model estimates of total biomass bear some resemblance to survey trends, estimates of mature and legal males are invariant with survey results. The SSC also noted that size compositions are based on 169-570 crabs of both sexes combined for Subarea 2, but just small sample sizes (15-80 crabs) for Subareas 3 and 4.

The SSC appreciates efforts to address previous SSC comments. For instance, historical catches have been confidential, owing to the participation of just 1-2 vessels since 2009. Following up on a SSC request, requests for waivers from harvesters were obtained. However, discussions are still in progress regarding processor waivers. The SSC hopes that these discussions will be fruitful. Also, in response to another SSC request, NMFS has now provided groundfish PSC data for PIGKC by calendar year over 2009-2016, which are included in this assessment.

The SSC would appreciate additional insights from the assessment author into the performance of the random effects model. The CPT noted that, upon subsequent inspection, the model converged and process error was estimated to be zero. There has been some work based on groundfish analyses toward determining a minimum value for process error for datasets with large observation error and/or noisy time-series. Obtaining an estimate of zero process error is not necessarily a model problem, but reflects that the data are uninformative with regard to trend. It is not possible to distinguish any significant difference from the mean unless additional information is added to the analyses. This could be in the form of a longer time-series, or from prior information regarding what a reasonable level of process error would represent for the stock; other crab stocks with similar life-history and/or survey interactions could be used for this. The SSC recommends the authors and CPT continue to work on this for PIGKC and other stocks where this problem occurs.

It may be helpful to plot size compositions sequentially by year (2008, 2010, 2012, and 2016) on one page for each subarea to help evaluate whether size compositions represent plausible progressions of size modes consistent with our understanding of recruitment, growth, and mortality. Preliminary inspections by the SSC suggest a potential lack of coherent progressions of size modes. Sample sizes in Subareas 3 and 4 appear to be too small to provide reliable estimates of size composition by sex. Small sample sizes for size composition, combined with a lack of contrast in survey biomass estimates, may contribute to the lack of fit. Possibly, an acceptable model may need to await additional years of more informative data.

Given ongoing concerns about the random effects model, the author and CPT recommended retaining PIGKC in Tier 5 and using the status quo procedures to calculate OFL with a 25% buffer for ABC, which is used for other Tier 5 stocks with similar levels of concern. The SSC agrees with this recommendation. In 2016, no vessels participated in this fishery and there was no reported bycatch in other fisheries. Thus, overfishing did not occur in 2016.

Western Aleutian Islands Red King Crab (WAIRKC)

The WAIRKC stock is managed using Tier 5 whereby total catch OFL is calculated using retained catch, non-directed crab discard mortality, and groundfish discard mortality averaged over 1995/96 – 2007/08. For the last few years, the ABC has been estimated with a 40% buffer below OFL to accommodate bycatch in groundfish fisheries and catch for cooperative surveys that operated as a test fishery. In 2016, the SSC expressed some concern about the size of the ABC, given the status of the stock and requested the author and CPT to review the buffer for next year's assessment. The cooperative survey in the Petrel area in 2016 revealed a very low CPUE of 0.11 crab per pot and no additional surveys have been planned. The SSC also appreciates the addition plots of size frequency data in Appendix 5. These appear to show some consistency in the annual progression of size modes, at least for a subset of years with sufficient observations.

As noted by the CPT, the assessment shows a high level of bycatch in groundfish fisheries in 2015/16 relative to previous years. Table 4 indicates that trawl fisheries are primarily responsible for this increase. The SSC broadens the CPT's request for additional information about the source of this bycatch to include fishery, specific area, season, sample sizes used for estimation, etc. The SSC also requests some evaluation to the extent possible about the potential that these removals represent a conservation concern to this crab stock. **Despite the new three-year assessment cycle for this stock, the SSC requests the CPT to review this issue in 2018.**

The author and CPT recommended calculation of OFL under Tier 5 using status quo methods. Given the depressed stock status and the lack of need to accommodate additional surveys, this year the CPT recommended increasing the buffer for ABC calculation to 75%, as had been used before accommodation was made for a test fishery. The SSC endorses these OFL and ABC recommendations. Overfishing did not occur during 2015/16 because the estimated total catch did not exceed the Tier 5 OFL.

Aleutian Islands Golden King Crab (AIGKC)

Through the 2016/17 fishing year, the AIGKC stock was managed using Tier 5 methods with data from ADF&G fish tickets, size-frequencies of landings, at-sea observations, and bycatch estimates from groundfish fisheries. A length-based stock assessment model has been developed that fits male-only population dynamics to data on catches and discards in the directed fishery, discards in the groundfish fishery, standardized indices of abundance based on observer data, fish ticket CPUE data, length-frequency data for the directed fishery (landing and total catch), and mark-recapture data. The CPT recommended, and the SSC approved, use of this model as a Tier 3 assessment for use in the 2017/18 specifications cycle. AIGKC is the only stock in the BSAI Crab Fishery Management Plan that is modeled with fishery-dependent catch and CPUE data without fishery-independent survey information.

In the current assessment, 11 model configurations were considered as summarized in Table T1 in the assessment chapter and as summarized below:

- Model 1 assumes that the proportion mature is a logistic function of length, was fitted to observer CPUE data for 1995/96 to 2015/16 and fish ticket data from 1985/86 to 1998/99, and fixed M for both the EAG and WAG to be 0.224yr^{-1} . B_{MSY} reference points are based on average recruitment over 1987–2012.

- Model 2 varied the assumptions of Model 1 by omitting the fish ticket data.
- Model 3 varied the assumptions of Model 1 by including additional observer CPUE data for 1991/92-1994/95.
- Model 4 varied the assumptions of Model 1 by considering three rather than two selectivity patterns.
- Model 5 varied the assumptions of Model 1 by assuming a lower value of M (0.189).
- Model 6 varied the assumptions of Model 1 by assuming a higher value of M (0.266).
- Model 7 is identical to Model 1, except B_{MSY} reference points are based on a longer time period (1982–2016) over which recruitment is averaged.
- Model 8 is identical to Model 1, except B_{MSY} reference points are based on a shorter time period (1996–2016) over which recruitment is averaged.
- Model 9 varied the assumptions of Model 1 by assuming knife-edged maturity at 111 mm CL.
- Model 10 varied the assumptions of Model 1 by assuming area-specific values for M .
- Model 11 involves knife-edged maturity at 111 mm CL and area-specific values for M .

The CPT felt that the maturity-at-length data appear unrealistic (e.g., the probabilities of being mature for large sizes are less than expected) and the logistic function does not fit well to the data for smaller animals. The SSC agrees. This logistic function was used for all models except Models 9 and 11. Thus, the CPT focused on Models 9 and 11, which are based on knife-edged maturity. The CPT also noted a weak retrospective pattern for Model 9 for the EAG (additional years of data lead to higher estimates of biomass), but not for the WAG. The CPT agreed with the assessment author's preferred model (Model 9). Model 9 was preferred to Model 11 because the evidence for area differences in M is weak. The SSC agrees with the choice of Model 9 for this year's assessment.

The SSC appreciates the efforts to investigate the spatial dynamics of the fishery data. Analysis of a subset 'core area' of spatial data indicated similar trends to those estimated for the standardized CPUE series using all of the data. However, this approach is not the same as predicting the CPUE in unfished areas; this type of spatial extrapolation has been the subject of considerable fisheries literature, and incomplete spatial analysis remains a fundamental problem in the interpretation of CPUE data.

The SSC requests that the assessment authors examine potential causes of the retrospective pattern for Model 9 for the EAG whereby additional years of data lead to higher estimates of biomass. The possibility that this feature is a function of population trend should be explored. AIGKC appear to be increasing in the EAG and more stable or declining in the WAG. To address the issues concerning model fits to maturity data, the CPT recommended that, for the next assessment, the maturity ogive should be estimated outside the model rather than inside the model along with other model parameters. The SSC feels that the veracity of the approach to estimate mature versus immature crab in this assessment needs to be evaluated.

As noted by the CPT, average recruitment used to set the 1960 recruitment and B_{MSY} were based on somewhat different time periods (1987-2012 and 1985-2015, respectively), contrary to the SSC's recommendation to use identical periods to calculate both quantities. Thus, the SSC supports the CPT's request that the authors base both the 1960 recruitment and B_{MSY} on the same set of years (1987-2012). The stock assessment author has already addressed this request.

Finally, the CPT noted that a single OFL and ABC need to be defined for AIGKC stock. However, separate models are available for each of the two areas, creating the need for a method to compute one OFL and ABC for the stock. The CPT considered two approaches:

1. Apply the OFL control rule by area and sum the OFLs by area.
2. Determine stock status for the stock by adding the estimates of current MMB and B_{MSY} by area. This stock status is then used to determine the ratio of F_{OFL} to $F_{35\%}$ by area, which is then used to

calculate the OFLs by area, which are then added together to calculate an OFL for the entire stock.

The CPT preferred the second approach because it relies on a single stock status determination. Use of the first approach would cause the EAG area to be in Tier 3a and the WAG area to be in Tier 3b. The SSC agrees with the choice of the 2nd approach.

In summary, the SSC supports the CPT's recommendation to base the $B_{MSYproxy}$ for the Tier 3 harvest control rule on the average recruitment from 1987-2012, years for which recruitment is relatively precisely estimated. For ABC determination, the SSC recommends a 25% buffer (consistent with the assessment authors) rather than the 20% buffer recommended by the CPT. The CPT justified their recommendation for a 20% buffer based on the buffers used for other Tier 3 crab stocks: BBRKC (10%), EBS snow crab (25% reduced to 10% in 2016), and EBS Tanner crab (20%). Instead, the SSC justifies the 25% buffer for AIGKC based on: (1) the use of fishery CPUE rather than fishery independent surveys used for all other Tier 3 stocks, (2) uncertainties in size of maturity for AIGKC, including the untested regression approach involving chela height against carapace length, (3) uncertainties in natural mortality, (4) limited spatial coverage of the fishery with respect to the total stock distribution, and (5) the small number of vessels upon which CPUE is based. For these reasons, the SSC feels that larger ABC buffer is warranted for AIGKC than other Tier 3 crab stocks. Overfishing did not occur during 2015/16 because the estimated total catch did not exceed the Tier 5 OFL established in last year's assessment.

The SSC thanks the assessment authors for impressive efforts on this assessment over the years. The SSC also thanks the CPT for their careful review and excellent comments and suggestions. The SSC supports other recommendations offered by the CPT.

Bristol Bay Red King Crab (BBRKC)

GMACS

The CPT report included discussions during their spring meeting and the 2017 modelling workshop summarizing efforts to reconcile remaining differences between data sets, parameterization and structural choices used in the GMACS (Generalized Model for Alaska Crab Stocks) and current assessment models. The SSC was in full agreement that a substantial amount of progress has been made toward applying this modelling platform to BBRKC, but that further work is needed.

The SSC noted the value in the time-consuming process of reconciling model outputs and troubleshooting differences in the code and input data. The SSC supported the CPT's recommendations for further GMACS improvements including: 1) estimating initial numbers-at-length in the same manner as is done in the assessment model; and 2) estimating the growth transition matrix as in the assessment model. These and other changes are likely necessary to achieve a close enough match between the two model results to provide a starting point for transition to GMACS for future assessments. The SSC also supports the CPT's proposal to wait until 2018 to use the GMACS platform for the stock assessment in order to provide sufficient time to reconcile these remaining issues.

The SSC looks forward to the 2018 assessment using GMACS, and further supports the long-term plan of including the crab assessment authors as part of the development team for GMACS. With identification of a designated lead to maintain the central code repository, and manage version and quality control, this can be a successful open-source tool for future assessments. The SSC encourages continued communication between current authors and GMACS development efforts, transitioning from separate to cooperative efforts.

Current BBRKC Stock Assessment Model

Five model scenarios were investigated prior to the spring CPT meeting, the results of which suggested relatively minor differences with regard to management quantities. The SSC supports the CPT's and author's recommendations regarding model scenarios to bring forward this fall, which include the following: add the 2016 BSFRF data, separate bycatch components, remove the informative prior and reparameterize NMFS survey catchability to exclude values greater than 1.0, as well as alternatives for data weighting within these scenarios.

The SSC noted that only scenarios utilizing Francis weighting methods were proposed for evaluation in the fall. As noted earlier regarding general guidance to the CPT and assessment authors, the SSC encourages stock assessment authors and the CPT to continue to consider alternative approaches, as data weighting is not a 'one-size-fits-all' problem. The best method for data weighting will depend on the quality of the data, the time-series length, the conflict among data sources and other factors unique to a specific assessment. Thus, the BBRKC stock assessment author should retain sufficient latitude to use a method appropriate for this particular assessment, noting that internal consistency is more important than blanket consistency across assessments dealing with a variety of unique data configurations and estimation issues. Evaluation of alternative data weighting approaches can be a useful diagnostic tool to better understand conflicts among data sources within the BBRKC assessment.

Also, the SSC encourages the BBRKC author to objectively define the terminal year of recruitment to include in reference point calculations in this assessment. For BBRKC, where all recent recruitment years have been used in the past, dropping one or more years at the end of the time-series might be warranted. A general rule could be based on the variance of the estimated recruitments and/or the youngest ages of crabs sampled by the fishing gear and/or survey gear included in the model.

BBRKC Bycatch

The CPT continued ongoing discussions about BBRKC bycatch in groundfish fisheries during their May meeting. They reported a table of bycatch as a percentage of crab biomass, MSST, ABC, and TAC. The low percentages suggest that bycatch does not currently pose a conservation concern. Specifically, the discussion concluded that the statement in the CPT minutes regarding the potential for irreparable damage was unfounded. However, the CPT raised a number of topics that are best addressed by future research. The SSC appreciates the CPT's thoughtful considerations of this issue and their suggestions for research priorities to improve our understanding about potential effects of bycatch on this stock.

Tanner Crab

Tanner Crab Stock Assessment

The primary effort in this assessment has been toward transitioning from TCSAM2013 to a separately coded model TCSAM02 with improved features and input/output capabilities.

The SSC finds the extensive and detailed comparison of TCSAM2013 with TCSAM02 to be very valuable, as it provided an improved understanding of some model features, as well as capturing an error in the input data from 2015. The SSC agrees with the CPT that the TCSAM02 model is ready for use in the 2017 assessment, with no further comparisons required.

The SSC agrees with CPT and author's recommended changes to the model: using the growth increment data from the EBS (rather than the Kodiak data used in previous models), changing the growth increment function to use the cumulative Gamma function, and estimating the scale parameter rather setting it to a fixed value.

During discussion of model parameters, there were questions raised related to survey catchability, and whether estimation was constrained by bounds or parameter priors. The SSC would like to see an evaluation of all parameters that are estimated to be at or very near bounds or substantially limited by priors (unless those priors can be logically defended; also identified in the general recommendations above). Likelihood profiles may be helpful in identifying why a parameter is behaving badly in the context of the individual component sources of input data.

The SSC supports the CPT's recommended sequence of models to be brought forward for September.

The SSC also supports the author's recommendation that additional data on maturity ogives would be very helpful for this assessment, noting that spatial patterns in maturity may be important as they contribute to a single maturity function in the assessment model.

The SSC supports the proposed approach of transitioning from TCSAM02 model development to development of GMACS after the 2017 assessment is complete, focusing future coding efforts on extension of GMACS rather than parallel coding, unless this is done in a function-based approach that can be integrated into GMACS.

The CPT noted that the Tanner crab model predicted more large crab than expected, and that subsequent discussion revealed that the fishery may discard legal crab due to shell condition under some circumstances. The SSC supports the CPT recommendation to investigate modelling time-varying retention, and suggests investigation of observer data for information on discards of legal crab.

Tanner Crab Harvest Strategy

The Alaska Board of Fisheries revised their harvest strategy for EBS Tanner crabs during a meeting held on May 17-18, 2017. The state's harvest strategy pre-dated the current Tanner crab stock assessment model, so an update to this strategy is overdue. During its May meeting, the CPT provided very thoughtful comments and recommendations to help reconcile the data and analyses used in the state's harvest control rule and federal specifications of OFL and ABC. Excellent advice was provided by the CPT with respect to years used to calculate female biomass based on considerations of productivity and regime shifts, geographic distribution of females used for biomass calculations, specific criteria used to determine female maturity status, and other issues. The SSC was very pleased to hear that the ADF&G has agreed to begin work on these considerations. Based on their findings, it may be appropriate for additional revisions to the harvest strategy to be forthcoming. The SSC looks forward to future updates on this issue.

Snow Crab

The SSC supports the CPT recommendations for 5 scenarios bracketing several aspects of the snow crab model to bring forward for consideration in the fall:

- Scenario 1. Leave out length bins below the kink in growth and fit one straight line for growth.
- Scenario 2. Estimate M for females, males, and immatures. Change the prior on the multiplier to work in log space with a zero mean and an appropriate standard deviation.
- Scenario 3. Start the model in 1982 dropping the survey data before 1982.
- Scenario 4. Split the survey selectivity periods in 1987 or 1988 - check the distribution of survey sampling to have a consistent area for each era.
- Scenario 5. Estimate survey availability parameters for the BSFRF survey in logit space with a penalty.

The SSC further supports the CPT recommendation for addressing parameters estimated on bounds. Although it was not presented during the SSC meeting, the SSC notes the value of applying Bayesian diagnostics (described in the general guidance above) to investigate poor estimation performance in the snow crab model.

This assessment is well done. However, as with assessments for other stocks, the primary purpose of alternative models appears to be to select the model that fits the data best. However, the SSC notes that alternative models can be viewed as a form of sensitivity analysis. The assessment would be enriched by some discussion about the implications of the alternatives on uncertainty. In addition, the SSC recommends that future efforts on snow crab (and other crab species) focus not only on modelling improvements, but continue to highlight important data gaps, such as the need for tagging studies to estimate mortality rates, which would reduce model uncertainty.

Table 1. SSC recommendations for three crab stocks (8-10) for 2017/18. Hatched areas not appropriate for that tier. Values are in thousand metric tons (kt).

Chapter	Stock	Tier	Status (a,b,c)	F _{OFL}	B _{MSY} or B _{MSYprox_y}	Years ^[1] (biomass or catch)	2017/18 ^[2] MMB	2017/18 MMB / MMB _{MSY}	γ	Mortality (M)	2017/18 ^[3] OFL	2017/18 ABC	ABC Buffer
1	EBS snow crab												
2	BB red king crab												
3	EBS Tanner crab												
4	Pribilof Islands red king crab												
5	Pribilof Islands blue king crab												
6	St. Matthew Island blue king crab												
7	Norton Sound red king crab												
8	AI golden king crab	3	a	EAG (0.75) WAG (0.68)	12.09	1987/88-2012/13	14.21	1.17		0.22	6.05	4.54	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_{MSYprox_y} 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 2/1/2017 for Norton Sound red king crab, 2/15/2017 for AIGKC, and 2/15/2018 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 2. Maximum permissible ABCs for 2017/18 and SSC recommended ABCs for three stocks where the SSC recommendation is below the maximum permissible ABC, as defined by Amendment 38 to the Crab FMP. Values are in thousand metric tons (kt).

Stock	Tier	2017/18 <i>Max ABC</i> ²	2017/18 ABC
EBS Snow Crab			
Bristol Bay RKC			
Tanner Crab			
Pribilof Islands RKC			
Pribilof Islands BKC			
Saint Matthew BKC			
Norton Sound RKC			
Aleutian Islands GKC	3	6.02	4.54
Pribilof Islands GKC ¹	5	0.08	0.07
Western Aleutian Islands RKC	5	0.05	0.01

¹ For Pribilof Islands golden king crab, this is for the 2018 calendar year instead of the 2017-2018 crab fishing year.

²For Tier 5 stocks this is 0.90 while all other stocks P*.

C-8 Research Priorities

Jim Armstrong (NPFMC) presented the Council's current research priorities and definitions and the SSC received a white paper and a presentation from Dr. Matt Baker describing the North Pacific Research Board's (NPRB) efforts to address the NPFMC's research priorities. There was no public testimony.

The SSC greatly appreciates NPRB's efforts to incorporate the Council's research priorities into their annual call for proposals and to develop tools to track whether a NPRB-funded research project is actually used by the NPFMC. **The SSC recommends forming a small workgroup composed of members of the Plan Teams, SSC, NPFMC, and NPRB, plus database developers, to try to align the tracking of NPFMC's research priorities and NPRB-funded research. The NPFMC might consider holding a workshop in association with the NPFMC meeting in February 2018 to allow input from the broader research community.**

The SSC notes that it would be useful to provide a link between newly funded research and the Research Status column associated with research priorities. If principal investigators noted which research priority their project responded to, then when the project is funded it would be relatively easy to update the Research Status column to indicate research is underway. If this improvement was developed, the SSC requests that the Research Priorities summary table be updated with the results of the current year's funding decisions prior to establishing research priorities in June.

The SSC reviewed the NPFMC's current terms and definitions document. To heighten the distinction between "Critical Ongoing Monitoring" (COM.) and "Important", the SSC recommends that the phrase "or work that could continue indefinitely" is deleted from the definition of "Important".

The SSC reviewed its own research priorities and the proposed changes provided by the Groundfish, Scallop, and Crab Plan Teams. The SSC reviewed all cases where the SSC disagreed with the Council. In some cases the SSC adopted the Council's proposed categorization, in others they maintained their original category. In a few cases, the SSC recommended changing the text (e.g., 533 and 556) or splitting the research description to better conform to the definitions. Of the five new research priorities suggested by the Plan Teams, the SSC accepted 571 and 592. We recommended merging 591 with 367; 593 with 150; and 594 with 212. The SSC also recommended several new projects. Recommended changes to the text or ranking of research priorities is provided in the edited spreadsheet.

1. The SSC recommends that priority 145 is modified to include a fishery independent survey for Aleutian Islands Golden King crab. AIGKC is assessed in Tier 3, yet it depends entirely on fishery dependent data. The SSC annually identifies the importance of fishery independent surveys for this stock. The CPT notes that estimates based on fishery-dependent data could be biased by hyper-stability or hyper-depletion masking population changes. Either a sentence should be added to priority 145 or a new COM priority should be developed that highlights the importance of a fishery-independent survey for AIGKC.
2. Priority 192: The SSC notes that the Bering Sea Fisheries Ecosystem Plan, the SAIP, the Bering Sea Regional Action Plan for climate change, and the Alaska Climate Integrated Modeling (ACLIM) all call for the development of models that incorporate bioenergetics and predator – prey interactions. Funding for AFSC's analysis of groundfish diets is critical to support these Council objectives. Given the importance of food habits data to the operationalization of climate-enhanced stock projection models, the SSC suggests that the NPFMC highlights the value of priority 192 to the NPFMC's critical on-going monitoring activities.
3. Priority 533: The SSC recommends that the text is changed to include a thorough analysis of the sampling design for the NMFS bottom surveys. We recommend that if this research is funded that

geostatistical approaches are considered as part of this activity. The SSC does not agree with the Plan Teams that this is COM. and suggests that the priority be retained in the Urgent category.

4. Priority 556: The SSC recommends that the title and description of this priority is changed to highlight how the research would address the Council's management needs with regard to herring.
5. Priority 591: Merge the proposed new project for GMACS with priority 367. The SSC agrees that development of the GMACS modeling framework is an important activity that will improve the transparency and ease of review for crab stock assessments. Furthermore, this framework is expected to foster innovation through improved flexibility in implementing alternative models. The SSC thinks that this activity falls under the Urgent priority 367 which addresses continued work to improve stock assessments.
6. New: "Collection of socio-economic data (COM) on commercial, recreational, charter fishing and fish processing" has been split out from priority 178 (now titled "Develop a framework for collection of socio-economic information") to distinguish COM needs from the Urgent need to develop the framework.
7. New: "Maintaining the observer program" (COM) has been split out from priority 381 ("Effects of changes to the observer program") to highlight that maintaining the observer data collection activity at a level sufficient to ensure that fishery-dependent data collected provides a valid representation of the catch is a critical on-going monitoring need. The SSC recommends that priority 381 ("Effects of changes to the observer program") be at Urgent status.

(Note: **The SSC recommends that the "Maintaining the observer program" research priority is highlighted in the NPFMC's report.** The importance of this research priority was supported by the annual report the SSC received from the Fisheries Monitoring and Assessment program of the AFSC. The annual report highlights that unless additional funding is generated, observer coverage in 2019 will drop below the level needed to provide a statistically rigorous sample of the fishery.)

8. New: "Maintain and update coupled biophysical projections for the North Pacific": Coupled model projection systems are needed to support the NPFMC's strategic initiatives related to the Bering Sea Regional Action Plan, the Bering Sea Fisheries Ecosystem Plan and the Alaska Climate Integrated Modeling activity. Research is needed on methods to dynamically downscale physics and bio-geochemical information derived from global models and earth systems models to regional ocean models (ROMs) as well as methods for coupling nutrient-phytoplankton-zooplankton (NPZ) into ROMs. Likewise, continued research on methods for coupling biological models (including the response of fishers) to projected environmental change will be an ongoing strategic activity. Projected environmental conditions from the ROMs/NPZ model will provide the foundation for management strategy evaluations needed to provide climate informed harvest strategies for the future. Support for continued update and refinement of the ROM/NPZ coupled models will be an ongoing strategic research need for the NPFMC.
9. New: "Expansion of catch in areas database to include BSAI and GOA crab and scallop fishing": The NOAA Catch in Areas database incorporates VMS and Observer data and is used to characterize the distribution of fishing activity by target; however, it does not yet include crab or scallop fishing activity. This information is required for assessment of fishing effects on EFH and calculating fisheries bottom contact and spatial overlap. Both VMS and observer data are available for these fisheries and work is needed to add it to the CIA database.

The SSC appreciates the careful review of research priorities by the Plan Teams. While we did not always agree, we carefully considered their input. The SSC also thanks the database developers. The improvements to the functionality of the database are most appreciated.