

# North Pacific Fishery Management Council

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## SCIENTIFIC AND STATISTICAL COMMITTEE REPORT TO THE NORTH PACIFIC FISHERY MANAGEMENT COUNCIL January 30<sup>th</sup> – February 1<sup>st</sup>, 2017

The SSC met from January 30<sup>th</sup> through February 1<sup>st</sup> at the Renaissance Hotel, Seattle, WA.

Members present were:

Farron Wallace, Chair <i>NOAA Fisheries—AFSC</i>	Sherri Dressel, Vice Chair <i>Alaska Department of Fish and Game</i>	Chris Anderson <i>University of Washington</i>
Robert Clark <i>Alaska Department of Fish and Game</i>	Lew Coggins <i>U.S. Fish and Wildlife Service</i>	Jason Gasper <i>NOAA Fisheries—Alaska Region</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>	Seth Macinko <i>University of Rhode Island</i>	Franz Mueter <i>University of Alaska Fairbanks</i>
Terry Quinn <i>University of Alaska Fairbanks</i>	Matt Reimer <i>University of Alaska Anchorage</i>	Ian Stewart <i>Intl. Pacific Halibut Commission</i>
Alison Whitman <i>Oregon Dept. of Fish and Wildlife</i>		

Members absent were:

Jennifer Burns <i>University of Alaska Anchorage</i>	George Hunt <i>University of Washington</i>	Kate Reedy <i>Idaho State University Pocatello</i>
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### SSC Election of Officers

The SSC reappointed Farron Wallace as chair and appointed Sherri Dressel as vice chair.

### C5 Norton Sound Red King Crab specifications; Aleutian Islands Golden King Crab and Tanner crab model reviews

Diana Stram (NPFMC) and Toshihide (Hamachan) Hamazaki (ADF&G) presented an overview of the Norton Sound red king crab stock assessment and related Crab Plan Team (CPT) comments. There were no public testimony.

#### Norton Sound Red King Crab

The catch specification process for Norton Sound red king crab occurs off-cycle at the February Council meeting because of the need for assessment in advance of a winter fishery in Norton Sound. The assessment is based on a male-only, length-based model of crab abundance that combines multiple sources of data. The assessment was updated with new data, including total catch, catch length composition, discard length composition data from the 2016 summer commercial fishery, and 2015/16

winter commercial and subsistence catch. The author examined six alternative assessment models in addition to the base model (Model 0) to address CPT and SSC comments from last year. The base model assumes a much higher mortality for the largest size class ( $M=0.59$  for crab  $> 123$  mm CL compared to  $M=0.18$  for all other size classes) to account for the lack of large crab in the survey area. Exploring several alternatives to the base model showed that the most parsimonious improvement in model fit could be achieved by simply freeing the molting probability at the smallest size, which had been fixed in the base model. Nevertheless, the model still includes a much higher mortality for the largest size class. Alternatives that assumed a constant  $M$  across size classes required strongly dome-shaped selectivities (Model 5) or a much higher mortality rate (Model 6) to achieve a similar fit with many more parameters.

**The SSC concurs with the choice of Model 3 and management of this stock under Tier 4a as recommended by the assessment author and CPT, resulting in a 2017 OFL (equal to the max ABC) of 0.66 million lbs (0.30 thousand t). The CPT recommended a 20% buffer in recent years due to concerns with model specification, lack of discard data, and unresolved issues associated with the high  $M$  for the largest size class. The SSC concurs with the choice of a 20% buffer, yielding a 2017 ABC of 0.54 million lbs (0.24 thousand t).**

The SSC discussed potential improvements to the model with respect to natural mortality, but noted that a somewhat higher mortality for larger, older crab may be reasonable due to senescence (for example, see Vetter [1988]. Estimation of natural mortality in fish stocks: A review. Fishery Bulletin 86: 25-43). **The SSC suggests that the author examine available evidence for higher mortality rates at larger sizes and perhaps an alternative way to parameterizing higher mortality at age rather than a step change at the largest size class.**

#### Aleutian Islands Golden King Crab and eastern Bering Sea Tanner Crab

The SSC received presentations from Diana Stram (Council staff), and Buck Stockhausen (AFSC) on Aleutian Islands Golden King Crab (AIGKC) and eastern Bering Sea Tanner crab stock assessment model development. This information was provided for planning purposes, and for SSC feedback on what models to bring forward for SSC review in June (for AIGKC) and October (for Tanner). The presentations summarized progress made since the October SSC meeting, including the January CPT report and recommendations. The SSC recognized the extensive amount of work that has been done on both of these assessments, and looks forward to seeing further developments planned for 2017. The SSC noted that the CIE review scheduled for the Tanner crab assessment may provide additional guidance moving into the next management cycle, as it will entail a more detailed review of the model than was possible during the SSC meeting.

**The SSC recommends that, pending completion of the CPT and SSC requests, the authors bring forward a Tier 3 analysis for AIGKC for consideration at the May CPT and June SSC meetings. The SSC notes that this assessment does not contain a reliable fishery-independent index of abundance, and therefore warrants a larger buffer between the OFL and ABC than is standard in order to account for the uncertainty related to relying solely on fishery CPUE for trend information. The SSC strongly encourages future efforts to develop a fishery-independent survey for this resource, in addition to continuing efforts to better understand the CPUE data through investigation of the annual spatial distribution of the fishery and changes in individual vessel participation.**

The SSC offers the following technical recommendations for the CPT and authors:

#### Aleutian Islands Golden King Crab

The SSC generally supports the CPT recommendations, but recommends a slightly revised approach to the treatment of natural mortality. The SSC requests that the author prepares a likelihood profile using a

finer resolution (smaller step-size). The SSC requests that the author make a run using both eastern (EAG) and western (WAG) data sets combined that includes a prior on natural mortality (0.18) with a CV of 50%. Finally, the author should perform jitter runs to avoid unexpected model behavior. When the final preferred model has been developed, the SSC requests one additional run that does not use this prior on natural mortality in order to evaluate its effect.

The SSC notes that the tuning of input-to-effective sample sizes for the McAllister-Ianelli method appears to have been conducted at the level of individual year's observations. This is not consistent with general practice, or the conclusions from the 2015 CAPAM workshop, which recommended tuning the input values to the harmonic mean effective sample size for all years by fishery or fleet. Regardless, the SSC appreciates the addition of reference scales on the residual plots, which indicate that the method applied (the Francis method) appears to have resulted in a reasonable weighting of the size information, and supports the CPT recommendation to use the Francis method for future analyses.

The SSC requested clarification of an apparent inconsistency in the CPT report regarding the treatment of which recruitment estimates to include in the  $B_{MSY}$  reference point calculations (recommendations 6 and 7). Recruitments that are included in the  $B_{MSY}$  calculations should have an estimated variance less than  $\sigma_R$ , and should generally not include the terminal year's estimates (2016 in this draft analysis) unless specifically warranted by informative data. The SSC recommends the CPT and authors review the Groundfish Plan Team (GPT) guidance on making these calculations and strive for some consistency in their approach.

#### Tanner crab

The SSC recognizes the challenges in reconciling differences in results stemming from complex model code, but supports the CPT's recommendation to continue this process until the remaining discrepancies have been resolved or the causes determined.

The SSC recognizes that the GMACS development team is currently working on implementations for red king crabs and will take on adaptations for *Chionoecetes* sp. after that effort is completed. Therefore, the SSC also recognizes that there is value in continuing to develop the TCSAM02 model. The SSC requests the author - communicate TCSAM02 model developments to the GMACS development team. Specifically, the GMACS development team should continue to be notified of the need to include features consistent with TCSAM02, such that efficient future comparisons between GMACS and TCSAM02 and transition toward a single generic framework for crab assessments will be facilitated.

## **C6 BSAI Yellowfin Sole TLAS Fishery**

The SSC received a presentation by Jon McCracken (NPFMC) of the draft EA/RIR/IRFA document for the proposed action that would limit access for trawl catcher vessels targeting Bering Sea and Aleutian Islands (BSAI) trawl limited access (TLA) yellowfin sole for delivery of the catch to a mothership or catcher processor. Public testimony was provided by Mike Hyde (American Seafoods), Brent Paine (United Catcher Boats), Stephanie Madsen (At-Sea Processor's Association), Susan Robinson (Green Hope), Jim Johnson (Glacier Fish), and Donna Parker (Arctic Storm).

The SSC commends the analyst for the thorough analysis and careful description of the different elements of the proposed action. Overall, the information provided in the analysis is very helpful for understanding the tradeoffs and the potential net benefits involved with the proposed action. While most areas of the analysis are comprehensive and complete, some areas of the analysis are deficient in providing information for the Council on this issue. **The SSC therefore recommends that the EA/RIR/IRFA be released for public review once the following items have been addressed:**

- A table should be included that lists the potential impacts of the proposed action, the stakeholder groups who could be affected, the direction (e.g., good or bad) and magnitude (e.g., small or large), and the likelihood of the effect (e.g., very likely or unknown). The rest of the document can then be used to justify the conclusions stated in the table. This makes it easier for people reading the document to understand the potential tradeoffs and the stakeholders involved.
- A table should be included that summarizes the catcher vessels (CVs) that participate in the yellowfin sole TLA fishery and what other fisheries they participate in. This is important for knowing the likelihood that CVs will continue to enter the fishery and whether there is the potential for spillover effects into other fisheries.
- The document should expand the background section to include the regulatory history and intent regarding the creation of the yellowfin sole TLA fishery under Amendment 80. This will provide context for evaluating the net benefits of the proposed action.
- The analysis needs more justification for why future participation of CVs and motherships is expected to continue at similar levels as 2015 and 2016. In particular, the analysis needs to characterize the potential capacity for CVs and motherships in the yellowfin sole TLA fishery to better understand the potential for a “race-for-fish” fishery in the future. Further, the analysis would benefit from a discussion of why the TLA allocation was not fully harvested until 2013 and why entry into the fishery did not begin until 2015. This information is useful for understanding what drives entry into the fishery and its likelihood to continue in the future.
- The analysis needs to provide additional justification for how the proposed action could result in lower halibut bycatch rates relative to the status quo, which relies largely on an informal fishing behavior agreement among existing participants. For example, is it because historical CVs are inherently “cleaner” than the new entrants or because a smaller number of CVs would make cooperative behavior more likely (or both)? Tables 2-11 and 2-12 (revised) are not sufficient to justify the former mechanism. A table that is similar to Table 2-12 (revised) but separates the halibut mortality rates between the historical CVs and the new entrant CVs would be helpful here. A discussion of why new entrants would make cooperation more difficult for keeping halibut mortality rates low would also be useful.
- More evidence should be presented that “race-for-fish” conditions currently exist in the yellowfin TLA fishery. Landings or harvest by week over time for the CVs in recent years, such as those described for the CP sector, would provide some hard evidence for this assertion.
- The EA is appropriately brief for this management action. However, a primary motivation for this action is to prevent or reduce the race-for-fish, or in effect, alter seasonal fishing patterns of the fleet. Yet, the EA asserts that no changes in this aspect of the fishery are expected to occur. The language used in the EA should be revised to be consistent with the language used in the RIR.

In addition, the SSC recommends that the suboptions under Alternative 2, Option 2.1 should be examined more closely. In particular, the current options under consideration would lift the restrictions on access to the yellowfin sole TLA fishery if the allocation is greater than a “knife-edge” threshold. More information should be provided as to how these thresholds were selected, since a threshold that is too small could result in “race-for-fish” conditions and a threshold that is too large could result in an unharvested TLA allocation. Other suboptions and/or thresholds should also be considered.

## **C8 Squid to Ecosystem Category**

The SSC received a presentation on the Initial Review draft of this EA/RIR/IRFA from Diana Stram (NPFMC) and John McCracken (NPFMC). Public testimony was provided by Donna Parker (*Arctic Storm*) and Brent Paine (United Catcher Boats).

The SSC appreciates the analyst's effort to address many of the comments provided by the SSC in June 2016. There were numerous changes made to the Initial Review draft since the SSC last reviewed it in June 2016 and presenters focused their comments on how the current document differs from the previous Initial Review draft. The updated document includes both a revised purpose and need statement and a revised Alternative 2 (the action alternative) that were adopted by the Council in June 2016 to better reflect its intent in this action. In addition, the document includes the newly revised NS1 guidelines that became final on October 18, 2016. In order for squids to be classified as an Ecosystem Component (EC) species complex under the newly revised NS1 guidelines under section 600.305, the squid complex must be a non-target stock that does not require conservation and management. Retaining the species complex within the FMP itself as an EC species can be used to assist in achieving ecosystem management objectives. The SSC noted that the technical guidelines for implementation of the revised NS1 guidelines are not yet available, and there is uncertainty in how they will address the guidelines.

As explained in our report on the revised NS1 Guidelines, a list of 10 non-exclusive factors and any other pertinent ones should be used for consideration of whether squids require additional conservation and management. It would be useful for the document to contain a paragraph with an explicit discussion of these factors, related to whether or not additional conservation and management is required. A conclusion that they are not required is necessary for squid to be included as an EC species.

**The SSC recommends that the document be released for public review following revision. If the Council takes action to move squids to an Ecosystem Component, the SSC requests to see catch estimates annually as part of the squid stock assessment, and requests to review a document in four years that contains both stock assessment and market information to evaluate the impacts of the amendment.**

Primary updates already made to the EA included:

- Descriptions of stock assessment methods that have been examined by the author, but not adopted by the GPT or SSC, and information why the methods were not considered an improvement to the current Tier 6 method (average catch) used for squids;
- Additional information on squid life history, how they respond to environmental changes, squid predators, and the potential for localized depletions due to predation;
- An expanded consideration of prohibited species catch (PSC) to include Pacific herring and Chinook salmon in addition to chum salmon; and
- Removal of data summaries on the amount and value of incidental catch of squids because they were no longer necessary due to changes in the NS1 guidelines.

Primary updates already made to the RIR included:

- Data from 2016 were added to tables;
- Description of how maximum retained amounts (MRAs) are calculated and enforced for the different fleets; and
- A section addressing net benefit to the Nation of both the status quo and the proposed action.

The SSC supports the conclusions in the document that current catch levels (Alternative 1) are unlikely to pose a conservation concern for squids. Biological reference points and analyses such as exploitation rates used to indicate the effects of harvest on squids are generally unreliable and there are no reliable biomass estimates for squids in the BSAI or GOA. Since the trawl survey likely underrepresents squid abundance relative to the true stock complex abundance, the exploitation estimates provided in the document are likely conservative, but are certainly based on the best available information. Observations of the species

suggest that squids are inherently highly productive, with rapid growth and maturation, and short lives. As such, it is considered unlikely that current catch levels (Alternative 1) that are constrained by both an OFL/ABC/TAC and a MRA of 20% pose a conservation concern for squids.

For the purposes of establishing whether squid require conservation and management, the SSC believes it is critical that authors justify in detail why squid catches are expected to remain similar, or increase only slightly, under Alternative 2 with no OFL/ABC/TAC. The EA states that catches of squids will likely be similar under Alternative 2 and Alternative 1, as they do not appear to be targeted in any way (i.e., likely truly incidental). Public testimony supported this interpretation, and further indicated that squid are actively avoided by the pollock fleet because they decrease processor efficiency. However, beyond relaying that squids are not targeted, the document doesn't fully justify that catches will remain similar, recognizing information is limited in this regard. On the contrary, the document states that Alternative 2 would likely relieve the adverse impact that exists on salmon and herring under Alternative 1 because vessels would not have to move to avoid locations with high squid catch. In addition, public testimony emphasized that it is very costly for fleets to avoid squids due to decreases in CPUE for pollock and other target species. Taken together, this suggests there will most likely be an increase in squid catches, but the magnitude of the potential increase is unknown. Describing the monetary incentives for the pollock fleet to avoid catching squids, such as negative operational impacts of catching and processing squids, would support the assertion that the increase in catch would be small. The magnitude of the increase is important because of the potential risk to squids and because squid are an important prey of northern fur seals (Sinclair et al., 2008, *Deep Sea Res. II: Topical Studies in Oceanography* 55(16-17):1897-1918).

To illustrate the changes in squid catch that can occur even due to small increases in retained percent squid relative to pollock, the SSC requests a sensitivity analysis showing changes in exploitation rates for a 1% and 2% increase in squid relative to pollock. The distribution of re-calculated exploitation rates should be shown for each biomass estimation method (i.e., RE, LT, 2\*RE) across all years. For example a panel of scatter plots can be produced, each panel specific to a biomass estimation method, with exploitation rate on the x-axis and year on the y-axis. On each graph, a horizontal reference line should be placed at 0.4 to illustrate the management threshold suggested in the analysis, and a line showing realized median exploitation rate for each incremental adjustment in catch (current, 1% increase, and 2% increase across years and within method). The intent is to show the relationship between small percentage increases in squid catch relative to pollock across all years, compared to the Caddy (1983) management objective.

As there will always be uncertainty in predicting levels of squid bycatch under a new alternative and there are currently no reliable indices of squid biomass, the SSC recommends editing the sentence on the bottom of page 10 from, "There appears to be no conservation issue that would necessitate reducing the MRA from the existing 20%" to, "There is insufficient information to determine whether a conservation issue exists that would necessitate reducing the MRA from the existing 20%".

When assessing the effects of the alternatives on prohibited species, the criteria listed in Table 3-22 were used for determining whether impacts were significant. It would be helpful to include the source of this table and how the criteria were developed, some description in the text of how to use the table for determining significant changes, and some mention of this table in the sentences that discuss significance in the EA sections on squid, salmon PSC, and herring PSC. In each of the EA sections, the conclusions of significance seemed contradictory to the summaries preceding them or unsupported by the information in the summaries. Mention of this table and some description to link the language in the sections with the conclusions of no significant effects would be useful.

The SSC appreciates the evaluation of impacts on herring PSC in the Initial Review draft. However, when fleet avoidance is discussed in the document, only salmon are mentioned, which is somewhat confusing. It would be helpful for clarity, if salmon and herring are both mentioned in each instance.

The herring PSC section of the EA is convoluted and would benefit from clarification. The topic sentence states that there is an impact of squids on herring PSC in the BSAI, but the supporting sentence describes the impact that avoiding herring has on squids and salmon. The support for why there will not be impacts on herring in the GOA is that there are no PSC limits, but whether there is action to establish a PSC limit is not, on its own, evidence that there is not an impact. Catches of herring in the BSAI are stated to be well below any conservation concern, but there is no benchmark for whether harvest of herring by the groundfish sector is too high other than consideration of the PSC limit, which was exceeded in 2012.

The SSC found Table 3-20, which provides the percentage range of squid in the pollock target by haul, extremely helpful for understanding the distribution of squid catch among pollock hauls. However, there is disparity between the comments made in the text describing the impacts of Options 1-3 associated with Alternative 2 and the values provided in the table. The number of hauls containing >2% squid is characterized as a “substantial number” but is, in fact, <1% of hauls in the BSAI and <2% of hauls in the GOA. Further, the number of hauls containing >10% squid is ~0.1% in the BSAI and ~0.2% in the GOA. The SSC suggests including percent of hauls in the text along with the number of hauls, and characterizing the relative occurrence of these hauls in the text as appropriate.

The SSC appreciates the inclusion of more information describing the likelihood of localized depletion of squids. The second paragraph on the top of page 36, however, seems to be in contradiction to the rest of the document. It seems to suggest that there may be localized depletion whereas the rest of the document suggests there may not be. Additional description would be helpful to reconcile the paragraph with the rest of the document or to describe how the two relate.

The current version of the RIR document made it clear that record keeping and reporting requirements would be retained for squid under all alternatives. However, the second sentence under “Alternative 2” on page 10 states that “record keeping and reporting requirements could be established for squid”. Clarification on whether record keeping and reporting is required or optional would be helpful.

While the SSC found the inclusion of squid life history and ecology information useful, the treatment of squids as important prey for the marine ecosystem was inconsistent. On page 32 squids are identified as an important prey item for birds, fish, and marine mammals, but on page 37 diet data for squid predators are identified as “highly uncertain.” The SSC recommends that the authors standardize their characterization of squid predation throughout the document, couching assumptions about dietary importance as necessary to account for data uncertainty.

In the section on the status of herring stocks, a number of edits should be made. The biomass forecast for Norton Sound in 2017 should be 31,007 mt rather than 142,453 mt (Table 3-21). For consistency and to avoid the unreferenced biomass value for Togiak Bay, the biomass forecast for Togiak Bay herring in 2017 was 142,453 mt (Table 3-21). Figure 3-16 is an older figure of herring migration modified from Barton and Wespestad (1980, Proceedings of the Alaska Herring Symposium. Alaska Sea Grant College Program Report 80-4: 27–53) that was cited in Tojo et al. (2007, Deep Sea Res. II 54(2007): 2832-2848). This figure should be replaced by the revised version presented later in that same paper and constructed by Tojo et al. (2007). The text summary describing two overwintering areas should be checked to make sure they apply to the revised migration figure rather than the old one. Due to large declines in a number of Alaska herring stocks, the description of Alaska herring as highly abundant and ubiquitous would better be described as a species that is distributed broadly throughout the state with variable abundance.

There are a number of SSC recommendations from June 2016 review that have not been addressed and the SSC requests that the authors refer to the SSC's June 2016 report and address these concerns to the extent possible. The SSC also requests the author do a thorough editorial review of the document.

## **D1 Bristol Bay Red King Crab PSC**

Diana Stram (NPFMC) presented an overview of the Bristol Bay red king crab (BBRKC) Prohibited Species Catch (PSC) discussion paper. Public testimony was provided by John Gauvin (Alaska Seafood Cooperative) and Craig Rose (FishNext Research). The discussion paper provides a brief overview of previous discussion papers, status of BBRKC, management measures in groundfish fisheries for BBRKC, available data, background on the Red King Crab Savings Area (RKCSA) and 10 NM strip, and next steps.

If the Council seeks additional development of this discussion paper to further address BBRKC PSC, then the SSC supports the CPT's request for the Council to develop a clear purpose and needs statement to frame future work and development of alternatives for analysis. Failing such a statement, benefits of additional work on this topic are somewhat doubtful. Specification of a purpose and needs statement, including a statement of objectives, will frame the appropriate analyses. For example, the Council should be clear whether the analyses should evaluate the efficacy in terms of both crab and their habitats, as indicated in Amendment 37.

Assuming that the Council's purpose and need has something to do with evaluation of the efficacy of the current PSCs for BBRKC in BSAI groundfish fisheries, as well as existing closure areas, then the SSC offers the following recommendations for further analysis.

The SSC recommends creation of two tables to help summarize the information that is available to reanalyze the existing trawl closure areas and BBRKC PSC schedule. The current discussion paper gives the impression that there is limited new information available upon which to base a new analysis. Thus, a clear summary of previously available and new information would help clarify the merits of proceeding with a reanalysis. The first table might include a list of data/information that was previously available and analyzed for the original plan amendments (e.g., Amendment 37). For each data type, additional columns in that table could indicate whether newer information is available to warrant an updated analysis (e.g., discard mortality rates). The second table might indicate any additional new information, not previously available, which could be analyzed in a new plan amendment (e.g., crab fishery logbook information on fall/winter BBRKC distributions, results of tagging work on oceanographic connectivity of crab population). This table could also indicate potential additional new analyses that could be undertaken to inform the decision process. One such analysis is an assessment of the fishery footprint changes due to rationalization and other management regulations since Amendment 37. Another is an analysis of summer bottom trawl survey data on structure-forming invertebrates at survey stations inside and outside of the RKCSA similar to McConnaughey et al. (2000, ICES J. Mar. Sci. 57: 1377-1388). A master's student of Dr. Brad Harris is working on such project. Another potential project was highlighted in the SSC report from the December 2016 meeting. Namely, the Bering Sea Fishery Research Foundation indicated interest in working with the Amendment 80 sector toward a collaborative survey conducted during the time window relevant to the flatfish fishery (late winter – early spring) that would provide critical information on the relative spatial distribution of BBRKC inside and outside existing closure areas during that time of year.

If the Council desires a full efficacy evaluation of current PSCs for BBRKC in BSAI groundfish fisheries, the following information would be helpful to a future analysis:



1. Full accounting of BBRKC bycatch including an assessment of observer subsampling-based estimates relative to whole hauling and an assessment of the large apparent increase in bycatch in the pot cod fishery,
2. Assessment and improvement of discard mortality rate estimates (e.g. validation using RAMP or other viability measures),
3. Accounting of “unobserved” mortality of BBRKC that encounter trawl gear on the seafloor, but are not captured,
4. Full accounting of all sources of fishing mortality on BBRKC (including target catch, discard mortality in crab fisheries, etc.),
5. Spatial and temporal patterns of BBRKC by sex and size composition using data from the NMFS summer survey, fall crab fisheries (i.e., observer data, logbook data), BSFRF survey, and bycatch in late winter/spring groundfish fisheries (observer data); analyses should be disaggregated into warm versus cold years, as crab molting timing and spatial distributions depend on temperature,
6. Analyses of structure-forming habitats inside and outside existing closure areas, and
7. Population impacts of PSC on adult mature male biomass, including whether the existing PSC stair step procedure based on mature female biomass is appropriate given current assessment methods.

If the Council desires to proceed, the SSC wishes to have the opportunity to comment on subsequent versions of the discussion paper as work advances.

## **D2 Stock Assessment Prioritization**

### *Overview of Stock Assessment Prioritization Process:*

Richard Methot (NOAA Fisheries) gave a brief overview of the national effort to consider stock assessment prioritization issues. He noted that the Pacific Fishery Management Council was the first to implement the task. The NPFMC and the South Atlantic Fishery Management Council are at similar stages of the process. The focus on stock prioritization addresses the Timely, Efficient, and Effective element of NOAA’s Next Generation Stock Assessment Enterprise. Guidelines for determining when stocks or stock complexes should be assessed are provided in Methot (2015) ([http://www.st.nmfs.noaa.gov/Assets/stock/documents/PrioritizingFishStockAssessments\\_FinalWeb.pdf](http://www.st.nmfs.noaa.gov/Assets/stock/documents/PrioritizingFishStockAssessments_FinalWeb.pdf)). The core elements include: stock status, biological vulnerability to fishing pressure, fishery importance, assessment information, and ecosystem importance.

Dr. Methot noted that there are several benefits of this prioritization process. He recognized that NPFMC has successfully demonstrated a capability to process a considerable number of assessments in a timely, efficient, and effective manner. He agreed that the Plan Teams’ focus on target frequency is right-minded given the current capability of assessment authors to conduct assessments. He recommended that the NPFMC should weigh the benefits of more frequent iterative improvements to the models against the possible advancements in understanding that could emerge from a less frequent, but more in-depth, evaluation of structural, parameter, management and measurement uncertainty. The guidelines (Methot, 2015) identify data types that could be compiled to assist the Councils in selecting the balance between frequently incorporating new data into stock assessments versus incorporating data into stock assessments on a less frequent basis, but allowing for expanded exploration of other model configurations including the development of multispecies, climate-enhanced, or spatially-explicit assessments, as well as studies of the performance of alternative harvest strategies (e.g., Management Strategy Evaluations) and advanced analytical methods.

Dr. Methot assured the SSC that the intent of this effort is not to re-purpose authors working on NPFMC assessments to other regions. Likewise he noted that although new data may become available (e.g., a

new survey) this alone does not constitute Best Available Scientific Information and therefore, he did not see a conflict with reducing target frequency and National Standard 2.

Review of Groundfish Plan Team Recommendations for Changes in Target Frequency:

Jim Armstrong (NPFMC) and Grant Thompson (AFSC, BSAI GPT Co-Chair) presented results of the GPT's stock assessment prioritization workshop held on January 11-12, 2017. Diana Stram (NPFMC) presented results of the CPT approach to stock prioritization.

The Plan Teams reviewed several informational documents including:

- a) The National Stock Assessment Prioritization Process (SAPP) Technical Memorandum (Methot , 2015);
- b) The AFSC white paper on options for changing NPFMC stock assessment frequency which was presented to the GPT in September 2017; and
- c) Results of an opinion poll distributed to GPT members and the authors and a statistical summary of the results.

The NPFMC decisions are currently informed by the timely delivery of stock assessment advice. Therefore, the final step described in Methot (2015) of engaging the NPFMC in ranking suites of stock assessments that should be conducted in a given year is not a critical step. Given the current timely delivery of stock assessment advice for stocks managed by the NPFMC the GPT focused their review on issues related to target frequency. **The SSC agrees that a focus on target frequency is a good approach for the NPFMC.**

The AFSC provided the GPT with summaries of the information needed to assess fishery importance, target frequency (based on estimates of mean age), ecosystem importance, and stock status (see white paper). Members of the GPT evaluated status quo relative to four alternative scenarios. Alternative scenarios were derived as modifications to the "Base Case" derived from the methods described in the Stock Assessment Prioritization Process (Methot, 2015).

In September the GPT reviewed the following scenarios:

- **Status Quo:** Current assessment frequencies, annual and biennial schedule for all groundfish stocks
- **Scenario 1 (S1):** This scenario was the "Base Case" recommended in Methot (2015): Target Frequency ( $\rho$ ) is estimated as  $\rho = \text{mean age} * \lambda$  (where the default  $\lambda = 0.5$  was applied). Then  $\rho$  was adjusted upward or downward for: +/-1 yr recruitment variability, +/- 1 yr fishery importance, +/- 1 yr ecosystem importance. In this scenario,  $\rho$  is capped at a maximum value of 10 years and a minimum value of 1 year.
- **Scenario 2 (S2):** Base Case (S1) with a maximum cap at 5 years.
- **Scenario 3 (S3):** S2 with fishery importance adjustment of +/- 2 years (using -2, -1, 0, 1, 2 based on quintiles of the fishery importance score)
- **Scenario 4 (S4):** S2 with regional scalar adjusted so that high commercial value stocks would be annual.
  - Total ex-vessel value of all the groundfish stocks was sorted.
  - "Highest Value Stocks (HVS)" were identified as the stocks in the the top 75% of the cumulative catch value (EBS pollock, BS Pacific cod, AK sablefish, and BSAI yellowfin sole).
  - $\lambda$  set to make sure that the target frequency was annual for "HVS" after having applied the standard adjustments (+/- 1 fishery, +/- 1 ecosystem, +/- 1 recruitment).  $\lambda = 0.139$ .

- **Scenario 5 (S5):** Combination of S3 and S4, fishery adjustment of +/-2 years with the regional scalar according to the high value stocks applied after taking adjustments into account. This resulted in a regional scalar of 0.209.

For the January GPT workshop, the team started their discussion with Scenario S4 as the base case. The authors and GPT members were provided the available information on Fishery Importance, Stock Status, Ecosystem Importance and Target Frequency. They then polled the authors and themselves as to their opinions on what the desirable target frequency would be for each assessment. Using the results of the poll and Scenario S4, the GPT members discussed the target frequency for each stock or stock complex and ecosystem component species group. **The SSC agreed that the process used to identify candidates for changes in target frequency was a good exercise in deriving expert opinion on an important decision for the NPFMC.**

The GPT recommended changing the target frequency for the following stocks:

- AI pollock (1y to 4y)
- Six flatfish stocks were identified as candidates for reduced assessment frequencies: Greenland Turbot (1y to 2y); BSAI other flatfish (2y to 4y); GOA shallow water flatfish (2y to 4y); GOA northern/southern rock sole (2y to 4y); GOA deepwater flatfish (2y to 4y); and GOA flathead sole (2y to 4y).
- Five non-target stocks (Squid, BSAI and GOA sculpins and BSAI and GOA grenadiers) were candidates for movement to a 4y cycle.
- Three rockfish stocks had reduced frequencies: GOA BS/RE (2y to 4y), BSAI shortraker rockfish (2y to 4y) and BSAI other rockfish (2y to 4y).
- The report did not address the forage fish complex, but it did address capelin (2y to 4y).

The SSC accepted the PTs recommendations with the following exceptions:

- The SSC did not support moving any rockfish stock or stock complex to a four-year cycle. Despite the longevity of rockfish, the SSC felt that the current two-year approach should be continued. Our rationale was that a two year cycle was needed to address the following issues: several non-target rockfish have relatively low abundance and therefore have the potential to become a “choke” species; several species have relatively high market value; several stocks show evidence of stock structure; and many stocks exhibit a patchy distribution which could result in high survey CVs and strong retrospective patterns.
- The SSC recommended that the current two-year cycle for squid assessments should be continued to evaluate the implications of the pending reclassification of this species complex as an Ecosystem Component. The SSC also requests that time trends in catch are closely monitored and are provided to the SSC on an annual basis.
- The SSC notes that the GPT did not provide a recommendation for target frequency for the forage fish complex, but it did recommend a four-year target frequency for capelin. The SSC recognizes that the MRA for forage fish is set quite low (2%) which serves as a deterrent to targeting. However, given the high turnover rate and high level of ecosystem importance, the SSC recommends that capelin is assessed as part of the forage fish assessment every two years.
- The SSC does not support the recommendation to move AI pollock to a target frequency of four years. The SSC recommends assessing this stock on a biennial time step based on the importance of this species in the ecosystem and the importance of data products derived in the assessment with respect to questions of pollock stock structure.

The SSC reviewed and accepted the GPT's recommendations for the delivery of information to the NPFMC on "off years". **Also, the SSC agreed with the GPT's recommendation that partial assessments for Tiers 1-3 should be an expanded version of the current off-year executive summaries, including catch/biomass ratios for all species in addition to re-running the projection model with updated catch information, and also including updated survey biomass trends when available (note that partial assessments for Tiers 1-3 do not involve re-running the assessment model; only the projection model). Authors would be expected to respond to Team/SSC comments during full assessments only, unless the comments pertain to features that are normally included in partial assessments.** The SSC requests that the GPTs clarify whether the catch/biomass ratios should be based on survey biomass or projected biomass. **The SSC agreed with the GPT's recommendation that partial assessments for Tiers 4-5 should be an expanded version of the current off-year executive summaries, including catch/biomass ratios for all species in addition to re-running the random effects model. Authors would be expected to respond to Team/SSC comments during full assessments only, unless the comments pertain to features that are normally included in partial assessments.**

Review of Crab Plan Team Recommendations for Changes in Target Frequency:

Diana Stram presented the CPT's discussions regarding target frequency. Given the life history characteristics and high market value of Bering Sea crab stocks, the CPT limited its discussions to options for one-, two-, or three-year assessment cycles. Given the small number of stocks under consideration for changes in target frequency, the CPT used expert opinion to rank Fishery Importance, Ecosystem Importance, Stock Status, and Target Frequency. As a test of the CPT's ability to rank Fishery Importance, they compared their Fishery Importance scores to those generated by the expert groups for groundfish as a check of their expert opinions. Their scores agreed favorably with the groundfish scores.

The CPT recommended the following target frequencies for Bering Sea crab stocks.

**Annual Assessments (status quo):**

Bristol Bay red king crab, snow crab, Tanner crab, St. Matthew Island blue king crab, Aleutian Islands golden king crab.

**Biennial:**

Pribilof Islands red king crab, Norton Sound red king crab

**Triennial:**

Pribilof Islands blue king crab, Pribilof Islands golden king crab, western Aleutian Islands red king crab

**The SSC agreed with the recommended target frequency for all stocks except for Norton Sound red king crab.** In the case of Norton Sound, the SSC requests that the State reviews the costs and benefits of changing the Target Assessment Frequency to a biennial time step.

The SSC noted that changes in target frequency could cause potential conflicts with the State harvest specifications if the State bases the Guideline Harvest Level on updated data and the Federal process does not update its information. This potential conflict would be a rare event given that the most valuable stocks will be assessed annually.

The SSC discussed what types of information should be delivered in the "off years". Dr. Stram informed the SSC that projection models are not currently utilized for Bering Sea crab stocks. The SSC recommends that the authors review the methods currently used to project groundfish stocks to evaluate what would be needed to develop a similar modeling approach for crab. As was the case for groundfish, the SSC would like to receive updated reports on the results of new NMFS and ADF&G surveys.

Dr. Stram informed the SSC that implementation of revisions to the target frequency for Bering Sea crab stocks would not occur until the 2017/18 cycle.

Other Issues and Summary:

The SSC noted that criteria should be established that could be used to trigger an “off cycle” assessment, also noting that extending the lag between assessments may result in more ‘surprises’ than have been seen in the past.

The SSC identified the following possible criteria but recognized that this is not an exhaustive list:

- Unexpected change in survey biomass or other data (perhaps implemented by a deviation of more than xx standard deviations);
- Evidence of a new environmental link to time trends in growth, recruitment, or mortality that substantially alters the estimation of biological reference points or stock status;
- Evidence of a marked change in retrospective bias or residuals that would indicate a change in productivity;
- Availability of new information on vital rates (M, maturity, growth) that alters estimation of biological reference points or stock status;
- Availability of new information on survey performance (selectivity, Q);
- Change in catch suggesting that targeting of a member of a complex is occurring;
- Evidence of stock structure and possibility of overharvest of a sub-population;
- Substantial change in catch to ABC ratio;
- Change in management regulations that would alter fishing behavior such as rationalization of GOA groundfish fisheries;
- Distributional shifts that would change catchability or types of fleet targeting the resources.

**The SSC requests that the authors and the Plan Teams develop guidelines for when an off-year assessments should be developed.**

The SSC also noted that there is a general need to address the treatment of uncertainty in the current tier system. Specific to assessment frequency, the SSC recommends an evaluation of how projected OFL-to-ABC buffers should increase in the intervening years between full assessments. This analysis should be brought forward before the changes are implemented.

The SSC agrees that the proposed change in target frequency should be considered a trial and we expect to receive an evaluation of the action in four years. The SSC recognizes that an advantage of proposed changes in target frequency is that the analysts’ time could be freed up to address four categories of stock assessment-related analytical tools:

- Development and testing of Next Generation Stock Assessment methods including: climate enhanced stock assessment models, multispecies models, and advanced analytical modeling approaches.
- Improved short- and long-term projection models to be used to evaluate the performance of alternative management strategies (e.g., MSEs). This might include evaluations of techniques to formally incorporate uncertainty based buffers for Tier 3 stocks and strategies for addressing choke species stock status including PSC caps.

- More rapid progress on innovative decision tables or decision theoretic approaches to management, including techniques for testing the utility of ensemble modeling approaches to groundfish management.
- Research to resolve specific modeling issues such as survey catchability, ideal sample sizes for core data sets.

These four categories of research illustrate the range of possible innovations that could be addressed in response to shifts in target frequency.

**The SSC recommends that a framework for evaluating the costs and benefits of changing the target frequency for the stocks identified above is needed before the changes are implemented.** This cost-benefit analysis framework would allow the NPFMC to evaluate the performance of the change in target frequency at the end of the four-year trial period. The SSC also requests a more quantitative evaluation of the potential risks of changing the target frequency of the GOA flatfish stocks to a four-year cycle. **The SSC would like to receive both the performance analysis framework and the risk assessment for GOA flatfish and crab stocks before implementing the change in target frequency.**

### **Economic SAFE**

The SSC received a report from Ben Fissel (AFSC), Alan Haynie (AFSC), Brian Garber-Yonts (AFSC) and Steve Kasperski (AFSC) on changes in the groundfish and crab Economic SAFE reports. The SSC notes that their review of these documents necessarily implies that the full documents are available prior to the meeting.

Ben Fissel presented a new set of nine indices that has been added to the executive summary of the groundfish SAFE as a Report Card, giving a broad but high-level picture of current performance relative to past performance. The SSC finds these measures to be very useful, and for the current year, they clearly and easily convey that there has been a slight reduction in groundfish performance, as represented by first wholesale value. This is largely due to reductions in the catch of flatfish and sablefish in the GOA and a reduction in wholesale prices resulting from the stronger US dollar and an abundant supply of global whitefish. The SSC suggested some additional considerations and refinements to the definition of individual indices, especially those designed to better identify whether increases in indices are due to (1) price increases for some products, (2) TAC shifts toward higher value species, or (3) processors moving toward higher-value product forms.

A plan for changing the structure of some of the tables that have been systematically reported in the SAFE was presented. The objective is to reduce the duplication of effort with data published by other agencies. While the SSC recognizes the expanding set of social and economic data, and the evolving environment for distributing them, it is imperative that download accessibility to time series of key variables is maintained, even if through links to other agency reports. The SSC also recommends that a table of annual TACs, ABCs, OFLs, and harvest by species be included in the SAFE and made available on the website.

The SSC was given a preview of a set of new Economic Performance Reports (EPRs), which add brief economic overviews to individual species' stock assessment documents. The SSC agrees that they are a good tool for introducing key economic and community information to stock assessment Plan Teams. To assure proper review, the SSC would like a presentation at the April meeting on the template for the content of these reports, and will set an annual schedule to evaluate the information that is used to populate the template, perhaps each October.

Alan Haynie presented a new analysis of the first four years of the Economic Data Report (EDR) required by Amendment 91, which has four components. First, the Vessel Master Survey captured harvesters' perspectives of annual fishing conditions and the relative importance of various salmon avoidance incentives in determining their fishing behavior. This narrative information complements vessel catch and location data, and nicely illuminates heterogeneity in attitudes and experiences within the fishery. Second, the Vessel Fuel Survey captures expenditures on fuel while transiting and fishing, which is useful for analyses of the costs of moving to avoid PSC. Third, the Compensated Transfer Report is meant to capture compensated transfers of Chinook salmon PSC quotas in order to determine the value of salmon PSC. Lastly, the logbook checkbox is meant to capture when vessel operators are moving to avoid catching salmon.

While some parts of the EDR appear to be working well, there are other components that are not performing as well as expected. For example, the Compensated Transfer Report is not proving to be useful because there are so few transfers of salmon PSC quota of the type that require reporting. In addition, the long gap between the fishing year and the survey itself may introduce recall biases in the Vessel Master Survey. Further, a vessel's numbers do not change much each from year-to-year in the Vessel Fuel Survey, and the reporting burden may be reduced by first inquiring whether the vessel changed gear, engine or processing plant since the last report. **Overall, the SSC recommends that the EDRs for Amendment 91 be reviewed in order to make revisions for improving the data collected for management purposes.**

Brian Garber-Yonts presented summaries from the upcoming release of the Crab Economic SAFE report. The major addition to the crab SAFE is a new database of individual quota ownership, mapping a morass of corporate structures that hold quota back to the people who control them. The SSC commends the effort that has gone into the identifying individual quota owners, and believes there is considerable potential to use this information in future analyses that resolve more precisely the extent of leasing activity, and the degree to which quota is being fished by people who own, rather than lease, it. The SSC recommends the groundfish SAFE consider similar analyses of trades and quota ownership. **The SSC recommends that the crab SAFE include report card indices that parallel those in the groundfish SAFE.**

Steve Kasperski presented changes to the community measures within the SAFE, in response to SSC recommendations last year. The measures aggregate across several variables, drawn from a range of NMFS, state, and federal data sources, to represent which communities are most engaged in Alaska fisheries. The SSC recognizes the AFSC has been without capacity to evolve this section, and currently has frozen vacant positions for one or two social scientists. When these essential positions are filled, it is critical to identify additional measures that capture how important fisheries are to the culture and economy of individual communities, and identify communities that are vulnerable to changes in fisheries or fishery management. These measures should be attentive to different groups within a locality, and in particular to the relationship between residents and non-residents who may be involved in fishing and processing.

Steve Kasperski presented the report from the Human Dimensions Workshop held at the AFSC in June 2016. The workshop brought together AFSC staff and collaborators with social science members of the SSC to identify how to better integrate human dimensions and economic data into the Council process. Specific needs to be addressed were to (1) understand current human dimensions data sets and initiatives; (2) assess the need for human dimensions information in current and future Council analyses/actions; (3) identify the types of human dimensions data and organizing frameworks that could go into a more comprehensive treatment of the human dimensions of North Pacific fisheries and communities; (4) evaluate options for the presentation and communication of human dimensions data and assessments (e.g., SAFE inclusion); and (5) discuss how a Social Science Plan Team (SSPT) could contribute to the

Council's process for conducting catch share program reviews and providing general guidance on social science methodologies.

The two-day workshop generated a mission statement for an SSPT, which would create an institutional structure responsible for implementing best practices developed in response to the persistent shortcomings in social science data and analysis articulated in the purpose for the workshop.

*The SSC has long expressed the desire to have more economic and social data and analyses available to assess proposed actions by the NPFMC. We are exploring the creation of a Socioeconomic Plan Team that would improve the economics and social science used in the Council process. This would occur through identification of cross-cutting needs for data and analytical frameworks that span specific management actions, provide constructive peer-review of economic and social science methods used by analysts in content provided to the Council and provide longer term guidance on how to best plan and execute analyses and data collections. This will increase the capacity to support the Council using the best data and science available and enable it to better meet its requirements under MSA.*

**The SSC concurs with the need for such a group to maintain and refine, on an ongoing basis, the human dimensions and economic data and analyses on which the Council draws.** It is important that the group's Terms of Reference (ToR) do not establish it as an additional barrier for reviewing individual regulatory analyses, but rather facilitate the presence and improvement of data and methods that advance best available science across multiple Council programs.

**The SSC recommends that the Council charge a group of SSC members, Council staff and AFSC staff with drafting a ToR for a SSPT.** The ToR should address the mission, structure, scope and meeting schedule (or conditions of convening) of the SSPT; ensure there is a need for a standing committee, as opposed to an *ad hoc* committee; and propose membership. The SSC suggests looking to the Ecosystem Plan Team for a model on which to base this structure.

## **Ensemble Modeling Workshop**

The SSC held a workshop on ensemble modeling with presentations by Rick Methot (NMFS HQ), Grant Thompson (AFSC), Allan Hicks (IPHC), and Ian Stewart (IPHC), to whom the SSC offers profuse thanks. The topic of ensemble modeling has emerged only recently and takes a different approach to handling several models in a stock assessment compared to the usual approach of selecting a single best model to set harvest specifications. In this approach, each model is assigned a weight and the weighted average of some quantity of interest is used instead of an estimate from a single model. When multiple models are fit to the same data, relative weights are computed from likelihoods of the models and the approach is called "model averaging." When weights are based on other criteria, which may range from expert opinion to measures of predictive skill, the approach is typically called "ensemble modeling." Super-ensembles derive the model weighting to combine predictions from individual models based on performance training against simulated data, to obtain the best overall prediction.

Rick Methot explained that the main advantage of ensemble modeling is the accounting of structural uncertainty or model misspecification. The selection of a "best" model masks the natural uncertainty present due to parameters being set to incorrect values (e.g., natural mortality), temporal variation in parameters, changes in processes (e.g., regime shifts, climate change), incorrect specification of processes, or too little or too much model complexity. Rick pointed out that ensemble models have been widely used in other fields (e.g., machine learning, weather prediction) and provide a way to determine the variance of decision parameters. Rick thought that models could be weighted based on their



predictive skill. He also noted that model-averaged outputs are generally less volatile than those from choosing a “best” model, but the outcome is still sensitive to the choice of models. A key disadvantage is that, due to the nonlinear processes of population dynamics, model-averaged estimates no longer obey the fundamental population dynamics equations and thus are not necessarily internally consistent.

Grant Thompson considered three different topics, the first of which dealt with the Council process. He was curious whether the Council process prohibits ensemble modeling. He found that the FMP language was broad enough to allow this, but that the SAFE guidelines may need some revision. The second topic was which models to use? If the suite of models results in a representative sample of the possible states of nature, then model averaging should work well. But if the models are far away from the possible states of nature, biased results would be obtained. The unresolvable problem is that one would never know. The third topic was an example of cross-validation with model averaging. Grant found that model averaging produced broader credible intervals than the “best” model approach, reflecting the incorporation of structural uncertainty.

Allan Hicks gave a presentation on the Pacific halibut assessment, which has used an ensemble modeling approach dating back to 2012. Considerations have included the value of natural mortality, the length of the time series, environmental effects on recruitment, data aggregation, sex-ratio, and data weighting. The 2016 assessment considers all of these sources of structural uncertainty, via: short versus long time series, crossed with coastwide versus areas-as-fleets assessments, resulting in an ensemble of 4 models. Model weighting has been equal because all models were considered plausible, and a decision table was constructed to show population status risk over a 3-year projection as an aid to the Commissioners. Allan Hicks pointed out that there is a natural connection the IPHC’s ensemble modeling approach and Management Strategy Evaluation, where the 4 ensemble models represent different potential states of nature. Hicks stated that the ensemble approach better characterized uncertainty by including structural uncertainty, but admitted the approach could overstate uncertainty with equal weighting, if there is evidence that some models are better than others. However, there are additional dimensions of uncertainty that are not included in the current set which could add appreciably to the plausible range or results.

Ian Stewart dealt with the topic of model weighting, giving his recent thoughts on the topic. He observed that weighting is an alternative to picking a “best” model and could be used in any situation where multiple models are considered. Static alternatives for model weighting include (1) range of parameter values for a parameter like natural mortality, (2) different structures, and (3) fit to key data sources such as the survey. Dynamic alternatives include weights based on (1) predictive ability and (2) retrospective performance. Stewart gave an illustration using Mohn’s rho to get dynamic weights over time. He concluded that model weighting was a lot like data weighting and is likely to be assessment-dependent. Dynamic weighting offers the advantage of an objective approach to determining model weights that would not require annual re-evaluation of weighting approaches. A key decision point is the choice of performance measure(s) to use, which may need to be stock specific in some circumstances

Tom Wilderbuer (AFSC) was a surprise guest who showed a spawner-recruit figure from one of his assessments showing about 10 possible curves. He posed the question of how he should deal with this uncertainty and whether model averaging would be appropriate.

The SSC concluded that the workshop was stimulating and a total success. Members now have a better idea of what an ensemble model is and some of its advantages and disadvantages. The SSC suggests that authors continue to explore ensemble models, but that a “go slow” approach is warranted. It was also noted that on-going research to resolve issues contributing to structural uncertainty should continue as a parallel effort. As stated by Rick Methot, protocols and best practices are needed for the implementation of ensemble models. Publications on this topic are only now beginning to emerge. As Grant Thompson

noted, methods for construction of confidence intervals and other statistics should be investigated. The SSC would like to see a ‘test case’ of how ensemble modeling works for one of our groundfish stocks. Hopefully one of our intrepid stock assessment scientists will take up the challenge!

## **NS1 Guidelines**

Erin Schnettler (NMFS HQ) gave a presentation on revised National Standard 1 guidelines, finalized in October 2016. The revised guidelines contain no additional requirements and provide additional flexibility for the Councils. The revised guidelines now contain a list of 10 factors that should be considered in determining whether a stock requires additional “conservation and management” and thus should be in the FMP. How a Council undertakes this consideration is unclear, and there are no benchmarks presented to make a determination of requiring additional conservation and management. Erin suggested that meeting one factor of the list of 10 was sufficient to bring a stock into the FMP, but it was unclear how this related to being in the Fishery or being an Ecosystem Component species, or under what conditions it could be removed from the FMP altogether. These issues should be clarified.

Furthermore, for a stock to be in the Ecosystem Component instead of the Fisheries, the stock must not need conservation and management, but keeping it in the FMP would aid one or more ecosystem objectives. The Council is considering an Amendment to move the squid species complex to the Ecosystem Component. Squids meet the first two items on the list of 10, being an important component of the marine environment and being caught in fisheries, but the expected exploitation is low relative to the assumed size and location of the stock so there is little need for additional conservation and management. Does this explanation satisfy what is suggested in the guidelines?

Though it is unlikely that the Council will need to use the new carryover provisions for leftover TAC, the SSC is curious about how the OY cap of 2,000,000 mt would affect a carryover. Even in the Gulf of Alaska, where the OY cap is not constraining, there does not seem to be utility to a carryover, as TAC can be set up to ABC. Moreover, for stocks with annual assessments, the biomass estimated in each year’s new stock assessment already includes the “uncaught” fish from the previous year.

Finally, the consideration of rebuilding time requires the determination of a minimum time ( $t_{\min}$ ) and a maximum time ( $t_{\max}$ ). Two additional options for  $t_{\max}$  are given in the revised guidelines, which previously had a single option that (1)  $t_{\max} = t_{\min} + \text{one generation}$ . These two new options are: (2)  $t_{\max} = 2 \cdot t_{\min}$  and (3)  $t_{\max} = \text{time to rebuild to } B_{\text{msy}} \text{ when fishing at } 75\% \text{ of MFMT}$ . The rationale for the two new options should be provided; in particular, option two which doubles  $t_{\min}$  seems extreme (e.g., if  $t_{\min} = 15 \text{ yr}$ ,  $t_{\max} = 30 \text{ yr}$ , a large 15 year difference).