Minutes of the Joint Plan Teams for the Groundfish
Fisheries of the Gulf of Alaska (GOA) and
Bering Sea Aleutian Islands (BSAI)

North Pacific Fishery Management Council
605 W 4th Avenue, Suite 306, Anchorage, AK 99501

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Joint Plan Teams

Administration

Introductions: The Joint meeting of the Gulf of Alaska (GOA) and Bering Sea Aleutian Islands (BSAI) Groundfish Plan Teams convened Tuesday September 18, 2018 at 9:00 AM at the Alaska Fisheries Science Center in Seattle, Washington. Introductions were made including approximately 52 attendees who were not members of the Plan Teams. New Plan Team members included Pete Hulson and Lisa Hillier on the GOA Team, and Kalei Shotwell, Lisa Hillier, and Andy Kingham (membership not yet official) on the BSAI Team.

Documents and presentations: All documents provided prior to or during the meeting as well as presentations given during the meeting were posted to the Council's Groundfish Plan Teams webpage. Adjustments to the agenda were made, and Diana Stram went over meeting logistics and assignments.

Report from the June BSAI Team workshop

The BSAI plan team organized and conducted a workshop on June 27-28, 2018 to discuss ensemble modeling and ABC adjustments. Attendance included some GOA and BSAI Team members, as well as fishery scientists and members of the public. The goal of the meeting was to develop recommendations on ensemble modeling and ABC reductions to be considered by the Joint Teams in September.

Grant Thompson presented a brief background to the workshop, provided a reminder that all of the presentations are available online, and then presented the recommendations from the workshop.

Eleven recommendations from the workshop report related to ensemble modeling were presented, and there was some discussion.

First, there was a concern for how much additional work ensemble modelling would entail, and how ensemble modeling would fit into the process. Treating an ensemble model similarly to a single assessment model is not prohibited in the NPFMC system; at least it can satisfy the FMPs. However, some modification to the review schedule may be necessary to allow time for consideration of models to include in an assessment and provide enough time for the assessment author to complete the work. Some questions asked were, "What needs to be seen in September for review of what goes into the ensemble," Can new models be added after September," and "will the SSC be able to decide what the ensemble is [composed of] in December?"

Another discussion point was related to status determination (i.e., overfished and overfishing). There are details to be worked out, and it could be difficult given the current definition of "overfished" status.

Therefore, the Joint Plan Team added a recommendation (3.4 shown below) related to status determination.

It was further noted that if there is new software for assessment projections, it should include methods to incorporate ensemble models.

Overall, the main conclusions of the workshop are that the ability to do ensemble modeling exists and there may be situations where it is reasonable and worthwhile. The eleven recommendations related to ensemble modeling are as follow, with changes made by the Joint Plan Team noted in italics.

The Joint Plan Teams endorse the following recommendations related to ensemble modeling.
1. **Assuming that some sort of model averaging is involved, an ensemble model should be treated the same as any other model (i.e., an ensemble is a "model" and should be treated as such in reference to the existing language in the FMP and SAFE report guidelines)**
2. **Continue efforts on ensemble modeling, including approaches that could be used in this year's assessment cycle**
3. **Resolve the following critical issues:**
   3.1. **Choosing and justifying members of the ensemble model**
   3.2. **Choosing among a number of available weighting schemes**
   3.3. **Justify the benefits of the added complexity resulting from moving to an ensemble model**
   3.4. *Because there are potentially many ways to determine "overfished" status with ensemble models, he specific details of determining status need to be specified.*
4. **Identify criteria for stocks amenable to ensemble modeling (e.g., fully-exploited, high model result variability)**
5. **BS Pacific cod and northern rock sole and/or yellowfin sole assessments should move forward with ensemble modeling options in the upcoming assessment cycle**
6. **Ensemble modeling seems appropriate for consideration in some NPFMC assessments but not necessarily for all assessments**
7. **For example, a good use of an ensemble model (at high levels of inclusion and complexity) would be to test current assessment methods and harvest control rules, which would help with:**
   7.1. **supporting a simple model for management purposes by showing that it compares favorably with the ensemble and**
   7.2. **improving transparency and alleviating review and model selection process at the Plan Team/SSC meetings**
8. **Candidate stocks for an ensemble model should be chosen judiciously because it will add significant workload to both assessment authors and reviewers**
9. **The process may need to be modified to allow for adequate review of model selections and weighting schemes (e.g, a CIE review may be required or additional Plan Team meeting for model selection)**
10. **Selection of models for the ensemble should be made no later than the September/October time frame and preferably earlier**
11. **If the SSC wishes to entertain ensemble models, they may need to devote more time for model review (e.g., during the February meeting)**

A presentation of the workshop recommendations related to reductions in ABC followed. It was noted that a committee was formed, led by Dr. Martin Dorn (AFSC), to develop rules for setting the ABC less than maxABC, which is reported in the next agenda item. There was a considerable amount of discussion around the seven recommendations.

The first discussion point centered around understanding the impacts of reducing the ABC, specifically how it may impact the TAC. There are some TACs that would be impacted by a reduction in the ABC, but other TACs that would not. It is important that socio-economic scientists work with assessment authors to understand the impacts. It was discussed that consideration of impacts would occur at all levels of the process, and the Plan Teams could include information to inform further discussion. However, this may be difficult to include in an annual specifications process and it was not certain when it would need to take the form of an EA in the Council process instead. Overall, understanding and considering the impacts of ABC reductions on the TACs could become a bigger issue than could be reasonably addressed by the Plan Team alone.

A further suggestion was to include a larger P*-type buffer if the assessment model does not characterize the structural uncertainty at least to the extent that an ensemble model would. The Plan Team some of the modified the workshop recommendations to make them less prescriptive and more succinct.

The Joint Plan Teams endorse the following modifications of the workshop recommendations related to reductions in ABC.
1. **Any reductions of ABC should be transparent and clearly described. Plan Teams will include a section in the Introduction to the SAFE report outlining extraordinary circumstances and major uncertainties, which could feature discussion of:**
   a. **What are potential direct and indirect biological, ecosystem, and/or socioeconomic implications of choosing an ABC below the maxABC?**
   b. **What are the current hypotheses and empirical support related to how this extraordinary circumstance has impacted the stock?**
   c. **What are possible current research priorities, including data needs and knowledge gaps to better understand the circumstances and uncertainties?**
2. **Clarify, with the SSC, the issue of the extremely high bar set for reducing the ABC for EBS Pacific cod:**
   a. **"unequivocal information justifying a further reduction"**
3. **The Joint Teams should recommend that AFSC task staff to continue to work on P* and decision theory approaches to develop uncertainty-based buffers, for example:**
   a. **Update the previous analysis using survey uncertainty to define the uncertainty to consider in a P* approach**
   b. **Determine the P* implied by a single "best model" approach and determine how different the buffer would be when using that P* with an ensemble approach.**
   c. **Consider an increase in the buffer if the estimated uncertainty from the assessment model does not capture structural uncertainty that could be estimated when using an ensemble approach.**

ABC < maxABC

Background

The BSAI Team workshop in June established a subcommittee, chaired by Martin Dorn (representing the Crab Plan Team), for the purpose of responding to the SSC's request for "identification of clear and transparent rules for defining the specific criteria to be used when adjusting the recommended ABC." Martin presented the report of the subcommittee. He began by reviewing the FMP text pertaining to setting ABC, the fourth step of which reads as follows:

> "Determine whether conditions exist that warrant setting ABC at a value lower than the maximum permissible value (such conditions may include—but are not limited to—data uncertainty, recruitment variability, and declining population trend) and, if so:
> 1. document those conditions,

2. recommend an ABC lower than the maximum permissible value, and
3. explain why the recommended value is appropriate."

Martin then introduced two general approaches that the subcommittee had reviewed and forwarded to the Joint Teams:

1. A multivariate logistic approach, with initial lists of variables and coefficient values determined by statistical analysis of previous Team recommendations (developed by Grant Thompson).
2. A risk classification approach, with initial tables of risk levels and percentage reductions determined by subjective judgment (developed by Martin Dorn and Stephani Zador).

Multivariate logistic approach

Grant presented the multivariate logistic approach, which is described in the document entitled, "Analysis of past BSAI and GOA Groundfish Plan Team recommendations to set ABC below the maximum permissible level." The statistical analysis identified a set of 25 variables that resulted in an R^2 of 0.82 for the 76 instances in which either the BSAI Team or the GOA Team recommended an ABC reduction over the course of the preceding 15 years (2003-2017). The multivariate logistic model, with coefficients constrained to be positive, forces all ABC reductions to fall within the 0-to-1 range, and the amount of the reduction always varies directly with the number of variables that apply in any given situation (i.e., a set of variables that is used to reduce ABC always results in a larger reduction than any proper subset of those variables). Variables are defined to be binary (i.e., a variable either applies in a particular situation or it does not apply). Grant emphasized that the initial lists of variables and coefficient variables are those that gave the best fit to the historical data and are not necessarily those that should guide reductions in the future, although they may provide a useful starting point for developing lists for future use.

Risk classification approach

Martin presented the risk classification approach, which is described in the document entitled, "A risk classification framework for setting the ABC less than maximum permissible level." The guiding principles for development of this framework were as follow:

- The framework should document the criteria that can be used making reductions in ABC.
- ABC reductions should be calibrated, so that a more extreme situation results in a stronger response.
- ABC reductions should be consistent, so that similar situations result in a similar response across different stock assessments.
- The framework should provide a set of guidelines or defaults (rather than inflexible rules).

Three types of considerations that could be used to support a recommended reduction were identified:

1. Assessment-related considerations—
   a. Data-inputs: biased ages, skipped surveys, lack of fishery-independent trend data
   b. Model fits: poor fits to fits to fishery or survey data, inability to simultaneously fit multiple data inputs.
   c. Model performance: poor model convergence, multiple minima in the likelihood surface, parameters hitting bounds, retrospective bias.
   d. Estimation uncertainty: poorly-estimated but influential year classes.
2. Population dynamics considerations—decreasing biomass trend, poor recent recruitment, inability of the stock to rebuild, abrupt increase or decrease in stock abundance.
3. Environmental/ecosystem considerations—adverse trends in environmental/ecosystem indicators, ecosystem model results, decreases in ecosystem productivity, decreases in prey abundance or availability, increases or increases in predator abundance or productivity.

Martin drew the Teams' attention to Table 1 in the document, which contained a draft of a risk classification matrix, with rows corresponding to four levels of concern (level 1 = normal, level 2 = substantially increased concerns, level 3 = major concern, level 4 = extreme concern) and columns corresponding to the three categories listed above.

Martin's suggestion was to equate the overall level of concern for the stock with the highest level of concern across the three categories. He then drew the Teams' attention to Table 2 in the document, which contained a draft of alternative sets of percentage reductions (columns) for each level of overall concern (rows). Martin emphasized that this draft table was for discussion purposes only, as he believes that the actual schedule of reductions should be a policy decision made by the Council.

Report of the subcommittee meeting itself

Subcommittee members offered the following comments on the multivariate logistic approach:

- Differences of opinion were expressed with respect to the level of consistency in past decisions that was revealed by the analysis.
- As emphasized in the document, the analysis considers only instances when a reduction was recommended and does not account for instances when the same conditions pertained and no buffer was applied (GOA demersal shelf rockfish is an example), implying that widespread adoption of the variables identified and the coefficients estimated by the model might increase the frequency that reductions are made.
- If this approach were to be adopted, certain variables probably should be dropped, and others could be added if deemed important.
- The approach would not be useful for situations that have not occurred previously.

Subcommittee members offered the following comments on the risk classification approach:

- The recommended range for reductions is intended as a guideline that can be deviated from if a rationale is provided. Specifying a range for the reduction would allow the life history of the stock to be considered (flatfish vs rockfish would be an example).
- If the assessment indicates a severe decline in abundance, resulting in a large reduction in ABC, it may not make sense to apply an additional buffer (e.g., GOA Pacific cod in 2017).
- Additional clarity is needed in the descriptions of risk for population dynamics considerations. Risk increases when the observed pattern is outside the bounds of normal variation. Stocks with highly variable recruitment will normally show periods of sustained population decline.
- There is no direct link between the buffer that is applied and a reduction in the risk that prompted the reduction. This is also a shortcoming of the present ad hoc approach.
- While analytical approaches are preferred, they will not be possible in all situations (particularly for environmental/ecosystem considerations), given the current state of the science.

The subcommittee also discussed the possibility of using economic considerations to reduce ABC, during which the following comments were made:

- The ABC concept is generally intended to account for scientific uncertainty rather than economic considerations.
- This is probably not the right framework for MEY considerations.
- There may be a role for consideration of transient economic factors, such as:
  - Delaying harvest to allow a year class grow to a more valuable size or weight.
  - Delaying harvest to even out variation in annual ABCs.

- ○ Supply and demand dynamics. For example, reducing harvest during a period of over-supply to allow demand to rebound.
    - ○ Considering bio-economic interactions may lead to higher long-term benefits than only considering annual TAC reductions from ABC.
- In some cases, the assessment author is ideally positioned to make a recommendation based on economic considerations (but not always).
- The subcommittee agreed that this was a promising avenue to continue exploring.

Team discussion and recommendations

During discussion of the multivariate logistic approach, individual Team members and members of the public offered the following comments:

- Many of the variables associated with past reductions should be excluded from further consideration, including variables like "none" and "precedent" that do not seem particularly compelling, but also reasons that factor into the process elsewhere, such as recruitment uncertainty (which would be more properly incorporated into standard projections).
- Grant reiterated that the list of variables he identified could serve as a starting point from which the Teams could develop their own list of variables leading to ABC reductions.
- Some variables that have been cited by the Teams as reasons to reduce ABC in the past, such as whale depredation, ended up with coefficients of zero in the analysis because they have historically co-occurred with other variables that had greater explanatory power when applied to the data, but this does not preclude the Teams from assigning non-zero coefficients in any list of coefficient values that they might develop in the future.
- The process of "winnowing" the initial list of 66 variables down to the final list used in the analysis is described thoroughly in the document.
- The approach is worthy of further consideration.

During discussion of the risk classification approach and also the report of the meeting itself, individual Team members and members of the public offered the following comments:

- Conditions under which it would be appropriate to use economic considerations in reducing ABC may not occur very often.
- It should be made clear, through the assessment process, what the maxABC is and why it is being reduced, thereby enabling members of the public to argue for setting ABC equal to maxABC on the basis of economic considerations.
- The Teams should not make TAC recommendations.
- Evaluation of proposed frameworks for making ABC reductions should include re-running the assessment models with those frameworks applied retroactively, to see what would have happened to the stocks if the proposed reductions had been applied historically.
- On the other hand, simply re-running the assessment models with retroactively applied ABC reductions will show only what would have happened given the one realization of history (year class strengths, etc.) that is available, and will not reveal the range or likelihood of outcomes that could have resulted under the prevailing magnitudes of random natural variability.
- Frameworks for making ABC reductions should aim to produce reductions in line with those that have commonly been observed in the past (e.g., 0-40%; see Figure 1 in the document on the multivariate logistic approach).
- Adopting a consistent procedure for making ABC reductions would help to avoid setting inappropriate precedents.
- The risk classification matrix (Table 1 in the document) should be forwarded to the SSC, but not the matrix of alternative reductions (Table 2 in the document).

- What problem are we trying to solve? Martin's response: Step 4 in the process described in the FMP is not being followed, and the current approach is both piecemeal and characterized by a lack of clearness and transparency.
- We are not ready to forward a recommended set of percentage reductions, which would require substantial new analysis.
- The rationales for the qualitative ratings in Table 1 should be more detailed in order to be of greatest use to the assessment authors.
- The results of the multivariate regression approach could be used as a starting point to refine the percentage reductions in Table 2 of the risk classification document.
- On the other hand, the variables in the multivariate regression approach are all binary (they either apply or they do not apply), whereas the risk classification approach requires identification of four levels of concern.
- The "Tier" column in Table 2 of the risk classification document will likely not be very useful, as buffer size does not always vary directly with Tier number (this comment was made multiple times).
- Findings from the ESP and ESR could replace the right-hand column in Table 1 of the risk classification document.
- Any new framework for making ABC reductions should be instituted initially on a trial basis.
- Both the magnitude of the concern and the uncertainty associated with the concern should be features of all items in Table 1 of the risk classification document.
- Do rules governing ABC reductions need to be applied to all stocks, even those where TAC is always well below ABC? Martin's response: Yes; the reduction needs to be documented even if it ends up being non-constraining.
- How were the percentage reductions in Table 2 of the risk classification document determined? Martin's response: For some columns, the percentage reductions increase by factors of 2 between level 2 and level 3, and by factors of 3 between levels 2 and 4. Similar (though not identical) procedures were followed in other columns. These are just a set of ideas, intended to achieve results roughly similar to what has been done in the past. They are included only as starting points for discussion and modification.
- The right-hand mode of the histogram in Figure 1 of the multivariate logistic document should be ignored, as it was largely driven by institutionally imposed rules that have since been discarded, whereas the left-hand mode more often reflects rationales that have been actively advanced by the authors.
- It might be best not to base the overall level of concern on the level identified for the ecosystem category unless it is supported by the level of concern in one or more other categories.
- Perhaps it should be necessary for at least two categories to exhibit "substantially increased concerns" before imposing an ABC reduction.
- Should stock structure be reflected in Table 1 also? Martin's response: Maybe if there are two species involved in an assessment, concern should automatically go to level 2.
- If the assessment involves multiple species but the model fits well, would it be better to associate the concern with the ecosystem category? Martin's response: The assessment's ability to determine status for each species will be murky, so the concern is more appropriately associated with the assessment category.
- In the risk classification approach, it is important that authors start with Table 1 and then proceed to Table 2; not the other way around.
- Does the risk classification approach open the door for members of the public to disagree with the author/Team/SSC regarding the appropriate levels of concern? Martin's response: Yes; this is a deliberative process in which people can disagree with each other, but in the end, rationales will have been thoroughly vetted and documented.
- The risk classification approach has much to commend it, including the fact that it highlights the value of non-binary categories.

- In the risk classification approach, would five levels of concern be better than four? Martin's response: It was a subjective decision, but four seemed like the most appropriate number.
- A hybrid approach would be to use Table 1 of the risk classification approach to determine if a reduction is necessary, then use the results of the multivariate logistic approach to determine the amount of the reduction.
- The ad hoc nature of the percentage reductions in Table 2 of the risk classification document is a concern.
- Only one column in Table 2 of the risk classification document contains ranges of reductions; use of ranges should be a standard feature of all the columns.
- In the version of Table 2 of the risk classification document that goes to the SSC, the percentages should be omitted, and replaced with a note suggesting simply that the percentages should vary directly with the level of concern.

The Teams recommend that the SSC consider the two general approaches reviewed by the subcommittee, along with the above comments made by individual Team members and members of the public during discussion, and determine whether there are aspects of either or both approaches that should be further pursued, particularly Table 1 of the risk classification document; noting that the percentage reductions in Table 2 of the risk classification document are just intended to be starting points for discussion and refinement.

The Teams commended Martin for a job well done.

ESP process update

Kalei Shotwell presented an overview of the ecosystem and socio-economic profile (ESP) and related projects. This initiative represents an effort to standardize a framework for operationalizing the integration of ecosystem and socio-economic factors within stock assessments. The Ecosystem and Socio-economic Profile (ESP) uses data collected from a large variety of national initiatives in a four-step process to generate a set of standardized products that culminate in a focused, succinct, and meaningful communication of potential drivers on a given stock. The four step ESP process creates 1) a priority list of stocks to conduct ESPs, 2) a set of metrics to grade stock vulnerabilities, 3) a set of indicators to monitor and 4) reporting templates to include in the SAFE reports and provide to fishery managers.

Where applicable, the ESP may replace the existing ecosystem considerations section described in the current Alaska Fisheries Science Center (AFSC) stock assessment and fishery evaluation (SAFE) report guidelines. Generally, these ecosystem considerations sections evaluate ecosystem effects on the stock and fishery effects on the ecosystem and provide an ecological context for the stock or stock complex. Stock assessment authors are encouraged to use indicators from the ecosystem status report (ESR) to assist with stock-specific analyses for this section.

Kalei provided an update on responses to SSC and Plan Team comments on the development of the Sablefish ESP over the past several years as well as information pertaining to on-going efforts, including upcoming workshops planned, manuscripts in development, and ESP webpages. The Plan Team and SSC have supported the development of ESPs in conjunction with lead assessment authors and have provided comments on avenues for improvements in ESP development that have been considered and addressed by the project teams.

ESP manuscripts: Three new manuscripts are being prepared on the ESPs: a baseline, enhanced metrics, and enhanced indicators. The first manuscript is focused on describing the methodology for designing a baseline ESP process and product. The intent is that this manuscript will serve as the starting point for refined development of the ESPs for any given region. The second two papers provide guidelines on how

to include the specialized metrics and indicators from process studies and long-term research projects such as IERPs.

ESP Workshop: A three-year ESP workshop project has recently been funded by the AFSC as part of the new regional work plan process. In order to implement the ESPs, a large amount of coordination is required between a diverse set of programs within the AFSC. This ESP workshop project will conduct a series of 3 annual workshops beginning in 2019 to inform and coordinate the ecosystem, economic, and stock assessment communities at the AFSC so that the recommended ESPs can be created and maintained for priority stocks.

ESP webpages: The authors are in the process of developing two new web pages to assist with communicating the ESP process and products. The first webpage will provide an overview of the ESP process, products, and workshops. Several infographics will assist with communicating the nature of the ESPs and how they connect with other aspects of the research conducted at the AFSC. The page will also contain links to ESP templates, examples of ESPs conducted at the AFSC, and potentially a GitHub page with scripts that allow for creating the baseline elements of the ESP. The AFSC Communications group will be working with the project team to develop this page. The second webpage will be designed to allow quick access to indicators specifically intended for use in the ESPs. The webpage will be designed following several commonly used oceanographic and ecosystem web pages including CoastWatch west and east coast data access pages, the California Integrated Ecosystem Assessment indicators pages, and the Bering Climate data access page.

Members of the public noted that these profiles and discussions seem to be missing a critical link to industry knowledge, which is as important as the other aspects. Kalei clarified that the socio-economic indicators are part of this whole development and will be incorporated. There was a recommendation to fold this in explicitly as a fourth node in the diagram (equivalent with stock assessment, ecosystem, and fishery management).

The following items were noted in discussion and the Teams recommended that they be referred to at the planned workshops for consideration, coordination, and development:

- Spatial footprint of different areas shown for data purposes on the webpages.
- Continued coordination with ESR and ESP development.
- Incorporating ROMS output into this framework in coordination with existing national initiatives and delivery of these outputs.
- ACLIM project coordination on projection modeling trends and defining appropriate time frames.
- Upcoming discussion papers on skipper surveys and ongoing socio-economic work.
- Continue to keep ecosystem information in context for individual stock assessment authors to query and keep the larger ecosystem context in mind in developing these.
- Continue to coordinate the myriad of individual efforts for ESR, ESP, and ongoing economic work.

SSC generic assessment requests

Grant Thompson presented the general SSC requests that were applicable to all AFSC assessments. There were four generic requests presented, including (1) balancing model complexity and goodness of fit, (2) reporting fish condition, (3) alternative projections that incorporate uncertainty in model parameters as well as uncertainty in future recruitment and that provide a distribution of future fishing mortality conditional on the point estimate of future catch, and (4) a pair of requests related to areas of assessment or ecosystem concern: 4a) use of the previous year's ESR to determine whether a severe decline in biomass, unanticipated in last year's stock assessment, is now anticipated; and 4b) determination of whether the "ESR information" is "OK" or "not OK" for each ecosystem and whether the "stock

assessment information" is "OK" or "not OK" for each stock or complex. The responses to requests 4a and 4b are to be provided in time for consideration at each year's October and December Council meetings, respectively. The presentation also included a plan for authors to respond to these requests for each of the four topics. This plan was developed by the Plan Team co-chairs, agreed to by SSMA and MESA leadership, and sent to assessment authors on June 29th.

The plan for responding to Request 1 calls for authors to pay due attention to the recommendation from the SSC's June 2018 minutes on this subject: "In the absence of strict objective guidelines, the SSC recommends that thorough documentation of model evaluation and the logical basis for changes in model complexity be provided in all cases."

The plan for responding to Request 2 conforms to the recommendation of a committee composed of all stock assessment and ESR contributors who reported fish condition last year, which was to use the "weight-length residual" method that has been featured in the ESR and last year's GOA Pacific cod assessment.

The plan for responding to Request 3 calls for SSMA and MESA leadership to relax the requirements for use of the previously standard "Proj" software and for measurement of spawning biomass at the time of peak spawning (thus enabling users of Stock Synthesis to explore the requested alternative projection methods), and tasking individuals with modifying both Proj and Tier 1 projection software so as to enable the requested alternative projection methods (with the understanding that this may not be finished in time for use in the 2018 assessments).

In regard to Request 3, a Team member suggested that Stock Synthesis does not project with parameter uncertainty and asked if the parameter uncertainty was dropped – to which Grant responded that SS projections do incorporate parameter uncertainty if run through the Hessian or MCMC. A Team member also noted that high uncertainty in parameter estimates would be a reason to lower ABC from the max ABC and noted that investigations are underway to modify projection model to account for uncertainty in numbers at age. It was also noted that the usefulness of the requested distribution of future fishing mortality conditional on the point estimate of future catch is unclear.

The plan for responding to Request 4a calls for the lead author of each assessment, no later than the summer of each year, to review the previous year's ESR and determine whether any factor or set of factors described in that ESR implies an impending severe decline in stock/complex biomass, where "severe decline" means a decline of at least 20% (or any alternative value that may be established by the SSC), and where biomass is measured as spawning biomass for Tiers 1-3 and survey biomass as smoothed by the standard Tier 5 random effects model for Tiers 4-5. The plan also describes steps to be taken in the event that an impending severe decline is indicated, as well as steps to be taken in the event that data from the current year's survey(s) corroborate or refute the indicated decline.
In regard to Request 4a, Grant noted that the documents presented for this week's Team meetings suggest that the authors' analyses of last year's ESRs did not result in any findings of impending severe decline for any stock in 2019.

The plan for responding to Request 4b includes acknowledgment of the SSC's suggestion that "implementation of these stock and ecosystem determinations will be an iterative process and will require a dialogue between the stock assessment authors, Plan Teams, ecosystem modelers, ESR editors, and the SSC." The results of the first step in this iterative process are summarized under the next agenda item

Dialogue on OK-ness of ESR and assessment information

In a series of communications, the SSC requested that "ESR information" be rated as "OK" or "not OK" for each ecosystem and that "stock assessment information" be rated as "OK" or "not OK" for each stock or complex, and that these ratings be provided at the December Council meeting in each year. (Note that this request is distinct from an accompanying SSC request for use of the previous year's ESR to determine whether a severe decline in biomass, unanticipated in last year's stock assessment, is now anticipated. The latter set of determinations is to be provided at the October Council meeting in each year. See Request 4a under previous agenda item.) The SSC stated that the ratings would be used "to aid in identifying areas of concern." The SSC further stated, "Implementation of these stock and ecosystem determinations will be an iterative process and will require a dialogue between the stock assessment authors, Plan Teams, ecosystem modelers, ESR editors, and the SSC."

Initial Team discussion revolved around what terms should be used to describe the things being rated, to avoid confusion with other ecosystem or stock status metrics. Team members noted that rating the "information" contained in the ESR and stock assessments as "OK" or "not OK" could be done but seemed inconsistent with the example criteria given by the SSC (ratio of how close a stock is to a limit or target reference point, thresholds for action concerning broad-scale ecosystem changes).

The Teams recommend that the terms "current and future ecosystem condition" and "current and future stock condition" be used in place of "ESR information" and "stock assessment information."

The Teams further discussed whether a binary rating system was appropriate (or even possible in the case of the ecosystem category) and what terminology should be used. Suggestions included "OK vs. not OK", "typical vs. atypical", "not anomalous vs. anomalous", "normal vs. unusual" and "no flag vs. flag;" no consensus was reached. Using a scaled rating system instead of a binary system was briefly considered.

While not discussed in depth, it was suggested that comparing environmental observations to the existing trend analysis in the ESR could be used in making determinations of ecosystem condition, although it was noted that some ecosystem metrics (e.g., bottom temperature) are not currently included in the ESR trend analysis. When making determinations of individual stock condition, it was suggested that stock assessment authors should have the flexibility to select rating criteria based on species-specific life history characteristics. A "not OK" determination of either ecosystem or stock condition would trigger further investigation in addition to serving as an early warning of potential severe stock decline and resulting reduction of fishing opportunity, although how this would avoid duplicating the SSC's request regarding environmental indications of impending severe stock decline was unclear (see Request 4a under previous agenda item).

SSC assessment prioritization requests

Grant Thompson presented an update of requested actions related to frequency and prioritization of stock assessments. In their February 2017 meeting, the SSC requested that the authors and the Plan Team develop guidelines for when an off-year assessment should be developed and suggested several criteria. Additionally, the SSC requested 3 actions related to changes in the frequency in assessments:

1. "Development of a framework for evaluating the costs and benefits of changing the target frequency for the affected stocks and complexes;
2. "A more quantitative evaluation of potential risks of changing the target frequency of GOA flatfish to a four-year cycle; and
3. "An evaluation of how projected OFL-to-ABC buffers should increase in the intervening years between full assessments"

In their December 2017 meeting the SSC clarified that the request for a cost-benefit analysis is intended to produce an evaluation framework to be used after a full 4-year assessment cycle is completed, and that the specific costs and benefits used in the framework should be identified right away, so that they can be recorded for use in the analysis. Several indicators of benefits and costs were suggested by the SSC.

Discussion on the criteria for conducting an off-year assessment focused on the example criteria from the SSC, with priority given to criteria that are based on information readily accessible to stock assessment scientists without requiring additional model runs.

The Team recommends that the following two criteria focused on catch and estimated survey abundance *require* an off-year assessment:

1) **A substantial and unexpected change in total catch, the spatial concentration of catch (i.e., the potential of overharvesting a subpopulation), or changes in targeting of a stock or member of a stock complex.**
2) **An unexpected major change in survey biomass.**

Additionally, the Team recommends that a non-exhaustive list of criteria that *may* prompt off-year assessments include:

1) **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;**
2) **Evidence of a marked change in retrospective bias or residuals that would indicate a change in productivity;**
3) **Availability of new information on vital rates (M, maturity, growth) that alters estimation of biological reference points or stock status;**
4) **Availability of new information on survey performance (selectivity, Q);**
5) **Evidence of stock structure;**
6) **Change in management regulations that would alter fishing behavior such as rationalization of GOA groundfish fisheries;**
7) **Distributional shifts that would change catchability or types of fleet targeting the resources.**

Discussion on the indicators to be used for the cost-benefit analysis also focused on the example indicators from the SSC. **The Team recommends that indicators of benefits to a reduction in frequency in assessments include:**

1) **Substantive improvements to the assessment.**
2) **Substantive improvements to the review and consideration of alternative treatment of the input data.**
3) **Environmentally linked assessments based on the ESP.**
4) **Development of methods for tracking progression of uncertainty.**

The Team also recommends that costs to a reduction in frequency in assessments include:

1) **Number of abrupt changes in the biological reference points and harvest specifications due to prolonged periods between assessments.**
2) **Reductions in annual productivity indices ... for use in evaluating environmental linkages or global productivity assessments.**

Identification of the methods for completing the 3 analyses required by the SSC, and of the personnel responsible for this work, are required before completion of the initial 4-year assessment cycle and will be considered by the Teams in future meetings, although the Teams would recommend input from the SSC as well.

Rationales for requests to authors

Grant Thompson discussed having the Plan Teams provide rationales for their requests to authors. Near the conclusion of the November 2017 BSAI Team meeting, an assessment author mentioned that the in-house reviewer for his assessment had suggested that Team requests to authors should always be accompanied by their respective rationales

The Team discussed this briefly and asked for it to be placed on the September 2018 agenda for the Joint Team meeting.

Pros:
1. Would help authors understand what is being requested
2. Would help Team evaluate whether the objective was accomplished

Cons:
1. Not clear that a problem exists
2. Loss of flexibility

The Team discussed this and did not think that this should be a rule per se but that both Teams should work hard to ensure that appropriate rationale and discussion is included to avoid this type of confusion.

Ecosystem climate update

Stephani Zador (AFSC, Seattle) presented the preliminary climate and oceanography update for the ecosystem status report to the joint BSAI and GOA Teams. This is a system-wide overview of the broad-scale oceanographic patterns in Alaska during winter and spring of 2017-2018. This continues the new presentation schedule implemented last year that provides the climate and oceanographic context for this year's survey results in September. At the November Plan Team, the individual Teams will receive a presentation on the ecological synthesis for each ecosystem. The current North Pacific climate highlights of the entire north Pacific in 2017 to 2018 were very similar to last year. Winter was moderate in the GOA, but there was a consistent pattern of warm sea surface temperature (SST) anomalies in the Bering Sea throughout fall 2017 through spring 2018. Persistent southwesterly winter winds across the Bering Sea in 2018 combined with warm sea temperatures delayed formation of Arctic sea ice and precluded sea ice formation in the NBS except in the most northwesterly sections towards the Gulf of Anadyr. The North Pacific atmosphere-ocean climate system was generally on the warm side during 2017-2018. There seems to be a transition occurring from a La Niña to an El Niño which is also supported by a predicted 70% chance of a weak to moderate El Niño in 2019. The Pacific Decadal Oscillation has been in a positive state for several years and moving toward a neutral state. The North Pacific Index reflects the strength of the Aleutian Low and was strongly positive early in 2018, which is somewhat common for a La Nina, but seemed stronger than expected. The North Pacific Gyre Oscillation has been in a low state for several years suggesting downwelling-favorable conditions in the Alaskan Gyre and upwelling-favorable conditions in the Alaska Coastal Current. In the eastern Bering Sea, sea ice extent in 2018 has been much reduced from the long term median, and the onset of sea ice in winter of 2017 was also delayed. Sea ice extent sets up the cold pool, and this year there is almost no cold pool, which is unprecedented in the time series.

The surface temperature for the Bering shelf survey was somewhat above average but the bottom temperature was near the maximum of the time series. In the Gulf of Alaska (GOA), the simulated winter surface currents from the PAPA trajectory index showed similar trajectories for the blob years from 2014 to 2016. In 2018, there was a slightly more northerly flow initially, but the endpoint of the trajectory was near the mean and was not indicative of increased transport or northerly shift of the Alaska Current. Eddy kinetic energy in the central and western GOA has been low in recent years, with the exception of a strong persistent eddy in 2016, but the eddy kinetic energy in this region now has returned to average. Moving west to the Aleutians, the persistent eddy in Amukta Pass has shown low kinetic energy since about 2012.

Sea surface temperature forecasts for 2019 from the national multi-model ensemble predict a continuation of the warm conditions across the North Pacific through December with a 70% chance of an El Niño. The greatest positive anomalies are in the northern Bering Sea, while northern GOA is predicted to be average. The Aleutian low is predicted to be deeper than normal in late winter 2018/2019, which implies warm weather and warm water for Alaska. No typical PDO pattern in the North Pacific because it is basically warm everywhere.

The Teams thank the contributors for the climate and oceanography update and appreciate the context this information provides for the following biological survey updates.

BS bottom trawl survey

Bob Lauth presented the 2018 groundfish bottom trawl survey results for the Eastern Bering Sea (SEBS). He noted that the bottom temperatures recorded in the trawl survey were *unusually warm.* Given the *unprecedented lack of sea ice in the Bering sea* during the 2017/2018 winter and the warm conditions, there was a substantial effort to add survey locations in the Northern Bering Sea (NBS) to this year's survey. There were logistical limitations to the survey that required fewer sampling stations in 2018 (49 stations) than were surveyed in 2010 (108 stations) and 2017 (110 stations). Time series results in the presentation were therefore standardized to the truncated survey area (158,286 km2, to correct for inter-annual bias due to data from those stations in the NBS that could not be sampled in 2018). The following summary is based on SEBS survey results (standard survey area since 1987) and NBS (truncated survey area in the Northern Bering Sea).

The surveys were conducted via two chartered vessels, the Alaska Knight and Vesteraalen. More than 200,000 length measurements were made on 40+ taxa, and more than 3,000 age structures were collected (with 2018 age readings for pollock already completed). Genetic samples, crab pathology, halibut data, and stomach samples were also collected on the survey.

Walleye pollock

The survey index of pollock biomass in the SEBS continued to decline from the recent 2014 high, with the 2018 biomass index at 3.1 mmt, representing a decrease of 35% from 2017 (4.8 mmt). The 2018 NBS pollock survey biomass index also declined 14% relative to 2017 (1.15mmt versus 1.34 mmt, respectively). The abundance index for pollock in the SEBS also declined by 30% (2018 index is 6.0 billion fish), with most fish in the 40-52 cm size range, although a pulse of 15-18 cm juvenile fish was also observed. A similar bimodal size distribution was observed in the NBS; abundance indices between 2017 and 2018 are similar (1.9 and 2.0 billion, respectively). Juvenile pollock <20 cm were more broadly distributed in the NBS in 2018 relative to 2010 and 2017, although patterns should be interpreted cautiously, as juvenile pollock are not consistently sampled by bottom-trawl gear. Adult pollock were broadly distributed across the shelf with pockets of high distribution in the Bering Strait, outer NW border and, unusually, there were also large catches in Bristol bay. Fish condition (residuals of predicted weight)

for 40-65 cm fish were lowest in the central SEBS and greatest (>6%) at the outer shelf, NBS, and near the Aleutian Islands.

Pacific cod

The survey index of Pacific cod biomass in the SEBS continued to decline in 2018, with a 21% decline in 2018 (547,000 mt) from 2017 (644,000 mt). In contrast, biomass indices in the NBS in 2018 (565,000 mt) increased 95% from 2017 (289,000 mt). Similarly, Pacific cod abundance indices in the SEBS declined 32% from 2017 to 248 million in 2018, while abundance indices in the NBS increased 78% to 244 million (as compared to 137 million in 2017). Of note, in contrast to 2017, some small juvenile cod were observed in 2018 in the NBS. Pacific cod condition residuals were similar spatially to those of pollock, with larger fish observed in the NBS, outer shelf, and near the Aleutian Islands. Juvenile 2018 Pacific cod distribution was largely restricted to a small area east of St. Lawrence and around the Pribilof islands, adult distribution was centered around St. Lawrence, St. Matthew, and a small focal concentration in Bristol bay. It was noted that fish in the NBS were largely consuming *Oplio spp.*

Yellowfin sole

At 1.9 mmt, the 2018 survey biomass index of yellow fin sole exhibited a 32% decline from 2017 (2.8 mmt), whereas there was little difference in the index for the NBS (1% increase, 373,000 mt in 2018). The abundance index also declined 32% from 9.7 billion in 2017 to 6.5 billion fish in 2018. There is evidence of some smaller fish in the SEBS. The distribution was similar to that of previous years but there were fewer fish.

Northern rock sole

Similarly, northern rock sole declined 21% in the SEBS from 1.33 mmt in 2017 to 1.05 mmt in 2018, while the NBS biomass index increased from 55,000 mt to 118,000 mt in 2018. While abundance indices of northern rock sole declined 12% to 4.63 billion fish in 2018, there is evidence of a settlement in St. Lawrence Island (and also Bristol bay) that is translating to recruitment of small fish to the population. NBS abundance indices increased 51% in 2018 (491 million) relative to 2017 (326 million).

Summary

Overall declines in biomass and abundance in the SEBS were observed over most species, concomitant with increases in biomass and abundance in the NBS in 2018. In the SEBS, the notable exceptions were arrowtooth flounder and Alaska skate; biomass and abundance indices for arrowtooth flounder increased (21% and 46%, respectively) and Alaska skate biomass remained similar to 2017 while abundance indices increased slightly (7%). A Team member noted that, while the % change between 2017 and 2018 in some species in the NBS was quite large, the relative magnitude between SEBS and NBS is still marked (e.g., Greenland turbot, where SEBS biomass is ~18 x NBS biomass).

Finally, it was reported that jellyfish increased markedly in the SEBS, especially near Unimak, with large abundances in the NEBS as well. Most species were (large Chrysaora).

Discussion / questions

There was discussion of the general appearance of fish in the survey and Bob noted that pollock across the entire shelf in 2017 looked skinny, while in 2018 this was mostly the case in the south.

There was discussion regarding model-based estimates of abundance and biomass and whether the Plan Team should develop recommendations for use of such estimates.

Given recent and projected warm conditions and recent distributional trends, the Team recommends that the NBS survey extension is conducted again in 2019 (and future years as needed) in order to support assessment estimates of fish biomass.

Acoustic-trawl surveys (EBS, Bogoslof, GOA)

Bogoslof Island survey

Denise McKelvey presented the results of the Bogoslof Island survey. The survey was conducted at the beginning of March along the northern slope area of the Aleutian Islands from Unalaska to Islands of Four Mountains. High backscatter observed in two areas – north of Samalga pass and north of Umnak pass. Five trawls were conducted, but trawling was not possible in the area of highest backscatter (Samalga pass) due to a mechanical issue with trawling gear on the Oscar Dyson. This high backscatter area was estimated to contain 66% of the total biomass. Fish sizes were pretty consistent between trawls, with most fish between 45 and 50 cm. Fish >55 cm were largely absent from the population, which differs from historic surveys. The survey typically does not see juvenile pollock (< 30cm). Fish maturity analysis showed that 82% of female fish were in spawning/spent condition, suggesting that the survey timing was a little late. Total biomass was 663k tons, a 31% increase from the previous survey (2016). For the survey time series, 2018 represents part of an increasing abundance trend since the low abundances observed in 2008-2014. The survey levels are approaching ~50% of a threshold that could trigger discussion of re-opening the Aleutian basin for international pollock fishing, although international interests in this are currently limited.

Questions:
- Historically, there were high abundances seen offshore in areas not currently surveyed. What is the plan for these areas? MACE response: More recent surveys have not seen any substantial pollock sign off the shelf. A tentative plan is to visit these deeper areas on the north end of the survey area (around Bogoslof Island) on a six year cycle, given available vessel time.

Winter GOA surveys

Sarah Stienessen presented the results of the winter GOA surveys. Surveys were done in Shumagin Islands archipelago, Sanak trough, Morzhovoi Bay, and Pavlof Bay in early February, and the Shelikof Strait and Marmot Bay in mid-March.

The shelf break just east of Chirikof Island was not surveyed this year due to reduced survey days caused by vessel mechanical issues. Abbreviated survey effort in outer bay of Marmot Bay was also due to vessel issues.

The Shumagin Islands biomass estimate was 44% lower than in 2017. Juvenile pollock were primarily seen in Shumagin trough. Adult pollock were observed in traditional locations off of Renshaw point. Sanak abundance was at historic lows, Morzhovoi Bay at similar abundances, and Pavlof Bay at roughly twice the abundance of the previous survey. Maturity evaluation showed 88% of females were in a pre-spawning state, indicating that the survey timing was appropriate.

Shelikof Strait biomass was slightly lower than in the previous year (1.3 million t), with 97% of the biomass consisting of adult pollock, assumed to belong primarily to the 2012 year class. The 2017 and 2018 estimates represent the highest biomass in Shelikof Strait since the 1980s. Fish distribution was fairly even throughout the strait, except that fewer fish were seen in the southern strait area. A CamTrawl stereo-camera system was used to estimate the length distribution of one trawl sample, with the codend left open as fish density was very high. Juvenile (< 20 cm, presumably age-1) fish were observed in deep

water in the central strait area, representing a moderate abundance for the age-1 year class relative to the time series.

The plan for next year is the same, with the addition of Kenai Bays, Prince Williams Sound, and the Chirikof area. There is a potential for survey delays due to an extensive planned repair period for the vessel.

A trawl selectivity correction was implemented for all winter GOA surveys. Specifics will be discussed by K. Williams in the GOA Team meeting on Thursday. The effect of this correction was ~2% reduction to the total biomass estimate.

Questions:
- Is there going to be any modification to the survey timing based on late arrival (spawning/spent fish) in Shelikof this year? MACE response: An earlier schedule is under consideration.
- What are the possible ramifications of survey timing issues / late arrival? MACE response: Two possible effects are fish moving out of the area following spawning, thus reducing index accuracy; and lower weight of individual fish post spawning, thus impacting the biomass estimate through lower weight at length. The latter issue can be corrected for, although the effect is small (<3%).
- How is the quality of automated length estimates using CamTrawl stereo camera? Were any POP observed during the survey? MACE response: Length comparisons show a high degree of agreement, and no significant POP fish sign was seen on survey.

Summer EBS pollock survey

Abigail McCarthy presented preliminary results of the summer EBS pollock survey. Final results will be presented in November. The survey plan was to extend the survey into the Northern EBS ("Northern extension" – NE) to detect potential shift in pollock distribution. Permission to survey the Russian EBS EEZ was not granted this year. The vessel (NOAA Ship Oscar Dyson) experienced mechanical issues which prevented complete sampling of the NE and the core survey area, with the 3 westernmost transects remaining unsurveyed. This unsurveyed area contained 5% of the total survey biomass in 2016 and 8% of the total survey biomass in 2014. 113 trawl samples taken, all of them midwater trawls in the core survey area, with a catch of 70% pollock by number. Four 83-112 bottom trawl samples were taken in the Northern extension, yielding 84% pollock by number.

Temperature measurements indicate that 2018 was a warm year, with a historical lack of the "cold pool" along the seafloor. Preliminary biomass is 1.83 million t, a 54% decline from 2016 in the core survey area. Results represent estimates from 16 m – 3 m off bottom, which is typical for a midwater survey. Approximately 7% of the total biomass was observed in the Northern extension. The decline in biomass was observed throughout the survey area, as shown by the cumulative biomass by transect, which had the same relative pattern between 2016 and 2018. Larger fish were observed in the eastern portion of the survey (mode 46 cm), slightly smaller fish in the middle shelf (mode = 42), and mixed sizes including juvenile pollock (< 35 cm, with separate modes consistent with age-1 and age-2 pollock sizes) seen in western portion of the survey.

Overall recruitment (fish < 20 cm) appears to be low compared with historical mean year class strength. A separate secondary analysis to provide an index of fish abundance in the 0.5 – 3 m zone showed similar results as 2016.

Questions:

- What is the status of the survey vessel repairs, especially in light of future survey work planned for 2019? MACE response: The vessel was already scheduled for a major drydock repair period; the added repairs may impact the winter survey schedule. Alternative platforms are being discussed, including other NOAA FSVs and charter vessels. More information on this will be available in November.
- Does the Team have any suggestions on how to deal with the missing survey data (3 western-most transects)? Responses: It may be possible to compare bottom trawl survey and acoustic survey data to fill in the gaps. An NPRB project with Stan Kotwicki to examine this question in depth is in progress.
- What was the total delay in survey due to vessel breakdowns? MACE response: Total survey downtime between legs 2 and 3 (transect 17, just west of Pribilof Islands) was 10 days.
- How do survey planners decide between alternative potential survey areas outside the core area (such as the Northern extension) in light of reductions in vessel functionality? MACE response: A survey-ending vessel breakdown occurred after completion of the NE survey lines. There was no option to complete the core area instead of the NE. A lot of planning went into deciding whether the survey should cover the Russian EBS EEZ vs. the NE, but the decision was made easier by not receiving permission to go to Russia.

EBS pollock "acoustics on vessels of opportunity, AVO" update

A short presentation was made explaining the MACE AVO (acoustics on vessels of opportunity) project, which collects acoustic data from the charter vessels conducting the EBS bottom trawl survey. Data are analyzed to provide a pollock abundance index based on acoustic backscatter and has shown good agreement observed with the biannual MACE survey data. Analysis results for this dataset are expected by late October.

EBS/NBS RPA surveys

Lauren Rogers presented the 2018 Recruitment Processes Alliance (RPA) survey results. The RPA conducts a collection of surveys throughout the Gulf of Alaska (GOA), Bering Sea (BS), and Arctic. The presentation was informational, organized around the geographic areas, and aimed to provide the basis for a dialogue regarding which data and indicators are most useful.

Field work alternates between the BS and the GOA, and while this was an "off" year for the GOA, whale and beach seine data were collected, and a survey was conducted in SEAK. Improved body condition of Humpback whales relative to last year was noted, as measured from Prince William Sound and Southeast Alaska. No calves were observed. In the eastern GOA inshore temperatures were average. There was high zooplankton density driven by small calanoid copepods while other taxa were below average density. The lipid content of these copepods increased to average or above average from last year. A Team member asked what species benefit from these copepods. Juvenile fish, including salmon and YOY groundfish, prey on small copepods. Salmon catches were low with a small uptick in juvenile Chinook salmon. There was a very poor showing of pink salmon, potentially indicating poor outward migration. Age-0 Pacific cod and pollock were present in high numbers in the Kodiak region, and Age-1 Pacific cod continue to be abundant, suggesting potential for strong 2017 and 2018 year classes.

There are a suite of surveys in the BS focused on lower trophic levels, zooplankton, forage fishes, young-of-year gadids, salmon, herring, and capelin. Temperatures were warmer and stratifications were set up later in the year than normal due to wind mixing. The spring bloom in chlorophyll started late and was consistently low across the SEBS prior to the bloom. However, zooplankton abundances were as expected in a warm spring. Small euphausiid abundances were low, as was also observed in 2015. The expectation is that large copepods will be less abundant in fall. Larval pollock appeared in good condition

with no indication of starvation. Few larval cod were surveyed in 2018. The BASIS cruise will be delayed and reduced in scope this year, so there is no information yet on fall zooplankton, age-0 pollock, energy density, etc.

Northeast BS surveys are underway. Leg 1 observations show no cold pool, with high surface temperatures. Herring, chum, and pink salmon are plentiful. Adult pollock in low numbers at least to 63 °N. Small copepods were abundant with few large copepods. Outer shelf data showed smaller age-0 pollock in relatively large densities.

Arctic ecosystem surveys are planned for next year.

Use of model-based estimates

Following the discussion on the EBS and NBS survey results, the Teams had a discussion of the use of new model-based estimates of survey biomass for all stocks. A workshop will be held next week to coordinate the progress on providing these estimates to authors for use in assessments. The Team discussed whether these estimates will be available for use in assessments during this cycle. The GOA will consider their use in the northern rockfish assessments and these are already being used in dusky rockfish. Additional information on the availability of these estimates will follow from the planned workshop.

The Teams recommend that the appropriate use, or non-use, of new model based estimates in this assessment cycle be left to individual authors' discretion. The Teams further recommend that, if an author chooses to incorporate these into the assessment, the assessment should also contain appropriate comparative models and a full set of diagnostics.

AI bottom trawl survey

Wayne Palsson gave the update for the 2018 Aleutian Island trawl survey. The survey was prosecuted according to the standard sampling protocol. Sampling was modified in only a very few (<5) stations out of the 420 total stations. Sea surface and bottom temperatures showed some interannual variability, but there were no long-term trends in temperature from the early 1990s to 2018. There is evidence of strong tidal variation in bottom temperature across the Aleutian Islands, but the survey data are not adjusted for this. Otolith sampling goals were met or nearly met for all species except Greenland turbot, rougheye rockfish, and shortraker rockfish. Survey CPUEs for most species were comparable to the 2016 survey. A few potential noteworthy results were a slight increase in sablefish biomass and a continued slow decline in Atka mackerel since 2010.

Longline survey

Chris Lunsford presented preliminary results from the 2018 longline survey which covered the Aleutian Islands and GOA. These preliminary results do not include corrections for whale depredation. Killer whale depredation was down this year in the Aleutians (compared to only Aleutian years) and has been declining since 2012, and no killer whale depredation occurred in the GOA this year. Sperm whale depredation was similar to last year.

Preliminary 2018 Relative Population Numbers (RPNs) for the following species relative to 2017 are:
- Sablefish up 8% (Alaska-wide)
- Giant grenadiers down 12% (GOA)
- Pacific halibut down 8% (BSAI), down 16% (GOA)

- Pacific cod up 53% (BSAI), down 40% (GOA)
- Rougheye and blackspotted rockfish down 31% (GOA)
- Shortraker rockfish down 15% (GOA)
- Thornyheads down 15% (GOA)
- Greenland turbot up 10%
- Arrowtooth flounder down 29% (GOA)

The decreases in the rockfish and grenadiers are within the normal variability of the species.

With respect to sablefish, the survey data continue to suggest a strong 2014 year class, and 2018 survey lengths indicate a second strong year class perhaps from 2015 or 2016. Survey catch numbers were up in the Western GOA, with larger numbers of small fish, and down in the Central and Eastern GOA, with reduced catches of large fish in all regions.

Other notable observations included the lack of the abundant pyrosomes observed in 2017 and increased vessel interactions in the West Yakutat and Central GOA.

Sablefish

Kari Fenske presented three topics in relation to the sablefish stock assessment: 1) alternative modeling approaches for fishery selectivity, 2) explorations for developing a prior on natural mortality, and 3) an update on ongoing apportionment analyses.

The last time selectivity was explored in the sablefish model was 2008. Since then, fits to some of the compositional data have degraded, resulting in both SSC and the Teams recommending re-examination of sablefish selectivities. For this analysis, the authors evaluated three groups of alternative models with varying fishery selectivity options for comparison to the current model. Four criteria were used for comparison of models: (1) data likelihood, (2) improvement of fit to the plus group, (3) parsimony and plausibility, and (4) retrospective performance. Nineteen models were presented. Time varying models all fit the data better overall and improved the plus group fit to varying degrees. However, retrospective performance for time-varying models was poor relative to the base model. The authors concluded that the inclusion of time-varying selectivity may be premature and of minimal benefit to the overall performance of the sablefish stock assessment.

The Teams discussed the apparent trends in selectivity over time and highlighted that there seem to be patterns which support time block changes in selectivity, which could be investigated further. In regard to the poor fit to the plus group, the author confirmed there are large sablefish caught in the western Aleutians by the fishery which are not captured by the survey and which are difficult for the model to resolve. A Team member also asked if the different selectivity choices that were examined had an impact on recruitment estimates. The author responded that the different options resulted in some minor reductions in the large 2014 recruitment estimate. It was noted that the effective number of parameters may be fewer than the actual number of estimated parameters because of constraints in the estimation.

Kari also provided information for developing a more informative prior distribution on natural mortality using life history-based methods and a mark-recapture estimate from the sablefish movement model. Life history estimators gave a broad range of M values and a wide empirical density, whereas the tag-recapture estimator was much more precise and similar to the current M estimated by the assessment model. The authors concluded that this new prior had a negligible effect on the stock assessment model but support its inclusion in the 2018 assessment because it is a more rigorous approach to implementing a prior on natural mortality than past practice.

Apportionment investigations included a retrospective apportionment analysis and an update on the ongoing apportionment MSE. The retrospective analysis applied twelve alternative apportionment options to ABCs from 2005-2018. This analysis helps to show some of the tradeoffs of the alternative options, and this subset of options may be selected for use in the full apportionment MSE that is under development. A timeline for the apportionment MSE was provided and preliminary results are anticipated for presentation at next year's September Plan Team meetings. The authors continue to recommend the static apportionment method that has been used recently in the sablefish assessment while also presenting the apportionment corresponding to the previously used method for reference.

The Teams recommend continued investigations on selectivity.

There was concern about moving forward with time-varying or alternative selectivity forms if the models have poor retrospective performance, but it was noted that eliminating models based solely on retrospective performance is not recommended. The several potentially large incoming year classes may have an effect on fishery selectivity and result in temporary biases in estimates of mortality-at-age. If the authors can identify selectivity functions that make improvements over the base model, they should present new models at that time.

The Teams agree with the authors' recommendation to use the newly derived M prior distribution.

The Teams recommend continued development of the apportionment MSE.

Sharks

Cindy Tribuzio gave a presentation on Pacific Sleeper Sharks (PSS), which are one of the most data-poor/data-limited populations being assessed in Alaska waters. There are hurdles in establishing a meaningful estimation of catch, particularly by weight. However, there are a number of research projects either in the pilot stage or currently being implemented to increase the data available for assessing the population(s) of PSS.

Some of the research projects being initiated or in progress are: a pilot study on age determination methods, a spatial analysis to examine catch location/time/depth/temp/haul duration, etc., as some hauls can catch hundreds of small PSS. Additionally, discard mortalities are being examined through tagging and blood work, and data limited analysis methods are being examined. An observer special project was started to explore fish size and weight estimates. Since most large PSS are not brought over the rail on longline vessels, and are therefore unavailable to be weighed, the weights that are allocated to PSS via the catch accounting system are biased low, sometimes substantially. One method to alleviate this issue would be to assess the population based upon numbers, but this has its own issues, not the least of which is that all other stock assessments are based upon weight. Therefore, work continues to try and improve estimates of catch by weight for PSS, particularly as electronic monitoring becomes more prevalent and less direct measurements become available. The author expressed the need to prioritize data-limited assessments in general so that issues such as these can be further investigated.

The Teams encourage continued exploration of utilizing data limited methods for this assessment.

Observer Program update

Craig Faunce provided a summary of the 2017 annual report, a preliminary review of 2018 observer coverage, and the draft Annual Deployment Plan for 2019. The Observer Program is employing optimal allocations of partial observer coverage while balancing information needed for in-season management and the Council's focus on PSC. Craig reported that the 2019 fishery monitoring program is likely to

provide minimum acceptable coverage rates for the observer program in all strata, with the possibility of missing tender strata with low fishing effort. Concerns for the future partial coverage portions of the fleet are that fee revenues are decreasing, program costs are increasing, and there are no federal funds. Therefore, the partial coverage program will need to be reduced in 2021 or secure additional funding. For 2019, for the partial coverage program, NMFS is recommending a 15% rate for all strata. The Council will be asked to recommend allocating the optimized days with crab PSC included or not included. With crab PSC included, more areas will be covered; and without crab PSC, trawl gear catcher vessels will receive increased coverage.

Craig also reported that Electronic Monitoring (EM) is not expected to expand much in 2019 unless outside funds are secured. Currently, fixed gear (longline and pot) EM is 141 vessels and is approved to expand up to 165 vessels. NMFS and the Council are now looking at moving trawl gear into an EM compliance-type situation. This is important to understand because no biological data come from EM vessels.

The Plan Team supports the NMFS recommendation for a proposed Plan Team subgroup (Cindy Tribuzio, Pete Hulson, Craig Faunce, and Sandra Lowe) to address biological data needed for different stock assessments, noting that a qualitative description of the importance of this data is acceptable, and that information on spatial and temporal distribution is critical.

Halibut DMRs

Jim Armstrong provided an overview of the Halibut DMR Working Group recommendations for specifying 2019 DMRs. Starting in 2016, the fishery definitions for DMR estimates and application transitioned from species composition to vessel/gear operational characteristics causatively linked to halibut mortality. A reduced reference period (2-3 years) is used now in the estimation in lieu of the longer (10 year) reference period to better incentivize improvement in halibut handling practices.

The estimation process uses weighted averages of halibut mortality (condition data) to expand estimated DMRs from the sample to the haul, trip, and fishery following the sampling hierarchy. All computations are completed within each sampling stratum (full coverage, gear-specific partial coverage, and EM) before estimates are combined across the strata to produce final DMR estimates.

Some improvements since last year include better identifying Rockfish Program trips in the dataset. This has resulted in some changes to the estimated values throughout the times series. Halibut condition data from the halibut deck-sorting EFP (Amendment 80 CP trawl) were excluded from the data summaries. This is due to the lower post-capture mortality of halibut sorted on-deck than halibut recovered during observer sampling in the factory. These data are not appropriate for DMR estimates that would be applied to non-EFP CPs.

EM data are not being used in the estimated DMRs for 2019. EM data from 2018 may be used in future DMR estimates; however, the Fisheries Monitoring and Assessment Division is also considering eliminating assessments of halibut condition (injury and viability) from EM vessels until there are EM-specific condition keys for reviewers. This is because it is time-consuming and yet often still results in an "unidentified" condition because the reviewer can't see both sides of the fish or can't determine a key condition criterion. EM reviewers would continue to document release method and any mishandling of halibut that would affect their condition (e.g., gaffing, lifting by the caudal peduncle, etc.).

Some future directions include completion of an IPHC study on halibut release methods, increased use of EM and understanding the implications thereof, regulatory deck sorting requirements, and improved basis studies for DMRs.

The Teams recommend the use of the current estimation methods, including the combined groupings and the 2-year reference period (2016-2017) as well as the average of the most recent 2 years (2015, 2017) for BSAI hook-and-line CVs for estimating DMRs for the 2019 fishing year.

Economic SAFE report

Ben Fissel of AFSC presented the September draft of the Economic SAFE Report. The Report updates available economic information for 2017; as always there is a one-year delay in economic data. Ben showed a summary of the principal data tables, noting they were updated / changed last year but that this year is the same as last year. Ben provided a brief summary of groundfish economic activity. Catch was stable in 2017 compared to 2016 and there was an increase in wholesale value of Alaska groundfish (up 4% to $2.52 billion) and ex-vessel value (up 7% to $949 million). Additional updates and several new sections will be added in the November SAFE. All data tables are currently accessible to AFSC and will be open to all in November but can also be requested from Ben.

Ben noted that there were economic performance reports (EPR) for 10 species last year, and these will be updated for 2017 by early October. Several Team members made positive comments on how easy it is to access and use the EPRs and the Economics SAFE in general. Ben commented that he has received positive feedback from diverse users on the EPRs. He welcomes additional input at any time. The Teams had some brief discussion and questions of how the EPRs and ecosystem and socio-economic profiles (ESPs) may go together in the future. Ben noted that he contributed to the sablefish ESP and that this is expected to evolve over the next year across species and the Plan Team will be able to weigh in.

After Ben's presentation, Steve Kasperski commented on the Council's Social Science Planning Team (SSPT), which held its first meeting this year. Steve commented that the SSPT is potentially available to provide input on different issues related to long-term planning of how to use socioeconomic data. Kalei Shotwell noted that input from the SSPT on the ESP would be useful. Alan Haynie also informed the Teams that he and Allan Hicks have followed up on last year's presentation on a potential survey of Pacific cod harvesters to gather their insights on historical and current fishing conditions. Some conversations with members of industry and survey design specialists suggest that a structured interview process would be valuable, although a survey provides broader coverage. Alan noted that recent distributional shifts make such a survey and/or interviews of potentially greater value than before, and that they will continue this undertaking.

BSAI Plan Team

Policy for off-cycle assessments

The Team discussed their previous policy not to take up any assessments brought forward in an off-year for reasons other than "an immediate conservation concern."

The Team chose to rescind its policy for off-cycle assessments in light of the Joint Team discussion on this topic and instead refer to the new Joint Team policy (see Joint Plan Team Report).

EBS Pollock

Jim Ianelli presented a report this year's EBS pollock fishery to date, and briefly discussed plans for this year's assessment.

The A-season catch has accumulated faster (measured against A-season time fishing) in 2018 than in previous years, and the geographic pattern of A-season fishing seems to be different (more concentrated in the southeast) than in the previous 3 years. The B-season catch is accumulating at an intermediate rate relative to previous years; and the geographic pattern of B-season fishing is quite different than in 2017, with catch more evenly spread out along the shelf edge (higher concentration in the northwest than 2017).

New data for the 2018 assessment includes the following:

- 2018 EBS bottom trawl
  - Plus NBS?
- 2 years of AVO
- 2018 acoustic trawl
  - Note that this year's data are somewhat compromised due to a lag in middle part of survey, and missing an important subarea; options for addressing this include:
    - Re-district index to identical coverage
    - Calibrate on the basis of the relative proportion of biomass from the missing area in other survey years
    - Ignore missing area and inflate variance for 2018
- 2017 fishery age and weight compositions

Assessment plans for this year focus on configuring the model to deal with the NBS component of the stock. The NBS component is implicitly included in the model now as a random effect on EBS survey catchability, without linking to the NBS data themselves, but Jim plans to explore a model with explicit movement between areas, which would require inclusion of the NBS data.

During discussion, individual Team members and members of the public offered the following comments:

- Some fishery participants have encountered sablefish in depths of 30-60 fathoms at a higher rate than ever before.
- How is genetic research progressing? Jim's response: We are getting more samples from the Bogoslof survey, but these have not been processed.
- Does movement into the NBS bias the model; is it "cryptic" biomass? Jim: The assessment model features time-varying Q, which captures this to some extent.
- Then do we need to include the NBS, or is it already handled adequately? Jim's response: Previous experience with catches from Russian waters may be instructive in this regard. When Russian catch was added to the model, it made the biomass bigger, so including Russian catches was not necessarily a precautionary step. Inclusion of data from the NBS might produce a similar result.
- Is the NBS a "sink?" Jim's response: The spawning contribution of the NBS fish is unknown, but the EBS data in previous years have sometimes indicated the presence of more fish than expected at older ages, which, in hindsight, may have been NBS coming back to the EBS.
- Would it be advisable to present two models, one with NBS data and one without? Jim's response: Including the NBS data will likely prove difficult, as they seem to imply that the proportion of the biomass residing in the NBS varies significantly over time.
- For years where no survey was conducted in the NBS, has there been a careful examination of the spatial distribution of fish within the EBS survey area, which might suggest that fish are spilling into the NBS? Bob Lauth's response: The problem with the NBS surveys prior to 2010 are that they: 1) are hard to compare, 2) focus mostly on Norton Sound, and 3) pollock and Pacific cod abundances appear to be low in those years. In the EBS survey, we typically have not seen large abundances up near the NBS border.

- Perhaps it would be possible to interpolate the trend between 2010 and 2017, bracketed for uncertainty; maybe with autocorrelated Q, resulting in the extra variance being autocorrelated.
- Will the Team see new models in Novembers? Jim's response: One idea would be to add the NBS and EBS biomasses together for 2017-18 only; it is not clear that this would count as a new model.
- Is there much catch in the NBS? Jim's response: There is a little catch of Pacific cod, but very little pollock.
- A recent survey in the Chukchi Sea showed mostly larval Arctic cod.
- What should be done about the 3 tracklines missing from this year's acoustic survey, given that a big portion of the fishery occurred in the missing tracks? Chris Wilson's response: The AVO data can be used to supplement the acoustic survey in the missing area; there are a number of things that can be done to fill in the blank.
- The NBS BASIS data are available for all years missed by the NBS bottom trawl survey, but only to depths of 70 m.

The Team recommends that the information content of the movement data from all available studies be evaluated, and that, if the information content is found to be significant, methods be developed that would allow them to be integrated.

The Team recommends that the author consider including a model in which the data from the EBS and NBS surveys are added together, with appropriate weighting of the variances.

Flatfish CIE review

Tom Wilderbuer (AFSC, Seattle) presented an overview of the spring 2018 Center of Independent Experts (CIE) review of BSAI yellowfin sole, northern rock sole, and Alaska plaice. Reviewers were Dr. Joseph Powers, Dr. Yan Jiao, and Dr. Matthew Cieri, with several participants from AFSC and council staff, along with an industry representative. Many participants gave presentations.

Terms of reference (TOR) for the CIE were reviewed and then a summary was provided on the recommendations for each species.

TOR 1: Evaluate the strengths and weaknesses of the assumptions made in applying the stock assessment model, including how survey indices are scaled to the populations. Specifics might include the following: How natural mortality estimates are estimated/applied, assumptions about survey "catchability", application of fishery and survey age-specific schedules (maturity, body mass, selectivity), and the application (or lack thereof) of a stock-recruitment relationship (and associated parameter estimates).

TOR 2: Evaluate the stock assessment approach used focusing specifically on how fisheries and survey data are compiled and used to assess the stock status relative to stated management objectives under the Bering Sea and Aleutian Islands Fishery Management Plan (FMP) and the Magnuson-Stevens Act requirements. Elements should consider the following: the FMP "Tier" designation, fishing rate estimation relative to overfishing definitions, stock status determinations relative to BMSY, and recommendations as to how assessment data and/or models could be improved.

For yellowfin sole, recommendations included the following: examining sex-specific natural mortality and the uncertainty around those estimates, use the new formulation of catchability that includes the start date and the interaction term that was presented at the meeting, continue to conduct research on effects of temperature on catchability, investigate a free-floating catchability estimate, check that patterns in fishery selectivity match patterns in growth variability, and state the reason why the Ricker model is used and why over-compensation occurs at high stock sizes relative to the Beverton-Holt model.

For northern rock sole, recommendations included the following: use a model run with M estimated for both sexes and explore the uncertainty in M (reviewer recommendations differed on this point), explore free-floating catchability and the rationale for using fixed catchability at 1.5 versus 1.4 (reviewer recommendations differed on this point also), check that patterns in fishery selectivity match patterns in growth variability, review difference in weight at age versus length at age, and state the reason why the Ricker model is used and why over-compensation occurs at high stock sizes relative to the Beverton-Holt model (reviewer recommendations differed on this point also).

There was a question from the audience concerning use of excluders. Could the time series of fishery selectivity be divided into a series of blocks to account for this gear change?

For Alaska plaice, recommendations included the following: vary estimating natural mortality and catchability and estimate both if possible (reviewer recommendations differed on this point also).

In general, issues raised in the review regarding methods and alternative approaches were inconsequential in terms of status determination, as all reviewers agreed with the current tier designations and status determination. Some concern was raised that specifying yellowfin sole as Tier 1 was implying that more is known about the stock-recruitment relationship than is supported by the data.

The Plan Team noted there were clear contradictions in the reviewers' recommendations and asked how this would be dealt with for the CIE response. Tom then presented a summary of short-term requests that were satisfied within the week of the CIE and then longer-term requests that will be considered in future research efforts. Five models were presented for yellowfin sole during the meeting that examined constant fishery selectivity, starting the model in 1982, and sex-specific natural mortality. Generally, the new models fit similarly and also better captured the cold 1999 year, with the exception of the shorter time series model. Two models were presented for northern rock sole during the meeting that examined the posterior marginal distribution of the base model and estimating sex-specific natural mortality. The posterior distribution of BMSY was wider in the base model than when estimating male natural mortality. This model was explored further in the ensemble modeling effort presented by Jim Ianelli (see concluding paragraphs in this section).

Tom also presented the proposed alternative model for the yellowfin sole assessment that will add survey start date and the interaction term with temperature to the catchability equation. He showed the fit to survey biomass for the current model, the start date model, and the start date with interaction term model. This work is part of a submitted (and "almost accepted") manuscript. One comment from the manuscript review questioned whether the interaction term was needed. This question may have arisen because the interaction term was not very large. Tom suggested that this will be his recommended new base model in November, noting that the addition of the start date and interaction term does not change the results from the base model appreciably.

The Team recommended that the new yellowfin sole model with the start date and interaction term be presented in November. The Team also suggested including information on the proposed mechanism that underlies the inclusion of the start date and the interaction term in the model.

Jim Ianelli (AFSC, Seattle) gave a presentation on creating an ensemble model for northern rock sole. The northern rock sole assessment is on a two-year frequency assessment cycle and the last full assessment was in 2016. The potential for considering an ensemble model for northern rock sole has been in development for several years. Ten models were explored but only two models plus the base model were put forward for consideration, both individually and as an ensemble.

The current base model estimates survey catchability with a fairly informative prior (mean = 1.5, CV of 5%) while natural mortality has historically been fixed at 0.15 for both sexes. The alternative presented was to estimate male natural mortality, with female natural mortality fixed at 0.15. Another model built off this was to estimate survey catchability with a diffuse prior. Additional models were tried, such as estimating natural mortality for both sexes, but were excluded from further consideration because they had little effect and the worry was that they would end up "over-weighting" one or more of the plausible alternatives. Comparisons of the two new models to the base model show that survey selectivity of all three models was fairly similar, for both males and females (both specified to be asymptotic).

Given the nearly equal number of parameters between the three models, comparisons of the negative log-posteriors (from MCMC output) was used to gauge relative fit. Overall, both alternative models fit the data equally well, and better than the base model, with improved fit for the fishery age composition data and the survey index. However, the base model fit the survey age composition data better. The authors explored the reason for the better fit to the survey age composition data and found that there is an initial age composition that varies by sex (differs from 50:50). The base model fits the initial fishery age composition data poorly because the fishery targets females (for roe). Considering a sex-specific "offset" for selectivity would seem appropriate (presently females and males have the same asymptotic selectivity). Jim showed that survey catchability and natural mortality where less confounded when only male natural mortality was freely estimated but became more confounded when both male and female natural mortality were estimated. The distributions of female spawning biomass, age 7+ biomass, and FMSY, across the three models were also compared. The authors then provided several MCMC-derived outputs for all the models and compared that to the mean point estimates. They concluded that they have followed some of the recommendations from the ensemble modeling workshop.

Team discussion made note of the difference between judging alternative models based on goodness of fit (and then picking one) versus constructing a set that included more structural (but plausible) differences. The selected ensemble here seemed to consist mainly of nested models, and a broader set of alternatives might be preferred.

The Team concluded that this exercise was beneficial as an initial step to begin reviewing a proposed ensemble.

The Team recommended that the northern rock sole ensemble be presented in November and also asked that the authors consider an additional model alternative involving an offset on selectivity to account for the unequal sex ratio.

BSAI Atka mackerel

Sandra Lowe presented her response to 6 of 8 items the Plan Team and the SSC had previously recommended that she evaluate regarding the BSAI Atka assessment. Each item is listed below, followed by the results presented by the author and the associated Plan Team discussion points and recommendations:

- *Investigate which parameters (including derived quantities) are changing in the retrospective peels that might contribute to the relationship between historical scale and number of peels:*
    - This investigation seems to indicate that the model is prevented from fitting the 2012 and 2016 large drops in survey biomass. The author feels that the retrospective bias is due to the data rather than any problems with the model. The model is trying to rectify these points. There was discussion within the Team regarding the validity of this; no recommendations were made.

- *Consider dropping the 1986 age composition from the analysis, to be consistent with the policy of not using pre-1991 survey data:*
  - The author performed simulations both with and without the 1986 survey age data.
  - This showed no real benefit to including 1986 age data.
  - There is also an inconsistency, because the assessment excludes the 1986 survey index, while it includes the 1986 age data.
  - The author proposed to exclude the 1986 survey age data from future assessments.

The Team endorsed the author's proposal to exclude the 1986 survey age data from future assessments.

- *Improve documentation for the process of using Francis weights to tune the constraint governing the amount of time variability in fishery selectivity:*
  - This was skipped in the presentation, but the author noted it is in the supporting document.
- *Continue to investigate fishery selectivity time blocks, with blocks linked to identifiable changes in the fishery:*
  - Additional time blocks were added to the model and compared to previous runs.
  - Addition of the 1999-2010 Steller sea lion regulation time block resulted in degradation of fit to the fishery age comps and tended to obscure significant recruitment events
  - The author noted that she is not a fan of time blocks, and that implementing time blocks would require downweighting the age composition data which may also miss age-specific targeting.
  - There was discussion among the Team and industry representatives regarding how area closures and fish size can dictate where and how fishing occurs. TACs do not always follow the apportionment from the survey.
  - The author noted that she will not pursue time blocks, unless the Team or SSC requests that they be implemented to replace annually varying selectivity with constraints as in Model 16.0b.
- *Evaluate the sensitivity of model results to an assumed average sample size of 100 for the fishery age composition data, or better yet (if possible), find a way to tune the sample size and the constraint governing the amount of time variability in fishery selectivity simultaneously:*
  - The author showed the results of simulations changing the sample sizes to 50 (half) and 200 (double).
  - Results were as expected in degree of fishery selectivity variability and also recruitment estimates.
  - A Team member noted that it is hard to say why one sample size is better than another. The Team member was reluctant to pick the one in the middle just because it's in the middle (i.e., if you used 25, 50, and 100, then 50 would be the best). The author responded that the 100 value is consistent with the level of observer effort and tows sampled. A suggestion was made to look at some recent methods for statistically estimating the upper limit for the sample size; however, this was not officially recommended by the Team. The author acknowledged that the sample size selection is a research priority and will continue to explore this issue. The author will continue to assume a mean sample size of 100 for the time period of observer data (1991-2017).
- *Continue the investigation of age-dependent natural mortality:*
  - Three established methods were used to evaluate this.
  - Largest impact is on ages 1-2
  - Minor increases in ABC and OFL resulted. This was clarified as being only 1 year out.
  - Results did not indicate clearly that age-specific natural mortality is an improvement as ages 1-2 are not selected and have very little impact on stock dynamics

○ A request was made by an industry participant to examine the change in age composition of the catch before and after the 4-year fishery closure in 543. The author noted the request; however, no recommendation was made.
○ The author suggests continuing with the current accepted model (Model 16.0b) with the assumption of fixed constant M=0.3.

BSAI BS/RE spatial issues

Paul Spencer provided an overview of options for modeling the BSAI blackspotted/rougheye (BS/RE) stock complex. This is scheduled for a full assessment in November. The options are provided in response to an SSC request to reevaluate the spatial area for the modeled stock; currently, the model is applied to a BSAI-wide stock with a single fishery and two survey indices (Aleutian Islands survey and eastern Bering Sea slope survey).

Paul noted issues with the 2016 model, including inconsistencies in year class strength between the EBS slope survey and AI trawl survey age compositions, uncertainty in the availability of the BSAI population to each survey, age and length composition data not consistent with the time series of Aleutian Island survey biomass estimates, and that projected population trends are based on relatively uncertain estimates of recent year classes.

There was discussion regarding the differences in the estimated scale of the population between assessment years that can occur as new age and length composition data become available. Neither the AI nor slope survey covers the whole distribution of the stock. The areas are treated as separate indices and independently fitted. Paul examined the methodology applied in some BSAI flatfish assessments (Greenland turbot, arrowtooth flounder and Kamchatka flounder) for determining the availability of the stock within a given survey area, which is a component of survey catchability. As in the BSAI blackspotted/rougheye assessment, these assessments generally use the proportions of the combined survey biomass across the various surveys conducted in non-overlapping areas, either as a fixed value or as informing a Bayesian prior for catchability (q). The need to specify a prior distribution for survey catchability would be not be necessary if it could be reasonably estimated; however, the estimates for q obtained without prior distributions in the BSAI blackspotted/rougheye models seemed implausible.

Paul provided an overview of a stepwise analysis designed to examine the influence of each type of age and length composition data on the fit to the survey biomass time series. Age and length composition data degrade the fit to survey biomass in the AI while improving the fit to the Bering Sea slope data. There was discussion of combining these into a single index in order to address conflicting trends, but this is complicated by the fact that surveys are done in different years, with different designs and gear, and applied in different bottom habitats; thus, combining them may not be appropriate.

The Team discussed the number of otoliths collected versus the number read. Paul noted that while there are some otoliths from previous years that could still be read, the priority is currently low as compared with other priorities of the age and growth lab. A suggestion was made to shift observer sampling to better cover the relative distribution of the BS/RE stock.

The Team discussed the potential to explore a two area vs one area model. One suggestion was to explore a nested submodel in lieu of two separate areas. There was further discussion of issues related to movement and assumptions thereof, with a suggestion to use time-varying recruitment proportions with no movement between areas as a compromise to migration. However, spatial subdivision of the data is complicated by the sparsity of the data in the eastern Bering Sea once the areas are split. Additionally, the current assessment model is applied to a two-species complex consisting of blackspotted rockfish and rougheye rockfish. Whereas genetic studies have indicated that rougheye rockfish are rare in the Aleutian

Islands (thus, the "complex" consists of only blackspotted rockfish in this area), both species are present along the eastern Bering Sea slope. Development of a BSAI-wide model entails combining two areas that have different proportions of the two species in the complex, which may account for some of the differences in the composition data between the EBS and AI.

Paul proposed evaluation of the following alternatives for the November 2018, Plan Team meeting: (1) current BSAI model (employed since 2016); (2) combination of an age-structured model for the AI with a Tier 5 approach for the BS; (3) Tier 5 considerations for both areas.

The Team recommends the author move forward with these suggested approaches for the November assessment. The Team also recommends consideration of a two area approach as outlined above in the future (i.e., beyond 2018).

Finally, the Team notes that other assessments exist in which multiple species are combined within an age-structured assessment model (e.g., flathead sole and Bering flounder), and identifying best assessment practices for these situations was the focus of a recent (unfunded) research proposal.

The Team recommends that AFSC assessment scientists continue to pursue research on mixed-stock assessment techniques.

Arrowtooth flounder CIE review

Ingrid Spies developed new models that addressed the comments about the arrowtooth flounder assessment from the BSAI Plan Team and the SSC in November and December of 2016 and the CIE review in the spring of 2017. This was done in response to the Joint Teams' request from September of 2017 for a document outlining the author's plans for addressing the CIE reviewers' comments. All of the new models used a smooth length-age matrix as requested by the Plan Team and SSC. Weight-at-age was calculated from length using the fitted length-weight relationship.

Model 18.0 used length-based rather than age-based selectivity for all three surveys so that females and males could be combined. Model 18.1 was the same as 18.0 except that it incorporated a two-parameter logistic selectivity by sex and age for the fishery. Model 18.2 was the same as 18.0 except that it included an ageing error matrix. All three of these models improved the survey age and length, but not biomass, likelihoods.

The CIE review wanted size-based estimates of natural mortality. Lorenzen natural mortality was used in Model 18.4 and Gislason natural mortality was used in Model 18.5. These models did not converge and resulted in poor fits to the age data for the EBS shelf survey.
Model 18.3 was the same as 18.0 except that it included an ageing error matrix. Model 18.6 was similar to 18.0 except that it incorporated length-based survey selectivity, non-parametric fishery selectivity, and an ageing error matrix. The models with the ageing error matrix produced better results than those that examined size-based natural mortality. Models 18.3 and 18.6 are preferred by the author, who plans to bring this forward, together with the base model (15.1b), in November.

The CIE review requested investigation of other ways to integrate the three surveys. Ingrid presented two models (not included in the assessment document) that addressed this. Model 18.7 applied to the EBS shelf and slope only, and Model 18.8 applied to the AI only. These models indicated changes in proportions among the areas, with a large increase in the Aleutian Islands and lowered proportions in the EBS shelf and slope compared to the base model.

The Plan Team recommends more investigation of Models 18.7 and 18.8, but not for November 2018. An ageing error matrix should be included.

Northern Bering Sea Pacific cod genetics

Ingrid Spies provided a summary of a newly completed project on genetic stock structure of Pacific cod (P cod) in the Northern Bering Sea (NBS). The impetus of this study was the marked change in abundance of P cod in the NBS trawl surveys between 2010 and 2017. Data were collected from 68 individuals just to the west of Norton Sound. These samples were then compared with previously collected and analyzed samples from Prince William Sound, Kodiak, Unimak Pass, Adak, Pribilofs, and Pervenets. Results showed very clearly that the NBS samples were from the same population as the samples from the other Bering Sea areas (Unimak, Pribilofs, and Pervenets) and distinct from the Gulf of Alaska (GOA; Prince William Sound, Kodiak) and Aleutian Islands (Adak) areas. Data also showed distinct differences among the Prince William Sound, Kodiak, and Adak populations. There was some discussion about the possibility that Northern Bering Sea fish and Russian fish are related. Although Ingrid concluded that the NBS fish were not of Russian origin, during the discussion she qualified this by noting that, in the event that a previously unidentified Russian stock turned out to be genetically similar to one of the EBS stocks, her conclusion would have to be modified. Overall, the Team was very impressed with the author's performance on this project. It provided extremely important stock structure results, was done in very timely fashion, and external funding was obtained to help make this project happen.

EBS Pacific cod

Grant Thompson presented the Eastern Bering Sea Pacific cod assessment, which he renamed the Bering Sea Pacific cod assessment in light of the results of the genetic study described in the preceding section. It was noted that a document describing a bridging analysis from 17.2 to 17.6 was provided two days prior to the presentation.

New data for inclusion in some of the models presented at this September meeting included new fishery age compositions for 2010 and 2011. Some of the otoliths chosen had been previously aged. No data for 2018 were available for inclusion in these models. Therefore, the base model (16.6) is exactly the same as it was last year, except that the ABC for 2018 was used as an input when projecting to 2019. Models 17.2 and 17.6 included the new age data.

New models included the following features: linking various parameters to environmental covariates, including the Eastern Bering Sea northwestern strata in the EBS survey index, using the Northern Bering Sea survey, and modeling two areas with migration. Sixteen models were created to satisfy requests from the BSAI Plan Team, the SSC, and AFSC scientists. Model numbers (minor and major changes) were assigned based on the magnitude of change to the spawning biomass.

Thirteen environmental indices were examined for potential linkage to various parameters. Additionally, a nutrition deficit index was created to link to natural mortality. The creation of this index was time-consuming and was not available in time for the author to include it in the assessment. Therefore, a "placeholder" nutrition deficit index was created and used in these model runs.

Modeling two areas with migration was a useful idea for including the Northern Bering Sea survey data, but there is not much information to inform migration between the Eastern Bering Sea and the Northern Bering Sea. Migration was modeled in only the recent ten years and was allowed to vary over time.

Many results were presented, often in novel and useful ways. Some interesting outcomes were mentioned. The year class estimates appear to be mostly consistent between models. Catchability decreases for the survey index incorporating the expansion strata and could be caused by a change in selectivity which is modelled as static over time. Some models fit each survey year consistently (in terms of negative log-likelihood) while other models showed some years with very good fits and some years with quite poor fits. Finally, the trends in depletion are similar across models, but the magnitudes are different.

Cross-validation was used to inform model averaging by looking at the fit to the survey. Model 17.6 receives nearly all of the weight with this method, even though model 17.6 was one of the models that fit some survey years very well and other survey years poorly. More investigation is needed to understand this result.

A cross-validation approach was also used to examine the relationship between the environmental covariates and the change in spawning biomass. It was noted that the "apex predator biomass" index includes Pacific cod abundance, and may be expected to show high correlation, although it did not.

The discussion mainly focused on which models should be brought back in November for further evaluation. First, it was noted that the Northern Bering Sea appears to be becoming an important area for the Bering Sea Pacific cod stock. In 2017, few vessels fished in the Northern Bering Sea, and those that did were barely beyond the dividing line with the Eastern Bering Sea. A meeting participant stated that in 2018, many vessels fished in the Northern Bering Sea, and some ventured far into the area with decent catch rates. It is likely that vessels will continue to fish in that area in the future. The question, "Should we ignore fishery removals in that area if we ignore the survey indices" was pondered, but not answered.

Recommendations

The Plan Team recommends to not consider models with linkages to environmental covariates for further review in 2018 but encourages continued investigations in the future of the relationships between environmental covariates and various stock assessment parameters as well as the mechanisms behind those relationships.

Given the recently realized importance of the Northern Bering Sea for Pacific cod, the Plan Team was pragmatic and focused on investigating models that included northern areas. The intention was not to downweight the importance of investigating environmental linkages, and the Plan Team recognizes the excellent work done by the author to investigate the linkages and the importance of understanding parameter linkages to environmental covariates. If range expansion of Pacific cod is occurring, linking various parameters to environmental covariates and understanding those relationships and the potential effects on the stock may be very important.

Similarly, the two-area models with migration seemed particularly useful for describing the observations in the Northern Bering Sea, but there is a paucity of data to describe the migration process.

Therefore, the Plan Team recommends suspending the investigation of two-area models for Bering Sea Pacific cod in 2017 but encourages further development of the models in the future if data suggest that they are warranted.

The Plan Team recommends not including Model 17.6 for 2018 runs for a number of reasons.

First, even though many diagnostics showed that model 17.6 fit the data well, it tended to fit certain data very well and other data not very well. There is the concern that this model may be overparameterized and chasing noise. Second, the predictions of the model were outliers that were not congruent with any

other models and did not agree with anecdotal trends in fishery performance. Lastly, plausibility of parameter estimates were suspect given current knowledge of the Pacific cod stock.

Given recent and projected warm conditions and recent distributional trends, the Plan Team recommends that the NBS survey extension is conducted again in 2019 (and future years as needed) in order to support assessment estimates of fish biomass, to continue to monitor potential range expansion of Pacific cod, and to understand the dynamics and behavior of the Pacific cod stock in relation to environmental conditions.

The ten-fold increase in the Pacific cod biomass in the Northern Bering Sea and distributional shifts between 2010 and 2017 is an important event to understand and monitor. Also, these observations led the Plan Team to recommend models that included data from northwestern EBS and Northern Bering Sea areas.

The Plan Team requests that five models (described below) be brought back in November, with 2018 data included, for further evaluation.

- 16.6: the base model
- model 16.6b, which includes the two northwestern Eastern Bering Sea strata in the EBS survey index and is modeled with a change in catchability from the early period without those northwestern strata.
- a combination of models 16.6b and 16.6g which includes the northwestern strata in the EBS survey index and modeled with time-varying catchability, and the Northern Bering Sea survey observations with estimated selectivity and time-varying catchability.
- model 17.2 as it was structured and parameterized in 2017, but with 2018 data included.
- same as model 17.2 but including the northwestern strata in the EBS survey index and modeled with time-varying catchability, and the Northern Bering Sea survey observations with estimated selectivity and time-varying catchability.

Additionally, if time allows, the Plan Team recommends that the author consider the following two models.

- same as model 16.6 but including the northwestern strata in the EBS survey index modeled with time-varying catchability.
- same as model 16.6 but adding the NBS survey estimates to the EBS survey estimates (with the northwestern strata) and model catchability as time-varying. Size compositions should be combined by weighting by the abundance estimates from each area (if available).

These models are based off two candidate base models for 2017 and include data from northern areas of the Bering Sea. The final model in the above list (a potential model for consideration) simply adds the NBS survey estimates to the EBS survey estimates. This may not be statistically satisfactory.

Therefore, the Plan Team encourages continued research on statistical methods (e.g., geospatial analysis) to combine the Bering Sea surveys into a single comprehensive biomass index, noting that it may be possible to include environmental covariates in this analysis, such as the cold pool and ice cover.

Relatedly, the Plan Team recommends investigating model-based approaches to estimate a consistent time-series for the NBS survey given that the survey design changed in 2018.

Finally, the Plan Team asks that the author provide a clear rationale for a reduction in the ABC from maxABC if one is proposed.

For example, some concerns may be the possibility of an uncertain but potentially dramatic increase in mortality in the northern areas if ice cover returns quickly. An ensemble of models may not capture factors that are of concern, as the magnitude of this potential mortality is unknown.

Greenland turbot

Meaghan Bryan of AFSC provided the BSAI Team with a presentation on the stock structure and the assessment of Greenland turbot.

Stock Structure

The data do not suggest differentiation between the eastern Bering Sea and the Aleutian Islands; genetic studies would be needed to confirm this. Length frequency data reflect the ontogeny of the species. Generally smaller fish are found on the shelf and larger fish on the slope and Aleutian Islands. The EBS slope and the Aleutian Islands length distributions are similar. The share of catch in the AI has increased in recent years, while the share of biomass has declined. In the AI, catch is generally highest in the East, and higher in the Bering Sea slope than the shelf.

Exploitation rates are generally below FOFL and FABC. Maximum sampling depth of the Aleutian Islands survey is 500m, which may underestimate Greenland turbot abundance. This may help to explain the large exploitation estimates in the Aleutian Islands. For both females and males, in general, fish are smaller on the shelf, and larger on the slope. Length distributions are similar in the slope and the Aleutians. There are not that many samples from the shelf but more from the slope and AI. Age at length is similar between the shelf and slope. Most of the maturity at age data are from the North Atlantic. Bering Sea work by TenBrink (unpublished) indicates that the age at 50% maturity is about 7 and 100% at 10 years with a maximum age of 30+, with L50 ~57cm. Most fish caught in the fishery are bigger than this. Genetic studies are lacking, so conclusions about isolation by distance in the Pacific cannot be made. There is some differentiation in the North Atlantic between the Faroe Islands and Greenland. The non-genetic data do not suggest differentiation between the EBS and the AI.

With respect to issues of stock structure and spatial management, the Team recommends a rating of "little or no concern" for Greenland turbot.

Assessment

Meaghan transitioned the 2016 assessment from SS V3.24 to SS V3.30 and got similar results. There has been some model instability, so Meaghan has made some small changes to address this. Many selectivity parameters are poorly estimated (1/3 of them have CVs >50%), although it was noted that the coefficient of variation may not be a good measure of imprecision for a variable that can take both positive and negative values (many selectivity parameters in SS are log-transformed or logit-transformed).

The base model (16.1) is estimated with 2 fleets and 3 surveys. Shelf and slope q's are fixed and the ABL longline q is analytically determined. The model is a split sex model with M fixed at 0.112 for males and females, and von Bertalanffy growth was estimated. For the stock-recruitment relationship, steepness was fixed at 0.79 and sigmaR was fixed at 0.6, but R0, the autocorrelation between recruitment deviations, and the recruitment deviations themselves were all estimated internally.

This year Meaghan ran two additional models:
  - Model 16.1a – Removed the ABL longline survey index and
  - Model 16.1b – Estimated the ABL longline survey catchability.

For selectivity, the ABL longline survey was logistic with externally estimated parameters (not fit to the sizecomp data because they are not sex-specific), while all other selectivity curves were of the double-normal form with time blocks.

A noticeable change in the longline fishery sizecomps occurred around 2008, which Meaghan will investigate further.

Meagan did a jitter analysis of Model 16.1, where only 6 of 100 iterations resulted in a solution (the same solution was obtained in each of these 6 runs). What caused the instability (estimation of selectivity, ABL longline catchability)?   She also conducted a jitter analysis with Model, 16.1b which improved model stability and generally give similar results to 16.1.

Meaghan noted that the early part of the series is relatively data poor. A meeting participant noted that one of the challenges of modeling the species is that there were very high catches in the early 1970s and the model needs to have large recruitments prior to that in order to explain that catch, but similarly large recruitments have not been observed since then.

A member of the Team noted that a substantial amount of length data are available from the ABL longline survey. However, that data are not currently used, partly because the lengths are not sex-specific. This may be worth further examination; perhaps the longline survey methods could be changed in order to collect length by sex. The author noted that there is a CIE review planned and she hopes to explore this more at that time.

For November, the Team recommends that the author bring forward the following models:

1) **16.1**
2) **16.1b with selectivity estimated**
3) **16.1b with environmental covariates included to help explain selectivities**

The Team noted that Meaghan plans to evaluate whether simplifying the time-blocks improves estimation of some of the selectivity parameters; she will reduce time blocks and bring forward additional models as appropriate.

The Team also requests that dynamic B0 output be displayed.

Sometime after the current assessment cycle, the Team recommends that the author consider excluding pre-1977 data.

Flathead sole

Carey McGilliard presented results of transitioning the flathead sole-Bering Flounder stock assessment into the stock synthesis framework along with new model options for the 2018 assessment. The transition from the 2016 model to SS will allow for additional assumptions, include more data, and provide the assessor with more options, in short. The author listed eight primary differences between the two model frameworks along with a suggestion as to whether each item was a positive attribute of the framework. Full details are in table on page four of the document.

The main differences between the frameworks are:

1. The 2016 model starts at age 3, while the SS model starts at age 0
2. The length-based, logistic survey selectivity estimates do not match

3. The growth models cannot be matched because the age-length transition matrix is estimated within SS and is more flexible, to allow fine tuning
4. Historical mean recruitment and fishing mortality leads to differences in initial model years, due to differences in recruitment age
5. Timing of population dynamics is different between the model frameworks
6. Modelling the relationship between temperature and catchability cannot follow the same equation in each framework
7. The 2016 model's predicted survey and catch biomass are based on mean numbers at length and catch at length, which are in turn converted from numbers at age

In order to create a match between the 2016 model and SS, the author had to modify the 2016 model (termed "modified 2016") such that a matching SS model (termed "modified SS 2016") could be created. The author then stepped forward by iteratively incorporating elements where inherent differences exist into both modified models to show the effect of that difference, resulting in 10 iterations, and ending in a comparison of the original 2016 model to a best matching SS model. The results showed that it was impossible to mimic the 2016 model with SS using the length-based, logistic survey selectivity curve and get similar results between the frameworks. The modified 2016 model resulted in a survey selectivity with an asymptote at 0.7, suggesting that some fish, while old, are not large enough to be selected by the fishery. Thus, the author used an age-based, sex-specific, flat-topped, double normal survey selectivity and fixed catchability at 0.7 in the SS model to mimic the 2016 model (this SS model is termed "SS 2016"). This approach cleaned up much of the difference between the two frameworks. However, the author does not recommend going forward with the SS 2016 model because it was found in one modified run that including the age 0-2 fish (as is done in SS) influences the length-based survey selectivity curve such that the derived age-based survey selectivity has an asymptote at 1. Therefore, fixing catchability at 0.7 while estimating age-based survey selectivity, as was required to make the models match, is unjustified.

The author presented two new models (18.0 and 18.0b, both in the SS framework) as alternatives for the 2018 assessment. Changes from the 2016 model to Model 18.0 include:

● foreign catches in the years 1964-1987
● the recruitment likelihood function used a sum-to-zero constraint
● recruitment was fixed to the mean value for the last 4 years due to lack of non-zero observations of young fish
● recruitment deviations were estimated dating back to 1961
● survey selectivity was changed to be age-based and sex-specific, using a double-normal selectivity curve
● Francis (2011) data weighting was used

Model 18.0b is the same as model 18.0, but estimates selectivity in time blocks: 1964-1987, 1988-2007 and 2008-2016, chosen to correspond with key management changes in the fishery.

Models 18.0 and 18.0b estimated similar spawning biomass and trends to SS 2016, but both estimates were lower than SS 2016. Estimated F was different for all three models in the first and last time block, but 18.0 and 18.0b were similar during the middle time block. The new models fit age and length composition data better. Males are selected at smaller lengths than females. It is not clear whether this is a result of flathead sole behavior (e.g., aggregation of fish by age) or if the model is mis-specified (i.e., some other aspect of population dynamics or observation processes aside from selectivity leads to observed age and length distributions where males are observed at smaller lengths than females).

Therefore, it is possible that all of the proposed models are mis-specified, but the new models are a better

fit to the data. The author plans to incorporate newly aged historical otoliths into the model for November and estimate growth internally using a conditional age-at-length approach. Longer-term plans are to conduct more data exploration, deal with the lack of uncertainty in M and q, investigate incorporating slope survey data and other gears, explore alternative methods for extrapolating Aleutian Islands survey data in non-survey years (currently a linear regression between years is used) and look into growth morphs/area-specific model options.

The Team discussed the author's four models: original 2016, SS 2016, Model 18.0, and Model 18.0b, along with the author's recommendations. Team members and other meeting participants had some additional suggestions for future work, such as reporting 1-SPR plots to look at the influence of fishing mortality and selectivity together. The Team agreed that the SS 2016 model was well done as a transition from the old model framework to SS, but that it should not be put forward for the November assessment. The Team preferred model 18.0b over model 18.0 because it incorporates important information on the fishery and fits to length composition data were better than for model 18.0.

The Team requests that the author bring forward Model 18.0b and the original 2016 model for the November assessment.

Alaska skate catch estimation

Olav Ormseth presented his investigation into improving catch estimations for individual species in the BSAI skate complex. A brief description of the issue in both words and pictures was presented. The issue comes from uncertainty in skate ID by observers on longline vessels, primarily in the P cod fishery. This is because observers do not ID soft-snout skates to species when they are not in-hand, since they are difficult to correctly ID without closely examining small anatomical characteristics. Thus, up to 80% of skates are recorded as soft-snout skate (Bathyraja spp). Most stiff-snout skate species do get ID'd to species by observers.

A brief description of the current method for estimating AK skate catches followed. In the Catch Accounting system, most skates get lumped into the "other skate" category (due to the majority of skates on longline vessels not being ID'd to species when not in-hand, as mentioned previously). The author noted that the 2018 data presented are not complete (thru August only). For Catch Accounting, this system works because skates are managed as one complex. However, it becomes a problem in the AK skate model, where there is a need to understand total AK skate catch. Also, if looking at other species individually, it would be useful to estimate catch by species.

The author also noted that skate ID has historically been problematic in the survey (not just the fishery). A brief presentation of the current method for estimating AK skate catches followed, with the note that estimates of selectivity from the model are very different by gear type.

The author presented his proposed new method for estimating skate catches. In short, this method assumes skates in-hand are representative of all skates in the observer's tally period and creates a species comp for the observed catch (the species rates of those in-hand are applied to all tallied individuals). Then the method stratifies by CP vs CV, and gear type. These are the same stratifications for observer data as those in Catch Accounting. For CP's, further stratify by statistical area (this was clarified as NMFS federal reporting area, not state statistical area). However, for CVs, there are not always comp data from stat areas where there is reported catch. So the author ignored stat area for CV's. The author noted also that the small amount of skate catch in the pot fishery was lumped into the trawl fishery for simplicity.

Some questions were raised regarding this new estimation method. The author clarified the following:

- The method is useful for the GOA as well as the BSAI
- While target species may have an impact on the stratification, the author was hesitant to do this because of the difficulty in matching target species from CA to the observer data, since target species is not recorded in observer data.
- Fishing depth is considered implicitly as stratification because the spatial component (stat area) in the BS has depth associated

Next the author presented a comparison of skate catch estimates in time series with the old method vs the new method. For unidentified skates, the vast majority of catch is AK skate. The skate unID ratio has gone way down over time, so this is good. For the new method, the stratified species comps were applied to the same catch, and apportioned based on that year's ID'd species comp. For the small percentage that is still unID, the author asked if it is valuable to apportion to species. It is a minor issue because the level is now so small.

Overall, skate catches have been increasing since 2010. In the BSAI, the majority is still AK skate. However, there has been a recent increase in proportion of white-blotched and big skates in the trawl fishery. The author noted that there has been no change in the biomass of white-blotched, so this change in catch may indicate a change in fishing behavior. Big skate biomass has been increasing in the SEBS during this time period, which could explain that change.

Continuing with the comparison of the new method vs. the old method: the new method produces a lower catch estimate of AK skate longline catch every year except 2017. For trawl gear, the new estimate is higher until recently, due to more white-blotched and big skates in the catch (as noted previously).

A Team member commented that they thought the new method is better and asked if it could be used for other skate species. The author noted that poor skate ID prior to 2003 means we should use caution (observers were not required to ID skates at all prior to 2003, although some did).

The Team recommends that, although this method appears to be a major improvement, the issue of how species composition may be affected by depth should be examined before the method is adopted. This could be addressed by a simple look at the observer data to see if depth-related differences in species composition exist. The November assessment should therefore include an examination of skate stratification by depth in the observer data.

The author again noted that spatial differences may account for depth, particularly in the BS.

Finally, the author raised the question of how to deal with the issue of skate unID in pre-2003 data. 60-70% of skates were not ID'd at all, in-hand, or tallied only. Should we assume that those that were ID'd to species are representative? There may be biases in terms of areas, fisheries, etc. due to uneven rollout of enhanced skate ID or other non-random species ID effects. The author has no doubt that, for recent data, the new method is better, so it is really just a question of how to handle the old data when poor ID existed. The Team was unsure how to answer this and elected to leave it to the author's discretion.

Stock structure evaluation requests

The Team requests that stock structure templates be completed for the following BSAI assessments: in 2019 – octopus (Ormseth); in 2020 – forage fish (Ormseth), Bogoslof pollock (Ianelli), and flathead sole (McGilliard).

Approve proposed 2019 and 2020 harvest specifications

The Team recommends adoption of the 2019 BSAI final harvest specifications (published in the Federal Register in February 2018) for the proposed 2019/2020 BSAI OFLs and ABCs for the purpose of notifying the public of potential final harvest specifications, with the exception of squid, for which harvest specifications are no longer set as a result of the complex being moved to the Ecosystem Component of the FMP.

Per request of the SSC, all of the assessment authors were asked to examine the 2017 Ecosystem Status Report over the course of the summer, to see if it contained indications of impending severe declines in their respective stocks, and none found any. The primary new data that pertain to possible stock declines, and that have become available since those examinations were completed, are the results from this year's surveys, which are addressed previously in these minutes.

GOA Plan Team

Administrative

The GOA Plan Team convened Tuesday September 18, 2018 at 9:00 AM at the Alaska Fisheries Science Center in Seattle, Washington. Chris Lunsford (ABL) was appointed/nominated as co-chair to replace Jon Heifetz.

Northern rockfish

Curry Cunningham presented a comparison of design-based and model-based survey indices of abundance for GOA northern rockfish, and their effects on the current assessment model. Model-based estimates of GOA survey biomass for northern rockfish were produced with a vector-autoregressive spatio-temporal (VAST) model, which estimates the spatial correlation structure within the survey data. Results from three assessment models for northern rockfish were compared: 1) the 2015 model (with the design-based estimates); 2) the 2015 model, but with replacement of the design-based survey biomass estimates and coefficient of variations (CVs) with those from the VAST model; and 3) the 2015 model, but with survey biomass estimates from the VAST model and the survey biomass likelihood weight decreased to approximate the higher estimated variances obtained from the design-based estimates.

The design-based survey biomass estimates show values of less than 150 kt for most survey years, but with some years above 300 kt; in contrast, the VAST model survey biomass estimates show less variation over time, with the estimates for all years less than 200 kt. The CVs of the VAST estimates was about 20% for all years, whereas the CVS for the design-based estimates ranges between 30% and 60%. Inclusion of the VAST survey biomass estimates had relatively minor effects on the likelihood of the age and length composition data. The two models with the design-based survey biomass estimates had lower estimates of survey catchability, which resulted in larger estimates of total biomass and spawning stock biomass in recent years relative to the 2015 model. The estimated variability in spawning stock biomass and total biomass was lower with the design-based estimates.

The stability of the VAST survey biomass across survey years was noted as being consistent with the expected temporal changes in true biomass for a long-lived such as northern rockfish. However, some of the interannual variation in the design-based estimates could reflect meaningful changes in the survey process, such as variability in gear efficiency or availability; one potential mechanism is interannual changes in the proportion of northern rockfish in untrawlable grounds. The Team discussed whether the CVs for the VAST survey biomass estimates underestimate the variability in the survey process, which

provided the motivation for the model run with a decreased likelihood weight on survey biomass. Another useful metric for stable time series is to the compare the variability between the year-specific values of survey estimates to the average variability estimated for a given survey year, and this may inform the scaling of the likelihood weights. The use of the VAST estimates of survey biomass also degraded the retrospective performance of the model, and it would be useful to determine whether this was caused by changes in estimated catchability.

The Team recommends that the existing model (with the design-based survey estimates), and an alternative with survey biomass estimates from the VAST model, be presented in November.

The Team noted that we do not have clear criteria to choose between the VAST and design-based estimates of survey biomass; for example, while the VAST estimates are more precise, it is not clear that they are more accurate to a "true" value of biomass. Simulation modelling of spatial populations can help indicate model performance, particularly if it captures realism regarding AFSC survey sampling methods, proportion in untrawlable grounds, etc. **The Team recommends that Curry and an AFSC workgroup focused on design-based model estimates conduct the following analyses recommended by the Joint Plan Team in their September 2017 meeting:**

1. **Investigate whether further increases in the number of knots continues to reduce the scale, and if there is a point at which the number of knots (spatial complexity) seems to provide no further gains in accuracy.**
2. **Evaluate a VAST model with the spatial-temporal components turned off (i.e., a typical delta-lognormal model) to determine the effect of the delta component vs. the spatiotemporal component.**
3. **Identify some criteria that could be used to decide if the VAST model estimates are better estimates. Becoming familiar with the work from the NWFSC investigation of the VAST model would be helpful in this regard.**
4. **Look at the anisotropy and the variogram to better understand the spatial correlation. This may provide some insight into the behaviors when the coastline is not linear along latitude or longitude.**
5. **Investigate adding a depth covariate and its effect on estimation.**
6. **Conduct a simulation analysis to study apportionment estimates. Redoing the past apportionment simulation analysis may be a feasible first step.**
7. **Determine a recommended specification for the VAST model for AFSC surveys, and whether this should be species and area specific.**
8. **Become familiar with past simulations that show the VAST model (or spatiotemporal models in general) is a better estimation method for survey data and compare and contrast those simulation results with the analysis of real data.**

Pacific cod

The assessment author was unable to present his recent work on the assessment. The Team reviewed the draft document produced and commended the amount of work that was undertaken. In particular, they reviewed the issue concerning GOA Pacific cod otolith age determination. It appears that there has been a change in the age-growth relationship based on otolith readings. Specifically, data prior to 2007 used a different protocol and this results in Pacific cod being older for a given size. In response, the samples used in the maturity work of Stark (2007) were reread. Consequently, several model configurations were explored that included these discrepancies in ageing.

The Team discussed that the the percent agreement between the age reader and the tester be examined to see if there are any indications of bias that may contribute to this problem. For presentation, the Team

suggested that length at age data may be examined in aggregate pre- and post-2007 to better understand the implications of the changed methods.

A suite of models were included for review. One model that was highlighted by Kirstin Holsman includes a heat wave index. This index calculates degree days and is a proxy for bioenergetic demand which has been determined to have an influence on natural mortality. The heat wave index fits reasonably well to the data and suggests a plausible mechanism for temperature related mortality. The Team examined the suite of models and appreciated that they reflected a logical progression of useful ideas. The Team commended the author for responding clearly to the CIE reports.

Thornyheads

Pete Hulson presented a new method to incorporate an additional survey index into the Tier 5 random effects model for GOA shortspine thornyheads. The AFSC longline survey Relative Population Weight (RPW) index was included along with the AFSC bottom trawl survey biomass index within the random effects model. Overall, the addition of the longline RPW index provided more stability across the estimated biomass time series and in apportionment among regions. The Team noted that a useful statistic to investigate would be the relative contribution of observation to process error when the longline survey RPW index was included in the random effects model. It was also noted that this method could be applied to a number of Tier 5 stocks, as well as for apportionment of Tier 3 stocks in which the longline survey is used as an alternate index within the assessment.

The Team recommends that the authors bring forward the proposed random effects model that includes the longline survey index in November to be compared with the status quo method of only including the bottom trawl survey biomass index. The Team also recommended that the current year's (2018) longline RPW should be included in the model to be presented in November.

The Team noted that there have been a number of otoliths collected for shortspine thornyhead and recommends that the authors contact the Age and Growth Program to inquire if methods have been developed to age this species, and whether production ageing for shortspine thornyheads is a possibility

Sharks

Cindy Tribuzio presented an analysis of the bottom trawl survey catchability for spiny dogfish. Currently, spiny dogfish are assessed using Tier 5 methods, but are considered a Tier 6 stock since trawl survey biomass is considered unreliable. Previously the author had proposed F_{OFL} = Fmax (based on a model) since F = M is a poor assumption for low productivity species. The Team endorsed F_{OFL}=Fmax but has delayed implementation until trawl selectivity was addressed.

A method for correcting trawl survey biomass was put forward that could potentially move the stock to Tier 5. This method adjusts the vertical availability of dogfish available below the headrope of the trawl, other catchability inputs, e.g., horizontal q are kept at a value of 1. Since the species is patchily distributed and in the water column (as opposed to demersal) using the upper confidence bounds of vertical q was proposed. A discussion ensued on the merits of using a trawl survey that was previously viewed as suspect for this species, but then accepting its use after addressing catchability. There has been some other work examining such issues so this method would not be precedent setting. However, a number of suggestions were put forward to deal with this issue with alternative methods, such as exploring a multi-year average of the biomass or utilizing VAST.

The author stated that for November she would bring forward model 15.3A which would move the species to Tier 5. It should be noted that Tier 6 calculation based on catch data is unavailable for this species due to poor catch records.

The Team encouraged an examination using VAST as it might provide a better time series of survey catches. Additionally, the author was encouraged to explore combining trawl and longline survey catches, similar to what is being done with thornyheads.

Shallow Water Flatfish discussion

The Team discussed expectations for shallow water flatfish, which is an aggregate of Northern and Southern Rock Sole (Tier 3), and the Other Shallow Water Flatfish (Tier 5). The shallow water flatfish assessments are on a 4-year cycle. Guidelines for assessment products for 4-year species require partial assessments in the intervening years for Tier 3 stocks. Requirements for Tier 5 stocks only require partial assessments in years 2 and 4. The Groundfish Plan Team requested that the whole Shallow Water Flatfish complex follow the Tier 3 guidelines for partial assessments (a full assessment followed by 3 years of partial assessments).

Guidelines for tier level partial assessments:

- 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).
- 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.

Pollock

Martin Dorn (AFSC) noted plans to use the same model as last year and noted new assessment information: age composition from last year's fishery, the 2018 winter Shelikof Strait survey (down a bit from last year but still comparatively high), the 2018 ADFG survey (results available soon). Kresimir Williams presented on his work on pocket nets, which is intended to correct acoustic survey estimates to account for escapement of juveniles from the midwater trawl trawls that sample acoustic backscatter, particularly in Shelikof Strait where adults and juveniles are mixed. Pocket nets are attached to midwater trawls to sample small pollock (primarily age-1 and age-2) that otherwise escape from the trawl mesh. In the 2018 survey, the midwater trawl net was permanently configured with pocket nets made of tough material that can be rolled up on the net reel. Kresimir presented options of either estimating a selectivity curve using aggregated data for all surveys or estimating a selectivity curve using only pocket net data associated with a particular survey. He proposed to correct the historical surveys using aggregated data, but to use only current survey data for 2018 and for future surveys. He showed a corrected survey time series, and in some years, there was notable change in the estimates, particularly in years of high juvenile abundance.

Martin then briefly presented on some new alternative model specifications for natural mortality that he is considering in the pollock assessment. This included allowing for a random-walk time-varying values of natural mortality. Comparing the estimated natural mortality trends with the abundance of arrowtooth flounder, a key predator, showed good correlation. Consequently, he evaluated model that that linked predator abundance and pollock natural mortality over time. Initial results seemed reasonable. Martin is

planning to develop an alternative assessment for next year that incorporates consumption estimates from pollock top predators that are being developed by Cheryl Barnes, a graduate student at UAF. The Team noted a number of things:

1. A cohort effect of differential mortality over time may affect results (the method presented omits this).
2. The assumption of proportionality between predator abundance and natural mortality may be problematic (a functional response seems more likely).
3. The change in M by year seemed abrupt and may be a consequence of fitting to arrowtooth survey data (as opposed to a smoother model result).

Regional Action Plan

As part of Martin Dorn's annual update on the GOA Regional Action Plan for the NMFS Climate Science Strategy, he invited PhD student Grant Adams to share his dissertation work via WebEx. Grant is adapting the CEATTLE multi-species trophic interaction model to species in the Gulf of Alaska. The CEATTLE model has been used exclusively in the BSAI (pollock) and incorporates temperature and bioenergetics as well as survey and fishery inputs and can be used to explore harvest options under future temperature regime scenarios. Grant reviewed his dissertation objectives, which, briefly, include building the model in Template Model Builder, incorporating diet data, evaluating the random effects model as an alternative to the penalized likelihood approach, incorporating spatial structure, and generating forecasts. The CEATTLE model outputs for the GOA should be useful for exploring strategic and tactical management advice and identifying research needs. Grant expects his dissertation work to be available for consideration in about two years, following incorporation of the 2019 GOA survey data.

Following Grant's presentation, Martin provided further background on the Regional Action Plan. This is a 5 year plan intended to move climate science forward in the Gulf of Alaska. The plan includes process-oriented research, climate monitoring surveys, risk assessment, and additional projections and modeling. Ongoing NMFS activities such as surveys and process-oriented research are important elements of the climate-related research, but new research is also planned, including research on ocean acidification, projection of future oceanographic conditions, and analysis of community-level economic impacts. Other components of the plan are not yet funded, and attempts are ongoing to obtain support for this research. The two main objectives of the plan are evaluating climate change impacts on fisheries management and on fishing communities in the Gulf of Alaska.

Demersal Shelf Rockfish/Yelloweye Rockfish

Andrew Olson presented a near final stock assessment that will be presented in November for demersal shelf rockfish in Southeast Outside (SEO). Yelloweye rockfish (YE) is a tier 4 assessment for which total biomass is estimated based on the density of YE * Ave wt * available habitat by management area. All other rockfish in the DSR complex (Quillback, Tiger, China, Canary, Copper, & Rosethorn) are Tier 6. Survey updates occurred in NSEO, CSEO, and SSEO areas in 2018 and new average weights from port sampling were available. Another change to the inputs is that instead of using preliminary sportfish harvest data, a recent 3-year average is being used. This was implemented because sportfish harvest information often lags the assessment time period by a year or more. Personnel changes changes at ADF&G continue to limit progress on the age-structured YE assessment.

One question that arose was that of catch of YE in the unobserved portion of the halibut fishery—once the new observer program is in place how will this be squared away—do those catch histories need to be adjusted—can get bycatch rates from offshore vessels and EM from observer program. It was noted that this is a full retention fishery, therefore this examination is not warranted.

The Team recommended an examination of converting ROV determined lengths to weights in order to examine the similarities/differences between the surveyed and harvested populations.

Stock structure assignments

The Team reviewed past and planned stock structure evaluations. Stock structure templates for GOA Pacific cod, flathead sole, and northern rockfish were requested for 2019 while rex sole, demersal shelf rockfish and sculpins were requested for 2020.

Approve proposed harvest specifications for 2019 and 2020

The Team recommended rolling over the 2019 GOA final harvest specifications for OFLs and ABCs (as published in the Federal Register in March 2018) for the proposed 2019 and 2020 OFLs and ABCs, with the exception of squid, which have been reclassified into the ecosystem component category through Amendment 106 to the GOA FMP.

As part of its recommendations for the 2019 and 2020 harvest specifications, the PT reviewed the presentations made throughout the Joint PT and GOA PT meetings to identify issues that might warrant changes to the proposed specifications, rather than simply rolling over the current specifications. Squid were removed from the harvest specifications (they now are covered as an ecosystem component). Other stocks, based on reviews and ESP reports, indicated that there were no issues or concerns warranting any changes to the existing specifications for the proposed 2019 and 2020 specifications (understanding that new analyses being prepared in the next month will affect these values when the Plan Team recommends the final 2019 and 2020 specifications).