North Pacific Fishery Management Council

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Bering Sea Aleutian Island Plan Team

MINUTES

November 12-15, 2019, Alaska Fisheries Science Center, Seattle, WA

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

Committee Members in attendance:

BSAI Team

Grant Thompson, AFSC REFM (co-chair)
Steve Barbeaux, AFSC REFM (co-chair)
Steve MacLean, NPFMC (coordinator)
Mary Furuness NMFS AKRO
Alan Haynie, AFSC REFM
Allan Hicks, IPHC
Lisa Hillier, WDFW
Kirstin Holsman, AFSC REFM
Andy Kingham, AFSC FMA
Brenda Norcross, UAF
Kalei Shotwell, AFSC ABL
Chris Siddon, ADF&G
Jane Sullivan, ADF&G
Cindy Tribuzio, AFSC ABL
Vacant, USFWS

Members absent: None

Administrative

All documents provided prior to or during the meeting as well as presentations given during the meeting were posted to the Council's electronic agenda.

Introductions: The meeting of the Bering Sea Aleutian Islands (BSAI) Groundfish Plan Team ("Team") convened Tuesday November 12 at 3:00 pm at the Alaska Fisheries Science Center in Seattle, Washington. The Team also met on Wednesday November 13 from 9:00 am to 6:00 pm, Thursday November 14 from 9:00 am to 6:00 pm, and Friday 15 November from 9:00 am to 12:00 pm. All Team members were in attendance. Members of the public were able to come and go to the BSAI and GOA teams throughout the week, and were asked to sign a sign-in sheet. Members of the public in attendance at some point during the week included: Keith Bruton, TJ Durnan, Steve Riccci, Landry Price, Richard Thummel, Jody Cook, Blake Burkholder, Bernie Burkholder, Lorena Rosenbagen, Craig Lowenberg, Craig Cross, Susan Robinson, Todd Loomis, Jim Thorson, J. Baine Etherton, Ruth Christiansen, Jon Warrenchuk, Joel Peterson, Dan Nichol, Lyle Britt, Liz Dawson, David Witherell, John Gauvin, Megan Peterson Williams, Shannon Carroll, Austin Estabrooks, Arne Fuglvog, Trent Hartill, Lauren Rogers, Paul Peyton, Qi Lee, Quinpeng Han, Scott Hansen, Yue Jin, Qiant Wu, Ray Rezab, Duane Stevenson, Chris Pugmine, Sabrina Devereaux, Anne Vanderhoeven, Scott Kent, Chad See, Matt Robinson, Jan Jacobs, Patrick Ressler, Denise McKelvey, Stephanie Madsen, Taina Honkalehto, Jeremy Harris, Stephan Zador

WebEx: Remote participation via WebEx was available for all sessions. Webex attendees did not all register with their full name, so a complete attendance list is not possible. Webex attendees noted include: Asia Beder, Ernie Weiss, Nicole, Paul, Raychelle Daniel, Sarah L, Stram, Tiara, MBryan, Steve

Kaspersky, Merrigan, Ali Whitman, Hunter Berns, Paul F. Peyton, Dana Hanselman, Fraser, Ebett, Jason, JMS, Liz Dawson, Jim, Paul Wilkins, Mike, Hunter, Jeremy Sterling, Dan, Keith, Stephanie, Curry Cunningham, Chad See. Others may have been on Webex but not noted by staff.

September Team meeting: The September Groundfish Plan Team meeting will be held September 15-18, 2020 at the Alaska Fisheries Science Center, Seattle. PLEASE NOTE: US Driver's licenses will not be accepted for admittance to the NOAA facility if they are not Real ID compliant. Alternative identification, such as a passport, will be required if a license is non-compliant. For more information see http://www.dhs.gov/real-id-public-faqs.

Special commendations

The Team extended special commendations to outgoing Team member Brenda Norcross for her many years of faithful service and to retiring authors Tom Wilderbuer and Dan Nichol for their many years of contributing flatfish assessments to the SAFE reports.

Team discussion of BSAI partial assessments in general

The Team discussed the formatting and procedures for review for partial assessments. The Team suggested that the authors strive for consistency in how the partial assessment guidelines are interpreted and aim for concise documents and presentations. The BSAI Kamchatka flounder partial assessment document and presentation were good examples for a potential template. The Team requested that some partial assessments be presented in September rather than November, specifically for those stocks that will not be reliant on new survey estimates in the partial year, thus alleviating some of the schedule concerns for the November meeting. For efficiency, the Team requested that the Center work toward a more streamlined approach to presenting partial assessments that allows the Team to concentrate more on full assessments during the stock assessment cycle. An option may be for a single individual to present a set of partial assessments in September.

Ecosystem considerations

Elizabeth Siddon presented the Ecosystem Status report for the Bering Sea (NBS and SEBS). More than 100 people contributed to the ESR report in 2019, representing an extensive collaboration across multiple knowledge holders with diverse expertise. Many indices were updated with 2019 data in time for this fall's assessment cycle. A Team member expressed support for the ongoing efforts to incorporate local and traditional knowledge into this chapter.

She began with reviewing the previous year's conditions, which set the stage for many of the patterns emerging in fisheries surveys and catches this year. Sea ice patterns in 2017/2018 were anomalous relative to any previous observation; in particular there was an "unprecedented" lack of sea ice across the 2017/2018 winter caused by 1) residual heat in the system, and 2) persistent high-pressure systems, which led to 3) anomalous winds from the south. Collectively, these processes precluded formation of sea ice accumulation/formation. As a result of a lack of sea ice in the winter, Southern EBS conditions were anomalous, including a summer cold pool that was much reduced, a general lack of stratification, weak and delayed spring bloom, and reduced sea bird survival and breeding among other indicators. The Northern EBS was also highly anomalous, marked by a lack of winter and spring sea ice, no ice algae to seed productivity, weak stratification, low zooplankton abundance (especially large copepods), low juvenile forage fish abundances (although it is important to note that adult groundfish biomass persisted), ice seal distributions shifted, and widespread sea-bird die offs were observed across species, regions (NBS & SEBS), seasons (May-Aug), and at all colonies monitored.

This year's (2018/2019) conditions were once again "unprecedented", perhaps better described as a "double whammy." That said, there were both similarities and differences with anomalous conditions observed last year. Sea ice appeared to return to near normal conditions but then rapidly retreated. January sea ice in 2019 was near normal (in contrast to record lows in 2017 and 2018), but in early February sea ice extent rapidly declined and remained low throughout the rest of the season. As a result there was a small cold pool in the NBS, slightly larger than 2018. The Inner domain in the NBS and SEBS was much warmer than previously observed and anomalously warm SSTs suggest protracted and sustained warm anomalies year-round.

There was declaration by NOAA of an Unusual Mortality Event (UME) due to 200+ emaciation-caused deaths of gray whales migrating back to the EBS. This likely reflects poor 2018 foraging conditions; in the EBS gray whales feed on amphipods, mysids, crab larvae, and may compete with groundfish in the NBS. Similarly, short-tailed shearwater die-offs were observed in 2019, reflective of 2018 foraging conditions (e.g., euphausiids) in the EBS before making migrations. As in previous years, ice seals continued to be impacted by lack of sea ice. A NOAA UME was also declared for ice seals in 2019. Like gray whales, many carcasses were young animals that were in poor condition or emaciated, and pups exhibited a decline in condition (blubber thickness), possibly reflecting competition with fish in the NBS and lack of ice.

In the SEBS, as in the summer of 2018, there was once again a small cold pool isolated in the NW quadrant of the bottom-trawl survey. Zooplankton in samples were again dominated by small copepods, the spring bloom was ~9 d earlier than normal, and jellyfish abundance continued to increase. Meanwhile, the OSCURS model based index of on-shore transport (key for flatfish recruitment) showed high on-shore transport, which is in contrast to previous years of offshore or little-onshore transport. Groundfish biomass in the NBS continued to increase (30% since 2017) as did abundance (52% increase relative to the 2017 survey). Abundance in the SEBS increased 112% from 2018 while biomass increased slightly (2% relative to 2018). There was indication of recruitment of some key fish species in both areas (e.g., Pacific cod). Juvenile Walleye pollock (age 0) pollock were captured in the NBS, and the SEBS saw a 75% increase in juvenile pollock biomass. For pollock, below average recruitment is projected from age 0 energy density, diet energy density, and surface silicic acid, while the temperature change index indicates increased recruitment. Combination of reduced predation and increased productivity may have led to increased survival (based on CEATTLE).

Bristol Bay sockeye are up, 4th largest since 1963. Crab biomass is down, which likely reflects multiple years of benthic productivity, difference in larval recruitment, and changes (increases) in predation.

Conditions likely improved in 2019 for other upper-trophic consumers like seabirds. Seabirds may have been successful at finding lipid rich copepods and euphausiids, even though abundances were low, and competition for available prey may have been reduced as a result of shearwater mortality or poor recruitment events for fish species. Colonies at the Pribilof Islands may have benefited from northward shifts in fish populations. In contrast to previous years, there were below average coccolithophore blooms in 2019. Similarly, fish condition in the SEBS survey in 2019 was above average.

Ecosystem implications in general are that 2019 represents the warmest bottom temperatures on record for the EBS, including unpreceded warm conditions in the inner domain, it is also a second winter in a row of low sea ice in NBS, with impacts on the cold pool and fish distributions (juveniles and adults). The zooplankton prey base was dominated by small, lipid poor copepods and there was a low abundance of lipid rich large copepods and euphausiids. This shift in prey base has potential impacts on the carrying capacity of the system, especially for newly recruited juvenile fish.

Multiple groundfish stocks like pollock appear to be persisting through warm conditions or are utilizing cold water refugia in the NBS. For example, the pollock 2018 year class appears strong, Pacfic cod biomass continues to increase in the NBS, and groundfish condition across multiple species increased from 2018. This is in contrast to starvation of some upper level consumers like short-tailed shearwaters.

There is increased concern regarding food security for local communities in Alaska that rely on subsistence resources including seabirds. That said, seabirds at colonies did better than expected, which is in contrast to the gray whale and ice seal UMEs (potentially more reflective of poor 2018 conditions).

The Team discussed other potential indicators of interest including indicators of Harmful Algal Blooms (HABs), indicators of changes in benthic productivity, carrying capacity, and benthic pelagic coupling in the NBS (e.g, walrus could be an indicator).

The Team recommended that authors continue to pursue indicators of benthic productivity and benthic-pelagic coupling for the NBS.

EBS pollock

Jim Ianelli presented the EBS pollock assessment. He began by overviewing the progress of this year's fishery. Roe production has increased for the last few years. CPUE in this year's "A" season was good, as the quota was taken in record time. However, the "B" season fishery was slow, compared to previous years. Jim introduced a new metric describing concentration of the fishery, computed as the mean distance between tows. This year's "A" season had the lowest mean distance (highest concentration) since 2000, whereas this year's "B" season had the highest mean distance (lowest concentration). Fish condition (weight at length) in this year's "A" season fishery is about average for the time series. Fishery weights at ages greater than about 4 or 5 have been below average for the last few years.

Jim also presented alternative estimates of the survey biomass time series, comparing the traditional design-based approach with the VAST approach (both sets included the Kotwicki density dependent correction, which has been used for the last few years). The Team discussed the merits of the two approaches, and possible ways to test which was better. Cross-validation was discussed, noting that lots of cross-validation of VAST has already appeared in published papers. Jim Thorson and Meaghan Bryan are engaged in a related project involving nonparametric bootstrapping that appears likely to be helpful in evaluating the robustness of the VAST estimates. Use of the cold pool as a covariate was noted as a helpful feature in avoiding too much reliance on mere temporal autocorrelation.

Regarding the assessment model, Jim highlighted the increased strength of the 2013 cohort estimated this year, meaning that both the 2012 and 2013 cohorts appear to be above average. It is unusual for this stock to have back-to-back strong year classes. Cole Monnahan has developed a promising approach for combining vertically overlapping surveys (such as the bottom trawl and acoustic-trawl surveys), which Jim anticipates using in future assessments. Jim also showed a series of model runs profiling various levels of the constraint on time-varying survey selectivity, and showed that the configuration in the base model (Model 16.1), which allows a fairly large degree of time variability, appears to be about right. Jim presented versions of the model using the design-based survey data and the VAST estimates.

A large change in the base model's estimate of F_{OFL} was noted. Jim ascribed this to a change in selectivity, due in part to fish moving from the EBS to the NBS.

The importance of obtaining stomach data from the NBS, both amounts and contents, was discussed. Daily food requirements of individual fish are estimated to have increased during the recent warm years, although a declining population means that overall predation impacts may not have changed much.

For the risk table, Jim scored assessment considerations as level 1, and the remaining categories as level 2. The Team ultimately agreed with Jim's scoring. Some of the comments that were made in the process of reaching this decision are listed below:

- Assessment considerations: There was some discussion of changing the assessment level from 1 to 2 due to concerns over fish moving in and out of Russian waters and also concerns over catches in Russian waters. While these concerns were understood, neither Jim nor the Team recommended changing Jim's original score. In those years where the US survey extended into Russian waters, the proportion of the stock on the Russian side of the line ranged from about 4% to about 20%.

- Population dynamics considerations: One Team member felt that the listed concerns do not really seem any different than those for a typical stock. On the other hand, it was noted that the presence of back-to-back strong year classes could have impacts on cannibalism and growth that might be an out-of-the-ordinary concern. Another Team member suggested that redistribution of fish into the NBS might justify a rating of 2 for this category.

- Environmental/ecosystem considerations: Elizabeth Siddon's contributions in compiling the information for this category were noted.

- Fishery performance considerations: Team members struggled to interpret this category and which factors were appropriate to consider under it. One Team member asked whether sablefish avoidance qualified as a fishery concern. A member of the public stressed the impacts of avoiding chinook salmon during the "B" season. Another member of the public felt that the items listed under this category in the assessment were no different from those that would be listed for a typical stock, and suggested that level 2 was unwarranted. Another member of the public suggested that fishery performance issues were only relevant if they reflect on the status of the stock. Two other Team members felt that the primary use of the risk table should be to document things that are unusual, and that ABC reductions were a separate issue.

The Team deliberated on choice of model. Both the base model and the VAST model appear to perform well. Recent surveys have confirmed the presence of a large pollock biomass in the NBS. Given the Team's decision to use VAST data in the EBS Pacific cod assessment, there was interest in doing the same for this assessment. However, unlike the Pacific cod case, genetic work on the relationship between the EBS and NBS fish has yet to be provided. Anticipating that genetic results will be forthcoming in the next year, the Team decided to stay with the base model (16.1) for another year. Another NBS survey is scheduled for next year, and data on cross-boundary movements of pollock will also be available from the moorings that have recently been deployed.

As in previous years, Jim is recommending a substantial reduction from maxABC. He prefers keeping biomass well above B_{MSY}, as experience has shown that a successful fishery can be sustained when this condition is maintained. Tables 48 and 49 in the SAFE chapter list several metrics and results that could be used to inform an ABC recommendation. Ultimately, Jim recommended setting ABC at the maxABC value associated with Tier 3, as has been the practice in recent years, the stock's Tier 1 status notwithstanding. The Team discussed the Tier 3 option, as it has for the last many years, and ultimately agreed with Jim's recommendation.

For next year's assessment, the Team recommended revisiting any variances in the model that are simply assumed rather than estimated, noting the potential for tuning those variances so as to set SDNR=1, and also acknowledging that, at the authors' discretion, it may be advantageous to consider re-estimating the constraint on time-variability in survey selectivity simultaneously.

The Team also commended the authors for developing the new index of spatial effort concentration, and recommended continued development of such metrics.

AI pollock

Steve Barbeaux presented the partial assessment for AI pollock. The only change was to re-run the projection model with updated 2019 - 2020 catch data. The 2020 projected (age 1+) biomass is 340,680 t (no change from the 2018 projections) and 2021 is 367,017 t. The ABCs for 2020 and 2021 are 55,120 t and 58,384 t and the OFLs are 66,973 t and 70,970 t. This stock is managed under a 19,000 t catch limit implemented under the American Fisheries Act of 1998 (AFA). Catch remains low in this fishery. The Team accepted the authors' recommendations for the 2020 and 2021 AI pollock ABCs and OFLs.

EBS Pacific cod

Grant Thompson (AFSC) presented a summary of the stock assessment for Eastern Bering Sea Pacific cod. Considering thirty-six comments from the SSC and Team this year, an updated set of ten models was provided. This included the base model from last year (Model 16.6i) along with nine models from a 3x3 factorial design. One axis of the design included three hypothesis about the spatial distribution of Pacific cod: 1) Pacific cod in the NBS are insignificant to the managed stock, so the assessment should include data from the EBS only, 2) Pacific cod in the EBS and NBS comprise a single stock, and the EBS and NBS surveys can be modeled in combination, and 3) Pacific cod in the EBS and NBS comprise a single stock, but the EBS and NBS surveys should be modeled separately. A second axis considered model complexity where 'basic' included the same model structure and assumptions as the 16.6i model, 'simple' added to that model structure by changing the selectivity functions and some other features, and 'complex' added a considerable amount of complexity including many time-varying parameters.

A different set of models was presented at this meeting than was presented at the September Team meeting because comments from the SSC related to Hypothesis #1 and retrospective performance suggested that those previous models may not be accepted. The updated models reduced the retrospective patterns by removing fishery age composition data and reducing the average input N for fishery size compositions. Concerns about Hypothesis #1 were dealt with in the determination of model weights for the ensemble.

The nine models in the 3x3 factorial design all used the vector-autoregressive spatio-temporal model (VAST) to predict a time series for the EBS and NBS surveys. A covariate for the cold-pool was included to add information when observations were not available. This was especially useful when predicting the time-series between 2010 and 2017 when combining the EBS and NBS surveys, since NBS data were not available for the intervening years. Model 16.6i used design-based estimates for the survey indices. The 2019 surveys in the EBS and NBS both saw a pulse of fish with lengths just above 20 cm.

The nine models showed various fits to the data and retrospective patterns. The complex models fit the data best because time-varying quantities were used. Complex models also incorporated time-varying selectivity which allows for changes in the availability of age-1 fish to the survey. Values of Mohn's rho, an indicator of retrospective bias, were within the acceptable range for all models except 19.4, for which Mohn's rho was very large. Several of the models had very small absolute values of Mohn's rho (0.06 or less).

These nine models were incorporated into two ensemble models. The first ensemble weighted each of the nine models equally. This ensemble with equal weighting was not recommended by the authors, because the SSC had asked that the models associated with hypothesis #1 be down-weighted, implying that the unweighted average would not be appropriate. The Team agreed.

The second ensemble weighted each model according to weights determined from applying various emphasis factors to nine criteria. This weighting scheme gave more than 75% of the weight to model 19.12, and more than 99% of the weight was given to 5 models: all three from hypothesis #2, and the complex models from the two other hypotheses. The differentially weighted integrated ensemble had the lowest absolute value of Mohn's rho and an acceptable retrospective pattern. The ensemble values were the weighted average of the MLE estimates, without consideration of the uncertainty estimates (which were reported for all quantities), although the calculation of P(ABC>truOFL) did incorporate uncertainty. The authors recommended this weighted ensemble, and the Team agreed, with much discussion, as noted below. It was noted that inclusion of all models, even though some were given effectively no weight, allowed those models to be retained for future use, in case dynamics change in the future and they are weighted higher. It was also noted that running nine models is time-consuming which may reduce the ability for thorough exploration of other models. The results from this ensemble showed a maxABC for 2020 (155,873 t) less than the 2019 maxABC (181,000 t), and a continued decline in the max ABC for 2021 (102,975 t) due to poor recent recruitment and reductions due to being in Tier 3b. A projection was made during the Team meeting, using only model 19.12, to show that a 130,000 t catch in 2020 resulted in a maxABC of 116,379 t in 2021 ABC.

Many discussions occurred, which included the following points:

- Mohn's rho may be a misleading statistic because it can be affected by a sudden loss of data in a sparse time-series (e.g., NBS survey). However, using survey estimates for every year, as estimated from the VAST model, alleviates this concern.

- Ageing bias was estimated to change in 2008 in the complex models, but it is not certain whether this is due to a change in ageing bias or a change in growth that is not modeled.

- Condition factors determined from the EBS and NBS surveys were both above average in 2019. However, it was not certain if the NBS analysis included all data or just data from the NBS.

- Removing the fishery age compositions solved the retrospective patterns, but the Team was not certain if there were trade-offs or effects from not using these data. Fishery age compositions have not been included in the assessment for years, but *a priori* there is no reason that they should not be useful.

- All three levels of model complexity should be retained because there are some important differences between each type. For example, even though the basic and simple models are largely similar, the basic models are the only ones that assume asymptotic selectivity for the fishery. There was also concern that the complex model could be overfitting the data.

- The determination of weights for the models was clear, transparent, reflected the Team and SSC priorities, and is a good framework to start from. The Team was interested in further thinking about the weighting process and would like to re-evaluate the emphasis factors, the criteria, and the process in the future. If an ensemble is developed for other species, this process would be useful (with different criteria and emphasis factors).

A major discussion point was whether all three hypotheses should be retained. Hypothesis #2, combining the EBS and NBS surveys, was deemed likely given the observations of Pacific cod in the NBS, no evidence of genetic difference, and the presence of age-1 fish throughout the EBS and NBS. Hypothesis #3 is useful because it admits that dynamics in the NBS may be different than in the EBS. However, the models presented did not capture this possibility and spatial models would be worth investigating. Hypothesis #1 is the most unlikely hypothesis but is worth retaining at this point because it: 1) is the legacy model, 2) is important to understand the dynamics operating at only the EBS level, 3) can help determine the synergy between the NBS and EBS regions, 4) had acceptable retrospective patterns, and 5) may be necessary if NBS surveys are discontinued. It was noted that models under hypothesis #2 may explain the dynamics similarly as models under hypothesis #1, but hypothesis #1 should be retained at least another year, even when given little weight in the ensemble. It was noted that hypothesis #2 carried most of the weight in the ensemble.

Use of the VAST model was discussed and the Team supported the use of a cold-pool covariate and bias correction. Recognizing that many papers have been published that investigated the performance of VAST, the Team still had some concerns and would like to see cross-validation analyses done to determine the efficacy of predicting missing data, which may be a task for someone or a team other than the assessment authors. It was noted that the VAST model predicts indices for years where the NBS data are not available, and that these years will have a larger variance, and thus lower weight in the model fitting.

Public comment included a concern for an unprecedented ensemble approach and lack of complete understanding as to why an ensemble is better than a single model. There was concern that the ensemble approach is avoiding choosing a best model, especially when the weighting shows a strong single model. The Team explained that this accounts for structural uncertainty, should stabilize advice in the future, and the Team and SSC have been working towards this for many years. With the amount of structural uncertainty in Pacific cod assessment models, the ensemble approach is warranted. It is likely that the weightings of the models will change in the future as new data describing new patterns become available. Additionally, the number of models in the ensemble can likely be reduced as more information supporting or not supporting the three hypotheses is gained.

Additional public comment was heard regarding catch rates for Pacific cod in various fisheries, which were generally seen as good. Some fisheries not targeting Pacific cod (e.g. the Amendment 80 fleet) had a difficult time avoiding Pacific cod, which seemed to be distributed throughout the EBS.With a more widespread distribution than in previous years,, Pacific cod are becoming a choke species for some fisheries, even using all available measures to limit the bycatch of Pacific cod. For target fisheries, the CPUE has been increasing and a large portion of the catch occurs in NBS, noting that catch-rates north of 62 degrees latitude were very good. The authors noted that fishery CPUE was around the long-term mean and the public noted that Freezer Longline Coalition vessels often do not fish in areas where the CPUE is greatest in order to avoid market issues such as parasites. Overall, catch is shifting throughout the Bering Sea and Pacific cod are becoming more prevalent in some non-target fisheries.

The risk table was discussed at length, especially how to classify substantial risk. The stock assessment authors presented three issues related to the risk table, and it was agreed that the risk table is a worthwhile work in progress and additional clarification of how it is completed and utilized is needed. A more general discussion on the risk table is provided elsewhere, but the Team agreed with the authors to fill in the risk table for Pacific cod, but not to suggest a specific reduction from maxABC. Some concerns highlighted were that: 1) the ecosystem is obviously affecting Pacific cod (as seen by the northward shift in abundance) and could possibly be resulting in a change in productivity that affects the carrying capacity of the stock, and 2) movement and subsequent mortality outside of the U.S. EEZ could possibly elevate the risk to the stock. The Team agreed with the author to classify ecosystem risk at level 2 and to classify fishery risk at level 1, noting that a post-doc at the AFSC is currently working on movement and mortality outside of the U.S. EEZ. Observations such as the movement of Pacific cod and associated fishery to the NBS could be seen as an adverse condition, but this stock assessment is able to account for that movement and mortality. It was noted by the public that there is inconsistency among stocks on how the risk tables have been implemented. It was also noted that it may be useful to review the models without having to consider a reduction.

The Team appreciated the hard work and thorough investigation that the authors put into the assessment.

The Team supported continued research into the abundance and mortality of Pacific cod outside of U.S. waters for inclusion in the stock assessment.

The Team recommended using spatio-temporal models for survey data (i.e., VAST with a cold pool covariate and bias correction) and also recommended that the survey team investigate the efficacy of VAST estimates using methods such as cross-validation.

The Team recommended the 3x3 factorial design for defining models in the ensemble and feels that the current nine models should be used for management advice. Hypothesis #1 is the hypothesis under which the assessment has historically operated, and it is useful to carry forward that legacy and retain the historic EBS only assessment. Hypothesis #3 is useful because it allows for a single stock with different dynamics in the two areas. Although the three models for Hypothesis #3 did not perform particularly well, this hypothesis is useful and the Team supports further development of models under this hypothesis that may incorporate spatial processes such as migration and differences in growth, for example. All three hypotheses and levels of complexity incorporate features that are of interest and useful for explaining structural uncertainty, but it would be useful to investigate reducing the number of models, such as eliminating one of the hypotheses or one of the levels of complexity.

The Team recommended that advice be based on the weighted ensemble of all nine models as stated by the assessment authors. The weightings give the majority of the weight to Hypothesis #2 and little weight to the other hypotheses, which are useful to retain at the moment. This results in a 2020 maxABC of 155,873 t and a 2021 maxABC of 102,975 t.

The Team recommended retaining all models in the ensemble for this assessment, but to simplify and reduce workload, only report models that are above a cutoff of 1% weight to represent the base model in the next assessment. This would include five models for comparison next year.

The Team recommended that discussions on the procedure for weighting models in an ensemble continue in the future and be included as a Joint Groundfish Team agenda item in September 2020.

The Team recommended organizing the environmental/ecosystem considerations content of the risk table to those items that are associated with the stock and those that are not (working with ESP and ESR editors may help with this).

The Team recommended a continued investigation into whether a change in growth contributed to the ageing bias fit for 2008 and onward in the complex models as ageing bias and growth may be confounded.

The Team recommended continued research into the inclusion of fishery age compositions in the models.

AI Pacific cod

Grant Thompson presented the Tier 5 results of the Aleutian Islands Pacific cod assessment. It was noted that VAST is not ready for use with survey data from the Aleutian Islands because it does not properly account for the presence of islands. The fishery performance was affected by a set aside in January, which is before the peak of the AI fishery when Pacific cod begin to school, thus making them more difficult to catch. This will likely not happen in the future with Amendment 113 being vacated in 2019. The Tier 5 2020 ABC recommendations are unchanged from the previous assessment and a harvest limit of 15.7% was determined for the western subarea based on results from the random effects model.

Ingrid Spies presented an age-structured model for AI Pacific cod and the Team commends the authors for their work on this as well as the thoroughness of addressing past Team comments and investigating the impacts of different natural mortality assumptions. The Team discussed a number of different aspects of the model. The estimated growth curve when corrected for observed lengths in the population did not fit the observed length-at-age data.

The Team recommended one potential solution of using a three-parameter Richards growth curve, which with its increased flexibility may better model Pacific cod growth.

The retrospective analysis showed a very large departure on the tenth peel.

The online tool to estimate natural mortality (http://barefootecologist.com.au/shiny_m.html) provided an estimate of 0.36. The Team noted that this tool uses multiple estimators, some of which are similar, and recommended that it would be useful to receive more information on the different components used and how they are related.

Two maturity curves were estimated, one from visual observations collected by observers and the other from a histological study reported by Stark (2007). The observer data have the benefit of a large sample size (over 2000 samples) collected in January through March since 2008, while Stark (2007) histologically analyzed 129 samples collected from Unimak pass in February 2003. The Team supported the authors' recommendation that the observer data are more representative, but look forward to verifying the visual samples with histological studies.

The Team recommended that model runs with both maturity curves be reported in the future until an appropriate curve can be identified.

The risk table issues for AI Pacific cod were the same as those identified for EBS Pacific cod.

The Team agreed with the author's recommendation of an overall risk level of 2 and recommended that the SSC determine if a reduction is necessary. Therefore, the Team recommended the Tier 5 maxABC of 20,600 t.

Yellowfin sole

Ingrid Spies provided a presentation to the Team on the BSAI yellowfin sole stock assessment. Model 18.1a was the 2018 model (Model 18.1) updated with 2019 data. Like previous models, Model 18.1a also included the survey mean bottom temperature across stations < 100m and catch date as covariates on survey catchability, based on Nichol et al. (2018). Model 18.1a used the same natural mortality for males and females, M=0.12. The second model presented (Model 18.2) is the same as Model 18.1a with a fixed value for female natural mortality (M=0.12), but with male natural mortality estimated inside the model. Model 18.2 estimated male natural mortality slightly higher than female natural mortality, 0.135, similar to other flatfish species where natural mortality has been estimated separately.

After the presentation there was public comment indicating that despite the continued high biomass of the stock, fishing in the last few years has been poorer than previous years. In the last few years fishers were said to be trawling longer for less catch. Pacific cod appeared to be more widespread, with few high density areas compared to previous years. There was discussion of how the warmer bottom temperatures due to the reduced cold pool may have had an impact on the stock distribution. The availability of the stock to the bottom trawl survey, timing of the survey in relation to the stock spatial distribution, and how these might have changed in recent years due to warm nearshore waters were considered. Ingrid was asked to comment on the proportion of the stock that was found in the NBS. The surveys of the NBS, including the 2010 survey, encountered some yellowfin sole, about 300 kt in 2010 and 500 kt in 2019. Although there was some concern that catchability was greater than 1.0 in the proposed models, Ingrid commented that there were no reasons for it not to be. Because many complex processes contribute to catchability, there is no specific reason why it should be constrained in this case.

Although Model 18.2 was the authors' preferred model and appeared to provide a better fit to the data, the Team recommended using Model 18.1a for management in 2020, as Model 18.2 had not received thorough review and there are no conservation or other concerns indicating that a switch to Model 18.2 is necessary this year.

This should not be considered a reflection on the quality of the model, but rather the policy of the Team that "for each assessment year, models introduced in that year should ideally be previewed in September or at least requested by the Team/SSC by September/October, and that the standard for acceptance of models that do not meet at least one of these criteria will be higher than for models that do;" and adherence to the SAFE chapter guidelines, which state (under "Guidelines Pertaining to the September

SAFE Report"), "...if a new assessment model or analysis is being recommended, a chapter should be produced that provides enough information for the Plan Team(s) to make a decision about what new models or analyses should be included in the November assessment." The Team noted that Model 18.2 was designated as a major change over last year's model.

The Team commended the author on her work on Model 18.2 and the Team recommended this model be presented for consideration in next year's cycle.

Under the recommended model, Model 18.1a, yellowfin sole continues to be managed as a Tier 1a stock and remains above B_{MSY}. The 2020 and 2021 maximum ABCs, 260,918 and 261,497 t, using F_{ABC} from this assessment model were higher than the 2018 maximum ABC of 249,100. The 2020 and 2021 OFLs estimated in this assessment were 287,307 and 287,943 t.

The Team agreed that the risk table presented in the assessment addressed all of the relevant concerns. There were some negative indicators but this doesn't necessarily translate to risk in the stock. Neither the author nor the Team recommended reduction of the ABC below maximum.

Greenland turbot

Meaghan Bryan presented the partial assessment for the BSAI Greenland Turbot, a Tier 3 stock. The partial assessment updated catch estimates used in the projection model for 2018 (final catch estimates) and 2019 (preliminary catch estimates). No other changes to the model or inputs were made. The 2020 estimated total (age 1+) biomass is 106,101 t, an increase of ~8% over last year's 2020 estimate. The 2021 estimated biomass decreases slightly to 98,532 t. Region-specific apportionments are specified for this stock as well. The Team accepted the authors recommendations for the 2020 and 2021 Greenland turbot ABCs and OFLs.

The assessment indicates that the general stock trend is continuing downward, and the survey abundance estimate is the lowest in the time-series. The author noted one concern about the stock is the continued lack of recruitment, and uncertainty for new recruitment, given current warming trends. An industry member noted that they are concerned about the continued lack of recruitment and what that means for them going forward.

In this context, the Team discussed the importance of the slope survey to this stock assessment; i.e., the need for more information about this stock. The Team noted that it may be helpful to quantify the value of the slope survey to this assessment. That way the impact of not having the slope survey information in the stock assessment could be clearly measured. However, specific metrics were neither identified nor discussed further. The author noted that there is already an "ad-hoc" group within the authorship group working to quantify the impact of this survey to the stock assessment.

The Team recommended that the authors report on efforts to quantify impacts to this assessment of the loss of the slope survey at the September 2020 meeting.

Arrowtooth Flounder

Ingrid Spies presented the partial assessment for BSAI arrowtooth flounder, a Tier 3 stock. The partial assessment updated catch estimates used in the projection model for 2018 (final catch estimates) and 2019 (preliminary catch estimates). No other changes to the model or inputs were made. The 2020 estimated total (age 1+) biomass is 934,008 t, a very slight increase over last year's 2020 estimate. The 2021 estimated biomass continues to increase, to 964,925 t. The Team accepted the authors' recommendations for the 2020 and 2021 Arrowtooth flounder ABCs and OFLs.

The harvest tables presented on-screen in the meeting showed a large increase in estimated total biomass and female spawning biomass for 2020 compared to the 2020 estimates in last year's assessment. There was some confusion about how these new estimates had changed so much when the only thing that had changed in the assessment was updated catches. It turned out that the presenter had accidentally grabbed the incorrect values for the presentation of the harvest table, so the discussion was moot in terms of this specific assessment, and the real numbers made more sense, once they were presented. However the apparent discrepancy on-screen during the meeting prompted some Team discussion about how to make the source of these kinds of errors clearly identifiable. One Team member recommended making an R Markdown template that all assessment authors can use, to eliminate "copy/paste" errors. However, the Team was not unified in this recommendation, as some members thought it too prescriptive. The current practice of presenting the Executive Summary table, with last year's estimated or specified values shown side-by-side with this year's estimated or recommended values, may be sufficient (for example, it enabled the Team to spot errors in two partial assessments this year).

Kamchatka Flounder

Meaghan Bryan presented the partial assessment for the BSAI Kamchatka flounder, a Tier 3 stock. The partial assessment updated catch estimates used in the projection model. The Team commended the author on the concise partial assessment document and presentation, and suggest this as a potential template for future partial assessments. The 2019 and 2020 estimated catches were updated and the projection model rerun. The 2020 estimated total (age 2+) biomass is 162,709 t, an increase of <2% over last years 2020 estimate. The 2021 estimated biomass continues to increase to 163,158 t. The Team accepted the authors' recommendations for the 2020 and 2021 Kamchatka flounder ABCs and OFLs.

Northern rock sole

Tom Wilderbuer presented a partial assessment; a full assessment was done in 2018. A full assessment model was not rerun but instead a Tier 1 projection model with an assumed future catch was used to estimate the stock level for the next two years. There were no changes in data inputs or methods. In 2018, the long slow decline that began in 2008 continued. The stock is projected to start to increase after 2024 as the 2013 year class is good. The OFL increases in 2021 because of this large year class entering the fishery. The exploitation rate was 9% and retention was 96%. The TAC was well below the ABC. Of note is that the cumulative catch asymptote was delayed by weeks. Representatives from the industry commented that avoidance of cod affected the distribution of the fishery.

The Team noted a large difference in 2020 projections from last year to this year and requested that the author verify numbers for female spawning biomass. The author discovered an error in the calculations in last year's (2018) full model and has determined that the values presented in the current document are correct. The Team accepts the values for female spawning biomass presented by the author.

The geographic distribution of this stock has moved northward since 2010.

The Team recommended that the Bering Sea survey group conduct a spatial analysis looking specifically at the spatial overlap of this species (and other commercially important flatfish species) with Pacific cod.

There is an apparent increase in Pacific cod in the rock sole fishery which is inhibiting fishers' ability to prosecute this fishery despite the decline in Pacific cod biomass. It was hypothesized that the recent warm trend may have changed the spatial distribution of these two species, resulting in increased overlap. It was noted by an industry member that such an analysis over a number of species would be useful, particularly including overlap of groundfish with Pacific halibut. It was also noted that it would be useful for industry if the survey group were to make species distributional maps available in GIS layers to the public.

Flathead Sole

Carey McGilliard presented the partial assessment for BSAI flathead sole. The only change was to re-run the projection model with updated 2019 - 2021 catch data. The 2020 projected (age 3+) biomass is 684,768t, which is a 2% increase from 2019. Similarly, the OFL and ABC for 2020 are projected to increase slightly from the 2019 estimates. Projections suggest additional small increases into 2021. Overall exploitation rates are projected to remain quite low for this stock. The Team accepted the authors' recommendations for the 2020 and 2021 flathead sole ABCs and OFLs.

Alaska plaice

Tom Wilderbuer presented a full assessment of Alaska plaice in 2019 as a partial assessment was conducted in 2018. For this assessment, the methodology was unchanged and Model 2011_1 was used. This is a Tier 3 stock. The whole model was retuned and there were no problems. Changes to input data included updated 2018 catch data and an estimate of 2019 catches through the end of the calendar year. Length compositions from the fishery for 2017 and 2018 and from the 2019 survey were added. Survey biomass estimates for 2018 and 2019 were included, as were ages from the 2017 and 2018 surveys. The Team concurred with the authors' recommendation on the continued use of Model 2011_1.

The exploitation rate is about 2.8% and the fishery catch decreased 12% from 2018 to 2019. The ABC is down 6% from last year. The decline in fishery catch is expected to continue through 2022 and then reverse as the above average 2014 year class matures and recruits into the fishery. The projected total biomass for 2020 is higher because the 2014 year class is now estimated to be well above average due to its prevalence in the bottom trawl survey. In 2010 and 2017, 38--40% of Alaska plaice were captured in the Northern Bering Sea survey area. However, there is no temperature effect on selectivity, i.e., they are not correlated. There are no known environmental concerns. The Team concurred with the authors' risk table level decisions. However, the Team discussed the confusion on entering a Level 1 for no apparent concerns in the risk table when the level of risk was in actuality unknown and commented on the lack of clarity on how to document this uncertainty.

Pacific ocean perch

Paul Spencer presented a partial assessment for BSAI Pacific ocean perch (POP). Since this is a partial assessment new input data include replacing estimated catch for 2018 with final catch and updating catch estimates for 2019-2021. Final catch for 2018 was very close to the 2018 estimate from last year. Estimated catch for 2017 was 17% larger than the value estimated in the 2018 projection model. There were no changes in assessment methodology. Area exploitation rates for POP were very similar to each other, with a slight increase in the Western AI, and have averaged 0.024, which is below the exploitation rate associated with fishing at $F_{40\%}$. Estimates of 2020 projected female spawning biomass are slightly lower than last year's estimate for 2020. The recommended ABC for 2020 was 3.4% less than the 2019 ABC and 0.7% less than the projected 2020 ABC from the 2018 projection model. The Team accepted the authors' recommendations for the 2020 and 2021 Pacific ocean perch ABCs and OFLs.

Northern rockfish

Paul Spencer presented a full update of the BSAI northern rockfish assessment. Several updates were made to the input data including updated catch through 2018, projected catch, 2015 and 2017 fishery age composition, 2018 survey biomass estimate, 2016 and 2018 survey age compositions, 2016 and 2018 fishery length compositions, and updates to age-length and weight-at-age curves for fishery and survey data. Due to the data updates, the assessment methodology was modified by constraining the asymptotic survey selectivity curve to ensure that selectivity at age 15 was close to 1. Paul discussed a notable increase in tows that have targeted northern rockfish (as defined from observed hauls in which the catch of rockfish (as a group) exceeded the catch of any other species or species group, and northern rockfish had the largest catch among the rockfish species) in the most recent years, but a member of the public suggested that the increase in the number of tows may have increased due to rules for the Amendment 80 fleet. Team members discussed the importance of considering the timing of implementing management regulations when examining shifts in the fishery.

Paul discussed decreases in length-at-age from east to west that were reflected in weight-at-age measures. The recent fishery catch (i.e., from 2015 - 2018) is obtained primarily from the western AI and central AI in relatively equal proportions, although from 2011 - 2014 the catch in the western AI was reduced due to the closure of the Atka mackerel fishery. In the survey, the majority of the biomass is found in the Western AI. The adjustment to the age-length keys involved recomputing the age composition based on subarea age-length keys rather than the global age-length keys. The adjustment did not change the fishery age compositions, largely because the otoliths are sampled randomly. However, there was a reduction in the age composition for younger ages in the survey (and an increase in older ages) when compared to the global estimates. This may be due to the length-stratified methodology for sampling otoliths on the survey. After making these adjustments, the base model scaled a little higher than last year, but there was a large change in selectivity, with selectivity less than 1 for all ages. Paul then added the penalty on survey selectivity to constrain the selectivity form. Paul and other members of the Team noted that there may be other selectivity curves to explore for the future rather than retaining the constraint. Recruitment is similar to the previous model but has increased slightly.

Paul then reviewed the risk table and his concerns by category. Overall, the scores were 2 for both assessment-related and ecosystem concerns, and 1 for population dynamics and fishery performance categories. Paul was concerned that key parameters for the model are strongly constrained by priors and there was a large negative retrospective bias for a long-lived stock. Paul mentioned the potential for loss of biomass and future productivity of the stock due to localized depletion, but this was a future concern rather than a current concern. Additionally, the spatial management of the stock is not consistent with the spatial structure of the stock, but exploitation rates are currently relatively low, so this was again a future concern. It was also not clear whether this went into the population dynamics category or the fishery performance category. A member of the public suggested that the harvest of northern rockfish was relatively evenly spread across the AI but that the fishery runs into northerns during daytime tows more than nighttime tows. There was a noticeable declining trend in the condition for northerns since 2010, as measured by length-weight regression measures, and a lack of forage fish in the system. However, since the stock biomass was high and fishing rates are low, a reduction from maxABC was not recommended despite the increased level of concern. The Team discussed the use of the risk table as being helpful to articulate the concerns of the author but to leave it to the author's discretion or the SSC to determine a reduction from maxABC. However, the Team also noted that it was easy to be inconsistent with other stocks and not weigh in on a reduction if the reduction would not have much impact since the catch was typically well below ABC. The Team accepted the authors' recommendations for the 2020 and 2021 northern rockfish ABCs and OFLs.

The Team recommended addressing the issues concerning the restrictive priors on key parameters in the model and exploring alternatives for estimating survey selectivity.

The Team recommended exploring global age-length keys that weight by population size between areas.

Blackspotted/rougheye

Paul Spencer presented the partial assessment for the Blackspotted/Rougheye stock complex. The only change was to re-run the projection model with updated 2018 - 2020 catch data. The 2020 projected (age 3+) biomass is 49,005t, which is a 5% increase from 2019. Similarly, the OFL and ABC for 2020 are projected to increase from the 2019 estimates (by 29% for the AI portion of the stock). Projections suggest additional increases into 2021 (by 28% for the AI portion of the stock). Overall exploitation rates were low, but higher in the WAI and EBS. MSSC was exceeded in the WAI again in 2019 even though members of the fishing industry at the meeting indicated that the fleet was actively trying to avoid them in the POP fishery. Members of the fishing industry at the meeting reported their belief that the increase in catch was due to an increase in abundance of small fish. It was noted that the survey selectivity on these small fish (which comprise 80% of the stock, as estimated from the 2018 model) is 20% or lower, and therefore have had limited observations in our survey data and may not provide a reliable basis for estimating recruitment for the most recent time period.The Team accepted the authors' recommendations for the 2020 and 2021 blackspotted/rougheye complex ABCs and OFLs.

Atka mackerel

Sandra Lowe provided a presentation to the Team on the BSAI Atka Mackerel stock assessment. It was an off year for the Aleutian Islands bottom trawl survey and therefore no new index values were available for this species. There were no changes in the assessment model from the base model (Model 16.0b). There were additional ages from the 2018 survey and fishery. The Team concurred with the authors' recommendation for the continued use of Model 16.0b with updated data.

The addition of the 2018 fishery age composition information impacted the estimated magnitude of the 2011 year class which decreased 2% relative to last year's assessment, and the magnitude of the 2012 and 2013 year classes, which increased 10 and 12% respectively relative to last year's assessment. The 2011 and 2013 year classes are about 10% below average, and the 2012 year class is estimated to be 28% above average. Estimated values of $B_{100\%}$, $B_{40\%}$, and $B_{35\%}$ are 3% higher relative to last year's assessment. Projected 2020 female spawning biomass (109,900 t) is 3% higher than last year's estimate of 2019 female spawning biomass, and 7% higher than last year's projection for 2020. Projected 2020 female spawning biomass is below $B_{40\%}$ (116,600 t) at $B_{38\%}$, thereby placing BSAI Atka mackerel in Tier 3b. The current estimate of $F_{40\%}$ (adjusted) = 0.41 is 7% lower than last year's estimate of $F_{40\%}$ (adjusted) due to changes in the fishery selectivity used for projections. The projected 2020 yield at $maxF_{ABC} = F_{40\%}$ (adjusted) = 0.41 is 70,100 t, which is 2% higher than last year's estimate for 2019. The projected 2020 overfishing level at $F_{35\%}$ (adjusted) = 0.48 is 81,200 t, which is 2.5% higher than last year's estimate for 2019.

The Team concurred with the authors and recommended the use of the most recent 4-survey weighted average for area apportionment. Due to the low survey estimates in 2018 in area 542 there was a large shift in apportionments to area 543 and a small increase in 541 but a substantial decrease in area 542. The reason for the lack of Atka mackerel in area 542 in the survey is unknown as there was no change in CPUE in the fishery. Although the SSC recommended presentation of an alternate apportionment method which included the blending of the bottom trawl survey estimates with fishery CPUE in a random effects model, this method was not deemed appropriate for use this year by the authors or the Team as there were continued questions on appropriate weighting and validation of the fishery CPUE index.

The Team reiterated its concern regarding the use of fishery CPUE for apportionment without further evaluation.

Although the Mohn's ρ statistic for this assessment is well within acceptable bounds at 0.08 there was some discussion on the retrospective pattern. The author restated the results of last year's analysis which concluded that the retrospective pattern observed is due primarily to the addition of recent survey estimates. In last year's assessment the authors found that the retrospective bias is a reflection of data rather than issues with the model configuration.

The Team recommended that an Ecosystem and Socioeconomic Profile (ESP) be developed for this stock in 2020.

The Team discussed the high variability observed in the area-specific survey biomass estimates, with particular emphasis on the 2018 and 2012 surveys where area estimates declined substantially without other indications that the true biomass declined to the same extent. It was noted that the assessment model appropriately weights survey index values and the main concern has been in area apportionment where the area-specific estimates had been used and these low values had been highly influential. The 4-year weighted mean method adopted helps to reduce the influence of these apparently errant local estimates. Although the authors have evaluated some environmental covariates that could not be shown to correlate with these declines, an ESP may be able to identify possible additional environmental covariates to evaluate. Improved bathymetry maps of the Aleutian Islands have been produced by Mark Zimmerman and should be consulted. Commercial fishing vessels collect and store data on bathymetry and may be a potential source for added data on habitat.

A risk table was completed for this stock with Level 1 ratings for all four categories, so no adjustment to maxABC was proposed. The Team agreed with the authors' evaluation and recommendation of no adjustment to maxABC.

Skates

Olav Ormseth presented the partial assessment update for the BSAI skate complex. This is a complex of Tier 3 (Alaska skate) and Tier 5 (other skates) assessments. The Tier 5 component of the complex was not updated for this partial assessment. The estimated catches were updated and the projection model was rerun for Alaska skate. This year's estimated 2019 catch is substantially lower than that used in last year's full assessment, and the estimated biomass for 2020 and 2021 changed accordingly. The projected biomass for Alaska skate in 2020 is 491,974 t, an increase of approximately 2% over last year's projected 2020 biomass. The 2021 biomass is projected to decrease to 478,477 t. The exploitation rate continues to be below 5%. The Team accepted the authors' recommendations for the 2020 and 2021 skate complex ABCs and OFLs.

Sculpins

Tom Wilderbuer presented the partial assessment for the BSAI sculpin stock complex, a Tier 5 complex. The 2019 EBS shelf survey biomass estimates were included, as were the 2018 AI survey biomass estimates. There were no new Bering Sea slope survey data. There were no changes in the assessment methodology. The biomass estimate for bigmouth sculpin declined 11%, and plain sculpin increased 67%, which was responsible for the increase in ABC and OFL. The EBS shelf total 2019 biomass was 230,291 t. compared to the total 2017 biomass estimate of 171,760 t. The random effects model was run using the updated shelf survey data since it is the largest component of the three surveys used in the assessment. Catches appear stable, with 5,339 t in 2017, 5,109 t in 2018, and 5,315 t in 2019 (through November 2, 2019). Retention is low at about 2%. The catch to model biomass ratio has remained stable at approximately 3% from 2014 to the present. This is the last year that sculpins will be assessed as a target species, as recent Council action recommended moving sculpins to the ecosystem component category.

Forage species

Olav Ormseth presented a report on the status of forage species in the BSAI. This report is prepared on a biennial cycle and not intended to be a formal stock assessment. The author has changed the title of the report from forage fish to forage species to incorporate other species including shrimps, and the 2019 addition of squids. Currently, there are no dedicated forage fish surveys and the author highlighted the inadequacy of current bottom trawl surveys for estimating annual changes in forage species abundance, but they are useful indicators of major changes in abundance and distribution. For this report, trends in forage species were evaluated using estimated biomass and frequency of occurrence (FO) from Bering Sea bottom trawl surveys. Overall trends were corroborated with other surveys conducted in the same areas (e.g., the NBS surface trawl survey). The author reports that capelin and arctic cod seem to have almost disappeared from the bottom trawl survey, and eulachon abundance is lower than average. Rainbow smelt appeared to have expanded offshore in the NBS.

In order to verify FO trends, patterns in abundance, and spatial distribution, the Team recommended that the author investigate survey gear and timing consistency between the 2010, 2018, and 2019 surveys in the NBS to evaluate survey data comparability, as survey variability and changes in coverage of Bering Sea surface and bottom trawl surveys have occurred over time.

The Team recommended that species-specific information from the ESR and the ESP be included in the reports for those species, even if it appears in two separate documents.

Eulachon/osmerid bycatch used to occur primarily in the pollock fishery, but now occurs primarily in the yellowfin sole fishery. Information for this report is primarily from observer data. The pollock trawl catcher vessel fleet moving to 100% electronic monitoring and how this switch will affect the quality of bycatch data were discussed. There is 100% retention of bycatch required for this fleet and concern was raised about species-specific information being collected at the plant and reported on fish tickets.

The Team looks forward to seeing the EFP report that addresses forage species monitoring and retention, and requests that it be attached or linked to the next forage species report.

Squid bycatch increased in 2019 and the Team discussed reasons for the increase. The author emphasized that squids are fast growing with large biomass fluctuations, but the overall abundance in the BSAI is unknown. Squid landings in 2019 were the highest since 1981, and Team discussion focused on whether the fleet encountered more squid because it was actively trying to avoid other species, or if the increase in bycatch was due to the lack of defined catch limits as squid were newly switched to be an ecosystem component complex. The Team remains uncertain about the reasons for increased bycatch in 2019 and is unsure if the increase is population related or due to the first year of the implementation of squids as an ecosystem component. There was also discussion by the Team about the proposal in front of the Council to allow the processing and selling of squid despite its inclusion as an ecosystem component. Although the Team recognized that this was likely not currently a conservation concern for this complex, the Team remains concerned that this sets a precedent for allowing ecosystem component species to be commercially processed and sold. A concern was also voiced about the need to have a clear path for reinstating this species back under the FMP if management or conservation concerns arise with any future expansion in harvesting and marketing.

The Team discussed the herring savings area closures and the potential mis-specificity of their application and locations. The Team noted that a review of the herring savings areas would be a good candidate for a case study for ecosystem management in the new Fishery Ecosystem Plan Climate Action module on Evaluating Climate Change Effects in the Bering Sea.