North Pacific Fishery Management Council

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Minutes of the
Bering Sea Aleutian Islands Groundfish Plan Team

North Pacific Fishery Management Council
1007 West Third, Suite 400
Anchorage, Alaska 99501

September 9, 2020

Administrative

The BSAI Groundfish Plan Team ("Team") convened on Wednesday, September 9, 2020 at 1:00pm PST.

Participation was remote via Adobe Connect.

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.

EBS and Bogoslof Pollock

Denise McKelvey (AFSC) presented the 2020 winter acoustic trawl survey for the Aleutian Islands and Bogoslof island survey. The survey is conducted biennially (last one was in 2018). It provides an index abundance for the Bogoslof Island pollock assessment and is key for the internationally managed "Donut Hole" region. The 2020 survey was 2 weeks earlier than 2018 and progressed as previous surveys east to west. Two nets were deployed to enable comparative sampling, the existing/past AWT and the new LFS. The AWT has 0.5 inch codend mesh liner and the LFS has 1/8 inch codend mesh liner. In addition, the LFS is smaller and more nimble and has a smaller vertical opening (17m vs 30m of the AWT). LFS is new and will be the primary mid-water net in the future (AWT has been the net to date). There were 4 paired trawls and these revealed that both nets caught the same sized pollock but LFS did catch more small organisms like shrimp (i.e., due to the smaller mesh).

The size range in the trawl samples was 29-69 cm FL, with two modes at ~30cm and 49cm. The smaller mode was from Umnak (both Samalga and Umnak also had a larger mode of fish). At Samalga 98% of females were pre-spawning; in Umnak 11.2% and 7.1% were in spawning, post-spawning, respectively. There were generally more fish in Samalga (30K t m2/nm2).

The 2020 estimated numbers are 350 million fish and 345 thousand t, with 85% of the biomass is in the Samalga region. Most fish were 49-59 centimeters FL and were likely from the abundant 2009/2010 yr classes. This represents a 48% decrease in biomass from 2018 (663 thousand t). In terms of the biomass time series, there was a drop in 1988 when biomass were much larger, and the lowest biomass was in 2012, which included a decline of larger fish. Backscatter similarly shows that biomass is "just a shadow" of 2018. A 1 million t threshold is needed for fishing to take place; the current biomass is 60% of that target.

Analysis improvements include:

- N1. Nearest haul
- N2. "Not just pollock"- acoustic return assigned to all species likely in the backscatter
- N3. Net Selectivity- to correct for those that might have been missed by the net

Historically:

- H1. Pooled length distributions
- H2. No species specific returns
- H3. No selectivity

Alternative approaches were compared. Historical methods varied from those with H2+H3 or H3 only and all three methods (H1-H3). Results represent an improvement in approaches and estimates.

In terms of nets, LFS is easier to deploy, results in estimates of pollock abundance comparable to those from AWT, and performs better in capturing smaller species. The next Bogoslof survey is planned for 2022. The intent is to continue paired trawls on the shelf as well (to address concerns that larger fish are on shelf and might not be captured by the LFS) and will depend on the feasibility of keeping AWT nets intact enough to run side by side.

Most pollock in this year's survey were in pre-spawning condition, which was the desired outcome (i.e., the survey timing was good).

Alex De Robertis and Jim Ianelli presented saildrone results. The AFSC Saildrone survey was a contingency plan in case surveys were cancelled. The goal was to use unmanned surface vehicles to add a data point to the existing acoustic timeseries. This was feasible because fish backscatter on the EBS shelf is dominated by pollock. The approach relies on recent research and development efforts.

Saildrones are wind- and solar-powered robots and include both a calibrated 38/200 kHz echosounder and a series of oceanographic and meteorological sensors. Methods for data collection/processing have been worked out such that saildrones produce pollock backscatter comparable to surveys via the Dyson. Acoustic trawl surveys match in pattern (scaled/normalized) the bottom trawl survey (r2=0.95). The methodologies are outlined in a recent publication: ICES J. Mar Sci. 2019, 76: p 2459.

The drones sailed from Seattle to Alaska in mid-May of this year and conducted a survey with 40 nautical mile spacing. When they return home in the next month, theAFSC will have a 2020 data point to add to the acoustic survey time series. The approach will provide an index of abundance, but not age/length compositions.

Initial analyses suggested that the saildrone index with 40 nautical mile spacing should perform similarly to the traditional acoustic survey index with 20 nautical mile spacing (based on VAST estimates). Analyses were conducted using the 2018 acoustic data by comparing estimates from the even-numbered transects against estimates from all transects, and also by comparing estimates from the odd-numbered transects against estimates from all transects. The estimates from both partial data sets were unbiased.

The Team thanked the authors and researchers involved with this project on the effort, speed, and ingenuity needed to collect 2020 biomass index for 2020 pollock assessment.

The Team supports the plan to evaluate model results that include saildrone based acoustic data in the 2020 BSAI pollock assessment.

The November 2020 assessment will include the following new data 1) saildrone index of abundance (if able) and 2) new catch data. The SSC went with a different model in 2019 than the Team recommended, but both will be presented again this year. VAST estimates with and without the cold pool covariate will also be included.

In terms of fishing reports, there is evidence that the B season is poor and there are anecdotal reports of lots of small fish while overall fishing conditions are quite poor (qualitative).

BSAI Blackspotted/Rougheye Rockfish

Paul Spencer provided an evaluation of data from the 2018 assessment models and discussed management implications of recruitment estimates for BSAI blackspotted and rougheye rockfish. He reviewed the three recommendations from the Team to address the conflict between the biomass estimates and the composition data, namely to 1) update the ageing error matrix, 2) evaluate dome-shaped selectivity for the survey, and 3) update the prior distribution mean and variance for natural mortality. In the last full assessment, the McAllister-Ianelli data weighting was compared to the Francis method and these two data weighting schemes were also considered in the model alternatives in this update.

In recent years there has been a dramatic decline in older fish and a concurrent increase in younger fish in both the fishery and survey. The model does not have a mechanism to explain the less than expected number of older fish in recent years, and when composition data are added there is a resulting data conflict and degrading fit to the survey biomass estimates. The Francis weighting scheme downweights the composition data and allows for a better fit to the survey biomass estimates and more stability in the recent recruitment estimates which seems more consistent with a long-lived stock. Additionally, the retrospective pattern is much reduced.

For the three suggested model specifications, the CV of ageing error was increased through a likelihood-based method using data from BSAI samples; both the mean and the variance of the natural mortality prior were increased, representing a range of methods and recent estimates from the literature; and dome-shaped selectivity was implemented using the standard double normal curve with an offset parameter. Both the ageing error and natural mortality modifications resulted in increasing recruitment for all or several year classes, while the dome-shaped selectivity had relatively minor impacts. Unfortunately, none of these modifications have resolved the issue of the poor residual pattern in the fit to the survey biomass estimates. Also, given that other initially large year classes have not manifested into the future (1998 and 2002), the retrospective pattern suggests that we are currently estimating large year classes that could be revised downward in the future. Three new exploratory models were then proposed to improve fit and reduce the retrospective pattern. In all three cases, the ageing error and natural mortality prior distribution were updated and then the two weighting schemes were applied and a final model consideration that uses the Francis method and sets the most recent 14-year classes equal to mean recruitment. There was a slight improvement in retrospective bias using the Francis method and the authors recommend this model for November 2020.

A Team member asked about long-term solutions for model changes. Paul hopes that, as we get more survey data, we can see if the missing older fish is a process or observation question. With really uncertain estimates in recruitment we should discount those if they are going to continue to be unreliable and not give as much emphasis to the composition data.

A member of the public discussed recent gear and procedural changes that enable fishing shallower for Pacific ocean perch as a means to avoid blackspotted and rougheye rockfish. They also use excluders for halibut and cod that could be used to exclude rougheye, but mostly avoidance is achieved through shallow fishing. They are seeing a lot more small rougheye and blackspotted rockfish (~18cm), particularly this year.

Another member of the public asked if observers are getting samples from discarded fish and if this could bias the observed composition data in the event that a certain size class gets discarded. A Team member responded that observers do collect samples from unsorted catch regardless of whether it is discarded or retained and that it is more about the dominance of the stock in the haul. Paul has discussed ways for increasing the number of hauls sampled for rougheye and blackspotted since it is often not a dominant portion of the catch. A member of the public also responded that the industry would be happy to help with any special projects that would improve the data available from the fishery.

The Team agrees with the author's recommendation to pursue the following three elements for the November 2020 assessment:

1. **Updating either the natural mortality point estimate or prior distribution using recent literature,**
2. **updating the ageing error matrix with likelihood-based estimates, and**
3. **using the Francis method for weighting composition data**

The Team also recommends exploring the updated maturity data for blackspotted and rougheye rockfish

BSAI Northern Rock Sole

Jim Ianelli presented a brief update on Northern rock sole which highlighted a coding error in last year's assessment and the plan to move back to a single model approach (rather than an ensemble) this coming November. In preparing for this year's assessment, a datafile error was found in which the spawning month was not read in correctly. Subsequently, the authors updated the Executive Summary table for this assessment. The corrected values for projected total biomass and female spawning biomass were approximately 10% greater than documented last year.

The Team recommends using the corrected ABC and OFL values for BSAI northern rock sole in the 2021-2022 harvest specifications. (See 2021 and 2022 Harvest Specifications section.)

In 2018, the SSC asked the author to examine ensemble approaches and the authors provided a preliminary examination for this stock. Four models were brought forward in an example ensemble, but for simplicity, a single model was selected. The last accepted model (15.1) will be brought forward in November along with the possibility of the individual models that were part of the ensemble.

NBS Pacific Cod Tagging

Suzanne McDerrmot presented a project involving tagging of Pacific cod in the NBS in 2019 with MiniPAT satellite pop-up tags. These tags record depth, temperature, light, and movement (acceleration and orientation). This work was completed in cooperation with AFSC survey charter vessels and crew (F/V Vesteraalen and F/V Alaska Knight); Norton Sound Economic Development Corporation (Dawn Wehde, Wes Jones); and Savoonga fishermen and plant personnel, including the crew of the Adeline (Capt. Perry Pungowiyi and crew), the crew of the Scarlett (Capt. Richmond Toolie and crew), and Orville Toolie, the Savoonga plant manager. The recent changes in Pacific cod distribution have led to several research questions concerning the basic movement patterns of adult cod between winter spawning and summer feeding grounds, specifically: 1) What is the movement between the NBS and EBS? 2) Do cod move between the US and Russia? 3) Do cod stay under ice in the winter in the NBS? 4) Can cod spawn successfully in the NBS? 5) Do cod return to the NBS in the following summer? A total of 38 MiniPAT tags were released, and to date 34 have been recovered. The tags were programmed to pop-up at different durations from 3 months to 12 months. Of the 34 recovered, ten popped up earlier than scheduled and four were recovered in the fishery. Four tags failed to pop-up and are missing. These timed recoveries show a pattern of feeding areas, transiting areas, and spawning areas. Some cod moved into Russian waters, with 6 out of the 30 tags recovered from Russian waters. Further, cod can move great distances between feeding and spawning, with one fish recovered in the Western Gulf of Alaska. Movement south appears to be timed with ice extension in the winter and one of the recovered tags was from a fish that stayed under the ice. This fish appears to have died before ice moved over its location, given temperatures and movement. It appears that all of the recovered fish moved out of the NBS for spawning. Of the 4 tag returns from June through August, 3 returned to the NBS and a single fish moved into Bristol Bay. Modeling effort is currently underway to develop geolocation models through depth and light to better assess location over time. There are plans to continue this work in the NBS and Western Gulf of Alaska with a planned NPRB proposal in development. There was discussion on the limitations of

these tags in not being able to tag smaller fish.The authors recognize this, and other tagging options are being investigated for smaller fish. It was also recognized that this work would complement the work being conducted on identifying spawning habitat for cod. Collaboration with researchers working on spawning habitat is ongoing. There was also a question about possible Russian fish moving into US waters. Suzanne indicated that it would be useful to collaborate with Russian researchers on this project, but this is not currently happening.

BSAI Yellowfin Sole

Ingrid Spies presented a 'Model Evaluation for Team consideration for the Yellowfin Sole Stock in the BSAI' which is co-authored by Jim Ianelli. An alternative model (18.2) for BSAI yellowfin sole was presented along with the currently accepted model (18.1a). The alternative model (18.2) had been presented last November but had not been reviewed previously and, given that there were no conservation or other concerns indicating that an immediate switch to Model 18.2 necessary, the Team determined that it required further evaluation, so was presented again at this meeting. Model 18.1a uses M=0.12 for both males and females; 18.2 estimates M for males and fixes for females. Split sex models are common for flatfish. There is a skewed sex ratio for this species (more females in the population), and therefore it is reasonable to assume higher M for males. Model 18.2 was an improvement over 18.1a in likelihood terms, although not consistent for all elements. There was a less negative Mohn's rho for 18.2. Model 18.2 produced higher estimates of biomass and recruitment and also increased OFL and ABC. Model 18.2 with different M for the two sexes resulted in selectivity being more similar between the sexes, with similar modes when fit to survey biomass and age compositions for both models.

A Team member noted that the SSC had commented that if M is estimated in the model at a value higher than 0.12, and if the best estimate of the value averaged across both sexes is 0.12, then female M has to be less than 0.12, by about the same amount as the male M exceeds 0.12 (depending on the sex ratio).

The Team requested that both models be included for consideration in November.

The Team recommends that, if the authors have time this year or else in the future, they should consider estimating male M freely but with female M adjusted so that the average across sexes is equal to 0.12 (e.g., M_female = (0.12-(1-P_female)xM_male)/P_female, where P_female is the proportion of the population that is female).

EBS Pacific Cod

Grant Thompson presented the preliminary assessment of Pacific cod in the Eastern Bering Sea. A review of past Team and SSC comments was provided along with an overview of the data, models, and approaches to weighting multiple models in an ensemble.

A few items were noted before presenting the models. First, an ESP for EBS Pacific cod is likely to be available in November. Second, no new information regarding fishing mortality outside of U.S. waters was available. Lastly, age composition data from the 2019 trawl survey may be available for the final draft, but were not included in this preliminary assessment.

Four general topics identified from past Team and SSC comments were translated into binary factors that were used by the author to identify eight (8) models. These were 1) time-varying Q, 2) separate areas, 3) separate surveys, and 4) model movement between the two areas. It was noted that including movement in SS in the fourth group of models is complex and it was not possible to estimate annual random deviations in movement with few surveys. Instead, environmental covariates were linked to movement parameters. The North Pacific Index (NPI, November through March) was linked to the probability of movement from the NBS to the EBS and the sea ice extent (August through July) was linked to the proportion of recruitment in the NBS and the probability of movement from the EBS to the NBS.

The sources of data were similar as in past years. Eliminating small sample sizes when calculating the fishery size composition data was an improvement with little change to the outcomes. Recently available fishery size composition data through August 2020 potentially show a strong 2018 cohort, which was also seen in the 2019 fishery and survey data. The longline fishery annual CPUE by weight in 2019 was higher than any other year in the time-series since 1991. It was noted that no catches for the NBS in the 1990's were available. It was later clarified that the catch-in-areas database does not extend back beyond 2003.

The estimates of natural mortality (M) were similar across all eight models. The survey catchability for the EBS was typically near 1.0 and more variable for the NBS. Survey selectivity in the NBS increased gradually for models without movement and increased sharply near 15cm for models with movement.

Models 19.12b and 20.1 (no time-varying catchability, no movement, separate surveys, and a single area) showed poor fits to the NBS survey time-series, specifically a high predicted biomass in 2010. A Team member noted that high predicted biomass may be implausible prior to 2017 with very little fishing occurring in the NBS and an extremely low survey estimate in 2010, despite a sizable model estimate. A member of the public commented that it is possible that fishing may not have occurred in the NBS regardless of the amount of biomass due to the distance needed to travel. However, it was also noted that local halibut and crab fishermen have anecdotally commented on recent increases of Pacific cod in the region. Models 20.1 and 20.3 showed retrospective patterns with Mohn's rho values of concern. The Team noted that when including a survey time-series such as for the NBS, there is the potential for significant retrospective patterns when sparse data are removed.

The cross-conditional decision analysis (CCDA) was presented as an option for assigning weights to models in an ensemble. The Team agreed that this work is promising, but it was noted that it is challenging and may be difficult to implement in a short period of time, thus may not be available in November for a large number of models. Grant noted that prioritization of models may be helpful.

Three public comment letters were provided for this topic: one from FLC, one from an industry work group, and one from an experienced fisheries consultant hired by industry. It was noted that these models are different from models conducted prior to 2016, whereas the alternative model described in a separate document is more consistent with those earlier models, although dome-shaped selectivity is not included. There was concern with the lack of fit on the part of the public (Grant noted that age data are the only data that do not fit well) and wondered if that is expected given the assumptions in these models. Public comment reiterated that CPUE has been the highest seen since 1991, and there are good signs of a strong 2018 year class in the EBS. There was concern of a misspecification in the model given the good signs seen in 2020. It was also noted that even though fishing did not occur in the NBS in the past, this does not mean that there were not fish there.

A member of the public asked if there is potential confounding in the model given the many estimated parameters, particularly related to growth and selectivity. Even with size and age composition data from the survey, there is the potential for confounding of parameters and possibly in the future a table of parameter correlations could be included.

Industry representatives summed up their comments indicating that they tried to provide information from the fisheries that would be useful given the lack of a survey in 2020, and they would be pleased to provide additional information, if desired, in November. Industry would also like the Team to retain the ability to choose a single model.

The discussion of the EBS Pacific cod assessment mainly revolved around the eight models and working to identify four new priority models for evaluation in November in addition to last year's base model 19.12. Therefore, a few models were removed from the final set based on heuristic criteria. Models 20.1 (20.5) and 20.2 (20.6) were removed (model numbers in parentheses are from the alternative ensemble proposed) as they were not well fit and because they represent models with separate areas but no movement which is in contrast to multiple lines of evidence that suggests high rates of migratory behavior

in the Bering Sea, including recent tagging results that show migrations across the system in less than 1 year. Model 20.3 (20.7) included movement and separate areas, but also included time varying Q, which is likely confounded with movement parameters. The Team would like to acknowledge that 20.3 (20.7) represent models that address past requests and the Team would like to see continued development of these models, but they are not a priority for 2020. Future work could include evaluation through peer review, use of ESP/ESR information, information from tagging data, etc.

Model 19.12c has movement and separate areas, satisfying Team recommendations for model development, but some Team members expressed concern over new methods that need further review (i.e., the model, methods, and covariates are a novel approach that has not seen wide use in other stocks) and some team members did not think adequate review had been conducted for its use without more evaluation while others were interested in seeing the model included in the November ensemble along with additional detail and indices to enable deeper-evaluation. The Team discussed that model 19.12c (19.12e) represents an innovation that potentially may address multiple issues facing this stock, especially regarding environmentally driven movement of the stock into and out of the NBS. That said, it is a new model at the front edge of the field of fisheries assessment modeling and additional review and validation is needed to understand how the model performs. The Team applauds the use of environmental covariates in the movement model and would like to see more details of the process to select these indices and continued development of this approach. That said, the Team raised concerns regarding the sensitivity and effect of the covariate in the model that warrants further validation and evaluation. ESP and ESR coordination could work towards a set of indices that can be used to validate the emergent patterns in movement and recruitment distribution.

The Team recommends that the ESR and/or ESP provide an index of movement (e.g., using the standard EBS bottom trawl survey stations, evaluate the proportion of Pacific cod biomass over time in the northernmost survey stations that are located between 59ºN and 60ºN in years 1982-2019) to validate the movement indices in this model. This would be needed in November if these models move forward, or if not, should be included in the ESP for Pacific cod in 2021.

Additionally, it may be useful to review other models with movement to identify if there are best practices or lessons learned.

Models 20.1 (20.5) and 20.2 (20.6) with separate surveys, no time-varying Q, and no movement predicted a high biomass in the NBS over all historical years, which was anomalous relative to other models in the ensemble. This is counter to multiple lines of evidence that Pacific cod in the NBS increased in biomass in recent warm years and NBS catches have increased considerably in recent years.

The Team discussed the approach of asking for the ensemble to include the 19.12c (19.12e) model, when it may be removed in November given the additional validation information requested above (or in absence of additional information). It was agreed that, if in November model 19.12c (19.12e) is determined to be problematic and results in high weights in the ensemble, the Team will instead advance a single recommended model (rather than requesting a full ensemble re-run) that best addresses the stock assessment needs of 2020.

This year a prior was added to NBS survey catchability and that is captured in the primary ensemble. The second set of alternative ensemble models represents “no prior” models, which are more consistent with past models. The Team recommends moving forward with the alternative ensemble for November as that represents continuity with previous models and the relative performance indicates that the models without the prior are relatively stable (based on Mohn’s rho).

The Team recommends the author run the model ensemble averaging approach using models 19.12a., 20.4, 19.12e, 19.12, 19.15, and using last year’s ensemble averaging methodology (without the exponential weighting as per the SSC recommendations from 2019).

Finally, following from comments made in the November 2019 Team minutes, use of the VAST model was briefly discussed. The Team was still interested in seeing a cross-validation analysis done to determine the efficacy of predicting missing data using areas in the EBS and years with data. It was acknowledged that this work was ongoing.

Discussion of the relationship between economic considerations and specification of ABC

This section is provided as a response to the several members of the Pacific cod industry who noted in written and oral public comment that the industry is suffering economically for a variety of reasons, including decline in access to markets and large reductions in ABC and TAC in recent years.

The Team notes that in October 2018, the Council passed the following motion:

"The Council clarifies its policy is that the Plan Team develop, and the SSC recommend, ABCs which are based on biological and environmental scientific information through the stock assessment and Tier process. Socio-economic factors should be considered during the TAC-setting process at the Council, and not incorporated into the ABC recommendations."

The Team interprets this policy to mean that we have no latitude to consider any economic hardship in setting the ABC for the coming year, or to make trade-offs between the ABCs over the next two years, consistent with the 2016 Revisions to National Standard 1 Guidelines, which allow a "phase-in" of ABC recommendations based on 2- or 3-year timeframes as long as they do not exceed annual OFLs. Information is provided in the Pacific cod Ecosystem and Socioeconomic Profile (ESP), the Economic Performance Report (EPR), the Ecosystem Status Report (ESR), and the Groundfish Economic SAFE that may characterize both ecosystem and economic conditions related to the stock, but the Team cannot use the economic data to adjust the ABC.

The Team welcomes any clarification from the Council regarding industry comments on considering economic factors in ABC recommendations.

Octopus Stock Structure

Olav Ormseth presented an "Evaluation of the potential for stock structure in the Bering Sea/Aleutian Islands octopus". The BSAI octopus complex is a data-limited, Tier 6 stock comprised of several individual species, none of which are targeted in a directed fishery. For these reasons, the author noted that applying the stock structure template to this stock complex is problematic. While he was able to address all of the various components of the stock structure template, the data have serious limitations and are insufficient to make conclusions regarding the patterns of exploitation or population structuring of the octopus complex and/or Pacific Giant Octopus (E. dofleini).

Octopus catch – both as bycatch in the fishery and in the survey – is a rare event, which can influence biomass estimates. Biomass estimates are likely underestimates due to the untrawlable habitat octopus typically inhabit. There are also limited species ID data available: they have only been collected since 2010 in the survey, and none exist in the fishery.

While there are limited movement/tagging data available, movement of E. dofleini appears to be relatively limited once larvae settle out. Adult octopus are stationary 94% of the time in Prince William Sound and maintain small home ranges. Adult E. dofleini do not move over large distances (movement is measured in meters), which might contribute to geographic isolation and a high degree of population structuring. However, there is no evidence of isolation by distance across the range from the few studies of genetic differentiation in Alaska and other regions. This may be due to dispersal of the planktonic larval life stage.

Given these inconclusive results, the author questioned the utility of stock structure analyses for Tier 6 stocks. A Team member pointed out that she had previously completed three similar analyses on Tier 6 stocks and had encountered similar frustrations, but contended that the "lessons learned" from completing

the template provided valuable insights into the stocks that made the analyses worthwhile. The Team agreed and concluded that in general, a somewhat inconclusive stock structure analysis report for a Tier 6 stock is acceptable given the data availability limitations. The Team will still need to make an evaluation of stock status in these cases. Another Team member noted that we sometimes interpret lack of information as "little or no concern," which is different from a clear demonstration that no problems exist.

With respect to stock structure issues, the Team agreed with the author that the octopus complex be given a rating of "little or no concern."

2021 and 2022 Harvest Specification Recommendations

The Team approved the proposed harvest specifications for 2021 and 2022 by recommending the 2021 BSAI final harvest specifications for OFLs and ABCs as published in the Federal Register in March 2020, with the exception of BSAI northern rock sole. The Team recommends the revised 2021 OFL and ABC for the proposed 2021 and 2022 from the model correction discussed under the northern rock sole agenda item above.

Adjourn

The meeting adjourned at approximately 3:00 p.m. PDT.