Minutes of the Bering Sea Aleutian Islands (BSAI) Groundfish Plan Team

North Pacific Fishery Management Council
1007 West Third, Suite 400
Anchorage, Alaska 99501
November 17-20, 2020

Administrative

The BSAI Groundfish Plan Team ("Team") convened on Tuesday, November 17, 2020 at 09:00am 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. Except for the Alaska plaice and northern rockfish assessments, which were written in "partial assessment" form, all assessments this year were written in "full assessment" form.

Eastern Bering Sea slope and Aleutian Islands surveys:

The Team noted that the continued lack of surveys in the eastern Bering Sea slope and the Aleutian Islands region is a concern for many flatfish and rockfish stocks that rely upon this data. The recent uncertainty analysis by Bryan et al., 2020 notes that stocks that rely on the biennial survey update are more impacted by the loss of one survey. A large number of stocks will have increased uncertainty in the biomass estimates, if future surveys in the Bering Sea slope and Aleutian Islands are not prioritized. This may result in increased risk levels in the assessment category.

Ecosystem Status Reports

Bering Sea Ecosystem Status Report

Elizabeth Siddon provided an overview of ecosystem conditions and considerations for the Bering Sea. There were 80 contributors to this year's report. There were multiple updates to the 2019 recap, but limited surveys in 2020 due to Covid restrictions resulted in no update to many of the ecosystem timeseries. Nevertheless the Team endeavored to assess the ecosystem and through collaborations and contributions that proved vital in 2020, including knowledge shared by Indigenous partners. The Team also thanks the long list of contributors for their continued contributions which provide invaluable understanding of ecosystem condition and productivity and context for stock evaluations and assessment.

These contributions represent some of the most exciting and cutting-edge knowledge for fisheries management in the US. The Team greatly appreciates the following contributions in particular:

The Team is appreciative of the co-production of knowledge for seabird and plastics information and thanks the contributors for sharing their knowledge with the Team, especially this year when such information is critical and when surveys were not available. This information illustrates that ecological conditions in the Northern (NEBS) and Southeastern Bering (SEBS) continue to exhibit divergent responses to climate- driven change, with indications of limited fish forage in the north and limited lower trophic zooplankton forage in the SEBS. This knowledge also highlights an important novel threat emerging in the NEBS in response to sea ice loss, that

of increased plastic marine debris which may have large impacts on marine ecosystems and human health and food security in the region. This is an emerging threat of ecological concern.

The Team was also thankful for the contributions of Drs. Kelly Kearney colleagues for the operational delivery of the ROMSNPZ based cold pool index and hindcast. These model-based cold pool estimates provide a standardized metric (on July 1) that allows for the comparison of cold pool areas across years, including years prior to standardized Bering Sea surveys, and in this year when a survey was not available. The second ROMSNPZ operation product of note is a crab-specific Ocean Acidification (OA) index developed by Dr. Darren Pilcher and colleagues, which provides spatial information on areas of highly corrosive bottom waters. This index is extremely important for understanding climate- driven changes to the distribution and survival of Bering Sea species and potential real-time impacts on crab habitat.

Finally, the Team appreciates the effort of Jordan Watson to provide a marine heatwave index for the NEBS and SEBS, using the standardized category 1, 2,3, 4 ratings of the Hobday et al. (2016) Marine Heatwave (MHW) index, providing the Team and Council with standardized information on the strength of each heatwave in addition to the persistence across seasons and regions. This MHW index is needed for EBS and will provide excellent information and context for the level of anomalous conditions in the Bering Sea. The Team notes that NEBS continues to be in a category 1 MHW through Fall 2020.

The Team encourages continuation, to the extent possible, of the contributions on seabirds and plastics, ROMSNPZ-based cold pool index and hindcast, and standardized marine heatwave index.

Bering Sea ecosystem conditions

Recent conditions in the Bering Sea and Aleutian Islands are not particularly favorable, with persistence of warmer than normal conditions, especially in the NEBS. Marine heatwaves (based on SST) as high as category 3 were observed in winter 2019/2020 but had decreased to warmer than average conditions in SEBS by end of summer 2020, while the NEBS remains in a MHW (category 1). While warmer than average, 2020 is markedly cooler in general (closer to average) than the extremely warm preceding years. Sea ice extent in the winter 2019/2020 was normal to slightly above normal, although thinner than normal and weak ice led to an early and rapid break up and melt in spring 2020. The cold pool index in 2020 is based on the hindcast of the high resolution ROMSNPZ model (which has good skill for bottom temperature). The cold pool index is approximately average for July 2020. A new ocean acidification index from the ROMSNPZ model predicts areas of corrosive bottom water for crab (< pH7.8) in areas of Norton Sound and along the shelf break.

There is evidence of earlier than normal spring bloom (~ 1 week) and below average Chl-a biomass during spring 2020 across all areas (has been low since 2016) except for the outer domain which was above average in 2020. Coccolithophores were more extensive in 2020 particularly over the middle shelf relative to 2019 and 2018 and indicate longer trophic chains and less efficient energy transfer through the food web. Coccolithophore blooms can reduce foraging success for birds and fish (visual predators).

Upper trophic conditions are limited by disruption of ecosystem surveys in 2020 due to Covid but multiple observations and knowledge sources provide insight into current conditions in the EBS. Co-production of knowledge in the report includes the seabird synthesis (see “Integrated seabird information”) and which found that NEBS had a die off event that continued in the Northern Bering Strait of primarily fish eating birds (as well as some planktonic foragers). In

contrast, bird populations in the Pribilof Islands were average or just below average for fish-eating bird species while planktivorous bird species continue to decline (i.e., fish eaters appeared able to find food while planktivorous birds could not find forage).

The Unusual Mortality Event for gray whales which began in 2019 continued into 2020. Whales spend summer and fall in the Bering and Chukchi Seas and feed on small invertebrates (mysids, amphipods, and crab larvae). This UME could be due to a variety of causes including disease, starvation, and Harmful Algal Blooms (HABS).

In 2020, Bristol bay had the 5th largest run of sockeye salmon on record. Juvenile sockeye salmon feed on zooplankton and age-0 pollock and adults feed on zooplankton and krill. Herring bycatch in 2020 was extremely high during the pollock A season in particular (exceeding the limit). Age 1 predation mortality of pollock continues to decline towards or below the long-term mean.

Co-production of knowledge in the report summarizes a large marine debris event in the Bering Strait including plastics along beaches and wrack lines. Debris is predominantly foreign in manufacturing (Russian and Korean writing). This emerging threat raises concern regarding food security and contamination.

Aleutian Island Ecosystem Report

The Aleutian Island Ecosystem Status Report was presented by Ivonne Ortiz. The report is presented every other year and the last update was in 2018. There were 29 contributors to the 2020 report. The author highlighted three noteworthy items:

1. Fisheries in the AI were greatly impacted by Covid19 in 2020 and industry spent over 50$ million throughout Alaska to reduce the risk of Covid19 in their operations.

2. There were also two high toxicity harmful algal blooms (HABs) events in 2020. One HAB event was Unalaska which sadly led to one fatality in July 2020, with unknown impacts on marine organisms . The HABs were in blue mussels and snails and were found in Amaknak Islands (Unalaska Bay). The second event was in September 2020, in the Kamchatka Peninsula where seals, octopi and numerous benthic invertebrates died; swimmers and surfers also reported sickness and corneal burns.

3. The Adak processing plant that was bought by the city and was closed in 2020.

Aleutian Islands ecosystem conditions

Conditions in the recent years have not been particularly favorable in the Aleutian Islands.

Since 2013 there has been an increasing trend in marine heatwave days with the eastern AI SST in a category 1 (of 4) prolonged marine heatwave in 2019. Warm conditions were observed in the central and western AI but were not as high or extended, and the number of marine heatwave days was much lower (below 100 vs over 300 in the eastern Aleutians). There have been extended periods of above average SSTs and subsurface temperatures since 2016. Warmer temperatures 1) may increase bioenergetic costs and consumption demands beyond what may be available, may partly explain why the observed body condition of several commercial groundfish has been lower than the survey mean since 2012, 2) may impact pelagic habitat and and ontogenesis of Atka mackerel eggs for example, and 3) is the most important determinant of egg and larval stage distribution of commercial fish in Alaska and may impact recruitment.

The North Pacific Gyre Oscillation (NPGO) has been below the long-term average since 2013-2014 and SST has experienced a positive anomaly across the AI chain. This was coupled with a decreasing trend in copepod community size, from 2013-2018, which. There has been low eddy kinetic energy (EKE) since 2012 in the eastern Aleutians which are typically characterized by high-intensity distinct eddy events, and less intense but consecutive or prolonged multi-year eddies characteristic in the north and south of the central and western Aleutians respectively. There is generally a low volume of heat, salt and nutrient flow through the passes. These changes coincide with decreasing trends in large diatom abundance and copepod size. Abundance of large diatoms has been decreasing, with a significant negative anomaly in 2019. Copepod community size was above the long term mean in 2019.

There was decreased storminess in 2019/2020 winter favoring seabird foraging. Seabird data was updated in 2019 and in both the west and eastern AI, the hatching chronology (phenology) of plankton and fish-eating seabirds had earlier or average timing potentially signaling an early spring bloom. Average or above average reproductive success of plankton and fish-eating seabirds compared to previous failures of fish-eating and zooplankton eaters, are all above average for Aiktak. In Buldir, only three species had below average reproductive success; common murres (failed), red legged kittiwake and fork tailed storm petrel had below average reproductive success, while all others had above average success, signaling favorable foraging conditions for chick rearing and thus, favorable foraging conditions are expected for groundfish as well.

Kamchatka pink salmon and POP are planktivorous species that have increased and been abundant in the last few years, while Atka mackerel has decreased since 2006. Area occupied by POP has also increased. Fish condition (weight at length) across the AI has been below average since 2012 for several commercially important groundfish. In the West AI there are continued declines in the numbers of pups and non-pups of steller sea lions in 2019 while in the east there are some increasing estimates of pups and non-pups.

During 2020, SST was lower compared to 2019 but still above the long-term average. Coming out of the winter of 2020-2021, slightly warmer SST is forecasted by the North American Multi-Model Ensemble (NMME) for the central and western Aleutian Islands.

EBS pollock

Alex De Robertis gave a presentation on the use of uncrewed surface vehicles (USVs, as hired from the company "Saildrone") to mitigate the loss of data resulting from cancellation of this year's acoustic-trawl survey (ATS), including a detailed response to an October SSC request for the assessment authors and Team "to thoroughly discuss assumptions, caveats, issues, and concerns with using the 2020 saildrone data in place of ship-based acoustic-trawl survey results."

Jim Ianelli presented the stock assessment for EBS pollock. The authors responded to several Team and SSC requests. In response to an SSC request for re-evaluation of the stock's Tier 1 designation, the authors examined the effects on the stock-recruitment relationship of relaxing the prior distribution on the slope at the origin, forcing the estimate of FMSY to equal the estimate of F35% (the Tier 3 proxy for FMSY), and ignoring the 1978 year class (the largest year class in the time series, despite having been spawned at one of the lower levels of spawning biomass in the time series). The authors did not recommend a change in tier designation, and neither did the Team.

Four models are included in the assessment:

- Model 16.2, the model selected by the SSC in 2019.
- Model 20.0, which is the same as Model 16.2, except that it includes the 2020 USV data as an extension of the standard (design-based) ATS time series.
- Model 20.1, which is the same as Model 16.2, except that, instead of the standard ATS time series, it substitutes a VAST-based time series derived from the RV Oscar Dyson backscatter data from 1994-2018 and the USV backscatter data from 2020.
- Model 20.0a, which is the same as Model 20.0, except that estimation of the stock-recruitment relationship ignores the 1978 year class.

The authors recommended Model 20.0a, because:

- It extends the ATS time series, which Model 16.2 does not
- It incorporates aspects of the ATS data that Model 20.1 ignores (i.e., species and size composition).
- The stock-recruitment curve is not strongly influenced by the 1978 year class, which may be an outlier in terms of current stock productivity.

The Team agreed with the authors' model choice.

The authors' scored the categories in the risk table as follows: assessment = 1, population dynamics = 1, environmental/ecosystem = 2, and fishery performance = 2. In discussing the risk table, Team members expressed varying views as to whether the scores should reflect current issues primarily, or whether the focus should be more on long-term issues. The Team agreed with the authors' scores.

The stock's Tier 1 designation notwithstanding, the authors' recommended ABCs for 2021 and 2022 are based on the Tier 3 maxFABC harvest control rule, as in previous years. In response to a question from a Team member, Jim noted that, although the factors listed under both the environmental/ecosystem and fishery performance categories contributed to his recommended reductions from the respective maxABC values, those listed under the fishery performance category figured somewhat more prominently. The authors' recommended OFLs for 2021 and 2022 follow from the Tier 1 FOFL harvest control rule. The Team agreed with the authors' ABC and OFL recommendations.

Jim and the Team also discussed the impact of electronic monitoring (EM) in some segments of the fishery on data availability. Overall weight composition, with some level of spatial resolution, is still available from shoreside sampling, but tow-by-tow weight frequencies are not. Also, effort data associated with EM is not as accessible as with traditional monitoring (e.g., EM effort data for 2020 will not be available in AKFIN until January 2021).

The Team recommended that the AFSC stock assessment groups evaluate the impact of data loss associated with the fixed gear EM program and the trawl EM Exempted Fishing Permit.

Bogoslof Pollock

Jim Ianelli presented the assessment of Bogoslof pollock. Despite the COVID-19 pandemic, the most recent acoustic-trawl survey was conducted in February 2020. The analysis included the

results of the acoustic-trawl survey along with age composition estimates. Natural mortality was reevaluated by the authors with the additional age composition data from the survey and minor fishery catches. The Team recommended the authors' Tier 5 estimate of ABC and OFL. No risk table was presented in the assessment document received by the Team, although the authors have since added one, with scores of 1 for all categories.

AI Pollock

Steve Barbeaux presented the assessment for the Aleutian Islands (AI) walleye pollock stock. Two models were shown, model 15.1 (accepted model from the previous assessment), which is an age structured model with a constant natural mortality (M) estimated by the model using a prior mean of 0.2 and prior CV of 0.2, and model 15.2, which additionally includes age-specific natural mortality. The 2020 AI survey did not take place in 2020 due to COVID-19 precautions, but the models were updated with new age compositions from the 2018 survey and fishery observer data, as well as updated 2019 and 2020 fishery catch estimates. Models show comparable fits in recent years, but diverge slightly in the early time series. The author recommended continuing with model 15.1, which has a low retrospective bias and good skill in terms of fit to survey and fishery composition data.

Results show that the strong 2012 year class remains dominant, but is not as large as the 1978, 1989, and 2000 cohorts. Recruitment has been low in recent years (last 2 years are based on average recruitment). The fishery has been small since reopening in 2005, after a 1998 closure. The stock is also limited by a 19,000 t cap. In 2019 and 2020 an Exempted Fishing Permit (EFP) was implemented which allowed for 500 t of Pacific ocean perch bycatch in the A-season pollock fishery instead of the trip specific bycatch limits. This EFP was intended to provide more opportunities for a limited directed AI pollock fishery. In 2019 weather precluded a substantial fishery; however, in 2020 three boats participated, landing a total of 702 t of pollock and 107 t of Pacific ocean perch. Total catch in the AI was 1,660 t in 2019, and as of October 22 the 2020 catch was at 2,828 t despite a much higher 19,000 t TAC.

The risk table analysis is set to Level 1: Normal across all four categories. The Team agreed with the recommended model (Model 15.1), reference points, and risk table values presented by the author.

EBS Pacific cod ESP

Kalei Shotwell presented a draft ecosystem and socioeconomic profile (ESP) for EBS Pacific cod (a few items incomplete). A complete ESP will be conducted in 2021. It was noted that the ESP may be considered a proving ground for the potential use of ecosystem and socioeconomic considerations in the stock assessment.

Past recommendations included investigating movement of Pacific cod between the EBS and NBS. The ESP used center of gravity and area occupied estimates from VAST to examine recent movement patterns. Center of gravity supported northward and westward movement in recent years, and the northern movement was correlated with the extent of sea ice. However, the area occupied did show large differences in recent years.

EBS Pacific cod assessment

Grant Thompson presented the EBS Pacific cod assessment. The assessment included seven (7) individual models representing four of five requested by the Plan Team in September

(models 19.12, 19.12a, 19.15, and 20.4, one additional model was removed by the SSC during the November meeting) plus 3 additional models (Models 20.8, 20.9 and 20.10). These models span specific combinations of four binary specifications: 1) time-varying catchability for the survey, 2) combine the EBS and NBS surveys, 3) estimate dome-shaped selectivity for the survey, and 4) include a new fishery CPUE index (Models 20.9 and 20.10). The four combinations of time-varying catchability and combining the EBS and NBS surveys were presented to the Team in September. Three additional models (with time-varying catchability and combined surveys) were supplied with or without dome-shaped selectivity and without or without a fishery CPUE index. Multi-area models with movement were not included in the ensemble but will be presented at the CIE review in 2021. Two ensemble combinations were presented; ensemble A composed of the 4 requested models (models 19.12, 19.12a, 19.15, and 20.4) and ensemble AB which included the four original models plus the three additional models 20.8, 20.9, and 20.10.

A new fishery CPUE index was introduced that combined observations across gear types by weighting by the catch for each month within a year and each gear type. Models 20.9 and 20.10 are fit to this index (as well as existing fishery and survey data). A large amount of data are used to create this index and the resulting uncertainty is low; because the fishery CPUE data have much smaller variances than the survey index data, Models 20.9 and 20.10 tend to fit the former much more closely than the latter. The Team noted that this CPUE index and method for deriving the index was new for the EBS Pacific cod assessment and has not been reviewed previously. In agreement with written public comment, it would be worthwhile to investigate statistical standardizing methods for CPUE, especially at the upcoming CIE review.

The fishery CPUE time-series was fit with time-varying catchability and time-varying selectivity, which are confounded. This resulted in accurate fits to the CPUE data and model 20.10 showed no deviations in catchability because selectivity was able explain much of the variation. Examining a simpler model for fitting CPUE data may be worthwhile as 20.9 and 20.10 may be overparameterized.

A set of nine criteria were defined to determine weighting for each model in the assessment ensemble, with each criterion given an emphasis of 1, 2, or 3. These criteria were originally developed to provide contrast between models in past ensembles, but the model set has been reduced and the current suite of models are more similar. Therefore, the criteria are often scored the same between models and the models are nearly weighted equally.

The ensemble represents structural uncertainty and therefore it is useful to have a range of models depicting alternative modelling assumptions and various data sources. The justifications for picking a single model are likely different than justifications for choosing an ensemble. The Team felt that this is an important concept to consider when choosing an ensemble model. The Team noted that the retrospective bias of both ensembles was very low, especially in comparison to past models that showed significant retrospective bias.

The presentation included a very useful comparison of management advice and population characteristics from different years to explain why OFL/ABC values are much less in the 2020 models than past adopted values. Comparing 2012 to 2020, there were many small fish in a few age classes, resulting in a biomass that was lower than equilibrium biomass. Based on current predictions of equilibrium reference points, the harvest rate in 2021 was higher than the equilibrium harvest rate. Furthermore, a comparison to 2019 shows that 2019 had higher abundance and biomass for a few age classes, in particular age 6, resulting in a higher OFL/ABC values than predicted for 2020 given a reasonable harvest rate.

The risk table was discussed and the Team agreed with the author's assignments. There is some concern with the assessment, but the Team felt that the ensemble captures a lot of uncertainty and the risk should remain at 1.

Public comment was provided in person by three individuals and also in the form of a submitted document. The work that Grant Thompson has done on the assessment was commended and the consideration of industry input was appreciated. It was noted that fishery observations have been increasing and indicating that the abundance appears to up in the Bering Sea, the Pacific cod estimate from the IPHC survey had increased by 32% in 2019, bycatch of Pacific cod has increased, fish conditions are above average, and many stakeholders are reporting the best fishing they have seen. The assessment models were quite different years ago (e.g., dome-shaped selectivity) and it may be that none of the current models are worth accepting. Therefore, it was noted that an option is to not accept a model, but to roll over last year's ABC until a CIE review can be conducted and additional observations are reported from 2021. Another commenter noted that industry has been monitoring the size of fish and has noticed a spike in small fish that may be indicative of a strong 2018 year class. Furthermore, boats are going to fish where CPUE is high and the stock is at a level where it is fairly easy to maintain high CPUE.

The Team recommended omitting the models containing fishery CPUE from the ensemble and including the additional model with dome-shaped selectivity along with the four models representing ensemble A. This ensemble of five models (models 20.4, 19.12, 19.12a, 19.15, and 20.8) is labelled ensemble C. The Team appreciates new models and data to be presented in September and was concerned that the new CPUE index may not be proportional to abundance and needs further review. The Team also noted that if an ensemble was not selected, the preferred single model was 19.12.

The Team recommended retaining only the following weighting criteria: those with an emphasis factor of 3; the fits consistent with variances; and new criteria of whether asymptotic survey selectivity is used and whether the model was previewed in September, both with an emphasis factor of 1. The new criterion would apply a 0 to the model with dome-shaped selectivity and a 1 to the four others, and a similar scoring for the September preview criterion. This resulted in the following weights for each model: M20.4 = 0.1509, M19.12a = 0.2075, M19.15 = 0.1887, M19.12 = 0.2453, and M20.8 = 0.2075.

The Team recommended that the fishery CPUE be standardized using alternative statistical methods and that it be discussed at the CIE review in 2021. This should also include a discussion of historical changes in the fishery that may affect the relationship of the index to abundance.

The Team recommended collating fishery information in the ESP. Although the CPUE index was of concern to the Team, the Team recognizes that fishery performance has been improving and that these observations should not be ignored. Inclusion of fishery performance in the ESP and evaluation of the CPUE index with those performance metrics may help provide important insights.

The Team recommended the following topics could be considered for the 2021 CIE review: development of a fishery CPUE index, incorporation of dome-shaped survey selectivity, models to include in an ensemble, whether to apply the sloping HCR before or after ensemble averaging of SSB and other reference points, and development of movement models.

AI Pacific cod

The Aleutian Islands Pacific cod Tier 5 assessment was presented by Ingrid Spies. An age-structured model was not updated this year, but will be presented in the future for consideration as a Tier 3 assessment.

Catch in 2020 was lower for a number of reasons. Public comment mentioned some reasons being no shoreside processing set-aside, closure of the Adak processing plant, more parasites in the fish, and little market for AI Pacific cod. The lower catch was not due to the COVID-19 pandemic.

The parasite load in AI Pacific cod was discussed briefly, during which anecdotal information suggested that there are generally two types of observations relative to parasites: small fish with a high parasite load and large fish that are parasite free. It is unknown if this is indicative of two stocks or if it correlates with observed genetic differences.

The Team agreed with the author's recommendation of a Tier 5 assessment. This stock is scheduled for an ESP.

The Team recommended that an age-structured assessment be presented to the Team in September 2021.

Yellowfin sole

Ingrid Spies presented the results from four assessment models. One is last year's model (18.1); one is the same as last year's model, except with natural mortality fit for males (18.2); and two are exploratory models with VAST estimates of survey biomass for either the eastern Bering Sea only (18.3) or for both the eastern and northern Bering Sea (18.4). The author recommended use of model 18.2 (which was previewed last November and again this September) for setting 2021-2022 harvest specifications and the Team concurred. The risk table indicated no adjustment to the maximum ABC was necessary, and the Team concurred.

A member of the public noted that yellowfin sole fishermen struggled to find areas with good yellowfin sole fishing and low Pacific halibut PSC in 2019. In 2020 bottom temperatures were cooler and fishing was better. Market issues drove the differences in the fishery this year. The yellowfin sole market had some issues in 2020 with the COVID pandemic affecting European and US "white table cloth" markets and tariffs affecting product reprocessed in China. However, these circumstances had normalized towards the end of the year.

The Team recommended that the authors investigate decreased female natural mortality and weight at age next year to help address the issue of a positive retrospective bias in the recommended model. In addition to the Team's recommendation from the September meeting on estimation of sex-specific natural mortality rates, one suggestion was to fix the male natural mortality rate at the current value in model 18.2 and fit the female natural mortality.

Greenland turbot

Meaghan Bryan presented the BSAI Greenland turbot assessment. Overall stock trends show increasing spawning stock biomass due to growth of the strong year classes from 2007-2010, while total biomass is slightly decreasing due to a lack of more recent recruitment. Three models were presented: 1) the base model from 2018 (16.4); 2) the base model with a correction so that the AFSC longline survey index is in units of numbers rather than biomass,

and run only with data through 2018 for comparison (16.4a); and 3) the corrected base model with data through 2020 (16.4a (2020)). The correction to the treatment of the longline survey index resulted in only minor differences to the model outputs and the author recommended model 16.4a (2020) for the current assessment cycle. A Team member commended the author for "catching" this error in the treatment of the AFSC longline survey data and the Team agreed that this correction is appropriate and needed.

The author presented the risk table scores of 1/1/2/1. The Team agreed that the score of 2 for Ecosystem Considerations was justified given the biology of the species and its dependence on the cold pool for recruitment. There was discussion regarding the score of 1 for assessment concerns and the author described going "back and forth" between a score of 1 and a score of 2 for assessment concerns but settled on 1 because the concerns are not new (i.e., they are known issues with the assessment). These include the positive retrospective bias in recruitment and spawning stock biomass as well as the lack of a slope survey in recent years including 2020. A Team member asked at what point the lack of a survey will lead to a higher risk table score, especially given the recent lack of recruitment creating a stronger need for updated survey information. The Team briefly discussed alternative options of filling in some gaps, such as using the VAST model to combine the EBS slope and AFSC longline surveys. However, discussion was fairly limited on this topic and no formal recommendations were made.

The Team accepted the author's recommended model (16.4a (2020)), risk table values, and reference points, of which the 2021 ABC is ~14% lower than previously estimated for 2021 and ~24% lower than 2020. The ABC is apportioned into the Aleutian Islands and Eastern Bering Sea sub-areas based on the proportion of adult biomass observed in the EBS slope survey estimates and the Aleutian Islands since 2010. These values were also presented and there was no disagreement or further discussion from the Team.

Arrowtooth flounder

Kalei Shotwell presented the arrowtooth flounder assessment. Overall the stock appears to be stable and biomass is increasing. The stock saw strong recruitment in 2016 and has seen fairly consistent recruitment (near the long-term mean) over the recent time series.

The assessment used the previously accepted age-structured model (model 18.9). There were no changes to the assessment methodology, but new catch, survey, and age/length comp data were included for 2020, and there were also some minor changes to the existing input data. The author described some of these changes to the input data - most notably, the catch proportions of Kamchatka and arrowtooth flounders were slightly adjusted for 2008-2010 after consultation with the Fisheries Monitoring and Analysis Division. There is little net effect on the model results from these changes.

The author presented the risk table and her rationale for landing on values of 1/1/1/1. Some concerns were identified and discussed, particularly for the Ecosystem Concerns category given the warming that occurred and the shrinking of the cold pool from 2016-2019. However, Arrowtooth tend to avoid the cold pool, are generalists, and had good body condition in 2020, so the author felt that these overall ecosystem concerns may not be applicable to this stock. This triggered another short discussion regarding whether risk table scores should be assigned consistently across assessments, or whether the differences between individual stocks (biology, life history, ecology, fishery interactions) and assessment methodologies (tier designation, model inputs/parameters, data weighting) prevent this. This discussion was again tabled for a future Joint Teams meeting. The Team accepted the author's recommended model (18.9), risk

table values, and reference points, of which the ABC's are ~10% higher than previously specified for 2020.

Kamchatka flounder

Meaghan Bryan presented the Kamchatka flounder assessment. This assessment is conducted biennially in even years. The Team commended the author for the clear and thoughtful presentation. The author presented the previously accepted model, Model 16.0a, as well as the same model but with updated data (except for the age transition matrix), and Model 16.0b, the same as 16.0a with updated data (including the age transition matrix). Thus, any differences in the model were due to changes to the input data. The author recommended Model 16.0b due to the improved retrospective pattern and model fit.

Meaghan completed the risk table. All categories were ranked Level 1. However, the author noted that the lack of an EBS slope survey could lead to increased uncertainty about the adult proportion of the population.

Meaghan laid out plans for future assessments, including: evaluating formal data-weighting to address overfitting of the EBS shelf survey; ageing error; and exploring separating age and length composition data between the Bering Sea and Aleutian Islands subareas. The Team supported these plans. The Team accepted the authors recommended Model 16.0b and the risk table levels.

Northern rock sole

Jim Ianelli presented the BSAI Northern Rock Sole assessment which he co-authored with lead author Carey McGilliard. Results from three models were presented: Model 15.1 (the accepted model from 2018), model 18.3 (which was presented in 2018, and which the authors were encouraged by the SSC and Plan Team to explore further), and "model 18.3 downweight", which was an exploratory model based on 18.3, intended to show the influence of reducing the weight given to age composition data by 75%. Model 18.3 led to improved values for all three major likelihood components (survey biomass, survey and fishery age composition data) relative to Model 15.1; thus the authors recommended adoption of 18.3. The Team agreed and accepted model 18.3, along with the author's recommended reference points and risk table values.

When the harvest tables were presented, a Team member questioned why the OFL and ABC for 2022 were so much larger than for 2021. The presenter noted that there has been a "slug of new recruits" showing up in the survey data, and there is uncertainty in where those fish are coming from and why the larger, older individuals are disappearing. A Team member commented that this dynamic is comparable to what is occurring with sablefish. This uncertainty in the model is what the authors used to justify a level 2 rating in the "assessment" category of the risk table (the other categories were all rated level 1). No reduction from maxABC was recommended, which led to another discussion about the risk tables in general and whether they should be consistently applied across assessments. The Team did not attempt to reach any consensus about this and it was determined that this is a Joint Plan Team issue, which should be taken up for resolution at a later Joint Plan Team meeting. Ultimately the Team agreed with the authors' recommendation not to reduce ABC from maxABC.

Flathead sole

Cole Monnahan presented the flathead sole assessment. Cole is the new author for this stock and did an excellent job with his presentation. Model 18.2 was accepted; this sex- and age-structured model is very stable, has little retrospective pattern, and was the model previously accepted after incorporating changes from a recent CIE review. Formerly, this model incorporated temperature directly, but was subsequently removed due to it no longer improving model fits. Cole will revisit temperature in the future and may examine splitting off the pelagic trawl fishery and estimating its selectively separately. As a new author this year, Cole will later address previous SSC comments that were not addressed for this assessment. Overall, the risk table showed little concern (level 1 for all categories) and the catch for this fishery is consistently well below the ABC.

Alaska plaice

Olav Ormseth presented the (partial) assessment for the BSAI Alaska plaice stock. Alaska plaice is a non-target species, but retention is high. Biomass is slowly declining. The estimates of reference points in this year's partial assessment are slightly different from those of the previous assessment, which was prepared by a different author who is now retired, but it is the author's judgement that the projections are acceptably similar.

Catch is well below maxABC and the TAC is adjusted to accommodate the existing levels of catch. Exploitation rate is trending upward but remains low, between 3-5% in recent years. Harvest recommendations are slightly higher than the 2021 projection from last year's assessment. The Team agreed to accept the harvest specifications recommended by the author. No risk table analysis was presented as this is a partial assessment.

Other flatfish

Cole Monnahan presented the assessment of the other flatfish stock complex. A full assessment is conducted for this stock every four years. For this Tier 5 assessment the methodology was unchanged. Catch estimates were added for 2017, 2018, 2019, and 2020 and catch for 2016 was updated. Survey biomass estimates were also added for recent years. Catch estimates of the 15 flatfish species included in the assessment were dominated by starry founder on the Eastern Bering Sea Shelf and rex sole in the Aleutian Islands. The author reported that longhead dab showed an extreme decrease in survey biomass on the EBS shelf, but the cause is unknown. Team members discussed the difficulties of assessing multiple stocks and highlighting concerns, if any, for individual species in the risk table. The Team accepted the author's recommendations for the 2021 and 2022 ABCs and OFLs. The risk table indicated no adjustment to the maximum ABC was advised, and the Team agreed.

The Team recommended that the author consider adding a secondary table, by species, to the risk table. This breakdown will highlight species specific concerns that can be tracked over time.

Pacific ocean perch

Paul Spencer presented the BSAI Pacific ocean perch (POP) assessment. New data were added to the model since the last full assessment in 2018, but there were no changes to the stock assessment model. New data include catch data updated through 2019 and 2020 projected catch, 2018 AI survey age composition data (replacing the 2018 length composition data), new 2018 fishery length composition and 2019 fishery age composition data, updated

length-at-age and weight-at-age schedules, and an updated length-at-age conversion matrix. Sample sizes for age and length compositions were reweighted using the McAllister-Ianelli iterative reweighting procedure. An economic performance report (EPR) for rockfish was included, as with the last full assessment.

Paul reviewed catch by month within the context of the EPR, showing that the northern rockfish share of the retained catch has more than doubled recently with prices decreasing for both POP and northern rockfish. Also, discards were higher this year than last year. There continues to be a conflict between the age and length composition data and the survey index data. With no new survey biomass data in the model this year, the new compositional data have more influence and create a stronger decrease at the end of the modeled time series. There is a fairly strong residual pattern in the model fit to the survey biomass index, consistently overestimating the middle of the time series and underestimating the last five survey years. The fit to the slope survey has not changed. There were no surprises in the age or length composition data as they look very similar to past data.

The model fits the age composition fairly tightly in the Aleutian Islands but not as well in the Bering Sea bottom trawl survey. However, the majority of the biomass is in the Aleutians. Paul expressed some concern over the lumping of the two regions together in the model as the Bering Sea and Aleutian Islands are very different ecosystems and the two areas have different compositions and survey trajectories. Also, smaller fish are caught in the Aleutian Islands than in the Bering Sea. There was a small change in the estimate of the fishery selectivity curve (higher at younger ages), which results in lower F_{spr} reference points. Mohn's rho improved from -0.45 to -0.24, which seems to be a result of not having a new survey this year. In general, estimates of recruitment by cohort are going up, as the model does not have a way of dealing with the large biomass estimates. Recruitment estimates were slightly lower in the 2020 model than the 2018 model.

In 2018, the Team recommended updating the prior on M using alternative methods for the next full assessment. Paul did not have a chance to look at this fully, but did use the maximum age methods from Then et al. (2015) and found that the average estimate of M from those methods was 0.059, which is similar to the M used in the last assessment (0.05). For this year's assessment, Paul retained the previous prior distribution for M (mean=CV=0.05), and obtained an estimate of 0.056. Paul intends to investigate alternative estimates of M, per the Team's recommendation, in the next full assessment.

The SSC encouraged sequentially removing data sources to see which data source was causing the poor fit to the survey and to allow flexibility in the survey selectivity. Paul did this and found that the fit to the Aleutian Islands survey biomass could not be attributed to any single compositional data set, but rather all the compositional data sets. Also, the model was run with a double-normal selectivity, which allows for dome-shaped patterns, but the selectivity was very consistent with the logistic curve and does not seem to suggest dome-shaped selectivity. Paul selected a level 2 for the assessment considerations in the risk table due to the poor fit to the survey index data and the large retrospective pattern. The remaining risk table categories were scored as level 1 and no ABC reduction was recommended. The Team accepted the authors' ABC and OFL recommendations.

The Team recommended investigating Francis weighting and trying different time blocks of natural mortality to help improve the fit to the Aleutian Islands survey index.

Northern rockfish

Paul Spencer presented the (partial) assessment of the northern rockfish stock. Updated information includes replacing the estimated 2019 catch with the final catch value, and revising the 2020 and 2021 catch estimates. Exploitation rates dropped overall, with a large decrease in the eastern Aleutian Islands and slight increases in the central and western Aleutian Islands. The SSC and the Team recently noted the strong spatial patterns in the length-at-age and abundance data. Paul responded that differences in survey age compositions result from subarea age-length keys and the length-stratified sampling protocol on the Aleutian Islands survey. A Team member asked if the transition to random sampling has improved these patterns and Paul replied in the affirmative, noting that this could be seen in the 2016 and 2018 survey composition data. The Team accepted the authors' recommended 2021 ABC.

Rougheye and blackspotted rockfish

Paul Spencer presented the stock assessment for blackspotted and rougheye rockfish. This stock complex is non-targeted, but catch has increased in 2019-2020. The author highlighted comparisons between an updated base model 18.1 (2020) and 4 models with differing weighting methods for compositional data, and inclusion/exclusion of the fishery length composition data. The authors recommended Model 20, which iteratively reweighted the composition data with the Francis method, and showed improved fits to the AI survey biomass and a gradual increase in survey biomass in recent years, which is consistent with recent estimates of survey biomass. The Team discussed the improvements that Francis weighting provided and commented on the decreased positive retrospective bias and recruitment variability. The Team agrees with the authors' model choice and agrees that data weighting is a critical component of the model.

A summary of the authors' concerns for this stock complex was provided. Most notable of them were a decrease in the abundance of older fish in the fishery and in recent AI surveys, and disproportional spatial targeting. An industry member stated that fleet fishing behavior has changed to avoid these fish in deeper water and now they fish shallower, resulting in increased catch of smaller/younger fish. The lack of large fish in the AI survey data was also discussed. One idea discussed was to look at the longline survey for information that could be used.

The Team is highly concerned over the disproportionate spatial harvesting of this stock. The "maximum subarea species catch" (MSSC) level was intended to help guide the fleet to voluntarily reduce catch in the WAI, but *catch has exceeded the MSSC for 5 out of the past 6 years, with "overages" increasing to 3 times the MSSC in recent years. The Team is extremely concerned with the effectiveness of the MSSC tool.* An industry representative commented that it has been useful for the fleet. Although several members of the Team noted the ineffectiveness of the MSSC, the Team does not recommend removing the MSSC because a superior alternative has not yet been clearly identified, and the MSSC may have some positive influence (relative to the absence of any spatial management measures).

The Team requests guidance from the SSC and Council on how to reduce incidental catch in areas with disproportionate spatial exploitation because the MSSC tool has not provided enough protection.

This assessment included the first risk table analysis for the complex and the Team agreed with the authors' recommendation to list a level of concern greater than 1 for three categories. The Team also agreed with the authors that, given the incidental nature of these species' removals, an ABC reduction may increase discards but not reduce catch. Additionally, the approved model (with the Francis weighting) better matches the scale and trend in the survey estimates and

lowers the 2021 and 2022 ABCs relative to the 2020 ABC. For these reasons, neither the authors nor the Team recommend a reduction from maxABC.

The Team recommended that the author assess the depth distribution of the survey samples to evaluate trends by depth, to help determine risk considerations and potentially help inform the industry on how to reduce incidental catch.

Shortraker rockfish

Kalei Shotwell presented the full shortraker rockfish assessment. This was a straightforward Tier 5 assessment as there were no new data and no model changes since the last full survey in 2018 (only the 2020 catch data were updated). The risk tables were completed and were scored level 1 for all categories. Catches are consistently below both TAC and ABC. In addition to ensuring that previous SSC comments are addressed, the author's main priority will be to examine the utility of the AFSC and IPHC surveys to improve biomass estimates for the next full assessment.

Other rockfish

Jane Sullivan presented the "other rockfish" assessment, complete with awesome figures that illustrate historical catch on maps. The "other rockfish" complex is a combination of 24 rockfish species not in the other specific rockfish categories. This complex is dominated by shortspine thornyhead (SST), with dusky rockfish making up the majority of the non-SST portion of the stock. There are many years in the Bering Sea bottom trawl survey for which the biomass estimate of the non-SST portion of the complex is zero (with standard errors also equaling zero), which makes modeling the complex challenging. Jane showed that it appears that catch is greater than biomass for the non-SST portion of the stock, which clearly says the biomass estimate is low.

A member of the Team noted that for September 2021, the Tier 5 authors will bring back new approaches to estimates for Tier 5 assessments. There was some discussion of whether the non-SST portion of the stock should be moved to Tier 6, but there was a recognition that the default Tier 6 formulae could either fail to give adequate protection to some species or prove to be unduly constraining in the future, given the upward trend in biomass estimates for some species. Jane noted that there was a high catch of SST in the eastern Bering Sea. She also noted that there were challenges for the risk table when an assessment covers multiple species, and applied a rating of 2 for assessment-related concerns, but did not recommend an ABC reduction. The Team accepted the Tier 5 approach.

The Team notes the significant issues with the non-SST share of the biomass estimate but did not recommend a change to Tier 6 at this point given research planned this year as well as the increasing trend in catch in the AI non-SST component of Other rockfish.

The Team recommended that the author pursue the planned work in collaboration with other authors to consider issues with the Tier 5 model process for stocks with variable, and at times sparse or missing, survey observations. Specifically, the manner in which biomass estimates of 0 are handled (i.e., currently ignored) should be revisited.

The Team recommended that the author consult with other rockfish assessment authors to consider revising M for the non-SST portion of the population in future assessments, noting that recent assessments reported to have based the M=0.09 assumption on GOA

dusky rockfish, when in fact M=0.07 has been the GOA dusky rockfish value used since 2006.

The Team recommended that the author do more spatial analysis of AI catch of non-SST rockfish. The Team recommended the author explore the locations, depths, seasons, the encounter rates and concentration of catch (i.e., frequent constant bycatch rates or a smaller number of highly concentrated hauls).

Atka mackerel

Sandra Lowe presented the Atka mackerel assessment. The model was the same as the base model from 2019, Model 16.0b, with updated catch and age composition data. The Team agreed with the author in model choice, reference point recommendations for 2021 and 2022, and risk table scores, which indicated that an adjustment to ABC was not warranted.

There was comment on the fishery in that it was somewhat different than previous years, with additional catch early in the season due to low demand for yellowfin sole and the fleet switching to Atka Mackerel in the spring.

Skates

Olav Ormseth presented the assessment for the BSAI skate complex. This stock complex is comprised of Tier 3 (Alaska skate) and Tier 5 (all other skates) species and is assessed biennially in even years. There were no changes to the author's recommended model for Alaska skate (Model 14.2), nor changes to the Tier 5 method. The Alaska skate projected biomass for 2021 increased, as did the spawning biomass. The Team noted that skate catch is generally correlated with Pacific cod TAC, which has been declining.

The Team discussed whether there have been any observed changes in distribution of catch or of critical habitat (i.e., nursery sites) given the warmer conditions. It does not appear that skates have shifted northward, nor do data exist to determine if nursery site locations have shifted. However, there is extensive research on temperature-induced changes to incubation timing. Warmer temperatures lead to shorter incubations, and it is possible that skate eggs could be hatching earlier, or incubation cohorts could overlap.

The author presented a risk table with considerations for the different tiers discussed separately. The author noted concerns over the lack of a slope survey for this assessment. While the stock complex is dominated by Alaska skate, a shelf species, the EBS slope region contains a greater diversity of species. Without the EBS slope survey, there is no indicator for those species in the EBS and no further data to inform the Tier 5 model. For population considerations, the author noted that Alaska skate trends are stable, and that Aleutian and Bering skates are declining but still above the long term average and therefore not a concern. The Team noted that the leopard skate, which is endemic to the Aleutian Islands, is also declining, but because this species may be at the geographic limit of its range in the U.S. portion of the Aleutian Islands and catch of skates in the AI is small, this may not be a concern.

The Team accepts the author's recommended Tier 3 and Tier 5 models for this stock complex and agrees with the risk table scores.

Sharks

Cindy Tribuzio presented the full shark assessment. Sharks remain a Tier 6 stock and no changes were made to the OFL or ABC reference points from previous years. In addition to the status quo method, three alternative methods for determining OFL were examined (median, 5th percentile, and 99th percentile of the 2003-2015 catch), but the author and Team felt there was insufficient evidence to deviate from the status quo. The authors have made continued strides improving catch accounting and have submitted an NPRB grant to help address the current inability to accurately age sleeper sharks. Additionally, all other previous SSC comments will be addressed in the subsequent full assessment, with the examination of some data limited methods being of top priority. There is some concern for this stock complex due to the data limitations and some indication through the IPHC long-line survey of declining catch rates of sharks (particularly Pacific sleeper shark) through time.

Octopus

Olav Ormseth presented the results of the Tier 6 assessment of BSAI octopus. Octopus are managed as an assemblage of at least nine species. In the BSAI, the assessment is based on an estimate of predation-based total mortality derived from Pacific cod stomach collections. The author recommended use of this Tier 6 method for setting the 2021-2022 harvest specifications, and the Team concurred. The risk table indicated no adjustment to the maximum ABC was needed, and the Team concurred.

It was noted that the catch of octopus has increased in recent years, with 2020 having the highest catch in the time series. The discard rate this year was also high, compared to previous years. There was a suggestion that the increase in catch was due to an increase in pot fishing in the Aleutian Islands where most of the increase in catch has occurred.

2021 and 2022 Harvest Specification Recommendations

The Team noted the compilation of the 2021 and 2022 harvest specifications, and recommended their adoption by the SSC. The Team also recommended that the Council and its committees consider two options for sablefish apportionments: these are provided in the Team's table of its recommended OFLs and ABCs for groundfish in the BSAI.

Adjourn

The meeting adjourned at 1:00 PST on Friday, November 20.