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

North Pacific Fishery Management Council
1007 West Third, Suite 400
Anchorage, Alaska 99501
November 15, 2021

Groundfish Plan Team Membership:

BSAI Team		**GOA Team**	
Grant Thompson	AFSC REFM (co-chair)	Jim Ianelli	AFSC REFM (co-chair)
Steve Barbeaux	AFSC REFM (co-chair)	Chris Lunsford	AFSC ABL (co-chair)
Diana Stram	NPFMC (coordinator)	Sara Cleaver	NPFMC (coordinator)
Mary Furuness	NMFS AKRO	Obren Davis	NMFS AKRO
Alan Haynie	AFSC REFM	Craig Faunce	AFSC FMA
Allan Hicks	IPHC	Lisa Hillier	WDFW
Lisa Hillier	WDFW	Pete Hulson	AFSC ABL
Kirstin Holsman	AFSC REFM	Sandra Lowe	AFSC REFM
Phil Joy	ADF&G	Nat Nichols	ADF&G
Andy Kingham	AFSC FMA	Jan Rumble	ADF&G
Kalei Shotwell	AFSC ABL	Paul Spencer	AFSC REFM
Cindy Tribuzio	AFSC ABL	Marysia Szymkowiak	AFSC REFM
		Kresimir Williams	AFSC RACE
		Andrew Olson	ADF&G

Administrative/Intro

Documents and presentations: The Joint meeting for the Groundfish Plan Teams ("Teams") began on Monday, November 15, 2021 at 9:00am PST. Participation was remote via Adobe Connect. Roughly 95 people attended the meeting, but attendance varied throughout the meeting. All SAFE documents were posted to the AFSC draft assessments page, and all other documents provided prior to or during the meeting as well as presentations given during the meeting were posted to the Teams' electronic agenda.

Minutes guidelines: Jim Ianelli reminded members to follow the Teams' most updated guidelines for minutes.

Future meetings: Tentative dates for 2022 meetings are: September 19-23 and November 14-18.

Council updates: Sara Cleaver provided Council updates to the Teams. First, the SSC has finalized guidance on use of risk tables in groundfish stock assessments. Diana Stram sent this guidance out after the October Council meeting. If others need a copy of the guidance please email Diana or Sara. Items coming up at the Council's December meeting in addition to final groundfish harvest specifications

include: Annual halibut charter measures, halibut abundance-based management in the BSAI, and consideration of an emergency action request to extend the Red King Crab Savings Area.

EBS/NBS Survey

Duane Stevenson summarized results from the 2021 trawl survey of the EBS and NBS, conducted May 31-August 16, 2021. Basic survey structure and data collection were reviewed. Changes in biomass and abundance were reviewed as were length and spatial distributions of pollock, Pacific cod, yellowfin sole, northern rock sole, and Alaska plaice.

Special projects that were covered included the NBS Pacific cod PSAT (tagging) project and some movement data from recovered tags were shared. A comparison of 15- and 30-minute trawl hauls were conducted to improve efficiency of the surveys and results are currently being analyzed. Lastly, the presenter described research on examining fish condition using a FatMeter and a study of physiological stress using blood chemistry and mucus.

The Teams inquired about the effects of the pandemic on surveys and were informed that although covid complicated planning and preparatory work, surveys were successfully conducted with no effect on methodology. The Teams also asked about the consistency of survey dates and were assured that the trawl surveys start reliably around Memorial Day in the EBS and then move on to the NBS afterwards. The Teams asked about limitations of stress and fat research during the narrow time frame of the survey and suggested reaching out to processors who measure oil and fat content in order to cover a broader portion of the annual cycle. The Teams also asked about cooperation with Russian counterparts to gain a more holistic understanding of the basin. Duane responded that efforts have been made and are ongoing, but thus far have been unsuccessful.

A separate presentation was given by Lukas DeFilippo on the effects of removing corner stations from the EBS survey grid to reallocate those resources elsewhere. Several analytical approaches were performed (design based and model-based using empirical data and simulations) and demonstrated that removing those stations had minimal impact on estimates of groundfish biomass, with the exception of yellow Irish lord. The Teams found the presentation very persuasive and were generally in favor of removing those stations to use the resources elsewhere, pending acceptance by the Crab Plan Team (CPT) and SSC. Comments from members of the CPT present urged caution given that the presentation has not been made to the CPT yet, and the effect of dropping those surveys from crab assessments has not been presented. The ecological importance of the area was also highlighted. It was acknowledged by the Teams that no changes should be made without acceptance from the CPT, who will be presented with the analysis in January 2022. The presenters also provided assurances that if corner stations are dropped, reallocation of resources would likely be used to address other questions regarding crab stock assessment that may be higher priority.

Essential Fish Habitat

Jodi Pirtle provided an update of the iterative review of components 1 (EFH descriptions and maps) and 7 (prey species lists and locations) of the 2022 Essential Fish Habitat 5-year Review. The next steps in the EFH process are presentations to the Crab Plan Team and Ecosystem Committee in January 2022, and to the SSC in February 2022. The Teams thank the EFH analysts for the development and application of the EFH models, the responsiveness to stock assessment author reviews, and for the detailed report describing the review process.

Comments on Assessments in General

The Teams acknowledge the added challenges of conducting stock assessments during the recent pandemic and under extended telework. Authors cannot "walk down the hall" to discuss assessment issues and are often working somewhat in a vacuum. The Teams recognize these challenges and the impacts they may have on assessment reviews. The Teams suggest that informal reviews be conducted out of cycle, so that they are not part of the crunch at assessment deadlines.

With staff retiring, new hires, and staff changing assessments, authors have highlighted a need for more transparent and reproducible assessments. To this end, the Teams encouraged authors to collaborate on issues they have in common to develop shared tools for use by all authors. Examples of these tools could include data extraction and processing scripts, data weighting methods and tools for deriving these weights, assessment model code and guidelines for model evaluation, use of dynamic reporting templates for SAFE documents such as with R Markdown, and development of stock assessment teams for standardizing groups of similar assessments (e.g., development of a generic flatfish model). The Teams support this effort as it will likely lead to more efficient, consistent, and streamlined assessments.

In the context of the sabelfish ESP, the Teams discussed how management changes may not be able to be distinguished from biological changes in some of the indicator time series, as in the case of high incidental catch of small sablefish in the BSAI. This indicator could be reflective of shifts in the fish distribution, changes in fleet behavior, or changes in management, and therefore is a challenge to categorize within the ESP. The ESP is used to report the indicator, not necessarily to explore the causality, which falls within the purview of the stock assessment. The Teams noted that some indicators may have ambiguous impacts on the stock. For example, the decrease in BSAI incidental catch could be interpreted as "good" because the fleet behavior has changed, but could also be interpreted as "bad" if considered an indicator of a decrease in abundance of small sablefish.

The Teams recommend that, for ESPs in general, when a fishery performance indicator may have ambiguous interpretations, no traffic light color coding should be assigned, but the scoring (which is indicative of a trend, but not the relationship of the indicator to stock health) should be maintained.

Sablefish

The sablefish agenda item began with a presentation by Kalei Shotwell on the Ecosystem and Socioeconomic Profile (ESP) of the sablefish stock for the first time in a Report Card format. This simplified template included current year data, although some indicators were missing, and a "traffic light" status indicator.

The Teams noted that changes in behavior due to observer restructuring in 2013 likely had impacts on some fishery performance indicators.

The Teams recommend that the authors explore the impacts of the 2013 switch to a new deployment plan and subsequent coverage changes on CPUE.

Dan Goethel presented the full assessment of sablefish. The recommended model (21.12) is an update of model 16.5 and includes a time block for a survey (and fishery CPUE) selectivity change in 2016. This also represents a slight modification of the model that the authors recommended at the September Joint Plan Team meeting (Model 21.10). The change from Model 21.10 is the use of an age-based GLM to estimate maturity *without* incorporating information on skipped spawning. The recommended model improved the fit to the survey indices and better stabilizes the recruitment estimates as demonstrated in retrospective analyses. Dan noted that the proposed model fit the composition data worse at younger ages.

He pointed out that small sablefish began appearing in larger numbers in deeper depth strata (i.e., > 400 m) on the annual longline survey in those years. The Teams discussed how the distribution of stations in each depth bin may affect this result, and survey staff noted that all stations sample down the slope, with approximately half of the sets shallower and half deeper than 400 m. The Teams noted that, in the Western GOA, small sablefish first showed up in shallower depths, but have now expanded their distribution to deeper depths. Dan noted that this appears to be a recent development and could be indicative of a change in the ecosystem and distribution of forage or expansion to adult habitats at smaller sizes due to their higher densities.

The Teams discussed the issues related to how estimated year class strengths changed over time. Two hypotheses were posed: 1) that natural mortality is higher than assumed; or 2) selectivity and availability have varied. The authors' recommended model included changes in selectivity and availability. Dan explained they had explored natural mortality in alternative models, but more work was needed to parameterize age-specific natural mortality rates.

The model is disaggregated by sex, but a 50:50 sex ratio was assumed. The Teams suggested research into sexual dimorphism including an evaluation of whether the sex ratio has changed over time. Presently the proportions at length (and age) are by sex instead of over sexes. Dan pointed out this was already high on the priority list for research.

The authors explored the impact of leaving out individual survey time series (i.e., the longline survey, fishery CPUE, and the NMFS GOA bottom trawl survey; Fig. 3.54). This type of exercise was useful to illustrate how recruit estimates and trend information are affected. Dropping the longline survey was most sensitive, especially relating to the recent recruitments after 2013.

The Team noted that maturity-at-age, including the influence of skip spawning, should remain a research priority.

The Teams discussed performance metrics for different sablefish catch strategies. For example, alternative management measures could be developed which consider more explicitly the population age structure by areas. An MSE, including what has already been done, could inform apportionment-related decisions. Dan noted that MSE work is planned to cover these factors and they are seeking to fill a post-doc position for this purpose.

The Teams supported the authors' planned research to develop an MSE.

The author highlighted potential data concerns, including: availability of logbook data, incorporation of electronic monitoring (EM) data, the transition to pot gear, and biological sample collections from both trawl fisheries and from vessels participating in the fixed-gear EM program (or lack thereof). The International Pacific Halibut Commission (IPHC) provides voluntary reported logbook data to the AFSC for use in the sablefish stock assessment. These data are always a year delayed, but the 2020 logbook data were not available in time for incorporation into the 2021 assessment. While these data do not substantially impact the model, they provide critical information for the stock assessment, including whale depredation data, and may be used to inform future apportionment.

The Teams agree that the fishery CPUE and logbook data are valuable to the assessment and recommend that the agencies involved prioritize access to these data so they are available with sufficient time to be incorporated into the assessment.

The fixed-gear fleet has undergone, and will continue to exhibit behavioral changes. This impacts the data streams for this assessment. Vessels are voluntarily participating in the EM program in favor of carrying

at-sea observers. This shift reduces the number of vessels that can carry observers, which in turn reduces both the haul level data used in assessments, and biological sampling. EM data are collected differently from at-sea observer data, and currently cannot be incorporated into a CPUE index for the assessment. Similarly, the fleet is transitioning to pots, a gear type not historically modeled in the assessment, and further complicated by vessels fishing different types of pots (e.g., rigid or slinky/collapsible). The Teams support development of methods to incorporate both EM and pot gear data into the assessment. Biological samples are not available from EM vessels, nor from trawl fishery bycatch. The Teams support discussions with FMA to determine if sampling from either fleet is possible. The Teams also suggested analyses which: examine historical catch data to see if there are any correlations between small fish and trawl catch during large recruitment events; incorporate uncertainty in catch by areas (i.e., the proportion of catch in each area); and the impact of using a fixed *F* ratio among the fleets.

The Teams agreed with the authors' recommended model, 21.12, and the ABCs and OFLs proposed (with the whale depredation included).

The Teams discussed the potential for expansion of current alternative harvest scenarios demonstrating possible impacts on future ABCs. An expanded analysis could ultimately include economic impacts (separate from ABC discussions). This type of analysis could demonstrate tradeoffs of future harvest levels on quantities other than just fishing effort, spawning biomass, and ABC.

The risk table was updated and the Teams agreed with the authors' reported risk levels.

The Teams discussed including information on economic tradeoffs in the fishery performance section of the risk table, but also noted that this information would be more appropriate to TAC discussions than ABC discussions.

The Teams agreed with the authors' recommended apportionment strategy. The Teams noted that the whale depredation model will need to be revisited as data streams change with changes in observer coverage due to EM and availability of whale depredation information in logbook data. The apportionment is currently in the second year of a 4-year stair step from the previous fixed-apportionment strategy to the 5-year survey average strategy. The Teams historically examine apportionment from a biological standpoint, and given the stair-step procedure, it is possible that a scenario could occur where at the end of the 4 years there is a much smaller proportion of small fish in the Bering Sea. The author noted that the 5-year average strategy is designed to dampen the effects of such hypothetical swings.

Economic SAFE

Ben Fissel presented the Economics SAFE Report, which is similar in format to recent years. Data for the Economic SAFE are available here https://reports.psmfc.org/akfin/f?p=501:2001 – thanks to Jean Lee. Also available are a broader set of related data and data visualizations at the AKFIN/AFSC Human Dimensions of Fisheries Data Explorer (https://reports.psmfc.org/akfin/f?p=501:2000).

The SAFE updates available economic information for 2020; as always, there is a one-year delay in most economic data. The SAFE includes 2021 current-year price projections and figures that compare inseason catch rates throughout the year.

Market profiles were done in collaboration with McKinley Research Group; the economic SAFE chapter information provided to the Teams is complete through 2020. An updated, more current report will be available early next year. It will go into further detail about tariff and COVID-19 impacts and will be in next year's economic SAFE. The authors have also created Economic Performance Reports (EPRs) that give stock-specific socioeconomic information, some of which have been incorporated into ESPs. Content

is still evolving. The Annual Community Engagement and Participation Overview (ACEPO) Report will be presented at the February SSC Meeting.

Ben presented a variety of 2020 summary statistics and trends and discussed revenue impacts from COVID-19, which included a notable decrease in prices for many of the products with significant exports to Asia. The Teams asked about the role of tariffs, and Ben noted that for Atka mackerel, for example, tariffs were significant issues in late 2019 and early 2020. Some impacts were not COVID or market related; catch / TAC was within a typical range, except for BSAI pollock where fish were apparently more dispersed which, along with other factors, led to poor fishing conditions.

A COVID-19 voluntary i-mpact survey of harvesters and processors was conducted by McKinley Research Group, although the extent to which this survey is representative is unclear. Salmon harvests were heavily represented among respondents and the survey did not break results down by species.

The Teams commended the author and ESSR for their contributions, especially the website presented as part of AKFIN. The Teams briefly discussed the SSC October 2021 suggestion "that it may be prudent to undertake a comprehensive review of how socioeconomic information is incorporated in a range of evolving Council decision-informing products" and to consider holding a regional workshop similar to the national Socioeconomic Aspects in Stock Assessment Workshop (SEASAW).

The Teams agree that it would be useful to have a coordinated effort to improve the integration of socioeconomic work, but recommend that this be done in careful consideration of existing workload as part of the process and that a broad discussion with NOAA, SSPT, and Council staff be undertaken in this planning process.

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 16-19, 2021

Administrative

The BSAI Groundfish Plan Team ("Team") convened on Tuesday, November 16, 2021 at 09:00 am PST. Participation was remote via Adobe Connect. All SAFE documents were posted to the AFSC draft assessments page, and all other documents provided prior to or during the meeting as well as presentations given during the meeting were posted to the Teams' electronic agenda.

Comments on Assessments in General

The Team recommends that the AFSC prioritize research on best practices for specifying the selectivity schedules used in projections for Tier 1-3 stocks in general.

Ecosystem Status Reports

The Team is impressed with the monumental reports that are assembled each year for our annual assessment and would like to commend the authors on the breadth and synthesis of these reports. The Team discussed the importance of the Ecosystem Status Reports and appreciates the ongoing developments in the content and presentation of the reports that enhances uptake of ecosystem information into the Team discussions. This year, as has been the case in recent years, the Ecosystem Report findings were often referred to when discussing trends in weight at age, changes in distribution (and sampling areas), and changes in recruitment and productivity. The Ecosystem Status Reports provide an important foundation and resource for these discussions. Towards furthering their use in these discussions, the Team discussed the value of having statements of confidence with some of the key findings, such as those summarized in the "Report Card" section. For example, after a given statement "*high confidence*" or "*high agreement, medium evidence*" could be used to provide context for the level of support for each statement. Examples of calibrated language for confidence statements include those used in national and international climate assessments (e.g., Crimmins, A. (2020). Improving the use of calibrated language in U.S. climate assessments. Earth's Future, 8 ,e2020EF001817. https://doi.org/10.1029/2020EF001817).

The Team recommends the Ecosystem Status Report team develop calibrated language statements for certainty (uncertainty) to accompany key messages summarized in the Assessment and Report Card sections of each report (when possible).

Bering Sea Ecosystem Status Report

Elizabeth Siddon presented the 2021 Ecosystem Status Report for the Bering Sea (NEBS and SEBS). The Team deeply appreciates the breadth of information synthesized and presented concisely and commends the author and co-authors on the presentation and contributions to this important Bering Sea report.

Common threads across the report include:

1. Cumulative impacts of thermal exposure and metabolic demands on multiple marine species (e.g., Chinook, chum, and coho salmon during their marine phase since 2016; cumulative impacts of temperature and predation on snow crab)
2. Stratification and shifts in the vertical distribution of prey (hypotheses, not yet published studies); likely related to sea ice dynamics and changes in stratification.
3. Prey switching and lack of functional redundancy (carrying capacity).

In addition to discussion around individual indices, the Team discussed the implications of multiple coincidental declines and collapses of NEBS species (and across trophic levels). The Team noted that the persistent warm conditions in the Bering Sea and the absence of a large cold pool indicate ongoing anomalously warm conditions in the Bering sea, especially in the NEBS. The Team shared the author's concern that climate shocks and subsequent declines across species and trophic levels observed in the NEBS indicate uncertain conditions and carrying capacity for that region going forward. The author noted during discussion that there are some early indications that climate shocks to marine mammals may be subsiding in the system, as evidenced by positive trends in marine mammals that may lead to the closure of the Unusual Mortality Event designation for gray whales and ice seals. However, the Team and author noted that ongoing and large-scale declines in bird, groundfish, and crustacean populations represent multiple "red flags" for the NEBS ecosystem.

Aleutian Island Ecosystem Report

Ivonne Ortiz presented the Ecosystem Status Report for the Aleutian Islands and reviewed the risk tables for stocks in the BSAI; 4 assessments have a Ecosystem Risk level 1 and 4 have a level 2 due to the persistent warming conditions and regionally or species specific poor prey quality. The author noted two points for discussion 1) levels of mercury in sea lion pups in the central and western AI high enough to induce tissue damage, and 2) evidence of non-lethal and lethal effects of plastics in seabirds from the AI. It was noted that phthalate levels are highest in zooplankton feeding seabirds, that a high proportion of ingested plastics are recyclable, and that ingestion rates are highest for birds foraging near marine debris or urban areas. The Team noted the level of plastics impacts on marine fauna in the region, which included increased seabird mortality and other sublethal effects in seabirds due to ingestion. Also, the high abundance of Eastern Kamchatka pink salmon in 2021 was noted because pink salmon biennial patterns can impact zooplankton abundance which, in turn, may impact food available for groundfish and seabirds. There was interest in whether these pink salmon were of hatchery origin and Ivonne noted that they were wild salmon from Eastern Kamchatka. Finally, the Team noted mixed signals in the AI, with some continued marine heatwaves but a subsidence of the extremely warm bottom temperatures noted in previous years.

The Team commends Ivonne and co-authors for the 2021 Ecosystem Status Report and the breadth and clarity of information synthesized within. The Team also notes that more comprehensive analysis and synthesis would be possible if there were an integrated research program in the Aleutian Islands, as has taken place in the EBS, GOA, and Arctic. The Team and author noted that, without a comprehensive integrated study, it is difficult to establish confidence statements regarding causal mechanisms of, or patterns in, changing ecological and oceanographic conditions and fisheries productivity, especially given recent anomalous conditions and marine heatwaves.

The Team recommends that an Integrated Research Project for the Aleutian Islands be initiated in order to help understand climatic, ecological, and social-economic mechanistic linkages in this highly complex region.

The Team would like to gratefully acknowledge Olav's many contributions over the years to multiple assessments including his attention to forage species and wishes him well in his new endeavors.

EBS pollock

Jim Ianelli presented the EBS pollock assessment, and Eleni Petrou (University of Washington) and Ingrid Spies described results of recent genetic research.

This year's assessment includes the current base model (Model 20.0a) and two alternatives (Models 20.0b and 20.0c). The data used by all three models included the usual updates to all time series, but the two alternative models included some additional data from the 2021 fishery as well: Model 20.0b included length composition data, and Model 20.0c included both length composition data and a preliminary estimate of age composition (based on a global age-length key). Development of the two alternative models was prompted by the atypical weight composition observed during this year's "B" season fishery, in which the overwhelming majority of fish were smaller than 500 grams. The authors recommended adoption of Model 20.0c, because they felt that it does the best job of reflecting the younger fish taken by the fishery in recent years. The Team agreed.

The authors responded to several Team and SSC comments. Some of these had to do with the sensitivity of stock-recruitment parameter or F_{MSY} estimates, how to specify the magnitude of reductions from the Tier 1 maxABC (when warranted), or both. In this year's risk table, the authors scored all categories as Level 2 ("substantially increased concern"), which, in the cases of the assessment and population dynamics categories, was an increase from the scores in last year's risk table. The authors presented a detailed decision table showing the likely impacts of alternative 2022 catch amounts. The authors also presented ABC alternatives based on Tier 3, Tier 2, and "constant F" strategies. The Tier 3 strategy, which the Team and SSC have used to specify ABC for this stock since the 2014 assessment cycle, gives a 2022 ABC of 904,000 t. The Tier 2 strategy, which was suggested as a possible alternative by the SSC at this year's October meeting, gives a 2022 ABC of 1,111,000 t. Keeping fishing mortality at the 2021 estimate, which is another strategy that has been used in the past by the Team and SSC, gives a 2022 ABC of 1,150,000 t. This year, the authors recommended use of the Tier 2 strategy because the ratio between the maxABC values resulting from the Tier 1 and Tier 2 harvest control rules is likely to be much less variable than the ratio between the Tier 1 and Tier 3 values. The Team agreed, also noting that the Tier 2 and "constant F" strategies resulted in very similar values.

Results of recent genetic research, which became available just in time for inclusion in the assessment, show clear separation of pollock in Japan from pollock in the U.S. EEZ. In terms of general tendencies within the U.S. EEZ, pollock in the AI, Bogoslof district, and GOA appear to be much more similar to each other than to pollock in other parts of the region, while pollock in the EBS, NBS, and Chukchi Sea tend to cluster together. However, there were some fish from the western GOA that clustered with fish in the EBS/NBS/Chukchi group and some Bering Sea fish clustered with the AI/Bogoslof/GOA. No samples from Russian waters were available for analysis.

The following were among the questions and answers, or stand-alone comments, that arose during Team discussion (and may or may not reflect Team consensus):

- In the context of the large proportion of small fish in this year's B season catch, is some of the variability in selectivity at age or weight at age driven by changes in the time of year when the share of fish of different lengths are caught? Jim's response: The relative amount of catch by season is relatively constant across years, so is probably not a major factor contributing to changes in selectivity or weight at age.

- For projections, is selectivity set equal to the average of the previous two years? Jim's response: That is what was done this year; but in last year's assessment, selectivity for the projection was based on a year (2005) which was deemed to be more representative of likely future selectivity (for the near term). Predicting future selectivity is difficult, and might depend on factors such as the relative strengths of the surimi versus fillet markets, etc. The assessment has always been clear about what selectivity is assumed for projections.
- The problem of projecting selectivity is common across all Tier 1-3 assessments; consistency and predictability would be desirable features.
- This is the first time that the Tier 2 estimates have been calculated since Vidar Wespestad conducted the assessment back in the 1990s.
- Changing from last year's Tier 3 strategy to a Tier 2 strategy, given that the latter results in a higher ABC than the former, seems at odds with the fact that this year's risk table scores were either equal to or higher than last year's. Jim's response: Last year's assessment did not include a Tier 2 option, which might have been recommended had it been considered. The fact that the Tier 2 and "constant F" strategies produce such similar values for 2022 ABC gives added confidence that the Tier 2 strategy is reasonable. Guarding against increasing fishing effort (and by extension, fishing mortality) for a stock that has been estimated to be below B_{MSY} and declining was the main reason for this recommendation.
- The success of the genetic research suggests that, in the future, it may be possible to identify the spawning source of individual fish, or to determine the extent of western GOA contributions to individual EBS year classes.

The Team commends Eleni Petrou, Eleanor Bors, Lorenz Hauser, and Ingrid Spies for their research into the genetics of walleye pollock, and supports efforts to obtain genetic samples from Russian waters for use in future such analyses.

EBS multispecies model

Kirstin Holsman provided an overview of the 2021 Climate-enhanced multi-species stock assessment for pollock, Pacific cod, and arrowtooth flounder in the EBS, which has been included as an appendix to the EBS pollock chapter since 2016. Output from this model is reported in multiple AFSC documents including the ESR and ESPs. Future directions for the model include adding the NBS, including uncertainty around climate scenarios and associated risks with changes in temperature. The Team asked for clarification of future plans to incorporate CEATTLE results within single-species assessment models and further inform how single species models perform under different climate regime scenarios. The current modeling effort is not tailored to mimic the single species models but could be tuned to help inform parameters (such as predation estimates) in single species assessments. The pollock assessment in particular has used indices from CEATTLE to explore natural mortality and climate impacts on that parameter. The modeling work can also help in exploring sensitivity analyses to assist with identifying covariates in assessments or to help to inform priors in these single species assessments. The Team discussed the potential for output from the model (in the single species context) to be used as one of a suite of ensemble models (with appropriate weighting) in one of the single species (e.g., pollock or Pacific cod) assessments in the future. This could also be addressed in the MSE that is under development as part of ACLIM. The Team appreciates the continued development of the CEATTLE model.

The Team recommends that authors work to streamline and coordinate the data pulls for single species assessments and CEATTLE in order to better align the data and multi-species model output for future use.

This would also be helpful for identifying covariates to include as indicators in the ESPs.

It was noted that there are plans for an EBS pollock ESP in 2023, so coordinating and streamlining model development and data pulls now would align well with that schedule. The Team noted the large effort to produce the multi-species model and supported the plans for creating a CEATTLE development team. The Team requested that the climate-informed projections for each species be included in next year's multi-species assessment and thanked the authors for their continued development of this large effort.

AI Pollock

Steve Barbeaux presented the AI pollock assessment. The assessment is a partial assessment this year so only the catch was updated and the projections re-run to obtain reference points for this year. Although open to fishing, there continues to be very little directed fishing for pollock in the AI. The Team accepted the authors' assessment and had no recommendations.

EBS Pacific cod ESP

Kalei Shotwell presented the EBS Pacific cod ESP and report card, noting that the full ESP and the report card are presented as Appendices in the EBS Pacific cod SAFE document. The appendices and the presentation were very comprehensive, noting that fishery performance, narrowly interpreted as fishery CPUE, was not presented in the ESP because it is in the main text of the SAFE chapter. In 2022 a report card will be created and a partial ESP will be provided if new indicators are available.

The Team appreciates the thoroughness of the ESP and report card, and thanks Kalei and others that contributed to these documents.

The Team recommends further consideration of ways to synthesize the EBS Pacific cod ESP and report card to succinctly convey the highlights.

EBS Pacific cod assessment

Grant Thompson provided a thorough presentation of the EBS Pacific cod assessment. All of the recent Team and SSC requests were more than adequately addressed. Following the recommendation from the SSC an ensemble consisting of four models and a corresponding set of model weights was presented in this year's assessment: Model 19.12a is the current base model, and the other three models each differed from the base model with respect to a single, model-specific, feature. Model 19.12 included time-varying survey catchability, Model 21.1 allowed for the possibility that survey selectivity declines at larger sizes ("dome-shaped" selectivity), and Model 21.2 incorporated a fishery catch per unit effort (CPUE) index as a relative measure of stock biomass. A fifth model (21.3), which estimated a constant that is added to the standard deviation of each year's log-scale abundance index, was considered in the preliminary assessment, but the SSC suggested in October that it be omitted. It was noted that the parameter scaling the effective sample size for the Dirichlet-multinomial likelihood for fishery and size compositions was at an upper bound and fixed, thus setting the effective sample size at the input sample size. However, the McAllister-Ianelli approach to compare the empirical variance with the theoretical variance suggested that the effective sample size was greater than the input sample size for size composition data.

As in the last two assessments, a survey index was created using VAST, combining EBS and NBS survey data into a single time-series. Areas with missing observations in some years are predicted in the spatio-temporal model, and no prediction was provided for the year 2020 in which there were no NOAA trawl surveys. The Team discussed using the VAST model to predict the missing 2020 estimates and including those in the data file. The authors had not previously discussed doing this, and the Team did not make any recommendations.

The IPHC fishery-independent setline survey was presented, although not used in the assessment, for further comparison. The Team noted that the IPHC survey design has changed in recent years and some areas are not sampled every year. Therefore, the figure showing station locations in the assessment document is outdated and design-based estimators of an index for the IPHC setline survey in recent years may need to be re-evaluated.

Retrospective patterns varied for each individual model but were within generally accepted bounds. A public comment indicated that it may be worthwhile to investigate other retrospective metrics, possibly related to $B_{35\%}$ or other values, to consider model reliability or model weights.

A Team member asked if in 2020 and 2021 (i.e., COVID years) there were fishing patterns that would indicate differences which could result in apparent changes to fishery data (e.g., heavier fish, etc.) The assessment authors had not addressed this issue with industry representatives.

An in-depth bridging analysis was presented investigating the change in ABC from 2021 to 2022. It was noted that substantial changes occurred from the preliminary 2021 assessment presented in September compared to the 2021 final assessment presented in November. The addition of the 2021 survey index, the 2021 survey size compositions, and the updated historic survey time-series accounted for 85% of the change. It was noted that age 4 fish were a large contributor to the change, the lack of a 2020 survey may have contributed to the large change when updating survey data.

The Team appreciated the pragmatic choice of the assessment authors to present the SSC recommended ensemble given the short timeframe to produce the assessment. However, the Team also expressed concern that there are no clear or consistent criteria for inclusion or exclusion of ensemble model components. One potential benefit of an ensemble is that each model may perform differently in response to new data, which may reduce the interannual variability. However, removing and adding models to an ensemble may introduce interannual variability and potentially important models may be lost to the process. One potential drawback of the use of the ensemble approach is that future model development may be stymied as authors are required to produce the full set of models used in the ensemble in the following year, populated with the most recent data.

The Team recommends the ensemble model consisting of models M19.12a, M19.12, M21.1, and M21.2 be used for management advice.

The Team recognizes that the considerations for development, presentation, and choice of a model ensemble are necessarily different from those associated with an individual model for use in management.

The Team opined that the Team and SSC criteria for reviewing and approving ensembles have not been consistent and recommends a more standardized approach continue to be developed within the Team and SSC process for defining appropriate sets of models and weighting of those models for use in management.

The Team commends Grant's work on developing, explaining, and justifying the risk table. The use of intralevel fractions and an alpha parameter to develop external probabilities was of interest to the Team. The Team indicated that development of more quantitative methods for evaluating when possible reductions from maximum permissible ABC would be warranted, such as the method presented by Grant, and should be explored further.

The Team agrees with the risk table presented in the assessment and recommends an ABC equal to the maxABC as determined in Tier 3b.

The Team recommends exploring environmental drivers of weight-length residuals, especially in recent years.

The Team encourages continued work of the AFSC fishery CPUE group regarding creating CPUE indices from fishery-dependent data and encourages assessment authors to consider best practices for incorporating fishing behavior.

A public comment letter was made available to the Team before the meeting. This letter was not discussed by the Team.

During the presentation, Grant highlighted how this assessment is treated differently from others. He suggested that the time may be right to consider a change to the process. While the Team did not discuss this point, the author's experience and opinion are valuable and it is noted for the record.

The Team expressed deep appreciation for Grant's efforts investigating and improving the Pacific cod assessment over many years, his many contributions to stock assessments in general, his willingness to provide analyses, insights, and presentations to inform the Council process, and his dedication as a Plan team member and co-chair of the BSAI Team. Many members of the public also expressed appreciation for his efforts, including thanks from the stakeholders, scientists, and fishery managers. The Team also learned that Grant "never liked fish too much until [he] found out [he] could count them." Thank you, Grant, for counting all those fish.

AI Pacific Cod

Ingrid Spies presented the Aleutian Islands Pacific cod full assessment. The Team commended the author for addressing Team and SSC recommendations and noted that data weighting remains to be explored. The last survey information for the AI Pacific cod assessment occurred in 2018. Fishery CPUE indices revealed mixed results with a decrease in trawl winter CPUE, but no such decline in other fishery or season CPUE. The author noted that the fishery CPUE trends presented were likely unreliable. Fishery length composition data showed a predominance of the 2016 year class. .

The Tier 5 base model (Model 13.4) was presented along with four alternative age-structured models. One age-structured model (Model 19.0a) used a natural mortality of 0.34 and a maturity ogive based on Bering Sea derived histological samples. The other two age-structured models used an estimated maturity curve based on observer samples and a natural mortality value of 0.34 (Model 19.0) or 0.40 (Model 19.0b). The Tier 5 random effects model (Model 13.4) used a natural mortality value equal to 0.34.

It was noted that there have been recent changes in management and fisheries (e.g., the state fishery and catcher-processors), and an attempt should be made to control for these effects in the analysis of CPUE data.

The Team recommends further examination of fishery CPUE beginning with methods to control for changes in the fisheries and management. Joining current efforts looking at CPUE analyses of other Pacific cod stocks may be beneficial.

The Team recommends further exploration of age-structured models given that there is likely to be an Aleutian Islands trawl survey in 2022.

Correcting for length-stratified age samples using Bayes theorem has improved recent modelling efforts, and ensuring that appropriate years use this approach may further improve fits. Estimating natural mortality using a prior developed from the barefoot ecologist website or other methods may alleviate

concern over the appropriate value of M to use as well as provide a reasonable level of estimation uncertainty.

The authors originally recommended the age-structured model 19.0 and a reduction in ABC from the Tier 3 maxABC to the Tier 5 maxABC (all categories in the risk table were scored as Level 2 except for population dynamics, which was scored as Level 1). Following the presentation and discussion with the Team, the assessment author decided that Model 19.0b (with M=0.4) was the preferred age-structured model, rather than the originally recommended Model 19.0. The Team did not have a discussion considering M=0.4 for the Tier 5 assessment but expects that the four models will be brought forward in the next full assessment with an additional survey observation.

The Team recommends using the Tier 5 Model 13.4 to specify the 2022 and 2023 OFL and maxABC. The Team recognizes that using Tier 5 with 2018 survey results is outdated, especially when the age-structured models predict an increasing trend in biomass. However, the Tier 3 projections would be similarly limited by outdated survey data and based on estimated average productivity with the only recent data included in the models being fishery length compositions, and the age-structured models commonly overestimate spawning biomass in the terminal year. The Team agreed that it was uncertain if the age-structured models, without new fishery-independent data, were an improvement over the Tier 5 model. The Team encourages the author to conduct sensitivity analyses after the 2022 survey data are included.

The Team does not recommend a reduction from the maxABC. The risk table presented by the author was based on the Tier 3 model recommended in the assessment. The Team agreed that using the Tier 5 model for OFL and maxABC addressed some of the reasons that the Assessment Considerations were listed as Level 2. Therefore, using Tier 5 warranted a change from Level 2 to Level 1 for Assessment Considerations. In summary, rather than moving to a new model and then using the risk table to justify using the ABC from the base model, the Team felt it was more straightforward simply to retain the base model for now.

The Team also recommends that authors investigate other sources of fishery-independent data for application in Tier 5, or to fit these within age-structured models. **This effort might begin with a re-examination of previous explorations involving use of the AFSC and IPHC longline survey indices (viz., the 2016 CIE review and Models 16.2, 16.3, and 16.4 from the 2016 assessment).**

Yellowfin sole

Ingrid Spies presented the BSAI yellowfin sole assessment. The assessment considers three models: the base model (18.2), an alternative model (18.2a) which uses a VAST estimate of the bottom trawl survey biomass for the EBS, and another alternative model (18.2b) which uses a VAST estimate of the bottom trawl survey biomass for both the EBS and NBS combined. The author recommended the continued use of the base model (18.2). The Team spent a considerable amount of time discussing the selection of the base model versus the model with the combined EBS and NBS VAST estimates (18.2b). One concern voiced by the author is that Model 18.2b did not use VAST-derived age composition data and that length and weight at age parameters were restricted to those derived from EBS data only. The move to a VAST estimate which includes both regions was considered a move towards consistency with other Bering Sea stocks that straddle the two regions. However there was shared concern that Model 18.2b did not include VAST derived age composition data. The Team discussed the available evidence to indicate whether the NBS and EBS portions of the population were indeed separate. The author indicated that there was no available evidence to preclude their connection. Although the available time series is short there is a trend in the bottom trawl survey yellowfin sole biomass estimates with an increase in the NBS as temperatures increased and a corresponding decrease in the EBS. However in 2021 as temperatures cooled in the

Bering Sea, although there was a drop in abundance in the NBS there was not a corresponding increase in the EBS. Upon examining yellowfin sole distribution in the bottom trawl survey in those years in which both areas were surveyed, there appeared to be no strong evidence of a large separation. An increasing trend in growth of this species was also brought up as a possible indication of stock separation, however it was pointed out that temperatures have been warming in both regions.

Given the lack of strong evidence for or against the connection of these two portions of the population and the lack of NBS age composition data or weight at age data within Model 18.2b, the Team concurred with the author's choice of Model 18.2 for management of BSAI yellowfin sole.

The Team recommends that the connection between the NBS and EBS portions of the yellowfin sole population be investigated and that alternative models be developed for consideration next year using the combined EBS and NBS VAST estimates for biomass and VAST-derived age composition data.

The Team recommends that differences in length and weight at age for yellowfin sole between the two areas be investigated.

The Team discussed possible impacts on fisheries data resulting from implementation of Amendment 80 in 2008. When this species became cooperatively managed there was a large incentive to reduce discards of smaller fish as these were then counted against cooperative quotas. The incentive to reduce catch of smaller fish may have caused the fishery to target larger fish through changes in gear, fishing practices, timing, and location. At this time there was also a change in observer coverage which may have impacted data collections.

The Team recommends the author investigate impacts of management changes since 2008 in the yellowfin sole fishery on fisheries data and subsequent impacts on estimates derived from these data, including mean length and age, length and weight at age, and selectivity.

The author indicated a level 2 risk for assessment considerations, based mainly on the lack of fit of the stock-recruitment curve. There was some discussion as to whether this was new to this year's assessment and, in light of the improved retrospective pattern, whether this met the criteria for a level 2 as the stock was rated level 1 last year. The author indicated that although the stock has always had a poor fit of the stock-recruitment curve, her concern was increased this year over last as she became more familiar with its ramifications within the model. Risk on population dynamics was also rated level 2 for this stock based on a slow, but steady decline in biomass and the 2021 survey estimate being the third lowest in the time series. It was pointed out that a slow and steady decline would not necessarily rate a level 2 and that the low survey biomass should be taken into account in the model. Environmental and ecosystem concerns were also deemed a level 2 by the author while fishery performance was rated as level 1.

Based on these levels, the author recommended a reduction from maximum ABC to the average of the Tier 1a and Tier 3a ABCs. The Team discussed the reasons for the reduction and the applicability and logic of the method of reduction. The Team also discussed the uncertainty of the connection to the NBS and the omission of NBS biomass data from the assessment model, with opinions expressed on both sides as to whether these argued for or against increased caution in setting ABC. As a poor fit of the stock-recruitment curve was one of the justifications for reducing from maximum ABC, there was some discussion as to whether the stock should be regraded to Tier 3a. The majority of the Team concurred that the stock should continue to be managed as Tier 1a.

The majority of the Team recommended some reduction from maximum ABC given the conclusions of the risk table and Team discussion. Two alternatives were proposed for reduction from maximum Tier 1a

ABC: 1) the author's recommended averaging of Tier 1a and Tier 3a maxABCs or 2) a reduction to the Tier 3a maxABC. The argument for reduction to the Tier 3a maxABC centered on the rationale that the Tier 3a maxABC is clearly defined, has a theoretical basis with known criteria meant to address uncertainty in the stock recruitment curve, and has previously been used in reduction from maximum ABC for other Tier 1a stocks, notably EBS pollock. The argument for the stepped approach recommended by the author was that it was a scaled decrease (-24%) from Tier 1a that was not as drastic as the Tier 3a reduction (-48%), and was considered appropriate by the author given their assessment of the risk to the stock, and there was no requirement for consistency among stocks or even within stocks between years for reduction from maximum ABC. A Team vote resulted in a 6:6 tie between these two options. However, in order to move forward with a single recommendation, the Team consensus was to defer to the recommendation of the author. Therefore, the Team recommends a reduction of ABC from the maximum to the average of the Model 18.2 Tier 1a and Tier 3a maxABCs provided by the author.

Greenland turbot

Meaghan Bryan presented the Greenland turbot partial assessment. This assessment is conducted biennially in even years so a full assessment will be presented in 2022. The presentation essentially consisted of an overview of recent catches, exploitation rates, and survey point estimates. The Team appreciated the concise presentation. The Team approved the OFL, ABC, and EBS/AI apportionments produced from the partial assessment.

Arrowtooth flounder

Kalei Shotwell presented the arrowtooth flounder partial assessment. This assessment is conducted biennially in even years so a full assessment will be presented in 2022. Regarding the IPHC survey trends that were presented, a Team member pointed out that the IPHC survey design has changed in recent years, and the 2021 trend in the IPHC survey may not be comparable in this area. Also, there was no IPHC survey in 2020. The author responded that this survey is not used in the assessment, so it is simply a point of reference. Given this, the Team determined that no formal recommendations were needed regarding this piece of information, but Allan Hicks of the IPHC indicated that the issue would be considered by the IPHC, including the implications of these changes for the arrowtooth assessment (and other assessments generated by AFSC)..

The Team appreciated the concise presentation and approved the OFL, ABC, and other reference points produced from the partial assessment.

Kamchatka flounder

Meaghan Bryan presented a partial update of the BSAI Kamchatka flounder assessment. This assessment is conducted biennially in even years so a full assessment will be presented in 2022. The Team commended the author for the clear presentation. The author presented catch and exploitation, showing low catch until Amendment 80 in 2008. Catch increased from 2018-2020 and was above TAC in 2020. Meaghan will look into how catch has changed recently in 2022.

AI, EBS shelf, and EBS slope surveys were used in last year's assessment. The only updated survey was the EBS shelf survey, which showed a 26% decline in 2021 from 2019 (2020 was not conducted). The projection model was re-run with updated catch. The biomass estimates were similar to last year, as were OFL and ABC. The recommended ABC for 2022 is 2.6% higher than 2021.

The Team accepted the author's model, recommended ABC, and other reference points.

Northern rock sole

Carey McGilliard presented the Northern rock sole partial assessment. The brief presentation consisted of fishery, survey, and exploitation rate trends, as well as the method used to project future catches. The Team appreciated the concise presentation and approved the OFL, ABC, and other reference points produced from the partial assessment, as well as the recommendation that no reduction from maxABC is warranted.

Flathead sole

Maia Sosa Kapur presented a partial assessment of the BSAI flathead sole-Bering flounder stock complex. A full assessment is expected in 2022. For this Tier 3 assessment the methodology was unchanged, final catch values for 2020 were used, and projected catch estimates for 2021-2023 were inserted. The Team asked why the spawning biomass increases rapidly in the final year compared to other years, and the author noted that past investigations have highlighted that assumptions about recruitment at the end of the time-series may be driving this rapid increase and that investigations will continue in future stock assessments of this species. The author presented recent trends in spawning and survey biomass which were decreasing and increasing respectively. The Team noted that this species is part of the flatfish exchange program, which may explain the variations in the TAC over time. The Team accepted the author's recommendations for the 2022 and 2023 ABCs and OFLs and had no recommendations.

Alaska Plaice

Olav Ormseth presented a full assessment of Alaska plaice. For this Tier 3 assessment, there were no changes in the methodology and Model 2011_1 was used. Changes to input data included updated and estimated catch, new fishery length compositions, new EBS shelf bottom trawl survey biomass estimate, survey age composition, and survey length composition. The survey biomass estimate for 2021 was 9% lower than the 2019 estimate and the lowest value in the time series. Model estimates of female spawning biomass have declined since 2013. Total biomass estimates, however, show an increasing trend since 2019, likely due to relatively strong recruitment since 2017. The NBS bottom trawl survey continues to estimate high biomass of Alaska plaice, and the 2021 estimate in the NBS exceeded the EBS estimate for the first time. The recommended ABC for 2022 was 3% more than the 2021 ABC and 6% greater than the projected 2022 ABC from the 2020 projection model. The Team concurred with the author's recommended ABC and risk table decisions (level 1 for all categories).

The Team discussed the carrying capacity of the NBS, the presence of small Alaska plaice in the NBS, and the population decline in the EBS, apparently due to warming temperatures. The Team requested clarification regarding the distribution maps and potential connectivity between the EBS and NBS. Olav responded that the distribution appears to be continuous throughout the Bering Sea and the increases in the NBS are not surprising given that Alaska plaice are a cold adapted species. The Team noted that there have not been any changes to this model for many years and asked about the potential for a future model to include NBS estimates. Olav responded that the survey results suggest including the NBS, but he could also understand the rationale not to include the NBS in previous models, as there is no fishing in the NBS.

The Team recommends that authors explore the relationship of the southern part of the stock in the EBS to the northern part of the stock in the NBS and consider developing models that include the NBS data.

Olav also suggested that Alaska plaice could be a candidate for a four-year assessment cycle. The Team discussed the prioritization criteria that were used for developing the stock assessment frequency table in 2017 and noted that Alaska plaice clustered most closely with the two-year frequency group, but was near the dividing line separating that group from the four-year frequency group. The Team noted the

importance of two-year monitoring for this stock given the downward trend in biomass in the EBS and the concerns over possible interconnectedness of this stock with the NBS.

Pacific Ocean perch

Paul Spencer presented a partial assessment for BSAI Pacific ocean perch (POP). Since this is a partial assessment, only the projection model is updated with new catch information. The assessment model is not re-run. Estimates of 2022 projected female spawning biomass are slightly higher than last year's estimate for 2022. The Team accepted the authors' recommendations for the 2022 and 2023 POP ABCs and OFLs and appreciated the concise presentation.

Northern rockfish

Paul Spencer presented the BSAI northern rockfish stock full assessment. Catches are still near record highs, but down in 2021 relative to 2020. The author presented a description of the degree to which the fleet is targeting northern rockfish using Observer data on species composition per tow (applying a similar 'predominance' definition of 'target' as defined by AKRO, but distinguishing between targeting of specific rockfish species rather than a general 'rockfish' target), which appears to be increasing. This became relevant later in the discussion when a public comment was raised regarding opening a directed fishery for northern rockfish.

Fishery CPUE of northern rockfish has declined slightly but has been on an upward trend since 2007. The Team asked whether CPUE data reflect availability of Pacific ocean perch (POP) and the author replied that the POP fishery is relatively clean and there is not a lot of overlap between POP and northern rockfish. A member of the public commented that northern rockfish tend to mix with Atka mackerel and that neither mix with POP.

The author reviewed his response to a Team recommendation about exploring global age-length keys that weight by population size between areas. Upon review, this method was found to be mathematically equivalent to the current method.

The author also addressed the Team recommendation that he explore alternatives to the restrictive priors on key parameters in the model. For this year's assessment, he chose to focus on the issue of selectivity. The author reviewed his exploratory analysis of relaxing constraints on selectivity and presented model results for several alternatives. He argued that the best option involved shifting the constraint from having selectivity reach 1.0 for age-15 fish to one that constrained selectivity to 1.0 for fish once they reach 30 years of age. This model (Model 21) was more flexible, produced results that more closely aligned with empirical survey data, and was more aligned with current knowledge about Alaska rockfish species and how they are modelled.

Model results from the preferred model (Model 21) demonstrated acceptable fit to survey biomass. Some of the age composition data demonstrated underfitting of some age classes and over-fitting of others, which is not unusual for rockfish stocks. Retrospective bias was worse in 2021 compared to 2019. Phase plane diagrams indicate that the stock is still in a good place relative to fishing reference points.

The risk table was scored similarly to 2 years ago with level 2 given to assessment related considerations and 1 given to other categories. The score of 2 for assessment-related concerns was justified based on the strong retrospective bias, the continued use of relatively constrained priors on key parameters in the model, and uncertainty regarding model choice. Despite the elevated concern, the author did not support a reduction in ABC given that stock abundance is high, and the exploitation rates are low.

The Team discussed the fact that the new model had not been presented at the September meeting and thus the bar for accepting the new model at the November meeting was higher. There was some discussion on whether this was permissible, but the policy was reviewed to ensure that the Team was within its bounds to accept a new (non-previewed) model in November. The Team supports the author in using Model 21 for the 2022 and 2023 harvest specifications.

The Team discussed whether the author's score of 2 for assessment-related considerations was appropriate given the elevated risk score for this category in 2019, and what should be the appropriate baseline for determining this score. There was discussion between the Team and the author regarding assessment-level considerations, and some exploratory models were examined and illustrate the large effects of the constraining priors/penalties on model results, indicating potential model misspecification and that the current model is understating uncertainty (and these issues are likely exacerbated by the cancellation of the 2020 trawl survey). The Team felt that concerns raised by the author did indeed warrant the score assigned.

A question was posed as to whether the ABC is the "actual" ABC and if it would be acceptable to open a directed fishery up to that level. With decreasing pollock stocks and halibut and cod constraints on flatfish, there is likely to be interest in this stock, and from a manager's perspective, fishing for northern rockfish would be preferable to fishing for POP, because the former is associated with a lower incidental catch of blackspotted/rougheye. The Team indicated that an ABC recommendation is an overall ABC for all uses and that how it is split among target fisheries is not part of the recommendation.

The author did not recommend a reduction from the maximum ABC despite the level 2 rating in the risk table due to the stock's high abundance and light fishing pressure. The Team accepted the author's model and recommended ABC.

Rougheye/Blackspotted rockfish

Paul Spencer presented the blackspotted and rougheye rockfish partial assessment. Recent catch data were revised, and the projection model was re-run for the AI portion of the stock, with the EBS portion assessed using Tier 5 methods and no changes to input data. The author highlighted that the fishery length composition data in the WAI in 2020 and 2021 show unusually high numbers of small fish (23-29cm) and that the recent survey data for this area also show small fish with larger size classes disappearing. The Team noted this as a research topic, in addition to spatial management concerns, to be addressed at a workshop before the next assessment. Responses to SSC and Team comments specific to this assessment will be addressed during the next full assessment. The Team accepted the authors' assessment and had no recommendations.

Atka mackerel

Sandra Lowe presented on the BSAI Atka mackerel stock assessment. This assessment presented results from the base model (16.0b) used in 2020 with updated fisheries data. There has not been an AI trawl survey since 2018, which is the only fishery-independent data source for this assessment. As this is a biennial survey, the Team would like to emphasize that conducting an AI bottom trawl survey in 2022 is a high priority and essential for the responsible stewardship of groundfish fisheries in this region.

The authors' recommended 2022 ABC is a 7% increase from the 2021 ABC. The author indicated that the increase was predominantly due to two factors: an increase in the projected female spawning biomass, as the 2012- and 2017-year classes were stronger in the fishery than expected last year; and a shift in selectivity to older fish, leading to an increase in F_{ABC} and F_{OFL}. The Team supports the author in using Model 16.0b for the 2022 and 2023 harvest specifications.

The author did not recommend a reduction from maximum ABC, which was supported by level 1 ratings in all categories of the risk table. The Team accepted the author's model and recommended ABC, other reference points, and continued use of a 4-survey weighted average for area apportionment.

There was some discussion of the dome-shaped selectivity for both the fishery and the survey in relation to the older fish.

The Team recommends that the authors continue research into possible reasons for dome-shaped fishery and survey selectivity patterns, including senescence or differential distribution by age.

The Team also discussed the lack of Atka mackerel in Area 542 in the 2018 survey and whether this would be a reason for increasing the level of risk for the stock assessment to a level 2. The author indicated that the model adequately deals with this uncertainty and that an increase in risk level in their opinion was not warranted. During discussion of possible alternative indices for this stock (e.g., AFSC longline), the author indicated that they had investigated a number of possible indices but none of those examined proved to be adequate for this species. The increase in rockfish in the Aleutian Islands was mentioned as a concern. The author agreed that there may be some competition for forage, but also noted that the depth distributions of these species do not greatly overlap and thus direct competition is likely limited.

Skates

Olav Ormseth presented a partial update of the BSAI skate stock complex assessment. This assessment is conducted biennially in even years so a full assessment will be presented in 2022. For the partial update, only the Tier 3 projection model for Alaska skate is re-run with updated catch. The Tier 5 portions of the complex harvest recommendations are rolled over from the previous assessment. The Team accepts the author's recommended ABC and other reference points. The Team noted that this is Olav's final skate assessment before he leaves the AFSC and thanked him for his extensive efforts over the years.

Forage Species

The Team received a presentation on the Forage Species chapter from Olav Ormseth. The Team had an extended discussion concerning trends in some forage species and indications that forage species in the EBS are in decline (e.g., much lower trawl survey biomass estimates of "FMP forage fish" in each of the last four surveys than previously). In particular the Team discussed coordination with ESR reports and data streams as well as the potential for a combined forage fish report across both the BSAI and GOA, similar to Grenadiers. After prolonged discussion of the trends, including a focus on the dramatic increase in squid bycatch in the EBS pollock fishery in recent years, the Team decided to reconvene on the forage discussion later in the week. The extra time was meant to address squid trends, go over the previous rationale for movement of squid to the Ecosystem component, and formulate Team recommendations.

Upon reconvening, the Team received a presentation from Council staff regarding the analyses to investigate moving squid to the ecosystem component in 2017. At the time, the decision was contingent on the assumption that the current levels of squid catch were close to the levels that would be realized if squid were moved to the ecosystem component. The Team discussed calculations for the range of anticipated catch levels and what might be considered low exploitation relative to the actual biomass of the squid population. Previous calculations of OFL were based on catch from 1977-1981, when some targeting of squid was potentially occurring. A Team member noted that current catch levels may have increased due to the recent warm temperatures, as squid bycatch did not seem to be an issue during the colder years in the EBS. In 2020, catch rates were also higher during the fall fisheries, whereas historically higher catch rates occurred in the mid-summer. The Team expressed concern over the more

than doubling of the squid bycatch in recent years following the movement of squid to the ecosystem component and considers this a "red flag" to be investigated further. The Team discussed the recent SSC and Council requests for updates on the squid bycatch and potential avenues for investigating estimation of squid biomass and impacts of climate change. A Team member noted that there are new ecosystem models in development (e.g., size-spectrum model) and a synthesis of current information could be used to develop a more realistic baseline than the large range of biomass estimates that were used in the 2017 analysis. A Team member asked about the availability of diet data for squid, but another Team member noted that the current diet information is very limited as the diet samples on the bottom trawl survey are focused on a limited number of species. The Team discussed the potential to investigate the squid bycatch concern within the larger context of the forage species and to consider conducting an annual update of squid bycatch within the forage species report. The author also noted that a team of forage subject matter experts had recently discussed the potential for an informal discussion on the future of the forage species report and coordination with the forage information in the Ecosystem Status Reports (ESR).

The Team recommends a forage species workshop where scientists, members of the Teams, SSC, and Council staff discuss 1) surveying and population estimation of forage species, 2) importance of forage to different managed species (e.g., evaluate the suite of current food web models), 3) questions about how climate change may impact forage biomass and exploitation rates, 4) how best to report on changing populations, scientific knowledge about forage species, and the dependence of other species on them; including timing, frequency, and scope of the report, and 5) potential resulting management measures from shift in bycatch or spatial distribution of the forage base.

The Team also acknowledged the need for continued research on forage species.

The Team recommends coordinating with the editors of the ESR to reduce redundancy in reporting between the forage and ESR report and consider a combined forage species report for Alaska rather than the two separate regional reports.

2022 and 2023 BSAI Harvest Specification Recommendations

The Team noted the compilation of the 2022 and 2023 harvest specifications, and recommended their adoption by the SSC.

Adjourn

The meeting adjourned at 09:30 PST on Friday, November 19.

Minutes of the Gulf of Alaska (GOA) Groundfish Plan Team

North Pacific Fishery Management Council
1007 West Third, Suite 400
Anchorage, Alaska 99501
November 16-19, 2021

Administrative

The GOA Groundfish Plan Team ("Team") convened on Tuesday, November 16 at 9:00 am PST. Participation was remote via Adobe Connect. All SAFE documents were posted to the AFSC draft assessments page, and all other documents provided prior to or during the meeting as well as presentations given during the meeting were posted to the Teams' electronic agenda.

GOA Ecosystem Status Report

Bridget Ferriss presented the GOA Ecosystem Status Report. The report continues to be synthesized in terms of combining indicators. Bridget noted several changes in the report for this year including a change in how EGOA and WGOA are divided to reflect fisheries management zones, continued collaboration on forage fish indicators to better compliment the biennial Forage Report, and a pause on human dimensions indicators as conversations around the role of those in the ESRs continues between the AFSC and SSC. There are a number of new contributions to the ESR and the ESR team worked to create a 4-minute video to communicate the results of the 2020 GOA ESR to the public. The Team agreed that the video was very well done and useful.

Overall, the Gulf was more normal and extreme conditions had dissipated somewhat. The lack of recovery from the recent marine heatwave period may be associated with cumulative effects and variable recovery time as well as lower productivity overall in the system. This year, 2021, marked a second consecutive non-marine heatwave year although the system is still in transition from the 2014-2016 heatwave period. Ocean temperatures for the coming winter 2021/2022 are predicted to be around average and for spring 2022 are expected to be below average, with a La Niña predicted. Indicators demonstrated below average conditions for planktivorous groundfish and seabirds indicating they are not finding an abundance of nutritious copepods.

Large pink salmon harvests in the Gulf this year may imply competition in the food web because of their large grazing capacity, which has been related in the literature to reduced copepods and impacts on seabirds and other fish. There was some evidence of that in indicators in the WGOA but not across the Gulf as a whole.

There was discussion surrounding the link between copepods and groundfish condition that was made in the presentation. The Team sought clarification on how information from the copepod indicator should be translated in terms of fish production. Age-2+ pollock may be eating more euphausiids and be more piscivorous at that age. Bridget noted that there is not a consistent euphausiid indicator and that some groundfish eat copepods in the spring. This copepod indicator should be interpreted in terms of how the system was developing in the spring related to general productivity that contributes to the diet of planktivorous fish in general, given the lack of data on other indicators like euphausiids.

The Team also asked about whether bottom up or top-down factors could be driving the differences in copepod abundance. Bridget responded that small copepods are less boom-and-bust in response to short-

term environmental fluctuations and are more consistent in abundance through warm and cool periods than larger copepod species. A low abundance of large copepods could indicate that they were not there, they were grazed down by predators, or that they entered diapause earlier. Each would have varying ecological implications.

The Team inquired about the linkage between declining seabird bycatch and shifts in gear in the sablefish IFQ fishery from hook-and-line to pot gear. The question was whether observer coverage or electronic monitoring could be a factor in that reduction. There has not been a change in the observer sampling design or in regulations to explain drops in albatross bycatch during 2017 to 2020. There was also a question about whether the bycatch numbers reflect mortality, and the author later clarified that all albatross "caught" are mortalities.

Regarding the stability and resilience of groundfish community indicators, there was a question about the mean life span indicator – this indicator reflects the mean lifespan (maximum known age) of the fish that are being caught. If the survey is catching more longer-lived species, the mean life span indicator increases, and the more shorter-lived species indicator decreases (this indicator is weighted by abundance). There is regional variability in which species are driving the stability and resilience indicator across the WGOA and EGOA.

The Team inquired about how to interpret the terms “high richness” and “high diversity.” How do these measures contribute to stability and resilience? Bridget explained that richness is the number of species and diversity is how evenly distributed those species are higher richness and higher diversity. Together, they should lead to higher stability and resilience. A rich and diverse system should be less vulnerable to short-term environmental fluctuations. If a large number of species exist in an area, there may be some functional redundancies, so if one type of forage fish declines, for example, another type of forage fish would be available as prey. The Team noted that while high richness and diversity contribute to stability and resilience, they may not imply high production.

The Team noted that the ESR is improving every year and thanked Bridget for her work.

GOA pollock

Martin Dorn presented the pollock ESP “report card”, which included no added indicators from the previous ESP. Some indicators were missing due to survey cancellations and data delivery timing. All ecosystem indicators were in an average or neutral state, except the nearshore Kodiak YOY survey which indicated a higher than average abundance of age 0 pollock. Most socioeconomic indicators could not be evaluated this year, but of the two that could, the spring fishery CPUE was high, however the amount of roe per unit catch was lower. Overall, the ESP portrays a return to average conditions.

Bayesian adaptive sampling analysis indicated that the spring larval CPUE had the highest inclusion probability, followed by the arrowtooth flounder biomass, although the fact that the latter has a positive effect on the pollock assessment is not intuitive given potential predation / competition issues. Some results from an ecosystem-linked research assessment model were presented, where natural mortality (*M*) varied with abundance of major pollock predators. This model resulted in an improved fit to survey biomass, and a high estimated *M* from 1995-2009.

Cole Monnahan presented the GOA pollock assessment. Highlighted investigations included concerns about the size of the 2018 year class (which is much lower in recent surveys), an increase in spawning fish weight-at-age, and the influence of the model assumptions related to the NMFS bottom trawl survey. Cole also noted an increasing trend in age diversity, indications of a large 2020 year class, and apparently favorable environmental conditions. The four surveys used in the model provided new data from 2021.

Three of them showed increases relative to previous estimates and it was noted that this contrasted with recent diverging trends among some surveys. The survey that indicated a decline (related to the 2019 value) was the summer GOA-wide acoustic survey. The reduction in the estimate of the 2018 year class was mainly due to the low value of age-2 abundance estimated in Shelikof survey data (in contrast to the high value of age-1 from this survey in 2019). A stable retrospective pattern was observed (Mohn's rho = 0.056). The stock is currently above B40%, with low risk of being reduced below B20%.

The Team inquired about how catchability parameters for the Shelikof Strait and ADF&G surveys were modeled and noted that they appeared to be inversely correlated. Cole stated that this is likely coincidental given the spatial and temporal differences between these surveys. The discussion then turned to whether a random walk process is an appropriate approach. It was noted that the residuals suggested a multi-year pattern and that led to this approach. Cole suggested that this and potentially other process error components should be evaluated and estimated within the model rather than specified.

In response to previous Team comments, Cole investigated catchability and the influence of surveys on the estimated scale of abundance. An investigation of the time-varying catchability on the Shelikof Strait acoustic index was performed by exploring a logistic transform on the parameter which limits the domain to a maximum of 1 as it is not expected that this parameter should exceed that value. This resulted in a more varied pattern in catchability and better fit to the survey. The Team also recommended performing a leave-one-out analysis with the surveys to assess sensitivity to the different time series. This showed that the NMFS bottom trawl influences the absolute scale of the population estimates.

The risk table was presented with all categories scored at level 1 (no increased concerns) with no reduction from max ABC. This is a change from 2019 when there were elevated assessment and population dynamics concerns. The Team agreed with this conclusion.

Three concerns for this years assessment were identified: 1) An increase in the survey data weight-at-age for almost all ages relative to the 2020 assessment; 2) the apparent reduction in the 2018 year class; and 3) uncertain scale of the population (which is driven by the prior for catchability in the NMFS bottom trawl survey).

The Team recommends that the methodologies for projecting weight at age from the survey data be investigated, possibly by implementing a random-effects model or a sample weighted mean approach rather than a simple average.

The Team discussed the issue of how model specification of the prior for catchability on the NMFS bottom trawl survey affects the scale of the population estimates. Cole noted that the prior distribution on BT survey catchability appears to drive the estimates. He noted that the prior was derived by consulting with survey scientists. The fact that the posterior distribution of the parameter was nearly identical to the prior suggested that the data are uninformative. Alternatively, it could be possible that the data were simply consistent with the prior.

The Team recommends the author further research this issue, including conducting a prior sensitivity analysis and potentially looking at applying priors (if available) for other surveys in the assessment.

Cole presented a list of planned research topics including constraints on catchabilities and development of prior distributions, investigating trends in weight at age, the influence of timing of the Shelikof survey on catchability, maturity, and selectivity, the scaling of the model, data weighting, combining bottom trawl and acoustic surveys, and selectivity functional forms. **The Team supports the authors' planned research into these topics and agreed their relative priority.**

The Team thanked Martin Dorn for his excellent guidance and efforts in conducting the GOA pollock assessment for the past many years, and wished him all the best in his retirement.

GOA Pacific cod ESP

Kalei Shotwell provided an overview of the Pacific cod ESP report card. The simplified report card template allows for including current year data to inform indicators but does not address Team or SSC recommendations which are done during partial or full reports. The indicator suite is composed of ecosystem and socioeconomic indicators but the author noted no updated community economic indicators were provided in this report card. The majority of ecosystem indicators were in a "neutral" or "average" status likely attributed to the GOA returning to a cooler regime following the marine heat wave stanza earlier. The economic indicators imply lower ex-vessel value and revenue per unit effort. Overall, there are more suitable above average transport and cooling, larvae appear to be low, both juvenile and adult condition factors are mixed, and economic indicators are low. The inclusion probability analysis identified two potential covariates, spawning habitat suitability and eddy kinetic energy in the Kodiak area. Additionally, ecosystem linked models using the age-0 CPUE Kodiak beach seine survey are being explored as alternatives for the operational assessment model. For 2022, the ESP Team will meet in January and review indicators in February to determine if a partial ESP or simplified report card will be recommended. If a partial is recommended, it will be presented at the June SSC meeting and to the Team in September.

The Team questioned what the motivation is for bringing forth indicators for the ESP team to review and the author responded that providing an indicator provides a direct link to stock assessment and provides an opportunity for non-stock assessment researchers to introduce their ecosystem and socioeconomic research into the assessment and Council arena. The author requested the Team respond if this simplified report card was appropriate in content and detail for Plan Team review.

The Team recommends the author and ESP Teams continue their work on the ESPs and appreciate the length and detail of this template report card for explaining the indicators and conveying pertinent information that informs management.

GOA Pacific cod assessment

Steve Barbeaux and Ingrid Spies presented this year's assessment. There are two interesting research developments. First, the genetic distribution of selective differentiation of the ZP3 protein shows that this protein is distinctly different in populations adjacent to the BSAI (WGOA and CGOA) compared to those in the SE GOA. The Team asked whether or not the spike in natural mortality during the heatwave could partially be explained by these genetics. They explained that it could also be due to movement. Second, satellite tagging data in the WGOA indicates substantial connectivity between the WGOA and the BS.

Steve presented the base model from last year and two updated models originally demonstrated in September 2021. Model 21.2 was recommended and the Team agreed. This model uses environmental links that were shown to be informative and were plausible given previous analyses on temperature-dependent growth and marine heatwave impacts on natural mortality.

A novel jack-knife approach (which Steve called "leave one out") was shown. This provided a unique way to evaluate the influence of annual data by leaving out all data in a given year. The Team appreciated this analysis and provided suggestions on alternative presentations of these results that may avoid some confusion. As a side note, the Team would like to establish some common terminology. In statistics, "Jack-knife" generally refers to sensitivities of individual data points. In stock assessments, "Leave one out" analyses commonly refer to dropping an entire time series to evaluate the contribution of different data sources.

Steve provided alternative projection scenarios, one based on recent average recruitment and the standard period (since 1977). The Team recommended the standard post-1977 projection period ("Projection A") for status determination but noted that continued poor recruitment will impact the potential for stock increases.

GOA Northern and southern rock soles

Meaghan Bryan presented the assessment for northern and southern rock sole. The most recent full assessment was in 2017, which treated the stocks as from a single area. This year Meaghan developed assessments that accounted for growth differences between regions. As rock sole catch estimates from the NOAA-Fisheries Alaska Regional Office are undifferentiated by species, the assessment assumes that rock sole catch was evenly split between the species.

In addition to the accepted northern rock sole model from 2017, other single-area northern rock sole models were considered in this assessment and included features such as asymptotic fishery selectivity and constraining the coefficient of variation (CV) of length at age for old fish (a parameter in fitting growth curves within the Stock Synthesis assessment model). Two-area models for northern rock sole estimated a parameter that distributes recruitment between areas, and also evaluated asymptotic fishery selectivity and fixing the CV of the length of old fish in the growth model. Models for southern rock sole are largely similar to northern rock sole.

The overall fits among the models for northern rock sole were similar. There was some improvement in the fit to survey biomass in the two-area models but autocorrelated residuals in the fits to the survey index persisted. The retrospective pattern for SSB was poor, with Mohn's rho ranging from 0.15 to 0.27 across the models. The southern rock sole models generally fit the data better and had a favorable retrospective pattern for SSB (Mohn's rho ranging from 0.05 to 0.09 across the models). Meaghan recommended the two-area model for both stocks and the Team agreed. These two-area models improve the fit of the spatial growth patterns relative to the previously used single area models.

The assessment authors identified several research recommendations, including addressing the autocorrelated residual pattern in the fit to the survey biomass data (this may motivate investigating time-varying selectivity), exploring methods for splitting the catch between species, and accounting for uncertainty in the catch. **The Team agreed that the recommended two-area models are an improvement over the previously used assessment models and supports these research topics.**

GOA Shallow water flatfish

Besides northern and southern rock sole, the remaining species in the SWF complex are in Tier 5. In general, the majority of these species other than rock sole have low exploitation rates. Rock sole catches have been declining since 2009. English sole catch has been increasing but at low levels relative to rock sole.

Biomass for tier 5 species was estimated using the random effects model. Survey biomass estimate trends varied among species between the 2019 to 2021 surveys. Biomass estimates of Alaska plaice decreased 53%, butter sole decreased 28%, English sole increased 101% , sand sole increased 16%, starry flounder decreased 34%, and yellowfin decreased by 1%. Biomass of the tier 5 species have shown a general decline since 2000 and the 2021 estimate was 1% lower than in 2020. ABC and OFL values for 2022 and 2023 are lower than previous estimates.

The Team noted there appeared to be a positive correlation between the survey biomass estimates and the catches. This may suggest that the incidental catches of these flatfish reasonably reflect patterns observed from the survey data.

Area-specific apportionments for this complex were based on survey data as evaluated using the standard random-effects model for the Tier 5 components. Together with the estimated northern and southern rock sole biomass results in the following apportionment: western 42.2%, central 49.5%, 5.5% Yakutat, and 2.8% for Southeast. The Team agreed with this approach and estimates.

For the risk table assessment, the author recommended an overall designation of level 1 but a level 2 was assigned to assessment related concern because yellowfin sole survey estimates have steadily declined. The Team agreed with the ABC and OFL recommendations.

GOA Rex sole

Carey McGilliard presented the full 2021 GOA rex sole assessment. Catch is typically well below ABC/TAC levels but was exceptionally low in 2021, attributed to both fishery closures and marketing/tariff issues rather than conservation concerns. Survey biomass in 2021 was an increase over 2019 with the greatest biomass or rex sole occurring in the Central GOA. Updates done in 2021 (Model 21.0) include using Francis data weighting methods, omitting the 1984 and 1987 bottom trawl survey data, and estimating survey catchability with a normal prior based on previously conducted survey efficiency studies. Mini-bridging analyses were conducted to see the effects of these changes. Removing the two surveys from the 1980's had little effect on model performance and were deemed appropriate since these surveys aren't comparable to the existing survey time series. For data weighting, the Francis reweighting method was chosen over other data weighting methods because it provided better fits to survey biomass. The previously used McAllister-Ianelli approach was not chosen because it emphasizes compositional data in its weighting scheme resulting in modeled survey biomass estimates that are higher than observed, attributed to several recent large year classes seen in the fishery that have high uncertainty at this time. Model fits to fishery data are markedly improved with the two-area model but still indicate some mismatch in growth may be occurring in the data not explained by the two area split. A small retrospective pattern exists in Model 21.0 but has a reasonable Mohn's rho and is within acceptable ranges. The 2022 author-recommended and Team-endorsed ABC/OFL are an increase in both areas and are higher than those recommended last year. The risk table had level 2 concerns in both the assessment-related concerns and the population dynamics considerations largely due to several new large year classes that have only been observed a couple times and are higher than historically seen and a potential that the model is not tracking time-varying growth as evidenced in the fits to conditional age-at-length data. The author provided several research priorities including developing an ageing error matrix, improving maturity-at-age estimates, and looking into growth further including time-varying growth.

The Team supports the author's research priorities, encourages further discussion on the utility of conducting maturity studies across the entire GOA, and endorses the author's intent to develop an ageing error matrix and further explore natural mortality rates.

GOA Arrowtooth flounder

Kalei Shotwell presented the full 2021 arrowtooth flounder assessment. In response to Team and SSC recommendations the authors provided a full risk table this year, will further investigate use of AFSC longline survey and the IPHC survey in future assessments, and provided a sensitivity analysis regarding non-standardized survey length frequency data. Catch in 2021 was low and attributed to poor markets and tariffs. The 2021 survey biomass was slightly above the 2019 estimates and survey age compositions indicate a potentially strong 2017 year class exists. Exploration of the AFSC longline survey data indicated a decadal pattern up to 2010 followed by a decline. For 2021, the authors continue to use the 2019 model but a data correction was made. Non-standardized survey length data from 1985, 1986, and 1989 were removed because sensitivity analyses showed very little effect on total and spawning biomass when these data were omitted. This model (19.0) provides reasonable fits to the data despite in some

years there is a lack of fit for females and a small retrospective bias is present. Total and spawning biomass are trending lower yet well above B40%, and the 2022 ABC is 5% lower than last year. For the risk table, the authors recommended Level 1, no apparent concern, for all categories and no reduction to maxABC was recommended. The author provided several future research priorities including investigating lack of fit in female survey age and fishery length compositions, exploring incorporation of new multi-species modeling efforts, and looking at alternative survey and VAST estimates.

The Team supports the author's recommended model and ABC/OFL recommendations, noting the stock trends are declining and the model is tracking this trend, and apportionments are stable. The Team also supports the author's suggested research topics including development of an ESP for arrowtooth flounder and incorporation of the CEATTLE multi-species model.

The Team discussed the use of non-standardized surveys including the 1984 and 1987 surveys that historically have been used in many assessments but were cooperative surveys with Japan and not comparable to our domestic survey index starting in 1990. Considering the length of the bottom trawl survey time series, it is no longer common practice to use any of these non-standardized surveys as part of the time series.

GOA Pacific ocean perch

The POP assessment was presented by Ben Williams. The model used this year is the same as the previous assessment, with normal updates to the assessment data. Catch has remained below the TAC and survey results show a high biomass index in 2021. The spatial abundance seems to continue a westward shift based on survey data. The 2019 survey age data suggest an above average 2016 year-class but this has yet to show up in the 2020 fishery age data.

The abundance estimates from the acoustic trawl (AT) GOA pollock summer survey appear to match the BT survey this year, in contrast with the results from the past two years which did not match. A length composition comparison shows that the AT survey may be missing smaller fish.

For the majority of model outputs, this year's assessment results are very similar to the 2020 assessment, with a slight increase in predicted total and spawning biomass. Retrospective pattern continues to be negative, Mohn's rho = -0.16, and stock appears to be under the control rule specification. Spawning biomass is projected to decrease in coming years.

The ABC recommendation is slightly higher for 2022 than last year's projection, with a slight decline projected for 2023. Apportionment based on survey biomass reflect a shift from the Eastern GOA into the Central and Western GOA areas, with the majority of the catch apportioned to the central GOA area (80.5%).

Questions from the Team included inquiry about the status of using the VAST spatio-temporal model as an alternative abundance index, work on which is ongoing and will involve a number of other rockfish stocks.

The ongoing industry-AFSC cooperative research study into estimating abundances in untrawlable habitats using industry vessels, headed by Madison Hall, was highlighted and is included as an appendix in the SAFE document. Further communication with this group and monitoring of their progress was encouraged by the Team.

The risk table scored the assessment and population dynamics considerations at level 2: Substantially increased concern (the presentation slide has an error in the text for the former, but is correct in SAFE document), and ecosystem and fisheries performance considerations at level 1: No apparent concern.

Despite the assessment and population dynamics concerns, due to the fact that the model is underestimating survey estimates, and thus less of an immediate management concern, no reduction in maxABC is recommended by the author. The Team accepted the author's recommendation. A general comment was made that assessment models often cannot accurately model unexpected increases in abundance indices, resulting in negative retrospective patterns.

The Team noted the apparent instability in apportionments for many rockfish species. The group was made aware of a UW graduate student, Kelly Mistry, who is working with Mark Scheuerell on issues associated with apportionment. This includes the potential for using random effects models, as well as the VAST framework to address this issue. There were also questions regarding the ongoing decline in abundance in the eastern GOA, where there is no directed fishery. This decline was noted as a potential area of future research. The Team would welcome a full assessment next year if warranted by any large changes, such as those that might result from incorporating VAST model abundance indices.

GOA Rougheye/Blackspotted rockfish

Jane Sullivan presented the rougheye/blackspotted rockfish assessment. She responded to Team and SSC comments including comparing species trends at similar depth strata between the longline and trawl surveys. She found that the surveys rarely tracked each other when split by area and depth strata, and that the surveys partition biomass differently among regions. She updated the Team on progress made on species identification and on biological parameters that had been estimated outside of the model.

The updated data resulted in reductions in ABC and OFL relative to last year, which tracks declines in recent survey biomass estimates. The retrospective pattern was poor and appears to be biased high. Likelihood profiles over survey catchability showed that the information content of the available data is poor. The Team noted that the estimated dome shape of the selectivity should be evaluated in the future as it was unclear why 40 year old fish would be so much less selected than a 30 year old fish.

The Team agreed with the data and model issues raised by the author including data weighting, trawl survey length data, survey index refinements, and parameterizations for survey catchabilities and selectivities. The Team continued to place a high priority on developing robust species identification methods and in estimating composition data.

GOA Shortraker rockfish

Katy Echave presented the Gulf of Alaska shortraker rockfish assessment. The assessment was a straightforward update using both trawl and longline surveys to estimate biomass. The majority of the catch occurs in the EGOA and catch in all areas has been decreasing since 2018. The HAL fishery catch of shortraker rockfish has decreased to low levels due to the transition to pot gear in the sablefish IFQ fishery. Discard rates for fixed gear under full retention mandates were higher than expected and an overall review is pending to determine how well this new regulation has been implemented and communicated with industry. The apportionments were updated and changed very little from the previous year.

The Team recommends that the authors look at natural mortality, and refers to recent papers in the literature addressing best practices. The Team further discussed that this is a request for rockfish in general and not only specific to shortraker rockfish.

GOA Dusky rockfish

Ben Williams presented the Dusky Rockfish partial assessment this year. A full assessment is expected in 2022. The authors will be examining the ways in which VAST survey biomass estimates differ from

design based estimates in the future. This is important because the parameterizations used for VAST greatly change the estimates of survey biomass (e.g., using the delta-Gamma approach instead of the delta-lognormal. The author provided the maxABC from the projection model as well as the SSC recommended stair-step ABC for 2022 and the Team agreed with using the stairstep ABC for 2022.

GOA Northern rockfish

This is a partial assessment year for northern rockfish, and thus the projection model is run with updated catch. Overall, the catch remains well below the ABC, and the 2021 recommended ABC is slightly lower than the previous year. The projected biomass continues a gradual decline with little apparent recruitment in the near term. The VAST estimates using the AFSC GAP program specifications are quite similar to the design based estimate, with both being highly variable, especially for a long lived species. This may be in part to an unknown and potentially variable proportion of the stock occupying untrawlable habitat, and thus being missed by the BT survey. The authors and GAP staff are evaluating the VAST index for several GOA rockfish species including northern rockfish for next year's assessment.

GOA Deepwater flatfish

Carey McGilliard presented a partial assessment for the deepwater flatfish complex. The next full assessment is scheduled for 2023. Kamchatka flounder was included in this year's assessment for the first time. Catch of Kamchatka flounder has been recorded as deepwater flatfish in the AKRO Catch Accounting System since 2011 but had not been previously included in the assessment. Based on Team and SSC recommendations, the author used a Tier 6 approach to assign a species-level OFL of 69 t (maximum historical catch) for Kamchatka flounder. The Team discussed the possibility of an important, small population of GOA Kamchatka flounder being negatively impacted by the assignment of species-specific ABC and OFL but decided that directed fishing was unlikely and no real concern existed. The Team also discussed the discrepancy between the ABC (52 t), OFL (69 t), and the 2021 survey estimated biomass (6 t) and recommended the author explore alternative Tier 6 methods for determining ABC instead of of maximum catch maximum catch for OFL in future assessments to bring ABC and OFL more inline with recent survey biomass estimates. The Team made no recommendation on what the timeframe should be used for average catch since that is a SSC determination.

GOA Flathead sole

Maia Kapur presented the partial assessment for flathead sole. A full assessment was scheduled for this year, but due to limited staff resources, the full assessment will be postponed until 2022. After next year's full assessment, the next full assessment for flathead sole will be the scheduled 2025 assessment, and then full assessments will continue on the normal 4-year cycle. The last full assessment was conducted in 2017 with an age-structured model and Tier 3 determination. The projection model for the partial assessment was run using parameter values from the accepted 2017 flathead sole assessment model, together with updated catch information for 2017-2020, and estimated catches for 2021, and 2022-2023. The 2022 and 2023 ABCs and OFL are very similar to last year's projected values for 2022. The Team concurred with the application of the projection model and accepted the recommended ABCs and OFLs. Area ABC apportionments for flathead sole are based on the projected survey biomass using the random effects model. The apportionments included updated 2021 survey information. This led to Team discussion on whether partial assessments should use updated survey information in the projections, or only updated catch information. The standard is to include updated survey information only when it has been used in the assessment model. However, the Team discussed whether there should be exceptions for stocks on a 4-year time schedule (e.g. flathead sole). The Team accepted the updated apportionments for flathead sole, but concluded that the policy of only applying updated information on catch and running the projection model was necessary for partial assessments and updating apportionment percentages by area based on new survey information should not be done even for stocks on a 4-year schedule..

GOA Demersal shelf rockfish

Kellii Wood presented this year's assessment. The most recent survey was in the Southern Southeast Outside section in 2020. ROV surveys occur across the 4 different management areas and each area is typically surveyed every 3 or 4 years. The yelloweye rockfish (the majority of the complex) biomass point estimate continues to be at low levels compared to historic biomass levels, warranting precautionary harvest levels and conservative management measures. The authors have adopted the SSC recommendations to use the lower 90th confidence interval of the DSR biomass for setting the OFL and ABC for the harvest specifications, rather than basing them on biomass point estimates. Three of the 4 risk level considerations scored at Level 2, while one scored at Level 1 (environmental/ecosystem considerations). The DSR assessment has always recommended an $F_{ABC} = M$ of yelloweye rockfish, which is below the Tier 4 maxF_{ABC}.

The Team discussed the assessment schedule for DSR: the last full assessment was in 2018. The authors asked for clarifications about the cycle for DSR assessments, and the Team agreed that this assessment should be on a two-year cycle in even years. Thus, the next full assessment should occur in 2022. The authors noted that there is ongoing effort to develop an age-structured assessment, which might be able to be incorporated into the next assessment. Additionally, recent IPHC surveys may provide additional data about yelloweye rockfish CPUE.

GOA Other rockfish

Cindy Tribuzio presented the GOA Other rockfish (OR) assessment. The OR complex comprises up to 27 species that are divided into two sub-groups within the complex based on life history, spatial distribution and fishery and survey characteristics. The two sub-groups include demersal shelf rockfish (DSR) (canary, China, copper, quillback, rosethorn, tiger, and yelloweye rockfish) and slope rockfish (20 remaining species).

The author presented updates to the assessment that included catch, trawl survey data, reporting catch from unidentified rockfish, random effects model weighted mortality estimates, and split fractions updated for EGOA to match assessment structure. The OR assessment is composed of Tiers 4, 5, and 6 and no new changes in the assessment methodology were presented. Catch of OR species in the W/C GOA exceeded the ABC where increases of harlequin, redstripe, silvergray, and yelloweye were observed, whereas catch continues to be well below the ABC in EGOA. Catch discards are generally variable but were higher than expected due to the full retention mandate of rockfish implemented in 2020 and is being further investigated.

Trawl survey biomass declined slightly from the previous survey and shifted to EGOA, however, there were many changes in species specific biomass. Notable declines in species specific biomass occurred for sharpchin (-26%), harlequin (-94%), and redstripe rockfish (-85%) whereas increases occurred for silvergray (48%), redbanded (87%) and yelloweye rockfish (109%). The author presented updated weighted M estimates for the random effects model 15.1, where M is responsive to the proportional biomass of Tier 5 species. Weighted M estimates decreased from the previous year due the survey catching less high M species and more low M species.

For the risk table assessment the author recommended not conducting a risk analysis due the OR complex consisting of up to 27 data-limited species, difficulty in identifying a single primary/dominant species as it changes between assessments and is untenable to complete a risk table for each of the six primary species which are varied in life histories, fishery characteristics, and survey availability. Additionally, if a single species were selected, data are sparse at the species specific level and much of the environmental data is borrowed from proxy species or generalized and overall may not be that informative for all of the species in the complex.

The Team discussed the discrepancy in catch and survey biomass due to survey catchability issues of higher M species and the resulting impact on weighted M for Tier 5. The author noted that many of the dominant species in this complex have patchy distributions and low catchability and small changes in biomass can have a large impact on ABCs. The Team noted that an individual or a few species should not have such strong influence on the weighted M estimates. It was further discussed that species groupings could be looked at for future improvement.

The Team appreciates and acknowledges the author's effort and time dedicated to determine a weighted (based on survey information) M applied to the Tier 5 aggregate so that harvest rates align with the species mix. However, the variability among species was too extreme, likely due to sampling variability in the survey. Given that there is little evidence that the survey is accurately tracking the species biomass and mix of species, there is insufficient information to warrant this approach. Consequently, **the Team recommended rolling over harvest recommendations from 2021 due to the discrepancy between catch and survey biomass and the estimation of weighted *M* being influenced by a few species that have patchy distributions and survey catchability/availability issues.**

The Team recommends the author further explore issues with using the current method of weighted *M* biomass estimates. The Team continues to support an earlier recommendation that the DSR subgroup be moved into the DSR assessment and make the DSR assessment GOA-wide pending a Council analysis on spatial management implications. The Team is encouraged that a working group is planning on addressing some of these issues and look forward to the outcomes.

The Team recommends incorporating 1 t of the northern rockfish ABC apportionment for EGOA to be combined with OR in the WYAK management area and added for management purposes.

GOA Skates

Olav Ormseth presented the assessment for big, longnose, and other skates. The presentation included an overview of the complex, survey results on biomass and size compositions and an update on stock status, catch information, apportionment methods and harvest recommendations. Skate diversity is highly depth dependent; the level of diversity increases with depth. Results from the AFSC bottom trawl survey indicate the majority of skate biomass occurs in the CGOA. There has been a general decline in skate biomass over the last 10-15 years, and the downward trend is most notable in the CGOA. Big skate biomass has decreased since 2011. For longnose skates, biomass estimates are more stable, with a bit of a decline in the EGOA, but overall AFSC BTS and RE estimates increased in 2021 across areas. The trend for other skates is domed-shaped, however, the AFSC BTS- and RE-estimated biomass of other skates increased slightly in 2021. Skate catch has shown a steady decline in the total catch since 2013.

Olav highlighted how the PWS survey does not overlap with any other survey, and therefore provides additional data that otherwise would not be obtained. It was noted that Kamishak and Kachemak Bay surveys have been discontinued due to budget constraints. The PWS survey has changed and is now rotating areas to match with districts for tanner crab. Olav noted that skates are caught a lot in recreational fisheries in localized areas and it may be worth looking at data if it is available to estimate catch and release in sport fisheries. Sport and research catches are included for federal waters.

ADFG members let the Team know a proposal is before AK Board of Fish to develop a directed skate fishery in PWS. Both ADFG and NMFS have commented to this proposal and should be of interest to the Council since past directed fisheries saw overages in skate catch, halibut discards surpassed skate catch, and no PWS stock assessment for skates so the GOA-wide skate assessment would be the only proxy available to management.

The author presented data on retention rates (pulled from catch accounting (CAS)) and described how an increase in ex vessel price likely caused increased retention up to 2013 (at least for longnose), which caused some ABC overages. Management measures such as inseason adjustments, and bans on retention began in 2013. Over time, the MRAs have changed from 20% to 5%. The Team had a few questions on retention rates which have increased in recent years. A member of the public mentioned that gear type could be influencing retention rates; more catch occurring in trawl fisheries and less catch by fixed gear (due to lower cod TACs) may drive retention rates higher. The Team highlighted that more investigation on retention rates by gear type in the directed fishery may be helpful for big skates.

The author recommended a decrease in ABC and OFL (and different areas) based on the random effects model for biomass for big skates, and a small increase for longnose, and a small increase for the other skates complex.

The Team inquired about how recently natural mortality had been reviewed for skates and whether it would be a worthwhile exercise. The author indicated that it would be useful and likely an improvement, however there is enough variation in these estimates that the status quo seems to be working and is likely precautionary. The author indicated that if the longstanding estimate of *M* were changed, it should undergo a comprehensive review. It was also noted that skate discard mortality rate is assumed to be 100%.

The Team inquired about the potential to move any skate species to Tier 3. Olav responded that both size and age-structured assessments have been explored for big and longnose skates in the GOA but are not currently used in management advice. He suggested that measures to streamline and simplify assessments might be something to consider. The Team does not have any recommendations on this at this time.

GOA Octopus

Olav Ormseth gave a presentation of the Tier 6 octopus assessment. He noted the differential size of octopus caught in the survey (smaller) versus bycatch in the fishery (larger). Olav noted that octopus often hide in crevasses and therefore the survey is a poor sampler of octopuses. For this reason, he asserted that survey biomass estimates are unreliable and hence poorly qualified for a Tier 5 approach. While minimal, they are the only estimates available.

Most of the octopus survey biomass and catches are in the Central and Western GOA. The main species is *Enteroctopus dofleini* which is also the most abundant octopus species in shelf waters and makes up the bulk of octopus catches in commercial fisheries. The majority of catch occurs in the Pacific cod fishery. Olav proposed that octopus may be best assigned to the ecosystem category. Alternatively, he suggested that the assessment frequency could be reduced.

Tier 6 specifications are based on the maximum historical catch (1,307 in 2014). The Team discussed the different approach used in the BSAI which is based on using Pacific cod consumption rates to estimate octopus biomass. Olav pointed out the problems associated with the different approaches, noting none were ideal. Being a Tier 6 stock and the lack of a conservation concern, a risk table was unavailable.

The Team noted that Olav was moving on from his current job. The Team commended and were grateful for all of Olav's contributions to non-target species assessments, his leadership in the research of nearshore middle trophic levels as part of the GOA Integrated Ecosystem Research Project, and detailed reporting on forage fish. The Team wishes him well in his move in 2022.

GOA Atka mackerel

Sandra Lowe presented the GOA Atka mackerel assessment, which is on a biennial assessment cycle. GOA Atka mackerel is a Tier 6 stock due to limited information from surveys and age composition data. Survey data for GOA Atka mackerel do not provide reliable estimates of biomass. In 2017 and 2019 there were very few Atka mackerel samples in the survey hauls; in 2021 there was a substantial number of mackerel in a single haul that was then extrapolated over a large strata. Additional age data for Atka mackerel is available from bycatch samples from the GOA fisheries. These data fail to provide a full distribution of ages, but the author noted that there is evidence of correspondence between strong year classes estimated in the Aleutian Islands and those observed in the Gulf of Alaska.

The author noted that this year is likely to be the last year in which the risk table is included in the stock assessment for Atka mackerel. Because stock abundance levels and trends are unknown, meaningful ABCs are not able to be set for Atka mackerel. Therefore, reductions from the maximum permissible ABC are not warranted. Uncertainty for GOA Atka mackerel is accommodated through management with conservative TAC specifications. Given that this is a Tier 6 stock and therefore lacks data to meaningfully set an ABC and inform the risk table, the inclusion of a risk table in future stock assessments is not warranted. The Team thanked the author for yet another excellent assessment and presentation.

General recommendations

The Team recommends all GOA authors evaluate any bottom trawl survey information used in their assessment prior to 1990 including the 1984 and 1987 surveys and conduct sensitivity analyses to evaluate their usefulness to the assessment. This may apply for Aleutian Islands surveys but this was only raised during GOA assessment considerations.

2022 and 2023 GOA Harvest Specification Recommendations

The Team had extensive discussions regarding the practice of removing a small amount of ABC from the northern rockfish assessment and placing it in the other rockfish complex since northern rockfish are included in the other rockfish complex in the Eastern GOA. Rather than treating this solely as aTAC revision, the Team agreed this should be an ABC reduction so that the other rockfish complex TAC is not greater than its ABC.

The Team recommends the summary tables reflect this proposed change in ABC for both northern rockfish and the other rockfish complex. If the SSC concurs, then this change should be captured as a change in ABCs in the harvest specifications. The Team also recommends the small amount of ABC taken from northern rockfish be placed in the West Yakutat management region of the other rockfish complex because this area is closest to the center of distribution of northern rockfish. Additionally, a rockfish trawl fishery operates in this region and is the most likely fishery in the Eastern GOA to catch northern rockfish.

The Team noted the compilation of the 2022 and 2023 specifications and recommended their adoption by the SSC.

Adjourn

The meeting adjourned at 12:00 PST on Friday, November 19.