Minutes of the Joint Meeting 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
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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)
Steve MacLean	NPFMC (coordinator)	Sara Cleaver	NPFMC (coordinator)
Mary Furuness	NMFS AKRO	Obren Davis	NMFS AKRO
Alan Haynie	AFSC REFM	Jennifer Cahalan (substitute for 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
Andy Kingham	AFSC FMA	Nat Nichols	ADF&G
Kalei Shotwell	AFSC REFM	Jan Rumble	ADF&G
Phil Joy	ADF&G	Paul Spencer	AFSC REFM
Cindy Tribuzio	AFSC ABL	Marysia Szymkowiak	AFSC REFM
vacant	ADF&G	Kresimir Williams	AFSC RACE
		Andrew Olson	ADF&G

Administrative/Intro/Council updates

The Joint meeting for the Groundfish Plan Teams ("Teams") began on Monday, September 20, 2021 at 9:00am PDT. Participation was remote via Adobe Connect. Roughly 115 people attended the meeting, but attendance varied throughout the meeting. All documents provided prior to or during the meeting as well as presentations given during the meeting were posted to the Teams' electronic agenda.

Future meetings: The November Groundfish Plan Team meetings will be held November 15-19, 2021. These will be remote meetings. Tentative dates for 2022 meetings are: September 19-23 and November 14-18.

Team members introduced themselves over video, and Sara Cleaver provided updates on Council activity. Updates included scheduling for upcoming Council meetings, recent Groundfish FMP amendments, updates on the research priorities process and Halibut Discard Mortality Rate (DMR) Working Group recommendations for in-season management of BSAI and GOA Groundfish fisheries for 2022-2023,

which were later approved by the individual Teams. Diana Stram provided updates from the Crab Plan Team meeting.

Fishery Ecosystem Plan (FEP)

Kerim Aydin provided an informational update on the Bering Sea Fishery Ecosystem Plan annual team meeting and updates from the FEP Local Knowledge, Traditional Knowledge, and Subsistence (LKTKS) Task Force and the Climate Change Task Force (CCTF). The FEP Team intended to meet in late August 2020. That meeting was delayed due to the COVID pandemic and instead occurred in May 2021. The next annual meeting is scheduled for March 2022.

The LKTKS Task Force has been working to develop a process to enhance the use of local knowledge, traditional knowledge, and subsistence information in Council management, and considering how to provide input to annual processes such as the Ecosystem Status Report (ESR).

The CCTF is developing tactical and strategic work products for the Council to allow for climate-informed fisheries management. The task force will develop a Climate Fishery Impacts and Adaptation Report, the first section is targeted for fall of 2021, to describe the Council's current state of climate readiness. The remainder of the report is scheduled for 2023, and will assess adaptation tools, key risks, gaps, tipping points, and limits to adaptation.

Kerim provided a description of the reports and products that address the ecosystem, and the distinguishing differences between the ESR, the Ecosystem and Socio-economic Profiles (ESP), and the Bering Sea Ecosystem Health Report (BSEHR) that has been proposed by the FEP Team. Kerim noted that there is some concern about implications associated with the term "health", and suggested that a new name might be developed. The BSEHR is envisioned to show cumulative, multi-species effects of climate variance, inform management strategy, be useful for a diversity of audiences, and monitor the success of EBFM management actions. The BSEHR is currently in initial scoping of indicators to fit under FEP objectives. A draft is expected in early 2022.

The Teams had no questions or discussion and made no recommendations regarding the report.

Electronic Monitoring (EM) Workshop

Cindy Tribuzio gave a presentation to the Teams summarizing the Electronic Monitoring (EM) workshop held on July 8, 2021. The purpose of this workshop was to inform stock assessment authors on EM programs and data streams, including differences between trawl and fixed-gear EM programs. Five areas of concern were identified and presented: 1) loss of haul-level data, 2) biological samples, 3) vessel selection bias, 4) author feedback process, and 5) data access. It was noted that logbooks are available from these fisheries, but currently the logbook data are not accessible to assessment authors. Some additional fields, such as observations of depredation, may be added to the logbooks in the future.

The Teams discussed the four recommendations from the workshop, including a process for assessment authors to provide feedback to the Council and agency divisions responsible for implementing the EM programs. There was agreement that a process should be developed, which may involve Team co-chairs, or others designated by the Teams, querying stock assessment authors and asking for their feedback, concerns, and experience with EM. A summary of these memos would be reported at the Joint Team Meeting, which would be further communicated to the NPFMC advisory bodies and committees. Overall, the EM workshop identified issues related to EM that should be addressed and concluded that communication between stock assessment authors, NPFMC advisory bodies and committees, and the

NMFS divisions involved with EM is important and useful. Resources required for this to happen need to be identified.

The Team recommended continuing work related to the four recommendations from the EM workshop, with the following comments.

1. A process for soliciting and delivering feedback from assessment authors should be developed, making sure to include NPFMC advisory bodies and committees as well as pertinent agency divisions in the delivery.
2. An iterative process will likely be needed to determine the important metrics for assessment authors to report, and whether every assessment should be required to report those metrics.

Observer Program

Jennifer Ferdinand (AFSC FMA) and Geoff Mayhew (PSMFC, AFSC FMA) gave an update on the "Observer and Electronic Monitoring Programs in the Groundfish and Halibut Fisheries off Alaska." The structure of the monitoring programs was reviewed, noting that there is not a single observer program but rather an assembly of several programs: full coverage (90% of monitored sea days), partial coverage (trip selection rates defined in ADP), fixed gear EM (169 vessels, trip selection rates set by policy at 30%), and the pelagic trawl EM EFP (41 and 48 vessels in 2020 and 2021).

The Annual Deployment Plan (ADP) documents how observer and electronic monitoring resources will be deployed to vessels in the partial coverage and EM programs, with proposed deployment schemes evaluated in a draft ADP. In addition to the Fishery Monitoring Science Committee (members from AFSC, AKR, IPHC, and PSMFC), three Council advisory groups (Partial Coverage Fishery Monitoring Committee, the SSC, and the AP) and the Council provide input to the ADP process.

Covid-19 Deployment Disruptions: In March 2020, observer coverage was waived in all fisheries. Full coverage fisheries maintained full coverage largely uninterrupted, but large disruptions to observer coverage occurred for all partial coverage vessels. In June 2020 a redesigned ADP was implemented that reinstated observer coverage for vessels operating from 14 ports. Substantial data loss resulted from the waiver of observer coverage, impacting the data stream from fisheries that are primarily harvested by the partial coverage sector. The Pollock Trawl EM EFP helped mitigate COVID-19 related data loss and additional shoreside observers needed to be deployed to GOA processing plants to ensure COVID-19 protocols could be followed while limiting data loss.

Port-specific coverage for COVID-19 protocols introduced bias, created data gaps, and was not cost efficient. The 2021 ADP continued port-based deployment of observers until changes in Alaska's health advisories and vaccine availability allowed coverage to be expanded to all ports under a mid-year revised 2021 ADP.

The 2022 Draft Annual Deployment Plan: Two of the analytic goals in the draft 2022 ADP are projecting 2022 fishing effort and determining how to allocate afforded samples to sampling strata while remaining within budget. Fishing effort projections were complicated by COVID-19 impacts to 2021 fishing activities; effort is projected to be approximately the same as 2021 (+/- 11%) using methods in Ganz and Faunce (2019; NOAA/AFSC-TM 395) with modification for COVID-19.

Four sample (deployment) allocation schemes were evaluated for use in 2022 in the partial coverage fisheries. Simulation methods were used to compare sampling rates and numbers of sea-days (costs) under the proposed deployment schemes. Additional evaluation of the proposed schemes assess the proximity of observed trips to other observed trips, EM trips, and trips in the zero selection pool (vessels < 40ft) using a similarity index. Proximity scores are assigned at 4 levels: covered trips, within 15 days and the same NMFS reporting area, within 45 days and the same FMP, or greater than 45 days and within the FMP.

Four sample (deployment) allocation schemes were evaluated. For the final ADP, NMFS proposes use of an allocation scheme that allocates sea-days to achieve equal deployment rates across strata up to an adjusted rate so that there is a 95% probability of achieving the 15% deployment threshold (adjusted minimum + optimization). The allocation of additional sea-days afforded is described in the ADP. Under this scheme, the highest deployment rates would be on trawl gear vessels (44.1%) followed by longline and pot (15%) gear vessels, with the added benefit of ensuring that the threshold 15% deployment rate is achieved.

It was noted in public testimony that it is difficult for stakeholders to evaluate the trade-offs in monitoring deployment without variance estimates. The Team concurred and noted that this topic was also discussed at the EM Workshop. The report of variance estimate methods and results is currently in review and will be provided in the forthcoming 2019 Annual Observer Program Report, which was delayed due to COVID-19.

There are several factors that impact the availability of fishery-dependent data: 1) monitoring is funded by industry and budgets have not been stable in recent years; 2) EM is expanding and with this increase there is an expectation of reduced collections of biological specimens (lengths, otoliths) from species discarded at sea and reduced spatial and temporal specificity from retained catch (no haul-specific information); and 3) changes in partial coverage monitoring do not impact all fisheries equally and may affect fishery-dependent data in ways that impact stock assessments. To address these types of changes, stock assessment scientists are in the best position to advocate for the collection of data used in stock assessments.

Ecosystem and Socioeconomic Profiles (ESP)

Kalei Shotwell presented the current status of ESPs and future plans for expansion to a national initiative to include all five NOAA Fisheries Science Centers. Five workshops (data, model, advice, and two follow ups) have been held between 2019 and 2021 which served to bring programs and agencies together under the central focus of the ESPs and allowed for streamlining the ESP process to the priorities of the AFSC. These workshops brought together a wide range of researchers from across disciplines including all AFSC programs, Alaska Regional Office, Council, other science centers, NOAA headquarters, universities, and other state and federal agencies. They also aided in integrating the ESPs into operations at the AFSC and provided building blocks for initializing ESPs at other science centers. Currently there are five ESP teams (sablefish, GOA pollock, Pacific cod, crab, and data limited stocks) working on 7 ESPs (four groundfish and three crab). The process and timelines for development, continuation, and reevaluation of ESPs were described. This included a 5 year cycle for each stock, with an initial full ESP followed by partial ESPs as

new indices are incorporated, as well as the production of annual report cards made available to assessment authors in time for assessments and integration of pertinent information into the risk tables.

Kalei sought the Teams' opinion on the adequacy of the proposed ESP schedule and its January start time. The Teams indicated that the ESP schedule as described appeared adequate. She further inquired whether it would be acceptable to continue with the 7 current ESP stocks for 2022, without initiating new ESPs, as the proposed new cycle is implemented. There are several stocks for which ESPs have been suggested (e.g., BSAI Atka mackerel, GOA other rockfish, arrowtooth, and POP). There was some discussion with feedback sought from AFSC supervisors on the current workload of their staff. AFSC staff are currently fully tasked, with little time to engage in new ESPs, and effort would be better placed in improving current ESPs and the ESP process. The Teams indicated that holding the ESP process at the current stocks while evaluating the process in 2022 would be acceptable. Feedback was sought on the indicators approach used in the ESP and the submission tool developed in AKFIN to report indicator data. It was noted that there does need to be more guidance on the socioeconomic indicators to ensure that they are relevant to stock health and not redundant with the Economic SAFE. In addition, each indicator should be evaluated for relevance and not simply included in the ESP because it is available. The Teams were asked about the adequacy of the three ESP reporting templates (Full, Partial, and Report Card). The Teams indicated that the templates appeared to provide the function required for the ESP, however they emphasized that the functionality of the templates should be evaluated with more use.

Climate Fisheries Initiative (CFI)

Anne Hollowed presented an overview of the NOAA Climate and Fisheries Initiative (CFI). Climate change is a national issue and NOS, NESDIS, OAR, NWS and NOAA Fisheries have come together to provide information, tools, and support for near-term to long-term climate-informed decision making. The CFI is a cross-NOAA effort which aims to build an operational ocean modeling and decision support system, provide state-of-the-art ocean forecasts and projections, climate-informed ecosystem projections, risk assessments and management strategies. These efforts will help reduce impacts and increase resilience of living marine resources (LMRs) and communities and identify the efficacy of adaptation actions and limits to how much change can be attenuated by adaptation and planning. There are three parts to the CFI; 1) science and development, 2) operations and infrastructure, and 3) extension and engagement. Those interdependent parts will provide support (through full-time positions, research funds, technical tool support, and public portals) for five primary outputs of LMR management including enhanced ecosystem foresight, teams and tools to support rapid response, "climate smart" decision support tools, climate-informed monitoring and research, and coordinate science and advice across sectors including fisheries. The CFI implementation plan v4.0 and a summary facts sheet provide additional information and are available on the meeting agenda.

ESR Climate Update

Bridget Ferriss (AFSC) provided an overview of the climate and oceanography sections of the ecosystem status report (ESR) for the Bering Sea (BS), Aleutian Islands (AI), and Gulf of Alaska (GOA). The overview began with climate information on the North Pacific and then covered information specific to each region.

There was a question from the Teams regarding the reference years for the North Pacific climatology and if that was the same for the projections. Bridget said all the climatology and projection figures were anomalies relative to the reference years of 1981-2010. The Teams thanked Bridget and the ESR team for their clear and useful overview of the climate and oceanography of the North Pacific.

Ecosystem Surveys

Ellen Yasumiishi presented a summary of the 2021 ecosystem surveys and research in the BS and GOA in support of ecosystem-based fisheries management. This effort was a cross division/agency collaboration, with many individual staff participating. Objectives of the presentation were: to give updates on surveys, so that this information can be integrated into stock assessment models; and also to get feedback about the most useful data and indicators, to guide future surveys. The author encouraged stock assessment authors to reach out if they have specific questions they need to have answered or suggest indicators that would be important.

Highlighted projects include: 1) predicting gadid year-class strength from larval and age-0 surveys, evaluating the predictive ability of the beach seine survey; 2) climate driven changes to Pacific cod spawning habitat in the Bering Sea, from which to develop indicators for ESPs and future spawning/timing projections.

The Teams inquired about why some of the fall surveys were cancelled. This was due to Covid-19 and vessel repairs. The Teams also asked when the results of the highlighted projects will be presented, because this information would be useful to include in the ESP. The author encouraged members to reach out to the authors who are in charge of these projects to coordinate information transfer as soon as it is available.

Essential Fish Habitat (EFH)

Members of the EFH team (Jodi Pirtle, Ned Laman and John Olson) presented progress on Component 1 (EFH descriptions) and the plan for Component 2 (fishing effects models). The stock author reviews of the Component 1 species distribution models (SDMs) were completed and a summary of results presented. The modeling efforts that are informing the 2022 EFH review were developed in the 2017 Alaska Essential Fish Habitat Research Plan after the completion of the 2017 EFH review. The stock assessment authors were presented with only one performance metric (Spearman's r^2) for their EFH reviews. The EFH team presented three new performance metrics to the Teams: proportion of deviance explained, AUC, and Spearman's rho, which they used to update the EFH descriptions. This information was not included for the assessment authors' reviews, and the EFH team does not plan to provide an opportunity for author review of that information. The presenters showed graphics comparing Spearman's r^2 with the three new performance metrics. The EFH team concluded, after the author reviews, that Spearman's r^2 did not adequately represent the model outputs; for example, a stock could exhibit a poor Spearman's r^2 value, but good-to-excellent model performance in other metrics. The EFH team will replace Spearman's r^2 with Spearman's rho (i.e., dropping the "squared" part) in future EFH drafts. They presented three examples of species EFH models that were considered to exhibit poor performance (GOA Atka mackerel), acceptable performance (GOA Pacific cod), and good performance (EBS arrowtooth flounder). The EFH team also presented an overview of the fishing effects model and the plan for the stock authors to review the results of that model in the spring of 2022.

While many review comments were deemed "positive," some stock models were identified as poor performers. The Teams' discussion focused on the process going forward for the poor performers. The EFH authors stated that, with the exception of both of the Pacific sleeper shark EFH descriptions, all of the stocks were going to be put forward, including the poor performers. Stocks for which the models were poor performers will be reviewed on a case by case basis, and the EFH analysts will present results to the authors for further review. This is expected to occur right after this weeks' Team meetings. The Teams expressed concern over the timing of this, as authors are working on stock assessments. The Teams noted that there is no requirement for this timeline, and expressed concern that the timeline may preclude a sufficient iterative review process with the authors. Overall, authors will not be given a chance to review

the updated EFH descriptions, incorporating the new performance metrics described in the presentation, nor responses to comments that were provided by authors during the review.

During the Sept 2020 JGPT review of EFH Component 1, the Teams requested to see the following two items for the 2021 Sept PT review, and the Teams again recommended that they be provided:

1) authors present each of the ensemble members so reviewers can see the influence or contribution of each ensemble member, and the variability associated with each.
2) see the iterative changes that result from each change or addition.

The Teams also noted that the inclusion of alternative data sources (e.g., AFSC longline survey, IPHC longline survey, ADFG ROV survey) is critical for the definition of EFH for some species. This need, while noted in the 2015 EFH review, was not included in the 2017 EFH research plan.

The Teams recommended that the inclusion of alternative data sources be prioritized for future EFH model developments.

The Teams recommended adding comparison of previous SDMs (when available) to the EFH description documents. For example, how has the spatial extent changed from the previous EFH? Reviewers need to be able to judge if any substantial changes are realistic for species before it can be endorsed.

The Teams also recommended consideration of the time series extent in future modeling efforts, as species distributions and habitat can shift over the 30+ year time series of the data.

Risk Table

Sara Cleaver provided an overview of the Council response to SSC guidance on risk tables. In June, the Council reviewed preliminary SSC guidance on risk tables for assessment authors, provided some additional comments and asked the SSC to present those recommendations for Team review. The SSC will review and revise its preliminary recommendations, considering input from the Teams and provide final recommendations to the Council in October of 2021.

The Teams asked for clarification on Council intent. Council staff clarified that Council discussion was meant to emphasize that risk tables are to be used to incorporate additional uncertainty outside of the stock assessment, as the Council is concerned with potentially double counting uncertainty from that which is already accounted for in the stock assessment and therefore the harvest control rule (to account for the risk of exceeding the OFL), and the additional buffering suggested by the risk table.

Anne Hollowed gave a presentation about the SSC Risk Table workshop that was held in February 2021 and the report that was developed from the results of that workshop. The report includes summaries of the 7 workshop discussion topics: Introduction to risk tables; Frameworks for addressing uncertainty; Quantifying the importance of assessment risk; Population dynamics risk; Risk of external changes in ecosystem conditions; Risk of changes in fishery performance; Comparing P* and decision – theoretic approaches; and Using joint probability to link the risk table to ABC reductions. The objectives of the workshop were to assess the progress and value of species-specific risk tables for all stocks; evaluate risk table consistency among species and highlight challenges; define “risk” and “uncertainty”; compare ABC and OFL buffers for scientific uncertainty with ABC reductions due to the risk table; and discuss future options.

The SSC provided preliminary guidance that was reviewed by the Council in June 2021. The SSC requested Team feedback specifically with respect to the SSC’s recommendations for:

- Inclusion of risk tables for Tiers 4–6 groundfish stocks;
- Selection of indicator species within stock complexes; and
- Reduction from four risk levels to three within each category.

The Teams discussed the challenges of completing a risk table for stocks in Tiers 4-6 due to the lack of available information. Anne suggested that the risk table could be used to describe why the stock is in a lower tier level, by detailing what information is lacking for the stock. A Team member noted that the assessments for Tier 4-6 stocks already contain that information; that is, the assessments discuss what data are available and what data are not available, thereby placing the stock in the appropriate tier. The Teams noted that doing risk tables every year can be excessively time consuming, especially in the lower tiered stocks where information to populate the risk table is lacking, and many of the complexes are in the lower tiers.

The Teams noted that completing a risk table for a stock complex may be difficult when stock trends within the complex are divergent. Anne noted that, if there is a switch in the dominant species for a complex, this would be noteworthy for the risk table and would point to the need to update the risk table. For a complex, the SSC's recommendation would result in two risk tables per assessment – one for the dominant species and one for the most vulnerable species in the complex. The Teams noted that, in some of the larger complexes, there are annual switches in which species are dominant, and the risk tables might just end up tracking noise.

The Teams discussed whether "risk" table is the right term, with some participants noting that this is consistent with the concept of the "risk of exceeding the OFL." The possibility of changing the name to "uncertainty" table, as raised by the SSC, was also discussed.

The Teams discussed the SSC's proposed shift from 4 risk levels to 3 ("normal, increased, extreme") within each category. Anne suggested that differentiating between 3 and 4 levels is difficult and switching to 3 levels may be easier for authors. The Teams agreed that changing to a 3-level system would ultimately be a good idea, because it is simpler, but did not have strong recommendations to make this change based on anything that would affect the overall assessment. The Teams noted that if the change to 3 levels were adopted for the current assessment cycle, this would be the first time that the Teams have endorsed a revision of the risk table template without first reviewing that revision. Therefore, any wholesale changes should be delayed until next year, since authors and ecosystem staff are already preparing 2021 assessments. Delaying implementation would also be consistent with the SSC's characterization of this as a "potential" revision. The Teams would like clarification on who is tasked with making the corresponding changes to the risk table template.

The Teams recommended that risk tables for Tier 4 to 6 stocks should be an optional tool for assessment authors rather than an annual mandate. For those authors choosing not to do a risk table, the Teams recommended that authors provide justification for why they chose not to include a risk table.

The Teams recommended that the selection of indicator species within stock complexes should be optional for assessment authors.

The Teams recommended an eventual reduction from 4 to 3 risk levels within each category, aligned with the SSC recommendation. However, because this reduction will necessitate multiple changes to the risk table template, the Teams recommended delaying its implementation until after the current assessment cycle, so that the Teams will have an opportunity to review any changes to the template prior to their use.

VAST Bottom Trawl Survey

Cecilia O'Leary presented a summary of recent, ongoing, and proposed future work by the Groundfish Assessment Program (GAP) on model-based indices, specifically the Vector Autoregressive Spatio-Temporal (VAST) model. She reminded the Teams of the VAST terms of reference, annual timelines, and the specific groundfish species that have a model-based abundance or age composition index for 2021. A Team member noted an error in the presented timeline and clarified that the final NPFMC meetings occur in December (not Oct-Nov).

Over the last year, VAST research has focused on model comparisons for GOA Pacific ocean perch and EBS Pacific cod, and on updates to the Cold Pool Extent Index (CPI) computations to improve reproducibility. Several alternative methods of kriging were applied to the CPI. Inverse Distance Weighting (IDQ) generally performed poorly most years. Because the Steins Matern method of kriging showed the lowest root squared prediction error across the majority of years, the VAST model will be using it this year. Next steps within this project are: to review and document these methods, potentially accounting for variation in survey timing; produce goodness of fit diagnostics; develop recommendation/rejection criteria with stock assessment authors; and formalize the bridging step between different years' models.

The GAP group proposed a research priority list for model-based indices and requested Team input on the suggested priority ranking and for additional stocks to prioritize. They also requested that the Teams develop criteria for including non-standard samples in the models such as the Norton Sound and NBS bottom trawl survey data. The Teams' discussion focused on these requests, along with general clarifying discussions regarding the VAST indices. Key discussion points are itemized below.

- The Teams agreed that all of the proposed research priorities were important, and the list should perhaps be viewed as more of a "short-term vs. long-term" ranking, rather than a "do or don't do" ranking.
- Priority #5 as presented, regarding diagnostics of fit and formalizing criteria for rejection or acceptance of indices, was identified as being extremely useful/helpful for assessments, and should be higher on the list. One Team member noted that increasing the number of diagnostics will give greater confidence to use of those models that score high consistently. Another suggested that since any work on diagnostics will feed into understanding differences between model- and design-based indices (priority #2 as presented), it should be higher on the list.
- A Team member suggested expanding Item 1b to include Russian data.
- It was noted that alternate runs (priority #3 as presented) would be interesting, but are not the top priority, so the Teams agreed with that item's ranking.
- It was generally agreed that Priority 1a – linking model-based indices to environmental drivers – was indeed a high priority. Some clarifying discussion occurred regarding whether this should be part of the ESPs, but ESPs have not linked any drivers with the VAST models; more have been done within the assessments themselves.
- There was additional clarifying discussion regarding Item 4a (estimation of survey age sampling methods and missing data). Cecilia responded that this item refers to interpolation when there is missing data. Another GAP project member described difficulty in doing their age-length key the same way as the assessment authors, since most authors either use the design-based comps, or use their own scripts to create them. A member suggested that the Teams should support the kind of consistency that would be gained from item 4a.
- BSAI northern rock sole and BSAI Greenland turbot were suggested as stocks to consider for model-based indices in the near-term.
- Regarding the best approach to determining consequences of including/excluding nonstandard data (e.g., abundance CVs, assessment retrospectives), the Teams agreed that they could not provide any recommendations at this time.

Based on this discussion, the Teams recommended altering the proposed research priority list as follows:

1. **Improving indices**
    a. **linking model-based indices with environmental drivers**
    b. **including additional data (ADF&G Norton Sound, etc.)**
    c. **species-specific model settings (could do 1 species/region/year)**
    d. **increase model resolution (# knots)**
2. **Diagnostics of fit and formalizing criteria for rejection or acceptance of indices**
3. **Understand/explain any differences between model- and design-based indices**
    a. **untrawlable habitat interpolation**
    b. **GOA depth cut-off (700 m)**
4. **Alternate index models**
    a. **run suite with alternative estimators: GAM or sdmTMB**
5. **Continued methods research**
    a. **estimation of survey age sampling methods and missing data**
    b. **barrier-SPDE models**
    c. **covariates affecting decorrelation rates**
    d. **accuracy/precision of variance estimates**

The Teams also recommended considering BSAI northern rock sole and Greenland turbot for model-based indices.

Age Composition Estimation

Matt Siskey and Jim Thorson provided an update on an analysis that evaluates how changes in otolith field-sampling during surveys impact input sample sizes and catch recommendation uncertainty in the stock assessment model. The objectives were to see if otolith sampling efforts on surveys can be redistributed across species without increasing survey effort, thereby optimizing age-reading efforts. A simulation analysis using a bootstrap estimator to predict input sample sizes was combined with a multinomial approach to weighting age and length data and then simulated using an age-structured operating model. A relationship between assessment outcomes and monetary cost that associates changes in otolith sampling and ageing efforts with uncertainty in stock assessment recommendations is also being investigated. Three GOA species were used as case studies in this analysis: dusky rockfish, Pacific ocean perch, and walleye pollock. Using these three species provided a data-rich to data-poor perspective for evaluating the effect of re-distributing otolith sampling on input sample sizes. Changing the number of otoliths collected during each tow and changing the number of tows sampled using these methods produced informative results generally indicating input sample size increased when the number of otoliths and hauls sampled increased. The authors requested input from the Teams on identifying what Bering Sea stocks this analysis might be useful for, if this type of analysis should become a routine part of assessments, and if ASFC should have a more formal process to evaluate ageing effort across stocks.

The Teams commend the authors for the work presented, and identified optimizing otolith collections as a priority because of the burden this effort places on AFSC resources. They also suggested that numerous different strategies are currently used to determine input sizes and that a method that can be broadly applied across assessments warrants further investigation.

The Teams recommended expanding this analysis to include species in the Bering Sea, but noted that additional considerations such as stratum-specific analyses and finer detailed information for select species may be warranted.

The Teams recommended that the AFSC initiate development of a "best practices" approach for specifying input sample sizes for compositional data in age-structured assessment models.

The Teams are supportive of a streamlined process to better formalize both collection and ageing efforts across stocks. Further discussion is warranted on who conducts this analysis and how often. Rather than having this done as part of the annual stock assessment, the Teams discussed reviewing otolith sample sizes (both the number collected and the number read) at regular intervals, such as 5 years, or having at least some of this work done as part of the survey planning efforts rather than as part of the stock assessment. It was also noted that this approach may be useful in fishery-dependent situations and with other biological collections.

The Teams recommended further work on this initiative, with a goal of providing specific sample recommendations to guide both survey sampling efforts and age reading efforts, as well as creating streamlined processes that can be done with minimal effort for specific species.

Random Effects-Tier 4/5 Assessment Considerations

Cole Monnahan (AFSC) presented on Tier 4 and 5 assessment considerations developed from efforts of the Tier 4/5 working group (WG) composed of Cole Monnahan, Jane Sullivan, Cindy Tribuzio, Grant Thompson, and Pete Hulson. The WG's goals are to:

1. Collate and summarize the range of Tier 4/5 approaches currently used
2. Identify areas for improvement in the assessment process
3. Get feedback and guidance on how to progress
4. Examine uncertainty calculations given multiple surveys/species
5. Examine survey reduction effect and P* approach potential

The WG found the primary discrepancies in the use of the random effects models in Tier 4 and 5 assessments were in the use of multiple model software versions, in how zeroes in abundance indices were dealt with, and in how estimates were combined if there were more than one index for multiple surveys or species.

Three model software approaches are currently being used:

1. The Random Effects (RE) model, which uses a single biomass time series
2. The Random Effects Multi-area (REM) model, which is a multivariate extension of the RE model
3. The REM with an additional longline survey (REMA), which was developed to include additional index data.

Ignoring zeros in survey indices is the current approach, by either removing them manually or using a model which filters them out. The WG recommends that:

1. Authors use standardized RE software that does not filter out zeros automatically. Under this scenario, the software will produce an error if zeros are used in the input, which will compel authors to be explicit about the treatment of those data.
2. Authors include in their SAFE chapters information about the zero biomass observations (e.g., when and where they occurred), and the method used to handle these (e.g., input as NA value).

The WG looked at combining estimates – model runs for multi-area/single species. Two approaches are used across assessments with authors fitting each index in a separate RE run, or fitting multiple indices in the same REM run. The WG also looked at combining estimates – model runs for multi-area and complexes. Four approaches are currently used among assessments, with authors grouping by natural

mortality (M), lumping due to low biomass or small sample size, lumping due to species ID issues, and estimating all species separately. The WG considered the different approaches used to fit multiple survey inputs for a single stock and recommended:

1. A consistent, well documented, tested, and understood source code be adopted
2. The REM model would be preferred because it is clear and simple to use (only one model run) and has expanded options for calculating uncertainty of the total biomass (see below)

The WG also addressed stock complexes. Their review found that authors use different methods for estimating input biomass and variances and the calculation of reference points for complexes. The WG recommended further analysis of the implications of alternative approaches, with the specific objectives of an analysis to include the following:

1. verify that the custom design-based estimator approach is the same as GAP's design-based estimator,
2. evaluate the differences in variance estimates between the summed GAP estimates and the custom design-based estimator, and
3. quantify the differences in estimates between the weighted-M approach and the method of summing species group ABCs to the complex level.

The WG also addressed the issue of having to determine total biomass uncertainty. Calculating total biomass estimates requires summing indices that are assumed to be lognormal. However, they note that the sum of lognormal variables has an unknown distribution (and is not lognormal). Therefore, uncertainty must be approximated. There are four different approximations and all assume a lognormal distribution for total biomass. The WG determined that it is unclear which method is best, and looked into whether the total biomass is approximately lognormal. However, an assumption of a lognormal distribution has been widely adopted.

The WG conclusions were:

1. The RE model has evolved for individual stocks
2. Zeroes are generally ignored, and it may be unclear what the software does internally
3. Important differences exist in combining multiple indices (mainly with order)
4. Approaches for complexes differ considerably, and
5. The uncertainty of combined lognormal estimates is a challenge

The Teams supported the WG's plan for moving forward, which is to:

1. **Create a consensus version of the RE model code for all Tier 4/5 assessments**
    a. **Based on REM which has several advantages and can handle the suite of cases**
    b. **Documented and version-controlled online**
2. **Encourage consistent approach to zeroes**
    a. **Explore alternative statistical approaches, e.g., delta-models, off-the shelf packages (e.g., GLMMTMB)**
    b. **Recommend that assessments note filtering of zeroes**
3. **Explorations of the preferred method for grouping multivariate models**
4. **Explore complex workflows for input variances and M approaches**
5. **Further tests of the lognormal issue**

The issue of how this model is used for apportionment in Tier 3 and other assessments was raised (e.g., for BSAI Atka mackerel). The Teams noted that these improvements would also apply to the apportionment applications and noted that the working-group title should probably be broadened.

Economic SAFE

Steve Kasperski provided an overview of social science products in the annual NPFMC process, including EPRs, ESPs, ESRs, the Econ SAFE, and ACEPO. The presentation included explanation of these documents, the geographic scale the document focuses on, and how the information in each documents: a) may inform stock health, b) the direction of impacts, and c) whether they indirectly or directly inform stock health. The presentation explained that, while fishing removals have a direct impact on health of stocks, economic, social, and fishery performance metrics can provide indirect information about health of stock, but are also a function of economic drivers. The presentation and discussion then focused on upstream and downstream indicators. Despite attempts at clarification during the meeting there remained some confusion within the Teams on the exact meanings of these terms.

The Teams discussed community information. Community indicators such as fishery participation can provide information on the health of the stock in specific regions, but these would be indirect and would also encompass responses to other factors in the social system (e.g., prices, regulations, etc.) as well as fisheries participants making decisions across the spectrum of their fishing portfolios (and not just a given species/stock). On the other hand, this was questioned in the context of the SSC's conclusions that community indicators could be red flags of stock/ecosystem condition, and that social sciences should not influence ABC recommendations. The presenter noted that the scientific literature needs to point to these causal relationships before they should be included in ESPs.

Ben Fissel provided a presentation on the Groundfish Economic SAFE, and the new platform for accessing data hosted by PSMFC. The Teams noted the utility and user friendliness of the website, and Ben clarified that he will still be doing the EPRs and the economic sections of the ESPs for stock assessment authors.

Relative to 2019, 2020 catch and revenue were down, and the value index was the lowest it has been since 2007, besides 2009 and 2010. The current decline is due to price and quantity, and the revenue impacts from Covid-19 were mostly price-related. There were notable decreases in prices for many products with exports to Asia, and production of fish meal increased for pollock as a result of the small fish size being caught in the pollock fishery.

Some revenue impacts were not Covid related; for example, there were reductions in catch due to reductions in TAC (GOA pollock, Pacific cod in both the BSAI and GOA). BSAI pollock, which is usually harvested very close to its TAC, was harvested at 95% of the TAC. This was because the TAC increased a bit but there was also a decrease in catch of 40-50 tons. Reports from the fleet indicate that this underharvest was a result of the stock being dispersed, leading to difficult fishing conditions, as well as small fish size, which reduced the return on catch.

Economic data for 2020 are still being finalized and validated. Preliminary results indicate that in the BSAI in 2020, volume and price decreased as compared to 2019 across most stocks, which is rare. The value of sablefish in the BSAI was stable due to low prices offsetting the increase in catch.

Decreases in ex-vessel value resulted in a revenue decrease of 16%. A team member noted that this revenue decrease will impact observer coverage for next year, and the importance of preparing for the impacts of that, because all partial coverage EM and observers are going to be funded through that ex-vessel value. There was a question about whether there are funding buffers for this reason. The team member responded that when the ADPs are developed, funding is spread out so that they do not end up with no coverage one year; however, the decrease in 2020 will probably lead to a decrease in coverage rates. The Teams noted that this should be brought to the Council's attention, and while it is beyond the subject matter expertise of the Teams, it should be flagged so that it can be addressed.

Sablefish Longline Survey

Kevin Siwike presented preliminary results from the 2021 longline survey covering the EBS and GOA, and included results of RPNs, sablefish and Pacific cod lengths, whale interactions, subsurface temperatures and reports on experimental slinky pots. New information from the survey included updated area sizes for calculations and variance estimates.

Sablefish continue to be well above long-term trends with recent recruitment. Smaller fish continue to be caught in high numbers, particularly at depth. There continues to be an absence of smaller cod and turbot are still well below long-term averages despite a recent uptick. The Teams noted the decline in thornyheads and the need to monitor this trend, in particular if hook competition could be partly the cause. Kevin explained one analysis they did by comparing the percent of hooks returning with bait as a proxy for hook saturation (the two being inversely related). Based on that aspect, evidence of hook competition appeared insufficient to explain the decline in thornyheads and grenadiers. The Teams noted that there may be other mechanisms besides hook saturation that could drive competition (e.g., the presence of other species impacting foraging effort).

Subsurface temperatures in the Bering Sea were above average but not to an alarming degree. The WGOA was above average, the CGOA was below average and EGOA was about average. No temperatures were noted as extreme.

The slinky pot study demonstrated that the pots caught much less (non-sablefish) bycatch relative to longline skates and sablefish sizes were similar between the two gears. The Teams inquired about the interaction with escape ring sizes (3.5” in the experiment). It was noted that the fishery does modify them to avoid bycatch of other species or smaller fish of the target species and also noted that the pots do catch some halibut. The Teams also asked whether CPUE between skates and pots was comparable and were reminded that the metrics are hard to compare (90 hooks per skate versus one pot).

Sablefish Assessment

Sablefish growth

Katy Echave presented an analysis of sablefish growth. Length, age, and weight data collected on the AFSC longline survey from 1996-2019 were used to update growth in the assessment, which has not been updated since 2008. For both the length-at-age and weight-at-age von Bertalanffy parameters, a k-means cluster analysis was performed to determine if there were significant time-dependent differences in growth. For both males and females, temporal changes in growth were indicated. Females showed a clear cluster break for both length and weight in 2004. However, males did not have such clear clusters, and the clusters that resulted included non-sequential years. The final recommended clusters for both male and female length-at-age and weight-at-age were 1996-2004 and 2005-2019. In general, for both length-at-age and weight-at-age, fish are larger in the recent time block, but growing at a slower rate.

While time-dependent changes in growth may have occurred, the Teams recommended that the assessment model update growth estimates with data through 2019 while further research is conducted to determine the appropriate use of potential changes in growth over time.

The Teams recommended conducting investigations into cohort effects on growth.

The growth modeling produced a constant weight-at-age schedule, which is estimated from recent data (because there are limited observations on weight available in the early years); however, length at age is estimated as varying between two time blocks.

Because time-varying length at age would be expected to produce time-varying weight at age, the Teams recommended modeling weight-at-age in the same time blocks as used for length-at-age. This could be done by applying a length-weight relationship (estimated from the more recent data) to the estimates of length-at-age from the two time blocks.

Finally, updated size-at-age relationships were estimated only with data collected since 1996: the estimated relationships for earlier years (1981-1993) were not updated.

Sablefish maturity

Ben Williams presented investigations into sablefish maturity that he and Cara Rodgveller have been conducting. Currently, the sablefish assessment uses maturity data from 1985 that was derived from macroscopic observations and converted from maturity-at-length to maturity-at-age. Previous research suggests that macroscopic observations are not comparable to microscopic observations, and microscopic observations are more accurate when determining if a fish is mature and will spawn. Field studies have also observed skip spawning in sablefish, which would need to be incorporated in maturity estimation to provide a 'functional' maturity that would more accurately determine the amount of spawning biomass that would be participating in spawning. Simulation analysis was performed to evaluate the impact of skip-spawning on spawning biomass estimates. Results showed that GLM estimates of maturity can result in large bias as compared to GAM estimates of maturity. The authors recommend using the functional maturity curve in the assessment, which accounts for skip spawning and estimates age/length-based maturity within a GAM model.

The Teams agreed with the authors' approach and recommended the following: (1) that field studies to determine sablefish maturity be conducted in areas besides the central GOA, (2) that ageing error and uncertainty in length-at-age be considered in the determination of age/length-based maturity, and (3) that potential year class effects that could skew the functional maturity curve be investigated.

Sablefish stock assessment model

Dan Goethel presented some updates on sablefish modeling, including the Pacific Sablefish Transboundary Assessment Team (PSTAT), data updates for 2021, and assessment model updates. PSTAT is currently developing a sablefish simulation model for the Northeast Pacific, with the aim of better understanding range-wide stock dynamics. A workshop was held in April, 2021, and focused on sablefish management strategy evaluation.

The fixed gear fishery catch per unit effort (CPUE) index will not be updated for 2020 due to limited observer coverage, and lack of funding to support collection and keypunching of logbook data. Additionally, the use of electronic monitoring (EM) has increased, but methods do not currently exist to incorporate EM in the CPUE index. The proportion of catch in pot gear has increased since 2016, and age and length samples in this gear have also increased.

The bulk of the presentation focused on updates and recommended changes to the assessment model, particularly focusing on updated biological information, changes in selectivity and catchability to gears and surveys, and data weighting. These model developments were motivated by overestimation of the survey RPNs and recruitment in recent years, as indicated by a retrospective pattern that decreases the estimated year class strength of the recent 2014 and 2016 cohorts as data are added to the model. Additionally, small/young sablefish are being observed more frequently in the survey, which may indicate increased availability in deeper water. The estimated maturity at age was updated and based on an age/length-based GAM that incorporates skipped spawning. The updated maturity analysis indicated reduced maturity for younger and intermediate ages relative to the current model. Estimated length and

weight were updated with data through 2019, with two time blocks for length at age, but time-invariant weight at age, and indicate slower growth but a larger maximum size relative to previous estimates of size at age. The effect of the maturity and growth updates was a rescaling of the population, with a slight reduction in the terminal year SSB and slight increase in $B_{40\%}$.

Parameterization updates included removing the prior distributions on all catchability parameters, and adding a recent time block for fishery selectivity, survey selectivity, and catchability for fishery CPUE. The effect of these changes has also been to rescale the biomass and lower SSB. However, estimated recruitment strengths of recent year classes are substantially reduced (with recent selectivity increased).

Data weighting with the Francis method was evaluated, and resulted in increased weights for the fishery size composition data and decreased weights for fishery and survey age compositions. The Francis data weighting reduced recent estimated recruitment, improved the fit to the survey RPN index, and produced estimated SSB that did not decline as sharply in the 2010s relative to the 2020 model. Additionally, the retrospective patterns in recruitment and spawning biomass were improved with the Francis data weighting.

The proposed model for 2021 includes all of these changes (updated maturity and growth, removal of priors for catchability, Francis weighting, and the additional time block starting in 2016 for fishery catchability and selectivity, and survey selectivity). This model produces a steadier trend in SSB in recent years, reduced recruitment estimates; increased selectivity at younger ages; improved retrospective pattern in SSB and recruitment; and improved fit to longline survey RPN, trawl survey biomass, and fishery CPUE indices. In the proposed model, the estimated recruitments for recent strong year classes are still among the largest estimated, but are now within the range of historical recruitment estimates.

The Teams support all of these modeling changes, view the proposed model as an improvement relative to the current assessment model, and anticipate seeing comparisons between the proposed and existing models in the November Team meeting. The Teams recommended incorporating updated length and weight at age resulting from the growth modeling recommendations listed above (i.e., modeling growth for all available data, and consistency in modeled time-variation between weight-at-age and length-at-age) into the assessment when these analyses are completed.

Halibut Discard Mortality

The Teams approved the Halibut Discard Mortality Rate (DMR) Working Group recommendations for in-season management of BSAI and GOA Groundfish fisheries for 2022-2023. Note that these were derived from separate considerations within the individual Team meetings.

Adjourn

The Joint Plan Team meeting adjourned at 530 Pacific time.