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

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

September 12 - 15, 2017

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vacant	USFWS	*vacant*	USFWS
* nominated replacement for Mike Dalton			
** initial meeting			

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Administrative

Introductions: The Joint meeting of the Gulf of Alaska (GOA) and Bering Sea Aleutian Islands (BSAI) Groundfish Plan Teams convened Tuesday September 12, 2017 at 9:00 AM at the Alaska Fisheries Science Center in Seattle, Washington. Introductions were made including approximately 17 attendees who were not members of the Plan Teams. One new Plan Team member was welcomed (Nat Nichols, who replaced Mark Stichert on the GOA Team). Membership on the Plan Teams was reduced by the departure of several people (Liz Chilton and David Barnard on the BSAI Team, and Patrick Lynch and Mike Dalton on the GOA Team) for which replacements are pending. Dan Lew (present at this meeting) has been nominated to replace Mike Dalton.

Documents and presentations: All documents provided prior to or during the meeting as well as presentations given during the meeting were posted to the Council's Granicus site. Jim Ianelli went over meeting logistics and assignments.

Council Activity: Diana Stram reviewed Council activity over the past year. She reminded the Teams that Council Executive Director Chris Oliver is now Assistant Administrator for NOAA Fisheries, and that David Witherell is now Council Executive Director, and Diana Evans is Deputy Director.

Diana also reminded the Teams that the Council took final action to reclassify squid species as ecosystem component species under the BSAI and GOA groundfish fishery management plans. National Standard 1 guidelines allow classification of non-target species either as "not in need of conservation and management" and thus "ecosystem component species" or as "in need of conservation and management." As ecosystem component species, OFL, ABC, and TAC will not be required for squid in either region. The existing squid maximum retainable amount (MRA) of 20% will remain, as will the requirements for recordkeeping and reporting. Stock assessments for squid will continue to be done, but no OFL/ABC determination will be needed.

Policy on recommendations: The Teams discussed rules for making recommendations, referring to a policy that was agreed upon in 2014. Several Team members suggested that this policy is overly rigid, particularly when it relates to non-SAFE chapter issues.

The Teams recommend removing the phrase "Except for emergency cases" and replacing it with "In general," to allow for less rigid application of the policy on documentation and recommendations.

The fourth bullet in the policy (relating to documents that are revised after posting), will be moved to a stand-alone paragraph, and so will be unaffected by the above revision.

The Teams further discussed guidelines for presenters and a request for a short summary (abstract) of each presentation prior to the Team meeting. This summary would be along the lines of a one paragraph overview of the content of the presentation and any particular requests for feedback from the Teams. In the future, the chairs and coordinators will, in advance of the meeting: 1) categorize items as "action" or "non-action," and 2) request a brief summary from each presenter.

Accessibility of the meeting via teleconference or online availability: The Teams discussed the accessibility of Team meetings by teleconference or Adobe Connect, as is currently done for Council meetings (one-way listening line), based on multiple requests for such access to the Council. The Teams recommend that Diana and Jim Armstrong work with the chairs to explore having a one-way listening line for November, with any available presentations posted to the Granicus site for downloading.

BS Fishery Ecosystem Plan update

The Council has formed a team to develop the Bering Sea Fishery Ecosystem Plan (BS FEP). This multi-agency team was put together in 2016 and has had three meetings since formation (two in Seattle and one in Homer). The purpose of the FEP is not to override an FMP, but to inform actions. More information can be found at https://www.npfmc.org/bsfep/.

The FEP will include ecosystem goals and objectives that are tied to the National Standards as well as a description of Council processes. More specifically, it will describe how to formalize some ecosystem practices (including many that Alaska is well known for). It will also provide a transparent process to bring ecosystem concerns into the Council process and clarify the Council process. The Team is also working to develop a system for tracking research and updating research priorities. A process for

coordinating information will be developed, and, using a conceptual ecosystem model to determine links between components, information gaps will be identified. The FEP will also include risk analyses and vulnerability analyses.

The Council desires that the FEP document be used, and the team is discussing how best to ensure that this happens. For example, the Council is considering the formation of an ongoing Fishery Ecosystem Plan Team to guide the integration of the FEP into the Council process. The team is currently drafting a recommendation for a permanent plan team and when an appropriate time for an annual meeting may be.

For now, the goal is to have a draft BS FEP available for the December Council meeting, with final action to adopt at either the April or June 2018 Council meetings.

The Teams discussed whether it is possible or useful to move review of assessments of ecosystem species to the FEP Team. One idea was to have the assessment authors for those species present to the FEP Team, and then the FEP Team will report to the Groundfish Teams.

Climate/oceanography update

Stephani Zador (AFSC, Seattle) presented a review of climate conditions to the joint BSAI and GOA Teams in order to provide a system-wide overview of oceanographic conditions in Alaska during 2016-2017. This was part of a new presentation schedule, with climate and oceanographic conditions presented to the joint Teams during the September meeting in order to provide an environmental context for this year's survey results. In November, ecosystem considerations syntheses will be presented to individual Teams. In general, oceanographic and climate conditions appear to be returning to climatological normal after three years of atypical conditions that were anomalously warm. The return to climatological normal was evidenced by patterns in most climatological indices in 2017, relative cooling in the Pacific south of Alaska in winter 2016/2107, spring 2017 conditions that were more neutral with a weakly positive PDO, and summer conditions where SST is near-neutral in GOA and EBS. The exception is persistent warm anomalies in the high Arctic and NW Bering Sea. Also somewhat atypical was a high sea level pressure system in the GOA in winter associated the weak Aleutian low (a high sea level pressure system in the winter typically happens during weak La Niña but not usually with the strength exhibited in 2017). Conditions appear somewhat favorable for groundfish production in the EBS; the cold pool extended into the S Bering sea, while being somewhat narrower than in past years. In the GOA, several indices indicate weak surface flow into the system during winter (the PAPA trajectory was SE in contrast to typical NE trajectories); eddy formation in the eastern GOA appears weak and may have immediate ecological impacts. Finally, seasonal forecasts from an ensemble of 8 national models portend continuation of warm conditions in the Arctic and NW Bering Sea through the winter but only slightly warm and neutral conditions in the EBS and GOA.

Species-specific ecosystem and socioeconomic considerations

Kalei Shotwell (ABL) presented a framework for including ecosystem and socioeconomic considerations within next generation stock assessments, following recommendations from the new (anticipated) stock assessment improvement plan. This process and the resultant products of the proposed framework are currently in preparation for a manuscript, and can also be used for refreshing the ecosystem considerations sections contained in each groundfish stock assessment chapter. These sections are separate from the large marine ecosystem (LME) considerations chapters for the EBS, GOA, AI, and Arctic, and may include both ecosystem and socioeconomic considerations. A working group was created in 2015, consisting of both stock and ecosystem assessment scientists, per Team recommendation. This past year, the species-specific ecosystem and socioeconomic considerations working group working group developed a coordinated effort through Google forms for creating stock profiles for all groundfish.

Initially, the species-specific information collected through the Google form was used for conducting the national prioritization initiative in 2016, and within the scoring process for climate variability. The data were then prepared for creating a baseline stock assessment consideration that can be compared across stocks and regions. Specifically, this may include: 1) data gap analyses 2) stock profile and conceptual model to refine important factors influencing the stock, 3) stock-specific indicator report cards to connect identified mechanisms, and 4) an automated R Markdown document to communicate results in a variety of formats.

In the future, the working group plans to set up an ecosystem indicator repository with on-line accessible indicators which are updated in a timely manner and time series available by LME. The working group also plans to automate the process of document creation using R markdown.

The next steps are to develop baseline documents for all AFSC groundfish and to develop enhanced documents for the 5 GOA IERP stocks for 2018.

The Teams discussed how these considerations should be integrated in the stock assessment chapters, e.g. enhancing or replacing the current species-specific Ecosystem Considerations sections, or included as an appendix to each SAFE chapter. The Teams also discussed how this new information will fit into the Team process. Suggestions were made for developing indicators from the fishery such as CPUE that might be better indicators of stock health than just survey data, setting consistent definitions for indicator categories (e.g. stock health), and improving the conceptual model by including more socioeconomic factors and public involvement. The Teams were reminded of the need to coordinate species-specific indicators with those contained in the larger Ecosystem Considerations Report. There was support from Team members for the section development particularly with the use of R Markdown script that will create the baseline for authors to include. Word versions will still be available as needed.

Recruitment Processes Alliance surveys

Janet Duffy Anderson, representing the Recruitment Processes Alliance (RPA), presented ecosystem observations in the SEBS, NBS, and high Arctic in 2017. The BASIS survey is now conducted in alternating years in the BS and the GOA; thus, there was no BASIS work in the BS this year. There was survey work in the Arctic, Northern Bering Sea, and various moorings that provided data. The various surveys collect data on physics/oceanography and biological data including fish, birds, zooplankton, and phytoplankton.

2014-2016 were anomalously warm years in the Bering Sea (2016 was the warmest recorded in NOAA surveys). While 2014 and 2016 were warm due to weak wind-driven advection of winter sea ice into the Bering Sea from the arctic, 2015 was warm despite winds from the north that drove ice into the northern EBS and set up conditions that would typically have resulted in a cold EBS year. In 2015 sea ice from the arctic descended as far as the Pribilof Islands and would have descended further but was stopped by the presence of very warm water that had intruded into the southeast Bering Sea from the Gulf of Alaska (the Blob) through Unimak Pass. The sea ice melted to create a large, northerly Cold Pool despite a warm southern shelf. Janet presented some hypotheses as to why these oceanographic conditions resulted in patterns where pollock did not decline as much as expected across the successive 3 warm years. While conditions were warm in the southern EBS in 2015, the north still had cold, ice-driven productivity (high densities of lipid-rich arctic phytoplankton and zooplankton taxa) available in the northerly Cold Pool. The northerly Cold Pool may have provided a metabolic refuge (low temperatures), a source of high lipid rich prey (large copepods) for YOY pollock, and low predation risk (adult piscivores avoid the Cold Pool). Thus, while 2014 and 2016 provided poor ecosystem conditions for YOY pollock across the EBS, 2015 was poor only for YOY pollock in the southern EBS; the northern Cold Pool may have provided a refuge and allowed for large recruitment survival.

2017 looks to be average with respect to temperature, but there was ice descent onto the lower shelf.

The spring RPA moorings were sampled between M2-M5 for copepods and euphausiids in 2017. Copepods were generally at low levels for both small and large copepods. Euphausiids were about average. Supplemental funding to sample the EBS in 2015 and 2017 (normally off-years) helped tell the story of the pollock temperature-recruitment effects.

There are some current surveys in progress that will sample both inside and outside the cold pool in late September that should be able to provide an energy density (ED) estimate for 2017 age-0 pollock. The researchers would like to provide time series since 2002 for energy density, plankton, and juvenile condition status. There will be limited spatial coverage for the 2017 ED estimate.

Janet explained that the term "traditional warm year" means warm temperatures in combination with little wind blowing cold water and ice down from the ice edge/Northern Bering Sea.

The age-0 and age-1 cold pool abundances have not been looked at to see if they correspond to the typical pattern in other warm years in which they seek refuge. The[ja1] energetic estimate was low in 2015 because the data was from the SBS shelf in the spring.

Janet was asked several questions during the discussion portion of the presentation:

1. What did she mean by her statement that pollock are unable to handle multiple bad years-- does this mean all pollock or just recruitment? Answer: With multiple warm years, there still is production of pollock, but they struggle during overwintering; whereas the warm years have less of an effect on the standing stock of adult pollock.
2. Does the production suggested by the initial data indicate that there will be low abundance of copepods? Answer: Unknown. Results from the autumn 2017 survey will be more conclusive
3. Was the refuge idea specific to 2015 or does it apply to all the recent warm years? Answer: 2014 and 2016 look similar to the previous warm year stanza 2001-2005; 2015 looks like a one-off due to effects of the transient Blob. A Team member commented that we should be looking at years other than those in the two most recent warm stanzas, such as those near 2005.

The presentation concluded with a brief mention of the following surveys:

1. NBS trawl survey
2. Distributed Biological Observatory
3. High arctic (IERP) sampling in the Chukchi and Beaufort seas are ongoing.

The Cold Pool is a refuge 3-fold over. A metabolic refuge due to low temps, a source of lipid rich copepods that congregate there to feed on the arctic ice algae brought down by the sea ice, and a predation refuge from adult ATF, pollock and cod that don't venture into the cold temps.

EBS/GOA 2017 longline survey

Chris Lunsford presented preliminary results from the 2017 longline survey which covered the EBS and GOA. These preliminary results do not include corrections for whale depredation, which was about average this year. Preliminary 2017 Relative Population Numbers (RPNs) for the following species relative to 2016 are:

- Giant grenadiers up 20%
- Pacific halibut down 23%
- Pacific cod down 53%

- Rougheye and blackspotted rockfish up 50%
- Shortraker rockfish up 28%
- Thornyheads up 30%
- Spiny dogfish up 378%
- Greenland turbot down 3%
- Sablefish up 13%

Based on length frequencies, there is indication of relatively strong 2013 and 2014 year classes for sablefish. Other notable observations included the pervasiveness of pyrosomes (pelagic colonial tunicates) in the stomachs of sablefish and rockfish in the eastern and central GOA, the sightings of a brown booby and a masked booby (which are rare in Alaska), and increased interactions with commercial vessels fishing close to survey stations. Sablefish pot fishing is now allowed in the GOA. Comparison of 2017 observer data from commercial pot and longline gear in the GOA indicates catches of slightly smaller sablefish for pot gear than for longline gear.

GOA 2017 bottom trawl survey

Wayne Palsson updated the Teams on the 2017 bottom trawl survey. Two vessels (F/V *Sea Storm* and F/V *Ocean Explorer*) were used this year, down from 3 vessels used during the 2015 survey. Both vessels had previously participated in this survey.

Standardization of the net is managed through mensuration, meaning sensors on the trawl send real-time feedback to the vessel so that adjustments can be made to keep the gear oriented correctly. Catch data processed at sea are entered into the Oracle database and a QA/QC routine is performed. Effort is currently being assessed by reviewing the amount of time the trawl net was in contact with the bottom. The next steps are to re-estimate survey biomass and the Yakutat-Southeast split factor, and then make survey data available on the AFSC website and the Alaska Fisheries Information Network (AKFIN). Data from this year's survey will be finalized and are anticipated to be uploaded to AKFIN by September 22.

There were 536 successful stations, which was 236 less than in 2015, out of a target of 550 (target for a 3-vessel survey would have been 825). An algorithm was used to select dropped stations and maintain relative sampling distribution across all areas. Some Team members expressed concern that the decreased number of stations led to small sample sizes in some strata and may increase CVs, particularly with Pacific ocean perch (POP) and pollock estimates. The survey visited stations in all depth strata except the 700 - 1000 m stratum. Grenadier, thornyhead rockfish, Dover sole, and sablefish data are likely to be most affected by lack of depth strata greater than 700 m. Further, concern was expressed that a reduced survey footprint with increased variability in the ecosystem has the potential to miss significant effects/changes in the ecosystem.

POP was the dominant species in the catch, followed by flatfish and arrowtooth flounder (ATF). Both walleye pollock and ATF were notably less abundant in the survey catch relative to recent years. Otolith sample targets were achieved for all species except Atka mackerel and Pacific cod, and over 160 thousand fish lengths were collected. Otolith samples were collected either randomly or via length/sex stratification. YOY walleye pollock catches were strong and well distributed across the survey area. Small sablefish were frequently caught, indicating that the strong 2014-2015 age class is persisting. More market squid were caught than usual and pyrosomes were caught for the first time. Sea surface and bottom temperatures continue to be elevated, but are down from the highs observed in 2015. These temperatures were not seasonally adjusted.

The Teams remain concerned that the primary survey for most GOA stock assessments is routinely being subjected to budgetary cuts in survey effort.

The Teams recommend that the survey group examine the effect that having one less vessel (i.e., ⅓ fewer stations) has had on the precision of the biomass estimates across species.

GOA 2017 acoustic survey

Abigail McCarthy presented results from the AFSC's winter 2017 acoustic surveys of walleye pollock in the Shelikof Strait and other areas. She presented results from the Shumagin, Kenai and PWS areas in addition to the Shelikof and other areas. Abundances were very high in Shelikof Strait with a biomass of nearly 1.5 million t, more than double the 2016 value and the highest estimate since the early 1980s. Catches were dominated by the 2012 year-class, with no substantial recruitment observed for the years after 2012. The pollock spawning population and fishery were both concentrated off southwest Kodiak Island, with a shift southward in Shelikof Strait from the "usual" distribution.

Darin Jones presented results from the recently completed acoustic-trawl survey of the GOA region. For walleye pollock, the biomass estimate was again quite high (~1.5 million t), but distributed differently than in the winter surveys throughout the region.

Regarding POP, a biomass of 235.5 kt was estimated, appearing to be composed of more mixed schools with pollock than in other summer surveys. This was also noted in the fishery, which affected the set-aside for incidental catches in the pollock fishery. The Teams discussed potential environmental effects that may be shifting the distribution of pollock, since the abundances are so high in the acoustic-trawl surveys compared to early indications in the bottom-trawl surveys (done by the AFSC and ADFG).

Ecosystem monitoring and assessment studies

Ellen Yasumiishi presented an overview of all the ecosystem surveys conducted during the 2017 field season. These consist of 3 Eastern Gulf of Alaska surveys, 2 Western Gulf of Alaska surveys, and 2 humpback whale surveys (in Prince William Sound and Southeast Alaska). The inside waters of SEAK (SECM) survey showed a general decline in juvenile salmon compared with 2016, while adult chum salmon have increased consistently since 2008. The Eastern Gulf outside survey also showed general declines in juvenile salmon compared to 2016. The extended Eastern Gulf survey (to examine YOY sablefish) caught almost no sablefish (but lots of rockfish). Based on anecdotal information, the survey was extended offshore of Kayak Island where they caught approximately 700 YOY sablefish. The spring Western Gulf Ichthyoplankton survey showed significantly more large copepods and krill than the 2015 survey, and larval pollock were markedly more abundant and widely distributed compared to 2015. Lastly, the summer Western Gulf survey also showed a marked increase in YOY pollock compared to 2015.

Observer program

Craig Faunce provided a summary of observer activities in 2016 as well as how optimal allocations of observer coverage worked out for the current program. He pointed out that coverage for pot gear is below 4% which may be a concern. Funding allocations changed from observer deployments to other programs and this has caused a significant drop in coverage. Craig also addressed the Council motion for EM that affects the observer program. There are 72 boats presently fitted with electronic monitoring. The Council has asked for expansion to 165.

Craig discussed the goal to have a baseline coverage of 15% and optimize coverage above that. The Teams discussed this approach as a way forward but were unable to review all the details in the document in order to make a formal recommendation. A question arose as to the science behind the 15% figure, to which Craig responded that, based on an earlier analysis, 15% was judged to be reasonable given strata

definitions at the time of that analysis and that more coverage led to diminishing returns.

A loophole was noted that boats delivering to tenders on their first trip could then operate (by delivering to tenders) the rest of the season without being selected.

Untrawlable habitat research

Chris Rooper summarized previous, ongoing, and proposed future research on untrawlable habitat, particularly in the GOA. In the GOA, untrawlable habitat currently comprises 17.8% of the "known" area (i.e., the total area of grid cells that have been sampled).

The long-term goals of this research are to:

- Map untrawlable regions within the survey area.
- Estimate rockfish abundance in untrawlable areas.

The objective for FY19 is to design a GOA-wide index survey for rockfish species in untrawlable habitat that can be run in parallel to the current trawl and longline surveys and provide data on trends and size structure for stock assessors.

Chris listed 4-5 research projects in each of 4 categories:

- Acoustic-optic assessment
- Availability to trawl survey
- Gear efficiency/behavior
- Survey design/analysis

A workshop is scheduled to take place immediately after the Team meetings in order to provide input on the following:

- Ideally random placement of stations/transects/acoustics into untrawlable areas—is this feasible?
- Sample design (stratified random only, untrawlable, or both)

Points raised during Team discussion included the following:

- It would be good to consider possible application of workshop conclusions to the AI as well as the GOA.
- Differences in behavior of fish between daytime and nighttime poses a challenge for projects conducted during nighttime only.
- Presentations such as this one on survey research are very helpful, as is the perspective of survey scientists in general.

The Teams recommend that a survey scientist be added to the membership of each Team.

VAST model of survey biomass

Curry Cunningham provided a detailed document and a thorough presentation on an analysis to compare status quo design-based estimates of survey biomass to geostatistical estimates (VAST model, https://github.com/James-Thorson/VAST). Past analyses have found similar or improved performance by using the geostatistical estimates (similar trends, smaller estimation intervals on average, and smaller inter-annual variation) for survey data collected off Washington, Oregon, and California. The questions asked for this analysis of GOA and AI survey data were: how do the two methods compare, does the

VAST model produce estimates with greater precision, how does spatial complexity (number of knots) influence trend and scale, how does the specification of intercept and autocorrelation influence the estimates, and how does the VAST model compare to apportionment estimates produced from the Tier 5 random effects model?

The VAST model differs from the design-based method in several ways. The main difference is that correlation across space is explained by a Gaussian random field. Another important difference is that a delta model (or hurdle model) is used by VAST, where the probability of a positive catch is modeled along with a model for the catch-rates of positive tows. Additionally, covariates can be included to explain variation, including vessel effects. Assumptions in this comparison included a lognormal distribution for the positive catch rates and no bias correction in VAST. No vessel effects or covariates were included. The number of knots ranged from 100 to 1000, for which VAST determines the locations by clustering (k-means algorithm) on density.

The comparisons for the GOA trawl survey showed varied results. Much less annual variation was observed in the VAST model for northern rockfish, harlequin rockfish, and spiny dogfish. Pacific cod and big skate showed little difference. For other species, the scale of the estimates for the VAST model was larger, but decreased with an increase in the number of knots (Dover sole, POP, ATF). However, the trend remained the same as the number of knots changed. A comment was made that the larger estimates from the VAST model may be due to the fact that the VAST model predicts over the entire grid, which may include areas that were unsurveyed in some years, while the design-based estimates provide an estimate for the surveyed area only. A discussion of why big skate might show similar results for the two methods hypothesized that contributing factors are: 1) big skate show a more uniform distribution across the area, 2) big skate are distributed more inshore where most survey effort occurs, and 3) big skate are the most abundant skate in the survey.

A second metric that was evaluated was the estimated uncertainty of the annual estimates. For the GOA survey, almost all species had a smaller coefficient of variation (CV) with VAST (pollock was an exception). A few cases showed reductions in the CV as the number of knots increased, but for most species the CV was similar across the number of knots.

The analysis of AI survey data showed similarities and differences to the GOA comparison. The scale of the VAST estimates was generally higher than the design-based indices and decreased slightly with an increase in the number of knots. The CVs, however, were mostly similar or higher for the VAST estimates. Discussion indicated that different designs for the two surveys and the presence of patchiness in some years may contribute to these differences.

Overall, the differences in trend and scale between GOA and AI appear to be species- and survey-specific. VAST estimates tended to have greater precision in GOA. With low estimated CVs, the scale from the VAST estimates tended to be higher than the design-based estimates, and when the CV was higher than in the design-based estimates the scale tended to be similar or lower. The scale, but not the trend, was sensitive to the number of knots. The Team was interested in the behavior when more than 1000 knots were added and if the clustering of the knots in high density areas was having any effect on the scale. Thorson (2015) mentioned that the number of knots is a trade-off between accuracy (more knots) and computational speed (fewer knots).

The autocorrelation in the intercept terms for both components of the delta model can be either fixed, a random walk, or a lag-1 autoregressive (AR) process. Many of the indices were insensitive to these choices. However, prediction in non-survey years was improved when using a random walk or AR process. Advice from the analyst was to specify the same process for both components. Computation time increased with a random walk or AR process on the intercept, but run times were typically less than 30 minutes (although bias correction may change that).

Estimates of apportionment within the GOA showed less interannual variability across years with the VAST model, most notably for Harlequin rockfish and Northern rockfish. Different specifications were evaluated for the autocorrelation in the intercept and the spatiotemporal random effects. The VAST model generally showed a similar apportionment across all years, except that the AR process on the intercept and a random walk on the spatiotemporal random effects (AR+RW) showed a trend in apportionment. It was noted that the apportionment estimates from the random effects model in this study do not always correspond exactly to what is done in practice (because some species are pooled in practice), but were useful for comparison. Also, looking further at big skate may be interesting. It is difficult to determine which method provides the best estimates of apportionment, but the AR+RW specification seems to make good sense (the pattern was consistent with the random effects model, but with much less annual variability, although this was species dependent).

Future work on this comparison could involve a simulation study for apportionment, a look at bias correction (although it significantly increases the computation time and memory usage), an examination of differences due to the assumed distribution for the positive catch rates, and the addition of vessel effects.

The Team was pleased with this work and had a productive discussion. However, the following concerns were expressed by Team members: 1) the effects of the delta model and the spatiotemporal components could not be separated, 2) there are no specific criteria from which to judge which method is better, 3) the coastline is not linear along latitude or longitude (which could affect the variogram), 4) the effects on q were not presented, and 5) the estimation of length and age compositions would be decoupled from the survey index with this method (although work is being done on how to create compositions that are consistent with spatiotemporal biomass index estimates).

The Teams recommend the following further analyses:

1. Investigate whether further increases in the number of knots continues to reduce the scale, and if there is a point at which the number of knots (spatial complexity) seems to provide no further gains in accuracy.
2. Evaluate a VAST model with the spatial-temporal components turned off (i.e., a typical delta-lognormal model) to determine the effect of the delta component vs. the spatiotemporal component.
3. Identify some criteria that could be used to decide if the VAST model estimates are better estimates. Becoming familiar with the work from the NWFSC investigation of the VAST model would be helpful in this regard.
4. Look at the anisotropy and the variogram to better understand the spatial correlation. This may provide some insight into the behaviors when the coastline is not linear along latitude or longitude.
5. Investigate adding a depth covariate and its effect on estimation.
6. Conduct a simulation analysis to study apportionment estimates. Redoing the past apportionment simulation analysis may be a feasible first step.
7. Determine a recommended specification for the VAST model for AFSC surveys, and whether this should be species and area specific.
8. Become familiar with past simulations that show the VAST model (or spatiotemporal models in general) is a better estimation method for survey data, and compare and contrast those simulation results with the analysis of real data.

It was also noted that this work was largely done by Curry Cunningham at the advice of a working group formed to investigate spatiotemporal modelling of survey data.

The Teams further recommend that the spatiotemporal modeling working group meet to discuss

these results and consider the recommendations above.

Finally, the Team discussed the process under which an assessment author may use VAST to analyze the survey data for their species. For now, this may be considered and examined on a case by case basis. If an author wishes to switch to the VAST model, a comparison of this model with the existing model should be presented in September. In all cases, the results of the existing model must be brought forward in November, although a new method may be compared to that and considered by the Team.

New assessment frequency

Grant Thompson reviewed the new schedule for assessment cycles based upon assessment prioritization. Depending on whether an assessment is conducted on a 1- 2- or 4-year cycle, the particular year within the cycle, and whether the stock or complex is managed under Tiers 1-3 or Tiers 4-6, the required product may consist of a full assessment, a "partial" assessment, or nothing at all. Partial assessments will be expanded versions of the "executive summaries" that were produced in off-years of assessments that were on 2-year cycles under the old assessment schedule, and will include catch/biomass ratios for all species.

Not counting assessments of stocks or complexes managed under Tiers 4-6 that are already conducted on 2-year cycles and will remain there under the new schedule, only 13 assessments (mostly Tiers 4-6) and 7 authors are affected by the new schedule. The amount of time freed by switching to the new schedule is likely to be small, perhaps on the order of one to two person-weeks per year (on average) for each of the 7 affected authors.

At its February 2017 meeting, the SSC asked the Teams to clarify whether the catch/biomass ratios for the partial assessments should be based on survey biomass or projected biomass.

For the denominator in the catch/biomass ratios required in the new "partial" assessments, the Teams recommend that model biomass be used for Tiers 1-3 and survey biomass from the random effects model be used for Tiers 4-5, noting which survey/surveys was/were involved in the latter.

The SSC also requested the authors and Teams to develop guidelines for when an off-year assessment should be completed. This item will be added to the Teams' agenda for September 2018.

The SSC and Council also requested various analyses pertaining to the new assessment schedule, to be completed at two different times. The SSC requested that the following analyses be completed by someone prior to the new assessment schedule being implemented:

1. An evaluation of how projected OFL-to-ABC buffers should increase in the intervening years between full assessments.
2. Development of a framework for evaluating the costs and benefits of changing the target frequency for the affected stocks and complexes.
3. A more quantitative evaluation of the potential risks of changing the target frequency of the GOA flatfish stocks to a four-year cycle.

The Council endorsed the SSC's request for analyses #2 and #3, assigned those analyses to the Teams, and requested that they be completed prior to proceeding with the *second* year of the new assessment schedule.

The Teams discussed how to proceed with respect to these requests. Among the points noted by individual Team members were the following:

- None of the SSC's three requested analyses have been undertaken.
- The AFSC has already proceeded with the new assessment schedule.

- Therefore, it is impossible to fulfill the SSC's request to have the three analyses completed prior to implementation of the new assessment schedule.
- It may be possible to fulfill the Council's request to have analyses #2 and #3 completed prior to proceeding with the *second* year of the new assessment schedule, but:
    - In the spirit of proceeding in a cost-effective manner (see analysis #2), the time needed to complete these two analyses may very well exceed the small amount of time freed by switching to the new assessment schedule.
    - Qualitatively, the risks associated with switching to the new assessment schedule would appear to be low. Although not addressed explicitly during this meeting, the minutes of the Joint Teams' January meeting show that stocks or complexes were not recommended for moving to a lower assessment frequency unless the following three criteria were met:
        - The average annual change in biomass was low.
        - The average ratio of catch to ABC was low.
        - The importance to the fishery was low.

With all due respect, the Teams recommend that the Council reconsider the need for the two analyses that were requested to be completed prior to proceeding with the second year of the new assessment schedule.

The SSC also developed a list of research areas which it said could be addressed as a result of decreasing the assessment workload of the affected authors. The Council then asked that the Teams refine that list during their 2017 meetings. The Teams reviewed the list and had no recommendations for changes.

Sablefish spatial model

Kari Fenske presented an overview of the results from a three-area spatial stock assessment model for the Alaska federally managed sablefish stock, along with results of sensitivity models examining the effects of alternative spatial parameterization and movement rates. The model is structurally similar to the single-area sablefish model used for management, but starts in 1977 and has other small differences in the data used. Overall, total and spawning biomass estimated in the base spatial model were similar in trend and scale to the single area model used for management. There were spatial differences in total and spawning biomass for the three modeled regions: The Western region (comprised of the Bering Sea, Aleutian Islands, and Western GOA management areas) had the greatest total biomass (49% in the 2015 terminal model year), the Central region (Central GOA management area) contained an estimated 28% of total biomass, and the Eastern region (West Yakutat and East Yakutat/SE regions) had 23% of total biomass. Model explorations examining alternative movement rates and model spatial parameterization suggested that the model was sensitive to both of these areas of uncertainty.

A question was asked that, if the Bering Sea fishing data is so different, should it be modeled separately from the other areas or should it be removed? The author responded that if the model was built again from scratch, other combinations of areas might be attempted, and may be in the future. Another questioner asked whether there was wording in the IFQ regulations that says how apportionment should be done. Team members said there was not and that the last version of the apportionment was recommended by the Teams and approved by the Council. It has been the Teams' policy to keep the apportionment fixed since 2013, because there was no clear biological reason to change it and many stakeholders have expressed the desire for stability. The reason we are doing this work is to try to understand the importance of the mixing of the stock and whether apportionment is important. Kari said that her model was a tool to explore potential consequences of apportionment to the population and fishery through management strategy evaluation. An area that is poorly understood is whether certain areas are producing more recruitment or holding more successful spawners. Our understanding is changing because of survey catches of very young sablefish in the EBS that clearly were not the progeny of sablefish in the GOA. Because of recent

movement modeling updates, the thinking on the directionality of movement has changed to be less directional than previously thought. A national working group is conducting simulation analyses on a sablefish-like population and is also constructing a tag-integrated model which will be fitted to sablefish data. Future research plan includes MSEs on apportionment, modeling additional spatial areas, and a coastwide model.

The Teams appreciated Kari's work and looks forward to further work on the topic of movement rates and spatial models, and agreed that understanding where spawning and recruitment are successful on a regional basis would be really useful.

BSAI flatfish CIE reviews

Ingrid Spies and Carey McGilliard gave an update of the CIE review of the BSAI assessments of Kamchatka flounder, arrowtooth flounder, and flathead sole. For all three assessments, the reviewers noted that various data sources are used in a unified modeling framework that uses well-established statistical methods. For Kamchatka flounder, the reviewers suggested that catch curves applied to survey data when fishing mortality rates are low may provide an indication of the natural mortality rate (*M*). The Kamchatka flounder assessment uses three surveys, and the CIE reviewers also suggested developing prior distributions for catchability based on survey attributes and the life stages of the stock. A Team member commented that developing prior distributions for survey catchability may be a difficult task, based on his experience. Integrating three surveys covering different spatial areas also occurs in the arrowtooth flounder assessment, and the reviewers recommended consideration of modeling the Aleutian Islands in a separate assessment. The assessment model currently calculates the catchability in each survey area as proportional to the survey biomass estimates, and the reviewers commented that this assumption should be reviewed if the selectivities differ between the surveys. It is unclear whether natural mortality, currently fixed within the model, is a function of gender or body size. The CIE reviewers suggested several approaches for estimating natural mortality, including modeling *M* as a function of size, and determining whether the differences in male and female *M* could be replicated through differences in selectivity. For flathead sole, the current estimated survey selectivity curve has a low slope, and poor fits to the age and length compositions. A stock assessment model was constructed with the Stock Synthesis software, with the survey selectivity modeled as age-based instead of length-based. Improved fits to the data were obtained, and work on improving the fits to the age and length compositions is ongoing. Future work may include modeling the Amendment 80 fishery component as a separate fishery; however, industry representatives suggested that using the fishery haul catch composition data to separate the portion of the fishery targeting flathead sole may produce more meaningful fishery components.

The Teams recommend that the authors provide a response document (i.e., a document listing not only the CIE reviewers' comments but also responses thereto) for the flatfish CIE review either for the November 2017 or September 2018 Team meeting. Additionally, the Teams recommend that a response document be provided for all future AFSC CIE reviews that pertain to stock assessments.

Marine mammal update

Lowell Fritz provided an update of research on Steller sea lion and northern fur seals. Overall, little has changed for the SSL population; the eastern stock is Recovered and the Western Stock is Endangered. Additionally, the far western portion of the Western stock continues to decline while there has been some increase in eastern portion of the western stock. Of note in the eastern stock, preliminary results suggest that the pup counts around Prince William Sound and Kodiak have declined 15-20% since 2015. The critical habitat for the western stock of SSL is currently being re-evaluated, but the timeline for completion is uncertain.

The northern fur seal population is listed as "depleted" and is well below optimum sustainable population (OSP); the population needs to double to be delisted. The population continues to decline in the Pribilofs and continues to increase in Bogoslof. The Bogoslof population has now surpassed that of St. George, although the volcanic eruptions and subsequent increase in the area of Bogoslof has unknown ramifications for this population in the future. While these three populations show strong site fidelity, the foraging habitats are all strongly overlapping. Current research for this population consists of data rescue, telemetry, and sail drone projects, which are focused on factors that influence demography. In addition, efforts continue to include northern fur seal data in the SEATTLE model.

Halibut discard mortality rates (DMRs)

Jim Armstrong provided an overview of ongoing work by the Halibut DMR working group, including a review of how estimation methods have changed as well as the recommended 2018 DMRs for the BSAI and GOA groundfish fisheries. This year, 2017, is the first year that DMRs developed by the Halibut DMR working group were specified for these fisheries. DMR estimates went from being based on species composition of the catch to being based on vessel/gear operational characteristics causatively linked to halibut mortality. Additionally, DMRs this year were based on 3-year averages to better incentivize improved handling practices, rather than the previous approach that used 10-year averages to emphasize stability for the fleet. DMRs increased from 52% to 60% for catcher vessels using non-pelagic trawl gear in the BSAI, and increased from 12% to 17% for catcher vessels using hook and line gear in the GOA. DMRs decreased from 67% to 62% for catcher vessels operating in the rockfish program in the GOA. Other DMR changes were relatively minor. Jim suggested that in next year's specification cycle, the working group may shift to a two-year average since the observer program shifted to randomized selection of halibut for viability assessment in 2016.

Two groups that were used for the 2017 DMRs were combined with others in the working group's recommended DMRs for 2018: 1) BSAI hook-and-line catcher vessels (n=2 in 2014-16) were combined with the corresponding GOA group, and 2) GOA non-pelagic catcher-processors (n=10 in 2014-16) were combined with the corresponding BSAI group.

The Teams recommend the use of the combined groupings as proposed, to accommodate small sample sizes.

Questions were raised regarding the determination of "low sample size," to which representatives from the working group responded that it is a qualitative determination rather a specific numerical threshold, with the objective being to combine functional and operational groups in a defensible manner.

The Teams recommend maintaining the new estimation method instituted last year and applying it to an updated 3-year reference period (2014-2016). The Teams discussed the variability in DMRs by group across the reference period and recommend that the workgroup explore how variability in annual DMR estimates could impact the incentivizing function of a short (2-3 year) reference period.

Shortening the reference period from ten to 3 years was done by the working group to allow operations to more quickly decrease their specified DMRs by improving handling practices**.** Annual variation is expected, but DMRs are also intended to incentivize careful release practices and increased viability of halibut.

The Teams recommend moving forward with the estimated DMRs as presented for 2018, understanding that these will again be updated next fall with new viability data and re-averaged.

Economic SAFE

Ben Fissel presented a short summary of changes in the Economic SAFE, which will be presented further (with an emphasis on current trends) in November. Ben discussed the expanding number of species economic performance reports (EPRs). EPRs completed last year will be revised to incorporate new data and discuss updated market conditions. Rockfish and flatfish EPRs will be completed this year.

Ben asked for feedback from the Teams on whether these EPR reports should be standardized, presented in an appendix or integrated with the main text of the SAFE?

Economic data tables have been extensively revised this year after discussion last year and in earlier years. The tables are divided into 4 relatively distinct sections: 1) All Alaska, 2) BSAI, 3) GOA, and 4) Pacific halibut.

Objectives of the revision:

- Reduce duplicative reporting of data readily available through other sources.
- Reduce the number of tables.
- Focus on better stratifications for commonly used tables.
- Respond to requests for more highly stratified data.

Changes to the economic data tables:

- Reorganized tables to AK summary, then focus on BSAI and GOA. Allow some different area-specific distinctions that differ by FMP.
- Removed most discard and prohibited species catch (PSC) tables.
- Focus on retained catch rather than total catch.
- Species-specific economic data for flatfish and rockfish.

AFSC is developing new R-Shiny economic visualization tools. An example can be seen here: http://psesv.psmfc.org:4949/ECON-GF-SAFE/table19/. The AFSC website is being revamped but .csv data files will be available in November in a more convenient format.

Ben will present more trend details in November, but presented some general summary information for 2016:

- Total catch: 2.3 million t (up 2.5%)
- Value showed little change across regions and sectors
- Wholesale value: $2.38 billion (up 4%)
- Ex-vessel value: $875 million (down 3.4%).

The Teams recommend that authors continue to have discretion as to whether economic performance reports are included in assessment text or as appendices.

Each SAFE Introduction will include a paragraph that describes where EPRs can be found for different species.

Amendment 91 and Pacific cod fisher questions

Alan Haynie and Allan Hicks (AH^2) briefly discussed several fishery surveys: 1) the current Amendment 91 Vessel Master survey of AFA pollock skippers that is described in the Economics SAFE and 2) a draft Pacific cod questionnaire.

The A91 survey collected was part of a larger data collection that collected some economic and survey information to evaluate the effectiveness of Amendment 91 Chinook avoidance incentives. The survey is submitted by June each year to discuss the previous year's fishing conditions, but sometimes it appears that the skippers may mix up fishing conditions between the current and previous year or summarize across several seasons. Team members asked if they could change the questions, but the Council has to approve any changes, so the questions have remained the same. The survey results are summarized in the economics SAFE.

Allan Hicks got involved in this project through the BSAI Team Subcommittee on Pacific Cod Models, and AH^2 drafted a questionnaire as a means to interact with stakeholders to learn more about patterns of selectivity and other model features that they may be able to explain through the way the fishery behaves and what they encounter.

These draft questions were designed to be sent to a few stakeholders that have a lot of experience with the fishery, to elicit feedback and then consider next steps. The questions ranged from effects of management, economics, and biology to how fishermen perceived the fishery over time.

One element of the survey is a table supplied with some of the management actions that occurred along with assessment measures of biomass, bottom temperature, and other measures that might help stimulate the memories of participants.

Alan suggested that using a skipper questionnaire that is separate from more general Economic Data Reports (EDRs) allows a more dialogue-based discussion for sharing qualitative but useful information. It is valuable to get input from a broad swath of the fishery participants. The Pcod questionnaire is only a pilot at this point, that will start with a small group as an iterative process. The authors asked if this might be useful to do for other fleets and many members of the Team expressed support.

There was useful discussion about how to make the survey accessible and effective.

A Team member used an example of getting a diverse group of people together and they drew historic herring distributions, and it was very interesting.

An audience member asked why this is needed if you can just use time-varying selectivity to match the catch-at-age to the observations. Allan said that this questionnaire was developed because the amount of time variability to allow in selectivity has long been an issue for the EBS Pcod assessment and a similar hake survey answered some useful data anomalies. For example, one year an increased retained catch of 1-year olds was explained by new Nigerian markets.

A Team member asked whether we need to have a deeper discussion among the Team about these issues

A Team member commented that the 2016 CIE review supported collecting “external” information about time varying patterns in parameters or data.

It was pointed out that the EBS pollock review also had similar comments about looking at product mixes and industry data in considering selectivity and several Team members expressed interest in seeing this work advance.

AH^2 plan to take the Teams’ input on the Pacific cod questionnaire and then go talk to industry.

Several Team members concurred with Alan’s comment that timing of the A91 vessel master survey may erode some of the of the value of the fishing information and that this should be adjusted.

Minutes of the
Bering Sea Aleutian Islands Groundfish Plan Team

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

September 14 - 15, 2017

Administrative

The BSAI Groundfish Plan Team ("Team") convened on September 14, 2017.

EBS pollock update

Jim Ianelli provided an update on data from this year and a review of some methods that had been introduced in recent stock assessments.

Data highlights include the fact that this year's A season required fewer hours (based on tow duration recorded by observers) fished in order to reach a catch of 400,000 t than any of the previous several years, while this year's B season required the second-fewest hours fished in order to reach a catch of 600,000 t.

Weight at length was another focus of the presentation, including figures describing between-fish, intra-annual, inter-annual, and latitudinal variability.

A member of the public commented on the importance of the flesh quality of the fish, as this impacts the types of products that can be produced.

Other items of information shared by Jim included the following:

- Kirstin Holsman will be making a presentation on growth and recruitment of EBS pollock under the auspices of the Alaska Climate Integrated Modeling (ACLIM) initiative at the October SSC meeting.
- A list of comments from last year's CIE review, along with responses thereto, will be provided in an appendix to this year's assessment.
- The Acoustic Vessels of Opportunity (AVO) index will be updated in time for use in this year's assessment.
- The Bogoslof area will likely be surveyed next year.

There was considerable discussion regarding the size of the pollock biomass in the northern Bering Sea (NBS). Although no conclusions were reached, the following were among the points made by various participants in the meeting:

- For 2018, the acoustic survey of the EBS may be extended into either Russian waters (assuming that permission to do so is received) or the NBS, but there will not be enough money to do both.
- In the event that a substantial pollock biomass is found in this year's NBS bottom trawl survey, it is unclear how, or whether, this should be addressed in the assessment, especially given the fact that only a small pollock biomass was observed in the 2010 NBS bottom trawl survey and there have been no other recent surveys of the NBS.
- It might be possible to obtain data from the survey that the Russians conduct in their own waters.
- If a relationship were found between the volume of the cold pool in the EBS and pollock biomass

in the NBS, perhaps this could be used to "fill in" the years where no NBS survey took place.
- Changing the geographic footprint of the surveys should not pose a problem for the assessment as long as the surveys cover nearly all of the population (which may not have been the case in 2016, when it appeared that some fish may have extended their range north of the standard acoustic survey area).
- Juvenile pollock in BASIS surveys occupy a larger area during warmer years (because it takes the juveniles longer to settle out).

Bering Sea Pacific cod preliminary stock assessment

Grant Thompson presented the preliminary assessment for Pacific Cod in the Eastern Bering Sea. This was the 11th year of a nearly year-round review process, during the first 10 years of which the analyst developed 174 EBS models and addressed 238 Plan Team and SSC comments. For 2017, the SSC suggested that new models be produced for a Pacific cod subcommittee of the BSAI Plan Team. This subcommittee met in June 2017 (see minutes), considered those models, and then provided advice for new models to bring forward at the September 2017 Groundfish Plan Team meeting.

Seven models were presented to the Team. Model 16.6 was last year's model, but translated from SS V3.24u to SS V3.30 and verified that results were the same. Additional models were a major change from 16.6 with the following names and changes:

Model 17.1:
- survey and fishery timing adjusted,
- add new fishery age comps (2015-2016),
- switch to haul-based input sample size and catch-weighted size comp data,
- develop and use a prior distribution for natural mortality,
- switch to age-based flat-topped double normal selectivity, and
- allow random time varying selectivity for the fishery and survey.

Model 17.2 was the same as **17.1** with
- weighted composition data using the harmonic mean approach, and
- allowing time varying selectivity for the fishery but not the survey.

Model 17.3 was the same as **17.1** with
- weighted composition data using the harmonic mean approach, and
- estimate additional additive survey index standard error internally.

Model 17.4 was the same as **17.1** with
- use Francis weighting for composition data.

Model 17.5 was the same as **17.4** with
- down-weight fishery comps relative to survey comps, and
- down-weight all size comps relative to age comps.

Model 17.6 was the same as **17.1** with
- weighted composition data using the harmonic mean approach,
- time-varying mean length at age 1.5, and
- time-varying catchability coefficient (Q) for the EBS shelf bottom trawl survey.

Fishery age composition data were included for 2015 and 2016. A subset of the otoliths to age were selected proportional to the catch in each gear/area/week stratum. The final P-cod assessment presented in November will contain fishery age compositions from 2013 and 2014 as well. The majority of ages were between 3 and 8 years.

A lognormal prior was used when estimating *M*, and was developed from 17 point estimates of *M* from the EBS, GOA, British Columbia, Korea, and Japan. Normal and lognormal prior distributions were

presented, but following the P-cod subcommittee recommendation, only the lognormal prior distribution was used in the models. The previous estimates of M from the EBS and GOA P-cod assessments were used in the development of this prior.

Selectivity in the models beginning with "17" (17.x) was asymptotic and time-varying (except for the survey selectivity in 17.2), but used the double normal option in SS V3.30. This allows for possibly testing dome-shaped selectivity in the future, especially when the northern survey has more observations. Deviations on the ascending width and the age corresponding to the peak of the selectivity curve were used for all years with composition data. It was noted that Models 17.4 and 17.5 did not include a time-varying ascending width for the survey due to convergence issues in 17.4 (and 17.5 was based on 17.4).

The results from these models showed a wide range of 2017 spawning biomass (*FSB*) and 2017 stock status (*B ratio*). However, the range of estimated *M* was small and estimated *Q* showed a range from 0.88–1.15. The analyst derived a statistic called "effective mean number of hauls" from the index to compare to the effective N from the composition data and evaluate the fits with regard to weighting of composition data relative to weighting of index data. Models 17.3 and 17.6 showed good weighting of all components when comparing effective sample sizes, although they achieved survey weighting through two different mechanisms. Model 17.3 estimated an additional standard error to add to the survey input standard errors, and Model 17.6 estimated time-varying catchability for the survey.

Overall, the models showed consistent results with regard to parameter estimates and patterns in time-varying quantities. Survey selectivity annual deviations tended to be smaller than fishery annual deviations, total biomass was similar except at the end of the time series, and estimates of mean length-at-age were consistent across most models. However, Model 17.4 was an outlier and showed high time-varying fishery selectivity, a slightly different pattern of recruitment, higher estimates of mean length-at-age, and always estimated the highest amount of variability in time-varying quantities. It is apparent that there are conflicts between the harmonic mean weighting approach and the Francis weighting approach. Mohn's rho was positive (range was 0.074–0.313) and two models (17.2 and 17.5) fell outside of the recommended range, although 17.2 was just slightly above the recommended maximum.

Although the P-cod subcommittee concluded that "the EBS P-cod model is not a good candidate for model averaging at this time," the analyst explored ways to weight the models presented here in a model averaging paradigm. The first choice of which models to include in the ensemble was not considered beyond including all of the models presented in the preliminary assessment. Weighting the models can be as simple as weighting them all equally, but it may be more appropriate to assign a higher weight to the better performing models. Performance was measured using the effective number of parameters (more effective parameters results in a lower weight) and the average aggregate effective sample size (a measure of fit where a bigger effective sample size was given a greater weight). Dividing the aggregate effective sample size by the effective number of parameters resulted in relative weights. Arithmetic, geometric, and harmonic means of the aggregate effective sample sizes were used to explore the influence of fitting one component (e.g., length comps) extremely well at the expense of poor fits to the other components. Using geometric or harmonic means, high weights were assigned to model 17.3 and 17.6. Model 17.4 showed the lowest weight under the harmonic mean approach, but the highest weight under the arithmetic mean approach.

The 2018 predicted ABC was model averaged using four weighting methods: arithmetic, geometric, harmonic, and equal. Using the prediction and the standard deviation estimated from the Hessian (with a normal approximation), the model averaged distribution of the 2018 ABC was provided for each weighting method. The results were slightly different for each weighting method, but all were less than last year's prediction. Uncertainty intervals were also provided. This assumes that the models in the ensemble are a sample of the universe of models, and is an unbiased sample.

Discussion of the Pacific cod assessment

The Team began the discussion with the topic of model averaging. The weighting methods presented show promise, especially as a method to define an overall fit since assessments are complicated with many components and fits to those components. These methods may also be useful for identifying outliers. Mohn's rho may be an additional statistic to determine weightings. A leave-one-out approach to the model averaging can also show the sensitivity to the inclusion of a model. The first step to model averaging is to define the core set of models that will make up the ensemble, and discussion included possibly getting rid of models that are subsets of another and the issue of whether non-age-structured models (outputs from Tier 5, etc.) should be included in the ensemble.

The Team focused on identifying models that are useful for management advice and to use in an ensemble. Model 17.5 was a sensitivity to determine the effect of the length composition data, thus is not a useful model for an ensemble. Model 17.4 was very different than other models, and it is not clear exactly why (other than weighting the data differently). The 17.x series of models were quite different than 16.6, and the difference mainly seems to appear in the last six to ten years of the models. The main differences between 16.6 and the 17.x models were the switch from specifying input sample size as the number of hauls or sets rather than the number of lengths rescaled to a mean of 300, using the new fishery age compositions, and estimating time-varying selectivity. However, it was not clear what changes from Model 16.6 to Model 17.1 resulted in the largest difference. It was noted that Models 16.6 and 17.2 do not have time-varying survey selectivity, and both were at the upper end of spawning biomass predictions in later years.

The Team agreed that they do not see Model 16.6 as "broken", but are trying to understand the differences between the models. A member of the public appreciated the discussion that the Team was having and asked that the Team be deliberate in the justification for departure from Model 16.6. This member of the public also noted that Model 16.6 was arrived at after lengthy discussion and a lot of work in previous years. However, it appears that there are some important potential improvements included in Model 17.6 that should be considered. These include weighting the data for internal consistency, the introduction of time-varying selectivity, and using catch-weighted size composition data.

The Team's discussion on the P-cod preliminary assessment concluded with the topic of a spring sub-committee teleconference. The Team wondered if a spring 2018 teleconference is necessary and if so, would developing a lot of new models prior to that meeting be necessary. The Team will make a recommendation at the November Groundfish Plan Team meeting, although at this time they are not intending to have a spring P-cod subcommittee meeting.

Recommendations for the Pacific cod assessment

The Team was pleased with the work done on model averaging, but recommends to not use model averaging in the final 2017 Pacific cod assessment.

In line with the SSC minutes from the ensemble modelling workshop, the Team agrees that work should continue, but "a 'go slow' approach is warranted." The Team supports continuing the work on this topic, and will report progress to the SSC.

The Team recommends considering only models 16.6 and 17.6 for the final Pacific cod assessment.

Models 17.1 through 17.5 were either subsets of Model 17.6 or sensitivities of other models. Model 17.6 incorporated potential improvements such as time-varying selectivity, weighting of data sources, and catch-weight composition data. Additionally, time-varying length-at-age 1.5 and time-varying survey catchability improved the fit to survey data. The Team is willing to consider additional models in November at the discretion of the analyst.

The Team would like to better understand the effects of the individual changes bridging from Model 16.6 to Model 17.6 and recommends that the analyst present a bridging analysis at the November meeting.

The Team leaves it up to the analyst to determine the best order of changes/elements to investigate, and will be happy with a linear analysis of sequentially adding in elements. Recompiling existing data or making "housekeeping" changes in the control file so as to keep Model 16.6 compliant with SS V3.30 do not necessarily constitute substantive changes in Model 16.6 and so do not need to be included as separate steps in the bridging analysis if the impacts of those changes are negligible.

Blackspotted/rougheye rockfish stock structure/spatial management

Paul Spencer presented some responses to a December 2016 SSC request for further analyses on the biological basis for spatially dividing the species catch and how it relates to MSSC. The presentation summarized an analysis to evaluate alternative boundaries for the subareas for BS/RE. A "management unit estimator" from Cope and Punt (2009) was applied to trawl survey data and he also looked at the fishery catches of BS/RE by 0.5 degree longitudes. Survey biomass estimates were produced for seven areas covered by the AI trawl survey after subdividing each of the WAI, CAI, and EAI into 2 parts (e.g., WAI -W, and WAI – E), for a total of seven areas (including the southern Bering Sea area). Some of the divisions corresponded nicely with the survey strata longitudinal division lines. Most of the biomass is in the CAI areas although there is a relatively large amount in the Eastern part of the Eastern AI. The trends in the WAI are similar among the two areas, and show a decline. In the 1990s the WAI-E and CAI-W (i.e., either side of the current WAI/CAI boundary) showed similar levels of biomass, whereas in the 2000s, the ratio of CAI-W biomass to WAI-E biomass was much higher. The management unit estimator is a pattern recognition tool, based on clustering similar patterns in catch CPUE or abundance data. This tool involves a two-stage clustering process. Simulated data sets are generated based on sampling from distributions of survey biomass estimates with that same mean and variances as the observed survey biomass estimates. Each of the simulations is clustered to group areas with similar trends, and a second stage of clustering is applied to the set of assigned areas. This procedure accounts for the underlying variability in the points estimates, as higher levels of input variances on the point estimates would reduce the similarity of areas within the cluster and thus produce clusters with less statistical "strength", where "strength" is measured by the silhouette width (a function of the relatively dissimilarity of a given area to potential cluster groups).

Paul said that a rule of thumb is that a silhouette width of 0.5 or greater is strong evidence of a similar index. A Team member asked if that rule of thumb depended on sample size or length of time series. Paul said it did not.

It was asked if there was measurement error on the dissimilarity index. Because this is a stochastic simulation, there is uncertainty in each set of draws. Paul said that the average silhouette width was 0.74 for the Western AI areas using the clustering, which is pretty high despite the large CVs of the time series used.

Paul provided cumulative catch graphs to show that there was not a lot of catch in the near the WAI-CAI border (i.e., within 0.5 longitude on either side of the border), and most of the catch in the WAI occurs between 174.5 E and 176 E, which is 1 degree or more separated from the border at 177E. In Zador and Ortiz (2016), the boundary between the western and eastern ecoregions also occurs at 177E.

Paul suggested that the decline in WAI survey biomass is probably related to historical fishing because fishing effort was high in the 1990s. Estimated exploitation rates have been reduced since the late 1990s, but the survey biomass estimates have not shown a population recovery.

A member of the public said that they have been successful in bringing down catches once they were aware of the concern. The point of discussing the 177 line was that there was a fairly large estimated ABC on one side of that line and a really small one on the other side, and whether that was a biologically reasonable thing to do.

A Team member asked which combinations of these subareas were considered, because if we do not see all of the combinations, we do not know if the next best is very similarly matched when clustering occurs. Paul responded that the program will choose the optimum clustering for the number of clusters specified, but it will not give the scores of all the other possible combinations. It was asked whether he had looked at the patterns in the EAI as well. Paul responded that the analysis with all seven areas showed two clusters that separated the WAI and CAI areas, with the remaining three areas interspersed within the two clusters.

An audience member said that he had seen the core habitat for rougheye in the AI identified by the EFH review. If we are not surveying the right habitat, then the trends in the poor habitat might not be representative of what the larger population does. It was asked if the authors thought that the trawl survey was trawling in the best habitat for rougheye, and if not, are the data we are looking at really a good index to consider for these analyses?

Paul said that there were other bits of evidence that he had brought forward in other years that also showed that fishing had some effects, such as on the age compositions. A Team member suggested that the trends seemed to be stable since that early period.

A Team member asked how to interpret these results and whether they could occur by chance. Paul responded that the lack of recovery from fishing is an indication that the fish are not moving into the WAI from the CAI.

Mary Furuness gave an overview of how WAI BS/RE has been managed over the last several years.

The management workload for doing an ABC or an MSSC is about the same. An MSSC from the stock assessment and SSC is administered by an information bulletin at the beginning of the year and in the catch reports. An advantage of MSSC is that the fleet is able to react more quickly than NMFS because they can communicate among themselves and avoid hot spots and fishing depths where BS/RE are being encountered. The number of vessels involved in catching BS/RE is limited, with 7 vessels catching less than a ton, and 18 total vessels fishing catching BS/RE.

If there had been a WAI ABC/TAC equal to the MSSC this year, this would have required more than 5 t of regulatory discards, because management would probably would probably have to prohibit retention before the TAC was reached.

Mary noted that this is now a truly incidental catch fishery, and fishermen are intentionally not taking up to their MRAs. There are other limits to the BS/RE catch. Two of the main WAI directed fisheries that take BS/RE, Atka mackerel and Pacific cod in 2016 and 2017, are limited by Steller sea lion protection measure regulations. The WAI Atka mackerel TAC is limited to 65% of the ABC. The WAI Pacific cod catch limit is based on the Pacific cod abundance in the WAI established in the stock assessment (2017 is 25.6% or 4,018 mt).

Retention rates for BS/RE have increased in recent years and were at 97% in 2014, which shows they are not reaching their MRAs that would require regulatory discards and that the species is valuable for retention. There are a lot of similarities between an ABC and an MSSC. The fleet has continued to reduce catches in the WAI.

The Team reviewed the 2016 November meeting recommendations. The Team had anticipated that if the MSSC were exceeded in 2017, subarea ABCs or some other management measures "would need to be evaluated." No other management tools that would reduce catch were identified by the Alaska regional office for BS/RE. Other than allocations by gear type, only the MSSC and sub-area ABC were considered in Mary's evaluation.

There was a discussion about the incentives to the industry of using an ABC or an MSSC.

An industry participant pointed out that they had negotiated a POP TAC lower by around 4,000 t in the Western Aleutians Islands in an effort to help keep the BS/RE incidental catch low. The main issue is that an ABC would cause regulatory discards that are wasteful, given that all discards for BS/RE are likely dead.

There was a discussion about how MRAs work. Mary and a member of the public stated that MRAs are instantaneous, so if you hauled in a large catch of BS/RE on board without having enough of the basis species (i.e., target) on board, you might have to discard it.

Paul said that POP management reduced the MRAs beginning in 1998 in responses to high catches in the 1990s. However, high exploitation rates (relative to the exploitation rates corresponding to a subarea ABC) consistently occurred after the MRA change in 1998, so MRAs alone are not necessarily a sufficient protective measure.

A Team member asked why, if MSSCs are better than sub-area ABCs, they are not used in more situations. Another Team member mentioned that there are not many other cases where the sub-area ABCs are as small as the one under consideration here. Another Team member said that in this case BS/RE are truly incidental catch and the industry is trying to avoid them.

A member of the public commented that these are really noisy survey data, particularly when divided up into smaller areas, and that we would not be setting an ABC on a reliable piece of data. It was reiterated that the industry has successfully decreased catches in response to concerns and MSSC.

Mary said it was likely that under an MSSC or an ABC, the catch would remain similar, but under an ABC the amount of discards would likely increase.

A Team member said that we need to keep MSSC around, but we need to be careful that we say why. One reason discussed was that management and stakeholders prefer it, and there was not a major biological concern given the decreasing catch and recent stable biomass estimates. A Team member also expressed that there is value in having opportunities like this for industry to self-organize that may have other benefits.

Mary said that in the last 10 years we have had a lot of changes to fishery management in the WAI. She says the process is working, as catches are indeed declining, so we might as well keep using MSSC. A Team member noted that the MSSC value will likely change in November, although that change may be small.

An audience member noted that the EBS slope biomass was one of the causes of the sharp decline in the MSSC. Paul noted that it was more of an EAI issue than an EBS slope issue, but the Team minutes from November 2016 also (perhaps incorrectly), implicated the addition of the EBS slope survey as causing much of the large drop in MSSC.

A Team member asked if we should make any recommendations or statements about what we would do next year if the MSSC is again exceeded. Generally, Team members thought that they would prefer to

evaluate how much catch was obtained relative to biomass at that time before making any recommendations.

The Team generally agreed that the MSSC had reduced catches of BS/RE in the WAI over the last few years, despite a small (in absolute terms) overage of the MSSC in 2017. For 2018, given the recent reduction in overall catches and the lack of evidence for further decline in biomass in the WAI, the Team will continue to request an MSSC so that catches in the WAI are encouraged to be minimized. In the absence of a conservation emergency, this avenue will continue to allow the industry and management to determine how to constrain the catches of BS/RE in the WAI.

BSAI sculpin stock structure

Ingrid Spies presented the results of applying the stock structure template to the BSAI sculpin complex. The BSAI sculpin complex includes all 47 currently recognized species of sculpin in the BSAI, and is managed under a Tier 5 harvest control rule. The ABC and OFL are calculated for the entire BSAI with no spatial allocations. OFL is calculated as the product of natural mortality, M, and the survey estimate of biomass for all sculpins in the BSAI, and ABC is 75% of the OFL. The sculpin complex mortality rate, M, is a biomass-weighted average of the instantaneous natural mortality rates for the six most abundant sculpins in the BSAI: bigmouth (*Hemitripterus bolini*), great (*Myoxocephalus polyacanthocephalus*), plain (*Myoxocephalus jaok*), threaded (*Gymnocanthus pistilliger*), warty (*Myoxocephalus verrucosus*), and yellow Irish lord (*Hemilepidotus jordani*).

Biomass trends of the six most abundant sculpins have been mostly stable, although some decline is apparent in great and plain sculpin, based on the random effects model, and also notably in the butterfly sculpin. Aggregated catch of sculpin species in the EBS and the AI has also been stable since 2004.

Differences in growth were observed among yellow Irish lord between the EBS and the AI, modeled by the von Bertalanffy growth curve. Growth and length differences have not been examined for other sculpin species in the BSAI, but differences have been observed for great sculpin in Kamchatka.

In general, sculpins are lightly exploited, and are taken only as bycatch in other directed fisheries in the BSAI. Some regions of higher catch relative to estimated biomass have been observed: average bigmouth catch in the central AI (2012, 2014, and 2016) exceeded a hypothetical area-specific ABC but not OFL, and average catch of yellow Irish lord on the EBS slope (2010, 2012, and 2014) exceeded a hypothetical area-specific OFL.

No genetic analysis has been done on these species to examine stock structure, or on any closely related marine species of sculpin. However, the diversity of sculpin species in the BSAI suggests that different components of the sculpin complex would react differently to natural or anthropogenic environmental changes.

The Team appreciates the work by the author to apply the stock structure template to this large complex.

Based on the stock structure analysis, the Team recommends that a rating of "little or no concern" be conferred upon the BSAI sculpin complex.

The Team recommends that future assessments consider the following two requests:

1. Determine if there was a change in the quality of species identification around 1998. That is when there was a large change in biomass for a number of the species.
2. Aleutian Islands survey data prior to 1991 may not be comparable to survey data after 1986, and should be noted as separate time series or omitted entirely.

Stock structure template

Stock structure analyses have not been done for the following species: Bogoslof pollock, Aleutian Islands Pacific cod, sablefish, Greenland turbot, Kamchatka flounder, northern rock sole, Alaska plaice, other flatfish, Pacific ocean perch, squid, octopus, and forage fish.

For September 2018, the Team recommends that stock structure analyses be presented for Bogoslof pollock, Greenland turbot, and northern rock sole.

The Team co-chairs and coordinator need to notify the affected authors to let them know that these analyses are requested.

Harvest specifications for 2018/2019

The Team recommends adoption of the proposed 2018/2019 BSAI OFLs and ABCs that were published in the Federal Register for 2018 for the purpose of notifying the public of potential final harvest specifications.

Adjourn

The meeting adjourned at approximately 4 pm.

Minutes of the Gulf of Alaska Groundfish Plan Team

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

September 14 - 15, 2017

Administrative

The GOA Groundfish Plan Team convened on 9am on Sept 14th. All members of the GOA Team were present. New to the team was Nat Nichols, who replaced Mark Stichert. Also in attendance was Dan Lew, who will be replacing Mike Dalton, pending approval by the Council.

Stock Structure Template

The Team inventoried completed stock structure documents to date.

The Team recommended that the template be completed for octopus and flathead sole for 2018.

The Team also recommended that templates be completed for northern rockfish and Pacific cod for 2019, and for sculpins and thornyhead rockfish for 2020.

Other rockfish

Cindy Tribuzio presented a follow-up to a multi-year examination of the potential to split the Demersal Shelf Rockfish (DSR) complex out of the Other Rockfish (ORX) complex GOA-wide. This split has been proposed due to differences in life history and availability or lack thereof, of the species to the trawl survey. The authors' examination of life history characteristics suggests this split is more biologically appropriate than the current species groupings. Regulatory implementation would be fairly straightforward and not require an amendment to the FMP.

The Team recommends moving ahead with the author preferred Alternative 3a to split DSR species out of the ORX complex. The Team also requests that the author develop clear justification for how the Tier 6 method was selected before the November meeting.

Redbanded rockfish were also discussed as they could fit in either group; Some life history characteristics suggest that they could be regrouped with DSR, but their availability to the trawl survey indicates they should remain in the ORX complex.

The Team recommends that redbanded rockfish remain in the ORX complex.

This proposed split raises no biological concerns for the Team, but there may be management implications to consider. The Team noted that the Tier 6 method for calculating ABC would need to be reevaluated if a regulatory amendment were adopted that required full retention of DSR species. If Alternative 3a is adopted, the Team suggests that combining WY, CGOA, and WGOA DSR ABCs may be appropriate to avoid manageability issues with multiple small ABCs and because fishing practices across these areas are similar. The Team again noted that spatial management decisions may apply under the Council Stock Structure and Spatial Management Policy, which the Council has stated "*should apply to both spatial structure (area management) and stock structure (e.g., splitting out a stock from a complex)*" (NPFMC, Dec 2015 minutes) The proposed alternatives involve changing the number of species complexes and/or the number of subarea ABCs for the complexes. The Council Policy consists of

a process which solicits public input to identify "*the economic and management implications and potential options for management response to these findings*" and "*the suite of tools that could be used to achieve conservation and management goals*" (NPFMC, Dec 2015 minutes), and a fishing industry representative also expressed interest in more fully considering the management implications of the proposed alternatives.

The Team requests clarification from the SSC and/or Council regarding whether the Council Stock Structure and Spatial Management Policy applies to the proposed changes to the other rockfish complex.

The Team appreciates this collaborative work between state and federal stock assessment authors.

Skates

Thomas Farrugia presented his work on development of length based stock assessments within Stock Synthesis for longnose and big skates. Thomas conducted his presentation via WebEx since he was in London at the time of the meeting. The work he presented is the subject of his PhD thesis.

Catches of longnose and big skates have increased gradually over the past several decades. Rationale for moving to an age structured assessment included possible reduction of forgone yield associated with the current tier 5 assessment. Thomas reviewed the basis for initial parameter values. For each skate species, he assumed a single GOA-wide population, single sex, von Bertalanffy growth, Beverton Holt stock-recruitment, double-normal size selectivity, two fishing fleets, and two surveys. He conducted sensitivity analyses on selectivity, discard mortality, recruitment deviations, and catchability. Data sources included longline and trawl fishery catches, NMFS trawl survey biomass estimates, length compositions, and length at age data, IPHC longline survey index of abundance and length compositions. It was noted that length comps from the NMFS trawl survey were unavailable before 1994. The timeframe for the model ran from 1984 to 2013 with the assumption of no fishing prior to 1984. He stopped at 2013 due to the change in the observer program.

Model convergence was achieved for both species with reasonable life history parameters including M = 0.25, which is different from the current M=0.1 assumption. The preferred model was chosen because it had the highest likelihood and most reasonable life history parameter values. He compared the SS3 results to current Tier 5 specifications values for M, total biomass, and OFL/MSY. For big skates, SS3 biomass and OFL estimates were fairly consistent. For longnose skates, biomass (96,000 t) was approximately twice the current estimate (43,000 t).

Thomas concluded that available data were not optimal, but were sufficient to develop stock assessments. Next steps included sharing the model and data with AFSC, extending the time series past 2013, improving model fit to survey indices, further exploration of catchability, fecundity, and recruitment, and discard mortality.

In providing feedback to Thomas, the Team suggested increasing the size of the length bins, exploring different starting conditions such as fishing mortality, evaluating selectivity over a range of catchability values, and constraining catchability to more reasonable bounds in the likelihood profiles.

Tier 5 will continue to be applied for the upcoming specifications (2018 fishing year) however, Olav Ormseth and Thomas expect the age-structured model to be available for possible use in establishing the 2019 specifications, i.e., next fall.

Pacific ocean perch

Pete Hulson presented a preliminary evaluation and analysis of changes to the POP stock assessment in preparation for November. The majority of these analyses are responses to previous PT and SSC comments pertinent to this assessment. The comments and subsequent analyses were grouped into four general categories: 1) analysis of length composition data; 2) analysis of the input sample sizes used for age and length composition data; 3) analysis of fishery selectivity; and 4) analysis of a GLMM alternative to the design based estimates currently used for the bottom trawl survey index.

To evaluate the influence of the different scenarios or methods several statistics of model performance were used: 1) the root mean squared error (RMSE) of model fit to the bottom trawl survey biomass index, the bottom trawl survey age composition, and the fishery age and length composition; 2) the estimates of spawning biomass and associated coefficient of variation (CV), and estimates of recruitment from 1961-2015; and 3) the percent difference compared to the 2015 assessment model for key parameter estimates.

Length bin size and plus group analysis
Fishery length compositions from 1963-1977, 1991-1992, and 1995-1997 are the only length compositions fit by the POP assessment model. The starting length bin is ≤12 cm, however, a very small proportion of age-2 fish have been observed to be smaller than 12 cm. The new lower starting bin was defined as ≤16 cm, which corresponds to the lower 95% confidence interval for age-3 fish. The current plus length group is set at ≥39 cm. A new plus length group bin of ≥45 cm was investigated because the upper 95% confidence interval of length for ages greater than 14 is 45 cm. Additionally, four alternative bin structures ranging from 1 to 4 cm in width were evaluated. In general, the influence of alternative bin structures and plus length groups to the assessment model were minor. The Team determined there was no biological justification to choose a specific bin interval because there were no significant effects of bin choice on the model results:

The Team recommends 1 cm bin sizes using ≤16 cm as the starting bin and ≥45 cm as the plus length group.

Input sample sizes used for age and length composition data
Currently, the input sample sizes for the fishery and bottom trawl survey age compositions are set at the square root of sample size, and for the fishery length composition are set at the number of hauls scaled to a maximum of 100. For this analysis two general classifications of input sample size estimation were considered: iterative estimation, in which input sample sizes are estimated through repeated iterative processes, and internal estimation, in which input sample sizes are estimated as parameters within the assessment model. Two iterative and two internal estimation methods were chosen for evaluation. Each of the four methods investigated has strengths and weaknesses and no single method consistently provided better fits to the data. Changes in catchability (q) occurred depending on the method and in general the q estimated by this model is quite high. The Team discussed investigating survey selectivity in relation to the age and length compositions to help better understand how the model estimates catchability. After evaluating model performance statistics, the author suggested pursuing the Francis and Dirichlet-Multinomial methods for the November assessment.

The Team concurs with the author and recommends bringing forward the Francis and Dirichlet-multinomial methods for consideration in the November assessment.

Fishery selectivity
In the current model, fishery selectivity is estimated for three time blocks with the logistic function (asymptotic), the gamma function (dome-shaped), and an average of the two. For this analysis, three alternative configurations were compared: 1) a catch weighted average depth fished related as a covariate to the gamma parameter for slope, 2) a bi-cubic spline function and 3) a time-invariant gamma selectivity.

The author noted that the first two methods, using depth as a covariate and the bi-cubic method, did not significantly improve model performance. The gamma selectivity method had the best data fit and the lowest RMSE. The Team discussed possible explanations for the dome shaped selectivity curve seen in the fishery and attributed some of the reason to a change from catcher/processor fleet to a catcher vessel fleet in the mid-nineties, the fleet's use of midwater nets versus bottom nets, and possible changes in fleet response to a larger POP population. Some concern was expressed regarding the gamma selectivity being time-invariant but:

The Team concurs with the author and recommends bringing forward the gamma selectivity method for the November assessment.

VAST/GLMM trawl survey index
The author investigated the applicability of the VAST/GLMM alternative trawl survey index and evaluated the use of trawl survey data from the 1980's surveys. The biomass estimates from the VAST model prior to 2001 are similar to the design-based estimates but after 2001 the VAST estimates are larger. Overall, uncertainty was reduced in the VAST estimates but the estimate of catchability increased. Based on broader discussions on evaluating the VAST model for a suite of species:

The Team recommends continuing use of the design-based estimates for bottom trawl survey biomass at this time.

The author also evaluated the effects of removing the 1984 and 1987 surveys from the survey index which has been done in many GOA assessments. With these surveys were omitted, no major changes to the assessment model occurred.

The Team recommends bringing forward a model alternative in November that investigates dropping the 1984 and 1987 survey biomass estimates from the survey index but continuing to use the age compositions from these surveys.

DSR/yelloweye rockfish

Andrew Olson summarized the current assessment for the DSR complex in southeast AK. The current abundance estimate is based upon multiplying density estimates of yelloweye rockfish by available habitat area and average annual fish weight by management area. The assessment of the other six species in the assessment is based on Tier 6 (average catch). Density estimates for the EYKT region were surveyed in 2017 and will be incorporated into the November presentation. There are plans to survey SSEO as well as NSEO and CSEO in 2018. The CSEO has been closed for past 4 years, NSEO was surveyed last in 1994 and estimates were updated in 2016.

Density estimates for yelloweye rockfish increased in 2016 and 2017 so biomass has increased by ~50 t. The lower 90% CI for biomass is used for the ABC calculation. Starting in 2009, there has been a state regulation to take subsistence catch off the top and allocate the remainder of the ABC to commercial and sport fisheries. The commercial fishery is conservative (as incidental catch can be substantial in some years) so hasn't generally met the TAC. There is a regulatory requirement to retain all rockfish caught-anything over bycatch allowance is forfeited to the state. The age-structured assessment has been delayed due to staffing changes and will be presented in 2018.

Pacific cod

Steve Barbeaux presented on incremental updates to the Pacific cod model. Otoliths from the fishery are currently being aged, so the model has not been updated with these data yet. Steve gave a brief overview

of the catch this past year, that was generally low (below TAC) with the exception of the Western Area trawl fleet that was near TAC. A number of model inputs were examined for consideration or future inclusion:1) how to deal with length composition proportioning; 2) exploration of the VAST model for survey indices; and 3) an examination of temperature based catchability.

Length composition is currently evaluated by trimester, for weighting, but entered into the model by year. There is concern with low observer coverage in the pot fishery resulting in inadequate sampling for lengths. The pot fishery accounts for 60% of cod catch (includes state waters catch) but had less than <4% observer coverage in 2017, down from 14%. To compensate for this situation Steve examined using state port sampling data, however there are different sampling designs between state and federal length collections. Additionally, state data cannot be linked to individual landings - must be year/trimester/area/gear level (particularly for data before 2017). There is not much trawl sampling for state data. There is good data for pots in first trimester and other for other trimesters as well. These data match up well with federal survey data from outside state waters but not with fishery data from outside state waters.

Two methods were examined for incorporating state data: 1) use state data when number of lengths in the state data exceeded that collected by observers in the pot fishery and 2) use state data when no pot data from observers is available. No substantial difference in model fits occurred with either method. The author recommends use of method 2 - if observers collected data is absent use state data (this is supported by examinations for this year). There was a question of whether this should be applied to the longline data as well.

The Team recommended that the author confer with the state about linking state port sampling data with fish ticket data to provide a dataset of lengths that can be used in concert with federal length data.

The author examined using the VAST model to estimate abundance from survey data. A suite of options was examined (e.g., bias correction, vessel effects, Gamma distribution) and the results were inconclusive. The VAST model produced lower abundance and biomass than the stratified estimator and performed best with an increased number of knots. The VAST model implementation appears to be heading in a good direction and the Team welcomes further explorations,

The Team recommended that the VAST model not be incorporated into the assessment at this time.

The author examined a catchability index linked to depth integrated temperature using the 10 cm fish bin as the "catchability index". The general result is that there appears to be "real" trends and higher temperatures in the GOA appear to reduce catchability of Pacific cod. There were some question on how to appropriately evaluate this model (resampling scheme with autocorrelations can be troublesome).

The Team recommended that incorporating temperature based catchability be examined further, though labeled "experimental" at this time with possibly more examination during a pending CIE review.

Rex sole

Carey McGilliard presented the background on past assessment approaches and specific issues, in particular, the patterns of selectivity relative to sexual maturity and the impact of those factors on fishery reference calculations. This issue is important because currently this species, while data exist to support a Tier 3 stock assessment is treated as a Tier 5 assessment because Tier 3 model outputs would result in a very high and potentially risky F value. For this reason, Carey had fishery otoliths aged for the

assessment, estimated initial selectivity parameter, and explored how to properly use fishery age length data.

One problem with length and age data is that it can come from port sampling and how to scale this data to corresponding catch data is not straightforward. The author evaluated whether or not there is spatial-temporal congruence in the collection of length data and catch data, and found that this was indeed true most of the time at the FMP and NMFS area, and calendar quarter level of aggregation. These results led the author to use raw lengths rather than extrapolated values in the assessment.

The length at age data was also evaluated by comparing haul sourced data and port sourced data to gauge the appropriateness of lumping or splitting these data. Model configurations were run with haul data only, haul and port data with raw length compositions, and age length keys specific to year, gear, season, NMFS area, and port vs haul data with raw length data.

Regardless of how this new fishery age data was added, the addition of new data dramatically reduced $F_{40\%}$ values from previous assessments, and new selectivity curves closely match sexual maturity. The addition of new fishery data has shifted selectivity to the left leading to a slightly biased fit to the length frequency data. The result from this analysis is that the growth estimates for this species needs to be updated.

New estimates for Tier 3 scenarios were presented with and without new fishery data added for comparison and steps needed for improvement in general were presented.

The Team recommended to include the new age data going forward based on the age-length keys specific to year, gear season.

The Team also recommended to re-evaluate how growth affects model results.

Rock soles

Meaghan Bryan presented the northern and southern rock sole models that were developed in Stock Synthesis (SS3). These include the 2015 assessment model using SS3 version 3.24ac (used in 2015) and SS3 version 3.30 (newest version of SS3). Models 15.1 and 15.2a were run using SS3 version 3.24 and Model 15.2b was run using SS3 version 3.30. The models assume von Bertalanffy growth. The parameters estimated include: length at minimum age, length at maximum age, growth coefficient, and CVs at young and old ages. Maturity at age was fixed and natural mortality for females was fixed at 0.2 and for males it was estimated.

The stock recruitment relationship was an average level of recruitment unrelated to stock size. Unfished recruitment R0 and the R1_offset parameter was estimated, steepness was fixed at 1, and recruitment variability sigma R was fixed at 0.6. The annual recruitment deviations from 1977-2015 were estimated.

Sex-specific length based selectivity was estimated for the fishery and survey with a double normal pattern. Male selectivity was estimated as an offset from female selectivity. For the fishery, the selectivity curve was allowed to have a dome-shape. For the survey, the curve was asymptotic for both male and female.

The main difference between the 2015 model (15.1) and the others pertain to model fitting. Model 15.1 was fit to the survey age composition data (1996-2013) and fit to the survey conditional age-at-length data for this same time period, and was not fit to the available survey length composition data. Hence, the same data were fit twice and effectively gave higher weight to these age data. The alternative models (Model 15.2a and Model 15.2b) were fit to the available survey length composition data and conditional

age at length data. The remaining model assumptions and estimated parameters were the same among the models.

The main outcomes of the models were:

- Stock Synthesis version 3.24 and version 3.30 perform similarly
- 2015 model (15.1) and the modified model (15.2) had similar results
- Suggest using the modified model for November
- Consistent residual patterns for northern rock sole and southern rock sole for length composition data

Northern rock sole

The results are similar among models. Both models underestimate the peak in the survey and the final years. Model fit to bottom trawl survey does not fit well.

The age-0 recruits time-series is similar among the models, Model 15.2 has slightly larger estimates throughout time. Fit to length composition data for the survey seems to fit female and males but does not fit the fishery data as well. For the length composition residuals, overall the fits were adequate but were missing some of the cohorts and the survey length composition missed the peak of the male frequency distribution. Fits to the female length composition are missing some of the peaks in the survey.

For fishery selectivity, the model is fit to the fishery length composition data. Fishery selectivity seems sensitive to using the survey length composition data and most parameters are not well estimated. Using fishery age data may help better inform selectivity. Model 15.2 had even more extreme estimates for female selectivity at larger sizes.

For survey selectivity, all three models estimated males to be selected at a smaller size than females, and among models there was a subtle shift in selectivity for males and females. In general, the models underestimated the peak of the male length distribution.

For the von Bertalanffy growth parameters, growth was reduced in the modified models for both females and males. There was greater uncertainty in the size at age at older ages. Slow growing, older individuals were similar in size as faster growing, younger individuals but it does a pretty good job at estimating parameters at younger ages. For model 15.2 von Bertalanffy growth curve parameters, age-based selectivity may be more appropriate.

Catchability is fixed so may want to estimate this to allow it to vary to add flexibility; may also want to estimate female and male natural mortality. Residual patterns were still persistent so likelihood profiles were used to better understand data conflicts, with no constraints on catchability. There are some obvious conflicts between the age, length, and survey data.

The Team recommends that some alternative data weighting methods be considered in addition to the current method of weighting by standard error to help alleviate the residual problems.

Southern rock sole

The model results for southern rock sole are more similar to each other than the northern rock sole models. For recruitment and spawning biomass, initial conditions (R0), 15.2 ~4% higher than 15.1 SSB in final year: 15.2 ~2% higher than 15.1

Model fit to the bottom trawl survey was almost identical to northern rock sole but does a better job getting the final estimate and fits the beginning of the index better.

The fit to the length composition data is adequate but is underestimating survey female age composition as opposed to the males; it is underestimating same cohorts as the northern rock sole length composition residuals.

In terms of fishery selectivity, female, selectivity is not well estimated. For survey selectivity, old and new model estimates female selectivity well, but male selectivity was shifted to the right in the new model. For the von Bertalanffy growth parameters, the new model estimates are similar to the old model estimates.

Likelihood profiles were conducted to identify where data conflicts exist and there were conflicts with catchability. Female and male mortality curves did not help elucidate the problem. The author is going to spend some time data weighting to find the mechanisms behind the problems.

Results from modified model 15.2 were similar to the 2015 model 15.1. In summary, the author suggests moving forward with model 15.2. There were similar residual patterns seen for both species and should be addressed in the future. She would like to more thoroughly evaluate sensitivity options or combination of sensitivity options and she will consider data weighting approaches.

The Plan Team recommends running both models 15.1 and 15.2b for the November meeting. The Team recommends looking at data weighting options and incorporating fishery age data as an input to the model for the future.

Arrowtooth flounder

Ingrid Spies presented an update of future modeling plans for the GOA arrowtooth flounder assessment. Several of the comments raised by the CIE reviewers for the BSAI arrowtooth assessment also apply to the GOA assessment, which uses a similar assessment model. Additionally, some responses to Plan Team comments were presented. The age-length conversion matrices were estimated by fitting growth models to size at age data (after applying age-length keys to length compositions). Biomass estimates from a model run with the new conversion matrices were similar to biomass estimates from the 2015 assessment. Modeling natural mortality as a function of weight will also be considered in future assessments, and several plots of survey catch by temperature, depth, and size do not suggest that these factors account for sex-specific differences in the availability to the survey. Future plans also include evaluation of either removing or standardizing the older surveys (from the 1960s and 1970s), and evaluating iterative reweighting of the age and length composition data. The GOA Plan Team has previously suggested investigating whether the IPHC longline survey could be added to the model; however, the hook size in this survey may be too large to be a useful index for arrowtooth flounder. The GOA Plan Team has also suggested evaluation of models with time-varying size at age. However, the size at age has varied over time only for young ages (1-3 for males, and 2, 3, and 5 for females) which are not currently in the assessment model.

The Team agrees with the planned proposed work on data weighting, estimating the conversion matrix, and modeling natural mortality as a function of weight.

Walleye pollock

Martin Dorn presented a summary of the CIE review that was conducted in May 2017 for the GOA pollock assessment. Several suggestions for improving the assessment were provided which the Team noted would be useful to have addressed explicitly in an appendix to the assessment. He discussed a plan to retain the current model and run a parallel version in Stock Synthesis. Relative to the conflicting signals in the survey data (acoustic trawl surveys are up whereas bottom trawl surveys down). The group

discussed alternative approaches and asked Martin about his plans. He may look at allowing some catchability (/availability) changes in the surveys to accommodate the divergence in observed estimates.

GOA climate science regional action plan

Martin Dorn presented an update of the climate science Regional Action Plan (RAP) for the GOA. which is based on EBFM roadmap. The link for the existing RAPs are found here. Martin is the lead for a large, diverse group charged with the development of the GOA RAP. Projected main changes in climate in the GOA include: increases in temperature and ocean acidification, changes in dissolved oxygen (oxygen limitation), and changes in ocean circulation and stratification. Impacts of climate change will affect the species we manage and we need to develop robust management policies. Martin noted that the stressors are different for each of the LMEs (Arctic, EBS, Aleutian Islands, and GOA). He highlighted the high value of fishery products from the GOA; Kodiak is the number 3 port in the country.

The AFSC Climate Science Strategy has 4 areas of activity:

- Long-term monitoring
- Process studies
- Risk assessment
- Modeling climate impacts and management scenarios

Not all areas are addressed directly, but AFSC research tends to contribute to these 4 areas.

Looming fishery management issues:

- OY range for GOA
- Biological reference points for status determination
- Community level social and economic impacts of climate change.

The activities and research in the GOA RAP will depend on external funding.

Martin noted long-term monitoring aspects of the program including a new source of funds on northern GOA site funds by NSF. Information on that can be found here. The Team questioned the selection of northern rock sole as a species for bioeconomic modeling relative to ocean acidification as other species seem to be more relevant and important (such a study does not appear in the Council's research priorities). The Team also discussed the need to do outreach for the GOA RAP, and how best to communicate this to communities.

Harvest specifications for 2018/2019

The Team recommended rolling over the 2018 GOA final harvest specifications for OFLs and ABCs (as published in the Federal Register in February 2017) for the proposed 2018 and 2019 OFLs and ABCs.

Other issues

The Team discussed the presentation of survey results in the Joint Team when was only applicable to specific assessments. This was an issue primarily because the lead author had a conflict and was unable to attend the Joint meetings where the discussions would have been most beneficial. There is some desire to have the MACE winter survey coincide with GOA stock assessment.

The Team recommended that the Council pursue filling Team vacancies including the following:

1. **WDFW**
2. **Marine Mammal expert**
3. **USFW (Seabird expert)**
4. **IPHC and**
5. **NMFS Headquarters**

Adjourn

The meeting adjourned at approximately noon.