Minutes of the Gulf of Alaska Groundfish Plan Team

North Pacific Fishery Management Council
605 W 4th Avenue, Suite 306
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*initial meeting

Administrative

The Teams discussed a number of new issues for consideration in compiling this year's SAFE report, in particular the treatment of stocks for which assessment updates are simple rollovers (or projections) from previous SAFE reports (the "no assessment" category). It was agreed that the Team would highlight these in the Introduction to the SAFE report and retain placeholders relevant to ensure that ABC/OFL specification process can proceed. For the "partial update" category of assessments, the Team reviewed the diagnostics for these placeholder updates and noted that figures showing "catch / biomass" time series were confusing and difficult to interpret.

The Team recommended that the authors simply report in words or a table whether catches exceed ABC as an indicator for "partial update" stocks.

Ecosystem considerations in the GOA

Stephani Zador presented the GOA ecosystem report (the second year of a GOA-only report). Highlights of the discussion and presentation include:

- Measures to split indicator variables at 144 W longitude due to the divergent oceanographic and biological characteristics continue to be evaluated
- While the "warm blob" is dissipating, a "marine heat wave" continues as a lingering effect
- There is a positive though reduced amplitude PDO
- Small copepods have been dominant in the water column which may lead to difficulty for planktivorous predators to fill nutritional needs.

- Fish eating birds have had poor breeding success, while more generalist feeding birds have had ok breeding success.
- The trawl survey apex predator biomass (Pacific cod, arrowtooth flounder, etc.) was at the lowest level in 30 years
- Body condition of fish generally declined throughout the gulf.
- High larval pollock abundance observed during spring in the western gulf. These age-0 pollock were still abundant in late summer - with the distribution is much more centered around Kodiak as opposed to Unimak Pass.
- Pyrosomes were observed on surveys (for the first time) from March to August - they were observed in the water and stomachs of sablefish and rockfish. These are subtropical tunicates that likely eat micro zooplankton.
- Some oceanographic evidence of a pulse of warm southern waters that has since stopped - so possibly this is a short term event.
- An index of the genetic stock composition of Chinook salmon bycatch was presented. The composition has been stable - most of Chinook caught are from west coast and BC.

There was a question of whether maps of age-0 distribution can be created for earlier years - and can this be related to stock assessment - previous examinations of age-0 correlations to adult abundance hasn't amounted to a good relationship. Additionally survey effort isn't equivalent between years and it is challenging to equate across years (apples to apples), so age-0 abundance likely is a poor index.

The Team asked whether the Chinook salmon bycatch indicator would be robust to ecosystem changes affecting oceanic conditions in the GOA. That is, what ecosystem conditions is it meant to reflect and how would changes be reasonably interpreted?

The Team noted that Steller sea lion pup data and pollock acoustic data might be added to the report as supplements.

It was noted that the pollock fishery has encountered POP more than normal and whether it could be due to food availability or population sizes. The Team and presenter suggested that it could be due to multiple factors.

Based on a discussion the Team questioned the value of the "mushy halibut index" since so little is known about factors that cause changes in the index and how they could be used in a meaningful way.

GOA Pollock

Martin Dorn presented a full assessment of walleye pollock, and Darin Jones presented an additional summary on the summer acoustic-trawl survey work, including issues related to accounting for age-0 pollock found in the acoustic backscatter in specific areas.

Martin highlighted the contrast in survey data. Both the winter and summer acoustic-trawl survey biomass estimates were well above-average levels while both the ADFG and AFSC bottom trawl indices were sharply down from recent years. Based on this (but done after the assessment was completed) Darin conducted a preliminary investigation on whether their acoustic data could detect changes in average distance-off-bottom over time. This preliminary analysis suggested an upward trend in recent years of fish being farther off of the sea floor based on the acoustic-trawl data from summer during 2013, 2015, and 2017. The Plan Team noted that such a pattern may partially explain the divergent trends between the acoustic and bottom trawl surveys (fish may becoming relatively more available to the acoustic survey by moving higher in the water column).

Martin compared four models with the 2016 selected model (16.2)

Model 17.1—Age composition data reweighted using the Francis (2011) method

Model 17.2—As model 17.1, but with variable catchability for the winter acoustic summer ADFG survey

Model 17.3—As 17.2, but allowing more variation in catchability

Model 17.4—As 17.2, but with an offset for natural mortality for the 2012 year class.

Of these, Martin recommended model 17.2 and the Team concurred. Model 17.1 improved model fits but results were similar to Model 16.2. Models 17.2 and 17.3 added a year specific catchability for the Shelikof Strait winter acoustic trawl and the ADF&G summer trawl survey to be estimated (a random walk process). Martin noted that the proportion of the stock that is surveyed by Shelikof Strait Acoustic survey and the ADF&G trawl surveys may be changing, making the assumption of constant catchability untenable and may be partially responsible for the data conflicts. Model 17.4 was posed as experimental and resulted in a lower estimate of M for the 2012 cohort, but also substantially lowered the recruitment estimate and failed to improve the overall model fit.

Other highlights noted were: 1) the sex ratio in the winter 2017 fishery data was unusual with females being less than 40% of the catch, 2) a lower maturity at age (but this may be due to the relatively few age groups being available), 3) a low Shannon-Weiner age diversity index (population dominated by the 2012 year class), and 4) a continued decline in weight-at age for fish > 5 years old. Martin noted that, in aggregate, these anomalies lead to concern about accuracy in predicting the near-term stock productivity.

Relative to apportionment, the diverging trends in the surveys also presented challenges. Area 610 had relatively high proportion of bottom trawl biomass compared with recent years and there was concern that this may poorly reflect the biomass available to fisheries in different regions (they generally use pelagic gear). Martin therefore evaluated five different options for determining apportionment. Of these, the Team concurred with his recommended approach which was to use the sum of the bottom trawl and acoustic summer survey biomass estimates by area. The rationale was that this is a better reflection of pollock abundance throughout the water column.

Overall, the Plan Team was in agreement with author's recommendations for model selection, ABC recommendations and season-area apportionments.

The Team recommended that trawl survey catchability relative to age structure be examined. That is, evaluate the extent that young pollock vary in availability to bottom gear compared to that of acoustic trawl surveys.

Regarding the Francis data-weighting approach, it was noted that the original paper recommended that age/length composition data sets with small numbers of years be paired with other similar data sources with increased number of years in order to estimate data weights. **The Plan Team recommends the author explore this option.**

The author is encouraged to examine different survey trends possibly due to pollock vertical distribution in the water column - possibly using the weighted availability by depth (initial presentation by Jones).**The Team encouraged the assessment authors to continue examining environmental covariates in the delta-GLMM survey abundance estimate.**

GOA Pacific cod

Steve Barbeaux presented the latest Gulf of Alaska Pacific cod stock assessment. The stock has experienced a rapid decline in abundance and biomass as supported by several data sources including the NMFS GOA bottom trawl survey, the AFSC longline survey, the IPHC longline survey, and the ADF&G bottom trawl survey. Steve presented alternative hypotheses regarding the recent decline.

As noted, the ecosystem experienced anomalously warm water conditions that extended throughout the water column. Temperature is correlated with increased metabolic demands for juvenile and adult Pacific cod, and warmer conditions likely reduce larval survival of Pacific cod. Warm conditions may also have

reduced food availability for young Pacific cod during 2015 and 2017. This is reflected in the condition of Pacific cod (weight at length). Such factors (i.e., poor condition, starvation, and increased predation) suggest reduced survival due to environmental conditions. This affected alternative model development and the fact that earlier data would not have predicted the declines observed in the surveys. As such, models presented include last year's with updated data and alternatives that:

- Used available ADFG port sampling data for some pot fishery year/trimester/areas
- Had a time-varying natural mortality allowance during 2015-2016 (to reflect poor environmental conditions
- Allowed for annually varying selectivity for trawl and longline fishery length composition data for 1977-1989
- Had trawl and longline fishery selectivity vary by period for 2005-2006 to reflect that the fishery was limited due to halibut bycatch and season closures (only large cod were landed)
- Allowed AFSC longline survey catchability to vary as a function of a water temperature index
- Included tuning for input sample sizes of composition data (Francis T.A18 method).

Based on Akaike Information Criterion (AIC) and retrospective patterns, Steve selected Model 17.09.35 for providing assessment advice. The Team concurred as this appeared to account for uncertainty and represented a trade-off between accounting for a natural mortality event and fitting the surveys reasonably. Steve conducted a sensitivity which included the IPHC survey; results were consistent with the model results when it was excluded. This was notable since it may provide new insight, particularly since it's an annual survey, therefore:

The Team recommends that the AFSC work with the IPHC and request they obtain Pacific cod length compositions from the IPHC setline survey.

The Team noted that the work undertaken by the assessment scientists illustrates the importance of collaborative work with others from diverse fields. They also note the importance of having nearshore and offshore surveys to cover all age classes, food habits (from observer and survey data), and to maximize the utility of multi-agency data sources such as the IPHC longline survey and the ADF&G. Steve intends to present this information at the December Council meeting to the SSC.

GOA Shallow water flatfish

Jack Turnock presented results for the shallow water flatfish assessment. The random effects model was used in the current assessment in the same manner as the recommended approach for the 2015 assessment. Changes in this year's assessment included using the random effects model for apportionment and for the proportion of species abundance within the complex for presentation of species-specific ABCs. With the exception of northern and southern rock sole, this group is comprised of Tier 5 species. The random effects model for each of the species was updated with 2017 bottom trawl survey biomass to obtain the GOA-wide biomass estimate for the complex (other than rock sole).

Catch has been declining since 2009 and has been well below the recommended ABC and TAC. When examined by species, the catch is well below species-specific ABCs. A member of the public noted that catch of shallow water flats in constrained by bycatch (not halibut).

The Team agrees with the author's recommended ABC and OFL for the shallow water flatfish complex.

GOA N and S Rock sole

Meaghan Bryan presented the assessment for northern and southern rock sole (NRS and SRS). NRS and SRS are Tier 3 species that are assessed independently with an age-structured assessment model for each species.

Data sets in the assessment include: 1) fishery catch data for 1977 – 2016 and preliminary catch data for 2017; 2) fishery size composition data for 1997 – 2016 and preliminary data for 2017; 3) GOA NMFS bottom trawl biomass estimates for 1996 – 2017; 4) trawl survey length composition estimates for 1996 – 2017; and 5) conditional age-at-length (CAAL) data for 1996 – 2015.

Rock sole are primarily captured around Kodiak. The bottom trawl survey for 2017 resulted in a 14% decline in SRS and a 5% increase in NRS compared to the 2015 biomass estimates; combined they decrease. The fishery captures NRS in wider range of lengths compared to survey over time and the mean length in fishery has been increasing recently. Conditional Age at Length (CAAL) for NRS is fairly consistent over time and larger females were observed in 2001, 2005, and 2011. SRS length comps agree more between survey and fishery then NRS, and in both the mean length has been decreasing in recent years. Female CAAL data is more consistent for females than males, larger males observed in 2001, 2003, and 2009. The majority of fish in the NRS age composition data are between 3 and 15 and the 2015 mean age is smaller than historical. SRS age compositions are more variable than NRS and the mean age has been increasing since 2007 with a decrease in 2015.

The SRS and NRS models were developed in Stock Synthesis. Growth is described by the LVB growth curve with parameters estimated within the model, maturity at age is a fixed input, weight-at-length is a fixed input that is assumed to be the same for males and females and for NRS and SRS, natural mortality is fixed at 0.2 for females and estimated for males. Recruitment variability is fixed at 0.6 and catchability is fixed at 1. Selectivity is length-based and is estimated with the double-normal; male selectivity is offset from female selectivity, the fishery selectivity is allowed to be dome-shaped, and survey selectivity is assumed to be asymptotic.

Two models were presented in September, that from 2015 and a modified model. In both there were consistent residual patterns in length comps and a lack of fit to the trawl survey biomass at the end of time series for NRS. In September, the Team recommended to evaluate these issues. In response, two alternatives were presented: 17.1 (a corrected 2015 model) and 17.2 (an alternative with trawl survey age composition data replaced with the survey length composition data). Other data weighting options were explored and included methods to weight composition data following Francis (2011), McAllister and Ianelli (1997), and the Dirichlet likelihood (Thorson et al. 2017). Each method, in general, increased weights for length and CAAL data for both NRS and SRS. These methods resulted in unrealistic selectivity and original sample size estimates were preferred. The author recommended model 17.2 be used for 2018 ABC and OFL based on model fit, retrospective patterns, and more appropriate use of data. The retrospective of the NRS model for 17.2 had a Mohn's rho of 0.14 (SRS was 0.06). The Team concurred with this choice.

Future investigations into the NRS and SRS models that were presented by the author include: (1) using trawl survey and observer data for apportionment, (2) evaluating methods to better account for uncertainty in catch time series, (3) investigating age based rather than length based selectivity (which would require age samples from fishery), and (4) a simulation study to determine the best modeling approach for mixed species fishery.

The Team recommended the author evaluate if the number of otoliths requested for the fishery is sufficient to improve selectivity estimates.

The Team also recommended evaluating if the "growth morph" approach taken for GOA Rex sole might resolve the residual pattern noted in the length composition data.

GOA Deepwater flatfish

Carey McGilliard completed a partial assessment for deepwater flatfish this year to recommend harvest levels for 2018 and 2019. Dover sole comprises almost the entire landings for this complex and is

assessed using an age-structured model using a Tier 3 designation. Greenland turbot and deepsea sole fall under Tier 6.

The 2017 catch was estimated for the last part of the year and the 2018 and 2019 catch was projected using the 2012-2016 average for Dover sole. The proportion of each species in the observer data are used to estimate catch by species in each year. The catch reporting system records catches at the stock complex level only.

Area apportionment was based on the Plan team's recommended method from 2016. The random effects model was used to determine area apportionment for deepwater flatfish complex. It was used to fill in depth and area gaps in the survey biomass by area of Dover sole and then used the resulting proportion of predicted survey biomass in each area in 2018 and 2019 as the basis for apportionment of the Dover sole portion of the deepwater complex. Greenland turbot and deepsea sole proportions based on average survey biomass for each species since 2001, the most recent year for which any catch of turbot and deepsea sole has occurred.

GOA Rex sole

Carey McGilliard presented a full stock assessment for rex sole. In September fishery ages had been added to the model which led to improvements in estimation of fishery selectivity at age, resolving a long-standing major source of uncertainty. Because adding fishery ages in the September version significantly changed model performance, for naming convention models presented in November were referred to as Model 17 with substantive differences labelled 17.x.

For November, new survey data and updated fishery data was added and growth was explored. Model 17.1 used survey conditional at length data to estimate a single growth curve within the model but this resulted in worse fits to the data. Investigation found that there are differences in length at age between fish the Eastern GOA and fish in the Central/Western GOA. Both females and males in the Eastern GOA were smaller than in other regions. Old fish exist in Eastern GOA but don't grow as large. To capture this difference in growth by area, model 17.2 treated growth in the Eastern GOA separate from the Central/Western regions of the GOA (which adds 4 parameters for the growth differences).

The author recommended treating growth separately by area and using Model 17.2. Fits to survey biomass are similar to last year and generally fit recent surveys well. Fits to fishery age compositions were mixed but fits to survey length compositions were better. Retrospective analysis shows a fairly minor retrospective pattern. The other model options presented were discarded in favor of model 17.2 because fishery ages were included in this year's models and the conditional age-at-length approach used in Model 17.1 did not adequately treat growth creating a mismatch in model fits to fishery length and age composition data.

In the past, rex sole were assessed as a Tier 5 stock. This year the author provided separate projections for the Eastern GOA and Central/Western GOA and then summed the resulting OFL and ABCs over the two areas. All catch is assumed to occur in Central/Western regions. By moving to from Tier 5 to Tier 3a, the ABC nearly doubled from last year to 2018 (8,311 t to 15,373 t), yet catches remain well below ABC. The Team agreed with the author to use Model 17.2 for setting ABC and OFL. The Team also recommends elevating rex sole to Tier 3a despite the doubling of ABC since Model 17.2 appears to be reliably estimating B40% and B35%.

The ABCs calculated for the Western-Central area (based on model estimates) are apportioned based on random effects model predictions of the proportion of Western-Central survey biomass in the Western and Central areas, respectively, in 2018-2019. Likewise, the ABC calculated for the Eastern area (based on model estimates) are apportioned based on random effects model predictions of the proportion Eastern survey biomass in the West Yakutat and Southeast areas, respectively.

GOA Arrowtooth flounder

Ingrid Spies presented the full assessment for arrowtooth flounder. Changes to the assessment methodology included updating the age-length conversion matrix and estimated weight at age, including an ageing error matrix, and weighting the length and age composition data with the Francis (2011) method. Inclusion of an ageing error matrix improved the fit to the age composition data. The age and length composition data were down-weighted with application of the Francis (2011) method.

The biomass estimate from the 2017 trawl survey has decreased relative to the 2015 survey biomass estimate, and all the models evaluated in 2017 show a decline from the 2015 model.

Trawl surveys from 1961 and 1975 are currently being fit by the model, and were considered for removal. The removal of these surveys results in modeled biomass estimates in the 1960s and 1970s that are relatively similar to estimates in the 1980s and early 1990s, whereas inclusion of these survey shows an increase in modeled biomass over this period.

Natural mortality (M) is fixed over age, with a larger value for males than females to account for declining proportion of males with age. Modeling natural mortality as a function of age or size within each sex was evaluated, and produced similar trajectories of estimated biomass and degraded fits to the age data.

The Team recommends documenting the survey design and spatial distribution of tows in the 1961 and 1975 surveys in order to evaluate comparability with recent surveys.

The Team also recommends evaluating the cooperative US-Japan longline surveys, and this may provide information on stock trends from 1979 – 1992.

GOA Flathead sole

Jack Turnock presented the full flathead sole assessment. For this year, there were no new changes to assessment methodology. For 2017 the following assessment inputs were changed: 1) 2016-2017 catch data were added and 2015 catch was updated; 2) 2016 and 2017 fishery length composition data were added and 2015 data were updated; 3) 2017 bottom trawl survey biomass and length compositions were included; 4) survey conditional age-at-length data for 2015 were added. This year's ABC and OFL are slightly lower to what was projected last year for 2018 but are expected to increase in 2019 because of the increasing trend in biomass. The majority of flathead sole catch is in the Central and Western regions of the GOA and has been declining since 2009 despite being well below ABC.

Model fits to survey biomass are similar to what was seen in 2015 and are trending up in response to an increase in biomass in the last two surveys. Fishery selectivity shifted to lower values in 2017 compared to 2015. There is a lack of fit to female length compositions in both the fishery and survey. Retrospective analysis indicates there is some bias towards overestimating spawning biomass but it's not major.

In response to Team and SSC comments the author investigated joint profile likelihoods for q and M but did not examine ageing error. Likelihood profiles over ranging values of M indicated 0.26 was a good estimate for M. The model trends to a higher q which may indicate catchability issues like net herding or trawlable/untrawlable habitat extrapolation issues in survey biomass estimates. The Team noted some issues with the magnitude of the profiles and commented that viewing the profiles in relative terms may be more beneficial since there was so much change the total likelihood. The results of the likelihood analyses indicate estimating growth may be an issue in this model. Growth is estimated for the entire time period and the Team felt changes in growth over time should be investigated.

The Team recommends the author investigate potential growth changes in flathead sole over time. Applying a single growth curve over the entire time series did not seem to perform well and there seems to be issues with fishery selectivity. One suggestion is to consider fixing mean weight at age and not try

to estimate growth inside the model and another suggestion is to consider down-weighting the age-weight component in the model.

The Team continues to recommend the author investigate ageing error in the flathead sole model. Additionally, the Team recommends including all available fishery ages in the next assessment.

GOA Pacific ocean perch

Pete Hulson presented the full assessment for Pacific ocean perch. Changes to the assessment methodology included fitting the bottom trawl survey with a lognormal distribution (a normal distribution was used in previous assessments), and adding an additional time block of fishery selectivity from 2007 to the present to correspond to the central GOA rockfish program. Changes to the data (other than updates of time series) were removing the 1984 and 1987 survey data from the assessment, and using 1 cm length bins for the age composition data, with the plus group at 45 cm.

The 2017 trawl survey biomass estimate was the highest on record, and the biomass estimates from the most recent three surveys (from the 2013, 2015, and 2017 surveys) are larger than the estimates from other survey years and are underestimated in the model. Modeling fishery selectivity from 2007 to the present with a separate time block improved the fit to the fishery age composition data, particularly the age 25+ group. Modeling the survey biomass estimates with a lognormal distribution increased the modeled survey biomass for all years, and thus also improved the fit to the high biomass estimates from recent 3 surveys. However, the model does not match the increase in survey biomass that appears in these recent surveys, and results in a relatively strong retrospective pattern (Mohn's rho of -0.22). The retrospective pattern is not unexpected given the survey data, and suggests that the survey biomass estimates are increasing at a faster rate than would be expected from our understanding of the population biology for a relatively long-lived stock.

Pete presented future research topics focused on investigating the cause of the retrospective pattern, including time-varying parameters that may be related to environmental indices (i.e. mean recruitment and the recruitment variability parameter), and using acoustic information to assess the vertical availability to the bottom trawl survey.

The Plan Team supports these future research topics, and additionally recommended:

1. **Investigating natural mortality, as the current estimate of 0.066 is higher than the expected value from the prior distribution (0.05)**
2. **Re-evaluating the age-plus group, as changes to the model and input data have occurred since this was previously evaluated**
3. **Continuing to evaluate methods for weighting for the compositional data as new models are developed and/or changes are made to input data.**

GOA Northern rockfish

Pete Hulson presented the partial assessment for northern rockfish. Curry Cunningham is now the lead author for this assessment. The 2016 catch of 3,427 t is below the value predicted in 2016 (4,225 t). In addition, the estimated 2017 catch of 1,789 t is substantially below the 2017 ABC of 3,790 t. The ABC and spawning stock biomass are projected to decrease from 2017 to 2019. The stock is currently in Tier 3a, but the spawning stock biomass is expected to fall below B40% in 2019, moving the stock to tier 3b.

GOA Shortraker rockfish

Pete Hulson presented a full assessment for shortraker rockfish. Although the bottom trawl survey is down 49%, the random effects model results in a more modest 33% decrease in biomass from previous estimate in 2016. In contrast, the 2017 longline survey Relative Population Numbers were up 28%. In 2016, an anomalously high amount of shortraker were caught in the pollock fishery. The Team discussed the high discard rates of this species in the halibut and sablefish fisheries (and trawl pollock fishery in 2016), and how these might change with possible regulatory changes that include full retention of this species and changes in future fishing behavior. The 2018 ABC for this species is declining 16% in the Western GOA, 1% in the Central GOA and 46% in the Eastern GOA.

The Team supports development of including the longline survey data in the random effects model for apportionment.

The Plan Team noted that regulations to decrease discards of this species, particularly in halibut and sablefish fisheries should be supported.

GOA Dusky rockfish

Pete Hulson presented the partial assessment for dusky rockfish. Kari Fenske is now the lead author for dusky rockfish. The projection model was run with updated 2016 catch and estimated 2017-2019 catches. The recommended ABC is slightly lower than last year's projection. Since the same random effects model was used, the same apportions are used in this model update. The author is projecting a decrease in ABC through 2019. Catch in 2017 accumulated more slowly than previous years due to market conditions.

GOA Rougheye-blackspotted rockfish

Dana Hanselman presented a full assessment of rougheye and blackspotted rockfish (RE-BS). Catch has remained generally consistent since 2010, with the majority of the catch coming from the CGOA. Both the longline and trawl surveys show consistent trends with low contrast. No changes were made to the assessment model. However, a number of data inputs were updated: 1.) catch estimate for 2016 and new catch estimates for 2017-2019; 2.) new fishery ages for 2014 and 2016, new fishery lengths for 2015; 3.) new trawl survey biomass estimate for 2017, new trawl survey ages for 2015, and; 4.) new longline survey relative population numbers (RPN) for 2016 and 2017, and new longline survey lengths for 2016 and 2017. Reasonable model fits were observed with a slight increase in the ABC. A strong 2010 year-class continues to be observed.

The question of how to meaningfully assess and manage a two species complex remains. Results of a genetic analysis show a mis-identification (mis-ID) rate of 13-23% overall that has shifted from higher BS mis-ID in 2009 to higher RE mis-ID in 2015. Additionally, RE are younger on average than BS (15 vs 20 years) and grow faster with slightly greater max size. Older fish generally seem to be easier to ID. The results of a recently published examination (2008-2012) of maturity shows a similarity in maturity at length, but a large difference in maturity at age between the two species. An examination of otolith morphology on 2009 fishery collected specimens showed 43% RE and 57% BS in the catch. The Team recommended that the assessment authors look at maturity scenarios based on historical ratio estimates (species specific estimates). The results of a worst case scenario, where catch is taken from a single species as relative to joint OFL, were presented and show that if all catch is blackspotted, then the BS OFL may occasionally be exceeded.

The Team recommend that the authors implement as worst case (bookended), dynamic weighting or apply genetically verified data to adjust the model for differences in maturity.

The Team previously recommended that the authors explore apportionment using a random effects analysis. This was presented, but the authors continued to recommend a 4:6:9 weighted average of the

proportion of biomass in each area from the three most recent bottom trawl surveys pending development of methods to use both longline and trawl survey data for apportionment.

The Team agreed with the authors that apportionment using the 4:6:9 standard was acceptable until the longline and trawl survey inputs can be combined to determine apportionment.

In a previous assessment there was an error in the Mohn's rho code for evaluating the retrospective patterns and on correction, was much improved. Dana noted the diagnostic (rho) could be highly dependent upon the number of years being examined.

GOA Demersal shelf rockfish

Ben Williams presented the assessment for demersal shelf rockfish. Catch information and the average weight of yelloweye rockfish caught in the commercial fishery were updated for 2017. Density estimates from the ROV survey were updated for the EYKT subdistrict. There were no changes to the Tier 4 or Tier 6 methodologies.

The yelloweye rockfish biomass estimate increased from 10,347 t to 11,508 t from 2017 to 2018. The increase in biomass is largely driven by an increased density estimate for the CSEO subdistrict – an area closed to directed commercial fishing since 2014 – as well as an increase in mean fish weight in CSEO and SSEO subdistricts.

Plans are in place to survey the SSEO subdistrict for density analysis in 2018 and hopefully also survey the CSEO and NSEO subdistricts if funding is available.

The results of a preliminary statistical age-structured assessment model (ASA) were not presented this year due to personnel changes. The ASA will be presented in full in 2018 or 2019.

GOA Thornyhead rockfish

Katy Echave presented an "enhanced" partial assessment for thornyhead rockfish. This stock was scheduled to have no assessment for this year; however, a partial assessment was produced in order to better monitor the time series of survey biomass estimates and evaluate catch relative to ABC. This partial assessment used results from the 2017 bottom trawl survey. GOA thornyheads are managed as a Tier 5 stock complex, with the random effects model applied to region and depth strata to account for missing data. The 2017 trawl survey biomass estimate was 10% lower than the 2015 estimate, whereas the 2017 longline survey estimate was 30% larger than the 2016 estimate, and the 2017 estimates for these two surveys were above their long-term means. The 2017 catch (through Oct 17) was below the ABC for each of the GOA subareas (western, central, and eastern). The GOA catch for 2017 is 19% lower than the 2016 catch. The 2018 ABC of 2,018 t is 3.9% larger than the 2017 ABC of 1,961 t.

GOA Other rockfish

Cindy Tribuzio presented this year's full assessment for other rockfish. Changes to the input data are updated catch and 2017 bottom trawl biomass estimates, an updated random effects biomass model, and an updated method for Tier 6 species. The author has separated this complex into a demersal sub-group and a slope sub-group. Current catch of the complex is below area-specific ABC. The bulk of the biomass is in the Eastern GOA. The random effects biomass models were run for all slope sub-group species; a Tier 4 for Sharpchin and a Tier 5 for all others. The Plan Team and SSC has requested evaluation of alternative Tier 6 methods for harvest recommendations in the past. The SSC recommended using 2003-2016 time series in lieu of a status quo historical catch of 2013-2014. The author supports the SSC recommended approach because while the early years in the time series do not include all sources of catch, they are likely an underestimate. Max catch is recommended because these species are not targeted

and they are patchily distributed. The resulting OFL and ABC are only changed slightly from the values from last year and the area allocation for all tiers combined is little changed from the previous assessment.

The Team inquired why, given the changes in biomass estimates for individual species , there were relatively small changes to the area specific allocation. The author explained that the ABCs are little changed because while the Tier 4 sharpchin biomass shifted east the harlequin biomass shifted west, effectively cancelling each other out and resulting in ABCs and area allocation for the complex that are similar to the previous assessment.

Relative to the issue of grouping demersal sub-group with a slope sub-group of other rockfish it was noted that there is Plan Team and SSC support to moving the demersal sub-group into the DSR assessment and make the DSR assessment GOA-wide. The SSC has asked the Plan Team to determine a level of concern within the context of Council's Stock Structure and Spatial Management Policy. The author proposed these species are of "moderate concern" given that they are a long-lived rockfish and placed into a complex that creates greater risk of overexploitation for individual species in that complex and less risk for others. In addition yelloweye rockfish are considered a highly vulnerable species given their life history. The Plan Team concurred with the author that a "moderate level" of concern is warranted. Given this level of concern, the author asserts that the proposal is appropriate given that demersal and slope sub-groups differ substantially from the slope sub-group in their biology, distribution, and fishery interactions.

The Team again supports the conclusions of the author and reiterates our earlier recommendation that the demersal sub-group be moved into the DSR assessment and make the DSR assessment GOA-wide pending Council evaluation of management and economic implications.

The Team concluded that the demersal sub-group of the OR assessment should be categorized as "moderate concern" in the Council's Stock Structure and Spatial Management Policy scale of concern.

The Team recommends that this issue move to Step 2 of the Council's Stock Structure and Spatial Management Policy.

GOA Atka mackerel

Chris Lunsford presented the Atka mackerel assessment. GOA Atka mackerel is a Tier 6 species and is assessed biennially, with this year being an assessment year. Since the 2015 assessment, updated age data show large numbers of the 2011 year class in the GOA. That year class had previously been prevalent in the Aleutian Islands. The 2006 and 2007 year classes also appear to be strong based on the updated age data. It was noted that the survey data does not assess the GOA Atka mackerel biomass well. The author recommended no change in ABC and the Team concurred.

GOA Skates

Olav Ormseth presented the updated stock assessment on skates (a Tier 5 species complex). The big skate survey biomass estimate declined from 50,857 t in 2015 to 37,975 t in 2017, while longnose skate biomass increased from 42,737t to 47,632 t. "Other" skate species declined from 25,580 to 18,454 t.

Fewer large-sized big skates were encountered in both the survey and the fisheries. Small size classes of big skates increased in the CGOA but declined in EGOA. Big skates generally dominate the shallowest depth zone, but this year, longnose skates were abundant in the shallowest depth zone.
Longnose skates are replacing big skates as the most abundant EGOA and CGOA skate species. Few skates of any species are caught by the survey in WGOA.

Age composition of big skate differs by regulatory area, with a wide age composition in CGOA,

predominantly younger skates in EGOA, and the oldest skates occurring in WGOA.
Haul locations that produced small-sized big skates included Kamishak Bay and outside of Prince William Sound. There were no dramatic changes in the length and age composition for longnose skates. The Aleutian skate is the most abundant species in the "other skates" complex.

The Team supported the author's OFL and ABC recommendations.

GOA Sculpins

Ingrid Spies presented the sculpin complex assessment. Assessment methodology was unchanged from the 2015 assessment which applies the random effects model to the four most abundant sculpin species in the GOA: bigmouth, great, plain, and yellow Irish lord. Beginning in 2017, the assessment schedule was changed from a 2-year to a 4-year schedule; the next full assessment will occur in 2021. The overall biomass trend for the complex is stable.

In response to declines in bigmouth sculpin biomass, the author examined fecundity, fishing mortality, and survey catchability as possible causes. Fecundity is unknown, but examination of a single female indicated bigmouth sculpin have fewer, larger eggs than great, plain, or yellow Irish lord. In recent years, fishing mortality has been well below natural mortality and fishery catch composition is similar to that of the trawl survey. It was suggested that larger nets used during the 1984 and 1987 surveys may have increased survey catchability of bigmouth sculpin and contributed to the highest biomass estimates in the time series, but available data are insufficient to draw solid conclusions.

The Team recommends that analysis of fishing mortality (catch/RE biomass) be expanded to the whole time series and done individually for bigmouth, great, plain, and yellow Irish lord.

GOA Sharks

Cindy Tribuzio made a presentation for the GOA shark assessment, however, this was an off-year and there is no assessment document. The purpose of the presentation was to highlight ongoing issues of concern for one of the species within the complex, the Pacific sleeper shark (PSS). The author highlighted three main areas of concern with respect to the shark assessment, as well as noting that survey and fishery data for PSS is limited. The three issues of concern included: declining survey indices, representativeness of observed average weights in the longline fishery, and, species vulnerability.

The author discussed a number of projects associated with improving the availability and accuracy of shark data. This included ongoing collaboration with the Alaska Region to estimate catch numbers in the Catch Accounting System. Catch numbers have been estimated for 2011 through 2017, with the preliminary finding that the estimated catch numbers suggest that there are large numbers of small sharks being caught in the BSAI. The next step in this project would be to estimate PSS catch in numbers back to 2003.

The author also discussed issues associated with the accuracy of mean weight of sampled species, because many animals are difficult to bring aboard vessels for actual collection of length and weight data. This is particularly true of longline vessels. A special project by the Observer Program in 2018 is intended to examine the issue on longline vessels, with the goal of enhancing shark data collection by vessels in this fleet. Other notable projects include a genetics project for PSS involving the development of microsatellite markers, and an effort to examine new methods for ageing PSS (e.g., infrared techniques spectroscopy or radiocarbon dating).

The author made the following suggestions for the Team to consider:

1. Supporting the AKRO effort to convert shark weights to numbers. This would provide better accuracy for shark catch estimates
2. Supporting continued efforts in genetics and ageing studies.

3. Requesting a stock structure document in 2018 for PSS only, and that it be taken up by the Joint Teams.

In response, **the Plan Team recommended:**

1. **Bringing forward a PSS stock structure document (across both FMPs) to the Joint Plan Team in September 2018 due to concerns that PSS in BSAI and GOA are one stock with a potentially small effective population size and that they are long-lived and slow maturing**
2. **Coordinating with AKRO catch accounting staff to extend the time series of PSS catch by number of animals back to 2003** (Catch by weight alone may miss high catches of small animals)
3. **Continuing to work on PSS genetics**
4. **Developing ageing methods for PSS**
5. **Implementing a special project in the observer program to quantify sizes of PSS caught in hook-and-line fisheries**

GOA Squid

Olav Ormseth presented the squid stock assessment to the GOA Plan Team. He noted that squid were being moved to Ecosystem Component status. The regulatory process has not been completed, so squid are still "in the fishery" for now. This is likely to be the last ABC/OFL specification cycle for squid. New catch data and new survey data from 2017 were added to the assessment.

Olav went over the last couple of trawl surveys noting that squid cpue dropped considerably on the shelf in the 2017 survey compared to the 2015 survey. The depth distribution of squid covered a wider range of depths than in the previous three trawl surveys. Fishery catches of squid occurs along the shelf break and fishery CPUE is greatest in Shelikof Strait. The Team supported Olav's recommended OFL and ABC.

GOA Octopus

Olav Ormseth presented the octopus assessment. a Octopus are Tier 6 because of unreliable abundance information. Catch in 2003 through 2017 was mainly in CGOA and WGOA (western Kodiak and Shumagins). The survey estimates dropped substantially from 2015 to 2017. Olav demonstrated that catch tracks the trawl survey observations which provided support for low 2017 survey biomass estimates. The Team noted that this feature is an important consideration for ABC/OFL specifications.

The Team discussed the random effects model estimates that has been used as a method for Tier 6 ABC/OFL recommendations in the past. The Team noted that the biomass estimates (although "unreliable") vary substantially between years. Given the life history of octopus, the low survey estimates this year may be a poor predictor for future abundances. Given this, the Team discussed a number of options for ABC (shown in parentheses):

1. Recommended ABC (612 t)
2. Average catch from 2003-2017 (data extent) (444 t)
3. Maximum catch (975 t)
4. Stairstep from last year to author recommended (2,745 t)

The Team recommended option 3, ABC equal 975 t (OFL=1,300). The rationale for selecting this option was:

- There are no directed fisheries for octopus
- There is no evidence of any conservation concern given they are highly fecund and robust
- The random effects model illustrates that process error (natural variability) in abundance is very high and that year-to-year changes are difficult to predict with any accuracy.
- Incidental catch varies greatly also which supports the variability in biomass estimates.

- Using historical maximum catch as a Tier 6 option has also been used for sharks (which have similar issues related to catch estimates, and survey biomass reliability) and some species of other rockfish. Octopus are less likely to have a conservation concern (in general).
- Using the long-term mean or the random effects model averaging of survey data ignores the process error that would indicate future abundance changes consistent with such short-lived animals.

Adjourn

The meeting adjourned at approximately 5 pm.