Gulf of Alaska Groundfish Plan Team

REPORT

North Pacific Fishery Management Council
605 W 4th Avenue, Suite 306
Anchorage, AK 99501
November 13 - 16, 2018

Committee Members in attendance:

Jim Ianelli	AFSC REFM (Co-Chair)	Nat Nichols	ADF&G
Chris Lunsford	AFSC ABL (Co-Chair)	Paul Spencer	AFSC REFM
Jim Armstrong	NPFMC (Coordinator)	Craig Faunce	AFSC FMA
Sandra Lowe	AFSC REFM	Jan Rumble	ADF&G
Dan Lew	AFSC REFM	Ben Williams	ADF&G
Obren Davis	NMFS AKRO	Pete Hulson	AFSC ABL

Members absent: Lisa Hillier (WDFW) is on BSAI and GOA Groundfish Plan Teams and was in BSAI for this meeting.

Others in attendance:
Julie Bonney, AK Groundfish Data Bank
Chad See, Freezer Longline Coalition
Mary Beth Tooley, O'Hara Corporation
Shannon Carroll Trident Seafoods

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 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 Status Report in the GOA

Stephani Zador presented the GOA ecosystem report. The presentation consisted of three portions: an update to the 2017 analysis which incorporate full datasets not previously available, and separate eastern and western GOA analyses. Highlights of the discussion and presentation include:

Recap of 2017

- Zooplankton lipid content was below average for all taxa sampled in Icy Strait.
- Data indicates were entering a heat wave in winter 2019 with a weak-moderate El Ni no and warm sea surface temperatures are expected through next winter.

- SST and sea level pressure anomaly index predicts anomalously warm temps in spring 2019

Western GOA

- Copepod community size increased in 2017, indicating an improvement in foraging conditions for planktivorous predators.
- Improved conditions were observed for planktivorous seabirds, but not as much for piscivorous seabirds
- Although the warm period ended in 2016, capelin still appeared to be a smaller component of seabird chick diets than in previous cold years.
- Fish apex predator biomass during 2017 bottom trawl surveys was at its lowest level in the 30 year time series, driven primarily by low biomass of Pacific cod and arrowtooth flounder.
- Generally improving conditions for western Gulf of Alaska Steller sea lions, with non-pup counts approaching the long-term mean in 2017

Eastern GOA

- Total zooplankton density in Icy Strait in 2018 was above average, but this increase was due to increased small copepod abundances in 2018 whereas large copepod abundance declined, leading to an overall decrease in mean size.
- Modelled estimates of eastern Gulf of Alaska Steller sea lion non-pups counts are above the long term mean through 2017, following estimated declines of 12% in 2017 relative to 2015.
- Rhinoceros auklet chick growth was anomalously low during the heatwave, with no chicks to measure in 2018, suggesting that the adult birds were not able to find sufficient prey.

Discussion points from the Plan team:

- The methodology for detecting the possibility of the current heat wave state was briefly discussed.
- Industry representative Julie Bonney asked why the coho salmon index does not include adult fish (only age-0,1). Industry opinion was that coho salmon returns around Kodiak and Cook inlet were strong. Authors agreed to investigate this for next year.
- A question was raised on the use of a discrete small area index for humpback whales (Glacier Bay) to infer patterns in larger population as the movement of individuals could be driven by changing local conditions. Authors responded that this time series represents a high quality dataset due to the ability to track individual whales over time, and a comparable dataset is not currently available.

GOA ABC below maximum permissible

The GOA Plan Team was presented with two stock assessments (GOA pollock and Pacific cod) that completed the risk matrix table and made ABC recommendations below the maximum permissible. The Pacific cod assessment had an overall score of Level 4 for extreme concern. The authors used the risk matrix table to articulate the concerns in all three categories and then selected an analytic rationale for the appropriate level of ABC reduction. The rationale was to achieve a specific goal (that the estimated SSB will be above 20% of unfished in 2019). This equated to a 13.6% reduction from the maximum permissible. The Team agreed that the information and conclusions provided in the risk matrix table were informative and provided support for the authors' (and Team's) recommended ABC.

The GOA pollock assessment authors noted Level 2 concerns in all three categories for an overall score of Level 2 indicating substantially increased concerns. The author used the risk table's score to come up with the author's recommended ABC = 85% of maximum permissible (15% reduction) based on mode of historical ABC reductions. The Plan Team agreed with the risk matrix table concerns and scoring. There was considerable discussion on the level of reduction and how it links to the concerns in the risk matrix

table. A question was raised about the benefit to the stock for the 15% reduction, i.e., what is the author trying to achieve, or how are concerns being alleviated. Since the level of reduction was based only the overall score and not explicitly linked to the concerns, the Team failed to come to consensus on whether to simply recommend the maximum permissible ABC or the authors' reduced ABC. However, since the Team recognized and agreed with the assessment, population dynamics, and environmental / ecosystem concerns, they agreed some added precaution was needed.

Specifically, the GOA Team noted that guidance on how to explicitly use the scoring to reduce ABC was lacking. Development and use of the risk matrix table was appreciated and the Team encourages further refinements. The Team encourages analysis of ways to reduce ABC that are linked to the category and level of concern, i.e., what are the anticipated benefits and how do they alleviate concerns. It was noted in some cases other management tools such as time/area closures, or gear restrictions could be more effective (and may already be in place) than simply reducing the ABC.

GOA Pollock

Martin Dorn presented a full assessment of walleye pollock. A single update to the model was incorporated which was a correction to the net selectivity from acoustic estimates. A number of data updates were included: the 2017 catch and catch at age, 2018 biomass and age composition from the Shelikof Strait acoustic survey, the 2017 age composition from the NMFS bottom trawl survey, the 2017 age composition from the summer acoustic survey, and the 2018 biomass from the ADF&G crab/groundfish trawl survey.

The AFSC bottom trawl survey and the hydroacoustic gulf-wide summer survey are scheduled for next summer. The Shelikof Strait survey abundance estimates were 13% lower than in 2017, which represents the 2nd highest estimate in the past 30 years. The stock biomass continues to be dominated by the 2012 year class (now at age 6), however a new 2017 recruitment class was observed that appears to be average. The ADF&G survey abundance increased 158 % from last year but this result is still low relative to the survey mean. This survey typically does not sample juvenile pollock well, so no information on potential recruits was available. Fishery performance was very good in 2018, with the entire ABC taken this year and fishing reported as excellent. Several trends observed in last year's assessment persist, including lower weight at age for the dominant 2012 cohort, low age diversity, skewed sex ratio in the fishery, very low proportion of older (age 8+) fish in the population, and potential earlier maturation at age estimates.

The author compared four models with the 2017 selected model (17.2):

Model 17.2   last year's base model with new data
Model 18.1   Net-selectivity corrected acoustic estimates, age-1 and age-2 indices for 2009-2018 for
                Shelikof + Shumagin surveys.
Model 18.2   Same as 18.1, but age-1 and age-2 indices for 2008-2018 Shelikof surveys only.
Model 18.3   Same as 18.2, but without a power term for age-1 index.

Of these, the author recommended model 18.3 and the Team concurred. The main difference in model structure in the 2018 suite of models is that the hydroacoustic winter survey time series includes a net-selectivity correction, which results in increased estimates of abundance of Age 1 and to a lesser degree Age 2 fish, while the estimates for adult (3+) fish are slightly reduced. The effects on overall biomass are small. The abundance estimates for Age 1 and Age 2 pollock from these surveys were used as separate indices in the model. Net selectivity corrected data were only available starting in 2008 for Shelikof Strait and 2009 for the Shumagin Island survey. Model 18.1 did not use the net corrected estimate for Shelikof strait in 2008 for consistency with the Shumagin Island time series. Model 18.2 drops the Shumagin Islands survey time series in favor of extending net-selectivity corrected estimates for Shelikof Strait back to 2008. Model 18.3 modified and simplified an assumption on the age-1 pollock index, removing a previously used power term made unnecessary by using selectivity corrected data. These models provided very similar estimates of SSB, but the fit to the survey age structure was substantially improved by using

selectivity-corrected data and age specific indices. Overall model performance was characterized by poor model fit to biomass indices due to continued divergence of the major survey indices. The time varying catchability estimate continues to show increasing catchability of the winter hydroacoustic survey and the inverse pattern for the trawl surveys, with potential explanations including greater population proportions observed recently in Shelikof Strait and lower vertical availability of pollock to the trawl surveys. Regardless of these poor fit issues, the retrospective analysis shows no bias and a very low Mohn's ρ score. The chosen model produced a substantially higher maxABC estimate relative to the expectation based on last years' projection for this year.

The author presented methods for deriving external model inputs, including age specific M, mean weight at age, and maturity schedule. The author presented a plot of cohort specific mortality, showing an apparent lower estimate of mortality of the 2012 year class relative to the mean responses of past cohorts. This anomaly also produces residuals in the model fits to fishery catch at age and survey age composition. The author presented the economic performance report, which highlighted the current high wholesale value for the fishery at about $92 million.

Other discussions of note during the presentation were the higher number of spawning and spent female fish (44% spent condition) in the 2018 Shelikof Strait survey, which could indicate the timing of the survey was not appropriate. The objective of the survey is to encounter primarily pre-spawning condition specimens, and the survey plans to start earlier in 2019. The Acoustic group also noted that the 2019 winter surveys, including Shumagin Islands, PWS and Shelikof Strait surveys, will be conducted aboard the NOAA Ship Bell Shimada, as the usual vessel (*RV* Oscar Dyson) is undergoing repairs. There also was discussion that the survey timing may be earlier in 2019. The Shimada is the same class vessel as the Dyson, and is very similar in operational characteristics such as noise quieted performance, acoustic instrumentation, and trawling capacity.

The pollock assessment also incorporated a risk assessment matrix for deriving an author recommended reduction in ABC. This represents a new approach in formulating additional risks to the stock that are not inherently captured in the stock assessment model. The author scored the current risk conditions as Level 2 across all categories, which are Assessment-related considerations, Population dynamics considerations and Environmental/ecosystem considerations. The details of the scoring rationale are included in the stock assessment document. In general the Team agreed with the author's categorization of the risk factors. With a Level 2 risk assessment the author proposed a 15% reduction from maxABC, based upon the median of historic ABC reductions. An incremental method for reducing ABC was suggested by averaging the projection of the current ABC from last year's assessment with the larger current year maxABC. This alternative produced a 14.3% reduction over the maxABC for 2019.

There was considerable debate on whether to use the authors proposed 15% (substantial discussion on the rationale for this number), the incremental strategy, or no reduction due to the conflict of a high population abundance coupled with concerns within the risk matrix evaluation.

The Team recommends using the incremental method (14.3%) but would appreciate guidance from the SSC on appropriate level(s) of reduction in response to substantial concerns of how to implement the risk matrix.

Overall, the Plan Team was in agreement with author's recommendations for model selection and season-area apportionments, as well as the ongoing concerns over the future status of the stock due to the uncertainty in the productivity potential of the single-year-class dominated population (77% of SSB is represented by the 2012 cohort) and risk for sub-par recruitment.

A number of additional topics were discussed with the assessment author. The Plan team discussed the possibility of altering the natural mortality estimate procedure by removing the Hollowed et al. study which shows a different pattern of mortality-at-age relative to the other studies. After discussion, the team

agreed to maintain the current analysis as is. This discussion may be revisited as more studies become available.

The Team recommends the author investigate the use of maturity at age estimation procedure.

The primary concern is that the current maturity estimation approach may not adequately capture recent shifts to earlier maturation. This includes potential for reducing the window of annual maturity estimates that are averaged to produce a mean maturity schedule, potential for using a random effects modeling for deriving mean maturity. In addition, there was interest in investigating mechanisms for propagating uncertainty for maturity estimation, potentially by fitting maturity estimates within the model. The effect of maturity estimates on reference points should be investigated, especially when the spawning stock is heavily dominated by a single cohort. Additionally, investigations on the effect of spatial patterns on maturity estimation should be examined as the primary spawning grounds in the Shelikof Strait constitute only a portion of the spawning area.

The Team recommends investigating model behavior sensitivity to abundance indices by incrementally dropping survey indexes to clarify how the data affect the model(s).

This analysis has been presented in the past and the Team would appreciate it being continued in the future.

The Team recommends the author check recent year estimates of fishery selectivity, specifically the rising edge of the selectivity curves, which appear overly static given the single cohort state of the population.

Fishery age data doesn't fit well, but the selectivity at age doesn't change much. If there is only one year that changes it is unlikely to change much. It was put forward that the selectivity at age is "stuck" and the random walk isn't performing well. It was suggested that selectivity should be varying more than it currently is though it might take more than 1 year-class to move selectivity.

GOA Pacific cod

Steve Barbeaux presented the latest Gulf of Alaska Pacific cod stock assessment. Eight model alternatives were presented for consideration by the Team (including last year's model with updated data). In each model, the rapid decline in abundance and biomass continued from 2017 to 2018. This decline was supported by the AFSC longline survey RPN index in which a 40% decline resulted from 2017 to 2018, with the 2018 value being the lowest in the time-series.

The new data used in the assessment this year included 2012-2017 fishery age composition data (which have not been previously available). The author discovered there was ageing error bias in otoliths aged prior to 2007.At the time of the assessment, it was not yet possible to correct for this effect.

Model alternatives that were presented included considerations of:

- Exclusion of pre-2007 age composition data, or all the age composition data
- Updating the version of Stock Synthesis
- Using length- rather than age-based maturity
- Expanding the heatwave natural mortality block to include 2014
- Using the marine heatwave index as a covariate to natural mortality
- Increasing the prior CVs on natural mortality
- New von Bertalanffy growth parameters generated from post-2007 survey age data

The author's preferred model was 18.10.44 in which the pre-2007 age composition data was removed, maturity was length-based, the prior CVs on natural mortality were increased, the heatwave block of natural mortality was expanded to 2014-2016, and the von Bertalanffy parameters were updated. This

model was selected because it was the best fit model to the index data used and had the best retrospective pattern. The Team concurred with the authors' recommended model.

For the 2019 projected ABC, the author recommends a decrease from the maxABC. Steve presented the risk matrix table in which the overall level that was recommended was level 4 (extreme concern) based on population dynamics considerations, as the spawning biomass is at its lowest point in the 41 year history of the assessment. Overall, the ABC that was recommended (17,000 t) resulted in a 13.6% reduction from the maxABC. This reduction was determined based on catch projections that resulted in the spawning biomass estimate being above 20% of unfished levels through 2020. Since the stock is already below $B_{40\%}$ the Team noted that the ABC reduction of 13.6% is in addition to the buffer incorporated by the sloping harvest control rule (which already reduces fishing mortality to slightly more than one third (0.38) of the F_{MSY} level or a "buffer" of 62% due to the harvest control rule alone).

The Team discussed having additional ABC reductions so as to avoid the stock dropping below 20% of unfished by 2020 and noted that this issue could also be addressed when setting TAC. However, to be consistent with last year's recommendation as adopted by the SSC, the Team agreed with the author's recommended reduction.

The Team recommended that the author investigate the role that fishery catch has had on the decline in abundance. That is, project estimated historical recruits forward without fishing mortality. This should help discern the extent that the stock declines are the result of environmental conditions versus the impact of fishing.

GOA Shallow water flatfish (including N and S Rock sole)

Meaghan Bryan presented the shallow water flatfish partial assessments. Northern and southern rock sole are Tier 3a species and assessed separately from the other shallow water flatfish. The shallow water flatfish stock complex has been moved to a 4-year assessment cycle. Last year, 2017, was the first year of the new schedule and a full assessment was completed. This year a partial assessment was done. Management advice was combined for updated rock sole projections and biomass estimates from last year's random effects model for other shallow water flatfish. The author did not run a 2018 random effects model for other shallow water flatfish because it was an off-year for the GOA trawl survey; biomass estimates from 2017 were used.

Updates to the projection model for northern and southern rock sole include updating the catch estimates from 2017 and 2018 (as of October 1,721 t with 205 t additional catch to end of year). The projected 2019 catch estimate was 1,600 t which is an average catch from 2013-2017. Recruitment from 1977-2015 was used rather than 1977-2017 in the rock sole projections.

For northern rock sole the OFL and max ABC are about 3% higher in 2018 than 2017. For southern rock sole, the OFL and max ABC increased by about 2%.

For the shallow water flatfish complex, the Plan Team accepted the author's recommendations which is an increase for OFL and max ABC of about 2%.

The author's suggested apportionment from the random effects model was the same as 2018, with most of the ABC going to the Western and Central GOA.

The author examined exploitation (catch/biomass) from 1990 to 2017 for the different species. Since 1999, butter sole had the highest exploitation rates, higher than rock sole. Rock sole represents 78% of the SWF catch (since 1993) and butter sole represents 12%. This exploitation of butter sole was driven by availability according to industry representative.

GOA Deepwater flatfish

Carey McGilliard completed a partial assessment for the deepwater flatfish complex this year to recommend harvest levels for 2019 and 2020. Dover sole comprises the vast majority of landings for this complex and is assessed using an age-structured model with a Tier 3 designation. Greenland turbot and deepsea sole fall under Tier 6.

New information for this assessment includes updated 2017 and estimated 2018 catch. The 2019 and 2020 catch was projected using the 2013-2017 average catch for Dover sole. The catch reporting system records catches at the stock complex level and then the proportion of each species is estimated by extrapolating observer data.

Area apportionment was based on the Plan Team's recommended method from 2016. For Dover sole area apportionment, a random effects model was used to smooth survey biomass estimates and fill in gaps in depth/area strata. The resulting proportions of predicted biomass by area are used as the basis for the 2019 and 2020 apportionments for the Dover sole component of the deepwater flatfish complex. Greenland turbot and deepsea sole area apportionments are based on average survey biomass for each species, 2001-2017.

GOA Rex sole

Carey McGilliard presented a partial assessment for rex sole which are assessed every four years. The next full assessment will be conducted in 2021. Carey reminded the Team that several long-standing issues had been resolved in 2017 through the addition of historical age data and by splitting the model to address separate treatment of growth in the Eastern GOA and the Central/Western GOA. These changes had allowed rex sole to move from Tier 5 to Tier 3a in 2017.

For the partial assessment, Carey updated catch data through 2018. Only 2 t of rex sole was caught in EGOA in 2017 and this was projected for 2018 as well to get 2019 biomass. Carey reviewed the apportionment, which is done using the random effects model for both stock areas.

GOA Arrowtooth flounder

Ingrid Spies presented a partial assessment for arrowtooth flounder. The next full assessment for arrowtooth flounder will be in 2019. The projection model from the last full assessment was run forward through 2019 with the following changes to the input data:

- 2017 catch was updated
- 2018 catch was estimated by adding the average catch between October 9 and December 31 from 2013-2017 to the 2018 catch through October 8, 2018.
- 2019 catch is estimated as the average catch over the past five years (including the 2018 estimated total catch).

The estimated catches are 13,649 t for 2018 and 23,347 t for 2019. The projected catch to biomass ratio remains very small (less than 0.02). ABC calculated for 2019 is nearly identical to the ABC from the 2017 assessment. The recommended area apportionment percentages were the same as last year's assessment. The stock is not overfished, and is not approaching a condition of being overfished.

The author briefly discussed the Plan Team and SSC recommendations related to evaluate older survey data, as well as ADF&G bottom trawl survey data, that could potentially provide insights into stock trends, indicating that the evaluation of these surveys will be considered in the 2019 assessment.

There was a short discussion about the markets for arrowtooth flounder, which are primarily foreign.

GOA Flathead sole

Carey McGilliard presented the flathead sole assessment. This is a partial assessment for 2018 with the next full assessment scheduled for 2021. The standard projection model was updated with final 2017 catch, estimated 2018 catch through the end of the year, and estimated 2019-2020 catch. The stock is in Tier 3a and the projection model was run to determine a max ABC of 36,782 t for 2019. Catches are well below max ABC. The projected 2019 female spawning biomass was slightly larger than what was projected in last year's assessment. The ABC and spawning stock biomass are projected to increase from 2019 to 2020. Area apportionment is determined using the random effects model and the majority of ABC is distributed in the Central and Western GOA. The catch/total biomass ratio time series is quite low.

GOA Pacific ocean perch

Pete Hulson presented an "off year" partial assessment for Pacific ocean perch. There were no changes to the assessment methodology. The 2017 catch data were updated as well as the estimated 2018-2020 forecasted catch, which were based on the catch to ABC ratio from the prior three years.

Spawning biomass is forecast to decrease slightly (~2%), although the stock remains well above $B_{40\%}$. The random-effects model was used for apportionment, with results similar to the last assessment.

The assessment authors are interested in investigating three primary topics in the next CIE review for GOA rockfish (scheduled for spring 2019): 1) incorporation of hydroacoustic info into the assessment as the species are regularly found throughout the water column; b) examine fishery-dependent info, e.g., how age samples are being collected; and c) a catchability manuscript is in prep to inform priors. Catchability has been an ongoing issue for POP and other rockfish species, coupled with selectivity.

The Plan Team supports the CIE review topics, and additionally recommends the assessment authors incorporate an examination of the VAST model during the CIE review.

GOA Northern rockfish

Curry Cunningham presented the GOA northern rockfish assessment, which used the Vector Autoregressive Spatio-Temporal (VAST) model to derive an index of survey biomass. Three assessment models were presented: 1) Model 15.4 (2018), the current assessment model with updated data and the design-based GOA trawl survey estimates; 2) Model 18.1, which replaces the design-based GOA trawl survey estimates and variances with those from the VAST model; and 3) Model 18.2, which uses the VAST survey biomass estimates but scales the variances of these estimates to be similar to the variances of the design-based estimates. Model 18.2 is the preferred model, and was motivated by a concern that the variance estimates from the VAST model were overly precise. The VAST analysis produced a biomass index with less interannual variability and lower CVs than the design-based index. The model fits to the VAST index from model 18.1 and 18.2 were very similar, but the estimated recent stock size for model 18.1 was larger than that for model 18.2 due to a lower estimate of trawl survey catchability. The estimated total biomass from models 15.4 and 18.2 were similar to each other, an expected result given the variances in the survey index were similar, and that the occasional unusually large survey biomass estimate from the design-based index did not have a large effect on the model fits. The Mohn's rho for model 18.2 was -0.20, larger in magnitude than the value for model 15.4, and part of the retrospective variability is due to differing estimates of catchability between the peels in the retrospective analysis.

The Team and Curry had a wide-ranging discussion on future steps for applying VAST results in assessments. Some next steps in the use of VAST are to 1) produce age and length survey composition data that are consistent with the VAST biomass estimates; 2) examine whether the variances from the VAST estimates used in assessments are appropriate (as one of the main motivations for migrating from design-based to model-based estimates is lower variances of the survey biomass estimates), 3) include the estimated covariance among biomass estimates produced by the VAST model within assessments, and 4)

to consider how the VAST results could be used to determine spatial apportionments of harvest quotas. These comments apply beyond the GOA northern rockfish assessment and to Alaska groundfish assessments in general and should be addressed by an AFSC workgroup being formed to evaluate the VAST methodology using both actual and simulated data. The issue of using simulation modeling for apportionment was also raised in the September 2017, Joint Plan Team minutes. While VAST models the spatial variability during specific survey years, apportionment will also require consideration of the process and observation errors describing changes in population abundance over time. Curry completed some exploratory VAST model runs with the spatio-temporal component turned off, which was raised as a research topic in the September 2017 Joint Plan Team minutes, and found that the difference between the design-based and VAST estimates may be due to the delta component of the model (i.e., partitioning variability between the encounter rate and the positive catch rate) rather than the spatial and spatio-temporal correlation structures.

The Team appreciated the responsiveness of the authors to split out whether the delta-GLM versus the spatio-temporal part of the VAST implementation was contributing to the differences observed with the design-based estimates.

The Team recommended
- **Examining the delta-GLM approach by survey strata to see if the stratum-specific estimates are affecting the differences in approaches (compared to the results from a GOA-wide model).**
- **Exploring using the covariance matrix from VAST in the stock assessment likelihood (i.e., to avoid using some variance inflation outside of the assessment).**

GOA Dusky rockfish

Kari Fenske presented the full GOA Dusky Rockfish assessment for 2019. This is a single sex, age-structured stock assessment that uses the VAST geostatistical model-based approach to develop biomass estimates from the trawl survey data. The assessment is unique as it is presently the only one that uses the model-based biomass index as input assessment data (typically design-based estimates are used). The Team noted that this approach was the accepted method for providing catch advice from the 2015 assessment. Interestingly, the design-based and the model-based biomass trends were similar from the 2017 survey (the most recent of the series). Notably the variability was much lower for the model-based time series. The authors noted that the VAST estimates seem more consistent with the life history of dusky rockfish compared to the high variability estimated by the design-based series.

The Team discussed the merits of exploring an alternative "plus" age group option since the model often overestimates the number of fish in the "plus" group compared to what's observed in the survey ages. The authors responded they have investigated the "plus" bin groupings in past assessments.

The Team discussed the validity of using survey data from the 1980's in this assessment (they are excluded from BSAI assessments for the Aleutian Islands trawl surveys). NMFS staff pointed out several differences in the survey methods between this decade and subsequent surveys. The most notable of these was that the gear was different in those earlier surveys. It was noted that the VAST model-based estimator may be able to treat those surveys differently if survey net catchability differences were defined. The Team also discussed whether using the VAST model-based method for apportionment was possible.

The Team recommended:
- **That the authors examine the impact of including the 1984 and 1987 survey data, and**
- **That the use of the VAST approach for spatial apportionment and for projections (similar to the one-dimensional random effects model) be investigated.**

GOA Rougheye-blackspotted rockfish

Kalei Shotwell presented a partial assessment update for rougheye and blackspotted rockfish which are assessed biennially in order to coincide with survey data. Updated 2017 catch data was added to the projection model inputs as well as projected current year catch. Catches were less than 50% of ABC in 2017 and 2018, but increased in 2018 in all areas. Significant catch occurs in non-directed fisheries relative to the directed fishery. Kalei noted that last year's projected 2019 ABC (1,427 t) was within 1 t of the updated estimate for 2019 (1,428 t).

Kalei noted that a project begun by Jon Heifetz addressed species differentiation within the complex using otolith morphology, growth, and weight supports easier, cheaper methods for species assignment as compared to genetic analyses. Of the three metrics otolith weight was the dominant predictor of species. The results suggest that two-thirds of the RE/BS catch is blackspotted rockfish. However, given that catches are low relative to total biomass (on the order of 0.6% to 2%), it was noted that presently there does not appear to be a conservation concern. A summary of the species differentiation project will be included in next year's full assessment report.

Apportionment is done using the three survey weighted average approach. Kalei stated that next year's assessment will include exploration of the random effects model may also include initial application of the VAST model. She reviewed several research priorities that included apportionment approaches, genetics derived differences in life history, historical age reconstruction, age gear-specific age differences.

GOA Demersal shelf rockfish

Andrew Olson presented a full assessment for demersal shelf rockfish. Catch information and the average weight of yelloweye rockfish caught in the commercial fishery were updated for 2018. Density estimates from the ROV survey were not updated as they are currently in review. Three management areas were surveyed in 2018. There were no changes to the Tier 4 or Tier 6 methodologies. The yelloweye rockfish biomass increased from 11,508 t to 12,029 t from 2018 to 2019 driven by increases in mean fish weight in CSEO and EYKT subdistricts.

There is a tendency of the survey to "capture" smaller fish than are present in the fishery. There was a question of how this is treated in the density calculations. There is currently work being done to update habitat maps using available data and developing a habitat suitability model that can be used to stratify survey areas. This is being done along with examining biological differences by management area.

Plans are in place to survey EYKT in 2019, update the density estimates (from the 2018 survey) in SSEO, NSEO, and CSEO. Generally, there is a desire to increase consistency in surveys for all management areas. An age-structured model continues to be in development - staffing changes have led to delays in bringing a model forward.

The Team asked the authors to discuss the rationale of setting the ABC below max ABC. Currently the assessment uses M instead of $F_{40\%}$ and the lower 90% CI for biomass rather than the point estimate, the Team noted that historical justification for these methods should be discussed and included in the assessment. Background on these topics is available in the GOA DSR SAFE (O'Connell et al. 1995) and the GOA Shelf Rockfish Assessment (O'Connell et al. 2002).

The Team recommends that the authors provide rationale in the assessment of why M is being used instead of $F_{40\%}$ and why the lower 90% CI for biomass is used rather than the point estimate.

The Team recommends the authors examine the risk matrix for the next assessment.

There was concern raised that there have been of many years of no directed fishing - but no concurrent increase in the population. As the bycatch fishery has been consistent there should be ongoing commitment to working with the halibut fleet to avoid bycatch.

GOA Thornyhead rockfish

Pete Hulson presented the GOA thornyhead complex assessment. This is the first full assessment since 2015, since a partial assessment was completed in 2017 in response to stock assessment prioritization changes. New methodology used in this year's assessment was to adopt a random effects model that incorporates two indexes instead of one to estimate biomass. The random effects model was fit to the AFSC Longline Survey RPW index as well as the AFSC bottom trawl survey biomass index. The addition of the longline RPW indices reduces the random effects model's sensitivity to the bottom trawl index, and further smooths the biomass estimates as well as apportionment across time.

The most recent 2017 trawl survey estimate was 10% lower than the 2015 estimate, whereas the 2017 longline survey relative population number was 38% higher than the 2016 estimate, and then decreased by 18% in 2018. Using the new random effects two index model results in a new exploitable biomass of 89,609 t, which is a 1% decrease from the 2017 estimate. The majority of catch occurs in the Central GOA and is below TAC. Discard rates have increased in recent years and are highest in the sablefish fishery. The authors stated that thornyhead retention is about 50% of total thornyhead catch in the sablefish fishery. The Team discussed the value of adding the longline survey in the random effects model considering the trawl survey CVs are low for thornyheads. The authors commented that the longline survey was added because it provides a long time series and covers the full range of thornyhead depths whereas some of the trawl surveys did not sample deeper strata. The Team agreed with the authors and endorsed adding the longline survey index to the random effects model. Apportionment is also based on the two index random effects model and for 2019 there are minor decreases in all areas.

GOA Sharks

Cindy Tribuzio presented an assessment for the GOA sharks complex. This complex consists of spiny dogfish, Pacific sleeper shark, salmon shark, and other/unidentified sharks. This was the first full assessment since 2015; the 2017 assessment was delayed until 2018 to align the BSAI and GOA shark complex assessment schedules. Spiny dogfish comprises the vast majority of catch for this complex and had been assessed using a random effects model under a Tier 5 approach (previously termed modified Tier 6 or Tier 6*). Pacific sleeper shark, salmon shark, and other/unidentified sharks fall under Tier 6. The assessment responded to several Plan Team and SSC comments including: 1) bringing forward average, maximum and median catches for the current time period used for Tier 6 calculations; 2) bringing forward the spiny dogfish status quo method in addition to Fmax and including the demographic method as an appendix, and 3) continued analysis to to improve the biomass estimates for spiny dogfish, The assessment incorporated updated 2017 and estimated 2018 catch; updated survey data (AFSC trawl, AFSC longline, IPHC longline, ADF&G trawl, and ADF&G longline); updated random effects model biomass; and an estimate of catchability (q) for spiny dogfish. Spiny dogfish catchability was estimated at 0.21, which reflects the gear efficiency and areal and vertical availability.

There were no changes to the assessment methodology for the Tier 6 shark species excluding spiny dogfish. For spiny dogfish, Cindy presented Model 15.3A in which minimum biomass (B_{RFX}) is adjusted by $q = 0.21$ to estimate an adjusted biomass (Ba), and $F_{OFL} = F_{max} = 0.04$ (demographic method), and OFL $= F_{OFL} * Ba$. The status quo model (Model 15.1) assumes $q = 1$, $F_{OFL} = M = 0.097$, and OFL $= F_{OFL} * BRFX$. The Plan Team agreed with the author's recommended Model 15.3A for spiny dogfish with a change to Tier 5 status, and Tier 6 (status quo) with OFL equal to the average catch from 1997-2007 for the rest of the shark complex.

The assessment results yield an OFL of 10,913 t and a recommended ABC of 8,184 t for 2019 for the combined Tier 5 spiny dogfish and Tier 6 other sharks. The Plan Team concurred. This is an 81% increase from the 2018 OFL/ABC, which is due to changes in the estimate of catchability (q) and F_{OFL} in the selected model.

The author updated the Team on:
1. Efforts by AKRO staff to convert shark weights to numbers back to 2003. This may be available for the next full assessment (2020);
2. An ongoing pilot study to age Pacific sleeper shark using bomb radiocarbon dating of the eye lens nucleus;
3. A genetics project for Pacific sleeper shark involving the development of microsatellite markers, and plans to produce a Pacific sleeper shark stock structure document by September 2019;
4. A potential tagging study to address Pacific sleeper shark discard mortality;
5. Concerns about accounting for undocumented spiny dogfish mortality in set net salmon fisheries in Cook Inlet and Yakutat Bay;
6. Efforts to estimate shark biomass in NMFS areas 649 and 659 for inclusion in the assessment; and,
7. Application of alternative data-limited assessment methods for the next full assessment.

The Team appreciates and supports the authors work on the items listed above, and in particular **the Team recommended the author continue with efforts to estimate biomass in NMFS areas 649 and 659 and further suggested that steps be taken to ensure future shark catches in Federal fisheries in areas 649 and 659 be fully accounted for in reporting. In discussions, the Team recommended that the author lead a small workgroup (J. Rumble, C. Faunce, and O. Ormseth) to examine estimation approaches for 649/659 federal fisheries catches and how they should be accounted within federal assessments.**

GOA Squid

For 2019 forward, squid have been moved to Ecosystem Component category in the GOA Groundfish FMP. This is the last year ABC/OFL will be specified for squid. In the future, Olav Ormseth will provide updates on squid species as ecosystem components.

GOA Forage Fish

Olav Ormseth presented the Forage Species Assessment. There was feedback to the author about a couple of issues that he addressed. Forage fish information is found in two different places - the forage fish chapter and the Ecosystem chapter. The Team previously recommended that all information should be included in one document. However, the SSC's response was to keep forage species information in both places. The author has made additional strides towards reducing duplication and confusion between this report and the Ecosystem chapter. For example, the document now cross-references information that is in the Ecosystem chapter.

The Team wanted to know what would have to happen for the author to be concerned about forage fish stocks and which data has utility in informing the author. Examining the data in comparison to the temporal mean was suggested. In response, the report now includes analysis of temporal means and uncertainty for the main species/species groups for which catch is reported (osmerids, squids, pandalid shrimps, and Pacific herring).

The author would like to change the title to forage species, since there are other non-fish species included in this category. The removal of squid from the harvest specifications process will begin in 2019.

The Plan Team supports the author recommendation to include squid in the forage species category in the Ecosystem Chapter.

Squid was moved to the Ecosystem Component through Amendment 106 to GOA FMP, which was implemented in August 2018. The primary components include: 1) placing squids in the Ecosystem Component category of the FMP, 2) prohibiting directed fishing for squid, 3) establishing a 20% maximum retention allowance (MRA), and 4) retaining recordkeeping and recording requirements.

An industry representative noted that this assemblage of species has different management measures associated with each species (i.e., herring is a prohibited species). The author noted that this detailed information is in the document.

Capelin has no directed survey; different surveys are used to estimate biomass and track frequency of occurrence (FO). FO shows an increasing trend with a lot of inter-annual variability. Estimating biomass was more difficult and the author had no confidence in his biomass estimates. The marine heat wave of 2015-2016 did negatively affect the population. A time series from the bottom trawl and summer acoustic surveys are beginning to develop and demonstrate coherence in biomass estimates. Both surveys show negative effects of marine heatwave with some recent recovery.

In the summer, eulachon are ubiquitous on-shelf with concentrations in Shelikof Strait and NE of Kodiak Island. Winter catches occur mainly in Shelikof Strait. The relationship between shelf populations, spawning runs, and the State of Alaska commercial fishery in Upper Cook Inlet are unknown.

The bottom trawl survey is better at estimating capelin than eulachon. The biomass estimate declined in 2017 and was consistent with low state waters catch; FO is stable. There was an Upper Cook Inlet biomass estimate of 48,000 t, derived from a larvae-based model. The biomass estimate increased as a result of this new modeling.

Adjourn

The meeting adjourned at approximately 4:55 pm.