Minutes of the Gulf of Alaska Groundfish Plan Team

North Pacific Fishery Management Council
605 W 4th Avenue, Suite 306
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November 16 - 20th, 2015

Administrative

The GOA Groundfish Plan Team convened on Monday, November 16, 2015, at 2:15 pm.

GOA Groundfish assessment issues

Some issues arose with groundfish stock assessments that resulted in some general recommendations.

First, the geostatistical approach applied in the Dusky assessment was considered a promising approach and one that is commonly used for US west coast rockfish assessments.

The Team recommends that a workgroup or subset of authors investigate applying the geostatistical approach to selected stocks. This would entail compiling the results and presenting these together (e.g., comparing QQ plots for a number of species together). Also this evaluation should provide guidelines on approaches to generating length and/or age data from such geostatistical abundance estimates. Given time, a large scale simulation study to better understand the geostatistical model would be encouraged.

Secondly, a few assessments incorporate multiple indices that could also be used for apportionment. **The Team recommends an evaluation on how best to tailor the RE model to accommodate multiple indices**.

Finally, an area apportionment approach using the RE model which specifies a common "process error" has been developed and should be considered. This may help in some situations where observation errors are particularly high and/or vary between regions.

GOA Ecosystem considerations

Stephani Zador presented the Gulf of Alaska ecosystem considerations update for 2015. In 2015, 7 new indicators were added, 51 were updated, and the first Gulf of Alaska Report Card was presented. The GOA report card was developed from the input of 44 experts (many participated online) who voted on appropriateness of data set inclusion and suggested data sets. The Report Card follows the format of the Bering Sea and Aleutian Island report cards with standardized trends for 8-10 indicators to represent complexity, focusing on the last five years, and a 1-page bulleted text summarizing the time series. It is expected that these indicators will evolve over time as indicators are refined and new indicators are developed. Since this is the first GOA report card, each indicator was reviewed and possible improvements were discussed:

1. Pacific Decadal Oscillation (PDO) which reached the highest recorded winter value extending back to 1990.
2. Freshwater input estimated at the GAK1 station with a variable, but recently increasing, trend.
3. Mesozooplankton biomass measured by the continuous plankton recorder with a biennial trend since 2009 with higher biomass during even-numbered years.
4. Copepod community size which has been declining in recent years.
5. Motile epifauna biomass which has been above its long-term mean since 2001.

6. Capelin captured by tufted puffins at the Barren Islands which have been at or below the mean since 2008.
7. Apex fish survey biomass which is currently below its 30-year mean.
8. Black-legged kittiwake reproductive success in the Semidi Islands which has been poor in recent years except 2014.
9. Steller sea lion non-pup estimates for the total Gulf of Alaska which are approaching the long term mean.
10. Human populations in the Gulf of Alaska coastal towns of Homer, Kodiak, Sitka, and Yakutat are above the 25-year mean.

Stephani described the nature of data sets and how they contribute to condition indices. Alternative indicators were discussed such as the Alaska small mesh survey for forage fish, multivariate indicators for forage fish and seabirds, and different emphasis for the human indicator. The current indicators will be reviewed by the GOA IERP in 2016 and feedback from the Plan Team and SSC will be incorporated. The possibility of splitting the Gulf into at least two areas (east and west) will be explored. Where possible multivariate indicators may be developed. Other indicators not included in the report card were also discussed such as structural epifauna, jellyfish, groundfish conditions, and the distribution of rockfish.

There were three hot topics for 2015. 1) Whether the water temperature is too warm for larval walleye pollock survival in 2015 - the 2015 Eco-FOCI larval survey found few age-0 pollock during their May 14 to June 5 cruise. 2) Very few age-0 pollock were found in late summer, 2015 - there were fewer age-0 walleye pollock in the Eco-FOCI index area in 2015 than in any other year in the time series. In addition to the low abundance of age-0 pollock, very few age-1 individuals were collected (ca. 14-20 cm SL) as evident in the size composition. 3) There was an Unusual Mortality Event (UME) for marine mammals. Since May 2015, elevated numbers of large whale mortalities occurred in the western Gulf of Alaska, encompassing the areas around Kodiak Island, Afognak Island, Chirikof Island, the Semidi Islands, and the southern shoreline of the Alaska Peninsula. One suspected cause is a harmful algal bloom.

In summary, while 2014 saw a reversal to warm conditions but with mostly high productivity, in 2015, conditions remained warm, but productivity dropped. This included small zooplankton species more abundant than large zooplankton, “mushy” halibut, poor groundfish conditions, few forage fish, poor seabird reproduction, and a large whale UME.

GOA Pollock

Martin Dorn presented the 2015 GOA W/C/WYAK pollock assessment. This year’s assessment features the following new data: 1) 2014 total catch and catch-at-age from the fishery, 2) 2015 biomass and age composition from the Shelikof Strait acoustic survey, 3) 2015 biomass and length composition from NMFS bottom trawl survey, 4) 2015 biomass and 2014 age composition from the ADF&G crab/groundfish trawl survey, and 5) 2013 and 2015 biomass estimates, 2013 age composition, and 2015 length composition from the NMFS summer acoustic survey. The 2015 Shelikof Strait acoustic survey estimate of age-3 pollock is 1.64 billion, which is the largest age-3 estimate in the time series. There was a large (58%) decline in pollock biomass in the 2015 ADF&G survey, which is a concern, especially since this time series has been the most stable used in the assessment. The 2012 year class still appears to be very strong based on recent information.

Changes from the 2014 assessment were required to accommodate the new summer acoustic survey, and therefore a stepwise comparison of four sequential models was presented. The models were:

- 14.9: The 2014 base model with new 2014 and 2015 data included for existing time-series.
- 15.1: Adding the summer acoustic survey.
- 15.1a: Adding a power term for age-1 catchability (q).

- 15.1b: Using the revised Shelikof winter acoustic estimates accounting for experimentally-derived net selectivity.

The 2014 assessment model used iterative re-weighting for composition data based on the harmonic mean of effective sample size. For 2015, an initial "tuning" step was conducted after incorporating new data.To facilitate model comparison, subsequent models were not tuned until a potential base model was identified, and then a final tuning step was done for that model.

To add the summer acoustic data as a new survey time series, the authors used a simple approach and assumed constant selectivity across all ages for modeling selectivity due to the limited amount of data. Although this assumption was corroborated by a reasonable fit to the age and length data (not presented, but discussed by the author), and a lack of statistical support for a more complex selectivity shape, this approach will need to be evaluated as additional data become available. **The Plan Team recommends re-evaluating the form of the selectivity curve used for the summer acoustic survey in the next assessment.**

Adding a power term for age-1 (Model 15.1a) significantly improved the model fit and is the authors' recommended model. Adding a power term for age-2 did not significantly improve the model fit, resulted in an estimate that was close to zero, and was therefore not used.

Adjusting the Shelikof Strait acoustic survey estimates to account for net selectivity (Model 15.1b) did not clearly improve the model fit for all components, although the fit to age-1 and age-2 indices appeared to be better. Sample sizes for age data were not re-tuned for this alternative model. Generally, the method for making the net selectivity correction should be fully documented and vetted by the Plan Team, or in peer-reviewed publication. **The Plan Team recommended further exploration, with an effort to implement this correction in future assessments.** The results may have implications for not only the model estimates, but also apportionment calculations if not applied to all winter survey areas (see section at the beginning of GOA minutes on general groundfish assessment issues).

A full diagnosis of model fit and residual patterns for model 15.1a was presented by the author. Model fits to fishery age composition data are reasonable in most years. There was some lack of fit apparent at age-4 and discussion suggested this might be explored by testing alternative selectivity parameterizations, perhaps with more flexibility than the logistic form currently used. Large NMFS bottom trawl survey age residuals were observed at ages 1-2, perhaps due to inconsistencies between the initial estimates of abundance and subsequent information about year class size.

Model fits to biomass estimates are generally similar to previous assessments. The author noted that the fit to the recent Shelikof Strait acoustic survey (particularly the rapid increase after 2012) was poor. The within-model calibration of vessel catchability did not have a large effect, nor was it able to improve this lack-of-fit. The fit to the age-1 and age-2 Shelikof acoustic indices appeared adequate though variable. The model is also unable to fit the extremely low value for the ADF&G survey in 2015 (down 58%), though otherwise the fit to this survey is quite good. There was considerable discussion about why the ADF&G survey may have seen so few fish. **The Plan Team recommended further exploration of hypotheses regarding temperature and fish distribution relative to bathymetric features and depth as it may relate to the low observation in 2015.**

The Plan Team accepted the authors' recommended final model configuration (15.1a) that incorporated the summer acoustic survey data and a power term for age-1 winter acoustic catchability. The model estimate of spawning biomass in 2016 is 321,626 t, which is 42.9% of unfished spawning biomass (based on average post-1977 recruitment) and above the $B_{40\%}$ estimate of 300,000 t. The estimated abundance of mature fish is projected to peak in 2017, and then decline as the strong 2012 year class passes through the population. Over the years 2009-2013 stock size has shown a strong upward trend from 25% to 50% of unfished stock size, but declined to 33% of unfished stock size in 2015. The spawning stock is projected to increase again in 2016 as the strong 2012 year class starts maturing.

The area apportionment estimates were updated to include the most recent data available within each season (Appendix C of the GOA pollock chapter). The NMFS bottom trawl, typically extending from mid-May to mid-August, was considered the most appropriate survey time-series for apportioning the TAC for the summer C and D seasons. Previously, apportionment of pollock TAC was based upon an unweighted average of the four most recent NMFS summer surveys. However, in the 2014 assessment, the authors used random effects models to fit smoothed biomass trends for each management area following the recommendation of the survey-averaging working group. In the current assessment, the performance of the random effects model appeared satisfactory, but led to an estimated biomass distribution that was more strongly influenced by the most recent survey, unlike the 4-survey average that had been used previously. The authors also noted that, in 2015, the spatial distribution of biomass from the NMFS bottom trawl survey was markedly different from the spatial distribution from the NMFS summer acoustic survey. To account for these differences for the 2016 apportionments*, the Plan Team requested that the authors average the results of the random effects model along with the spatial distribution of the 2015 NMFS summer acoustic survey for spatial C and D season apportionments.* They agreed this was a reasonable approach and the Team noted this is intended as a one-time approach to the summer apportionment. Moving forward the Team anticipates a more comprehensive method will be used which combines both the NMFS bottom trawl and acoustic surveys for these calculations in the future.

GOA Pacific cod

Teresa A'mar presented the 2015 Pacific cod assessment. Model 0, last year's model is now model 1.

Newly available historical age data from the 1984 and 1987 GOA NMFS bottom trawl survey were analyzed. Finding that these data were incomplete, the author decided not to include age data prior to 1990 in this assessment. The following trends were highlighted: During 2013-2015, the NMFS bottom trawl survey biomass estimates are down by 50% and total abundance estimates decreased by 42%. In addition, the abundance of fish ≥ 27 cm, predominantly ages 2+, decreased by 57% since 2009; however, levels have not yet reached the low values seen in the early 2000s. The abundance of smaller (< 27 cm) fish is highly variable in the bottom trawl survey.

Four models (two with variants) were discussed. Model 0 is the model used in 2014. Model 1 is model 0 with updated data, Model 2 is the September 2015 model 4 with some changes, and Model 3 is Model 2 with additional period of fishery selectivity during 2013-2015. This additional period of selectivity was added because a greater proportion of smaller fish appear in the fishery during these years and this period corresponds with the restructured observer program. Teresa noted that model preference depends on whether or not those new fish are due to new data being collected (and are therefore an artifact of sampling a new portion of the fished population), or whether they reflect true changes in the population or fishery characteristics (e.g., a shift in selectivity).

The temporal trends in biomass estimated from model 0 and model 2 did not corroborate each other nor the trawl survey biomass in recent years. The author investigated using lower weights for the fishery length composition data since these data account for a large component of the log likelihood in the models. Eight combinations of models 2 and 3 were investigated. All Model 2 configurations exhibited an increase in survey abundance from 2013 to 2015, while Model 3 configurations with ½ and ¼ weighting of fishery lengths exhibited declining trends in estimated abundance (Models 3½ and 3¼, respectively). Model 3¼ was recommended by the author and accepted by the Team. It was noted that Model 3 fits the recent bottom trawl survey trend better than Model 2. The lower weight on fishery length composition data reduced the magnitude of the age 0 recruitment estimates from the 2011 year class relative to previous assessments, and increased some earlier recruitment estimates compared to Model 2.

The Plan Team acknowledged the hard work of Dr. A'mar and thanks her for her valuable contribution to the assessment of this important stock.

The Team recommended further examination of the effect of changes in observer sampling (dockside versus at-sea), and evaluation of alternatives for treatment of these data. In particular, if the at-sea sampling includes discards of small Pacific cod, then perhaps a retention function can be estimated (and landings data includes the retained component).

GOA Rex sole

Carey McGilliard presented the rex sole stock assessment. This year completed the conversion of the assessment model to SS3 (Stock Synthesis version 3.24u).

The last full assessment was conducted in 2011 so all model comparisons were relative to the 2011 model. Previous SSC and Plan Team comments were to use the random effects model for determining apportionment and to run models in SS3 which was done this year. In this year's assessment, three models were presented; 1) an SS model that mimics the 2011 model, 2) a 2011 SS model with updated input data, and 3) the author-recommended 2015 alternative model that changes how effective sample sizes for data weighting are determined. The effective sample sizes for length and age compositions were changed to equal the number of hauls that samples were taken from based on methods described in McAllister and Ianelli (1997). Model fit to length compositions from the survey and fishery were good and fits to the survey age compositions appeared reasonable. The new model application was a clear improvement and the Team commended the author.

Rex sole is managed under Tier 5 of the FMP with the age-structured model used to provide an estimate of adult mature biomass. Model-based reference fishing mortality rates, e.g., $F_{40\%}$ have always been estimated to be unreasonably high, precluding management in Tier 3. Apportionments were computed using the random effects model and included the 2015 NMFS bottom trawl survey biomass distributions. The Team concurred with the author's approaches.

The Team recommends examining rex sole age, growth, and maturity information and updating the growth data used in the model as it currently only includes data up to 1996.

GOA Flathead sole

Carey McGilliard presented the flathead sole stock assessment which was conducted using Stock Synthesis version 3.24u (SS3). SSC and Plan Team recommendations are still being explored and will be presented in future assessments. However, the extreme patterns in early recruitment deviations seen in the past and commented on by the SSC were not evident in the 2015 assessment. For this year's model, the author recommends using the 2013 model updated with most recent data and applying alternative compositional data weighting methods. The effective sample sizes for length and age composition data were changed to equal the number of hauls that samples were taken from, following McAllister and Ianelli (1997). Three models were presented: 1) the 2013 model; 2) the author-recommended 2015 model with no new data, and 3) the author recommended 2015 model with new data.

The majority of bottom trawl survey flathead sole catch is in the Western and Central Gulf of Alaska. Survey biomass was up slightly in 2015 compared to 2013. Model fits to length compositions are reasonable but poor in early years for both fishery and survey. Fits to the survey biomass index and resulting estimates of spawning stock biomass over time are similar among the three model runs in recent years. Biomass estimates prior to 2000 were higher for the 2015 model with and without new data, indicating that differences in estimated biomass fits can be attributed to changes in the effective sample sizes and methods for data weighting among data sources. In addition, the 2015 model without new data fit the survey biomass index slightly better than the 2013 model, and the 2015 model does not require a constraint on peak female fishery selectivity.

Spawning biomass appears to be stable and relatively high. Estimated fishing mortality appears to have been low. Apportionments were computed using the random effects model and included the 2015 NMFS bottom trawl survey biomass distributions. This results in a decrease in ABC in the Southeast Outside District of the Eastern GOA but is generally similar to previous apportionments. The Team concurred with the author's improvements to this assessment.

GOA Deepwater Flatfish Complex

Carey McGilliard presented the assessment for the deepwater flatfish complex which includes Dover sole (Tier 3) as well as Greenland turbot and deepsea sole (both Tier 6). For 2015, the author presented the 2013 Dover sole model with updated data and two model changes. For the first model change, the effective sample sizes for length and age composition data were changed to equal the number of hauls samples based on methods described in McAllister and Ianelli (1997). Second, fishery selectivity was set to be asymptotic since evidence of dome-shaped selectivity in earlier runs was lacking.

Deepwater flatfish catch has been stable since 2000 and in recent years has been substantially less than the pre-2000 catch levels. For this year, the random effects model was used to fill in depth and area gaps in the survey biomass estimates. The 2015 survey biomass was the lowest biomass on record and had a relatively low *CV* of 9%.

Model fits were reasonable but this year's model fit the 2015 survey biomass poorly (the lowest estimate in the time series). Estimated spawning stock biomass was lower in all years in the 2015 model when compared to the 2013 model. Estimates of recruitment deviations are similar among models with the 2015 model estimating a larger number of recent (2010-2012) recruits than the 2013 model. The changes seen between 2013 and 2015 were largely influenced by changes in data weighting and the addition of the most recent data including the low 2015 survey biomass estimate.

The Team noted that a low ABC for the Western Gulf is estimated when the random effects model results are used for apportionment. Using the Dover sole distribution as a proxy to apportion Greenland turbot and deepsea sole was highlighted as a concern. *The Team requested that the authors use a mixed apportionment strategy by applying the survey biomass distribution (percentage by area for all survey years) for Greenland turbot and deepsea sole to determine area apportionment for those species.* These resulting values should then be combined with the Dover sole to get overall apportionments. The author agreed and made the changes accordingly for this assessment.

The Team recommends the author explore alternative apportionment strategies for the overall deepwater flatfish complex that will better represent Greenland turbot and deepsea sole distribution in the GOA.

GOA Arrowtooth flounder

Ingrid Spies presented the arrowtooth flounder assessment which implemented a generalized arrowtooth model for use in both the GOA and BSAI. The fishery length composition data was updated for all years from 1977-2015, which included adding the previously missing length compositions for 1982 and 1983. The age-length transition matrix and weight-at-age vector were re-estimated based on data from 1977-2015, and the maturity-at-age ogive was updated based on Stark (2008). Model changes included development of a common ADMB model to be used for both the BSAI and GOA arrowtooth flounder assessments. This resulted in the modeled ages for the GOA arrowtooth flounder changing from 3-15+ to 1-21+, with selectivity estimated non-parametrically for ages 1-19.

Several model runs were presented to demonstrate the effects of the various data and model changes. The generalized model (with an age range of 3-15+) and the 2013 model produce very similar results when applied to a given dataset. The various data and model changes had relatively little effect on the time series of estimated total and spawning biomass. The age at 50% maturity was slightly decreased in the new maturity ogive, but the female size was slightly larger for a number of ages, and these two factors offset each other to produce nearly identical $F_{SPR\%}$ rates.

The Team recommended that in future assessments the authors consider the following suggestions:

1. Fit growth curves and age-length transition matrix such that the effect of length-stratified otolith sampling on estimated size at age is removed. It was noted that weight-at-age appears to be decreasing over time for most male and females between 1 and 10.
2. Evaluate models which allow time-varying size at age.
3. Evaluate additional variance components as the design-based variances may be underestimates.
4. Investigate if the IPHC longline survey data could be used as an additional tuning index.
5. Examine potential for iteratively reweighting age and length composition data, potentially with one of the methods described in Francis (2011).
6. Re-evaluate sex ratios and sex-specific natural mortality rates. The natural mortality for one sex could be fixed and the other estimated. The hypothesis that males are in deeper water and thus less available to the survey and fishery should be re-examined.

The Team recommends evaluation of standardizing the surveys from the 1960 and 1970 with the more recent NMFS trawl survey estimates or, alternatively, removing the older surveys from the model. The trawl survey biomass estimates are obtained from several sources, including IPHC surveys in the 1960s and exploratory NMFS surveys in the 1970s. The estimated variances for several survey biomass estimates appear to be small.

GOA Shallow water flatfish

Jack Turnock presented the assessment for the shallow water flatfish complex and evaluated random effects results for survey averaging for the Tier 5 stocks in this complex and also for the apportionment. The Team commended him for a clear presentation of the different options and concurred with the author's recommended ABC and OFL specifications.

Changes for this assessment included determination of catch estimates for each species using a standardized method and the addition of 2015 survey data. The random effects model was used to apportion ABC and to estimate the percent of each species in the total biomass to estimate ABC by species. Catch was updated by species, area, and fishery.

Model runs included using the: 1) random effects model run on survey biomass for sum of species excluding rock sole with rock sole current biomass from A'mar model; 2) random effects model run by area using survey biomass for all species (including rock sole) to get area split for ABC; 3) random effects model run by species (excluding rock sole) to get split in ABC by species.

This is a Tier 5 species group. Rock sole comprises ~80% of the shallow water flatfish catch; unidentified (or "unspecified") species are lumped together and comprise ~10-20% of the total caught. Shallow-water flatfish are caught mostly in the following fisheries (in order of abundance within each): Pacific cod, pollock (bottom trawl), arrowtooth flounder, and flathead sole. The species composition from the observer fishery database and catch data are compared when calculating splits by species.

Overall catch has gradually decreased and the commercial harvest level (~10% of TAC) is well under the OFL. For 2016, the assessment author's recommendation for OFL/ABC is nearly equivalent to 2015.

GOA Northern and southern rock sole

Teresa A'mar presented the combined-species assessment for northern and southern rock sole (NRS, SRS).

Data sets in the assessment include: 1) fishery catch data for 1977 – 2014 and preliminary catch data for 2015; 2) fishery size composition data for 1989 – 2014 and preliminary data for 2015; 3) GOA NMFS bottom trawl biomass estimates for 1984 – 2015; 4) survey population length composition estimates for 1984 – 2015; and 5) Survey population age composition estimates, mean length-at-age, and conditional age-at-length data for 1990 – 2013 (not using data from 1984 and 1987).

Concern over inconsistencies in recent recruitment estimates (especially in 2011) was addressed by the author in the 2015 models; this included changing the length composition weighting. There were concerns by the author and the Plan Team about the female length composition data set and the proportion of females in the population. From the survey data, SRS females comprised >60% of the population in all years except 2009. NRS fishery data also show a skewed sex composition, with females comprising a low fraction in the past four years. Female NRS were essentially missing from sampling efforts in 2013.

NRS biomass estimates show a decrease of 20-30% since 2013. Most of the biomass in the Western Gulf is thought to be composed of NRS but this is unconfirmed. Few NRS seem to appear in the Eastern Gulf catches. Southern rock sole are more widely distributed, and overall, the assessment for this component fit the available data better and seemed more stable. The Plan Team was encouraged by the developments made for these stocks and **recommends (following the advice of the lead author) to continue separating analyses into NRS, SRS, and undifferentiated categories.** They also noted that given the status of the stock and the lack of a directed fishery, the Council may consider reducing the frequency of this assessment.

GOA Pacific Ocean Perch

Pete Hulson presented the assessment for Pacific ocean perch. Several improvements to the model were made, including extension of the ageing error matrix across more ages to account for multiple ages in the plus group, and accounting for length-stratified otolith sampling when estimating growth curves. The age at which to set the plus group was evaluated, and the existing plus group of 25+ was found to have a sufficiently small proportion of fish. The extension of the aging error matrix improved the fits to the age composition datasets. The model shows an increasing biomass trend, with a relatively stable retrospective pattern.

The ABC apportionment method for POP could result in harvest rates in the West Yakutat area that are disproportionate to biomass. **The Team recommends evaluating harvest rates in West Yakutat to compare with F_{ABC} rates.**

The length composition has a plus group at 39+ cm, and contains a large proportion of the fish in many years, which may be a result, in part, to adult rockfish across a wide range of ages showing a similar size. **The Team recommends increasing the plus group for the length compositions to evaluate model performance.**

GOA Northern rockfish

Pete Hulson presented the assessment for northern rockfish. Several improvements to the model were made, including extension of the ageing error matrix across more ages to account for multiple ages in the plus group, accounting for length-stratified otolith sampling when estimating growth curves, and increasing the plus group in the age composition data to 45+. The extension of the aging error matrix improved the fits to the age composition datasets. Model results indicate a decreasing abundance and a lack of recent above-average year classes.

Survey biomass estimates prior to 1999 are low. Beginning in 1999, several large trawl survey estimates were obtained (with relatively large variances) along with low biomass estimates in 2003, 2009, and 2015. The model fits the low biomass estimates during this period, but not the high biomass estimates. Year class strengths can be observed in the age composition data, but are not consistent with an increase in biomass after 1999. **The Team recommends evaluating how the definition of the length composition plus group, and alternative data-weighting methods, affect model performance.**

The large interannual variation in survey biomass estimates between years, and the low biomass estimate in the 2015 survey motivated exploration of model-based estimators of survey abundance, and initial exploratory biomass estimates using a geostatistical estimator were conducted in 2015. **The Team recommends continuing to evaluate geostatistical estimators of survey biomass for this stock.**

GOA Shortraker rockfish

Pete Hulson presented the shortraker rockfish assessment. This year the random effects model was used to determine trawl survey biomass. Further exploration of the longline survey as an auxiliary index will be explored in future assessments.

The Gulfwide estimate of exploitable biomass decreased 3% compared to the previous assessment. Recent trawl survey catches show even distribution of shortraker rockfish Gulfwide with the highest catches occurring in the EGOA. Trawl survey catches and biomass in the WGOA continue to decline. Commercial catches are highest in the rockfish trawl and sablefish longline fisheries. **The Team recommended looking at the sources of shortraker bycatch data.** In particular, there appears to be an anomalously high value reported in 2010.

For apportionment, the Team agreed with the author to use the random effects model rather than the 4:6:9 survey average approach which provided very similar results. The author noted that the current 2015 WGOA catch (47 t) exceeds the proposed 2016 WGOA ABC apportionment (38 t). The Team noted that with such a small ABC in the WGOA, shortraker rockfish will likely be on PSC status in the WGOA and will be discarded. **The Plan Team recommended that authors present gear specific catch by region and explore incorporating the longline survey RPWs into area apportionment calculations.**

In addition, the Plan Team recommends exploration of the geospatial estimator used in this year's dusky rockfish assessment as an alternative approach for estimating regional and overall biomass estimates (see section at the beginning of GOA minutes on general groundfish assessment issues)**.**

GOA Dusky Rockfish

Chris Lunsford presented the dusky rockfish stock assessment. The major change for this year was application of a geostatistical biomass estimator to survey data. In addition, the recommended random effects model was used for apportionment. Changes to the assessment model included estimating growth using a length-stratified design, extending the ageing conversion matrix, and setting the plus group at age 25+.

In September the Team received a presentation on a geostatistical biomass estimator Thorson *et al*. (2015) which was applied to survey catches of dusky rockfish to generate biomass estimates used in this assessment. Compared to the standard design-based method, the geostatistical approach uses spatial correlation estimated over years whereas the standard method assumes each survey is an independent.

The Geostatical approach captures the same trends as the standard method with inter-annual variability that is more consistent with the biology of this stock.

For this assessment, the geostatistical method was only used for the biomass estimates for model fitting. The recommended random effects model was applied to the conventional estimates of biomass to determine apportionment.

The Team recommends exploring geostatistical-based apportionment estimates. This could be as part of the random effects method or since spatial correlations are accounted for, a standalone approach for regional biomass estimates. (see section at the beginning of GOA minutes on general groundfish assessment issues).

Without further analysis, the Team cautioned using priors on catchability parameter 'q' with geostatistical estimation. The central tendency of the probability distribution used in the geostatistical model may have a different interpretation. Similarly, weighting of composition data and the data themselves, should be evaluated, especially given alternative spatial abundances estimated using the geostatistical approach.

The retrospective pattern from the current dusky rockfish assessment improved significantly, presumably due to the different survey time series that was used. The Team accepted application of the geostatistical biomass estimation method in general and the Team commended the author for taking on this task.

The Team recommends exploring adding an extra variance parameter for the survey index.

GOA Rougheye and blackspotted rockfish

Dana Hanselman presented the Rougheye/Blackspotted stock assessment model. Rougheye/Blackspotted rockfish catch has been fairly stable at around 560 t since 2010. The catch increased in 2014, but 2015 was similar to the long-term average. The catch is typically only 20-60% of the ABC, and the bulk of the catch occurs in the Central GOA. The 2013 trawl survey was at a historical low, but the 2015 survey increased by 25%. The 2015 longline survey RPN abundance index decreased 6% from 2014, but was 10% above the long-term average for that series. There is an ongoing genetic study to determine differences in species composition as visually identified species are mistaken due to the similar appearance of RE/BS. The visual identification accuracy has improved with the utilization of a new rockfish guide. Rougheye rockfish tend to be 15-20 years younger, grow faster, and reach a larger average size than blackspotted. Rougheye rockfish are most prevalent in the eastern Gulf of Alaska and blackspotted are caught in the highest frequency in the Western GOA.

A full assessment was conducted this year, which addressed several issues identified in previous analyses. Trawl survey age samples are no longer treated as randomly collected but are analyzed consistently using the length-stratified sampling design. The ageing error matrix was updated to appropriately model the ages at or near the plus age group which addresses the poor fits in the age bins adjacent to the plus group. The plus group was adjusted to reduce the aggregation of a large proportion of the observations and predictions into a single bin (to approximately 10-15%). Seven models were presented in the assessment, starting with the last full assessment model (M0), updating that model with the most recent data (M1), and adding the revised ageing error and length stratified growth (M2). The final two models (M3 and M4) explored differing treatment of the trawl survey selectivity and included sub-models (a and b) to explore the choice of age composition plus group. The female spawning stock biomass trajectory was similar across all models. The recommended model is M4a which included: improvements to growth estimation, adjustments to the plus group (adjusted to age-42), adjustment in the treatment of ageing error, and application of a parsimonious Gamma form for trawl survey selectivity. The changes produced an improvement in fit to the age bins adjacent to the plus group. There was an 11% increase in estimated spawning biomass, which corresponded to an 18% increase in the recommended ABC; however there were very wide confidence intervals around the absolute stock size, indicating poor information regarding population scale. Weak information on model scale is likely a contributor to the poor retrospective pattern in this assessment.

There was considerable discussion about how to calculate the apportionment estimates for 2016. The authors produced the random effects results, but for now recommended using the status quo apportionment scheme of the 4:6:9 weighting based on the trawl survey. They rationalized that the longline survey should be included along with the trawl survey to best represent the current distribution of the stock. The Plan Team concurred, noting that the *status quo* method recommended by the authors was reasonable as an interim approach until a more in-depth exploration of combining indices is available.

The Team recommends exploring apportionment methods (such as the random effects model) for the next full assessment. (see section at the beginning of GOA minutes on general groundfish assessment issues).

GOA Demersal shelf rockfish

Kristen Green presented the Demersal Shelf Rockfish (DSR) assessment. The assessment incorporates density data for yelloweye rockfish from submersible surveys and remotely operated vehicle (ROV) surveys. Yelloweye rockfish density was updated for East Yakutat (EYKT) using the 2015 survey data (ROV-derived). The only change to the current assessment included a recommended option for calculating non-yelloweye DSR biomass using Tier 6 calculations with catch data from 2010 to 2014 for recreational, commercial and subsistence fisheries. Additional ROV surveys in the Central Southeast (CSEO), Northern Southeast (NSEO), and Southern Southeast (SSEO) areas are anticipated in 2016. An updated random effects model (last presented in 2013) was also discussed. Density estimates from the random effects model were similar to the survey density estimates for 2015, but the *CV*s were greater and the calculated biomass estimates were lower. Further evaluation of the random effects approach is expected for the next assessment.

Commercial catches of DSR have remained stable in recent years and are not approaching the ABC. However, the author noted concerns about increases in incidental catch during the halibut fishery if halibut quotas continue to increase in southeast Alaska.

Kray Van Kirk presented revisions to the yelloweye rockfish age-structured assessment presented to the Team in September. A separate model is run for the three regions in Southeast Alaska: EYKT, CSEO, and SSEO. Revisions to the model included modifying likelihood and penalty forms, estimating an additional variance term for the ADF&G survey data, merging directed and incidental catch, updating CPUE, fixing *M* at 0.026, and using a new ageing error matrix.

Changes to the methodology improved model performance and reduced the number of estimated parameters. Abundance estimates appeared to show declines in all areas, although spawning biomass in EYKT increased. The modified likelihoods improved model performance and as expected, the additional variance estimated for the ADF&G index likelihood increased uncertainty estimates. Overall, estimated total biomass from the revised model was comparable to the previous draft model. The Team was encouraged by these developments and provided the following suggestions for future considerations:

1. Rescale CPUE data to avoid possible numerical issues with catchability estimates,
2. Modifying the terminal plus-class,
3. Estimating a single natural mortality under the new likelihood/penalty formats (the random walk part was interesting but may be misleading given the level of uncertainty associated with these assessments)
4. Evaluate using the lower 90% confidence interval as is done with the status quo assessment.

The Team noted that this model was close to being acceptable for management advice and expects that if improvements continue and are presented in September 2016, it may be applicable in November for 2017 advice. **The Team recommended that a high priority be placed on combining areas and indices so that a region-wide assessment of yelloweye rockfish can be evaluated.** They further suggested that the separate indices can be combined using priors on the relative magnitude of each area surveyed.

GOA Thornyhead Rockfish

Pete Hulson presented the assessment for thornyhead rockfish. The thornyhead rockfish complex is assessed as a Tier 5 species. The random effects model was applied to biomass estimates by area and depth subareas to account for missing data, with the total biomass estimate obtained from summing the subarea model runs. Thornyhead rockfish are caught in a large proportion of survey tows, resulting in low variances of survey biomass estimates. The random effects model results were also used to determine apportionment by management region.

High rates of discards appear to have occurred in some recent years (e.g., 41% in 2013). **The Team requests the authors investigate the reasons for these high discard rates.**

Additionally, the Team requests a summary of the thornyhead rockfish tagging data be presented at the September 2016 Plan Team meeting so that it may be considered for the next full assessment.

GOA Other Rockfish

Cindy Tribuzio presented the assessment of the Other Rockfish stock complex in the GOA. The stock structure template has been updated following SSC and Plan Team comments (Table 16B.6). A detailed history of the composition of this complex is also provided in the document in addition to comparisons of published life-history information by species (Figure 16B.2). The DSR species appear more similar to other species in the DSR complex and Other Rockfish species are more similar to Other Rockfish species.

The authors reported in September that discard rates for the seven DSR species were similar before and after Observer Program restructuring that began in 2013, suggesting that the catch time series prior to 2013 was representative. However, in November the authors noted that the previously reported discard rates had been calculated incorrectly. There is now evidence that discard rates changed after 2013, suggesting that prior to 2013 the catch estimates likely did not include all sources of discards. Consequently, the Tier 6 estimates for the management alternatives presented in Appendix 16A (e.g., gulfwide DSR assessment) were recalculated based on the 2013-2014 time series only. The estimated ABCs included in Appendix 16A have been updated to reflect the new time series.

The Other Rockfish ABC was exceeded in WGOA during 2015, but the total harvest was under overall GOA ABC.

Three alternative harvest recommendations were proposed: (1) status quo (all species treated as Tier 4 or Tier 5); (2) seven species with no or rare biomass estimates or which are primarily caught in longline fisheries treated as Tier 6, and 17 species treated as Tier 4/5 using the 3 – survey biomass average; and (3) the seven Tier 6 species and the Tier 4/5 species allocated as determined using the random effects biomass.

The standard Tier 6 time series (1978 – 1995) cannot be used for this assessment because species specific catch is not available prior to 1991. Therefore, the time series presented for Tier 6 included 1997-2007 (same as used for many of the Tier 6 species in the GOA and BSAI) and 2013-2014. Tier 6 harvest recommendations are based on maximum catch from the years 2013-2014 because this time series is likely the most representative catch time series and the maximum is used because these species are not targeted, are patchy, and while large catches do occur, they are rare. Yelloweye contributes about 120 t to the Tier 6 ABC; if yelloweye was added as a Tier 5 species it would have added only about 20 t.

The author recommends alternative (3), using the random effects biomass for the 17 Tier 4/5 species and a Tier 6 approach using maximum catch (2013-2014) for the seven other species. Random effects models were used for apportionment of quota to area. The author recommends continuing with combining the Western and Central GOA ABC. The author believes that the preferred harvest approach gives maximum flexibility to harvest in the Western Gulf. The Plan Team agrees with the author's preferred harvest recommendation (3).

The Team recommends that while acceptable in the short term, maximum catch including incorporating future values should be avoided (can only increase). The Team noted that exceptions to the Tier 6 approach are specified by the SSC.

Potential areas of future research include: verifying that these species are more similar to each other in their complex than to species in other complexes with statistical models such as ANOVA or investigating the relationship between individual species in a multivariate approach (i.e., k-nearest neighbors).

GOA Atka mackerel

Sandra Lowe presented the Gulf of Alaska stock assessment for Atka mackerel. The TAC allows for bycatch in other fisheries, and in 2014 was 2,000 t; the total catch was 1,042 t. TAC remained the same for 2015 but catch was 1,191 t. Above average year classes (e.g., 2006-2007 and 2011) seen in the Aleutian Islands were also evident as predominant age classes in the fishery and bottom trawl survey age distributions (age 6 and 7; however, 2-year olds are now evident in the survey data). This is a Tier 6 species, and the Team discussed briefly that this may be a spillover population from the Aleutian Islands (the center of their abundance), or other FMP areas, rather than a self-sustaining population. In addition, Atka mackerel in the Gulf is thought to be at the edge of its distribution, so targeted fishing may depress population expansion (or recovery from fishing pressure in the 1990s). This is a patchily distributed species, and bottom trawl survey biomass estimates are associated with large CVs which have declined from 67 to 62% from 2013 to 2015. While most catch occurs in the Shumagin Island area, there is no apportionment of quota for this species in the GOA. For the above reasons, the Team did not recommend any change to the author’s proposed harvest values from last year carried into this assessment. The author believes that this assessment could be conducted every other year or every third year.

GOA Skates

Olav Ormseth presented the skate assessment. Big skate and longnose skate are by far the most abundant skate species in the fishery catch and the trawl survey. All other skate species are grouped into “other skates”, and this group is dominated by the Aleutian skate. Big skate are found mostly in the 0-100 m depth stratum while longnose are most commonly found in the 100-200 m stratum. Among the GOA regions, the two dominant species are most abundant in CGOA, followed by EGOA. Within the areas covered by the survey, WGOA has the largest number of skate species but relatively low abundance and longnose skate are uncommon there.

The random effects model was recommended for use for skates in 2014 and that approach was used this year by species and region. The biomass of big skates in the CGOA is much higher in 2015, reversing a declining trend since the early 2000s. The biomasses of longnose skates and other skates declined slightly in 2015, but are generally stable throughout the time series. Big skates are larger in CGOA than in EGOA suggesting ontogenetic shifts in distribution. Longnose skates do not show as skewed a size distribution relative to spatial distribution.

Prior to the prohibition on retention in 2013, fishery catches of skates are dominated by big skates. Skate ABCs were exceeded regionally and overall several times for big skate and longnose skate. It was noted that the SSC has emphasized that regional ABCs for skates should not be “borrowed” from to deal with overages in other areas.

The updated OFL for big skate is a large increase going from 4,340 mt to 5,086 mt. OFLs for longnose and other skates represent small decreases, and there is potential for longnose ABC in WGOA (61 mt) to be exceeded since the historic time series of catches show catches above that level. There was some discussion about discard mortality rates (all skates caught are assumed to die). Jaw damage often present in discarded skates.

The Team recommended considering the following suggestions for future assessments:

1. Exploring shared process error among areas in RE estimates of biomass,
2. Examining a more thorough accounting of skate catches in the directed halibut fishery,
3. Including IPHC survey for regional CPUE and apportionment
4. Given skate association with depth strata, consider analyzing skate abundance as a function of habitat.

For big skate catch estimates in the CGOA, the ABC was exceeded from 2010 to 2013, and in 2014, big skate was closed to retention early in the season in the CGOA, therefore the catch did not exceed the 2014 ABC. Catch estimates for longnose skates have exceeded the ABC in the WGOA four times since 2005 but these ABC’s and catches are significantly lower than the CGOA.

Estimates of incidental catches increased substantially for longnose skates and “other skates” in 2013, mainly in the IFQ halibut target fishery. For longnose skates, most of the increased catch occurred in the EGOA. For “other skates” the increased catches occurred in the CGOA and EGOA. It is likely that this increased level of catch is due to the increased catch reporting from the halibut IFQ fishery as a result of increased observer coverage in 2013.

Currently, there are catch accounting issues with skates. Even though skates are a federally assessed and managed species, there have been problems incorporating skate catch information from the state waters. State waters catch information is available through the statewide catch accounting system but this information has not been incorporated in the federal total catch information. State managers mirror federal management actions for skates in state waters and had assumed until last year that their catch information was included. State managers encourage that Federal catch accounting methods incorporate this information since skates are federally assessed and managed species.

There was significant discussion about how the random effects model should be used for skate biomass estimates for each area. The random effects model had results that fell between (mostly) the 3 year survey average and the biomass point estimate.

The Team recommended that the random effects model be used to estimate the gulf-wide ABC by species or species aggregate.

Also, the Team recommended that the apportionment be determined by the individual area random effects biomass estimates.

GOA Sculpins

Ingrid Spies presented the sculpin assessment. The biggest changes compared to the previous assessment was the application of the random effects model. The 2015 approach applies the random effects model for the entire time series rather than a four-year average for stock complex biomass. This was applied to the four most abundant sculpin species in the GOA: bigmouth, great, plain, and yellow Irish lord.

Biomass trends differed among species with bigmouth sculpin showing a decline since the mid-1980s. Bigmouth sculpin also differs by having much lower fecundity ~ 2,000 eggs per female vs 10-100 times that for other species in the top four for abundance. The overall trend for the complex is stable to positive.

In order to calculate OFL and ABC, biomass-weighted *M* was used for each species (Tier 5 - OFL=*M**Survey Biomass).

The Team had the following recommendations for GOA sculpins:

1. **Calculate OFL/ABC for species as product of species-specific *M* and biomass,**
2. **Apply average *M* to "other sculpins",**
3. **Examine whether a combination of low fecundity and fishing mortality explain long term decline of bigmouth sculpin.**

GOA Sharks

The 2015 Gulf of Alaska shark complex assessment was presented by Cindy Tribuzio. This complex consists of spiny dogfish, Pacific sleeper shark, salmon shark, and other/unidentified sharks. This was a full assessment, and incorporated model inputs such as updated catch through 2015, survey data (NMFS bottom trawl, NMFS longline, and IPHC), ADF&G trawl and longline survey indices, and a new biomass time series (random effects approach to survey averaging) for spiny dogfish.

Because of the uncertainty surrounding the data quality for these species, sharks are classified within Tier 6. The complex OFL is based on the sum of the modified Tier 6 (for spiny dogfish) and Tier 6 recommendations for individual species. The RE approach is used to assess spiny dogfish populations, while all other species have only average catch history data for such estimates. All computations include the updated time series of shark catch.

The assessment results yield a recommended OFL of 6,020 t and ABC of 4,514 t. This is a 25 percent reduction from the 2015 ABC, which the author explained as primarily due to implementing the RE model for biomass.

The **Team recommended that the authors incorporate the "shared process error" code** that has been developed by ABL staff, which may improve the process used for area distribution (see section at the beginning of GOA minutes on general groundfish assessment issues). The PT also noted that it continues to endorse the $F_{OFL}=F_{max}$ rate for the spiny dogfish ABC/OFL calculations as opposed to $F_{OFL}=M$. The F_{max} rate is based on a demographic analysis conducted by the author and published in Tribuzio and Kruse 2011. The author recommended the improved F rate in this assessment, however, the author recommends delaying implementation of using this F rate until trawl survey selectivity can be addressed in the next assessment.

GOA Squids

Olav Ormseth presented the 2015 executive summary for the squid assessment. This was the first full assessment since 2011. The squid category includes many different squid species, which are not evenly distributed geographically or by depth strata. Two of the larger species are caught by the surveys and in the fishery, typically at depths between 201 and 500 m. Thus, many squid species are under-represented in available survey and catch data. Squid abundance is highly variable. In the fishery, the largest proportion of squid catch occurs in Shelikof Strait (Area 620) in conjunction with pollock fishery.

The PT and SSC recommended that squid be considered as a candidate species for inclusion in the Ecosystem Component (EC), rather than continue be included in the fishery. The Council concurred with this recommendation (for both the GOA and BSAI) in October 2015, and is preparing an analysis to consider moving squid to the EC. This is intended to reduce the possibility that squid catch may constrain the pollock fishery, particularly in the BSAI. In the interim, the PT may wish to consider alternative models or approaches to estimating squid biomass, OFL, and ABC.

Olav developed a variety of alternative approaches to estimate squid biomass in both the BSAI and GOA. For the 2016 and 2017 assessment, the author developed and recommended a new squid assessment approach. The author recommended an alternative similar to a Tier 5 approach for squid. Specifically, the author recommended a biomass-based approach incorporating parameter estimates for GOA squids. This includes setting M=1.0, as squids live at most 2 years. The approach also incorporates using the Baranov equation to account for mortality during the current year, because squids high mortality rate makes this more appropriate than an approach using long-term average mortality. The new approach uses the long-term survey average for the biomass estimate (6,889 t). It also yields an OFL of 2,978 t and an ABC of 2,234 t. The approach continues to maintain a Tier 6 assessment status.

The author's recommended approach is different from the modified Tier 6 assessment method that was used for previous assessments. That method uses maximum historical catch during 1997-2007 as the basis for OFL and ABC calculations.

PT discussion ranged from rejecting the author's recommended model and using the status quo approach to accepting the new model. The revised approach was not presented at the September PT meeting. However, the PT noted the continued lack of reliable data about the true squid biomass and mortality. There was a general consensus that using historic catch as a basis to calculate OFL and ABC is inappropriate. Adopting the new approach yields a large increase in the squid ABC in 2016 compared to 2015, which the PT considered acceptable, as it provides an interim increase to the squid ABC while squid undergoes review to be placed in the EC component.

The Plan Team recommended adopting the author's new methodology for assessing squid biomass, OFL, and ABC.

GOA Octopus

Liz Conners updated the octopus stock assessment for 2015 to include: updated catch, the 2015 survey biomass and length frequency data, the random effects model estimate of survey biomass, pot CPUE time series for the Central Gulf of Alaska area 630, and updated figures and tables (similar to previous years). There were no changes to the methodology for setting catch limits, which is based on a modified Tier 6 procedure. The author is working on a size-based stage structured model.

The pot cod fishery caught a lot of octopus in the fall of 2014, three times the previous two years. This year (2015) is following suit. The majority of octopus is taken incidentally in the pot cod fishery and very little is taken in other fisheries; there are no directed fisheries. There was an increase in catch in 2014 and then again in 2015 in area 620. Questions arose whether these increases may be because of estimates generated from the restructured observer program. The author does not think this is the reason, and thinks this is due to actual increased catches in the pot cod fishery. A possible explanation may be that the cod fishery was fishing a little further east than they have historically, maybe fishing different areas with pockets of abundance. The percent retained is 30% overall but in the Kodiak Area is about 80%.

The GOA trawl survey octopus biomass estimates increase an order of magnitude higher than all other surveys. Estimated biomass is 12,990 t and is associated with a standard error of 1,849; the variability is similar to previous years. The 2015 survey octopus catches came from a small number of tows (octopus only shows up in 15 % of the tows), but there were tows that contained multiple individuals which is an unusual occurrence. The highest biomass estimate before this year was ~5,000 t in 2011. The author believes that these two estimates show a true increase in abundance and are not an artifact of observer coverage changes. Other explanations include climate change.

Increases in survey biomass were mostly in the CGOA and WGOA (biggest here); increases were not observed in the EGOA. It is not clear what variables and factors may have contributed to the large increase in biomass and increased incidental catches. Gulf of Alaska CPUE estimates from the area 630 pot cod fishery show a general increase over the last 2 years.

The CIE review comments from 2013 non-target review include: incidental catch history should be used as a last resort, using the bottom trawl results are problematic because of catchability issues, preferred random effects model to 3-year survey average, suggest a species specific index survey for octopus, and suggest using uncertainty to set a buffer between OFL and ABC. The CIE reviewers also noted that survey biomass should be used as an abundance index, but not as an absolute estimate.

The author is working on developing a new size-based stage-structured model to bring forward for next year's assessment model and ABC.

The Team recommends that the stock structure template be presented in September 2016 for octopus.

The Team recommends that the stage-based model be presented by the author for the September 2016 meeting.

Adjourn

Friday afternoon, November 20th 2016.