NORTH PACIFIC FISHERY MANAGEMENT COUNCIL

Bill Tweit, Interim Chair | David Witherell, Executive Director
1007 W. 3rd Avenue, Suite 400, Anchorage AK 99501
Phone 907-271-2809 | www.npfmc.org

Meeting of the Bering Sea/Aleutian Islands Groundfish Plan Team

Plan Team Report

September 21, 2023

BSAI Groundfish Plan Team Members:

Steve Barbeaux	AFSC REFM (co-chair)	Phil Joy	ADF&G
Diana Stram	NPFMC (coordinator)	Cindy Tribuzio	AFSC ABL (vice chair)
Steven Whitney	NMFS AKRO	Andrew Seitz	UAF
Allan Hicks	IPHC	Beth Matta	AFSC REFM
Lisa Hillier	WDFW	Jane Sullivan	AFSC ABL
Kirstin Holsman	AFSC REFM		
Andy Kingham	AFSC FMA		
Kalei Shotwell	AFSC REFM (co-chair)		

Introduction

The Bering Sea Aleutian Islands (BSAI) Groundfish Plan Team meeting was held on Thursday, September 11, 2023 at the AFSC. Participation was both in person and offered remotely via Zoom. Roughly 40 people attended the meeting in person, with more signed in remotely, but attendance varied throughout the meeting. All documents and presentations were posted to the Team's electronic agenda. All presentations are also linked in the header for each agenda item in this report.

CEATTLE

Kirstin Holsman (AFSC) presented an overview of the CEATTLE climate-enhanced multi-species (EBS pollock, Pacific cod, and arrowtooth flounder) stock assessment model, which has been updated annually since 2016. The model has a number of optional features that can be used to predict predation mortality, growth, and recruitment while considering environmental covariates. Though the model provides the capability to set climate-informed biological reference points, the results of using these can be counterintuitive. For species being negatively impacted by the climate trend it can lead to fishing harder on a descending stock as the reference points decrease and for stocks that are positively impacted, it can lead to underharvest as the reference points increase. For this reason, Kirstin and co-authors of the multispecies assessment use a climate-naïve target (B0 and B40%) and use a climate-informed model to determine present status and ABC for the next year (and +2 yr). Starting with the 2020 assessment, Kirstin and authors also began including near-term, medium-term, and long-term summaries of the probability of increases or decreases in catch and biomass based on an ensemble of climate scenarios (high and low carbon mitigation). Kirstin asked for feedback on using this approach and if figures or tables of the information might be useful.

The Team commends the CEATTLE modeling team's efforts to compare the model with single-species stock assessments. There has been increasing interest in using the model as a method to bring climate information into the assessment process, particularly for Bering Sea pollock and Pacific cod. The Team expressed interest in receiving more details regarding the recruitment projection model selection process and which environmental covariates were most influential; these covariates could be included in future

ESPs. There was also some discussion about the effects of the 2 million ton cap on the retrospective analysis as was reported in their 2020 paper and as continues to be a focus of ACLIM management strategy evaluations. The Team also supports using CEATTLE to help direct process research and data collection to better understand the relationships of environmental covariates (e.g., dissolved oxygen) with population dynamics and to validate ROMS models.

Pollock AVO Index

The authors reviewed updates to the AVO methodology that have improved the index for use in the EBS pollock assessment. During recent years there has been a degradation in the correlation between the AVO index and the MACE acoustic-trawl (AT) survey owing to spatial changes in pollock distribution which violated assumptions built into the automated portion of the AVO data processing. New methodology using fully manual examination of systematically subsampled acoustic data was shown to produce consistent results and the new methods improved the correlation between the AVO index and the AT survey from an r^2 of 0.6 to 0.9. The updated time series is being used in this year's pollock assessment.

The Team was grateful for the hard work of the AVO team. The Team asked if the fully manual methods required more dedicated staff time to process the data and were told that the subsampling scheme reduced staff time by approximately 40%.

The Team inquired about how the index variance was calculated and remarked that the confidence intervals for the index appear to be remarkably small. The authors replied that they use a geostatistical model and there is ongoing evaluation of how uncertainty is calculated in the index (presented in a later agenda item at this meeting). The Team suggested that the plot showing the relationship between the AVO and AT survey include error bars on both axis and the authors agreed that was a good idea. Lastly, the Team asked if there were any covariates that might explain the difference between the AVO index and AT survey, such as age compositional data. The authors agreed that this was worth exploring but not currently under investigation.

Pollock Movement

Robert Levine presented an analysis of acoustic data collected by four bottom-up transducers moored near the US-Russia border in the Eastern Bering Sea. These were strategically placed at depths most commonly inhabited by the EBS pollock stock. The study quantified the numbers of fish moving back and forth across the US-Russia border by analyzing the backscatter, estimating individual fish and their lengths, and extrapolating to the areas between the buoys. They found substantial movement during the study year of 2019-2020, which was characterized by a net cooling in the EBS as it transitioned from the warm period prior. Much movement back into the US by small fish – likely age 0s and age 1s - was observed during the winter period. Pollock movement is hypothesized to be driven by the shift in population due to annual temperature differences.

Team discussion was mostly clarifying in nature (i.e. not action-oriented), and centered around 1) size class estimates based on backscatter, and 2) the possibility of converting these size estimates to biomass. The presenters noted that since size class is estimated from target strength, there is error around that, and the error estimation has not been worked out yet given how many age-0 and age-1 pollock were observed. Given this, biomass conversions are not possible at this time. Some suggestions for getting there from the Team and the public were:

- Ground truthing by working with a catcher vessel to dip a net and verify size comps. The survey team noted that this would be great, but would be challenging in the winter and given the remote location in the EBS.

- Examining the observer data to line up hauls in the area within times of high backscatter.

Overall the Team was impressed with the research and looks forward to seeing how these results could be accounted for and/or applied in the EBS pollock assessment,

EBS pollock model considerations

Jim Ianelli presented some model evaluations of the eastern Bering Sea walleye pollock stock assessment model. He presented model results using the revised acoustic vessels of opportunity (AVO) index (see above). This was evaluated since the new series covers a broader area of the pollock distribution. In addition, Jim developed a random effects model for the spawning weight-at-age and compared this with using a simple constant mean and also time-varying empirical weights-at-age. The Team agreed with the author and **recommended both changes be brought forward** in November. Jim informed the Team that the assessment model was expanded so that it can use different aging errors for different data components for arbitrary sets of years. This will facilitate including alternative aging error matrices such as the FT-NIRS (see above) aging data for pollock when they become available.

Jim presented an evaluation of the tradeoffs of considering process errors and observation errors, specifically as related to the acoustic trawl survey (ATS) and the AVO index. He found that a modest amount of process-error in time-vary selectivity for the ATS data improved the model consistency compared to the input assumed CVs for the ATS data (but see section above on "Acoustic Trawl Survey uncertainty"). He also directed the meeting to a github repository containing an R-package and access to the pollock model, vignettes, and sub-modules. Within these vignettes was an example application of the "One-step ahead" residual approach (but see section above on this topic).

The current base model uses a covariance matrix for the survey age composition data which provides information on interannual relationships among the data. Given that this functionality is unavailable in most other commonly used stock assessment packages, Jim provided a model run which ignores this correlation. The purpose of that exercise was to evaluate the impact and to provide better ability to compare alternative assessment model platforms. Jim also evaluated the use of annually varying generalized gamma distributions for the shelf bottom trawl survey (see above section on "Index Likelihoods").

The Team recommended adopting the new full AVO index, evaluations of process-error weights, and including the random effect model estimates spawning weight-at-age for November.

Yellowfin sole model considerations

Ingrid Spies presented a new model configuration for the yellowfin sole stock assessment for the Bering Sea and Aleutian Islands. This new model, based on last year's accepted model, proposes to remove split-sex time varying fishery selectivity and incorporate a single time-varying fishery selectivity curve. The motivation for this change was that early years in the time series did not estimate male and female fishery selectivity well and switching to single-sex selectivity reduces the number of parameters estimated by the model. A similar change was adopted for this model last year for survey selectivity.

The Team asked if the model simplification impacted the management quantities. Ingrid and a co-author noted that they did not provide that for the presentation but they anticipate that there may be a small change in B0. The Team requested clarification on the table of likelihoods and why the selectivity likelihood declines substantially. Ingrid replied that this is due to the large reduction in parameters and noted that the fit to the age data is slightly worse but other fits were similar. The Team agreed that

reducing parameters and simplifying the model was helpful and that the small change in fit was also good. The Team agreed with the author's recommended model changes for November.

AI Pacific cod model considerations

Ingrid Spies presented model exploration for a Tier 3 Aleutian Islands Pacific cod model. Sensitivity tests evaluating use of conditional age at length (CAAL) and bootstrapped input sample sizes were presented and the authors plan to adopt both for all future models. Ingrid presented several new models considering time-varying fishery selectivity, including longline survey estimates, and time-varying growth. The retrospective pattern was moderately improved with some level of time-varying fishery selectivity and is supported by changes in past fishing patterns. The retrospective pattern was greatly improved by including time-varying growth; however, error tuning is needed to capture how much information is present in the data for time-varying growth parameters. The models presented were all run in SS3 and are available at https://github.com/afsc-assessments/AI_Pcod_2023/tree/main.

The Team asked for clarification on the use of time blocks instead of annually time-varying fishery selectivity and how many time blocks might be considered. The author suggested that less splitting is preferred to more and the Team suggested to leave the number of time blocks to incorporate to the discretion of the authors. The Team noted that there is a substantial positive retrospective bias when the most recent survey point is removed and asked why that may be. The author suggested this was due to no information on recruitment and also why the inclusion of time varying growth improves this pattern. The Team supported inclusion of time varying growth combined with time blocks for the November models.

The Team discussed the Pacific Cod Trawl Cooperative (PCTC) program and the potential impact on this stock. The Team noted that a result may be the Bering Sea closes sooner and there may be more effort on the Aleutian stock, but there is substantial uncertainty with the introduction of a new program. The author suggested that this program is important to consider and the Team noted this may be a new time block in the future. The Team discussed the use of the longline survey and the spatial constraints on the survey. The Team noted that this survey has not been recommended for other Aleutian Islands stocks and that the longline survey team also does not recommend stocks other than sablefish use the Aleutian Islands longline survey estimates at this time. It was noted that anyone that wishes to use the longline survey for stocks other than sablefish should consult with the survey group beforehand. The Team also noted that this is a stock for which future data availability is sensitive to the proposed changes outlined in the draft ADP (see above). The Team supported continued coordination with the State of Alaska to obtain data from the State fishery.

The Team asked for clarification on the confidence interval around empirically-derived estimates of natural mortality and the sensitivity of the model to this choice. The prior on natural mortality in the model was shown by the author to be fairly wide. The Team supported the use of the low variability on the time-varying growth noting that the CAAL and the mean length in the model are from the survey that only happens every other year. The Team discussed their optimism with these new Tier 3 models, particularly the improvements when adding in the time varying growth. This option was also implemented in the Bering Sea Pacific cod model. The Team appreciates the repeated efforts of the authors for their work on the Tier 3 models.

The Team recommended three models for November: 1) Tier 5 base model, 2) Tier 3 model with time-varying growth using the low variability option, and 3) Tier 3 model with time varying growth and time blocks for fishery selectivity. The Team supported the author's recommendation for error tuning on time-varying growth.

The Team recommended the EBS and AI authors continue to coordinate on their decisions regarding constraints on natural mortality for consistency.

EBS Pacific cod model considerations

Steve Barbeaux presented explorations of alternative stock assessment models for Eastern Bering Sea Pacific cod. He first identified some issues with the 2022 ensemble models and then presented a series of models beginning with a simplified model and then sequentially added complexity. Many additional models were investigated but not presented or discussed. There was one comment letter associated with this agenda item.

Input sample sizes for the survey composition data were updated following methods presented by Pete Huslon (see the Age and length sample sizes presentation from this meeting's Joint GPT session). Input sample sizes to the fishery size compositions were standardized to the mean of the bootstrapped input sample sizes to the survey size compositions. It was noted that when using conditional catch-at-age (CAAL) data, the marginal age comps should be removed. It was also clarified that averages of time varying quantities for the years 1977-2018 were used for benchmark calculations and projections.

A question was asked if any external analyses of ageing bias were planned. The current values for ageing bias were fixed in the investigated models based on previous model results because they matched the past isotope analysis. However, the ageing lab at the AFSC is planning to expand that analysis to more age classes, thus it may be updated in the future.

It was clarified that the models with the maximum age at 12 used the same maximum age for the data and the population dynamics. When asked if this maximum age should be considered for a management model, it was noted that there appears to be some bias and more investigation of an appropriate maximum age should be done.

The ensemble model accepted in 2022 incorporated four models based on three concepts: 1) dome-shaped survey selectivity, 2) using fishery CPUE, and 3) time-varying catchability for the survey index. The proposed assessment models do not incorporate those concepts for the following reasons: a paper by Sean Rohan (AFSC) investigating dome-shaped survey selectivity relative to the longline fishery will be coming out soon which may provide additional guidance; the fishery CPUE index was developed as a strawman option for a CIE review and not intended for use in an operational model, it was, in the opinion of the author, premature to use it; and, time-varying catchability is a complicated issue and it would be preferable to come up with a linkage rather than estimate a random process, even though there appears to be a signal that catchability varies over time. It was noted that simulation studies for crab assessments showed that it is difficult to estimate time-varying catchability, but similar simulations have not been done for a cod-like species.

Fitting fishery age composition data in the stock assessment has not been investigated in many years. When asked if this was considered, the authors were concerned about how to weight the data appropriately across regions given differences in growth and fishing effort.

Time-varying growth considerably improved model fits and past research supports interannual changes in growth. Variability was estimated for the size at a minimum age and the Richard's growth parameter that determines the inflection of the curve on the y-axis. It was explained that this fourth parameter allows asymmetry in the curve, thus providing annual flexibility across all ages. Investigations (not presented) showed these two parameters to have the best fits to data and that the fishery size composition data was the most influential data source. Predation, density-dependent growth, and environmental linkages may be contributors to this variation.

A member of the public reminded the Team of the following statement from the December 2022 SSC minutes: "While the SSC continues to support the use of a model ensemble to provide stability for this assessment, it highlights that the continuation of an ensemble modeling approach should not come at the cost of the authors' ability to pursue alternative model structures...". A member of the public also suggested prioritizing model structural uncertainty (i.e., an ensemble), investigation into spatial biology of the species (i.e., across stock research), and investigation of specific model structure (i.e., a single model). A member of the public mentioned their desire to move away from an ensemble and have a more clear investigation of a single model.

The Team supported the authors' prioritization of single model structural investigation rather than ensemble investigation, noting that an ensemble model does add an additional burden to the stock assessment and that the simplified models showed a large uncertainty in management outcomes that was approaching the overall uncertainty of the past ensemble assessment. The ensemble model will be brought to the Team in November 2023 using the four individual status quo models with status quo weights. The Team noted the considerable amount of research on Pacific cod being conducted (e.g., genetics and tagging research in support of a spatial stock assessment), and the Team supported research track assessments and collaboration across the stocks of Pacific cod.

Natural mortality (M) is an important parameter to the assessment model and is highly negatively correlated with catchability (q), resulting in a wide uncertainty in scale of the population. When M is fixed in the assessment, catchability is stabilized. It was noted that the uncertainty bounds around R0 were higher with fixed M but the estimates of other parameters were not against the prior bounds (better model performance). The higher uncertainty bounds around R0 are not unexpected as the assessment models assume a constant M across ages, and there was discussion of future directions that could include incorporating higher natural mortality at younger ages (e.g., potentially guided by CEATTLE outputs). Alternatively, starting the model at age-1 or higher may be useful to omit the uncertainty of these young ages where there are few or no observations. The benefit of using a prior on M was discussed. The uncertainty in a prior determined from maximum age of Pacific cod is large (a lognormal SE = 0.4) and the authors' explained that when tested, it resulted in a wide range of q estimates with only small changes in the negative log-likelihood.

The Team supported the current path of development and recommended a model similar to M23.1.0.d with the following changes: 1) use conditional age-at-length data (CAAL) from the survey, remove marginal age comps for the years with CAAL, and include all length composition data, 2) fix M at 0.3866 based on a maximum age of 14, and 3) potentially estimate growth CVs (authors' discretion which growth CVs to estimate). The Team is interested in learning more about how influential the fishery length compositions are on growth estimation given that a wider range of lengths for a given age are collected from the fishery and sampling occurs throughout the year, as compared to the survey data. The Team is also interested in exploring uncertainty related to alternative values of M, and supports the authors' suggestion to profile over different values of the CV on a prior for M, sequentially reducing the uncertainty of the prior to examine the effect of estimating or fixing growth on assessment outputs including reference points.

The authors indicated that they will run M23.1.0.a with updated data, and the Team recommended that this updated model be brought forward in November as a sensitivity to better understand uncertainty.

The Team discussed the current model begins at age-0 and if that is appropriate for this stock. There may be substantial differences in the M at age and having a model which starts at a later age should be investigated. Stock synthesis does not have an option for beginning at a later age and the team discussed

providing feedback to the developers for future versions. A Team member noted that the WHAM model has a number of M options and has been developed for EBS Pacific cod.

Northern rockfish stock structure

Paul Spencer provided an overview of a re-evaluation of stock structure for BSAI northern rockfish. He provided a brief background on the development of the stock structure template and the application to this stock in 2012 and resulting Plan Team recommendations. This represents the 3rd stock structure evaluation for this stock. In 2012 the plan team noted that there was evidence of stock structure but that splitting the ABC spatially would not decrease mortality and may result in increased regulatory discards, economic losses and management difficulties. Subsequent discussions in various years resulted in the request that catches and exploitation rates be provided in on-year assessments and additional stock structure templates brought forward should new information become available. The assessment author has continued to note spatial concerns with this stock, as the estimated spatial scale of the stock (i.e, lifetime dispersal distances estimated as less than 200 km) is much smaller than the current management areas.

The catch of BSAI northern rockfish has increased five-fold over the last decade, from ~ 2000 t in 2013 to ~ 10,000 t in 2023. However, current exploitation rates (both for BSAI and in various spatial subareas) do not exceed the exploitation rates associated with fishing at $F_{40\%}$. The number of tows targeting northern rockfish have increased recently, although a member of the public noted that this could be due to smaller net sizes and an increased total number of all tows since 2008. An evaluation of the proportion of Northern Rockfish by target indicates greater targeting, with about 40% - 50% of the catch of BSAI northern rockfish in tows observed by the North Pacific Fishery Observer Program in recent years coming from targeted fishing. Team members noted that based upon an informational presentation earlier in the week on rockfish genetics (see Larson presentation) that there are indications of high stock structure in northern rockfish in contrast to other rockfish species.

The Teams noted the continuing evidence for stock structure and concerns over risks to stock biomass and productivity from disproportionate harvesting. The lack of spatial harvest regulations would not prevent spatially disproportionate harvesting, which has occurred for other BSAI rockfish such as Pacific ocean perch and blackspotted/rougheye rockfish. However, the low rates of harvest for BSAI northern rockfish suggests that this risk has not yet been realized. **The Team recommends this information be included in the risk table for the November assessment and that the author and Team continue to monitor this stock for potential spatial concerns.** The Team looks forward to additional genetic information when it becomes available.

Paul also provided an update on plans to include a new aging error matrix in the November assessment. Previous sensitivity runs indicate that the addition of this does not have a large impact on the model results. The Team appreciated the notice and looks forward to the full assessment in November.

Proposed specifications (including halibut DMRs)

The Team recommends approval of the 2024 specifications for use in informating the proposed rule in 2024 and 2025. The Team recommends the revised DMRs as shown below for use in 2024-2025.
The Team notes that we anticipate changes to the fleet DMRs as a result of Pacific cod Trawl Cooperative (PCTC) action in 2024.

Area	Gear	Operation	2023 DMRs (specified)	2024/25 DMRs (recommended)
BSAI	Pot	All	26%	26% [b]
	Hook-and-line	CP	9%	7%
	Hook-and-line	CV	9% [a]	7% [a]
	Non-pelagic trawl	Mothership / CP	85%	85%
	Non-pelagic trawl	CV	62%	63%
GOA	Pot	All	27%	26% [b]
	Hook-and-line	CP	13%	11%
	Hook-and-line	CV	9%	10% [b]
	Non-pelagic trawl	Mothership / CP	83%	83%
	Non-pelagic trawl	CV	74%	69%
	Non-pelagic trawl	CV-Rockfish Prog	55%	56% [b]
All	Pelagic trawl	All	100%*	100%*

[a] Based on BSAI HAL CP [b] 4-year average *Fixed, not estimated