Gulf of Alaska walleye pollock stock assessment review

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For The Center of Independent Experts (CIE)

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Executive Summary:

The Gulf of Alaska (GOA) pollock are not overfished and no overfishing is occurring according to the most recently accepted stock assessment (2016). The total allowable catches (TAC) is divided into four seasonal and regional quotas to minimize interactions with Steller sea lions. The GOA pollock fishery is largely shore-based and uses pelagic trawls. The fishery has good observer coverage. Data provided from the fishery are total catch and age composition. Fishery-independent data are obtained from two acoustic surveys (one in Shelikof Strait and one broad scale in summer) and two bottom trawl surveys (National Marine Fisheries Service (NFMS) bottom trawl and Alaska Department of Fish and Game (ADFG) trawl). Data are taken for length, and otoliths are extracted to provide estimates of age. Abundance is estimated from bottom trawls with an area-swept method. About 75% of the tows contain pollock. Abundance varies depending on the presence of periodic dominant year classes.

Early discrepancies between the acoustic survey and bottom trawls were seen in the 1980s. The acoustic survey showed continuing substantial decline in abundance, while bottom trawls showed no declines. Since then both indices have been included in the assessment but with less apparent conflicting data. Many improvements in survey indices have been made subsequent to previous reviews, such as dropping the egg production survey and the historic surveys in the stock assessment. In the present assessment, the ADFG survey shows a trending decline in pollock abundance not evidenced in the acoustic or bottom trawl surveys. It was not clear that an explanation exists for this, but if the discrepancy continues, then further investigation is warranted.

The stock assessment team has been responsive to earlier strategic reviews and has done a good job of addressing the challenges that appear with any data collection and modeling task. When abundance estimates are derived from area-swept methods, one is always plagued with dealing with the presence of "zero" tows. About 75% of the tows in the GOA contain pollock. To deal with the zero tows, the stock assessment team has investigated zero-inflated approaches and I recommend that they continue to explore some of the newer statistical models that have been developed. To deal with the change from the Miller Freeman to the Oscar Dyson in the acoustic survey, a catchability ratio has been developed and applied to "correct" older data. Over time, different nets have been used for the trawl component of the acoustic survey. Because net samples are used to validate the acoustic signal, it is important that backscatter from fish lengths seen in the acoustic signal match the length proportions evaluated by the nets. Hence, with changes in nets, NMFS has also tested the catchability of the net by using retention pockets to test for net selectivity and used these data to adjust data accordingly.

The aging program for pollock is very comprehensive. I make a few suggestions to explore in order to improve efficiencies and variance estimates.

Improvements to the stock assessment include the evaluation of a spatial GLMM to replace the area-swept method of estimating abundance. The GLMM allows for use of non-normal distributions and associated link function, and includes both fixed and random effects, thus improving variance estimation. It is a nice improvement. Although not ready for implementation, a new geostatistical approach to estimating biomass was presented during the meeting. The presentation shows real promise and it is an avenue of research worth pursuing.

Acoustic surveys follow strict protocols to validate aspects of the survey. To validate the acoustic signals, net samples are also taken as part of the acoustic protocol. Net selectivity is measured by attaching fine-mesh pockets to the net to quantify the size and proportional abundance of fish able to pass through the nets. The additional use of a stereo camera to validate species identification and lengths is also an important component of validation. The ability of the acoustic survey to measure biomass depends of the distribution of fish across the shelf and the timing of fish movement to the spawning grounds. It is a challenge to measure biomass of prespawners when the scheduled ship timing may not match the movement of fish under changing response to climate drivers. The survey teams are aware of this as is the assessment team. I discuss the issues of using gonad-free weights to calculate biomass, but I don't envision this to be a significant problem. I also encourage the continued research into using moored bottom echosounders. There are challenges in calibrating moored and towed echosounders, and also to the difference in what the data time-series are measuring. Nonetheless, I would see this as an important line of development.

The output of the ADMB model with that of a newer version of Stock Synthesis was presented at the meeting. There was little significant difference between the model output. An earlier version of Stock Synthesis had been used in 1989. The issue of which model to use then becomes the importance of flexibility in coding the models, the ease of learning the programs and the importance of using a standardized approach. This is a decision that should be examined by the Scientific and Statistics Committee (SSC) of the North Pacific Fishery Management Council (NPFMC) and the Alaska Fisheries Science Center (AFSC).

It was heartening to see the ongoing research to quantify predation mortality in the GOA. Advances are steadily made in understanding GOA ecosystem function and the sources and magnitude of predation mortality to pollock. Although not ready for incorporation into the stock assessment model at this time, the advances toward better quantification of natural mortality are important to the assessment.

Background:

The walleye pollock (*Gadus chalcogrammus*) sustains an important fishery in the Gulf of Alaska (GOA). Although genetic results are equivocal, it is considered a separate stock from the Eastern Bering Sea (EBS) and is managed as its own unit. GOA pollock had been a target of foreign fishing in the 1970s, but has become fully domestic since the 1980s. Most of the catch is landed in just three ports, which allows for easier monitoring. It is a shore-based fishery with 90% of the catch taken in pelagic trawls. Ninety-five percent of the catch is pollock, so incidental catch is low. Chinook salmon are the most important prohibited species caught as bycatch and when bycatch of this species exceeds its limit, the fishery can be suspended. Recent management measures have decreased the catch of chinook.

Important predators of pollock are Steller sea lions and Pacific halibut, and on young fish, Arrowtooth flounder. Steller sea lion abundance has stabilized recently and Arrowtooth flounder abundance has increased (Aydin et al. 2007). In fact, predation mortality on pollock is likely to be higher than fishing mortality (Dorn et al., 2011). Ecosystem analyses are now broken into the eastern and western GOA. For the past few years warm conditions have affected the GOA, changing the abundance and type of zooplankton available to higher trophic levels. The A Climate-Enhanced, Age-based model with Temperature-specific Trophic Linkages and Energetics (CEATTLE) multi-species stock assessment has been applied to the EBS pollock, but to my knowledge not to the GOA pollock. To permit sufficient pollock to support the Steller sea lion recovery, The Total Allowable Catches (TAC) of GOA pollock has been apportioned into four seasons so as to spread out the catch.

The current stock assessment model (since 1999) is a catch-at-age, specially built model coded in AD model builder (ADMB) which relies on likelihood estimation of parameters. The assessment includes 2-10+, assumes a constant natural mortality of 0.3, and an empirical estimate of annual recruitment. The model has similar assumption to Stock Synthesis. Data that is used in the assessment (Dorn et al. 2016) is:

Source	**Data**	**Years**
Fishery	Total catch	1970-2015
Fishery	Age composition	1975-2015
Shelikof Strait acoustic survey	Biomass	1992-2016
Shelikof Strait acoustic survey	Age composition	1992-2016
Summer acoustic survey	Biomass	2013-2015

Summer acoustic survey	Age composition	2013,2015
NMFS bottom trawl survey	Area-swept biomass	1990-2015
NMFS bottom trawl survey	Age composition	1990-2015
ADFG trawl survey	Area-swept biomass	1989-2016
ADFG survey	Age composition	2000-2014

Review Activities:

Review of the Gulf of Alaska Walleye pollock stock assessment was held at the Alaska Fisheries Science Center in Seattle, May 22-25, 2017. The stock assessment was accepted by the NPFMC last year, so this review was not held for acceptance of an assessment but rather with the expectation that three CIE reviewers provide insights for improving future data quality, model approaches, integration of surveys, etc.

Prior to the meeting, I reviewed documents that were provided for us on a Google drive site two weeks before the meeting. For the first two days of the meeting, there was a series of presentations that covered issues related to the five terms of reference that reviewers were given. On Wednesday, the reviewers requested further clarification of the assessment team on several issues and began work on the report Wednesday and Thursday. Reviewers contributed equally to the discussions. In particular, I discussed some improvements to using otoliths to assess age and growth and with the use of Markov chain Monte Carlo (MCMC) convergence chains in the assessment. The AFSC scientists were very helpful in providing information and materials to the review panel both during and after the meeting.

Upon my return home, I re-read the documents and obtained several other references to help me clarify my understanding of the assessment. I also reviewed CIE reports for the previous assessment. These are listed in the references section of this document.

The meeting agenda was:

<u>Monday, May 22, 2015</u>

9:00 a.m.	Welcome and Introductions, Adopt Agenda	Anne Hollowed
9:15 a.m.	Overview of biology, surveys, fishery, management system	Martin Dorn
10:00 p.m.	Gulf of Alaska bottom trawl survey	Wayne Palsson 1 hr
11:00 p.m.	Acoustic surveys in the Gulf of Alaska	Chris Wilson 1 hr
12:00 p.m.	Lunch	
1:30 p.m.	Acoustic survey research projects	Kresimir Williams and Alex DeRobertis 1 hr
2:30 p.m.	Fishery monitoring of the GOA pollock fishery	Chris Rilling or designee 1 hr
3:30 p.m.	Age reading	Tom Helser or designee 1 hr
4:30 p.m.	Role of pollock in the GOA ecosystem	Kerim Aydin or designee 1/2 hr

5:00 p.m. Meeting adjourns for the day

Tuesday, May 23, 2017

9:00 a.m. Morning welcome and announcements

9:15 a.m. pollock stock assessment model Martin Dorn 3 hrs

12:00 p.m. Lunch

1:30 p.m. pollock stock assessment model (continued)

3:30 p.m. Discussion of proposed assessment model changes

5:00 p.m. Meeting adjourns for the day

Wednesday, May 24, 2017

9:00 a.m. Morning welcome and announcements

9:15 a.m. Evaluation of alternative model configurations

12:00 p.m. Lunch

1:30 a.m. Continued evaluation of alternative model configurations

Thursday, May 25, 2017

9:00 a.m. Report writing. AFSC analysts will be available to respond to requests and to answer questions

Summary of findings for each TOR wherein weaknesses and strengths are described, with conclusions and recommendations in accordance with terms of reference:

The terms of reference (TOR) are listed below. Summary of my findings for each TOR follows.

Terms of Reference for Peer Review of the Gulf of Alaska Walleye pollock Stock Assessment

1) *Evaluation of the ability of the stock assessment model, with the available data, to provide parameter estimates to assess the current status of pollock in the Gulf of Alaska.*
2) *Evaluation of the strengths and weaknesses in the stock assessment model for GOA pollock.*
3) *Review of the use of indices from spatial delta-GLMM models rather than area-swept estimates as abundance indices for the bottom trawl survey.*
4) *Review of the use of biomass and size composition estimates from the acoustic survey that have been corrected for net selectivity.*
5) *Potential evaluation of an equivalent walleye pollock assessment model in Stock Synthesis*

TOR 1. Evaluation of the ability of the stock assessment model, with the available data, to provide parameter estimates to assess the current status of pollock in the Gulf of Alaska.

The stock assessment model relies on both fishery-dependent and fishery-independent data input. Data provided from the fishery are total catch and length and age composition. Age composition is obtained from analysis of otolith annuli taken by on-board observers. Fishery-independent data are obtained from two acoustic surveys (one in Shelikof Strait and one broad scale in summer) and two bottom trawl surveys (NMFS bottom trawl and ADFG trawl). Data are taken for length and otoliths are extracted to provide estimates of age from both acoustic survey trawls, and NMFS and ADFG trawls. Additionally stomach contents are obtained from the NMFS bottom trawl survey. Abundance is estimated from bottom trawls with an area-swept method.

About 75% of the tows contain pollock. Abundance varies depending on the presence of periodic dominant year classes.

There are some challenges with the data that have been effectively handled by the assessment team. In 2007, the Oscar Dyson, a “quiet” ship replaced the Miller Freeman as the ship used to conduct Shelikof Strait acoustic surveys. At that time a side-by-side comparison was done to calibrate the ratio of “catchability” between the two ships and this ratio used to weight acoustic survey data in the time series. Because such comparisons are always time limited, the ratio would not be a full realization through the time series. However, as the new time series data accumulate, this is less and less of concern. Over time, different nets have been used for the trawl component of the acoustic survey. Because net samples are used to validate the acoustic signal, it is important that backscatter from fish caught in the acoustic signal match the nets. Hence, with changes in nets, NMFS has also tested the catchability of the net by using retention pockets to test for net selectivity and used these data to adjust data accordingly. Previous reviewers have reviewed the problems in matching acoustic methods to estimate biomass with compositional data from the trawls. Many of these suggestions have been implemented in this latest assessment.

The bottom trawl survey has been done in odd years since 1999, has used about 20 vessels since its inception, has standardized start dates, and is not targeted specifically to pollock. Because it is a general survey, there is more variability in the pollock catches. Because the survey has a fixed start date, there can be a mismatch between the timing of the cruise track and the presence of spawning pollock. Also, some areas can’t be sampled because they are rocky, and there is a potential to under-sample pollock if they use these habitats. NMFS is aware of this limitation and has explored options to assess these habitats. A problem that plagues bottom trawls, and especially non-targeted ones, is the presence of zero catches in tows. Sometimes a large portion of the tows are empty of the target species and this leads to non-normally distributed abundances data. I cover options on modeling this in TOR 3.

The aging program for pollock is very comprehensive. Fish samples for otolith removal are taken randomly from the catch so as to be proportional to the yearclass occurrence in the fishery. This approach makes for a straightforward projection of abundance at age. But it also means that lots of 1s and 2s are aged with otoliths and that some older age classes may be missed. I suggest that NMFS look into a potential efficiency based on length. If length is a near perfect indicator of age 1 fish, for example, then there is little gained in examining all the otoliths in this size range. NMFS knows the proportion of these lengths in the sample and this gives them the proportion of 1s. It is also important to have a sub-sample of this length category to validate with far fewer otoliths that these are all 1s. If this is workable, it could save time and money.

I would also suggest three additional avenues for research. Otolith weights can provide a proxy for age in some species and can also be used as covariates to reduce variance. I suggest that AFSC scientists test to see if walleye pollock are a species that would benefit from this approach. One of the scientists also mentioned that the annuli on older fish are more difficult to see. We see this frequently in the fish that are aged in our laboratory. In our laboratory, we use Flo-Texx (Lerner Laboratories) as a liquid coverslip to clarify annuli for various species with ages ranging into the 60s. We find that the use of Flo-Texx often clarifies outer rings. In another query, I understood that the ageing laboratory doesn’t test for ageing drift over time. This occurs when protocols are modified and personnel change, resulting in a drift of criteria in evaluating annuli. I also suggest that each year the agers re-age (blind test) otolith samples from previous years as a test of whether there is any ageing drift over time. I can make our protocols for this available if requested.

TOR 2. Evaluation of the strengths and weaknesses in the stock assessment model for GOA pollock.

Model inputs include fishery catch, catch-at-age, Shelikof Strait acoustic survey, NMFS and ADFG trawls which have been discussed above. The current model is programmed in ADMB.

The strength of these input data lies in their long time series. The vast majority of pollock are landed in just three ports, there is good observer coverage of the fleet, and data are submitted electronically. For fishery-independent data, even though gear and ships have change, NMFS has been careful to standardize data as much as possible. There is a bit if concern that the ADFG trawl abundances are showing a downward trend contrary to the NMFS data and this could be investigated further to uncover the reasons for the different estimates. ADFG may be surveying a different sub-unit of the population (the age structure differs), and this area may be subject to different impacts from climate warming.

It has been unclear from the meeting and from the documentation if the weight length keys are based on gonad-free weights. My concern is that female weights will vary by 15% or so for a batch spawner depending when they are sampled in the spawning period. If gonad-free weights are not being used, then they are adding unnecessary variance to the biomass estimates. If it is not practical to remove gonads from all samples, then a subsample can be done and used for correction. Because the surveys have relatively fixed starting dates, and because spawning is more dependent on temperatures not the calendar, fish can be in different maturity states between years that result in differing estimates of female weights.

I discussed with Dr. Dorn the approach to the MCMC for measuring the convergence in the ADMB model. I recently completed a graduate course in simulation modeling where we spent considerable time discussing convergence criteria. Most simulation references recommend using three chains and the Gelman-Rubin criteria to test for convergence. Right now the ADMB model uses only a single chain. I am not accomplished enough a programmer in ADMB to know how to program three chains, but I recommend that Dr. Dorn pursue this because a single chain can give false evidence for convergence that is resolved with three chains.

As I understand for the acoustic survey data, q is freely estimated and highly variable which translates into additional variability in estimates of abundance. If not already done, one suggestion would be to have running average bounds set for q to remove some of this variation; variation is more likely due to patchiness in pollock size distributions and how the nets are towed through the patches. Reviewers often suggest the use of informed priors in a Bayesian analysis. I don’t know if that has been tried or if it would be useful. This might help in fitting the abundance data and avoid outliers as seen for age 2 from the acoustics data. I recognize that it is a challenge to rectify proportions at length between the trawl and the acoustic signals.

Several parameters are estimated outside of the model, for example the natural mortality rate, M, with a new age-specific pattern from 2014. The approach was thoughtful and seems reasonable. I don’t have further suggestions beyond what they are doing. I also believe that the new random effects model for fishery weights at age is justified and will perhaps result in improvements for variance estimation. The other parameter estimated independently is percent maturity. Because maturity is taken on the spawning grounds, these may be censored data. Previous reviewers have suggested that immature fish would be under-sampled and the logit function mis-specified. I would agree, but it is not a simple task to properly sample for maturity schedules in a stock that spans an area as large as the US East Coast and with a changing temperature regime. However, it would be nice to see samples taken outside these grounds as a random check on the assumptions that are being relied upon.

Previous reviews of the pollock stock assessment model have suggested adding terms to account for predation mortality on M. AFSC scientists have made progress in quantifying ecosystem effects on pollock, but not to the extent that an additional component of natural mortality has been added to the model. Simple modeling suggestions abound, but I don't see these are reasonable because of the complex nature of functional responses of the predators to their pollock prey. The predation mortality on pollock is not a simple matter of a numerical response. It is also the predator's functional response to prey abundance and with several predators that cause mortality at different life stages, this modeling is not simple. During the meeting, scientists presented their latest research into ecosystem effects and I encourage continued work in this area, especially given the stability and potential increase in Steller sea lion abundance.

<u>TOR 3. Review of the use of indices from spatial delta-GLMM models rather than area-swept estimates as abundance indices for the bottom trawl survey.</u>

The assessment team has used alternate models, 16.2 that uses delta-GLMM estimates of abundance from trawl surveys and 16.4 that uses a spatial GLMM index. Admittedly the use of area-swept estimates for abundance provides challenges to stock assessment. Over the years there have been various approaches to deal with zero abundance tows that result in non-normal data starting with Pennington's use of the delta distribution approach which separated out zero tows into their own strata and then worked to normalize the remaining abundance data. Newer approaches use distributions other than the normal or use link functions that bridge alternate distributions to the normal. Nonetheless the presence of zeros remains a challenge to estimation. This is especially true when the zero tows are spatial intermixed with positive tows. The challenge to obtain minimal variance estimates with stable central tendency has also been addressed in the ecological literature (see Zuur's publications on zero inflated models) and that literature may hold some alternate methods that could be explored.

The use of the spatial GLMM appears to be a good avenue to explore. The assessment team has made good progress although the approach does not appear to be fully developed. A GLMM model simultaneously accounts for non-normal distribution of abundance and the problem that different sampling components have random versus fixed effects. It might also be worthwhile to pursue research into the latest spatially explicit models to estimate abundance. In a comparison between the area-swept method and the spatial GLMM, the GLMM had a tendency to produce estimates with greater abundance (6 of 12; 5 equal; 1 under). Perhaps that isn't surprising if the zero tows pull down the arithmetic mean but I would suggest that the assessment team clarify the reason for the higher estimates.

TOR 4. Review of the use of biomass and size composition estimates from the acoustic survey that have been corrected for net selectivity.

I've covered some of these issues in TOR 2. The acoustic surveys follow strict protocols to validate aspects of the survey. To validate the acoustic signals, net samples are also taken as part of the acoustic protocol. Net selectivity is measured by attaching fine-mesh pockets to various areas of the net to quantify the size and proportional abundance of fish passing through the mesh of the standard net. To validate the length and species compositions interpreted from the acoustic signals, trawl samples are interspersed to validate species and length. Additionally, a stereo camera was mounted to the net to validate species identification and species lengths as fish entered the net. The stereo camera can be used with an open cod-end to estimate species and proportion at length when towing through dense aggregates. It wasn't clear to me how variance is estimated when the stereo camera is used.

The acoustic surveys are designed to measure the abundance of prespawners. Once spawning commences, fish spawn and then emigrate from the grounds. Hence the timing of the surveys is critical in obtaining an unbiased measure of abundance. Part of the protocol is to measure the proportion at maturity stage. If a high proportion of spawning or spent females is encountered, then the surveyors know that they are obtaining a lower-bound estimate of abundance. In 2016, the most predominant spawning grounds were measured prior to spawning and, so, these estimates should be correct. To be careful, two methods of measuring abundance from backscatter were done and matched. Steinessen et al. 2017 report seems to indicate that the coverage area of the winter surveys had changed between years. I wasn't able to discern if that had any impact on abundance estimates. That should be made clearer in the next report.

It wasn't as clear to me from the documentation or in the meeting, how weights were calculated from the surveys. During the acoustic surveys, gonads are weighed and a gonadal somatic index (GSI) is calculated. The GSI of spawning females was in the range of 11% and the GSI of prespawners 7-9% or so. This is typical of a batch spawner. Fisheries prefer to calculate weights as gonadal free because additional variance is introduced depending on the stage of maturity during the survey. It wasn't clear from the documentation if gonad free mean weights were used to calculate weight at age abundances. If this isn't being done, then it will be introducing variance of about 5% or so (assuming half females which have a higher GSI than males).

AFSC has been experimenting with the potential of moored echosounders. Moored arrays could provide season long measures of abundance and potentially cost less than shipboard surveys. Preliminary study shows that five echosounders would provide sufficient coverage. Several difficulties must first be overcome before they can be relied on. They need to be calibrated with the ship surveys because they use different equipment with different frequencies and in experiments, they give different measures of abundance. This research could be very useful and cost effective and I encourage NMFS to keep developing the use of moored echosounders.

TOR 5. Potential evaluation of an equivalent walleye pollock assessment model in Stock Synthesis

The ADMB model was constructed to match Stock Synthesis version 3.24U invoking the weight-at-age option in SS3; it was not a surprise that the assessments match each other. Specification were that steepness=1. It would be interesting to see how well these models match if h was 0.8 or so that some Beverton-Holt relationship were modeled. Bottom trawl net selectivity differed slightly with ADMB higher at ages 1 and 2 and lower at 5-7. The estimates of F, SSB and recruitment closely matched. Hence, changing from the ADMB model to Stock Synthesis would be evaluated on the basis of flexibility, availability of software and software updates, amount of training required to use each model framework, and institutional norms.

I would not claim that I have expertise in Stock Synthesis. I did, however, teach a graduate course in Likelihood to biologists and statisticians that used ADMB and teaching it was enlightening. In teaching that course, I found that once students understood likelihood, they were able to write the code in either R or ADMB. For complex models, ADMB was better than R for its time efficiencies. However, the error codes in ADMB were, at times, obtuse. Years ago ADMB was neither well documented nor well supported but that is no longer the case. Still, it requires a steep learning curve and statistics graduate-level understanding of likelihood.

I am less familiar with the actual coding of Stock Synthesis although in our discussion at the meeting, it was presented as being a bit more of a standardized, black box program. If that is true, then it would be easier to use but also less flexible unless the core code is available to be modified.

One concern that I did have for the ADMB model was its use of only one MCMC chain. I don't know whether this is an issue in Stock Synthesis. I have stated this concern in my response to TOR 2. The concern is that one chain can mislead one into thinking that convergence had been achieved when in fact it hadn't. That concern is eliminated when three chains are used and a metric such as the Gelman-Rubin criteria is used.

Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products:

This review of the GOA pollock assessment differed from the SARC or SAW process. The assessment had already been accepted by the NPFMC and our job was not to approve or disapprove of its use for management. We were to provide a general review with suggestions to improve the model, and provide insights to alternate ways of handling sampling and data analysis. I commend the NMFS AFSC for this approach. It gives a reviewer more scope to engage creatively to improve the assessment and data collection.

I found that reading previous CIE review reports was helpful in understanding more subtle issues with the assessment and in seeing that many of the suggestions had been addressed and incorporated. Even though the reviews are available on line, it was convenient to have them available as background material. One concern with making the reports available would be that new reviewers could be “trapped” into focusing on old concerns. That will depend on the independent-mindedness of the new reviewers. Perhaps a way to avoid this, but also provide insights, would be to include a presentation showing how previous suggestions were addressed.

It was very helpful to have a folder of published papers to support the stock assessment documents provided for our review. I like to read the abstracts of these published papers at the very least to be better informed during the meetings. I did not have time to do my own search for this meeting and the folder of published papers was useful.

Appendix 1: Bibliography of materials provided for review

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<u>BACKGROUND INFORMATION</u>

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(1) <u>Presentations at the review</u>

- "Overview: Gulf of Alaska pollock" presented by Dr. Martin Dorn:
- "Gulf of Alaska Bottom Trawl Survey" presented by Dr. Wayne Palsson:
- "Gulf of Alaska Acoustic-Trawl Surveys Overview" presented by Dr. Chris Wilson:
- "Development and applications of bottom-moored echosounders" presented by Dr. Alex De Robertis:
- "Ecosystem Considerations Report" presented by Kerim Aydin

- “GOA Walleye pollock (*Gadus chalcogrammus*) Age Determination at the Alaska Fisheries Science Center” presented by Delsa Anderl
- “Gulf of Alaska pollock assessment” presented by Martin Dorn
- “GOA pollock: ADMB vs SS smackdown” presented by Martin Dorn
- “Dynamic changes in eastern Bering Sea groundfish stocks and relative impacts of growth and recruitment and consequences for fisheries management” presented by Jim Ianelli
- “Spatio-temporal index standardization for survey data” presented by Curry Cunningham and Jim Ianelli

Appendix 2: A copy of this Statement of Work

Statement of Work

National Oceanic and Atmospheric Administration (NOAA)

National Marine Fisheries Service (NMFS)

Center for Independent Experts (CIE) Program

External Independent Peer Review

Fisheries Stock Assessment for Walleye pollock in the Gulf of Alaska

Background

The National Marine Fisheries Service (NMFS) is mandated by the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act to conserve, protect, and manage our nation's marine living resources based upon the best scientific information available. NMFS science products, including scientific advice, are often controversial and may require timely scientific peer reviews that are strictly independent of all outside influences. A formal external process for independent expert reviews of the agency's scientific products and programs ensures their credibility. Therefore, external scientific peer reviews have been and continue to be essential to strengthening scientific quality assurance for fishery conservation and management actions.

Scientific peer review is defined as the organized review process where one or more qualified experts review scientific information to ensure quality and credibility. These expert(s) must conduct their peer review impartially, objectively, and without conflicts of interest. Each reviewer must also be independent from the development of the science, without influence from any position that the agency or constituent groups may have. Furthermore, the Office of Management and Budget (OMB), authorized by the Information Quality Act, requires all federal agencies to conduct peer reviews of highly influential and controversial science before dissemination, and that peer reviewers must be deemed qualified based on the OMB Peer Review Bulletin standards. (http://www.cio.noaa.gov/services_programs/pdfs/OMB_Peer_Review_Bulletin_m05-03.pdf). Further information on the CIE program may be obtained from www.ciereviews.org.

Scope

The Alaska Fisheries Science Center's (AFSC) Resource Ecology and Fisheries Management Division (REFM) requests an independent review of the integrated stock assessment that has been developed for Gulf of Alaska walleye pollock. The fishery for these species is managed by the North Pacific Fisheries Management Council. The ABC for pollock in the Gulf of Alaska is 203,769 t in 2017. The catch limits are established using Automatic Differentiation (AD) Model Builder software that uses survey abundance data and survey and fishery age and length composition data with a harvest control rule to model the status and productivity of these stocks and set quotas. Having these assessments vetted by an independent expert review panel is a valuable part of the AFSC's review process. The Terms of Reference (TORs) of the peer review and the tentative agenda of the meeting are below.

Requirements for CIE Reviewers

NMFS requires three reviewers to conduct an impartial and independent peer review in accordance with the SOW, OMB Guidelines, and the TORs below. The reviewers shall have working knowledge and recent experience in the application of fisheries stock assessment processes and results, including population dynamics, separable age-structured models, harvest strategies, survey methodology, and the AD Model Builder programming language. Experience with the Stock Synthesis Assessment Model would also be helpful. They should also have experience conducting stock assessments for fisheries management.

Statement of Tasks

- Review the following background materials and reports prior to the review meeting:

Dorn, M.W., K. Aydin, B. Fissel, D. Jones, W. Palsson, K. Spalinger, S. Stienessen. 2016. 1. Assessment of the walleye pollock stock in the Gulf of Alaska. In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. pp. 45-174. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, AK 99510. https://www.afsc.noaa.gov/REFM/stocks/assessments.htm

NPFMC. 2017. GOA Introduction. *In* Stock Assessment and Fishery Evaluation Report for the Groundfish

Resources of the Bering Sea/Aleutian Islands Regions. North Pacific Fisheries Management Council, Anchorage, AK.

https://www.afsc.noaa.gov/REFM/stocks/assessments.htm

Other materials relevant to the review of the pollock assessment will be made available by May 8, 2017, such as working documents, publications, and similar material.

- Attend and participate in the panel review meeting
    - The meeting will consist of presentations by NOAA and other scientists, stock assessment authors and others to facilitate the review, to provide any additional information required by the reviewers, and to answer any questions from reviewers
    - The review meeting is a public meeting and stakeholders that attend may provide perspectives and information relevant to the pollock assessment.
- After the review meeting, reviewers shall conduct an independent peer review in accordance with the requirements specified in this SOW, OMB guidelines, and TORs, in adherence with the required formatting and content guidelines; reviewers are not required to reach a consensus
- Each reviewer may assist the Chair of the meeting with contributions to the summary report, if required by the TORs
- Deliver their reports to the Government according to the specified milestone dates

Foreign National Security Clearance

When reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for reviewers who are non-US citizens. For this reason, the reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/ and http://deemedexports.noaa.gov/compliance_access_control_procedures/noaa-foreign-national-registration-system.html. The contractor is required to use all appropriate methods to safeguard Personally Identifiable Information (PII).

Place of Performance

The place of performance shall be at the contractor's facilities, and at the Alaska Fisheries Science Center, Seattle, Washington.

Period of Performance

The period of performance shall be from the time of award through July 14, 2017. Each reviewer's duties shall not exceed 14 days to complete all required tasks.

Schedule of Milestones and Deliverables: The contractor shall complete the tasks and deliverables in accordance with the following schedule.

Within two weeks of award	Contractor selects and confirms reviewers
No later than May 8, 2017	Contractor provides the pre-review documents to the reviewers
May 22-25, 2017	Panel review meeting
June 16, 2017	Contractor receives draft reports
June 30, 2017	Contractor submits final reports to the Government

Applicable Performance Standards

The acceptance of the contract deliverables shall be based on three performance standards:

(1) The reports shall be completed in accordance with the required formatting and content (2) The reports shall address each TOR as specified (3) The reports shall be delivered as specified in the schedule of milestones and deliverables.

Travel

All travel expenses shall be reimbursable in accordance with Federal Travel Regulations (http://www.gsa.gov/portal/content/104790). International travel is authorized for this contract. Travel is not to exceed $10,000.

Restricted or Limited Use of Data

The contractors may be required to sign and adhere to a non-disclosure agreement.

NMFS Project Contact:

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Seattle, WA 98115-6349

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Peer Review Report Requirements

1. The report must be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether or not the science reviewed is the best scientific information available.

2. The report must contain a background section, description of the individual reviewers' roles in the review activities, summary of findings for each TOR in which the weaknesses and strengths are described, and conclusions and recommendations in accordance with the TORs.

   a. Reviewers must describe in their own words the review activities completed during the panel review meeting, including a brief summary of findings, of the science, conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each TOR even if these were consistent with those of other panelists, but especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the summary report that they believe might require further clarification.

   d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

   e. The report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed.

3. The report shall include the following appendices:

Appendix 1: Bibliography of materials provided for review

Appendix 2: A copy of this Statement of Work

Appendix 3: Panel membership or other pertinent information from the panel review meeting.

Terms of Reference for the Peer Review

1. Evaluation of the ability of the stock assessment model, with the available data, to provide parameter estimates to assess the current status of pollock in the Gulf of Alaska.
2. Evaluation of the strengths and weaknesses in the stock assessment model for GOA pollock.
3. Review of the use of indices from spatial delta-GLMM models rather than area-swept estimates as abundance indices for the bottom trawl survey.
4. Review of the use of biomass and size composition estimates from the acoustic survey that have been corrected for net selectivity.
5. Potential evaluation of an equivalent walleye pollock assessment model in Stock Synthesis

Tentative Agenda

TBD

Alaska Fisheries Science Center

7600 Sand Point Way NE

Seattle, WA 98115

May 22-25, 2017

Point of contact: Martin Dorn (Martin.Dorn@noaa.gov)

Appendix 3: Panel membership or other pertinent information from the panel review

Participants of the CIE review of the Gulf of Alaska pollock stock assessment, May 22-25, 2017

Name Affiliation

James Ianelli, AFSC, Chair

Martin Dorn, AFSC, Lead assessment author

Kresimir Williams, AFSC

Alex De Robertis, AFSC

Patrick Ressler, AFSC

Sarah Stienessen, AFSC

Abigail McCarthy, AFSC

Wayne Palsson, AFSC

Delsa Anderl, AFSC

Craig Faunce, AFSC

Jennifer Cahalan, AFSC

Kerim Aydin, AFSC

Ernie Weiss, Aleutians East Borough

Austin Estabrook, At-Sea Processors Association

Remote:

Jim Armstrong, North Pacific Fisheries Management Council

Katy McGauley, Alaska Groundfish Data Bank

CIE reviewers:

Yong Chen, School of Marine Sciences, University of Maine

Cynthia Jones, Old Dominion University

Kurtis Trzcinski, University of British Columbia

AFSC: Alaska Fisheries Science Center