CIE Independent Peer Review Report

Aleutian Islands Atka Mackerel and Walleye Pollock Stock Assessments

Panel Review Meeting 9-13 June 2008, Alaskan Fisheries Science Center, Seattle Washington

Prepared for the Center for Independent Experts

By:

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I. Executive Summary

Researchers at the Alaskan Fisheries Science Center have developed a general stock assessment model (Assessment Model for Alaska: AMAK) which uses AD Model Builder as an engine. AMAK was applied to the Aleutian Islands (AI) Atka mackerel and walleye pollock assessments. These assessments along with background information (observer sampling and coverage, estimation of age and growth, overview of bottom trawl survey, Atka mackerel tagging, Atka mackerel spawning characteristics and habitat, Aleutian Islands ecosystem and food web linkages, and age-structured multispecies modeling) were presented to the Center of Independent Experts (CIE) review panel at the Alaskan Fisheries Science Center on June 9 to 13.

Project leaders Sandra Lowe, Steven Barbeaux and Dr. Jim Ianelli presented the stock assessment and eight others (see Appendix 3: Agenda) presented background and other relevant materials. Overall, I found the presentations well organized giving the review panel a thorough overview of the background and methods. The presentations were good, but at times were disjointed. Future plans for research were suggested and the researchers sought input on these ideas, but I thought a more structured and cohesive presentation of specific concerns and future avenues of research would have helped produce more specific and useful comments. As it was, they were somewhat buried in the presentations. The atmosphere and exchange of ideas was very good, but at times the meeting suffered from the lack of a Chair. I do not want anyone to overreact to this point, but the tempo of the meeting suffered a bit, several discussions went on too long and a few members held the floor too long.

Given the assumption of a closed population, which I have some difficulty with for pollock and some (but less) concern for Atka mackerel, I believe that a high quality assessment has been conducted which provides good advice to management. I have made some recommendations that could be adopted in the short term, and other recommendations for long term research. In particular, I suggest that studies of movement and the spatial heterogeneity of these species be pursued at the same time as methods for modelling the spatial structure of these populations are developed. Without a doubt, these populations, this ecosystem and the presence of large fishing exclusion areas presents a huge challenge to the assessment and the provision of advice.

II. Terms of Reference

Additionally, the review shall (to the extent practical) evaluate and provide advice on:

- The strengths and weaknesses of the modeling efforts for Aleutian Islands Atka mackerel and pollock assessments and harvest recommendations. Specifically, the review shall evaluate:
    - The analysts' use of fishery dependent and fishery independent data sources in the assessments;

- Gaps or inconsistencies in the population dynamics modeling methodology or logic;
- If uncertainties in assessment model results are appropriately applied to management advice; and
- Whether the assessments provide the best available science.

I have some concerns with the current use of fishery dependent and fishery independent data which could be easily dealt with if the paradigm of a closed stock is followed. I found some gaps or inconsistencies in the population dynamics modeling methodology or logic mostly related to how selectivity and catachability were modeled, but I also think that a variance in opinion should be allowed. Uncertainties in assessment model results are appropriately applied to management advice, if one truly believes the stock is a closed population. If the population is a meta-population or a population sustained by neighboring populations then the uncertainties may be inappropriate for management advice. If not formally incorporated, I think this uncertainty should be stated in the report. I believe that these assessments provide the best available science, but in the long term alternative methods of incorporating spatial structure should be pursued.

- The determination of appropriate sample size for the multinomial distribution used for survey and fishery catch-at-age in both models.

I will defer to Drs. Ana Parma and Chris Francis's comments on the determination of appropriate sample size for the multinomial distribution.

- The incorporation of differential growth parameters for Atka mackerel

I suggest incorporating the variation in growth of Atka mackerel by developing separate age-length keys by area and length-weight relationships by season.

- The incorporation of abundance and movement information from tagging studies of Atka mackerel

There has been a large amount of effort put into tagging Atka mackerel and I suggest that more effort be put into tag recovery. I also recommend that the analyst tests to see if incorporating this data improves model estimates and performance.

- The potential pitfalls and possible solutions to the use of pollock summer bottom trawl abundance index for a fishery that primarily occurs in the winter on a pelagic spawning population

I do not think there are serious pitfalls with conducting a summer bottom trawl survey to assess pollock abundance; rather, I think it could be an advantage. The real issue is stock definition which needs to be addressed with more studies on movement.

- For pollock assess the appropriate spatial delineation of fisheries and survey data.

I find it hard to make recommendations on the spatial delineation of fisheries and survey data, because the argument for the current approach was poorly justified and explained, and because I do not believe the stock is well defined. Consequently, I suggest that these artificial lines for assessment be broken and that AI pollock be modeled as a sub-component of the Bering Sea and/or Gulf of Alaska. However, this is a huge endeavour and should be a long-term research goal.

III. Summary of findings

It is difficult to estimate Aleutian Islands Atka mackerel and pollock population size and trends for many reasons. The most prominent of these is the patchy distribution of the population, the difficult terrain over which a survey is trying to operate and closures to fishing due to Steller sea lion management. These difficulties lead to high variability in survey estimates and questions about the representiveness of fishery based data. To complicate things further the stock unit is ill defined for both species. Pelagic surveys have only found juvenile Atka mackerel (< 2 years old) outside the stock unit in the Bering Sea, and there is some question about the degree of movement between the Gulf of Alaska (GOA) and the AI. Currently the GOA is treated as a separate stock but it is thought that much of the recruitment comes from the AI. Pollock are thought to move much more than mackerel and there is large uncertainty about the degree to which the AI stock mixes with the Bogoslof Island and Central Bering Sea stocks. These seem to be the core difficulties in assessing these stocks, and overall the authors have done a good job dealing with these issues, however, it was difficult at times to determine how well founded decisions about the data or analysis were particularly when buried in previous documents.

The survey operates under some difficult conditions. There are only 412 trawlable units in the survey (most of which are trawled every year) which are then used to estimate a biomass over a huge area (about 6 to 7 times the size of the cod and haddock stock units I work with). Clearly, it is difficult to estimate biomass, as the survey data shows high variability among tows (CV, Table 15.4, Figs 1A.5, 15.6), and it appears that the survey could not tow more without returning to a previous spot. There was little discussion at the meeting about ways to improve the survey, and perhaps there are none, but its effectiveness in estimating biomass trends should continue to be of concern. For example, are tows taken in both day time and night time? If not, could they? If so, this variation could be taken into account when estimating biomass for mackerel, which are up in the water column during the day, and pollock which are up at the night. Both assessments presented temperature at depth data. I suggest using this and other similar data to refine abundance estimates and possibly the aerial expansion factor. I presume the estimates are stratified estimates of abundance. What is the stratification scheme, depth? Could the stratification be improved? The authors of the mackerel assessment suggest improving survey stratification with habitat mapping (section 15.11), which seems like an important of future research. If such analyses do not reduce the variation in the biomass estimates, then the AFSC might consider a small dedicated but widespread Atka mackerel and pollock survey using smaller boats and different gear which would be able to access more

area. This is no small undertaking and I am reluctant to recommend it, but it may be feasible if done in collaboration with industry.

Much of the information in these assessments comes from the fishery prior to spatial closures in 1999, after which most of the data comes form the survey. This pattern is much more pronounced for pollock than mackerel as fishing mortality goes close to zero. I suspect such a switch in what sources of data are dominating the model fit could have important consequences for estimating trends in biomass. Presumably effective sample sizes for the age composition data reflect these changes and are accordingly down weighting the fishery data in the recent period. It *might* be interesting to run the pollock assessment model up to 1998 and look at the contribution of each data set to the likelihood and then compare it with the model run out to 2007 (or perhaps for every year in the assessment). This exercise will probably tell us what we expect, that the current estimate of SSB is dominated by the age composition in the survey, but it may show that old catches tend to still be an important component of overall fit particularly when surveys are only done every 2 to 3 years. The Steller sea lion fishing closures have probably protected a segment of the population, but it also make it more difficult to observe this segment of the population, which could cause some bias in the model. There may be a retrospective problem with the estimate of SSB, but I cannot tell without further analysis. I suggest that a retrospective analysis be done to see if there is any pattern and if so that some simulations be done to see if spatial closures could be generating a retrospective pattern.

The difficulties with stock definition, survey coverage and fishery closures lead me to consider the importance of tagging data. I was surprised there was little to no discussion of methods used to define stock structure. In the pollock assessment there is a reference to Bailey et al. (1999) which did not appear in the reference section. I tracked it down and found it immensely useful. My interpretation of Bailey et al. is that spawning areas are fairly well defined, adults move throughout the Bearing Sea and AI when feeding, and there is the potential for larval transport between the GOA and AI, and the Bearing Sea and AI. There appears to be little spawning in the AI. We do not know if there is natal philopatry or the degree of exchange between regions. Historically, tagging studies have been used to define stock structure in many populations around the world and I presumed there had been extensive tagging of pollock. In fact, it appears that little traditional tagging has been done. Bailey et al. recommend more tagging studies particularly of spawning individuals along with more advance methods such as otolith chemistry. There probably have been numerous publications, meetings and discussions about the stock structure of pollock, and I think that this needs to continue, but perhaps with more of an emphasis on the relationship to assessment. My interpretation of Bailey's interpretation is that AI pollock is not a self-sustaining population; rather, it is a satellite population that is mostly dependent upon input (larvae and/or adults) from neighbouring populations. If this is the case, any stock recruitment relationship generated from a traditional assessment model is dangerously misleading, and estimates of reference points and fishing mortality nonsensical. If the flux of pollock is not too great over the 2 to 3 year interval in which surveys are conducted, then at least we could have some confidence in the survey biomass estimates. Alas, the estimates seem highly variable probably due in part to high

movement. I would have liked to have seen a table like 15.4 in the Atka mackerel assessment in the pollock assessment. In my view, this leaves the AI pollock population in a precarious and highly dependent situation. If the Bering Sea or GOA pollock do well, then AI pollock are expect to also do well. If this is true, then there should be a high degree of correlation between the survey estimates of these three areas. Currently, this is difficult to do because the surveys are conducted in different years. These observations are not particularly consoling to the assessment modeller or the manager as they are difficult to deal with on both levels. If the current closed population assessment model is to be used, then maybe advice could be modified by trends in other regions. In the long term, more formal spatial modeling should be a goal. There probably is spatial or meta-population structure to AI pollock which could be important to their stability and long term persistence.

I was impressed with the recent tagging work done on Atka mackerel. The studies presented were well designed to answer specific questions about local movement across the boundary of Steller sea lion management areas. It appears to me, however, that this data is under utilized for answering larger questions about the spatial distribution of Atka mackerel. Approximately 75,000 tags have been deployed between 1999 and 2006 (impressive!) and only 1,000 have been recaptured, a recovery rate of only 1%. The fishery is spatially restricted and the survey only occurs every 2 or 3 years, so the probability of recapture must be quite low. A greater number of recaptures could give information on the degree of population mixing and site fidelity of adults. It is assumed that Atka mackerel do not move much between islands, and this is a good opportunity to test it. I suggest some dedicated trips to try and recapture more fish, particularly in areas where the fish were not tagged, this could be done in conjunction with a mini-survey for pollock and mackerel (as suggested above). Finding Atka mackerel juveniles (<2 years old) along the shelf of the eastern Bering Sea in salmon pelagic trawl surveys is an important result which causes me to ask many questions about stock structure. Were any other salmon surveys done in other areas (GOA, Russia, Japan), and did they find any juveniles? Absence is also an important result. Have juveniles ever been found in the AI? Are juveniles drifting into the AI form other areas? Given the currents, are the juveniles in the Bering Sea though to be derived from the AI population? I think it could be very important to tag these juveniles and see where they end up. Can recruitment patterns in the AI be explained by environmental factors or human activity in the Bearing Sea? If this is just a displacement of the younger portion of the population do individuals return to their natal site (otolith chemistry) and what implications does it have for stock stability and management? By working more on tagging and tag recovery important questions about stock structure and maybe recruitment variability can be answered. Although this tagging study was not designed to estimate fishing mortality and stock size, I encourage the assessment scientists to do a model run where the probability of recapture is estimated and incorporated into the overall likelihood of the stock assessment model. The independent results of local population size and fishing mortality seem reasonable, and I suspect this could strengthen model estimates. The problem is that the probability of recapture is unequal across the stock area, hence my suggestion to increase tag recover effort over the entire stock area. Regardless, of whether this is done or not, I think there probably is a clever way to use this data, even if it is spatially restricted. One could

estimate the probability of recovery in that area given the expected biomass in that area from the assessment model.

I was concerned with how selectivity was estimated for the fishery and survey in both the mackerel and pollock assessments. First, why would you expect the selectivity of the survey to change annually? I would expect it to remain relatively constant over periods where the gear and survey methods stay the same. I am trying to think of some mechanisms which could cause the selectivity of a survey to change from year to year, but I am having difficulty thinking of any. It is more likely for the selectivity in the fishery to change over time, but is the fishery really so dynamic that the selectivity would change annually? Fig. 1A.4 shows that in 1995-1998 the fishery migrated westward as eastern areas became less productive. Do you think this change in fishing practice affects your model estimates? Is the size or age composition any different in theses areas? Is there any reason to expect that selectivity has changed? Sure, annual parameters make the model fit better, but it may hide other problems. There was a request at the meeting to compare the likelihood of a model with a change in selectivity in two time blocks with the likelihood of a model with annual selectivities, and I do not think the improvement was statistically significant. In general, I think it is important not to add parameters unless they significantly improve model fit. I suggest estimating selectivity in 2 or 3 time blocks based on changes in the fishery or survey. Secondly, the authors state that the fishery exhibits a dome-shaped selectivity pattern. Can you hypothesize a mechanism? Do they just pick up and leave? If older individuals are less vulnerable to the gear, then why? Do they outswim the gear? With a dome-shaped selectivity one must assume that there is a large unobserved biomass out there somewhere. Do you have reason to think this might be true? Later, in section 15.8 you state that 'importanat survey and catachability assumptions are sensible from biological and mechanistic standpoints.' If this is the case, I suggest you put the possible mechanisms in your report. I also noted that the model seemed to consistently overestimate recruitment (ages 1 and 2 in Fig. 15.19). This is somewhat surprising given the flexibility of your selectivity curves. I think Dr. Jim Ianelli found it was related to the smoothness penalty between ages. Overestimating recruitment could be a serious problem, which I encourage Dr. Ianelli to hammer out.

The greatest technical concern revolved around fixing q. Dr. Chris Francis requested a profile q at the meeting. I think both assessment models showed that q could not be estimated where one was infinitely small and the other infinitely large. I suggest putting the profiles in each document. This would give the authors some justification for fixing q. I am not sure why q can not be estimated. Certainly, the short time series of the survey is part of the reason, but maybe the survey is simply not a good index of population size, particularly if the population is larger than the AI. I understand fixing q is a way to provide some advice, but if q can't be estimated, there must be a larger problem.

It is interesting to note that all runs of Doug Kinzey's minimum realistic model including Atka mackerel, pollock and Pacific cod estimated less mackerel, and most runs estimated more pollock than the single species models. Certainly, this type of model is important to continue and the results should be used to provide context in individual assessments.

Comments specific to each assessment

Chapter 15. Stock Assessment of Aleutian Islands Atka Mackerel. 2007. Lowe et al.

I would go about the whole length-at-age and weight-at-age problem differently. The differences in length at age from west to east suggest that separate age-length keys should be developed for each sub-region. This variation is probably more important to account for than annual variation in growth, but this should be tested. It also would be important to have separate length-weight relationships for estimating the catch-at-length for seasons A (pre-spawning) and B (post-spawning). When estimating weights-at-age, consideration should be given to using season and year-specific relationships, if possible. Season could be more important than the year effect.

In the meeting you did some additional runs which showed there is a conflict between fitting age composition and survey biomass data. What does this tell you about the survey? You seem to be able to track cohorts well in your age data, and given all the problems with the survey it seems reasonable to weight the age composition data a bit more.

P. 827. 15.1 Introduction. Stock structure. You question weather AI and GOA populations should be managed as a unit or separate populations. This seems like a huge question that could have had more treatment in your document and discussion in our meeting. You seemed to plough ahead with the paradigm of separate populations, but it would be nice to compare these results with an alternative, spatially-explicit, approach. I hope this is considered as a longer research agenda.

P. 829. 15.2.3 Management History. The fishing season is broken up into two periods (A-season and B-season). Is there any reason to believe that the fishery is different spatially or that the gear is more or less efficient?

P. 830. 15.2.4 Bycatch and Discards. Please state in the document what the observer coverage was. It was nicely presented at the meeting.

P. 834. 15.3.2 Survey Data. The US-Japan cooperative surveys may not be directly comparable, but it might be useful if a separate selectivity and catchability were estimated. I presume you have looked into this in the past and you might simply state those results.

I think it would be helpful if you had a couple of sentences describing the calculations from numbers per tow to a survey biomass estimate. Is there a stratification scheme? How is it used?

P. 836. Survey length frequencies. You state that there is a strong east-west gradient in Atka mackerel size. I think it would be interesting to speculate why in the discussion.

P. 836. Survey abundances indices. I understand your argument for excluding the earlier time series, although I can not be convinced that this is a good idea when it is given such a short discussion in the report. Excluding an abundance index is an important decision that I think deserves greater discussion in the document.

P. 838. Natural Mortality. Please state in the text the distribution of the prior used. Lognormal? Likewise for P. 840. Survey catchability. It might be informative to examine the change in the likelihood components with respect to fixed values of these parameters.

P. 837. 15.4.1 Model structure. Is the model any more stable or are the estimates any more precise if the plus group is made larger? You might try a plus group with roughly 5% of that year's individuals in it. How does this compare to truncating the data at the bottom of that plus group?

P. 839. Length and weight at age. It has been 10 years since Kimura and Ronholt's study. Has there been any temporal change in the length at age when compared to recent data? I suggest more maturity work be done.

P. 15.6.5 Model fit. There seems to be some pattern in the residuals of the model fit to survey biomass. The last 4 years are underestimated and the previous three years overestimated. Can this pattern be removed?

P. 848. 15.10.1 Ecosystem considerations. What size distributions of Atka mackerel do Steller sea lions prey upon?

Earlier you stated that Atka mackerel forms large aggregations. Is it possible their population dynamics could be linked to disease? Has anyone looked at this? Similar to herring studied by Terry Quinn and others.

P. 849. You hypothesize a competitive effect between mackerel and pollock. Could the east-west gradient in body size be related? Could predation by sea lions alter the competitive balance?

I think there should be some mention of the sex ratio of the catch. Growth rates of males and females are similar, so the sex ratio is probably close to 1:1. You must be using some ratio to calculate female spawning biomass.

P. 882. Should the error bars in Fig 15.15 be symmetric?

Minor edits:
P. 856. Roff published his work on the evolution of life history parameter in teleosts in 1984.

P. 857. No page number for Sinclair and Zeppelin 2002. They are: 973-990.

P. 865. I suggest putting (q, M) next to Prior in Table 15.8

P. 873. Add dates for A-season and B-season to legend for Fig. 15.2

P. 892. Did you start the model in 1963 or is that a typo?

Table A-3. Did recruitment start in 1963?

In Table A-2. I would drop the subscript i in your index of catchability (q).

'In years where selectivity is constant over time' in Table A-2 seems inappropriate for the current runs of the model.

Chapter 1a Stock assessment of Aleutian Islands Region Pollock. 2007. Barbeaux et al.

In general, I found the pollock assessment more difficult to read than the mackerel assessment. I think some more care could be taken in the writing and the flow of logic. For these types of review, the authors need to assume less prior knowledge on the reader's part.

I am not really concerned with the 'potential pitfalls' of using a summer bottom trawl survey as an abundance index for this population. A survey is probably a better index of abundance when the population is more spread out and well mixed. This statement may be less true in your case because trawl locations are not randomly selected (rather all possible locations are sampled). It appears that pollock move large distances and the fish you sample in the summer may be from other stock units, but this could also be true of the spawning aggregations. Our Atlantic cod surveys in the spring (March) are closer to when spawning occurs and we have found them to be much more variable (as one would expect), and as a consequence less useful for assessment. I think the real problem is not the timing of the survey, but the lack of effort put into traditional tagging and studying pollock movement in general. Admittedly, this is difficult but not impossible. Acoustic surveys provide additional information on distribution and abundance and may be used to refine the bottom trawl survey, but unless they are done consistently (every year for 5 years and over as broad an area as possible), I do not see how they will improve the assessment.

There needs to be a coherent argument for why the data in the commercial catch and survey are treated differently. Currently some data are excluded in one data set but not in the other. The authors also need to better explain the decisions made to divide up the catch into different areas. I find it hard to make recommendations when the argument for the current approach is so poorly justified and explained. I do not believe the stock is well defined, and consequently, I suggest that these artificial lines for assessment be broken and that the AI pollock be modeled as a sub-component of the Bering Sea and GOA.

There was some discussion about sex ratio in the catch. The authors stated that there are more males in recent years (1991-on), because there has been more fishing on spawning aggregations. Females leave after spawning and males stay around, therefore, males are more susceptible. I think this pattern should be noted in the report. It is unclear if and how the assessment accounts for these changes in fishing practice.

The maturity ogives are out of date and for the wrong stock. Why not estimate for the Aleutians? The growth of AI pollock is different from the Bering Sea and GOA (AI grow faster). It would be interesting to see if the maturity at length or age is different. In Atlantic cod we saw a decrease in maturity at age in 5-year intervals. I suggest you do more maturity work.

It was interesting to note at the meeting that M goes up when the age composition data are de-weighted. Why might this be so?

Please note in your report where the confidence bounds come from (Hessian?).

It looks like mackerel and pollock have large recruitment events at the same time. Are they responding to similar environmental conditions? Can these conditions be incorporated into the model?

Can results from the acoustic survey be used to better stratify the RV survey, in particular, with regards to estimates of pollock abundance?

I do not think there is sufficient justification for excluding 1978 yc. I suggest including it, which I suppose means I favour Model 2C

Bailey et al. 1999 is not in Literature Cited section

Appendix 1. Bibliography of all materials provided

Steve Barbeaux, James Ianelli, Sarah Gaichas, and Mark Wilkins. December 2007. Chapter 1a Stock Assessment of Aleutian Islands Region Pollock.

Sandra Lowe, James Ianelli, Mark Wilkins, Kerim Aydin, Robert Lauth, and Ingrid Spies. December 2007. 15. Stock Assessment of Aleutian Islands Atka Mackerel.

Bailey, K. M., D. M. Powers, J. M. Quattro, G. Villa, A. Nishimura, J. J. Traynor and G. Walters. 1999. Population ecology and structural dynamics of walleye pollock (*Theragra chalcogramma*).

McDermott, S. F., L. W. Fritz, and V. Haist. Estimating movement and abundance of Atka mackerel (*Pleurogrammus monopterygius*) with tag–release–recapture data. 2005. Fisheries Oceanography 14:113-130.

Other supplementary materials and talks provided at:
ftp://ftp.afsc.noaa.gov/afsc/public/atka/default.htm

Appendix 2: Statement of Work for Dr. Kurtis Trzcinski
External Independent Peer Review by the Center for Independent Experts

Aleutian Islands Atka Mackerel and Pollock Stock Assessments
Panel Review Meeting 9-13 June 2008

General

The Alaska Fisheries Science Center (AFSC) requests a Center of Independent Experts (CIE) review of stock assessments for the Aleutian Islands stocks of Atka mackerel and pollock. In the Aleutian Islands Atka mackerel and pollock are key prey for several top trophic level consumers in the region. Of particular concern, Atka mackerel and pollock are dominant prey items for the endangered Steller sea lion. In addition, Aleutian Islands Atka mackerel supports a valuable commercial fishery. The pollock fishery was closed to directed fishing between 1999 and 2004 due to concerns for Steller sea lion recovery. Directed fishing is still restricted to outside of SSL critical habitat. A limited fishery outside SSL critical habitat was attempted in 2005, but resulted in very little catch (~200 t). In 2006 and 2007 a fishery within SSL critical habitat was conducted in conjunction with a cooperative acoustic survey under an exempted fishing permit, but total removals per year remained below 2,500 mt. There is a high level of interest from commercial fishers in reestablishing a directed pollock fishery in the Aleutian Islands. Because of their unique role in the Aleutian Island ecosystem and their importance to industry, it is critical that biomass is estimated accurately and that harvest recommendations are set in a manner that will sustain the resource and its predators. Both the pollock and Atka mackerel assessments utilize the same age-structured statistical model, and these species share many life history and population dynamics characteristics. Several changes have been made to improve the assessments and these changes have never been formally reviewed by a CIE panel. Several recent research projects have focused attention on the seasonal movements, stock structure and reproductive ecology of Atka mackerel and pollock. We will be seeking advice on techniques to incorporate this information into the assessment.

Overview of CIE Peer Review Process:
The Office of Science and Technology implements measures to strengthen the National Marine Fisheries Service's (NMFS) Science Quality Assurance Program (SQAP) to ensure the best available high quality science for fisheries management. For this reason, the NMFS Office of Science and Technology coordinates and manages a contract for obtaining external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of stock assessments and various scientific research projects. The primary objective of the CIE peer review is to provide an impartial review, evaluation, and recommendations in accordance to the Statement of Work (SoW), including the Terms of Reference (ToR) herein, to ensure the best available science is utilized for the National Marine Fisheries Service management decisions.
The NMFS Office of Science and Technology serves as the liaison with the NMFS Project Contact to establish the SoW which includes the expertise requirements, ToR,

statement of tasks for the CIE reviewers, and description of deliverable milestones with dates. The CIE, comprised of a Coordination Team and Steering Committee, reviews the SoW to ensure it meets the CIE standards and selects the most qualified CIE reviewers according to the expertise requirements in the SoW. The CIE selection process also requires that CIE reviewers can conduct an impartial and unbiased peer review without the influence from government managers, the fishing industry, or any other interest group resulting in conflict of interest concerns. Each CIE reviewer is required by the CIE selection process to complete a Lack of Conflict of Interest Statement ensuring no advocacy or funding concerns exist that may adversely affect the perception of impartiality of the CIE peer review. The CIE reviewers conduct the peer review, often participating as a member in a panel review or as a desk review, in accordance with the ToR producing a CIE independent peer review report as a deliverable. The Office of Science and Technology serves as the COTR for the CIE contract with the responsibilities to review and approve the deliverables for compliance with the SoW and ToR. When the deliverables are approved by the COTR, the Office of Science and Technology has the responsibility for the distribution of the CIE reports to the Project Contact.

Requirements for CIE Reviewers:
The CIE assessment review requires a total of three CIE reviewers who are thoroughly familiar with various subject areas involved in stock assessment, including population dynamics, separable age-structured models, harvest strategies, survey methodology, and the AD Model Builder programming language. They should also have experience conducting stock assessments for fisheries management. Three CIE reviewers are requested to conduct an impartial and independent peer review in accordance with the Terms of Reference (ToR) herein. Each CIE reviewer's duties shall not exceed a maximum of 14 days conducting pre-review preparations with document review, participation in the panel review meeting, and completion of the CIE independent peer review report in accordance with the ToR and Schedule of Milestones and Deliverables.

Specific Activities and Responsibilities
Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the Terms of Reference (ToR) herein. The reviewers will travel to Seattle, Washington, to participate during a panel review meeting on AFSC's Atka mackerel and pollock stock assessment, conduct the independent peer review, and provide editorial assistance to the Chair with the summary report. Overview presentations by AFSC scientists will be made on several topics to facilitate the review, and assessment authors will be available for questions from reviewers.

Prior to the Peer Review: The CIE shall provide the CIE reviewers contact information (name, affiliation, address, email, and phone), including information needed for foreign travel clearance when required, to the Office of Science and Technology COTR no later than the date as specified in the SoW. The Project Contact is responsible for the completion and submission of the Foreign National Clearance forms (typically 30 days

before the peer review), and must send the pre-review documents to the CIE reviewers as indicated in the SoW.

Foreign National Clearance: If the SoW specifies that the CIE reviewers shall participate in a panel review meeting requiring foreign travel, then the CIE shall provide the necessary information (e.g., name, birth date, passport, travel dates, country of origin) for each CIE reviewer to the COTR who will forward this information to the Project Contact. The Project Contact is responsible for the completion and submission of required Foreign National Clearance forms with sufficient lead-time (30 days) in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations at the Deemed Exports NAO link http://deemedexports.noaa.gov/sponsor.html

Pre-review Documents: Approximately two weeks before the peer review, the Project Contact will send the CIE reviewers the necessary documents for the peer review, including supplementary documents for background information. The CIE reviewers shall read the pre-review documents in preparation for the peer review.

Each of the reviewers shall generate individual reports. In addition, the chairperson shall generate a Summary Report that compiles the points made by the three individual reviewers into one succinct document. The individual reports shall be appended to the Summary Report, thereby providing the complete detailed information from the individual reviewers.

Terms of Reference

All reports shall address the following points.

- The strengths and weaknesses of the modeling efforts for Aleutian Islands Atka mackerel and pollock assessments and harvest recommendations. Specifically, the review shall evaluate:
    - The analysts' use of fishery dependent and fishery independent data sources in the assessments;
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Additionally, the review shall (to the extent practical) evaluate and provide advice on:

- The determination of appropriate sample size for the multinomial distribution used for survey and fishery catch-at-age in both models.
- The incorporation of differential growth parameters for Atka mackerel
- The incorporation of abundance and movement information from tagging studies of Atka mackerel
- The potential pitfalls and possible solutions to the use of pollock summer bottom-trawl abundance index for a fishery that primarily occurs in the winter on a pelagic spawning population.
- For pollock assess the appropriate spatial delineation of fisheries and survey data.

The AFSC will provide copies of stock assessment documents, survey reports, and other pertinent literature on a web site.

Specific

1. Read and become familiar with the relevant documents provided to the reviewers.
2. Discuss the stock assessment with the lead assessment scientist and survey scientists in Seattle, Washington, from June 9 to June 13, 2008.
3. No later than June 27, 2008, submit a written report of findings, analysis, and conclusions. More details on the report outline and organization are provided in Annex I.

Schedule of Milestones and Deliverables
The milestones and schedule are summarized in the table below. No later than June 27, 2008, the CIE panelists should submit their CIE independent peer review reports to the CIE for review[1]. These reports shall be submitted to Mr. Manoj Shivlani, CIE Lead Coordinator, via email at shivlanim@bellsouth.net, and to Dr. David Die, CIE Regional Coordinator, via email at ddie@rsmas.miami.edu.

Milestone	**Date**
CIE will provide CIE reviewer contact information, and project contact will distribute pre-meeting material to the CIE reviewers	May 26, 2008
CIE reviewers attend the **Atka Mackerel and Pollock Stock Assessment meeting** to conduct peer review at AFSC, Seattle, WA, USA	June 9-13
CIE reviewers submit CIE independent peer review reports to CIE for approval	June 27
CIE provides reviewed CIE independent peer review reports to NMFS COTR for SOW and ToR compliance approval	July 3
COTR notifies CIE of approval of CIE independent peer review reports	July 4
COTR provides final CIE independent peer review reports to AFSC contact	July 5

Acceptance of Deliverables:
Upon review and acceptance of the CIE reports by the CIE Coordination and Steering Committees, CIE shall send via e-mail the CIE reports to the COTRs (William Michaels William.Michaels@noaa.gov and Stephen K. Brown Stephen.K.Brown@noaa.gov) at the NMFS Office of Science and Technology by the date in the Schedule of Milestones and Deliverables. The COTRs will review the CIE reports to ensure compliance with the SoW and ToR herein, and have the responsibility of approval and acceptance of the deliverables. Upon notification of acceptance, CIE shall send via e-mail the final CIE report in *.PDF format to the COTRs. The COTRs at the Office of Science and Technology have the responsibility for the distribution of the final CIE reports to the Project Contacts.

Key Personnel:
Contracting Officer's Technical Representative (COTR):
William Michaels
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-713-2363 ext 136

Stephen K. Brown
NMFS Office of Science and Technology
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[1] All reports will undergo an internal CIE review before they are considered final.

Contractor Contacts:
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Project Contact:
Sandra Lowe
Sandra.Lowe@noaa.gov, Phone: (206) 526-4230;

Steve Barbeaux,
Steve.Barbeaux@noaa.gov, Phone: (206) 526-4211

Request for Changes:
Requests for changes shall be submitted to the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the Contractor within 10 working days after receipt of all required information of the decision on substitutions. The contract will be modified to reflect any approved changes. The Terms of Reference (ToR) and list of pre-review documents herein may be updated without contract modification as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToR are not adversely impacted.

Annex 1: Contents of Reviewer Reports

The following requirements refer to all reports, both the individual reports and the Summary Report.

1. All reports shall be prefaced with an executive summary of findings and/or recommendations.
2. In accordance with each Term of Reference, the main body of all reports shall consist of a background, description of review activities, summary of findings, conclusions and recommendations, and references.
3. The reports shall also include as separate appendices, the bibliography of all materials provided and any additional papers cited, along with a copy of the statement of work and meeting agenda.

Appendix 3: Statement of Work for Dr. Kurtis Trzcinski

CIE Aleutian Islands Atka mackerel and Pollock assessments review, NMFS Alaska Fisheries Science Center, 7600 Sand Point Way NE, Building 4, Seattle, Washington

AGENDA MAY 27 DRAFT VERSION June 9-13, 2008

Monday June 9th
9:00 Welcome and Introductions
9:15 Overview (management, fishery, biology descriptions)
Management control rules and general modeling approach Jim
Atka mackerel Sandra
Pollock Steve
11:30 Observer sampling and coverage Lisa Thompson and Jennifer Cahalan
12:00 Lunch
13:00 Age and growth Delsa Anderl and Betty Goetz
13:30 Bottom trawl survey Mark Wilkins

Research
14:15 Atka mackerel tagging Susanne McDermott
14:30 Spawning characteristics and habitat for Atka mackerel Bob Lauth
14:45 Genetics Ingrid Spies and Mike Canino
15:00 Cooperative research survey on pollock Steve
15:30 Aleutian Islands ecosystem overview FEP, foodweb linkages Kerim Aydin
16:00 Age-structured multispecies modeling Doug Kinzey

Tuesday June 10th
Atka mackerel and pollock stock assessments
9:00 Assessment model details Jim
10:00 Atka Mackerel stock assessment Sandra
10:45 Break
11:00 Atka Mackerel stock assessment (continued) Sandra
12:00 Lunch
13:00 Pollock stock assessment Steve
14:45 Break
15:00 Stock assessment issues
Initial age composition, recruitment, effective N, incorporation of uncertainty selectivity, stock-recruitment relationships
Reviewer discussions with assessment authors

Wednesday June 11th