REVIEW OF ALEUTIAN ISLANDS ATKA MACKEREL AND POLLOCK STOCK ASSESSMENTS

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Prepared for the Center for Independent Experts

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Executive Summary

A workshop was held at the Alaska Fisheries Science Center (AFSC) in Seattle June 9-12 2008 to review the 2007 stock assessments of the Aleutian Islands Atka mackerel and pollock. The AFSC staff made a series of presentations on different aspects relevant to the assessment work, followed by discussions with the three CIE reviewers. Additional model runs were conducted by the assessment scientists and discussed by the workshop. The activities were well organized and allowed the reviewers to get into the technical details of the assessment work conducted.

My conclusion based on the material discussed during the review is that the overall approach used to assess these stocks is appropriate, and that the integrated model applied in the assessments provides the best-available tool to examine the information provided by the different data sources. A number of recommendations are offered to improve the quality of the assessments, especially in terms of suggested exploratory data analyses, alternative parameterizations, and on the need to provide more explicit rationales for some of the data input and model choices. These recommendations will not resolve the fundamental weaknesses in the assessments, which result from the intrinsic characteristics of the species (patchy distribution leading to high surveys CVs), the logistic difficulties to survey the grounds due to the dominance of untrawlable habitat, and the uncertainty about stock structure especially in the case of pollock.

Further research should give high priority to:

- Continue investigation of pollock stock structure to improve understanding of how neighboring stocks overlap in time and space, and to help formulate alternative hypotheses about stock delineation to better rationalize the different choices of data inputs and model formulations.
- Continue with the cooperative acoustic survey to evaluate pollock biomass at the local scale, and further develop decision rules for recommending local quotas based on the acoustic survey estimates.
- Evaluate the feasibility of using the results from past tagging experiments to estimate larger-scale movements of Atka mackerel, or at least to provide indications about the magnitude of the exchanges between management regions.
- Investigate the spatial heterogeneity in the Atka mackerel age-composition in connection to the marked contrasts in past exploitation rates among the different areas.
- Investigate model performance using smaller areas to help evaluate the feasibility, benefits and costs of implementing a spatially-stratified assessment model that may allow incorporation of tagging results.

Background

An independent review of the stock assessments of the Aleutian Islands (AI) Atka mackerel and pollock was organized by the Center for Independent Experts (CIE) at the request of the Alaska Fishery Science Center (AFSC). Relevant documents were made available to the reviewers and discussed during a technical meeting held at the AFSC in Seattle. The following review report covers the documents and issues discussed during the meeting. Although the material covered was broad, including analyses on the role of the species in the ecosystem, and aspects of the harvesting strategies and management framework, the scope of this report centers on the stock assessment modeling approaches, as requested by the Statement of Work prepared by the CIE (Appendix 1).

Description of Review Activities

The review took place at the AFSC from June 9-12, 2008. The three CIE reviewers (Drs. Chris Francis, Kurtis Trzcinski and I) met during four days with the assessment scientists and other staff of the AFSC. The week prior to the review, the reviewers were given access to an internet link containing assessment documents and other relevant materials as described in Appendix 2. During the first three days of the meeting, the AFSC staff delivered detailed presentations about different aspects related to the assessment work, including background information about the species and their role in the ecosystem, the data collection programs (observer program, bottom trawl surveys and ageing for both species, tagging studies on Atka mackerel and the cooperative acoustic survey for AI pollock), the assessment models and results, and the management framework. The original agenda for the meeting is included in Appendix 3. All presentations were followed by in-depth discussion of the materials covered. During the third and fourth day the assessment scientists presented the results of additional model runs that were conducted at the request of the reviewers.

The review was informal and the AFSC staff that participated were extremely open to discuss the approaches used and their rational, and to considering alternatives. The review allowed for detailed technical discussions about the modeling work, and even to examine some of the details in the actual program used.

This report does not add anything substantive to the issues discussed during the meeting in Seattle, which I see as the main product of the review. The ideas and recommendations presented here are a result of the fruitful exchanges that took place during the meeting. Of course, I take full responsibility for the views expressed below, which are not necessarily shared by all participants. Also, I apologize for any misunderstanding of the material presented that may be reflected in my comments. I am very thankful for the opportunity to review this work, and appreciate the kindness and support given by all participants at the Center, which greatly facilitated our work.

Summary of Findings

Model structure

Both assessments used the same age-structured model and ADMB code, and same sources of information (mainly the AI bottom trawl survey and observer program). The main features of the assessment model discussed in the review were the assumptions about the stock-recruitment (SR) relationship and, in more depth, the parameterization of the selectivity ogives and its connection with the likelihood components dealing with the age-composition data.

The parameterization of the stock-recruitment relationship was found to be adequate and the ability of the program to restrict the period over which the SR penalty (on deviations from the SR function) is applied is an interesting feature to evaluate sensitivity to exclusion of extreme year classes or periods. A feature that I did not notice during the review is a slight penalty applied to the departures between the stock-recruitment parameter *log-R0* and the parameter corresponding to the *mean-log-R*. I am not sure if this penalty was active in the assessments reviewed, or only in the version of the code that I looked at. In general, I would not keep that penalty effective through the last phase of the estimation as it may introduce bias in cases where recruitment has declined with spawning stock size.

With regard to the selectivity parameterization, I support the general approach of allowing for constrained year-to-year variability in the selectivity parameters as a way to incorporate process variability resulting from changes in targeting and availability in the commercial fishery. As explained by the authors, this approach is a compromise between two extreme assumptions used in other standard assessment methods: separable models in which the selectivity is assumed to be time-invariant, and VPA-type models in which selectivities are allowed to change freely from year to year under the assumption that catch at age is known without error. Exactly where one should be in between these extremes is rather subjective, but some of the input variance parameters (at least in relative terms) can be rationalized based on known changes in fishing practices (e.g. in pollock when the fishery started to target spawning aggregations).

The absolute amount of year-to-year variability is more difficult to select and is related to the effective sample size used to weigh the age-composition data, and also to the *CV* assumed in other likelihood components, especially the trawl survey. Each component can admit some level of process error added to the sample variability so the sensitivity to different choices needs to be evaluated. One possible approach to bound the sensitivity analyses would be to:

(1) Estimate sampling variances of all data components trying to incorporate all sources of sampling variation (e.g. via bootstrap as it is done for the age composition data in these assessments). If a multinomial likelihood is used for the age proportions, estimate the effective sample size by solving for the n that best matches the empirical (bootstrap) variances of the proportions with those predicted by the multinomial *over all ages*. A different n_y can be estimated in this way for each year y. An alternative to the multinomial likelihood is a lognormal with variance equal to the sum of process and

sampling error. In a lognormal formulation, the empirical variances can be used directly as the sampling component of the total variance.

(2) The workshop discussed some alternatives for incorporating process error not accounted for in within-year sampling variance estimates (for example, variability of bottom-trawl biomass estimates due to year-to-year changes in survey catchabilities).

(a) *Max variability in selectivity*:

- assume that the errors in the age proportions (or the effective sample sizes) and in the trawl indices are as estimated in (1) and relax the constraints in the year-to-year variability in the commercial selectivity parameters until the effective sample size estimated from the model residuals (using the equation discussed in the review) approximates the input. Note that the residuals in the equation can be weighted differentially to incorporate trends in effective sample size over time, i.e., if n_y is the effective sample size for year y estimated in (1), then

$$\frac{1}{n'} = \text{average}\left[\frac{n_y\left(p(a)-\hat{p}(a)\right)^2}{\text{average}(n_y)\,\hat{p}(a)(1-\hat{p}(a))}\right] \qquad \text{and} \quad n'_y = n'\frac{n_y}{\text{average}(n_y)}$$

- assume that survey selectivities are constant (unless there is independent evidence to justify relaxing the constraints in some years or periods) and evaluate if the *CV* of the survey residuals is larger than estimated from sampling variance alone. If so, add some process error to the sampling variance and repeat the above.

This approach is extreme in that all process errors not explained by recruitment variation are modeled as year-to-year changes in selectivity (and added survey process error if residuals suggest it). It is still less extreme than a VPA, especially if realistic sampling variances can be estimated.

(b) *Reduced selectivity variability*:

- allow for some additional process error in the trawl survey to account for year to year changes in survey catchability.

- reduce the *CV*s for year-to-year changes in commercial selectivity to produce an "acceptable" result (i.e. a subjective evaluation, similar to what was done in the assessments reviewed) and re-evaluate effective sample sizes for the age-composition data using the equation above. If a lognormal likelihood is used instead of the multinomial, a constant additive variance can be estimated to account for process error not accounted for by the (constrained) changes in selectivity.

Reference Points

ABC recommendations under Tier 3 are based on $F_{40\%}$. Given that the assessments reviewed included a stock-recruitment relationship, the reviewers asked about a comparison between the estimates of $F_{40\%}$ and F_{MSY} , or alternatively, the implied steepness parameter that would lead to $F_{40\%} = F_{\text{MSY}}$. An analysis was presented that

showed that in most cases when the condition $F_{35\%} = F_{MSY}$ was imposed, lower slopes at the origin were estimated for the stock-recruitment indicating that the reference point was conservative.

Pollock

I believe that the overall approach used to assess AI pollock is appropriate and that the integrated model applied in the assessment provides the best-available tool to examine the information provided by the different data sources. Notwithstanding, as the authors clearly state, the resulting estimates of abundance are highly uncertain. The main weakness in the assessment derives from a great deal of uncertainty about the relative contribution of the neighboring pollock stocks to the commercial and survey catches in different years and areas. The degree of mixture between the AI stock with the much larger stock in the Eastern Bering Sea and with the AI Basin stock is unknown, which in turn leads to difficulties in the selection of input data for the assessment. The fact that the bottom trawl survey takes place in summer, out of the spawning season when the fishery operates, adds to the problem, as it is not clear how much of the abundance estimates are affected by "contamination" from other stocks. These problems are highlighted in the assessment reports and also in the statement of work, which requested comments on:

- 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.
- The appropriate spatial delineation of fisheries and survey data.

Unfortunately, the workshop did not have a magic bullet to offer. Without additional information to discriminate stock identity in the survey and commercial catches, and without further understanding of seasonal migrations and possible expansion/contractions of the other pollock stocks, the best that the stock assessment can do is to clearly lay out the possible alternative hypotheses about stock delineation in space and time, choose the input data accordingly, and compare the assessment results under the alternative hypotheses.

The problem is particularly severe in the east of the AI, where high catches in some years continued eastward, beyond the border of the management area. This, together with examination of the length compositions that showed similarities between the fish caught in the easternmost portion and those from the AI Basin, led the authors to exclude from the assessments the commercial catches from the subarea to the east of 175 W. However, the survey catches from the eastern portion were still included in the survey biomass estimates used for most assessment models. The exception was Model 1, in which both commercial and survey catches from the easternmost portion were excluded. As could be expected given the magnitude of the catches from the eastern portion, and the marked temporal shifts in the contribution of the different regions to the total catch and to the survey biomass estimates, the results were very sensitive to the choice of input data. The inclusion of the survey catches from the entire area was justified in terms of substantial improvement in the likelihood (especially in the survey component), as Model 1 could not fit the sharp drop in abundance estimated by the last two surveys in the area west of

175 W. This outcome is rather unsettling given the lack of an explicit hypothesis about stock delineation to justify the different treatment of the commercial and survey catches. Further elaboration on the rational behind the alternative choices is warranted. Even if the information available does not allow delineation of the stock structure in space and time, further research may still help to formulate alternative hypotheses as internally consistent conceptual models to rationalize the different selections of commercial and survey data in time and space.

A second problem addressed by the workshop was the high variability of the bottom trawl survey estimates and the fact that the assessment predictions did not follow the survey trends. Sensitivity runs conducted during the workshop showed that the poor fit to the trawl survey indices was still present when the age-composition data were down-weighted. Apparently the main conflict in the data is that the trawl indices do not drop in response to the increases in catches in the mid 1990s. If we were more confident that the trawl survey indexed the fished stock reliably, such a finding would point to a very large stock size. Consistent with this interpretation is the fact that when the survey catchability q was treated as a free parameter (q is fixed to 1 in the base assessment model) the estimate of q was very small. Given the noise in the survey data, and the uncertainties in the stock delineation, such interpretation would be risky. The authors opted instead to fix the catchability parameter to one. Although a q=1 is difficult to justify based on knowledge of the survey operation, I think the choice is sensible from a practical point of view considering the management framework in place. My understanding is that, in the absence of an analytical assessment to provide an estimate of biomass, the management advice would be based on the survey estimates directly (based on q=1). In my view, the analytical assessment represents a substantial improvement over the use of the survey estimates alone in that it allows for the integration of all sources of information in the assessment smoothing out inter-annual variability.

A closer examination of the survey data outside the model would be informative, especially to examine trends in indices of abundance by age along cohorts in search for changes in total mortality over time and their relationship with the catches and other ecosystem variables. Also, an analysis of the sources of variability of survey catch rates may be helpful to standardize the survey indices. I do not expect that such analysis would achieve substantial reductions in survey *CV*s, which seem to be a function of the patchy distribution of pollock.

The third final major topic discussed by the workshop relates to the mismatch between the regional scale of the assessment and the local extent of the fishery given current management regulations that restrict access to catch-only boats. Clearly, an ABC for the local fishery derived from the regional biomass estimates would lead to local depletion, with negative impacts on the predators and on the fishery itself. In response to this problem, an acoustic survey program involving small commercial boats was developed to evaluate the biomass present in localized areas where the fishery is likely to operate in the future. Results were positive and there were indications that if the acoustic surveys were conducted at night a lot of the problems of species identification would be resolved given that pollock are off the bottom at night while POP stays close to the bottom.

I very much support the continuation of the cooperative acoustic program, even if the resulting biomass estimates cannot be used directly in the analytical assessment. The use of a two-prone approach to evaluate abundance at the global scale via the age-structured assessment model, and at the local scale using the cooperative acoustic survey appears very appropriate given the management intention to develop a local fishery, and given the high uncertainties in the global assessments. I understand that the idea is to use the same target harvest rates as used globally to recommend local quotas. In the future, a simple decision rule based primarily on the local abundance estimates could be developed to smooth out the inter-annual variability in the acoustic survey estimates.

Below I summarize a series of more specific technical issues addressed by the workshop:

- The age-range used to normalize selectivities (i.e. assume average of one over that range).

Under the assumption that $q = 1$, the choice of ages affects directly the factor that scales biomass. The base assessment used an age range from 6 to 10 to normalize survey selectivities, but some of these ages are not fully selected (e.g. at age 6 was close to 0.6 in the fixed selectivity run completed during the workshop). I recommend that the age-range is shifted to only include fully-selected ages. This change should result in larger biomasses.

- Variability in survey selectivity – Is it needed?

Based on the assessment report I did not think that the inclusion of inter-annual variability in survey selectivity parameters was needed. In particular, I was concerned that the estimated changes in selectivity led to an effective increase in the overall survey catchability over time due to increase selectivity of older age classes. Sensitivity runs conducted during the workshop showed that assuming instead a constant selectivity resulted in a slight change in the overall biomass trend. In discussions with the assessment leading author, there appears to be qualitative information indicating that in recent years the gear operation has improved so that the net has been maintained closer to the bottom, where the larger fish are. This information is consistent with an increase in the catchability of the older animals estimated in the assessment. The likelihood decreased appreciably when the selectivity was assumed constant, although perhaps most of the effect could be captured with fewer estimated parameters.

- Ageing errors

The aging errors estimated for AI Pollock appear to warrant the inclusion of an ageing error matrix in the assessment, something that the code can readily handle.

- Selectivity ogive for projections

The choice of a selectivity ogive to be used for future projections was difficult given the lack of a significant fishery in recent years and the consequent uncertainty around recent selectivity estimates. As a result, a selectivity ogive estimated for the EBS stock was utilized. I think the choice of selectivity needs to be better rationalized in connection to

the type of fishery that may develop and whether or not the future fishery will target spawning aggregations.

Atka Mackerel

The integrated assessment of AI Atka mackerel based on the age-structure model is appropriate as a basis for providing management advice and as a tool to evaluate the information content of the different data. The main challenges for this assessment are related to the high variability of the survey trawl estimates, and to the spatial heterogeneity of the population, probably resulting from its apparent limited mobility. The latter are related to the specific issues mentioned in the Statement of Work, which requested comments on:

- The incorporation of differential growth parameters for Atka mackerel.
- The incorporation of abundance and movement information from tagging studies.

A series of tagging experiments have been conducted in different areas and time periods with the aim of estimating small-scale, short-term exchanges between closed areas and trawlable open areas to evaluate the effectiveness of the closed areas. While the experiments were clearly not designed to estimate large-scale movement rates, analyses of the tag recoveries over time may still provide some insights on movement rates and likely exchanges between management areas. Low exchange rates would be consistent with the data discussed during the workshop and with the existence of different growth rates among areas. I think that the spatial heterogeneity not only in growth patterns but also in the population dynamics and harvest rates deserves further attention, as discussed below.

Jim Ianelli presented some interesting analyses indicating substantial contrasts in the historical harvest rates experimented by the different management areas over time. If movement rates were indeed low, such contrasts in harvest rates could have persistent effects in the dynamics and age compositions by area. Further exploratory analyses of the age-composition data by region would be valuable to evaluate the extent of the differences.

From a modeling point of view, the incorporation of spatial heterogeneity would require a spatially structure model, perhaps at the scale of the management regions. While the possibility is attractive in terms of a likely more realistic population dynamics model, one should be aware that the survey variability for each region would increase as the number of stations is reduced (CV inversely proportional to sqrt(n)). On the other hand, increasing the spatial resolution would be the only way to incorporate the results derived from local tagging studies. Without going all the way to build a spatially stratified model, it would be interesting to examine how the estimates behave if the areas assessed are reduced. An informative first exploratory run would be one in which the eastern area (which is especially problematic in terms of high survey variability) is not included in the assessment. How different would the estimated biomass trends be?

A series of more specific technical issues addressed by the workshop is discussed below:

- Spatial gradients in size and age

Size distributions of the commercial fishery and the survey by region showed that larger fish were caught in the eastern area. The assessment report explained the trend in terms of differences in growth rate (fish size at age is larger in the east). The workshop noted that differences in age composition appear to also contribute to the observed trends. In particular, the absence of small fish from the eastern region was noted. A difference between the two seasons (A and B) was shown in one of the tagging papers, where a high abundance of small fish recruited into the trawlable habitat outside Seguam pass in June-July. Analysis of the survey age composition by region should be conducted to investigate possible differences. It was not possible to examine this issue during the workshop because only global age-length keys were available. Only the commercial catch-at-age was preliminary examined and some differences were encountered. Evaluating the extent of the differences among areas may be important to interpret assessment results (e.g. changes in selectivity over time associated with shifts in the contribution of the different regions to the catch and changes in survey age composition), and also to help evaluate whether or not a spatially-explicit model may be more adequate.

- High variability in the survey estimates

The high variability of survey estimates especially in the eastern region was discussed. In 2000, the survey did not catch Atka mackerel in the eastern region while high biomasses were estimated there by the tagging study. Also, I believe it was mentioned that commercial catches were also high in the same year (it would be useful to report a table of catches by region). No specific problem could be identified in the survey operation to explain the absence of fish. This high level of variability in the relative contribution of the different areas to the total estimated biomass is a concern. If meaningful differences in the age distributions among areas are present, the inter-annual variability in the contribution of the different areas to the total biomass may affect the overall age composition. Given that the eastern area seems to be most problematic, it would be interesting to evaluate how biomass estimates in the central and western areas are affected when the data for the eastern area (survey and commercial) are excluded.

- Survey catchability

The point estimate of survey catchability was close to 1.5, about 2 standard deviations above the mean of the assumed prior distribution. Although not impossible, a high q is not what one would expect *a priori* considering that some variable fraction of the fish are off the bottom during daytime. In previous years different assumptions were evaluated to estimate q and M, and confounding between those parameters was encountered, leading to the current assumptions (M=0.3 and q estimated with a prior). A sensitivity run was conducted downloading the age-composition data. It resulted in lower estimates of q and better fits to the survey data. Given concerns (discussed earlier) about possible variability in the age-composition data associated with inter-annual variability in regional biomass distributions, I am not convinced that the age-composition data should receive more weight in the estimation. Sensitivity to alternative choices needs to be conducted.

- Evaluate the use of a lower plus group in the fitting.

Conclusions and Recommendations

I believe that the overall assessment approach is appropriate. A number of recommendations can still be made to improve the quality of the assessments, especially in terms of terms of suggested exploratory data analyses, alternative parameterizations, and on the need to provide more explicit rationales for some of the data input and model choices. However, these recommendations will not address the fundamental weaknesses in the assessments, which as highlighted in the assessment reports result from the intrinsic characteristics of the species (patchy distribution leading to high surveys CVs), the logistic difficulties to survey the grounds due to the dominance of untrawlable habitat, and the uncertainty about stock structure especially in the case of pollock.

Below I summarize the main recommendations made for the two stock assessments.

Pollock

- Priority should be given to continue research on stock structure issues to help understand how neighboring stocks overlap in time and space. Even if the substantial uncertainty about stock delineation cannot be resolved, further elaboration of the rationales behind alternative choices for the inclusion of commercial and survey catches from different regions in the assessment is warranted. Further research should be conducted to help formulate alternative hypotheses as internally consistent conceptual models that would lead to different choices of data inputs and model formulations.
- Continue with the cooperative acoustic program and further develop decision rules to set local ABCs based on the acoustic survey results.
- Examine temporal trends in survey indices of abundance by age outside the model to evaluate changes in total mortality over time.
- Evaluate sources of variability in surveys and the impact of environmental conditions on survey catchability.
- Reconsider the choice of ages used to normalize the survey selectivities to exclude ages that are not fully selected.

Atka Mackerel

- Continue with the analysis of tag recoveries over time with an emphasis on estimation of rates of exchanges between regions. Although the tagging studies have not been designed for this purpose, results may provide preliminary estimates of longer-range movement rates which will be informative in terms of possible differences among areas related to their different history of harvest, and possibly recruitment rates.
- Analyze age-composition data by region to investigate possible differences related to marked historical contrasts in harvest rates.
- Investigate model performance using smaller areas to help evaluate the feasibility and the benefits and costs of implementing a spatially-stratified assessment model.

Suggestions for Future Reviews

A number of issues that were raised by the reviewers during the meeting had been already addressed by the authors, but were documented in assessment reports of previous years (also posted on the web site). The task of the independent reviewers would be greatly facilitated if a document was prepared specifically for the review, compiling a summary of the evolution of ideas and analyses that led to the current assumptions and approaches, with pointers to specific results documented elsewhere. Such a review of past work was covered by the authors during their oral presentations, which provided a rational for many of the modeling decisions made.

Appendix 1. Statement of Work

This appendix contains the statement of work prepared by the Center of Independent Experts (CIE) as part of the consulting agreement between the CIE and the author.

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;
    - 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.

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[2]. 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

[2] All reports will undergo an internal CIE review before they are considered final.

Technology have the responsibility for the distribution of the final CIE reports to the Project Contacts.

Key Personnel:

Contracting Officer's Technical Representative (COTR):

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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.

Appendix 2. Materials Provided

Prior to the workshop the reviewer was provided access to the following link
ftp://ftp.afsc.noaa.gov/afsc/public/atka/default.htm

which contained the most recent assessment reports for the two stocks:

Barbeaux, S., Ianelli, J., Gaichas, S. and Wilkins, M. Chapter 1a. Stock Assessment of Aleutian Islands Region Pollock. Alaska Fisheries Science Center. November 2007.

Lowe, S., Ianelli, J., Wilkins, M., Aydin, K., Lauth, R. and Spies, I. 15. Stock Assessment of Aleutian Islands Atka Mackerel. December 2007.

as well as reports corresponding to previous assessments, documentation about the observer program and other data sources, and papers containing background information on the stock structure and biology of the species, ecosystem considerations, and the management context and harvesting strategies utilized for the groundfish resources of the Bering Sea and Aleutian Island.

Appendix 3. Meeting Agenda

Below is the meeting agenda prepared by the assessment authors.

CIE Aleutian Islands Atka mackerel and pollock assessments review

NMFS Alaska Fisheries Science Center
7600 Sand Point Way NE, Building 4
Seattle, Washington

AGENDA 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
Reviewer discussions with assessment authors