External Independent Peer Review Pacific Blue Marlin Assessment Desk Review

By

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For the
Center for Independent Experts

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Executive Summary

The current review is for the Pacific blue marlin stock assessment conducted by the International Scientific Commission (ISC) in July 2013. The assessment provides the basis for scientific advice on the status of the Pacific blue marlin stock and will be the foundation for international management decisions of the Inter-American Tropical Tuna Commission, the Western and Central Pacific Fisheries Commission and its Northern Committee, and domestic management decisions by the Western Pacific Regional Fisheries Management Council (WPRFMC) of the USA.

I conclude that SS3 is appropriate for the data available and used for Pacific blue marlin and the results appear to be reasonable and that the science reviewed is the best scientific information available.

I conclude that the assessment model configuration, assumptions, and input data and parameters (fishery, life history, and spawner recruit relationships) are appropriate. The data are properly used, input parameters seem reasonable, models are appropriately configured, and assumptions are reasonably satisfied. Uncertainties have been estimated by running sensitivity analyses. Uncertainties are likely underestimated in the base case results e.g. the CV of the 2010-2011 SSB is likely to be greater than 15%.

The assessment document concludes that " Based on the results of the stock assessment the stock is not currently overfished and is not experiencing overfishing. The stock is nearly fully exploited. ". I agree with that conclusion.

The projections were done directly in the SS3 assessment model. The scenarios provide a good basis for management decision. The methods used to make the projections are consistent with the assessment model data, assumptions and parameters. The method to project future population status is considered adequate, appropriate, and correctly applied.

The current assessment of Pacific blue marlin is a sufficient basis for management if fishing mortality is indeed less than F_{MSY} and if SSB is above SSB_{MSY}. Further research into the possibility that sensitivity cases 2, 3 and 5 provide a more realistic description of the status of Pacific blue marlin would however be useful.

Background

The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance with the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee. The current review is for the Pacific blue marlin stock assessment conducted by the International Scientific Commission (ISC) in July 2013. The assessment provides the basis for scientific advice on the status of the Pacific blue marlin stock and will be the foundation for international management decisions of the Inter-American Tropical Tuna Commission, the Western and Central Pacific Fisheries Commission and its Northern Committee, and domestic management decisions by the Western Pacific Regional Fisheries Management Council (WPRFMC) of the USA. The independent peer-reviews are expected to provide valuable feedback to the ISC in conducting future assessments. The Statement of Work, including Terms of Reference (ToRs) of the peer review, is attached as Appendix 2.

Description of the Individual Reviewer's Role in the Review Activities

I was informed on December 23, 2013 that I had been selected as one of the reviewers for the Pacific blue marlin stock assessment. The purchase order, statement of work etc. were received on December 29 at the end of the day and I sent back the completed paperwork on the following day December 30. The assessment report and background documentation were supposed to be sent on January 7, 2014 but were not received until a full week later on January 14, 2014 at the end of the day. The reason for this delay is not clear as the assessment and background documents had been prepared earlier for the ISC meetings in May and July 2013.

The statement of work indicates that "*CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein*" but there remained sufficient time to read and review all documents for the peer review.

I conducted an independent peer review in accordance with the SoW and ToRs.

This is my Independent CIE Peer Review Report in accordance with the Statement of Work completed according to the required format and content as described in Annex 1 of the SoW and addressing each ToR. As requested, I have:

1) Conducted the necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact.

2) Conducted an impartial and independent peer review in accordance with the tasks and ToRs specified herein, and each ToRs in Annex 2 of the Statement of Work (Appendix 2 here).
3) Submitted an independent peer review report addressed to the "Center for Independent Experts" sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and to CIE Regional Coordinator, via email to Dr. David Die ddie@rsmas.miami.edu written using the format and content requirements specified in Annex 1, and addressing each ToR in Annex 2 of the SoW.

Summary of Findings for each ToR

1. Review of the assessment methods: determine if they are reliable, properly applied, and adequate and appropriate for the species, fisheries, and available data.

The assessment uses Stock Synthesis 3, implemented as SS3 Version 3.24f, in the NOAA Fisheries Toolbox (http://nft.nefsc.noaa.gov/SS3.html). SS3 is scientifically sound and easily available on the NFT website. It has been widely used on the west coast of the USA for a long time, but it is increasingly used on the east coast as well as in several assessments of the International Council for the Exploration of the Sea (ICES) in the northeast Atlantic.

ICES classified SS3 as an Integrated Analysis model describing this class of model as tending "*to be highly general with regard to the types of data that can be included and, on the whole, they strive to analyze data with as little pre-processing as possible, for example using length composition data and information in the age-length key directly, rather than inputting the derived age composition data to the model*" (http://www.ices.dk/community/Documents/SISAM/Report%20on%20the%20Classification%20of%20Stock%20Assessment%20Methods%20developed%20by%20SISAM.pdf).

I conclude that SS3 is appropriate for the data available and used for Pacific blue marlin and the results appear to be reasonable and that the science reviewed is the best scientific information available. However, while SS3 is a highly flexible assessment tool, it is also highly structured with many options and built-in assumptions. Because of its structure and underlying assumptions, SS3 can provide stock estimates and fisheries management benchmarks even when very little data are available. It is also sometimes difficult to ascertain the most important influence on the assessment results: the data or the assumptions in the model. I do not know which it is for the Pacific blue marlin. Without having access to the full output of the assessment it is difficult to judge which of the assumptions or the data have the largest influence on the assessment results. Figure 6.3 of the assessment document suggests that both are influential but it is not possible to ascertain the relative importance of each.

2. Evaluate the assessment model configuration, assumptions, and input data and parameters (fishery, life history, and spawner recruit relationships): determine if data are properly used, input parameters seem reasonable, models are appropriately configured, assumptions are reasonably satisfied, and primary sources of uncertainty accounted for.

While the most recent genetic studies are at least a decade old, no evidence of population structuring was detected in that and previous studies and the current working hypothesis is that blue marlin consists of a single stock within the Pacific Ocean. More recent studies on blue marlin in the Atlantic found no evidence of more than one stock in that ocean, which is consistent with the treatment of Pacific blue marlin. Some CPUE series (e.g. Hawaii longlines) show different trends than the others. It would be useful to know if the difference is due to relatively low mixing and possibly implying sub-stocks. The assessment (section 3.1) assumes instantaneous mixing at each quarterly time-step which is unlikely to occur in reality and could, at least in part, explain differences in CPUE trends.

The reproductive dynamics of Pacific blue marlin seems reasonably well known based on studies that sampled gonads from landings, and indirectly from spawning condition of females captured at sea and larvae collected by surface plankton sampling. It would be useful to show the information on spawning time and area (section 2.1.2) on a map, if necessary in a schematic way.

Growth is notoriously difficult to research for billfishes because of sampling difficulties, the minute size of their otoliths, reliance upon other hard parts for age determination, the rarity of smaller size classes in fishery catches, and reliance on longline and other distant water fisheries for obtaining samples. Otolith sections provide distinct daily growth increments (DGIs) out to about age-2; thereafter the DGIs become indistinct. Early growth phase of blue marlin has been determined based on otolith DGI counts and is estimated to be among the fastest growth rates recorded for teleosts. Figure 3.4 of the assessment generally show a single mode in the fishery length frequencies which indeed suggests relatively rapid growth. Figure 3.4b shows two or more modes, but this does not seem to have been used in the estimation of growth. Growth is similar for both sexes at small sizes but differ quickly with females reaching substantially larger weights than males. Longevity estimates remain tentative and has not been validated. A maximum age of 26 years was used in SS3 modeling. The presence of 2-3 modes in the length frequencies in Figure 3.4b suggest that it could be useful to attempt more intensive seasonal sampling over a few years to evaluate if it would be possible to follow modes in the length frequencies to study growth.

Conventional tag-recapture data from the Pacific NMFS Cooperative Billfish Tagging Program since the 1960's indicate that most re-captures are taken in the general vicinity of their original tag-release location although several spectacular long-range movements within the Pacific have been documented. The recapture rate from tagging experiments is extremely low (0.6%). It would be useful to list the reasons for the low recapture rate and comment on the possibility that such a low rate (0.6%) is indicative of a low exploitation rate. Explaining the low recapture rate may require additional field work.

Sixteen fisheries were defined on the basis of country, gear type, and reported unit of catch (Table 3.1). These fisheries were considered to be relatively homogeneous, with greater differences in selectivity and catchability from one fishery to the other than temporal changes in the parameters within fisheries. In the case of the Japanese distant-water-longline fishery, two fisheries were defined because of significant differences in data reporting and compilation before and after 1994. Other catch series were separated by area but not by time. The last paragraph of section 2.2 is somewhat misleading. It states "*The blue marlin catches reached the highest reported catch in 1993 where the reported catches totaled about 25,509 tons. Afterwards, the catch decreased significantly to around 18,000 tons and maintained at that level in 2010−2011*". To my eye, Figure 3.2 shows the maximum catch in 2003 and a more or less steady decline since, not the stability implied in the sentence quoted above.

Catch and effort data for the Japanese distant water and offshore longline for the early (before 1994 - F1) and late (from 1994 - F2) period, the Hawaiian longline (F7), and for the Taiwan distant water longline (F10), were used to develop standardized time series of catch-per-unit-effort (CPUE), which were assumed to be proportional to population size used as relative indices of abundance. From these, six standardized annual relative indices of abundance were developed based on the annual quarter in which the majority of the catch was recorded. For Japan longline fisheries, two temporally separate indices were defined as years: 1975-1993 and 1994-2011 to account for changes of operation (depth of hook), hook-per-basket (HPB) distribution, and targeted main species. Three indices (S4-S6) covering different time periods were separated for the Taiwan longline fishery (F10) to account for the temporal effect of the fishing ground shift from the South Pacific Ocean to the whole Pacific Ocean since the 1980s and the shift in the target species from albacore to bigeye tuna since 2000. The last paragraph in section 3.3 puts too much emphasis on conflicting trends in longline indices in 1970-1990; in contrast, I see reasonably good agreement. The text on the discrepancy may have been kept from earlier assessments when it might have been more apparent. Generalized linear models and generalized models were both used to standardize CPUE. It would be helpful to indicate why different approaches were taken for different data sets.

The assessment models the two-sexes separately to account for known differences in growth, expected differences in natural mortality rates (mostly because of differences in growth) and the observed length-weight relationships but there are no data on sex of individual fish taken in the fisheries. Therefore information by sex is not used in fitting the model to data.

Natural mortality (M), assumed to be age- and sex-specific, were derived from a meta-analysis of nine estimators based on empirical and life history methods to represent adult fish. M was assumed to be constant after maturity. The natural mortality rates at age used seem reasonable.

Catchability (q) was estimated by assuming that survey indices are proportional to vulnerable biomass. Catchability was assumed to be constant over time for all indices. This assumption is unlikely to hold for long periods of time. The assessment addresses this problem by splitting the time series (in 2 periods for the Japanese longlines and in 3 for the Taiwanese longlines). Catchability is likely to be affected by technological changes in the fleets, but also by behavioral changes due to changes in management. The assessment seems to have addressed the technological and fishing method changes, but it is not clear that behavior changes due to fishery management have been taken into account to the same extent.

The SS3 model was fit to three data components (catch, CPUE indices and size frequency data) as illustrated in Figure 3.1. The assessment document recognizes that CPUE indices are direct measures of relative abundance while size composition data are at best indirect measures and are less informative about changes in population size. The intention was clearly to give more weight to the CPUE indices in model fitting, but it is not clear that the method chosen to do so, additional parameters in the selectivity pattern process, has indeed achieved that objective. That CPUE indices were given greater weight could be more clearly demonstrated.

The discussion of CPUE indices in section 4.7 suggests that if the indices do not agree, one or more must be wrong and not indicative of changes in stock size. This is not necessarily the case. An alternative hypothesis would be that the assumption about a single stock with complete mixing every quarter is wrong. Under that alternate hypothesis, different CPUE indices in different areas could show conflicting trends without implying that one of them is wrong. This alternate hypothesis should be considered in the next assessment.

The retrospective analysis (Figure 5.5) suggests that the model underestimated biomass for the first 3-4 peels, but since 2005, the tendency appears to have reversed with female spawning stock biomass being overestimated. The overestimation is relatively small for the last 4 peels, but there was a substantial decrease from the 2006 to the 2007 estimate. Management advice should take into account the possibility that the current assessment could suffer from the same overestimation.

The sensitivity analyses (section 5.6) illustrated in figures 5.11 to 5.15 do not show any surprise and the results are generally as expected (e.g. when assuming different natural mortality rates). Figure 6.3 shows the ratio of the 2011 relative F to the 2011 relative spawning biomass on a Kobe plot indicating that sensitivity cases 2 (SS3 fitted to Hawaii CPUE), 3 (low M model), 5 (steepness = 0.65) and 6 (steepness = 0.75) would lead to different conclusions about the state of the stock: those sensitivity cases imply that the stock is overfished and that overfishing is occurring, particularly for sensitivities 2, 3 and 5; sensitivity 6 is borderline. The likelihood of sensitivity cases 2, 3 and 5 being correct should therefore be thoroughly investigated.

It is not possible to judge from the available information if sampling was adequate. Absolute values derived from SS3 can differ markedly with small changes in data or configuration.

I conclude that the assessment model configuration, assumptions, and input data and parameters (fishery, life history, and spawner recruit relationships) are appropriate. The data are properly used, input parameters seem reasonable, models are appropriately configured, and assumptions are reasonably satisfied. Uncertainties have been estimated by running sensitivity analyses. Uncertainties are likely underestimated in the base case results e.g. the CV of the 2010-2011 SSB is likely to be greater than 15%. The possibility that sensitivity cases 2, 3 and 5 could be correct should be further investigated and the consequences taken into account in formulating management advice.

3. Comment on the proposed population benchmarks and management parameters (e.g., MSY, Fmsy, Bmsy, MSST, MFMT); if necessary, recommended values for alternative management benchmarks (or appropriate proxies) and clear statements of stock status.

MSY, F_{MSY}, SSB_{MSY} , $F_{20\%SPR}$ and $SSB_{20\%SPR}$ were estimated in the assessment model. MSY was estimated at MSY = 19459 t ± 623, SSB_{MSY} was estimated at SSB_{MSY} = 19437 t ± 653, $SSB_{20\%SPR}$ was estimated at $SSB_{20\%SPR}$ = 26324 t ± 909. F_{MSY} was estimated at F_{MSY} = 0.32 ± 0.004 and $F_{20\%SPR}$ was estimated at $F_{20\%SPR}$ = 0.29 ± 0.003. These calculations are performed directly in the SS3 assessment model and are therefore consistent with the data, assumptions, and parameters of the assessment model. As I concluded above that the assessment model configuration, assumptions, and input data and parameters (fishery, life history, and spawner recruit relationships) are appropriate, I logically conclude that the proposed benchmarks are appropriate, noting the caveats about sensitivity cases 2, 3 and 5.

No estimates of the maximum fishing mortality threshold (MFMT) and the minimum stock size threshold (MSST) are provided, presumably because fisheries on Pacific blue marlin are managed internationally under two separate Regional Fishery Management Organizations, the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC) which may not have a requirement to define those benchmarks.

The assessment document concludes that "*Based on the results of the stock assessment the stock is not currently overfished and is not experiencing overfishing. The stock is nearly fully exploited.* ". I agree with that conclusion, noting the caveats about sensitivity cases 2, 3 and 5.

4. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status.

Spawning stock biomass and yield were projected from 2012 to 2020 under four scenarios:

1. If current F (⟦F_(2009-2011)=F⟧_(23%SPR)) is maintained, the stock is projected to be stable above SSB_{MSY} at roughly 26,200 t by 2020.
2. If F is increased to F_{MSY}, the projected SSB is expected to decrease gradually to about SSB_{MSY} by 2020.
3. If F is further increased to the average for 2003-2005 (F_(16%SPR)), the projected SSB would be below SSB_{MSY} by 2015.
4. Conversely, if F is decreased to F_(30%SPR), the projected SSB would gradually increase.

The projections were done directly in the SS3 assessment model. The scenarios provide a good basis for management decision. The methods used to make the projections are consistent with the assessment model data, assumptions and parameters. The method to project future population status is considered adequate, appropriate, and correctly applied.

5. Suggest research priorities to improve our understanding of essential population and fishery dynamics necessary to formulate best management practices.

Some CPUE series (e.g. Hawaii longlines) show different trends than the others. It would be useful to know if the difference is due to relatively low mixing and possibly implying sub-stocks.

It would be useful to show the information on spawning time and area (section 2.1.2) on a map, if necessary in a schematic way.

The presence of 2-3 modes in the length frequencies in Figure 3.4b suggest that it could be useful to attempt more intensive seasonal sampling over a few years to evaluate if it would be possible to follow modes in the length frequencies to study growth.

It would be useful to list the reasons for the low recapture rate and comment on the possibility that such a low rate (0.6%) is indicative of a low exploitation rate. Explaining the low recapture rate may require additional field work..

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The intention was clearly to give more weight to the CPUE indices in model fitting, but it is not clear that the method chosen to do so, additional parameters in the selectivity pattern process, has indeed achieved that objective. That CPUE indices were given greater weight could be more clearly demonstrated.

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On Figure 6.3, sensitivity cases 2 (SS3 fitted to Hawaii CPUE), 3 (low M model), 5 (steepness = 0.65) and 6 (steepness = 0.75) would lead to different conclusions about the state of the stock implying that the stock is overfished and that overfishing is occurring, particularly for sensitivities 2, 3 and 5; sensitivity 6 is borderline. The likelihood of sensitivity cases 2, 3 and 5 being correct should therefore be thoroughly investigated.

The current assessment of Pacific blue marlin is a sufficient basis for management if fishing mortality is indeed less than F_{MSY} and if SSB is above SSB_{MSY}. Further research into the possibility that sensitivity cases 2, 3 and 5 provide a more realistic description of the status of Pacific blue marlin would however be useful.

Conclusions and Recommendations in accordance with the ToRs

I conclude that SS3 is appropriate for the data available and used for Pacific blue marlin and the results appear to be reasonable and that the science reviewed is the best scientific information available. However, while SS3 is a highly flexible assessment tool, it is also highly structured with many options and built-in assumptions. Because of its structure and underlying assumptions, SS3 can provide stock estimates and fisheries management benchmarks even when very little data are available. It is also sometimes difficult to ascertain the most important influence on the assessment results: the data or the assumptions in the model. I do not know which it is for the Pacific blue marlin. Without having access to the full output of the assessment it is difficult to judge which of the assumptions or the data have the largest influence on the assessment results. Figure 6.3 of the assessment document suggests that both are influential but it is not possible to ascertain the relative importance of each.

I conclude that the assessment model configuration, assumptions, and input data and parameters (fishery, life history, and spawner recruit relationships) are appropriate. The data are properly used, input parameters seem reasonable, models are appropriately configured, and assumptions are reasonably satisfied. Uncertainties have been estimated by running sensitivity analyses. Uncertainties are likely underestimated in the base case results e.g. the CV of the 2010-2011 SSB is likely to be greater than 15%. The possibility that sensitivity cases 2, 3 and 5 could be correct should be further investigated and the consequences taken into account in formulating management advice.

The assessment document concludes that " Based on the results of the stock assessment the stock is not currently overfished and is not experiencing overfishing. The stock is nearly fully exploited. ". I agree with that conclusion, noting the caveats about sensitivity cases 2, 3 and 5.

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The current assessment of Pacific blue marlin is a sufficient basis for management if fishing mortality is indeed less than FMSY and if SSB is above SSBMSY. Further research into the possibility that sensitivity cases 2, 3 and 5 provide a more realistic description of the status of Pacific blue marlin would however be useful.

Appendix 1: Bibliography of materials provided for review

Chang, Y.-J., Brodziak, J., Lee, H.-H., DiNardo, G., and Sun, C.-L. 2013. A Bayesian hierarchical meta-analysis of blue marlin (Makaira nigricans) growth in the Pacific Ocean. Working paper ISC/13/BILLWG-1/02 submitted to the ISC Billfish Working Group Workshop, 16-23 January 2013, Honolulu, Hawaii, USA, 23pp. Available at: http://isc.ac.affrc.go.jp/pdf/BILL/ISC13_BILL_1/ISC13BILLWG-1-02.pdf

ISC. 2013a. Stock assessment of blue marlin in the Pacific Ocean in 2013. Billfish Working Group, ISC. 116 pages.

Kanaiwa, M., Kimoto, A., Yokawa, K., and Hinton, M.G. 2013. Standardized abundance indices for blue marlin (Makaira nigricans) in Pacific Ocean from analyses of catch and fishing effort from offshore and distance water longline vessels of Japan. Working paper ISC/13/BILLWG-1/05 submitted to the ISC Billfish Working Group Workshop, 16-23 January 2013, Honolulu, Hawaii, USA, 87pp. Available at: http://isc.ac.affrc.go.jp/pdf/BILL/ISC13_BILL_1/ISC13BILLWG-1-05.pdf

Lee, H.-H. and Chang, Y.-J. 2013. Age-structured natural mortality for Pacific blue marlin based on meta-analysis and an ad hoc mortality model. Working paper ISC/13/BILLWG-1/07 submitted to the ISC Billfish Working Group Workshop, 16-23 January 2013, Honolulu, Hawaii, USA, 19pp. Available at: http://isc.ac.affrc.go.jp/pdf/BILL/ISC13_BILL_1/ISC13BILLWG-1-07.pdf

Sun, C.-L., Chang, Y.-J., Tszeng, C.-C., Yeh, S.-Z., and Su, N.-J. 2009. Reproductive biology of blue marlin (Makaira nigircans) in the western Pacific Ocean. Fish. Bull. 107: 420-432.

Sun, C.-L., Su, N.-J., and Yeh, S.-Z. 2013. Standardizing catch and effort data of the Taiwanese distant-water tuna longline fishery for blue marlin (Makaira nigricans) in the Pacific Ocean, 1967-2011. Working paper ISC/13/BILLWG-1/09 submitted to the ISC Billfish Working Group Workshop, 16-23 January 2013, Honolulu, Hawaii, USA, 13pp. Available at: http://isc.ac.affrc.go.jp/pdf/BILL/ISC13_BILL_1/ISC13BILLWG-1-09.pdf

Walsh, W., Chang, Y.-J., and Lee, H.-H. 2013. Catch statistics, size compositions, and CPUE standardizations for blue marlin (Makaira nigricans) in the Hawaii-based pelagic longline fishery in 1995-2011. Working paper ISC/13/BILLWG-1/13 submitted to the ISC Billfish Working Group Workshop, 16-23 January 2013, Honolulu, Hawaii, USA, 79pp. Available at: http://isc.ac.affrc.go.jp/pdf/BILL/ISC13_BILL_1/ISC13BILLWG-1-13.pdf

Appendix 2: A copy of the CIE Statement of Work

Attachment A: Statement of Work for Dr. Jean-Jacques Maguire

External Independent Peer Review by the Center for Independent Experts

Pacific Blue Marlin Assessment Desk Review

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Representative (COR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: The International Scientific Commission (ISC) will be completing a Pacific blue marlin stock assessment in July 2013. The assessment provides the basis for scientific advice on the status of the Pacific blue marlin stock and will be the foundation for international management decisions of the Inter-American Tropical Tuna Commission and Western and Central Pacific Fisheries Commission and its Northern Committee, and domestic management decisions by the Western Pacific Regional Fisheries Management Council (WPRFMC). An independent peer-review of the assessment will provide valuable feedback to the ISC in conducting future assessments. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

Requirements for CIE Reviewers: Three CIE reviewers shall have the necessary qualifications to complete an impartial and independent peer review in accordance with the statement of work (SoW) tasks and terms of reference (ToRs) specified herein. The CIE reviewers shall have expertise in population modeling, stock assessment, and billfish stock assessments to complete the tasks of the peer-review described herein. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall participate and conduct an independent peer review as a desk review; therefore travel will not be required.

Statement of Tasks: Each CIE reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer contact information to the COR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the assessment and other pertinent background documents for the peer review. Any changes to the SoW or ToRs must be made through the COR prior to the commencement of the peer review.

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Desk Review: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. Modifications to the SoW and ToRs shall not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COR and CIE Lead Coordinator. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in **Annex 2**.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Conduct an impartial and independent peer review in accordance with the tasks and ToRs specified herein, and each ToRs must be addressed (**Annex 2**).
3) No later than January 29, 2014, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to Dr. David Die ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in **Annex 1**, and address each ToR in **Annex 2**.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

23 December 2013	CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
7 January 2014	NMFS Project Contact sends the CIE Reviewers the assessment report and background documents
11–25 January 2014	Each reviewer conducts an independent peer review as a desk review
29 January 2014	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
12 February 2014	CIE submits CIE independent peer review reports to the COR
19 February 2014	The COR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: This 'Time and Materials' task order may require an update or modification due to possible changes to the terms of reference or schedule of milestones resulting from the fishery management decision process of the NOAA Leadership, Fishery Management Council, and Council's SSC advisory committee. A request to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent changes. The Contracting

Officer will notify the COR within 10 working days after receipt of all required information of the decision on changes. The COR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:

(1) The CIE report shall completed with the format and content in accordance with **Annex 1**,

(2) The CIE report shall address each ToR as specified in **Annex 2**,

(3) The CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COR. The COR will distribute the CIE reports to the NMFS Project Contact and Center Director.

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Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

   The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

Appendix 1: Bibliography of materials provided for review

Appendix 2: A copy of the CIE Statement of Work

Annex 2 – Terms of Reference

Pacific Blue Marlin Assessment Desk Review

1. Review of the assessment methods: determine if they are reliable, properly applied, and adequate and appropriate for the species, fisheries, and available data.
2. Evaluate the assessment model configuration, assumptions, and input data and parameters (fishery, life history, and spawner recruit relationships): determine if data are properly used, input parameters seem reasonable, models are appropriately configured, assumptions are reasonably satisfied, and primary sources of uncertainty accounted for.
3. Comment on the proposed population benchmarks and management parameters (*e.g., MSY, Fmsy, Bmsy, MSST, MFMT*); if necessary, recommended values for alternative management benchmarks (or appropriate proxies) and clear statements of stock status.
4. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status.
5. Suggest research priorities to improve our understanding of essential population and fishery dynamics necessary to formulate best management practices.