Center for Independent Experts (CIE) Independent Peer Review of Technical Documentation for the Vertical Line Analysis Model Supporting an Amendment to the Atlantic Large Whale Take Reduction Plan

November 2012

Executive Summary

The Vertical Line Analysis model is being developed to provide an exploratory and analytical tool to evaluate various management scenarios under which the number of vertical lines could be reduced to lower the risk of entanglement to large whales.

The documentation for the model, which was the subject of this review, does not specify the specific structure of outputs, but it is important that separate outputs be available for each species of large whale at the finest level of resolution (*i.e.* monthly time steps and 10-minute cells) so that users may evaluate the potential effects of different management interventions at scales that are relevant to fishery participants and other interested stakeholders. The geographic scope of the model captures the entire range covered by the ALWTRP, including some inshore waters that are exempted from the Plan. The scope of the model seems appropriate.

Input data on fishing effort are extremely heterogeneous, particularly in state waters. This is, to some degree, inescapable, given the model structure but it is a source of concern. The NARWC SPUE data set is also quite heterogeneous. Although there has been an effort to limit this variation by specifying minimum data standards for inclusion, it is very likely that the data set includes many cells with an estimated SPUE value of zero for which the true value is not zero. The issue of non-zero SPUE values must be resolved, especially given the heterogeneity in the NARWC data set. There are several analytical approaches to deal with this problem but it is not appropriate to assume that whales were absent from a grid cell that contains a low level of survey effort and no sightings. In addition, the data set could be improved by incorporating other data types, such as satellite-linked telemetry of individual whale movements.

The model structure is rather awkward and very dependent on empirical data inputs for both fishing gear and whales. A preferable approach would have been to model the distribution of vertical lines and whales independently with respect to environmental factors and then overlay the two model outputs to determine the degree of co-occurrence. This approach would have been more satisfactory in that the separate models would have allowed prediction of the relative densities of vertical lines and whales in areas where empirical observations were lacking. It would have also facilitated model validation and analysis of the sensitivity of results to various assumptions.

I was surprised that the authors of the model did not describe any attempts to validate their results. This is especially important given that the model outputs are intended to be used to guide management decisions that will have important effects on fishermen and whales. If no validation is to be performed, then I recommend that the performance of the IEc model be compared with alternative models which have been produced to predict the co-occurrence of large whales and vertical lines.

Thus, it is my opinion that other model approaches might have been preferable and that this version of model is not ready to be used in a management application until its performance has been validated or compared with other approaches.

Background

The Vertical Line Analysis model (hereafter 'the model') is being developed to provide an exploratory and analytical tool to evaluate various management scenarios under which the number of vertical lines could be reduced to lower the risk of entanglement to large whales.

Industrial Economics, Inc. (IEc) correctly notes in the preamble to the documentation that the model does not provide an estimate of the probability of entanglement which, in addition to the probability of co-occurrence, will depend on many other factors, including, most importantly, the behavior of the whales. There is still much to be learned about how and why entanglement occurs once a whale encounters vertical lines or other components of fishing gear. Nevertheless, a model of co-occurrence is a useful first step in identifying areas where the probability of encounter is high and where management actions may be warranted to decrease the probability of entanglement.

The model incorporates data on fishing activity in federal waters from 2000 to 2009, with additional years of such data forthcoming. Observations of fishing activity in state waters are more limited, but the model incorporates data from at least 2008 to 2010 within three miles from shore. All major fisheries employing vertical lines are included in the model, which treats the following fisheries separately: lobster, gillnet; blue crab (south of New England); and other trap/pot fisheries. Information of the distribution of whales comes from a sightings-per-unit effort (SPUE) data set provided by the North Atlantic Right Whale Consortium (NARWC). The SPUE data set covers a longer time period than the fisheries data set, extending back as far as October 1978 and forward in time to May 2010.

Description of Individual Reviewer's Role in the Review Activities

I was notified on July 30 2012 that I had been selected as a reviewer for the Center of Independent Experts and provided with the technical documentation of the model on August 13, 2012. I was aware of the existence of the model prior to conducting this review, mostly in my role as Chair of the Atlantic Scientific Review Group, but had never fully explored its structure, data inputs assumptions or outputs.

Summary of Findings

(1) Does the documentation provide a clear description of the model's purpose and scope, and of the data and methods it employs to characterize: (a) vessel activity in the fisheries subject to the requirements of the ALWTRP; (b) the distribution of gear associated with these fisheries; and (c) seasonal variation in the potential distribution of endangered right, humpback, and fin whales?

The documentation clearly describes the model's purpose and scope and provides detailed summaries of the estimated number of active vessels and gear configuration in each area. The documentation specifies that the model "can further aggregate the sightings data, producing combined SPUE datasets that sum across all or a subset of the whale species

within each grid cell and month." Thus it should be possible to provide separate outputs for *each species* of large whale at the finest level of resolution (*i.e.* monthly time steps and 10-minute cells) so that users may evaluate the potential effects of different management interventions at scales that are relevant to fishery participants and other interested stakeholders. It is slightly worrying that the examples given in the documentation combine both right and humpback whales – separate results should be presented for each species.

(2) With respect to the characterization of fishing activity in Federal and state waters: (a) Are the data, methods, and assumptions the model employs to estimate the number of vessels active in each fishery appropriate? (b) Are the data, methods, and assumptions employed to characterize the location of fishing activity appropriate? (c) Are the data, methods, and assumptions employed to characterize monthly variation in fishing activity appropriate? (d) Are key data limitations and uncertainties appropriately identified? (e) Within the limits of available data, how could IEc improve the model's characterization of fishing activity?

Overall, the characterization of fishing activity in terms of the number of vessels active in federal and state waters seems appropriate. The number of vessels fishing in federal waters is characterized more accurately than the number of vessels fishing in state waters, due to better reporting requirements. Taken as a whole, however, the data on fishing activities used in the model are extremely heterogeneous, ranging from direct inputs from Vessel Trip Reports in federal waters to expert opinion in some state waters. The quality of data inputs for the number of vessels in state waters is uncertain and likely highly variable. This heterogeneity is a significant source of concern. The documentation does not seem to contain any descriptions of attempts to test assumptions regarding the accuracy of data inputs on fishing activity. Absent a peer review by individuals familiar with fishing activities in each state, it is not clear what else IEc could do to improve the model's characterization of fishing activity.

(3) With respect to the characterization of gear use in the fisheries of interest: (a) Is the use of model vessels to describe the typical configuration of gear in particular areas and at different times of year a reasonable and appropriate approach? (b) Are the parameters employed to characterize configurations of gear in trap/pot fisheries - i.e., total traps fished, number of traps per trawl, number of endlines per trawl, length of groundline between traps, number of anchors per trawl, and length of anchor lines - appropriate for the model's purpose? (c) Are the parameters employed to characterize configurations of gear in gillnet fisheries - i.e., total strings fished, number of endlines per string, number of anchors per string, and length of anchor lines - appropriate for the model's purpose? (d) Are the equations the documentation specifies to calculate the number of vertical lines and length of groundline associated with each model vessel conceptually correct? (e) Are the data, methods, and assumptions employed to define model vessels in the Federal lobster fishery appropriate? (f) Are the data, methods, and assumptions employed to define model vessels in the Federal blue crab fishery and other Federal trap/pot fisheries appropriate? (g) Are the data, methods, and assumptions employed to define model vessels in Federal gillnet fisheries appropriate? (h) Are the data, methods, and assumptions employed to define model vessels in state waters appropriate? (i) Are key data limitations and uncertainties appropriately identified? (j) Within the limits of available data, how could IEc improve the model's characterization of gear use?

Given that there is no requirement to report relevant metrics of fishing effort (i.e. the number of vertical lines employed) at appropriate temporal and spatial scales across all fisheries in state and federal waters, the use of *model vessels* to describe the typical configuration of gear in particular areas and at different times of year is a reasonable, if slightly clumsy, approach. IEc indicates that nearly 300 such model vessels are used to characterize gear use under baseline conditions, although these model vessels are not identified or described. A preferable approach would have been to model the distribution of vertical lines directly in each fishery with respect to environmental factors (home port, depth, distance to shore, etc.). Overall, the parameters employed to characterize configurations of gear in both pot and gillnet fisheries seem appropriate, although I am much more familiar with the latter than the former.

The equations used to calculate the number of vertical lines and length of groundline associated with each model vessel (*e.g.* Exhibits 5 and 6) appear to be conceptually correct.

The data, methods, and assumptions employed to define model vessels in the Federal lobster fishery appear to be appropriate, although it is not clear why these vessels should be exempt from the requirement to complete a Vessel Trip Report (VTR). The approach used in the model documentation to deal with vessels that hold only a lobster permit and are not required to submit a VTR seems appropriate. The data, methods, and assumptions employed to define model vessels in the Federal blue crab and other Federal trap/pot fisheries seem appropriate, although I am not particularly familiar with these fisheries.

It seems to me that there should be adequate information available about the specific gear requirements used by vessels participating in fisheries included in the model. However, a few of the data inputs for some of these fisheries seem at odds with my personal experience. For example, in North Carolina fishermen typically set at least five Spanish mackerel gillnets on any given day, repeatedly hauling and resetting these nets. This is very different than the description of this summer fishery given on Page 173 of the documentation. In addition, these nets each employ two, rather than one, anchors. I am not sufficiently familiar with many of the other state fisheries described in the model documentation to judge the accuracy of their descriptions, but this error concerns me.

As is the case for the number of vessels, the documentation does not seem to contain any descriptions of attempts to test assumptions regarding the accuracy of data inputs on fishing activity.

In this case, I believe that a peer review of the gear configurations described for certain state fisheries would improve the model's characterization of gear use.

(4) With respect to the seasonal distribution of endangered species of large whales in waters subject to the ALWTRP: (a) Are the whale sightings data the model employs to characterize monthly variation in the potential distribution of right whales, humpback whales, and fin whales appropriate for this purpose? (b) Are key data limitations and uncertainties appropriately identified? (c) Within the limits of available data, how could IEc improve the model's characterization of seasonal variation in the potential distribution of endangered whales?

As noted by other scientists, the NARWC SPUE data set is also quite heterogeneous, including observations from both aerial and vessel survey platforms, for example. These data have also been collected over a period over more than 30 years, during which patterns of occupancy may have changed. Although there has been an effort to limit this variation by specifying minimum data standards for inclusion in the data set, it is highly likely that the data set includes many cells with an estimated SPUE value of zero for which the true value is not zero. This could have been addressed by modeling the distribution of whales directly, so that the influence of such observations is reduced (see comments above regarding number of vertical lines). Nevertheless, as recognized by other reviewers (*e.g.* the Atlantic Scientific Review Group), this is a significant flaw and must be rectified. There are several analytical approaches to deal with this issue but, especially with such a rare species, it is not appropriate to assume that whales were absent from a grid cell that contains a low level of survey effort and no sightings. In addition, the data set could be improved by incorporating other data types, such as satellite-linked telemetry of individual movements. Recent work using passive acoustic monitoring, for example, has indicated the presence of calling whales in areas where no visual detections have been recorded.

(5) The model's primary outputs include: (a) estimates of the number of vessels that participate in a given fishery, by month and location; (b) estimates of the number of vertical lines deployed in waters subject to the ALWTRP, by month and location; and (c) an indicator of the potential 'co-occurrence' of whales and vertical line, by month and location. (a) Are the data, methods, and assumptions employed to develop these measures appropriate for the model's purposes? (b) Given the limits of available data and knowledge concerning factors that contribute to the risk of an entanglement, does the co-occurrence indicator provide a reasonable basis for evaluating relative differences in the likelihood that whales will encounter vertical line in a particular area during a particular month? (c) Are key data limitations and uncertainties appropriately identified? (d) Within the limits of available data, how could these indicators be improved?

This is a fairly straightforward model approach that seeks to capture spatial and temporal variation in the co-occurrence of vertical lines and large whales for particular baseline periods. The number of vertical lines in each grid cell is derived from observations or estimates of the number of 'model vessels' active in that cell and the number of vertical lines typically deployed by each type of model vessel. Multiple model vessels can be active within a grid cell in any single time step. Once the geographical and temporal layers of the distribution of vertical lines are assembled, they are overlaid with the NARWC SPUE data. A scaled indicator of co-occurrence is then generated for each one-minute grid cell, ranging from zero to 10^3. Then, apparently, for each grid cell index values are multiplied to generate a combined indicator score, which may range in value from zero to 1 million. No rationale is given for using this scaling approach, nor is there adequate description of the manner in which scores are multiplied.

Input data on the *number* of lines in a given grid cell does not seem to capture one additional source of variation; how long each line is fished in a given cell? For example, compare multi-day gillnet soaks for monkfish with soaks of gillnet for Spanish mackerel, which may last only a few hours. I am not as familiar with variation in the soak time of

lobster gear (inshore versus offshore, for example), but is seems plausible that similar variation could occur. How is variation in soak time accounted for in the model?

There is a mismatch in the grain (*i.e.* level of spatial resolution) in the input data on fishing effort and whale distribution. The former is aggregated at a spatial scale of one-minute grid cells; the latter at a scale of ten-minute grid cells. This necessitates a rather coarse spatial analysis of overlap scores, which may not be adequate to address fine-scale variation in fishing effort or other management regulations.

As alluded to above, an alternative, and perhaps preferable, approach to the one taken by IEc would have been to model the distribution of vertical lines and whales independently with respect to environmental factors (home port, depth, distance to shore, etc.) and then to overlay the two model outputs to determine the degree of co-occurrence. This would have been more satisfactory in that the separate models would have allowed prediction of the relative densities of vertical lines and whales in areas where empirical observations were lacking (see below). It would have also facilitated model validation and analysis of the sensitivity of results to various assumptions.

(6) Overall, what steps should IEc take to improve the model and/or its documentation?

It was very surprising to me that the documentation did not describe any attempts to validate the model. This is especially important given that the model outputs are intended to be used to guide management decisions that will have important real-world effects on fishermen and the conservation of whales. Validation is a demonstration that model predictions are accurate to within certain limits specified by the user. In this case, it would be instructive to know from representatives of the fishing, environmental and scientific communities on the ALWTRT what level of accuracy is both desirable and acceptable.

There is, of course, another line of thought that asserts no model can be validated, but instead each model should be compared with a series of alternate models. Thus no single model can be validated as correct, but merely considered to be better than its competitors. I am aware that alternative models have been produced to predict the co-occurrence of large whales and vertical lines - it would be useful to compare the results of these models to determine which is best able to explain new observations.

It would be possible, for example, to predict overlap scores for a sub-set of grid cells and then, either using existing data or data collected specifically for this purpose, determine how well each model predicted the observed overlap. Such comparisons can reveal problems with the model structure or limitations of the data used to parameterize the model, both of which are concerns in the present case. There is an extensive literature on validation and comparison of ecological models and I am surprised that there has not been more of an attempt made here to ensure that such work has been done before the model is used to assess potential management proposals.

Validation can also help to constrain limits under which the model performs adequately. For example, there have been many past management measures put into place that effect the distribution of vertical lines - how do such past measures affect our ability to predict

future distribution? This is a particular concern when future applications of the models may be made in a world that is different from that in which the model was created – if, for example, areas currently closed to fishing were to be opened in the future.

Thus, it is important that the performance of the model be validated prior to its use in any real-world application. This type of exercise will reveal much about the performance of the model, which is obviously of great concern to all members of the ALWTRT and to the sensitivity of model outputs to assumptions and the quality of data inputs. If the model has not been validated it is critical to compare its predictive capacity with other models to determine whether it provides the best possible predictive power.

Conclusions and Recommendations

I appreciate the enormous amount of work that has gone into the development of this model. My comments are by no means intended to be unduly critical. Nevertheless, it is my opinion that other model approaches might have been preferable and that this version of model is not ready to be used in a management application until its performance has been validated or compared with other model approaches.

Appendix 1: Bibliography of materials provided for review

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Appendix 2: Statement of Work

External Independent Peer Review by the Center for Independent Experts

Review of Technical Documentation for the Vertical Line Analysis Model Supporting an Amendment to the Atlantic Large Whale Take Reduction Plan

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: NOAA's National Marine Fisheries Service (NMFS) intends to expand large whale conservation efforts by amending regulations that implement the Atlantic Large Whale Take Reduction Plan (ALWTRP). Since its implementation in 1997, the ALWTRP was modified on several occasions to reduce the risk of injury and mortality of large whales that interact with commercial trap/pot and gillnet fishing gear. The ALWTRP consists of regulatory and non-regulatory programs including: broad-based gear modifications, time-area closures, disentanglement, research and outreach. Despite these efforts, there continues to be injuries and mortalities of large whales from entanglements in vertical lines from commercial trap/pot and gillnet fishing gear. Therefore, additional modifications to the ALWTRP are needed.

At the 2003 Atlantic Large Whale Take Reduction Team (ALWTRT) meeting, the ALWTRT agreed to two overarching principles associated with reducing large whale entanglement risks: reducing entanglement risks associated with groundlines (lines between trap/pots) in commercial trap/pot gear; and reducing entanglement risks associated with vertical lines (endlines or buoy lines) in commercial trap/pot and gillnet gear. NMFS addressed the first principle; reducing entanglement risk from groundlines in October 2007 with the implementation of a sinking groundline requirement for all trap/pot fisheries throughout the entire East coast (72 FR 57104, October 5, 2007). NMFS is addressing the second principle, reducing entanglement risks associated with vertical lines in commercial trap/pot and gillnet gear, in this current process.

In 2009, the ALWTRT agreed on a schedule to develop conservation measures for reducing the risk of serious injury and mortality of large whales that become entangled in vertical

lines. NMFS committed to publishing a final rule to address vertical line entanglement by 2014. Unlike the broad-scale management approach taken to address entanglement risks associated with groundlines, the approach for the vertical line rulemaking will focus on reducing the risk of vertical line entanglements in finer-scale high impact areas. Using fishing gear characterization data and whale sightings per unit effort (SPUE) data, NMFS developed a model to determine the co-occurrence of fishing gear density and whale density to serve as a guide in the identification of these high risk areas. The ALWTRT agreed that NMFS should use the model to develop suites of conservation measures that would ultimately serve as options for the ALWTRT to consider when identifying management alternatives. The conservation measures would address vertical line fishery interactions with large whales by reducing the potential for entanglements and minimizing adverse effects if entanglements occur.

Given the significant public interest in this topic, it will be critical for NMFS to obtain a transparent and independent review of the model documentation. It is important that the model contain the best available information on both whale density and fishing gear density and that the associated caveats seem reasonable. Therefore, we seek an independent CIE peer review of the model documentation, and the independent CIE peer review reports formatted as described in **Annex 1** will be made publicly available. The CIE reviewers shall conduct an independent and impartial scientific peer review of this scientific information in accordance with the Terms of Reference (ToRs) for the peer review as specified in **Annex 2**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. The CIE reviewers shall have combined working knowledge and recent experience in spatial analysis, scenario modeling, marine mammal biology, and fisheries management. 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 conduct an independent peer review as a desk review, therefore no travel is required.

Statement of Tasks: Each CIE reviewers 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 information (full name, title, affiliation, country, address, email) to the COR, who forwards this information to the NMFS Project Contact no later than the date specified in the Schedule of Milestones and Deliverables. The CIE Coordinator 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 background documents, reports, and other pertinent information. 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: One week 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. The CIE reviewers

shall read all documents in preparation for the peer review, and are responsible only for the documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. 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.

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 can 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 independent peer review in accordance with the ToRs (**Annex 2**).
3) No later than **28 September 2012**, 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 Sampson david.sampson@oregonstate.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.

24 August 2012	CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact.
31 August 2012	NMFS Project Contact sends the stock assessment report and background documents to the CIE reviewers. Background documents may be sent to the CIE reviewers one week earlier.
7-21 September 2012	Each reviewer conducts an independent peer review as a desk review.

28 September 2012	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator.
12 October 2012	CIE submits the CIE independent peer review reports to the COR.
19 October 2012	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).

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.

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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.

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 for the Peer Review

Review of Technical Documentation for the Vertical Line Analysis Model Supporting an Amendment to the Atlantic Large Whale Take Reduction Plan

The Atlantic Large Whale Take Reduction Plan (ALWTRP) is designed to protect three endangered species – the western North Atlantic stock of right whales, the Gulf of Maine stock of humpback whales, and the western North Atlantic stock of fin whales – from the risk of serious injury or death associated with entanglement in commercial fishing gear. A continuing concern in achieving the goals of the ALWTRP is reducing the risk of entanglement in vertical line; i.e., buoy lines associated with lobster trap/pot gear, other trap/pot gear, or gillnet gear. To better understand these risks and the impact of potential management measures designed to address them, the National Marine Fisheries Service (NMFS) requires information on the spatial and temporal distribution of gear used by fisheries that are subject to the requirements of the ALWTRP, along with information on the likely presence of whales in the waters the plan regulates. This information will contribute to formulation of NMFS' vertical line management strategy.

Under contract to NMFS, Industrial Economics, Incorporated (IEc) has developed a tool that provides the information described above: the Vertical Line Analysis Model. The model is designed to help NMFS address basic questions that are fundamental to whale conservation and fisheries management, such as:

- Where do fisheries subject to the requirements of the ALWTRP operate?
- Where are concentrations of vertical line likely to be the greatest?
- Are whales likely to frequent areas with high concentrations of line?

By integrating available information on patterns of fishing activity, gear configurations, and seasonal changes in the likely distribution of the species of concern, the model provides indicators of relative entanglement risks at various locations and at different points in time. This information will help NMFS identify and evaluate the potential impact of management options designed to reduce the chances that whales will encounter and become entangled in commercial fishing gear.

To support the development of the model, NMFS has arranged for a review of its technical documentation by a team of independent experts. The review is to address the following questions:

1) Does the documentation provide a clear description of the model's purpose and scope, and of the data and methods it employs to characterize (a) vessel activity in the fisheries subject to the requirements of the ALWTRP, (b) the distribution of gear associated with these fisheries, and (c) seasonal variation in the potential distribution of endangered right, humpback, and fin whales?

2) With respect to the characterization of fishing activity in Federal and state waters:

   a) Are the data, methods, and assumptions the model employs to estimate the *number of vessels* active in each fishery appropriate?

   b) Are the data, methods, and assumptions employed to characterize the *location* of fishing activity appropriate?

   c) Are the data, methods, and assumptions employed to characterize *monthly variation* in fishing activity appropriate?

   d) Are key *data limitations and uncertainties* appropriately identified?

   e) Within the limits of available data, how could IEc *improve* the model's characterization of fishing activity?

3) With respect to the characterization of gear use in the fisheries of interest:

   a) Is the *use of model vessels* to describe the typical configuration of gear in particular areas and at different times of year a reasonable and appropriate approach?

   b) Are the *parameters* employed to characterize configurations of gear in *trap/pot fisheries* – i.e., total traps fished, number of traps per trawl, number of endlines per trawl, length of groundline between traps, number of anchors per trawl, and length of anchor lines – appropriate for the model's purpose?

   c) Are the *parameters* employed to characterize configurations of gear in *gillnet fisheries* – i.e., total strings fished, number of endlines per string, number of anchors per string, and length of anchor lines – appropriate for the model's purpose?

   d) Are the *equations* the documentation specifies to calculate the number of vertical lines and length of groundline associated with each model vessel conceptually correct?

   e) Are the data, methods, and assumptions employed to define model vessels in the *Federal lobster fishery* appropriate?

   f) Are the data, methods, and assumptions employed to define model vessels in the *Federal blue crab fishery* and *other Federal trap/pot fisheries* appropriate?

   g) Are the data, methods, and assumptions employed to define model vessels in *Federal gillnet fisheries* appropriate?

   h) Are the data, methods, and assumptions employed to define model vessels in *state waters* appropriate?

i) Are key *data limitations and uncertainties* appropriately identified?

j) Within the limits of available data, how could IEc *improve* the model's characterization of gear use?

4) With respect to the seasonal distribution of endangered species of large whales in waters subject to the ALWTRP:

a) Are the whale sightings data the model employs to characterize monthly variation in the *potential distribution of right whales, humpback whales, and fin whales* appropriate for this purpose?

b) Are key *data limitations and uncertainties* appropriately identified?

c) Within the limits of available data, how could IEc *improve* the model's characterization of seasonal variation in the potential distribution of endangered whales?

5) The model's primary outputs include (a) estimates of the number of vessels that participate in a given fishery, by month and location; (b) estimates of the number of vertical lines deployed in waters subject to the ALWTRP, by month and location; and (c) an indicator of the potential "co-occurrence" of whales and vertical line, by month and location.

a) Are the *data, methods, and assumptions* employed to develop these measures appropriate for the model's purposes?

b) Given the limits of available data and knowledge concerning factors that contribute to the risk of an entanglement, does the co-occurrence indicator provide a reasonable basis for evaluating *relative differences* in the likelihood that whales will encounter vertical line in a particular area during a particular month?

c) Are key *data limitations and uncertainties* appropriately identified?

d) Within the limits of available data, how could these indicators be *improved*?

6) Overall, what steps should IEc take to improve the model and/or its documentation?