**Performance Work Statement**

**External Independent Peer Review by the Center for Independent Experts**

**Review of the Atlantis Ecosystem Model in Support of Ecosystem-Based Fishery Management in the Gulf of Mexico Large Marine Ecosystem**

**March 28 - 30th, 2023**

**Background**

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

Scientific peer review is defined as the organized review process where one or more qualified experts review scientific information to ensure quality and credibility. These expert(s) must conduct their peer review impartially, objectively, and without conflicts of interest. Each reviewer must also be independent from the development of the science, without influence from any position that the agency or constituent groups may have. Furthermore, the Office of Management and Budget (OMB), authorized by the Information Quality Act, requires all federal agencies to conduct peer reviews of highly influential and controversial science before dissemination, and that peer reviewers must be deemed qualified based on the OMB Peer Review Bulletin standards[1].

[1]<https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/memoranda/2005/m05-03.pdf>

**Scope**

The purpose of this review is to evaluate the performance characteristics and to identify appropriate management applications of an Atlantis ecosystem model, employed by the University of South Florida to support SEFSC’s evaluation of Ecosystem-Based Fishery Management (EBFM) strategies for the Gulf of Mexico (GOM) Large Marine Ecosystem. This review is being undertaken as part of an EBFM funded project at the SEFSC.

NMFS strongly endorses the concept of Ecosystem-Based Fisheries Management and the related need for the development of Integrated Ecosystem Assessments, in support of EBFM. Although this review is directed at efforts in the SEFSC, and more specifically for the U.S. federal waters of the Gulf of Mexico, the findings will be more broadly applicable throughout the agency.

Objectives of the CIE review are as follows. Objective 1 is to evaluate the data, parameterization, and skill of the GOM Atlantis model, with emphasis on predicting stock dynamics and catch of Penaeid shrimp (Brown, White and Pink Shrimp groups) and major interacting species. Objective 2 is to identify the extent to which the GOM Atlantis model is suitable for incorporating environmental effects relevant to shrimp production. Objective 3 is to determine the readiness of the model to conduct simulations that assess ecosystem-level impacts of climate change. This could include representation of habitat changes, changes in environmental conditions, and tolerances of species. Objective 4 is to review recent updates to the Atlantis code base specific to the GOM Atlantis model which improves representation of seagrass dynamics. A novel routine was developed in 2021-2022 with CSIRO Australia. The routine partitions seagrass using pseudo age structure to improve representation of herbivory. The review will not otherwise focus on the Atlantis code base nor will it focus on data quality except as it pertains to model performance.

The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

**Requirements for the Reviewers**

Three reviewers shall conduct an impartial and independent peer review of the GOM Atlantis ecosystem model provided, and this review should be in accordance with this Performance Work Statement (PWS) and the methodology review ToRs herein. The chair, who is in addition to the three reviewers, will be provided by the Southeast Regional Office; although the chair will be participating in this review, the chair’s participation (i.e. labor and travel) is not covered by this contract.

The reviewers shall have working knowledge and recent experience in the application of multi-species or ecosystem models of marine ecosystems. This application of Atlantis includes a full dynamic, spatial representation of the marine food web including ocean circulation, biogeochemistry and fisheries. Reviewers should have expertise with models that span these levels of complexity, at a minimum coupling several species to fisheries. Reviewers should have published or supervised development of at least two different types of such models (different model platforms or frameworks), though experiences with the Atlantis model itself is not a requirement. Reviewers shall have direct experience in model development with EBFM application, including direct senior level policy applications or recommendations in addition to scientific publications.

**Tasks for the Reviewers**

**Task 1. Review background material.**

The CIE reviewers are asked to familiarize themselves with all the articles listed in Background Documents list below. The reviewers should especially be familiar with these publications: Ainsworth *et al.* (2015, 2018); Masi et al. (2017, 2018), Tarnecki et al. (2016), Morzaria-Luna et al. (2018, 2022), Court et al. (2020), Dornberger et al. (2020, 2022). Full references for these articles and other supporting documents are found below in the table 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 reviewer any recent information required for this peer review. This will include a draft technical document in preparation by Perryman et al. and other technical output.

*Perryman, H., et al. Draft technical document describing updates to Atlantis. (MS in preparation). Contact:* [*ainsworth@usf.edu*](mailto:ainsworth@usf.edu)*.*

Background Documents

*GOM Atlantis technical documentation*

Ainsworth, C. H., Schirripa, M. J., and Morzaria-Luna, H. (eds.) 2015. An Atlantis Ecosystem Model for the Gulf of Mexico Supporting Integrated Ecosystem Assessment. NOAA Technical Memorandum NMFS-SEFSC-676, 149 p.

*GOM Atlantis applications*

Morzaria-Luna, H.N., Ainsworth, C.H. and Scott, R.L., 2022. Impacts of deep-water spills on mesopelagic communities and implications for the wider pelagic food web. Marine Ecology Progress Series, 681, pp.37-51.

Ainsworth, C.H., Paris, C., Perlin, N., Dornberger, L.N., Patterson, W., Chancellor, E., Murawski, S., Hollander, D., Daly, K., Romero, I., Coleman, F., Perryman, H. 2018. Impacts of the Deepwater Horizon oil spill evaluated using an end-to-end ecosystem model. PLoS One. 2018 Jan 25;13(1):e0190840. doi: 10.1371/journal.pone.0190840

Court, C., Hodges, A.W., Coffey, K., Ainsworth, C.H., Yoskowitz, D. 2020. Effects of the Deepwater Horizon Oil Spill on Human Communities: Catch and Economic Impacts. In: Deep Oil Spills, (pp. 569-580). Springer, Cham.<https://doi.org/10.1007/978-3-030-11605-7_33>

Dornberger, L., Montagna, P., Ainsworth, C.H., 2022. Simulating oil driven abundance changes in benthic marine invertebrates using an ecosystem model. Environmental Pollution (in press).

Dornberger, L.N., Ainsworth, C.H., Coleman, F. and Wetzel, D.L., 2020. A synthesis of top-down and bottom-up impacts of the Deepwater Horizon oil spill using ecosystem modeling. In Deep Oil Spills (pp. 536-550). Springer, Cham.

Masi, M.D., Ainsworth, C.H. and Jones, D.L., 2017. Using a Gulf of Mexico Atlantis model to evaluate ecological indicators for sensitivity to fishing mortality and robustness to observation error. Ecological indicators, 74, pp.516-525.

Masi, M.D., Ainsworth, C.H., Kaplan, I.C. and Schirripa, M.J., 2018. Interspecific interactions may influence reef fish management strategies in the Gulf of Mexico. Marine and Coastal Fisheries, 10(1), pp.24-39. DOI: 10.1002/mcf2.10001

*Diet*

Tarnecki, J.H., Wallace, A.A., Simons, J.D. and Ainsworth, C.H., 2016. Progression of a Gulf of Mexico food web supporting Atlantis ecosystem model development. Fisheries Research, 179, pp.237-250.

Morzaria-Luna, H.N., Ainsworth, C.H., Tarnecki, J.H. and Grüss, A., 2018. Diet composition uncertainty determines impacts on fisheries following an oil spill. Ecosystem services, 33, pp.187-198.

*Spatial biomass calculations for GOM Atlantis*

Grüss, A., Drexler, M.D., Chancellor, E., Ainsworth, C.H., Gleason, J.S., Tirpak, J.M., Love, M.S. and Babcock, E.A., 2019. Representing species distributions in spatially-explicit ecosystem models from presence-only data. Fisheries Research, 210, pp.89-105.

Grüss, A., Drexler, M.D., Ainsworth, C.H., Babcock, E.A., Tarnecki, J.H. and Love, M.S., 2018a. Producing distribution maps for a spatially-explicit ecosystem model using large monitoring and environmental databases and a combination of interpolation and extrapolation. Frontiers in Marine Science, 5, p.16.

Grüss, A., Perryman, H.A., Babcock, E.A., Sagarese, S.R., Thorson, J.T., Ainsworth, C.H., Anderson, E.J., Brennan, K., Campbell, M.D., Christman, M.C. and Cross, S., 2018b. Monitoring programs of the US Gulf of Mexico: inventory, development and use of a large monitoring database to map fish and invertebrate spatial distributions. Reviews in Fish Biology and Fisheries, 28(4), pp.667-691.

Grüss, A., Drexler, M.D., Ainsworth, C.H., Roberts, J.J., Carmichael, R.H., Putman, N.F., Richards, P.M., Chancellor, E., Babcock, E.A. and Love, M.S., 2018c. Improving the spatial allocation of marine mammal and sea turtle biomasses in spatially explicit ecosystem models. Marine Ecology Progress Series, 602, pp.255-274.

*California Current Atlantis model review*

Horne, P.J., Kaplan, I.C., Marshall, K.N., Levin, P.S., Harvey, C.J., Hermann, A.J. and Fulton, E.A. (2010) Design and Parameterization of a Spatially Explicit Ecosystem Model of the Central California Current. *NOAA Technical Memorandum* **NMFS-NWFSC-104**, 1–140.

Kaplan, I.C., Marshall, K N. 2016. A guinea pig’s tale: learning to review end-to-end marine ecosystem models for management applications. ICES J Mar Sci, 73: 1715-1724.

Kaplan, I.C., Brown, C.J., Fulton, E.A., Gray, I.A., Field, J.C. and Smith, A.D.M. (2013) Impacts of depleting forage species in the California Current. *Environmental Conservation* **40**, 380–393.

Kaplan, I.C., Gray, I.A. and Levin, P.S. (2012a) Cumulative impacts of fisheries in the California Current. *Fish and Fisheries* **10.1111/j.1467-2979.2012.00484.x**.

Kaplan, I.C., Horne, P.J. and Levin, P.S. (2012b) Screening California Current Fishery Management Scenarios using the Atlantis End-to-End Ecosystem Model. *Progress In Oceanography* **102**, 5–18.

Olsen, E., Kaplan, I.C., Ainsworth, C., Fay, G., Gaichas, S., Gamble, R., Girardin, R., Eide, C.H., Ihde, T.F., Morzaria-Luna, H.N. and Johnson, K.F., 2018. Ocean futures under ocean acidification, marine protection, and changing fishing pressures explored using a worldwide suite of ecosystem models. Frontiers in Marine Science, 5, p.64.

**Task 2. Attend review panel meeting**

Reviewers will attend and participate at a panel review meeting. The draft meeting agenda is provided in Annex 3. The meeting will consist of presentations by NOAA. Other scientists will be available to answer questions from the reviewers and to provide additional information required by the reviewers. The review panel will be chaired by a member of the Gulf of Mexico’s Fishery Management Council’s Scientific and Statistical Committee (SSC), and the panel will include other SSC members as well as Center for Independent Experts (CIE) reviewers. The review will follow the Methodology Review Process established by the Pacific Fishery Management Council, and the Terms of Reference below adapt portions of those Terms of Reference for our application in the Gulf of Mexico.

**Task 3.** **Produce summary report from meeting**

Reviewers will assist the Chair of the review meeting with contributions to the summary report from the meeting.

**Task 4.** **Prepare peer-review report**

Reviewers will prepare an independent peer review with report following the review meeting in accordance with the requirements specified in this PWS, OMB guidelines, and TORs, in adherence with the required formatting and content guidelines in Annex 1 and peer-review TORs in Annex 2. Reviewers are not required to reach a consensus. Reviewers will deliver their reports to the Government according to the specified milestones dates listed below.

**Foreign National Security Clearance:**

When reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for reviewers who are non-US citizens. For this reason, the reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the [Foreign National Guest website](https://sites.google.com/noaa.gov/cao/ocao-services-and-guidance/personnel-technology-security/how-to-sponsor-a-foreign-national-guest).

**Place of Performance:**

Each reviewer shall conduct an independent peer review during the panel review meeting scheduled in St. Petersburg, FL during the following dates: March 28 - 30, 2023.

**Period of Performance**

The period of performance shall be from the time of award through May 2023. Each reviewer’s duties shall not exceed 14 days to complete all required tasks.

**Delivery**

Each reviewer shall complete an independent peer review report in accordance with the PWS. Each reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. Each reviewer shall complete the independent peer review addressing each stock assessment ToR listed in **Annex 2**.

**Tentative Schedule of Milestones and Deliverables**

The contractor shall complete the tasks and deliverables described in this PWS in accordance with the following schedule.

|  |  |
| --- | --- |
| Within two weeks of award | Contractor selects and confirms reviewers |
| Two weeks prior to the panel review | NMFS Project Contact provides reviewers the pre-review documents |
| March 28 - 30, 2023 | Each reviewer participates and conducts an independent peer review during the panel review meeting |
| Within three weeks of the panel review meeting | Reviewers submit draft independent peer review reports to the contractor’s technical team for independent review |
| Within two weeks of receiving draft reports | Contractor submits final reports to the Government |

\*The Chair’s Summary Report will not be submitted to, reviewed, or approved by the Contractor.

**Modifications to the Performance Work Statement:** Each reviewer will write an individual review report in accordance with the PWS, OMB Guidelines, and the TORs below. Modifications to the PWS and TORs cannot be made during the peer review, and any PWS or TORs modifications prior to the peer review shall be approved by the Contracting Officer’s Representative (COR) and the CIE contractor. The PWS and ToRs shall not be changed once the peer review has begun.

**Acceptance of Deliverables:**

The acceptance of the contract deliverables shall be based on three performance standards: (1) The reports shall be completed in accordance with the required formatting and content; (2) The reports shall address each TOR as specified; and (3) The reports shall be delivered as specified in the schedule of milestones and deliverables.

**Travel**

All travel expenses shall be reimbursable in accordance with Federal Travel Regulations (<https://www.gsa.gov/policy-regulations/regulations/federal-travel-regulation>). International travel is authorized for this contract. Travel is not to exceed $15,000.00.

**Restricted or Limited Use of Data**

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

**NMFS Project Contact**

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

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

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

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

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

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

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

1. The report shall include the following appendices:

Appendix 1: Bibliography of materials provided for review

Appendix 2: A copy of this Performance Work Statement

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

**Annex 2: Terms of Reference**

**Peer review of the Atlantis Ecosystem Model in Support of Ecosystem-Based Fishery Management in the Gulf of Mexico Large Marine Ecosystem**

**TERMS OF REFERENCE**

These terms of reference are meant to provide guidance for technical requirements for the final peer review report. It is assumed this report will be developed after the panel meeting and will contain inputs from CIE reviewers, SSC members, and others. The final report should address the readiness of the model to address priority model capabilities in TOR 1. Model capabilities can be evaluated on the basis of technical merits and deficiencies indicated in TOR 2.

1. **TOR 1. Reviewers will comment on the technical merits and deficiencies of the methodology and recommendations for remedies.** 
   1. What are the data requirements of the methodology?
   2. What are the general situations, management uses, and spatial scales for which the methodology is applicable? (also to be discussed further in TOR 2)
   3. What are the assumptions of the methodology?
   4. Is the methodology correct from a technical perspective?
   5. How robust are results to departures from the assumptions of the methodology?
   6. Does the methodology provide estimates of uncertainty? How comprehensive are those estimates?
   7. What is the process of model fitting and calibration?
   8. Areas of disagreement regarding panel recommendations: among panel members; and between the panel and proponents.
   9. Unresolved problems and major uncertainties, e.g., any issues that could preclude use of the methodology.
   10. Management, data or fishery issues raised during the panel review.
   11. Prioritized recommendations for future research and data collection.
2. **TOR 2. Reviewers will address model readiness concerning priority capabilities**
   1. Evaluate data, parameterizations and skill of GOM Atlantis with emphasis on Penaeid shrimp.
   2. Evaluate the treatment of environmental processes in the model relevant to shrimp production.
   3. Evaluate the readiness of the model to perform climate change simulations, including habitat effects.
   4. Evaluate the use of a novel seagrass routine (C++) developed for the GOM by USF and CSIRO

**Please refer to the final agenda here:** [**https://docs.google.com/document/d/1ETanQ80XumcRgm3oo9ap3xeVgFQYaZrmrOZ9BBO9Dzc/edit**](https://docs.google.com/document/d/1ETanQ80XumcRgm3oo9ap3xeVgFQYaZrmrOZ9BBO9Dzc/edit)