TECHNICAL SUMMARY

STUDY TITLE: Development of a Decision Support Tool to Reduce Sea Turtle Dredging Entrainment Risk

REPORT TITLE: Review of Sea Turtle Entrainment Risk by Trailing Suction Hopper Dredges in the US Atlantic and Gulf of Mexico and the Development of the ASTER Decision Support Tool

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COMPLETION DATE OF REPORT: December 2017

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KEY WORDS: sea turtle, trailing suction hopper dredge, decision support tool, mitigation, sea turtle behavior, ASTER

BRIEF ABSTRACT: The Bureau of Energy Management (BOEM), through its Marine Minerals Program (MMP), authorizes the use of Outer Continental Shelf (OCS) marine mineral resources, particularly sand and gravel, in shore protection and coastal restoration projects. A significant factor impacting how and when projects are conducted is the potential for entrainment and mortality of federally protected sea turtles when using trailing suction hopper dredges (TSHD). As a responsible steward of OCS resources, BOEM seeks to minimize adverse environmental effects related to project-

specific dredging operations through deliberate project planning efforts and implementation of relevant and effective mitigation measures.

The ASTER DST is a standardized geographically and temporally based decision support tool for use by practitioners in the US Atlantic and Gulf regions to assess project-specific dredging entrainment risk for sea turtles within a common framework. ASTER DST users can define biological and environmental parameters for candidate dredging areas, including suitable benthic habitat, bottom type, bathymetry, and sea turtle presence/density. The final output of the ASTER DST includes a report informing the user of the relative risk of sites within the selected area of interest, thus providing resource managers a documented process of the mitigation factors considered for site-specific projects. The ASTER DST will be used to guide future mitigation planning decisions within marine mineral resource areas, so that better informed decisions may minimize impacts to sea turtle species. In addition, the ASTER DST would help resource managers understand the best way to decrease dredging costs through reduced downtime associated with entrainment incidents and potentially allow more flexibility of environmental windows in areas perceived to have less risk.

BACKGROUND: The BOEM MMP authorizes the increasing use of TSHDs to extract and transport OCS marine mineral resources in the US Atlantic and Gulf of Mexico waters for shore protection and coastal restoration projects. The potential for entrainment and mortality of federally protected sea turtles is one of the significant factors impacting how and when projects using TSHDs can be conducted. In accordance the Endangered Species Act (ESA), BOEM is required to consult with the National Marine Fisheries Service (NMFS) on these potential impacts. As a responsible steward of OCS resources, BOEM seeks to minimize adverse environmental effects related to project specific dredging operations through deliberate planning management and the implementation of relevant and effective mitigation measures.

Historically, the USACE, dredging industry, academia, and other partners have made significant investments in improving protective measures and best management practices by principally focusing on dredging windows, the use of sea turtle deflecting dragheads, dredging operational parameters, and relocation trawling. However, there has been less emphasis on analyzing existing data and subsequently tailoring mitigation strategies on a project- and/or geographic-specific level. BOEM and its Federal partners coordinated with both sea turtle and dredging industry technical experts, soliciting existing sea turtle behavior and dredging operation data, to identify associated dredging entrainment risk parameters. Based on information gathered from a review of available literature and feedback from the experts, these data have informed the development of a standardized application to consistently assess project-specific dredging entrainment risk across a regional scale and improve the effectiveness of mitigation planning decisions within OCS marine mineral resource areas. The Analyzing Sea Turtle Entrainment Risk Decision Support Tool (ASTER DST) can help BOEM and other resource managers make better informed decisions that may minimize impacts to sea turtle species while also decreasing dredging costs through reduced down-time associated with entrainment.

OBJECTIVES: The overall objectives of this project were to:

- Evaluate and document entrainment risk parameters for dredging activities in the US Atlantic and Gulf of Mexico OCS within the US exclusive economic zone
- Identify and leverage existing sea turtle telemetry data and document future telemetry needs to better understand the space use conflicts and interaction of sea turtles with TSHD activities in the OCS
- Assess and evaluate the existing mitigation suite currently implemented to reduce entrainment risk and solicit ideas for modifying, removing, and/or adding mitigation measures for future consideration
- Solicit from sea turtle research experts input regarding the current state of science with respect to temporal and spatial distribution of sea turtles in the water column relative to OCS sand resources and TSHD entrainment risk
- Solicit from dredging industry representatives specific information pertaining to the various parameters that may impact the efficacy of current TSHD operational mitigation measures to reduce the entrainment risk of sea turtles when dredging OCS sand resources
- Solicit from sea turtle and dredge industry experts specific risk-reduction methodologies when dredging OCS borrow areas
- Identify and prioritize critical parameters to be incorporated in the ASTER DST
- Develop the ASTER DST, a standardized geographically and temporally based DST for use by multiple practitioners in the Atlantic and Gulf region to assess project-specific dredging entrainment risk within a common framework

METHODS: Initial results from the literature review identified important issues, data gaps, and associated questions/discussion topics for the technical expert meetings, which involved the sea turtle research and dredging industry community. All information gathered for the literature and data review served as a working background document and was distributed before two separate stakeholder meetings: one with sea turtle research experts and one with dredging industry experts. Feedback and discussions from the expert meetings were documented and, along with the reviewed literature, have facilitated the development of the ASTER DST.

RESULTS: Over 850 references were gathered for the literature review on entrainment risk of sea turtles from TSHDs in the US Atlantic and Gulf of Mexico OCS waters, including references on background information, dredging, environmental datasets, sea turtle biology, sea turtle telemetry datasets, and decision support tools.

The ASTER DST is now fully functional with the ability to run through a four-step process resulting in recommendations of relative entrainment risk for a user-selected area. The output of the tool is shared via a PDF report and a feature class of the area that contains a summary of the original data and analysis results. The tool is currently available internally at BOEM, and plans are to deploy to a larger audience in the future.

CONCLUSIONS:

The development of the ASTER DST provided a standardized framework for analyzing sea turtle entrainment risk, uncovered other data gaps and limitations of available data, and identified potential future work that would improve the tool and mitigation planning.

Based on the available literature and feedback recently gathered directly from experts in the sea turtle research and dredging industry community, the priority risk factors needing more data to improve entrainment risk analysis are:

- The temporal and spatial relationship of sea turtle behavior within the water column relative to draghead operating parameters
- The borrow area design relative to turtle deflecting draghead efficacy

Considering the full array of all potential risk factors within the project-specific context, targeted mitigation strategies may be more effective than the conservative presence/absence-based dredging windows currently used. The literature review and technical insight from expert stakeholders were imperative for informing the development of the ASTER DST and would continue to be valuable resources for any new information to be incorporated in the future.

STUDY PRODUCT(S):

1. Ramirez, A, Kot, CY, Piatkowski, D. 2017. Review of sea turtle entrainment risk by trailing suction hopper dredges in the US Atlantic and Gulf of Mexico and the development of the ASTER decision support tool. Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-084. 275 pp.

2. ASTER: Analyzing Sea Turtle Entrainment Risk. 2017. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean and Energy Management; [accessed YYYY Mon DD]. http://34.200.19.196/demo.

3. Ramirez, A. 2016. Development of a Decision Support Tool to Reduce Sea Turtle Dredging Entrainment Risk StoryMap. Prepared for the U.S. Department of the Interior, Bureau of Ocean and Energy Management. [accessed YYYY Mon DD]. http://arcg.is/1qW1TX.

4. Complete Endnote reference library: 858 references, organized into broad subject groups such as “background information” (n=114), “dredging” (n=277), “environment” (n=100), “sea turtle biology” (n=467), “sea turtle telemetry datasets” (n=232), and “tools” (n=28). A copy of the Endnote reference library is archived in the BOEM Marine Minerals Program and in the Duke University Nicholas School of the Environment Marine Geospatial Ecology Lab.

5. Kot, CY. 2017. Subject bibliography for the review of sea turtle entrainment risk by trailing suction hopper dredges in the US Atlantic and Gulf of Mexico and the

development of the ASTER decision support tool. Prepared for the US Department of the Interior, Bureau of Ocean Energy Management. Beaufort (NC): Duke University, Nicholas School of the Environment, Marine Geospatial Ecology Lab. 123 pp.

6. Kot, CY, Ramirez, A, Jarvis, C. 2016. Dredging industry expert meeting to inform the development of a decision support tool to reduce sea turtle entrainment risk in trailing suction hopper dredges: Summary of meeting outcomes. Prepared for the US Department of the Interior, Bureau of Ocean Energy Management. Beaufort (NC): Duke University, Nicholas School of the Environment, Marine Geospatial Ecology Lab. 11 pp.

7. Kot, CY, Ramirez, A, Jarvis, C. 2016. Sea turtle research expert meeting to inform the development of a decision support tool to reduce sea turtle entrainment risk in trailing suction hopper dredges: Summary of meeting outcomes. Prepared for the US Department of the Interior, Bureau of Ocean Energy Management. Beaufort (NC): Duke University, Nicholas School of the Environment, Marine Geospatial Ecology Lab. 10 pp.

8. Criss, K, Skahill, J, Ramirez, A. 2017 ASTER DST technical architecture. Prepared for the US Department of the Interior, Bureau of Ocean Energy Management. Aurora (CO): Argis Solutions. 12 pp.

9. Ramirez, A. 2017. ASTER DST user manual. Prepared for the US Department of the Interior, Bureau of Ocean Energy Management. St. Petersburg (FL): Quantum Spatial, Inc. 23 pp.

10. Piatkowski, D. 2017. Development of a Decision Support Tool to Reduce Sea Turtle Dredging Entrainment Risk. Proceedings of the FSBPA: National Conference on Beach Preservation and Technology; Stuart, FL.

11. Piatkowski, D, Levenson, J, Kot, CY. 2017. Reducing Sea Turtle Incidental Takes by Hopper Dredges: Partnering with Stakeholders in the Development of a Decision Support Tool. Proceedings of the International Sea Turtle Symposium; Las Vegas, NV.

12. Ramirez, A. 2017. Marine Minerals Information System (MMIS) and a Sea Turtle Decision Support Tool (ASTER). Proceedings of the BOEM Information Transfer Meeting; New Orleans, LA.

13. Piatkowski, D. 2017. ASTER: A Decision Support Tool Developed in Partnership with Stakeholders. Proceedings of WEDA: Eastern Chapter Annual Meeting; Providence, RI.

14. Piatkowski, D. 2017. ASTER: A Decision Support Tool Developed in Partnership with Stakeholders. Proceedings of the ASBPA: National Coastal Conference; Ft Lauderdale, FL.

15. Jarvis, C. 2017. Analyzing Sea Turtle Entertainment Risk (ASTER) Decision Support Tool. Proceedings of the ESRI Ocean GIS Forum; Redlands, CA.

MAP SHOWING AREA OF STUDY (Figure 7 of report OCS Study BOEM 2017-084):

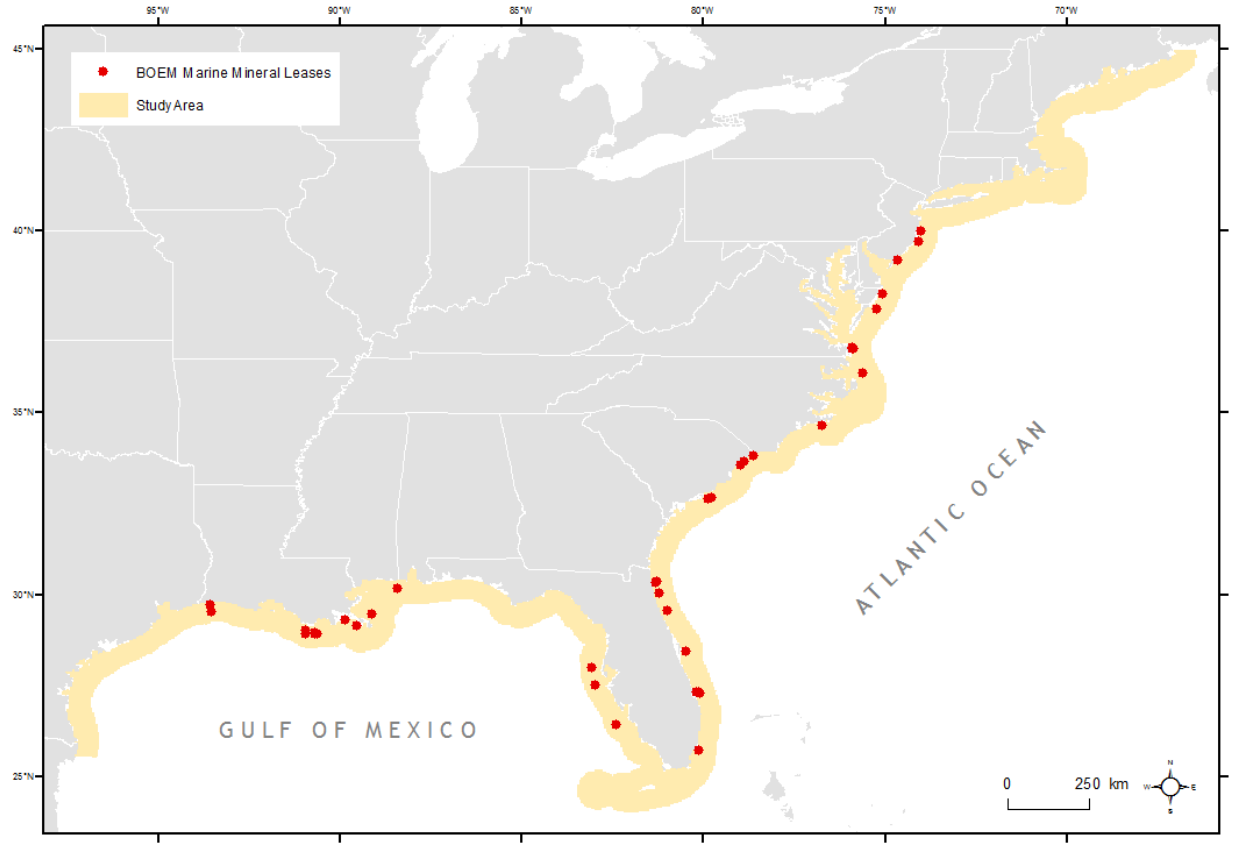

Figure 7. Extent of the ASTER analysis grid
The beige area represents the available areas for analysis covered by the canned data grid within the ASTER tool.