Transparent Modeling of Collision Risk for Three Federally-Listed Bird Species in Relation to Offshore Wind Energy Development: Technical Summary

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ABSTRACT: To estimate risk of avian collisions with offshore wind energy turbines in the U.S. Atlantic, a stochastic collision risk model using movement data from automated radio telemetry studies has been developed for three federally protected bird species: the Roseate Tern (*Sterna dougallii*), Piping Plover (*Charadrius melodus*), and Red Knot (*Calidris canutus*). An online web application of the model, called Stochastic Collision Risk Assessment for Movement (SCRAM), and accompanying user manual have been made publicly available to help transparently estimate collision risk from offshore wind farms in the U.S. Atlantic. This report refers to SCRAM Version 1.0.3, available at https://briloon.shinyapps.io/SCRAM/.

BACKGROUND: Collision risk models are often used to estimate risk of avian collisions with offshore wind energy turbines (e.g., McGregor et al. 2018). Such models typically use avian density data derived from observational survey datasets for a location, along with a suite of behavioral and site-specific variables that predict collision risk. However, very limited survey data are available for the Roseate Tern, Piping Plover, and Red Knot. Thus, automated radio telemetry data (e.g., Loring et al. 2018, Loring et al. 2019) was used to develop movement models that were linked to monthly population estimates, density estimates at specific flight heights, and other species- and site-specific characteristics (such as number of turbines in a specified turbine array) to estimate collision risk for locations across a portion of the United States Northeastern Continental Shelf Ecosystem (NES).

OBJECTIVES: Create a collision risk decision support tool for offshore wind energy development based on current knowledge of three federally protected bird species on the NES.

METHODS: We built on previous collision risk models (Band 2012, Masden 2015, McGregor et al. 2018) and adapted them for use with individual tracking data, particularly data from the Motus Wildlife Tracking System. There were four main components of the collision risk process: (1) movement modeling to determine monthly occupancy rates over the NES, (2) linking of monthly population estimates to occupancy rates to estimate species density across the NES, (3) flight height estimation from Motus data to further refine the proportion of the population at risk for collision, and (4) a collision risk model that uses density estimates at specific flight heights (along with a suite of other species- and location-specific parameters) to estimate collision for a specified turbine array. These models were packaged into a web application accessible via the SCRAM public user interface.

RESULTS: The Motus movement models, species data, flight height distributions, and collision risk models are all publicly accessible via the SCRAM online web application and accompanying user manual. The underlying code is available in a GitHub code repository. This final report further documents the published model, presents associated case study data to demonstrate evaluation of collision risk of Roseate Tern, Piping Plover, and Red Knot at offshore wind energy areas in the U.S. Atlantic, and includes a framework for using site-specific data to estimate cumulative collision risk across spatiotemporal scales. There are a variety of assumptions and limitations to the underlying models, case studies, and cumulative effects framework, some of which will be further explored in future work.

CONCLUSIONS: The goal of SCRAM is to help transparently estimate collision risk to birds from offshore wind farms in the U.S. Atlantic. SCRAM will continue to be updated with model improvements, bug fixes, and additional functionality in the coming years; future changes will be documented in the GitHub repository and on the SCRAM webpage at briwildlife.org/SCRAM. Several immediate next steps have been identified for the application under the current funding support mechanism, which extends until September 1, 2024.

STUDY PRODUCT(S):

1. **Model code:** Available at https://github.com/Biodiversity-Research-Institute/SCRAM.

2. **Web application:** Stochastic Collision Risk Assessment for Movement (SCRAM). 2022. Version 1.0.3. Available at: https://briloon.shinyapps.io/SCRAM/.

3. **User manual for web application:** Gilbert AT, Adams EM, Loring P, Williams KA. 2022. User documentation for the Stochastic Collision Risk Assessment for Movement (SCRAM). Available at https://briloon.shinyapps.io/SCRAM/. 39 pp. (Available via the book link at the header of the application UI).

4. **BOEM study report:** Adams EM, Gilbert A, Loring P, Williams, KA (Biodiversity Research Institute, Portland, ME and U.S. Fish and Wildlife Service, Charlestown, RI). 2022. Transparent Modeling of Collision Risk for Three Federally Listed Bird Species in Relation to Offshore Wind Energy Development: Final Report. Washington, DC: U.S. Department of the Interior, Bureau of Ocean Energy Management. 79 p. Report No.: OCS Study BOEM 2022-071. Contract No.: M19PG00023.

5. **Project webpage:** SCRAM. November 20, 2022. 1st Edition. Portland, Maine: Biodiversity Research Institute; November 20, 2022. Available at https://briwildlife.org/SCRAM.

MAP OF STUDY AREA: Figure 2 of report OCS Study BOEM 2022-071.

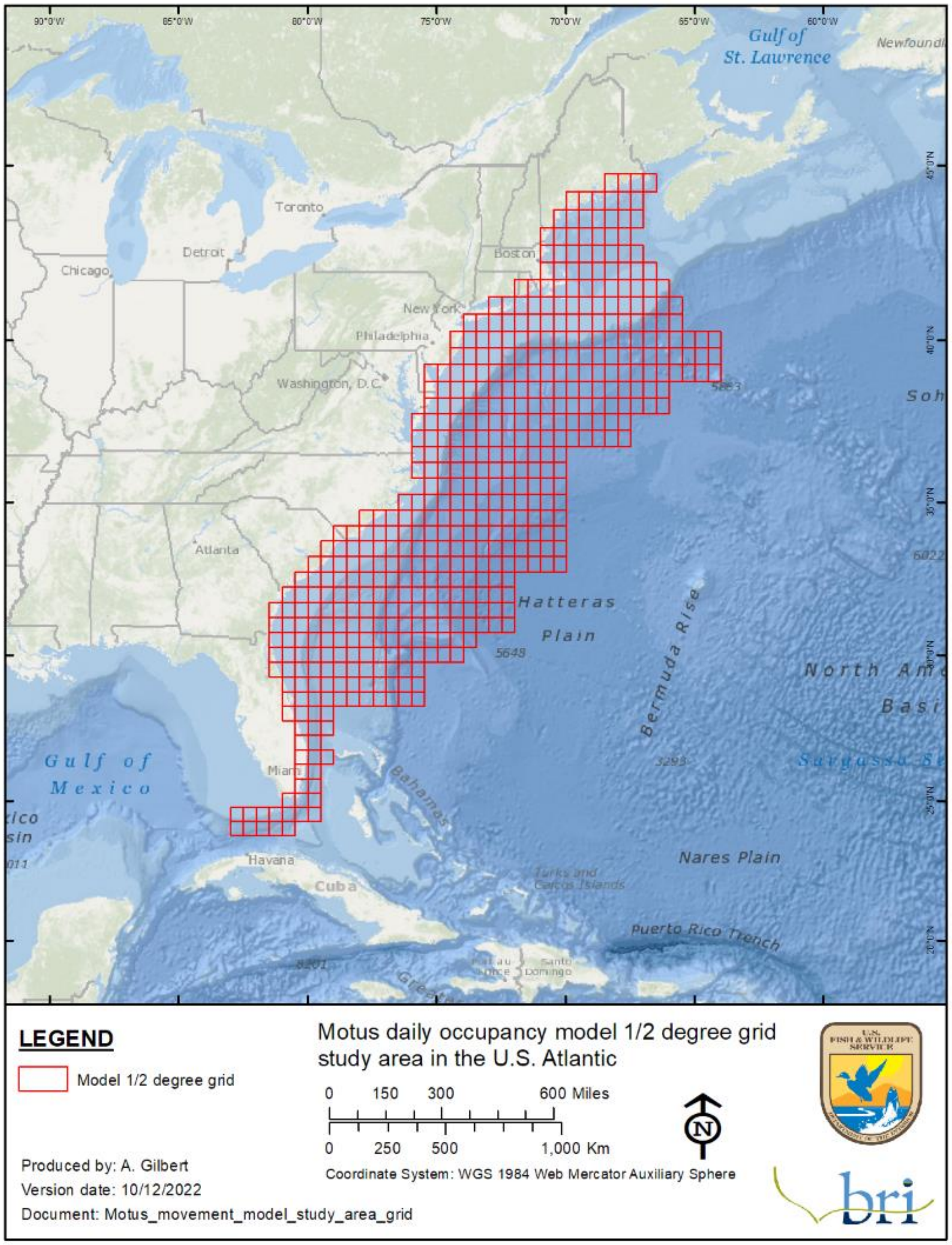

Figure 2. Map of the study area with a ½ degree grid throughout the Northeastern Continental Shelf Ecosystem (NES).