Environmental Studies Program: Ongoing Study

Field	Study Information
Title	Live Forecasts of Migratory Bird Movements Offshore to Monitor Potential Avian Interactions with Wind Development (GM-22-02)
Administered by	Gulf of Mexico Regional Office
BOEM Contact(s)	Timothy White (timothy.white@gmail.com)
Procurement Type(s)	Cooperative Agreement
Conducting Organization(s)	Cornell University
Total BOEM Cost	$200,000
Performance Period	FY 2022–2024
Final Report Due	September 2024
Date Revised	October 30, 2023
Problem	During spring and fall migration, significant numbers of birds migrate offshore at night in the Gulf of Mexico and the Atlantic. These diverse populations may lethally interact with offshore wind energy infrastructure.
Intervention	We propose modifying migratory bird forecasting models previously developed to track terrestrial bird migratory movements and apply them to offshore forecasting in areas with high wind energy development potential.
Comparison	We will compare the updated forecasting models of migratory bird movement and densities with NEXRAD imagery collected at coastal stations in the Gulf of Mexico and the Atlantic to determine overlap with high potential offshore wind energy sites.
Outcome	Proposed products include offshore near-real-time forecasts of migratory bird populations to inform offshore wind energy site planning and permitting. Live model predictions will consist of migration traffic rate (thousands of birds/km/hour) for offshore locations in the Gulf of Mexico and the Atlantic.
Context	Gulf of Mexico and Atlantic planning areas.

BOEM Information Need(s): To determine suitable areas of offshore wind development in the Gulf of Mexico (GOM) and Atlantic, BOEM must examine potential environmental impacts to biological resources in potential Wind Energy Areas (WEAs). Wind energy installations have the potential to negatively impact avian resources through strike, habitat loss, or fragmentation of migratory corridors. The careful selection of WEAs could likely mitigate these potential impacts. BOEM can determine potential spatial conflicts between WEAs and bird migration routes by evaluating real-time forecasting of migratory bird movements with the NEXRAD network by NOAA's National Weather Service. Live forecasting of migration traffic rates near WEAs could inform the permitting process of wind energy planning and development in the GOM and the Atlantic. This project will examine the forecasting accuracy of migratory bird movements associated with data collected at individual NEXRAD stations nearest to coastal BOEM lease areas. Real time forecasting also provides mitigation options if short-term operational shutdowns could minimize significant mortality events.

Background: While the GOM has established an- active offshore conventional energy industry, no offshore renewable infrastructure yet exists in the region. However, interest in offshore wind is growing in the GOM. For example, Louisiana's governor requested that BOEM establish a renewable energy task force for the development of offshore wind in Federal GOM waters. Two studies published in 2020 determined that offshore wind has promising resource potential in offshore areas of Texas, Louisiana, and Florida.

A critical first step to realizing an offshore wind facility in the GOM is locating a WEA. Roughly 2.1 billion migratory birds cross the GOM during spring and fall migration every year, as estimated from models derived from the NEXRAD network and visual observations (Horton et al., 2019). Cornell University has developed terrestrial real-time forecasts of migratory bird populations to help citizens and managers track daily movements with the free online tool BirdCast. These forecasts work well when applied to the identification of migratory flight volume and in-flight aggregation zones (Horton et al., 2019; Van Doren et al. 2017).

Objectives: Determine migratory patterns of birds in nearshore Federal waters of the GOM and Atlantic. The specific objectives are:

- Modify migratory bird forecasts created by Cornell to extend the terrestrial models of BirdCast to include offshore regions.
- Create real-time interactive maps of offshore migration for managers and the public to access.

Methods:

- Develop an initial analytical pipeline using NEXRAD imagery at locations nearest to the coast and for locations with heavy migratory bird traffic rates (e.g., Brownsville and Corpus Christi, TX). This first step is meant to calibrate the models to detect and filter bird-like scattering in the imagery for areas with heavy seasonal migration. After calibration, the modeling framework will be applied to imagery collected from different NEXRAD stations close to the coast.
- Use synoptically occurring eBird data to verify bird-like scattering in NEXRAD imagery. Birds migrate at night and feed during the day. We will use eBird observations to infer the constituents of the NEXRAD scattering (migratory flocks) the night before, which is routine practice.
- Modify existing terrestrial bird forecasts (i.e., BirdCast) to create offshore forecasts of landbirds in the GOM and the Atlantic.

Specific Research Question(s):

1. Can imagery collected by the NEXRAD network be used to develop seasonally reliable forecasts of migratory bird movement and densities in the GOM and the Atlantic?
2. Which locations in the GOM and the Atlantic will the offshore bird migration forecast maps produce the highest confidence and be most useful for wind energy development?

Current Status: The following activities have been completed:

- Profile analysis all coastal radar stations (spring and fall).
- In-depth exploration of 4 radar stations closest to the coastline to develop methodology for decomposing radars into separate land vs water profiles.

- Partitioning Land and water separation and evaluation.
- Altitude modeling and extrapolation, developed methodology using XGBoost (Machine Learning) to predict densities of birds at lower altitudes, this will allow us to extend our analysis to all coastal stations (particularly ones farther away from a coastline).

Publications Completed:

Curley SR, Farnsworth A, White TP, Dokter AM. Using Weather Surveillance Radar to describe phenology of offshore migration with application to wind energy development. Presented at: American Ornithological Society. London, Ontario.

Affiliated WWW Sites:

NEXRAD locations: https://www.roc.noaa.gov/WSR88D/Maps.aspx

BirdCast: https://birdcast.info/

References:

Horton KG, Van Doren BM, La Sorte FA, Cohen EB, Clipp HL, Buler JJ, Fink D, Kelly JF, Farnsworth A. 2019. Holding steady: little change in intensity or timing of bird migration over the Gulf of Mexico. Global Change Biology. 25(3):1106–1118.

Horton KG, Nilsson C, Van Doren BM, La Sorte FA, Dokter AM, Farnsworth A. 2019. Bright lights in the big cities: migratory birds' exposure to artificial light. Frontiers in Ecology and the Environment. 17(4):209–214.

Van Doren BM, Horton KG, Dokter AM, Klinck H, Elbin SB, Farnsworth A. 2017. High-intensity urban light installation dramatically alters nocturnal bird migration. Proceedings of the National Academy of Sciences. 114(42):11175–11180.