Evaluating the relationship between weather and detections of nanotagged birds using R Shiny

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According to the Smithsonian, wind turbines in North America are estimated to kill between 140,000 and 328,000 birds every year. As the United States transitions from coal and gas to green energy, specifically by harnessing the power of ocean wind with offshore turbines, seabirds such as the Common Tern (*Sterna hirundo*) and the Federally endangered Roseate Tern (*S. dougalli*) could be harmed.

Our goal is to determine when terns are most active within the vicinity of the turbines so that we can contribute to assessments of exposure and avian collision risk. To do this, we built an application using R Shiny that displays weather and tern detection data collected from Block Island, Rhode Island – where the first offshore wind farm in the United States resides. Our application will ultimately allow researchers and agencies such as the Bureau of Ocean Energy Management (BOEM) and U.S. Fish and Wildlife Service to assess how weather patterns relate to tern abundance around the Block Island turbines.

Our application allows users to evaluate correlations between tern detections and several covariates. First, activity of our tagged terns around Block Island peaked in late June and early July, 2016. This likely occurred because of increased foraging demands from adults that were feeding two-week-old chicks during this time period.

Second, visibility and precipitation were negatively correlated with tern detections, which indicates that the terns were less likely to visit Block Island during poor weather. While this may sound intuitive, it is critical information for determining the operation schedule of the wind farm, as avian collision risk may increase in periods of bad weather and limited visibility.

Third, our results suggest a roughly quadratic relationship between wind speed and tern detections. The majority of tern detections occurred between wind speeds of 9 and 13 miles per hour, with detections tapering off at wind speeds below and above this range.

Last, the majority of tern detections in late June and early July coincided with low and rising tides. This is consistent with evidence in the literature that the positive effect of low tides on food availability increases foraging activity in terns (Safina and Burger: 1988, 160).

Our results suggest that tidal patterns, wind speed, and visibility are useful covariates to consider when assessing the exposure of terns to near shore wind farm developments. Our application is an important tool that can be used to help management agencies make decisions about how to optimally regulate offshore wind turbines.