Global wind patterns assist the migration of millions of birds and bats through the Great Lakes region, where shorelines provide important stopover habitat. Shorelines are thought to concentrate migrants because they offer the last refuge adjacent to a geographic obstacle and are likely used for navigation. Shorelines are also attractive for wind energy development. Because of this potential for conflict of interest, more information is needed on the aeroecology of the Great Lakes shorelines. We used two avian radar systems to simultaneously identify the activity patterns, timing, and duration of migration along the shorelines of the Great Lakes. We placed avian radar systems near Lake Ontario in New York, where the automated systems continuously tracked and recorded target (bird and bat) movements from late March to early June, 2013. We calculated the direction of movement, target passage rates, and altitude profiles for the air space above our study areas. We also modeled the vertical sample volume to estimate target density by altitude band.

Heavy migration was observed along the studied shorelines in New York and at a site surveyed inland of the lake shore. The mean nocturnal passage rates were greater than the mean passage rates for dawn, day, and dusk combined at all but one of the four studied locations. Nocturnal movement was typically oriented in a northeasterly direction, but we also recorded other behaviors associated with migrants, such as a slight dawn ascent and migrants returning from over water to land at dawn. Peak density occurred between 100 and 250 m above ground level at 3 of the 4 sites. At the fourth site, the peak density occurred at 400–450 m, although clutter likely interfered with detection at lower altitudes. At all of the sites, density may have been underestimated at higher altitudes due to loss of detection at longer ranges. Underestimation of target density may also have occurred at lower altitudes due to clutter.

Our research results highlight the potential role of radar in implementing the USFWS Land-Based Wind Energy Guidelines and help to identify areas where impacts to wildlife would be minimized. We documented migration activity in the air space above our study areas, which indicates that the density of targets at low altitudes may present conservation concerns. The data we collected revealed the ebb and flow of migration across the sampling period, with nocturnal peaks that continued into June. Given the length of time during which migration occurred at the sampled sites, curtailing wind energy operations during nocturnal pulses could result in limited operational time along the shoreline during the migration season. Combining the results of radar studies and fatality searches would greatly improve risk assessments and facilitate the interpretation of standardized radar studies.

Avian radar has been relied upon to perform surveys for pre-construction risk analysis but has been used rarely in New York in recent years. The consistent methodology and reliable data analysis techniques that we present in this report may promote the future use of avian radar. Although it is an important tool, few regulatory agencies possess experience implementing avian radar or recognize both the strengths and limitations of the technology.

This report highlights some considerations regarding avian radar and reviews potentially confusing metrics. We also introduce new metrics to report radar data. In addition to providing information relevant to wildlife conservation in the Great Lakes region, the concepts we present in this report are widely relevant to reviews of avian radar studies and provide methods that identify components of migration such as the following:

- Nocturnal pulses
- Season length
- Estimated density per altitude band
- Migrant behavior near a geographical obstacle

Given the rapid growth of the wind energy sector, our most effective conservation efforts may require the identification of locations where migrants concentrate to avoid development in these areas. Our use of commercial-grade avian radar to document migration and, in subsequent reports, to identify concentrations of activity is a broad-scale effort toward this goal.