United States Department of the Interior

FISH AND WILDLIFE SERVICE

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October 4, 2017

U.S. Department of Energy
Golden Field Office
Attn: Kristin Kerwin
15013 Denver West Parkway
Golden, CO 80401

TAILS# 03E15000-2017-I-1867

Re: Draft Environmental Assessment for Lake Erie Energy Development Corporation's Project Icebreaker, Offshore Cleveland, OH (DOE/EA-2045)

Dear Ms. Kerwin:

This is in response to your August 22, 2017 Draft Environmental Assessment (EA) for the Lake Erie Energy Development Corporation's (LEEDCo's) proposed Project Icebreaker, which involves the construction and operation of six 3.5 megawatt (MW) wind turbines, 12 miles (mi) (19.3 kilometers (km)) of transmission cable, and a substation. The turbines would be installed in Lake Erie, 8-10 mi (12.9-16.1 km) offshore of Cleveland, Cuyahoga County, Ohio. The transmission cable would run from the turbines, across the lake bottom, to the shore, where it would connect to a new substation to be located at the Cleveland Public Power substation. Additionally, 150 feet (ft) (45.7 m) of overhead transmission lines would be constructed to link the new and existing substations. The turbines are expected to operate for 25 years. Each turbine has a rotor diameter of 413 ft (126 m), yielding a rotor-swept area of 3.08 acres (0.012 km^2) per turbine, and 18.48 acres (0.075 km^2) for the total project. At its closest point, each blade will be approximately 65 ft (20 m) above water level. The EA states that LEEDCo (applicant) plans to conduct post-construction monitoring to assess all-bird and all-bat mortality and to monitor avoidance/attraction/displacement that may occur. The EA also states that the applicant plans to develop a Bird and Bat Conservation Strategy that would outline conditions for adaptive management implementation based on the results of post-construction monitoring.

Funding for the project may be provided by the U.S. Department of Energy (DOE) as a U.S. Offshore Wind: Advanced Technology Demonstration Project. According to the Draft EA, "By providing funding, technical assistance, and government coordination to accelerate deployment of these demonstration projects, DOE can help eliminate uncertainties, mitigate risks, and support the private sector in creating a robust U.S. Offshore Wind Energy Industry." Additionally, the U.S. Army Corps of Engineers (Corps) may permit the project under sections 404 and 408 of the Clean Water Act and section 10 of the Rivers and Harbors Act. The Corps published a Public Notice on September 13, 2017 soliciting review and comment on the project

under their authorities (Application No. 2010-00223). The U.S. Coast Guard will assess the impact of the project on navigation. The Draft EA has been developed to analyze the potential impacts to the human environment that may occur if DOE authorizes the expenditure of federal funding on this project and the Corps issues permits to allow for construction.

This letter transmits the U.S. Fish and Wildlife Service's (Service) comments on the Draft EA. The Service and DOE have concluded section 7 informal consultation under the Endangered Species Act of 1973, as amended (ESA), thus this letter does not address any ESA issues.

General Comments

In general, the Service agrees with the characterization of impacts to fisheries and benthos included in the Draft EA. Our comments in this letter address our three outstanding concerns: 1) characterizing bird and bat use of the project area; 2) evaluating collision mortality of birds and bats from the operating project; and 3) monitoring to inform items 1 and 2.

Section 2.7.2 of the Draft EA references the Memorandum of Understanding (MOU) between LEEDCo and the Ohio Department of Natural Resources (ODNR) committing to pre- and post-construction wildlife monitoring and states that LEEDCo has had discussions with ODNR and the Service to develop a sampling plan that lays out testing and analyses that will be conducted before, during, and post-construction for birds and bats. While the Service has been engaged in discussions with LEEDCo, please note that the Service is not a party to the MOU, and that only some of the Service recommendations on pre- and post-construction monitoring have been included in the MOU or sampling plan (See Service comments dated Feb. 28, 2017, attached). Also note that the MOU and sampling protocol do not provide detailed methods for several critical components of the pre-and most components of the post-construction monitoring. We recommend that DOE condition the funding of the project on inclusion of a robust pre- and post-construction monitoring protocol reviewed and commented on by the Service, and that specific funding be targeted for this project component.

The conclusions reached in the Draft EA regarding potential impacts to birds and bats are based on available data collected primarily outside of the project area. For example, some of the data are from the Cleveland water intake crib (located approximately 3 miles offshore of Cleveland, approximately 5 miles from the project area) or nearshore areas of the lake near Cleveland. Additional data on bird use of the airspace were generated using NEXRAD weather radar data from the Cleveland area which provides limited data about bird and bat use within the airspace that will be occupied by the turbines (the "rotor-swept zone"). Waterfowl surveys conducted by ODNR over Lake Erie several years ago that occurred in the project vicinity are used to inform waterfowl distribution within the project area. Collision mortality estimates were generated using land-based wind projects in the U.S. and Canada. The available bird and bat data is summarized in several appendices to the Draft EA (Appendices J, K, and L). Studies of bird and bat use of the specific project area have been recommended by the Service for several years (Attachment 1, Service correspondence dated April 24, 2009, November 15, 2013, March 24, 2014, October 21, 2016, February 28, 2017, March 3, 2017) but are just starting to be implemented. A bat acoustic study within the project area was started in spring 2017 and aerial waterfowl surveys will begin in fall 2017. Data from these site-specific studies are not available

for inclusion in the Draft EA, though the first quarterly report for the bat acoustic survey was recently provided to the Service.

Thus, the conclusions in the Draft EA are based on assumptions that observations from other parts of Lake Erie are relevant to the project area, and that impacts at onshore wind facilities in the U.S. and Canada are relevant predictors of impacts to birds and bats at offshore wind developments in Lake Erie. These assumptions may or may not be accurate. Because of the potential risk of bird and bat mortality, and because this project is designed to be a demonstration project to evaluate offshore wind installation in the Great Lakes, pre-construction monitoring to inform risk and post-construction monitoring to assess actual impacts are necessary components of the project that must be implemented. Should the findings of site-specific pre-construction monitoring yield results that contradict the assumptions in the Draft EA, the findings in the Draft EA should be revisited to ensure accurate information on risk to birds and bats is publicly available. All pre- and post-construction data should be made publicly available such that this project can inform future project planning.

We note that the small size of the project (6 turbines) is driving the effects analysis relative to potential impacts to birds and bats. That is to say, because there are only 6 turbines, even if the per-turbine mortality rates for bird or bats at the project area were to be much higher than at land-based wind projects, the total impact of this project will be minor. While that may be true, one goal of this demonstration project should be to measure what the actual effect of offshore turbines is on birds and bats, to inform potential future wind development in the Great Lakes. If per-turbine impacts are not accurately measured for this precedent-setting project, risk levels of larger future projects may be substantially underestimated.

Section 3.4.1.3

Section 3.4.1.3 of the Draft EA describes the Affected Environment relative to birds and bats. Pages 3-29 and 3-32 describe a NEXRAD weather radar analysis of bird and bat use of the project area (Draft EA Appendix J, Nations and Gordon 2017). Page 3-32 states, "Several recent studies employing marine radar in shoreline environments have demonstrated relatively high densities of nocturnal migrant birds along the shorelines of Lake Erie and Lake Ontario, reinforcing the understanding that such migrants tend to concentrate along coastlines and avoid flying over large water bodies, such as Lake Erie, if possible (Rathbun *et al*. 2016; Horton *et al.* 2016)." Page 3-51 includes a similar statement. These statements are misleading; Rathbun *et al.* (2016) and Horton *et al.* (2016) both document that large numbers of migrants do fly over water bodies. For example, Horton *et al.* (2016) showed that nocturnal migrants flew predominantly to the north and northeast from the coast of Erie County, Ohio during spring. Overwater flight has been observed at all Great Lakes sites reported in these publications. These publications instead state that migrants concentrate on the shoreline during dawn and daytime when they land to rest and refuel. During the actual nocturnal migration, however, migrants commonly cross Lake Erie and all of the other Great Lakes. Additional evidence for migrants crossing over Lake Erie is included in the NEXRAD weather radar analysis appendix (Nations and Gordon 2017). In the spring, the predominant migration movement direction (Figure 4, Appendix J) was to the NNE from Cleveland, indicating that migrants are heading out to cross over the lake.

The NEXRAD weather radar analysis primarily provides data on migrating birds and bats located above the rotor-swept zone, thus most of these migrants would not be at risk from turbine operation. There was, however, some overlap between the rotor-swept zone of the turbine and the area included in the NEXRAD radar analysis (Nations and Gordon 2017):

> "…at the 0.5 degree elevation the height of the lower −3 dB point ranged from 105 to 135 m above the Project Area. Thus, there was some overlap of the radar beam and the rotor-swept zone for the proposed turbines, which have a maximum blade tip height of 146 m."
>
> And
>
> "Differences in migration intensity with radar elevation indicate that, at the Project Area, there are more than twice as many birds at the lower 0.5 degree elevation (Figure 6c and Table 5). While the airspace sampled at this elevation does overlap with the rotor-swept zone, the extent of overlap is small (Figure 3), thus the migrant bird activity detected by this lower beam primarily comes from altitudes immediately above the rotor swept zone of the turbines. Given the limitations of NEXRAD resolution, it is not possible to determine the precise flight altitudes of birds within the radar beam."

Thus, due to the coarse resolution of NEXRAD data, it is impossible to use this data to determine if birds and bats are flying within the rotor-swept zone or above it. Bird and bat densities at higher altitudes do not always correlate with densities at lower altitudes, and this may especially be the case in a different environment such as offshore. The general pattern of increasing densities of birds and bats at lower altitudes does fit with what the Service's Avian Radar Team has found at many sites across the Great Lakes (Rathbun *et al*. 2016; Horton *et al.* 2016). However, unlike NEXRAD, the radar units used by the Service are able to track individual targets and distinguish target flight altitude exactly. The densities shown in the Service results indicate that densities often increase as altitude decreases, especially and often significantly at lower altitudes (50-150m) that include the rotor-swept zone. This area is a key gap in the NEXRAD analysis, and a main reason that the Service recommended on-site avian radar studies to be conducted for pre- and post-construction. Unpublished data collected on Lake Erie in Cleveland this fall by the Service (Attachment 2) using avian marine radar indicates large numbers of bats and birds migrating across the lake during fall, often within or near the rotor-swept zone.

The ongoing bat acoustic surveys will help to elucidate how distance from shore affects the number of bat calls detected and will provide project-area specific information on bat call detections as well as information on seasonal passage rates that may inform risk, but more detectors, and detectors within the rotor-swept zone, as requested in the Service's February 28, 2017 letter, would provide a better understanding of these patterns. Other authors (Kunz et al. 2007) have recommended even more acoustic detectors on a per-turbine basis to effectively assess potential flight activity through the rotor-swept zone.

The first quarterly report on the bat acoustic survey was provided to the Service in September, 2017 (Gordon *et al*. 2017). This report indicates that hundreds of bat calls are being detected at both the 7-mile buoy (within the project area) and 3-mile buoy (near the crib) location, and that

bats are being detected in spring, summer, and fall at 3 and 7 miles from shore, implying that bats migrate across the lake. A large proportion of bat calls recorded at both buoys have been migratory tree bats (the three species most frequently involved with wind turbine collisions (Arnett *et al*, 2008; Kunz *et al*, 2007; Cryan *et al*., 2014), and specifically hoary bats, a species of concern for the Service due to their high mortality rates at wind energy facilities (Arnett and Baerwald, 2013).

Page 3-33 of the Draft EA states, "Because there were substantially lower levels of bat activity 3 miles from shore when compared to the onshore activity, and the proposed turbines would be 8 to 10 miles offshore, even lower levels of bat activity are expected where the turbines would be located." This is not an appropriate assumption, as bats that are migrating across Lake Erie could encounter both the crib at 3 miles from the shoreline, and the project area at 10 miles from the shoreline. Acoustic monitoring efforts to date have been inadequate for assessing bat use of the project airspace and risks to bats.

Section 3.4.2.3.

Section 3.4.2.3 of the Draft EA assesses environmental impacts to birds and bats. Birds are known to collide with tall stationary structures such as buildings, power lines, and communication towers. It is estimated that between 100 million and 1 billion birds are killed annually in the U.S. from striking man-made structures (Klem 1990; Manville 2000). Wind turbines pose an added threat to birds which may collide with the stationary base, or may be struck by the spinning blades. Erickson *et al.* (2014) evaluated 116 post-construction mortality studies from wind power projects and based on these estimated that 368,000 birds are struck by turbines each year. Of the observed bird mortality, wood warblers comprise 10.8% of all bird mortalities, second only to larks which comprise 13.7% and are dominated by horned lark mortalities. Horned larks have aerial breeding displays which may make them particularly susceptible to wind turbine collisions (Erickson *et al.* 2014). Shorebirds comprise 1% and waterbirds comprise 0.2% (Erickson *et al.* 2014). Rates of avian collision mortality at existing wind facilities in the east and upper Midwest of the United States have been documented to range from zero to approximately 11 bird fatalities per MW per year (Erickson *et al.* 2014), and post-construction studies at land-based wind projects in Ohio from April-November fall within this range (USFWS unpublished data).

Canada recently analyzed post-construction collision data for 37 wind power projects in Ontario over multiple years ranging from 2006-2014. Data collection was standardized to occur within 50 m of the turbine from April 1-October 31. Based on this data, the estimated mortality for non-raptors was 6.14 +/- 0.31 birds/turbine, with a range of 0-44.31 birds/turbine (Bird Studies Canada *et al.* 2016). Passerines accounted for the most mortality (69%) across wind projects in all of Canada, while waterbirds (which would include shorebirds) accounted for 3.2% of mortality (Bird Studies Canada *et al.* 2016). For projects located along the north shore of Lake Erie in Ontario opposite Cleveland (Port Alma, South Kent, and Erieau), bird mortality rates ranged from 1.15-2.5 birds/MW/year (see: https://drive.google.com/drive/folders/0B24A4SH_cewXV0VhTENxTGp3LVk). Results from the NEXRAD study (Nations and Gordon 2017) suggest that bird/turbine collision risk for the proposed offshore project is lower than it would be for a similar project located near shore or onshore in the Cleveland area because migration intensity was 2.5 times lower at the project area than over land. However, this fails to account for the observations that birds will sometimes seek

man-made structures to land on while migrating over large bodies of open water such as oil platforms or even freighters (Perkins 1964). This probably results from the migrants encountering adverse weather conditions during the crossing. In such cases, attraction to the turbines could increase mortality rates.

Although avian collision mortality can occur at any time of year, patterns in avian collision mortality at tall towers, buildings, wind turbines, and other structures suggest that the majority of fatalities occur during the spring and fall migration period (NRC 2007). Data from Ontario indicated slightly higher bird mortality during fall (mid-July-Oct. 31) (Bird Studies Canada *et al.* 2016). Erickson *et al.* (2014) also found a peak in mortality in fall, and a smaller peak in spring but cautioned that peaks may be influenced by species-specific behaviors (e.g., horned larks are often found as mortalities in spring, when aerial mating displays may result in more flights into the rotor-swept zone of the turbine). Limited data from existing wind facilities suggest that migrant species represent roughly half the fatalities, while resident species represent the other half (NRC 2007).

The Draft EA indicates that waterfowl and waterbirds have overall low collision susceptibility and are not found in large numbers in the project area. Further, it finds that gulls have high maneuverability and are likely to avoid turbine collisions. The proposed aerial flight surveys in 2017 and 2018 will help to elucidate how distance from shore affects the distribution of waterfowl and waterbirds, and will provide project-area specific information on seasonal passage rates that may inform risk.

While the density of migrating passerines over Lake Erie may be "less than half" than the density over land based on the NEXRAD analysis (Nations and Gordon 2017), there are still likely to be millions of individual birds crossing Lake Erie during spring and fall migration each year, and a proportion of these are flying at altitudes within the rotor-swept zone (Horton *et al*. 2016, also see Attachment 2). Weather patterns likely influence large migration events to some degree, although these patterns are probably complex (Newton, 2008). Among birds, passerines comprise the majority of mortality at wind power projects. With the available data we are unable to estimate how many passerines might be crossing through the project area while flying at altitudes within the rotor-swept zone, and thus that might be at risk of collision with the turbines. The Service recommended conducting a radar study to evaluate this risk, but implementation of the study within the project area has not occurred to date. According to the Draft EA, based on land-based mortality, "studies show fatality rates would most likely be between 2.10-3.35 birds/MW/year for small passerines, most of which are nocturnal migrants, which would lead to roughly 21-42 total bird fatalities per year for the proposed project. However, this is making the assumption that conditions and migrant behavior are the same over land and over water, which as described above may not be accurate.

To minimize the risk of mortality for all birds, LEEDCo has proposed to utilize only flashing red and yellow lights on the turbines and work platforms, respectively. Gehring *et al.* (2009) found that communication towers lit at night with only flashing lights, as opposed to steady-burning lights resulted in 50–71% fewer avian fatalities. If future bird studies in the project area indicate the potential for large numbers of birds to be exposed to the turbines, additional minimization measures (such as turning turbines off during high risk weather events during night migration periods) should be proactively implemented, particularly at night during spring and fall

migration when mortality is expected to peak. Further, if post-construction monitoring indicates that bird mortality rates are higher than predicted in the Draft EA, then additional minimization measures should be used in an adaptive management context. The EA currently does not provide or require specific plans to obtain this data. As currently written, future studies remain undefined, are not required, and may not reliably indicate the number of fatalities for both birds and bats that occurs once operations begin. Studies need to be fully defined, should be reviewed by both appropriate state and federal agencies, and be required as part of the EA to be of value in determining impacts on biological systems.

Wind energy facilities in various habitats across the U.S. and Canada have been documented to cause "widespread and often extensive fatalities of bats" (Arnett *et al.* 2008). Within the midwestern U.S. states, bat mortality rates (adjusted for bias such as searcher efficiency, carcass removal, and unsearched areas) range from a low of 1.43 bats/MW/study period at the Big Blue facility in Minnesota (Fagen Engineering, LLC 2014), to 30.61 bats/MW/study period at the Cedar Ridge facility in Wisconsin (BHE Environmental, Inc. 2010). For wind projects located along the north shore of Lake Erie in Ontario opposite Cleveland (Port Alma, South Kent, and Erieau), bat mortality rates ranged from 3.37-6.8 bats/MW/year within 50 m of the turbine from April 1-October 31
(see: https://drive.google.com/drive/folders/0B24A4SH_cewXV0VhTENxTGp3LVk).

At this time, research into the mechanisms that cause mortality of bats at wind power sites is ongoing but collisions associated with moving turbine blades are clear proximate causes of death. It is unclear if bats are attracted to turbines, but the potential for attraction is of concern, particularly in an offshore setting where attraction may be intensified if turbines are perceived by bats as the only available roost (Cryan and Barclay, 2009). Research on how to avoid fatalities is continuing. Currently, only a few operational tools have shown success at avoiding or minimizing take. Feathering of turbines (changing the orientation of the blades out of the direction of the wind in order to stop the blades from turning during low wind speeds) during times when bats are most at risk has been shown to reduce mortality (Arnett *et al*. 2011, Good *et al*. 2012).

The draft EA concludes that the project is most likely to cause mortality of 1-4 bats/MW/year, but because bat and turbine interactions are not well understood, it could cause mortality of as many as 20-30 bats/MW/year. The ongoing bat acoustic studies may help to characterize patterns of bat use of the offshore airspace during various seasons and provide relative information on bat use of the project area (10 mi offshore) compared to areas closer inland. This data may help to inform collision risk to some degree.

To minimize the risk of mortality for all bats LEEDCo has proposed to feather turbine blades until the manufacturer's cut-in speed of 3.0 m/s has been reached at night during fall migration. At a study at Fowler Ridge, IN, feathering below the manufacturer's cut-in speed (3.5 m/s) reduced all-bat mortality by 36% and feathering at higher cut-in speeds showed greater reductions in bat mortality rates (Good *et al.* 2012). If the acoustic studies currently ongoing indicate the potential for large numbers of bats to be exposed to the turbines then DOE should require that the applicant implement higher cut-in speeds, particularly in the fall (August 1-October 31) when most bat mortality occurs, as a minimization measure. For all species of bats, nearly all migration occurs when temperatures are above 50 degrees Fahrenheit, and wind speeds are less than 6.9 m/s at night. Feathering during these conditions could avoid a large proportion

of bat mortality (Bowden *et al*. 2014).

Further, if post-construction monitoring indicates that bat mortality rates are higher than 1-4 bats/MW/year, the EA should state whether higher cut-in speeds will be used in an adaptive management context.

Post-construction monitoring

Because of the potential risk of bird and bat mortality, and because this project is designed to be a demonstration project to evaluate offshore wind installation in the Great Lakes, post-construction mortality monitoring is a necessary component of the project that this EA is evaluating. It will be difficult to detect carcasses struck by turbines in the open water environment. Developing and validating methods for generating robust mortality estimates for bats and birds, and testing methods to collect and identify carcasses at offshore wind projects is critically important if this demonstration project is to inform future offshore wind development in the Great Lakes and elsewhere. LEEDCo has proposed several methods of post-construction monitoring and the Service has recommended pursuing certain options, including emerging technological tools (see Service's Feb. 28, 2017 letter, also Flowers 2015, Suryan et al., 2016). However, in order to first test if these technologies would be effective, preferably in conjunction with each other, they need to be tested on land where traditional fatality monitoring could also be done for validation purposes. To date these tests have not occurred. The Service recommends that the draft EA be revised to include a plan for effective fatality monitoring and that the techniques be validated using land-based facilities prior to funding construction and preferably prior to finalizing the EA. We strongly recommend that DOE condition the funding of the project on inclusion of a robust post-construction mortality monitoring protocol which has been reviewed and commented on by the Service, and that specific funding be targeted for this project component.

National Environmental Policy Act (NEPA)

In our October 21, 2016 letter (attached), we advised DOE that we believed an EA was not the proper document for the proposed project. We stated, starting on page 7, that this project had three attributes that typically require an Environmental Impact Statement (EIS) according to CEQ regulations. This included (1) that possible effects on the human environment are uncertain and (2) that the project is precedent setting since it is the first proposed off-shore wind facility in freshwater and that it is intended as a demonstration project. Finally, (3) there is uncertainty regarding the potential impacts of this project, which may be understandable and acceptable for a demonstration project; however, given the lack of defined robust pre- and post-construction studies, there is likely to be little more certainty of biological impacts after the project is constructed and operating than is currently available.

The draft EA is also missing two additional components that should be found in a NEPA document. Except for the Proposed Alternative, this document does not fully analyze any additional alternatives as called for in 40 C.F.R. § 1502.14. The Service recommends an alternative where a complete set of detailed pre- and post-construction studies for impacts to birds and bats are presented and required, along with a robust adaptive management plan to address impacts, should they be greater than anticipated.

A second missing component is a discussion in the Cumulative Impacts section that addresses the cumulative impacts of commercial wind development in Lake Erie under both the existing alternative and the one proposed above. The draft EA states that "by providing funding, technical assistance, and government coordination to accelerate deployment of these demonstration projects, DOE can help eliminate uncertainties, mitigate risks, and support the private sector in creating a robust U.S. Offshore Wind Energy Industry." Thus, one of the cumulative effects of funding the project could be the accelerated development of utility-scale wind power in the offshore waters of Lake Erie. The Cumulative Impacts section does not anticipate or analyze this reasonable outcome. The importance of including detailed studies and adaptive management in one of the alternatives and comparing that to the current Proposed Alternative is that the Cumulative Impacts analysis would showcase the difference in impacts to birds and bats from utility-scale wind developing in Lake Erie between an alternative that provides robust biological studies and assessments of impacts and one with less rigorous pre-construction monitoring and an uncertain post-construction impact analysis method. An alternative with robust pre-and post-construction monitoring and adaptive management would clearly help eliminate uncertainties and mitigate risk, as per the goals of funding the demonstration project, better than an alternative with a to-be-determined method of monitoring, as currently proposed.

Summary

In summary, there is great uncertainty as to how birds and bats are using the airspace in and around the project area, and how many individuals may be exposed to and strike the proposed turbines over the life of the project. Birds and bats in the offshore environment may behave similarly to those on land, or they may not. Pre-construction monitoring data that is in the process of being collected and may be collected in the near future may help to inform some of these gaps. But there are not any detailed plans the Service is aware of to accurately determine numbers and altitudes of nocturnal migrants passing over the construction site which would both help inform the potential for interactions and fatalities and could also determine whether birds and bats are displaced by turbines. Methods for post-construction fatality studies are only conceptual at this point, and will require substantial time and effort to develop and validate. These studies are imperative in order for this project to serve as a valid demonstration project for commercial construction. Bird and bat interactions with wind turbines are not well understood and this is especially true for off-shore facilities.

Existing off-shore wind projects in Europe have collected post-construction data relating to avoidance and displacement of waterfowl, but mortality data has proven to be much more difficult to collect. Pre-construction studies are needed to determine the numbers, altitudes, and behavior of nocturnal migrants and robust post-construction mortality monitoring will be essential to address whether risks are translated to fatalities. Innovative technological methods will be necessary in the offshore environment where traditional monitoring methods are not feasible, but in order to rely on these innovations, they need to be validated at on-shore locations.

We believe that an EA is the incorrect NEPA document for this project. Additionally, in order for an EA to be reasonably sufficient, we believe that DOE should include an alternative that presents defined and adequate pre- and post-construction studies and an adaptive management

strategy. Finally, the NEPA analysis should include an analysis of the potential cumulative impacts of facilitating accelerated development of utility-scale wind power in Lake Erie. Thank you for the opportunity to provide comments on this proposed project. Please contact Megan Seymour at extension 16 in this office for further information.

Sincerely,

Dan Everson
Field Supervisor

cc: Erin Hazelton, ODNR Division of Wildlife, Columbus, Ohio, Erin.Hazelton@dnr.state.oh.us
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Attachments:

Attachment 1: Service correspondence on the LEEDCo project: March 3, 2017; February 28, 2017; October 21, 2016; March 24, 2014; November 15, 2013; and April 24, 2009.

Attachment 2: U.S. Fish and Wildlife Service avian radar, preliminary data from Cleveland, Ohio, early fall 2017

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ATTACHMENT 1

Service Correspondence on the LEEDCo Project

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993 / FAX (614) 416-8994

March 3, 2017

Mr. Patrick Donlon
Ohio Power Siting Board
180 East Broad St.
Columbus, OH 43215-3793

TAILS: 03E15000-2016-TA-1571

Re: Icebreaker Wind Farm Project 16-1871-EL-BGN

Dear Mr. Donlon:

This is in reference to the Ohio Power Siting Board's (OPSB) February 2, 2017 letter regarding the proposed Icebreaker Wind Farm Project Application (Application), to be located in Lake Erie offshore of Cleveland, Cuyahoga County, Ohio. The proposed Icebreaker Wind Farm involves the installation of up to six wind turbine generators, submerged electric collection cables, and a facility substation. The total generating capacity of the facility will not exceed 20.7 megawatts (MW). The project is located approximately eight to ten miles off the coast of Cleveland. Only the substation interconnection is occurring on land; no impacts to wetlands or forested areas are anticipated. The project is being proposed by Icebreaker Wind Project Incorporated (Applicant).

The following comments are being provided pursuant to the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; BGEPA), the Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA), the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, 87 Stat. 884; ESA), and the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742 d-l; 70 Stat. 1119), as amended.

GENERAL COMMENTS:

The U.S. Fish and Wildlife Service (Service), Applicant, their representatives, and the Ohio Department of Natural Resources (ODNR) have been involved in discussions regarding this proposed project since 2008. We have participated in numerous meetings and conference calls, and provided recommendations relative to addressing fish and wildlife impact assessment throughout the development of this project. The project has evolved over the years, including changes to the number of turbines and the location of the project relative to the shoreline.

Construction and operation of offshore wind turbines presents a very different set of challenges than land-based turbines in terms of wildlife impact mitigation. Not only are common techniques for quantifying mortality impossible to implement (e.g. carcass surveys), large inland water bodies such as the Great Lakes have unique hydrological, biotic, and ecological properties compared to sea and land installations, for which there is no data and no precedent. This will be

the first installation of wind turbines in a freshwater ecosystem anywhere in the world. It will be the first installation of offshore wind anywhere in the Great Lakes, and likely only the second offshore wind facility in the western hemisphere. The manner in which this project is evaluated and permitted will be a model for future similar projects. According to the Application, this project is proposed as a "demonstration-scale project to help assess the potential success for future larger-scale offshore wind farms in Lake Erie and other Great Lakes." Information gathered from this project will be used to assess the feasibility of developing commercial-scale wind facilities in Lake Erie, or the Great Lakes as a whole.

Because of the unknown consequences of developing offshore wind energy in the Great Lakes and the precedent-setting nature of this project, the pre- and post-construction evaluations of potential impacts on fish and wildlife are crucial. As such, it is essential to have rigorous and scalable pre- and post-construction studies within the project area to evaluate potential impacts.

Some pre-construction wildlife studies were initiated by the Applicant in 2010 based on recommendations from the Service and ODNR. These included bat acoustic monitoring April 1 – November 10, 2010 and radar monitoring March 31-October 12, 2010 (Svedlow et al. 2012) from the Cleveland Crib. Two additional surveys were conducted that were not part of the studies recommended by ODNR or the Service (avian acoustic surveys, and boat based nocturnal surveys). Substantial complications occurred during the 2010 radar studies that rendered the study results uninformative to the proposed project area. Further, the radar and acoustic studies did not include the currently proposed project area. The Applicant provided analysis of bird and bat risk using NEXRAD radar data (Livingston, 2008; Nations and Gordon 2017). While these reports characterize bird and bat migration in spring and fall over the project area compared to other areas in the region, NEXRAD data by nature do not provide information on numbers and altitudes of birds and bats flying within the rotor-swept zone of the turbines, which is the data we need to inform risk to these species. Thus, the Service, ODNR, and the Applicant are working on developing a new bird and bat study protocol to be implemented in 2017-2018 that should help inform risk to birds and bats within the currently proposed project location.

Implementation of a pre-construction bird and bat study protocol is challenged by the remoteness of the project area, the depth of water, and limited accessibility during certain seasons (e.g., winter). All of these accessibility limitations drive up the cost of studies and present unique technological hurdles. The Service and ODNR are working with the developer to design a pre-construction bird and bat study protocol that is technologically and economically feasible, scaled to the project size (6 turbines), gathers site specific data where possible, and uses comparable data collected from a more accessible location (for example, the Cleveland Crib) when necessary. While this is not ideal and would not be appropriate for a utility-scale offshore wind project, we believe it will be sufficient for a demonstration scale project. We are also working with the Applicant to design an innovative post-construction monitoring protocol that will use emerging technology to assess a suite of impacts to birds and bats.

ODNR and the Service also requested a suite of aquatic and benthic studies to assess the importance of the project area to fish and to establish baseline conditions pre-construction. The Applicant began implementing these surveys in 2016, and work continues.

Any certificate issued by the OPSB should be contingent upon full implementation of the pre- and post-construction studies agreed upon by the Service, ODNR, and the Applicant.

MIGRATORY BIRD COMMENTS:

The Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA prohibits taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the MBTA has no provision for allowing unauthorized take, the Service recognizes that some birds may be taken during activities such as wind turbine operation even if all reasonable measures to avoid take are implemented. The Service's Office of Law Enforcement carries out its mission to protect migratory birds not only through investigation and enforcement, but also through fostering relationships with individuals and industries that proactively seeks to eliminate their impacts on migratory birds. Although it is not possible under the MBTA to absolve individuals, companies, or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures), the Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented.

The Service strongly encourages developers to coordinate with Service biologists regarding their projects. Proper coordination will help developers make informed decisions in siting, constructing, and operating their facilities. Additionally, the Service hopes to work cooperatively with wind developers to advance the state of the art of wind power siting, construction, and operation. Advancements in these areas will represent great strides toward the environmentally safe development of this otherwise renewable and clean source of energy. The Service recommends that the Applicant develop a Bird and Bat Conservation Strategy (BBCS) to address pre- and post-construction monitoring to assess risk to migratory birds and bats, to identify minimization measures that will be implemented to minimize risk, and to identify potential mitigation actions to implement if such risk reaches high levels. We note and appreciate that page 122 of the Application includes a commitment to complete a BBCS.

The proposed project location is between 8-10 miles off the coast of Cleveland, thus does not provide habitat for many species of birds that breed in Ohio. However, millions of migrating birds move through the Great Lakes region during spring and fall migration each year (Rich et al. 2004, France et al. 2012, Horton et al. 2016) and could cross through the project area and potentially be exposed to risk.

Gordon and Erickson (2016) completed a bird and bat risk assessment for the project using data collected from other land-based wind projects, offshore projects in Europe, and NEXRAD. This assessment concludes low risk of adverse impacts to birds primarily because of the small scale of the project (6 turbines) and because "the level of use of this area by birds and bats is low compared to bird and bat use of terrestrial or nearshore environments" (Gordon and Erickson 2016). We agree that the small number of turbines generally will result in a limited amount of impacts from both mortality and displacement, but we do not believe that the data currently available provides conclusive evidence of low risk based on the level of bird use.

Further, because this project is meant to be a demonstration project with wider applicability to future offshore wind projects, we believe it is important to gather site specific data to understand the baseline use of the project area by birds and compare that with post-construction data to elucidate what the actual impacts are, and to be able to extrapolate those conclusions to a larger project. Thus the question is not just, "is this project 'low' risk to birds?" rather we want to understand larger issues such as, how much risk to birds do offshore turbines present relative to land-based turbines (e.g., how much mortality occurs on a per-MW basis), and how do birds respond to offshore turbines in the Great Lakes?

The waters around Cleveland provide important overwintering habitat for gulls (herring, ring-billed, Bonaparte's, great black-backed, etc.), ducks (greater and lesser scaup, red-breasted and common mergansers, goldeneye, bufflehead, redhead, canvasback), common loons and horned grebes. During winter, flocks of over 10,000 birds are not uncommon near Cleveland. Additionally, several locations (Wendy Park, Edgewater Park, Cleveland Lakefront Preserve, etc.) along the lakeshore are known for their large concentrations of passerines during migration. The site is approximately 4.5 miles from an area designated by The Audubon Society as the Cleveland Lakefront Important Bird Area (IBA). This area was selected as an IBA due to the large concentrations of birds that congregate there during spring and fall migration (also wintering waterfowl, gulls, and eagles). ODNR completed two years of spring and fall pelagic bird distribution surveys in the offshore waters of Lake Erie (Norris and Lott 2011). These surveys indicate that during spring and/or fall common loon, horned grebe, Bonaparte's gull, common merganser, red-breasted merganser, ring-billed gull, herring gull, double-crested cormorants, and goldeneye are likely to occur in the vicinity of the project area in numbers ranging from single individuals to flocks of several hundred (Norris and Lott 2011).

The Application indicates that risk to waterfowl is low due to the low abundance of birds near the turbine sites and the tendency for waterfowl to avoid turbine locations, but project-specific data on waterfowl use and abundance is lacking. We are currently working with the Applicant and ODNR to recommend site-specific pre- and post-construction waterfowl surveys fall through spring to quantify waterfowl use in the project area before and after construction, to better document displacement effects, should they occur.

Large concentrations of waterfowl in the offshore environment may attract raptors. Peregrine falcons have been observed hunting from the Cleveland Crib (~3 miles from shore); therefore turbines may provide similar foraging opportunity for species like peregrines, though most species of raptor avoid flying over large open bodies of water due to the absence of thermals. We generally agree that because the project is so far from the shoreline, overall raptor use of the project area is likely to be low, and thus collision risk to raptors is also likely low.

The bird and bat risk analysis (Gordon and Erickson 2016) categorizes the risk to nocturnally migrating songbirds as "low," based on our understanding of bird migration along the shorelines of the Great Lakes and NEXRAD analysis of the open water. NEXRAD data generally provides coarse information on densities of birds migrating well above the height of the rotor-swept zone and thus does not accurately characterize risk to songbirds flying within the rotor-swept zone. While the intent of the 2010 radar study was to help quantify the risk to migratory songbirds

from the Applicant's project, and was at a scale appropriate to address the question, due to radar malfunctions, the site where the radar was located, the time when the radar was operational, and other factors, the data obtained was not sufficient to inform risk. The Service is now working with the Applicant to design a radar project (both pre- and post-construction) to provide important site-specific information for assessing the potential impacts of offshore wind facilities on nocturnally migratory songbirds.

BALD EAGLE COMMENTS:

The project lies within the range of the bald eagle (*Haliaeetus leucocephalus*). Bald eagles are protected under the Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA), and are afforded additional legal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, BGEPA). The BGEPA prohibits, among other things, the killing and disturbance of eagles.

Bald eagles nest in super canopy trees and typically forage on fish, mammals, and carrion. The project area does not support suitable nesting habitat, and it is unlikely that eagles would forage eight to ten miles offshore during the summer, when plentiful food resources are present much closer to their nesting habitats. The Service anticipates that take of eagles is unlikely during the summer due to the distance this facility is from the shoreline. Conversely, in winter when ice forms along the shoreline it may force wintering birds closer to the proposed facility. Within the last several years Lake Erie has almost completely frozen over. As the ice builds along the shoreline it forces ducks, gulls, etc. further into the lake. Eagles, which will feed on fish and waterfowl, will congregate long the leading edge of the ice, or near open leads in the ice. Should the ice extend far enough, it may put waterfowl and eagles in close proximity to the turbines. The Service is currently working with the Applicant to develop a study protocol and analysis of Lake Erie ice formation that will inform bald eagle risk during the winter based on ice conditions. If take of eagles cannot be avoided, the Applicant should work with the Service's Division of Migratory Birds to obtain an eagle take permit.

ENDANGERED SPECIES COMMENTS:

The proposed project is located in Cuyahoga County, in Ohio. There are five species of birds or bats that are federally endangered, threatened, proposed, or candidate species that may occur in Cuyahoga County during some portion of the year: Indiana bat (*Myotis sodalis,* endangered), northern long-eared bat (*Myotis septentrionalis*, threatened) Kirtland's warbler (*Setophaga kirtlandii,* endangered), piping plover (*Charadrius melodus,* endangered), and red knot (*Calidris canutus rufa,* threatened).

Cuyahoga County has confirmed records for Indiana and northern long-eared bats. Suitable summer habitat for Indiana bats and northern long-eared bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags $\geq$3 inches diameter at breast height (dbh) that have any exfoliating bark, cracks, crevices, hollows and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or

loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat. Northern long-eared bats have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat. Both of these species may travel several hundred miles between their summering habitat and winter hibernacula (Griffin 1945, Winhold and Kurta 2006). In the winter, Indiana bats and northern long-eared bats hibernate in caves and abandoned mines.

The project area does not provide suitable summer or hibernation habitat for Indiana bats or northern long-eared bats. Thus, no impact to these species is anticipated during the summer or winter. The only potential risk periods for either of these species are during spring and fall migration.

The Indiana bat range does not extend into Canada. Thus, there is no reason to expect that Indiana bats would be flying across Lake Erie during spring or fall migration. Therefore we do not anticipate that this species will be impacted by the proposed project.

The range of the northern long-eared bat does include Canada north of the project area. However, northern long-eared bats are thought to be short-distance migrants. Short migratory movements between summer roost and winter hibernacula between 56 km (35 mi) and 89 km (55 mi) have been documented most often (Nagorsen and Brigham 1993 p. 88; Griffin 1945, p. 53). However, movements from hibernacula to summer colonies may range from 8 to 270 km (5 to 168 mi) (Griffin 1945, p. 22). Thus it is unlikely that northern long-eared bats would be migrating long distances across the open waters of Lake Erie (~50 miles of open water from the Cleveland shore to the Canada shore). Additional acoustic surveys proposed to occur offshore will help to evaluate potential risk to this species from offshore wind development.

Piping plovers, red knots, and Kirtland's warblers all migrate through Ohio but none are known to nest or overwinter within the state.

The Great Lakes population of piping plover nests primarily in Michigan and consists of approximately 63 pairs of birds. These birds overwinter primarily along the Atlantic coast, with some along the Gulf coast (USFWS 2009). While their migration paths are unknown, they have been documented to stop over on sand beaches along the shore of Lake Erie in Ohio. It is unknown if they migrate across the open waters of Lake Erie, or if their migration path would take them through the proposed project area.

Kirtland's warblers nest in young stands of Jack pines primarily in Central Michigan. Their current population is over 3,000 individuals (USFWS 2012a). They overwinter in the Bahamas. Individual birds have been banded during spring and fall migration, and geo-locators have indicated at least some of these birds are likely to have migrated across open waters of Lake Erie. Further, Kirtland's warblers have been documented to stop over all along the Lake Erie shoreline in Ohio (USFWS 2012a).

Red knots nest in the high arctic, and winter along both coasts of North America and south into Central and South America. While the vast majority of the red knot population migrates along the Atlantic and Pacific coastlines, occasionally small numbers of birds have been found in Ohio, typically along marshes in the western basin of Lake Erie. The proposed location for the facility does not have suitable habitat for these species. Most observations of these species in Ohio occur along the shoreline of the western basin of Lake Erie where there is more stopover habitat.

FISHERIES COMMENTS:

One of the responsibilities of the Service is to manage interjurisdictional fisheries, i.e., fisheries that are managed by more than one state or nation. The waters of Lake Erie are managed by four states (Michigan, Ohio, Pennsylvania, and New York), and Canada. A component of the pre-construction survey project developed jointly between ODNR and the Service are studies to assess the fisheries in the proposed project area and to evaluate potential risk to fish during construction and operation of the project, including the electrical lines. Pre-construction studies began in 2016 and are still ongoing to establish baseline conditions. Post-construction studies are being developed by ODNR and the Applicant, with Service input to evaluate actual impacts to fish and the aquatic environment.

NON-LISTED BAT COMMENTS:

Less than a decade ago the biggest threats to bat populations were loss of hibernacula and destruction of summer habitat. Since then the spread of white-nose syndrome (WNS), a novel fungal disease rapidly spreading across the Midwest, has caused the death of millions of cave hibernating bats (USFWS 2012b). Populations of cave bats have declined so significantly, mostly attributed to WNS, that the Service has recently listed the northern long-eared bat as a threatened species. The Service is currently conducting status reviews for two additional species, the little brown bat (*Myotis lucifugus*) and tri-colored bat (*Perimyotis subflavus*) due to declines associated with WNS. Both of these species were documented in acoustic surveys conducted in 2010 (Svedlow et al. 2012).

As of September 2011, the 13,361 installed MW of wind energy in the Midwestern U.S. is anticipated to cause mortality of, on average, 106,000 bats per year (Arnett and Baerwald 2013). The majority of these are long-distance migrating tree bats, but cave hibernating bats also make up a small proportion of mortality. A recent publication indicated that the hoary bat population could experience "rapid and severe declines…within 50 years and increased risk of extinction in 100 years" solely based on mortality occurring at existing wind projects (Frick et al. 2017).

The results of the bat acoustic study at the Cleveland Crib (Svedlow et al. 2012) state that 4 bat passes/detector-night were recorded in 2009. Ninety five percent of the calls recorded were of the three bat species most susceptible to collisions with wind turbines (Svedlow et al. 2012, Arnett and Baerwald 2013). The bird and bat risk assessment (Gordon and Erickson 2016) indicates that the number of bat calls detected during acoustic monitoring at the Cleveland Crib in 2010 was on the low end of detections compared to other land-based wind projects, but fails to note that other comparable land-based wind projects with similar rates of bat acoustic calls are

among the sites with the highest post-construction bat fatality rates (e.g., Fowler Ridge, Forward Energy, Blue Sky Green Field, etc.).

There are several factors that confound the results of the bat acoustic survey conducted on the Cleveland Crib in 2009. Since all monitoring had to be conducted from the Cleveland Crib, acoustic monitoring sites were co-located with radar monitoring locations. Radar has been shown to reduce bat activity, potentially due to electromagnetic fields causing discomfort (Nicholls and Racey 2007). Large concentrations of insects were also observed swarming above the Cleveland Crib. Bats have been observed pausing during migration to take advantage of congregations of insects around offshore wind turbines (Ahlén et al. 2007, 2009). Thus the acoustic monitoring included a factor that may reduce bat activity, and one that may increase bat activity. It is unknown if either factor influenced the number of detections recorded at this site.

The Applicant's bird and bat risk assessment acknowledges the difficulty in predicting bat mortality rates for the project due to our limited understanding of bat and wind turbine interactions, but concludes that the overall bat collision risk is low due to the small number of turbines (Gordon and Erickson 2016), regardless of whether or not the mortality rates per megawatt are at the low or high end of the spectrum of mortalities seen at land-based wind facilities.

We believe that the available information is insufficient to determine bat mortality risk on a per-MW basis, given the lack of site-specific data and the inconsistencies in pre- and post-construction data collected at land-based wind projects. We believe it is important to gather site specific data to understand the baseline use of the project area by bats and compare that with post-construction data to elucidate what the actual impacts are, and to be able to extrapolate those conclusions to a larger project. Thus the question is not just, "is this project 'low' risk to bats?" rather we want to understand larger issues such as, how much risk to bats do offshore turbines present relative to land-based turbines (e.g., how much mortality occurs on a per-MW basis), and how do bats respond to offshore turbines in the Great Lakes?

The Service is working with the Applicant to develop a new radar and acoustic monitoring protocol that will evaluate bat activity within the proposed project area pre- and post-construction. These studies are anticipated to be completed in 2017-2018. These studies will provide a baseline index of bat activity within the project with which to compare post-construction data on behavior and mortality. Innovative methods will be used to estimate bat mortality post-construction with the aim of generating bat/megawatt mortality rates that can be extrapolated to larger offshore projects, compared with onshore projects, and to determine if minimization measures to limit mortality are necessary.

To date the only mechanism known to reduce bat mortality at wind turbines is to curtail turbines during nights of low wind speed, which is the period when bats are most susceptible to being struck. Should this facility be constructed, the Service requests that at a minimum, turbines should be curtailed (the blades should be oriented such that they do not catch the wind) until the manufacturer's cut-in speed (3.0 m/s for the turbine model proposed in the Application) is reached at night during bats' active periods (generally April-October). If, based on the results of

post-construction monitoring, bat mortality is anticipated to be high, a higher cut-in speed may be warranted during periods of time when bats are most at risk.

POST-CONSTRUCTION MONITORING:

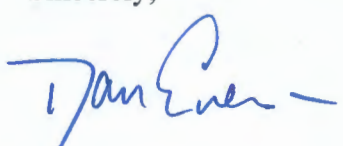
In order to assess the actual impact of the project in migratory birds, bats, fish, and the aquatic environment, post-construction monitoring is critical. Further, one of the purposes of a small-scale demonstration project is to assess the impacts of the project and be able to extrapolate those impacts to a larger scale. Thus, this project should have a valid post-construction monitoring plan that is approved by both the ODNR and Service that quantitatively and qualitatively describes impacts to birds, bats, and aquatic resources.

This project presents unique risks to migratory bats and migratory birds due to the proximity of the project area to the offshore waters of Lake Erie. Because the turbines will be sited in an open water environment, conventional post-construction mortality monitoring to determine impact of the project and birds and bats will be impossible to implement. Thus, innovative new methods for monitoring bird and bat mortality in the offshore environment will have to be developed and implemented, and their reliability is unknown. The Applicant, Service, and ODNR are currently evaluating multiple innovative methods for assessing impacts to birds and bats. A post-construction monitoring plan for fisheries has been developed and is being finalized. Implementation of a post-construction monitoring plan for birds, bats, fish, and the aquatic environment, agreed upon by the Service, ODNR, and Applicant should be made a condition of any issued permit.

This letter provides technical assistance only and does not serve as a completed section 7 consultation document. If project plans change, if portions of the proposed project were not evaluated, or if additional information on listed or proposed species or their critical habitat becomes available, it is our recommendation that you reinitiate coordination with this office.

If you have questions, or if we can be of further assistance in this matter, please contact our office at (614) 416-8993 or ohio@fws.gov.

Sincerely,



Dan Everson
Field Supervisor

cc: Scudder Mackey, ODNR (via e-mail)
Kate Parsons, ODNR (via e-mail)
Jeff Gosse, USFWS Region 3 (via e-mail)

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LeedCo Icebreaker Pre-construction and Post-construction Monitoring Survey Protocol

U.S. Fish and Wildlife Service and Ohio Department of Natural Resources Division of Wildlife

Comments

Feb. 28, 2017

The below comments represent U.S. Fish and Wildlife Service and Ohio Department of Natural Resources Division of Wildlife recommendations relative to the matrix of pre- and post-construction monitoring options provided by LeedCo via e-mail on January 5, 2017.

1. Bat acoustic monitoring
    a. Pre-construction
        i. On 10 mile large buoy—high (~50 m or as high as possible) and low (~water level) detectors. If the "high" and "low" detectors are separated by at least 40 m, add a "middle" (~30 m) detector too.
        ii. On 3 and 7 mile buoys—low detector
        iii. On Cleveland crib—high (~50 m) and low (close to water surface) detectors
        iv. Per ODNR protocol, use AnaBat detectors (either SD1 or those equipped with CF ZCAIMS), with sensitivity adjusted to detect a calibration tone3 at 20 meters.
        v. March 15-November 15, half hour before sunset until half hour after sunrise; all monitors running concurrently for the entire season.
    b. Post-construction
        i. On 3 turbines (at least one on an end)—high (nacelle), medium (~ 30 m), and low (~10 m)detectors
        ii. On crib—high, low detectors
        iii. On 10 mile buoy –high and low detectors
    c. Rationale
        i. Provides bat species composition at various altitudes, index of bat activity overall and at various heights, seasonal patterns of movements. Allows comparison between site-specific data and crib data, assuming that site-specific data may not be as high as can be obtained from crib.
    d. Successful performance criteria
        i. 80% of nights per detector recorded during active period (March 15-Nov 15)
2. Waterfowl aerial surveys—with observer
    a. Pre-construction, *see attached protocol*
        i. Focus on waterfowl (esp. red-breasted mergansers that are easily spooked), bald eagles, ice relative to location of birds
        ii. Survey transects should run parallel to the turbine string.
        iii. Dates: mid-October - end of May
        iv. Frequency: Every 2 weeks

v. Transect spacing: Transects should be close enough to the turbines to observe birds between the turbines, but need to be a safe distance from the blades.
vi. Flight heights: 76-100 m in order to detect small waterbirds.
vii. Flight speeds: 150-200 km/h (unless constrained by local flying restrictions)
viii. Weather conditions: 4 or below on the Beaufort scale, winds approximately 37 km/h or less. Minimum of 3.2 km of visibility (or pilot's discretion).
ix. GPS location for each bird or flock should be recorded.

b. Post-construction
   i. Similar transect protocol as pre-construction
   ii. Year 1 after construction, year 4 after construction

c. Rationale
   i. Species numbers, distribution, use of project area seasonal patterns; eagles; ice; avoidance/attraction/displacement

d. Successful performance criteria
   i. Bi-weekly surveys during designated timeframe in appropriate weather conditions.

3. Radar
   a. Boat based radar is not technologically there yet, nor cost advantageous, and it focuses on waterfowl, but we have other methods outlined to address waterfowl. NEXRAD data is not useful for assessing bird/bat behavior within rotor swept zone, which is the data we need. Thus we suggest these approaches should not be considered further.
   b. Pre-construction
      i. We strongly recommend S-band radar, *see attached protocol.*
      ii. Preferred is radar data from project area—FWS and ODNR have been requesting this information since 2008. We still advocate for a single radar, on its own platform, within project area for spring and fall season of pre-construction monitoring as the preferred option.
      iii. Our second choice is to install one or all turbine bases prior to fall (2017), put a radar on one of the turbine bases for fall 2017-spring 2018, then install turbines after spring 2018.
      iv. Our third choice is to install one or all turbine bases prior to fall. Once the first turbine base is installed at the furthest point from shore, place radar unit on it and begin collecting data on fall migration as other bases are being installed. Install towers, with radar on platform collecting data until last tower is erected. (Assumes data collected for 6-8 weeks over fall migration period, which is key focus). Additionally, install radar on Cleveland crib with elevated antenna for spring and fall.
         1. Limitations of this approach: We are only getting fall data (we believe that fall is the most important season due to high bat mortality in fall migration), no information on spring risk. We would use the comparison between crib data and onsite data in fall to extrapolate what may be occurring onsite in spring. This is not ideal, but we think it is workable.

Construction activities may cause "clutter" on the radar map and may alter bird activity within the project area.

v. Site specific radar data is critical to our analysis. If none of the above options can be implemented, we will work with the applicant to evaluate other methods of obtaining site specific radar data.

c. Post-construction
   i. Preferred is single radar, on its own platform, within project area, in years 1, 3, and 5, from spring-fall.
   ii. Our second choice is 2 radars mounted on turbine platforms, in years 1, 3, and 5, from spring-fall.

d. Rationale
   i. Site specific data on night migration of birds and bats. Altitude data of bird and bat targets within rotor swept zone, counts of targets, peak dates of migration, seasonal patterns. Avoidance/attraction/displacement.
   ii. Because this is a pilot project the intent is to study and understand the impact of the project on various resources. Without project-specific radar information we cannot get key information needed to understand that impact.

e. Successful performance criteria
   i. Site-specific data; radars operating and collecting data over at least 80% of nights during spring/fall migration period.

4. Carcass monitoring
   a. Pre-construction—proof of concept development
      i. Bat nets—We believe this concept could have merit, but we would like to see a more fleshed-out conceptual proposal first. Please draft a detailed proposal and plans, and a land-based test concept and submit to FWS and ODNR for review. Be sure to consider carcass distribution of bats relative to distance from turbine. Net should be designed to collect at least 30% of bat carcasses and carcasses should be recoverable from the nets.
      ii. "Thunk" detection—We believe this concept could have merit. We request follow-up with the technology developer to ensure the technology could be ready to deploy within the project timeframe (testing in year 1, deployment in 2018-2019, etc.). Please draft a detailed proposal and plans, and a land-based test concept and submit to FWS and ODNR for review.
      iii. Identiflight—The original application for this technology (detecting golden eagles during daylight and shutting down turbines) is very different that the application needed for this project (detecting small nocturnal animals striking turbines). We think that the other options are more applicable and closer to being ready than this option. We suggest not using this option at this time.
   b. Post-construction
      i. Bat nets— If proof-of-concept test works, then install on 3 turbines during years 1, 3, and 5, and through the lifespan of the technology.

ii. “Thunk detection”—If proof-of-concept test works, then install on 3 turbines during years 1, 3, and 5, and beyond, through the lifespan of the technology.
iii. Live observers—do not recommend this for carcass monitoring, as most mortality is expected to occur at night and could not be observed. Do not recommend this for waterfowl displacement study because aerial flights and radar would be better to address displacement.

c. Rationale—to detect collisions of birds/bats, identify carcasses at least to guild
d. Successful performance criteria—ability to detect bird/bat collisions. Generate a reasonable estimate of collisions/MW/year. Set up an adaptive management program to address potential performance issues with new technology.

UNITED STATES DEPARTMENT OF THE INTERIOR
U.S. Fish and Wildlife Service
Ecological Services Office
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993 / Fax (614) 416-8994

October 21, 2016

Mr. Roak Parker
U.S. Department of Energy
15013 Denver West Parkway,
Golden, CO 80401

TAILS: 03E15000-2016-TA-1571

Re: Development of an Environmental Assessment for the Icebreaker Wind Facility, DOE/EA-2045

Dear Mr. Parker:

This is in reference to the development of an Environmental Assessment for Lake Erie Energy Development Corporation's ("LEEDCo") proposed Icebreaker Wind Facility. The proposed project involves the installation of up to six wind turbine generators, underground collection cables, and connection to an existing substation. The total generating capacity of the facility will not exceed 20.7 MW.

The project is located in Lake Erie, approximately eight to ten miles off the coast of Cleveland, OH in Cuyahoga County. This project plans to connect to an existing substation in Cleveland, thus transmission lines will be trenched into the substrate of Lake Erie from the shoreline to the project (~12 miles). The majority of this project will occur within Lake Erie with only the substation interconnection occurring on land; no impacts to wetlands or forested area are anticipated.

The following comments are being provided pursuant to the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; BGEPA), the Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA), the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, 87 Stat. 884; ESA), the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742 d-l; 70 Stat. 1119), as amended.

The U.S. Fish and Wildlife Service (Service), LEEDCo, their representatives, and the Ohio Department of Natural Resources (ODNR) have been involved in discussions regarding this proposed project since 2008. We have participated in numerous meetings, conference calls, and correspondence regarding this project. LEEDCo initiated some pre-construction wildlife studies in 2010 based on recommendations from the Service and ODNR. These included bat acoustic monitoring April 1 – November 10, 2010 and radar monitoring March 31-October 12, 2010 (Svedlow et al. 2012). Two additional surveys were conducted that were not part of the studies recommended by ODNR and the Service (avian acoustic surveys, and boat based nocturnal surveys). Due to the potential impacts to fisheries ODNR and the Service requested several surveys to assess the importance of the area as a fishery. LEEDCo is currently working with

ODNR and the Service to undertake the fisheries studies. Substantial complications occurred during the 2010 radar studies that rendered the study results uninformative to the proposed project area. Further, the radar and acoustic studies did not include the currently proposed project area. Thus, the Service and LEEDCo are working on developing a new radar and acoustic study protocol (among other studies) to be implemented in 2017 that should help inform risk to wildlife from the proposed project at the proposed location.

GENERAL COMMENTS:

Construction of offshore wind turbines presents a very different set of challenges than land-based turbines in terms of wildlife impact mitigation. Not only are common techniques for quantifying mortality impossible to implement (e.g. carcass surveys), large inland water bodies such as the Great Lakes have unique hydrological, biotic, and ecological properties compared to sea and land installations, for which there is no data and no precedent. Because of the unknown consequences of developing offshore wind energy in the Great Lakes and the precedent-setting nature of this project, the pre- and post-construction evaluations of potential impacts on wildlife necessarily must meet a standard of rigor greater than wind projects on land. Further, this project has always been, and continues to be, proposed as a "demonstration project" or "pilot-project." Information gathered from this project will be used to assess the feasibility of developing commercial-scale wind facilities in Lake Erie, or the Great Lakes as a whole. As such, it is essential to have scalable pre- and post-construction studies to evaluate potential impacts.

MIGRATORY BIRD COMMENTS:

The Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA prohibits taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the MBTA has no provision for allowing unauthorized take, the Service recognizes that some birds may be taken during activities such as wind turbine operation even if all reasonable measures to avoid take are implemented. The Service's Office of Law Enforcement carries out its mission to protect migratory birds not only through investigation and enforcement, but also through fostering relationships with individuals and industries that proactively seeks to eliminate their impacts on migratory birds. Although it is not possible under the MBTA to absolve individuals, companies, or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures), the Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented.

The Service strongly encourages developers to coordinate with Service biologists regarding their projects. Proper coordination will help developers make informed decisions in siting, constructing, and operating their facilities. Additionally, the Service hopes to work cooperatively with wind developers to advance the state of the art of wind power siting, construction, and operation. Advancements in these areas will represent great strides towards the environmentally safe development of this otherwise renewable and clean source of energy. The Service recommends that LEEDCo develop a Bird and Bat Conservation Strategy (BBCS) to address

pre- and post-construction monitoring to assess risk to migratory birds and bats, to identify minimization measures that will be implemented to minimize risk, and to identify potential mitigation actions to implement if such risk reaches high levels.

The proposed project location is between 8-10 miles off the coast of Cleveland, thus does not provide habitat for many species of birds that breed in Ohio. But, millions of migrating birds move through the Great Lakes region during spring and fall migration each year (Rich et al. 2004, France et al. 2012, Horton et al. 2016).

The waters around Cleveland provide important overwintering habitat for gulls (herring, ring-billed, Bonaparte's, great black-backed, etc.), ducks (greater and lesser scaup, red-breasted and common mergansers, goldeneye, bufflehead, redhead, canvasback), common loons and horned grebes. During winter, flocks of over 10,000 birds are not uncommon near Cleveland. Additionally, several locations (Wendy Park, Edgewater Park, Cleveland Lakefront Preserve, etc.) along the lakeshore are known for their large concentrations of passerines during migration. The site is approximately 4.5 miles from an area designated by The Audubon Society as the Cleveland Lakefront Important Bird Area (IBA). This area was selected as an IBA due to the large concentrations of birds that congregate there during spring and fall migration (also wintering waterfowl, gulls, and eagles). Within the 2013 Avian Risk assessment it contends that "the Icebreaker site does not appear to be on a heavily used migration path for waterfowl or seabirds." While large numbers of birds may not feed within the area, they likely cross through the area to reach their overwintering areas near shore. These large concentrations of birds may attract raptors. Peregrine falcons have been observed hunting from the Cleveland crib (~3 miles from shore); therefore turbines may provide similar foraging opportunity for species like peregrines.

While the intent of the 2010 radar study was to help quantify the risk to migratory birds from construction and operation of the LEEDCo project, due to radar malfunctions, the site where the radar was located, the time when the radar was operational, and other factors, the data obtained was not sufficient to inform risk. The Service is now working with LEEDCo to design a radar project (both pre- and post-construction) to address our concerns and provide critical information for assessing the potential impacts of offshore wind facilities in the Great Lakes. We anticipate that this new radar study will occur in 2017. Until we have the results of this study we cannot assess the potential impact of the project on migratory birds.

BALD EAGLE COMMENTS:

The project lies within the range of the bald eagle (*Haliaeetus leucocephalus*). Bald eagles are protected under the Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA), and are afforded additional legal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, BGEPA). The BGEPA prohibits, among other things, the killing and disturbance of eagles.

Bald eagles nest in super canopy trees and typically forage on fish, mammals, and carrion. The project area does not support suitable nesting habitat, and it is unlikely that eagles would forage eight to ten miles offshore during the summer, when plentiful food resources are present much closer to their nesting habitats. The Service anticipates that take of eagles is unlikely during the

summer due to the distance this facility is from the shoreline. Conversely, in winter when ice forms along the shoreline it may force wintering birds closer to the proposed facility. Within the last several years Lake Erie has almost completely frozen over. As the ice builds along the shoreline it forces ducks, gulls, etc. further into the lake. Eagles, which will feed on fish and waterfowl, will congregate long the leading edge of the ice, or near open leads in the ice. Should the ice extend far enough, as it did this past winter, it may put waterfowl and eagles in close proximity to the turbines. The Service is currently working with LEEDCo to develop a study protocol that will inform bald eagle risk during the winter. Until this study is completed, we cannot assess the potential impact of the project on bald eagles. If take of eagles cannot be avoided, LEEDCo should work with the Service's Division of Migratory Birds to obtain an eagle take permit.

ENDANGERED SPECIES COMMENTS:

The proposed project is located in Cuyahoga County, in Ohio. There are five species of birds or bats that are federally endangered, threatened, proposed, or candidate species that may occur in Cuyahoga County. Indiana bat (*Myotis sodalis,* endangered), northern long-eared bat (*Myotis septentrionalis*, threatened) Kirtland's warbler (*Setophaga kirtlandii,* endangered), piping plover (*Charadrius melodus,* endangered), and red knot (*Calidris canutus rufa,* threatened).

Cuyahoga County has confirmed records for Indiana and northern long-eared bats. Suitable summer habitat for Indiana bats and northern long-eared bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥3 inches diameter at breast height (dbh) that have any exfoliating bark, cracks, crevices, hollows and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat. Northern long-eared bats have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat. Both of these species may travel several hundred miles between their summering habitat and winter hibernacula (Griffin 1945, Winhold and Kurta 2006). In the winter, Indiana bats and northern long-eared bats hibernate in caves and abandoned mines.

The LEEDCo project area does not provide suitable summer or hibernation habitat for Indiana bats or northern long-eared bats. Thus, no impact to these species is anticipated during the summer or winter. The only potential risk periods for either of these species are during spring and fall migration.

The Indiana bat range does not extend into Canada north of the project area. Thus, there is no reason to expect that Indiana bats would be flying across Lake Erie during spring or fall migration. Therefore we do not anticipate that this species will be impacted by the proposed project.

The range of the northern long-eared bat does include Canada north of the project area. However, northern long-eared bats are thought to be short-distance migrants. Short migratory movements between summer roost and winter hibernacula between 56 km (35 mi) and 89 km (55 mi) have been documented most often (Nagorsen and Brigham 1993 p. 88; Griffin 1945, p. 53). However, movements from hibernacula to summer colonies may range from 8 to 270 km (5 to 168 mi) (Griffin 1945, p. 22). Thus it is unlikely that northern long-eared bats would be migrating long distances across the open waters of Lake Erie (~50 miles of open water from the Cleveland shore to the Canada shore). Additional acoustic surveys proposed to occur offshore are currently being developed by the Service and LEEDCo and will help to evaluate potential risk to this species from offshore wind development.

Piping plovers, red knots, and Kirtland's warblers all migrate through Ohio but none are known to nest or overwinter here.

The Great Lakes population of piping plover nests primarily in Michigan and consists of approximately 63 pairs of birds. These birds overwinter primarily along the Atlantic coast, with some along the Gulf coast (USFWS 2009). While their migration paths are unknown, they have been documented to stop over on sand beaches along the shore of Lake Erie in Ohio. It is unknown if they migrate across the open waters of Lake Erie, or if their migration path would take them through the proposed project area.

Kirtland's warblers nest in young stands of Jack pines primarily in Central Michigan. Their current population is over 3,000 individuals (USFWS 2012a). They overwinter in the Bahamas. Individual birds have been banded during spring and fall migration, and geo-locators have indicated at least some of these birds are likely to have migrated across open waters of Lake Erie. Further, Kirtland's warblers have been documented to stop over all along the Lake Erie shoreline in Ohio (USFWS 2012a).

Red knots nest in the high arctic, and winter along both coasts of North America. While the vast majority of the red knot population migrates along the Atlantic and Pacific coastlines, occasionally small numbers of birds have been found in Ohio, typically along marshes in the western basin of Lake Erie. The proposed location for the facility does not have suitable habitat for these species. Most observations of these species in Ohio occur along the shoreline of the western basin of Lake Erie where there is more stopover habitat.

FISHERIES COMMENTS:

One of the responsibilities of the Service is to manage interjurisdictional fisheries, i.e., fisheries that are managed by more than one state or nation. The waters of Lake Erie are managed by four states (Michigan, Ohio, Pennsylvania, and New York), and Canada. A component of the pre-construction survey project developed jointly between ODNR and the Service were studies to assess the fisheries in the proposed project area and to evaluate potential risk to fish during construction and operation of the project, including the electrical lines. These studies are underway, but have yet to be completed. Until these studies are complete we are unable to evaluate the potential impacts of the project on interjurisdictional fisheries.

BAT COMMENTS:

Less than a decade ago the biggest threats to bat populations were loss of hibernacula and destruction of summer habitat. Since then the spread of white-nose syndrome (WNS), a novel fungal disease rapidly spreading across the Midwest, has caused the death of millions of cave hibernating bats (USFWS 2012b). As of September 2011, the 13,361 installed MW of wind energy in the Midwestern U.S. is anticipated to cause mortality of, on average, 106,000 bats per year (Arnett and Baerwald 2013). The majority of these are long-distance migrating tree bats. Populations of cave bats have declined so significantly, mostly attributed to WNS, that the Service has recently listed the northern long-eared bat as a threatened species. The Service is currently conducting status reviews for two additional species, the little brown bat (*Myotis lucifugus*) and tri-colored bat (*Perimyotis subflavus*) due to declines associated with WNS. Both of these species were documented in acoustic surveys conducted in 2010 (Svedlow et al. 2012).

LEEDCo's Bat Risk Assessment states that "relatively small numbers of migratory bats are likely to encounter the project." Long distance migrants including the eastern red (*Lasiurus borealis*), hoary (*Lasiurus cinereus*), and silver-haired (*Lasionycteris noctivagans*) bats are the species most susceptible to mortality at wind turbines (Arnett and Baerwald 2013). These species are known to cross large bodies of water and can be found far from shore (Pelletier et al. 2013). The results of the acoustic study (Svedlow et al. 2012) state that 4 bat passes/detector-night were recorded offshore at the Cleveland crib during acoustic surveys in 2009. Ninety five percent of the calls recorded were of the three bat species most susceptible to collisions with wind turbines (Svedlow et al. 2012, Arnett and Baerwald 2013). There are several factors that confound the results of acoustic surveys. Since all monitoring had to be conducted from the Cleveland Crib, acoustic monitoring sites were co-located with radar monitoring locations. Radar has been shown to reduce bat activity, potentially due to electromagnetic fields causing discomfort (Nicholls and Racey 2007). Large concentrations of insects were also observed swarming above the Cleveland Crib. Bats have been observed pausing during migration to take advantage of congregations of insects around offshore wind turbines (Ahlén et al. 2007, 2009). Thus the acoustic monitoring included a factor that may reduce bat activity, and one that may increase bat activity. It is unknown if either factor influenced the number of detections recorded at this site.

The results of the offshore acoustic monitoring conducted as part of LEEDCo's application showed higher numbers of bat calls than similar monitoring that has occurred at two existing wind facilities in Ohio. These two onshore wind projects, Timber Road and Blue Creek, recorded 2.78 and 1.31 passes/detector-night respectively. Both projects have resulted in higher than anticipated bat fatalities, based on post-construction monitoring conducted over three years of operation. Based upon this information it is unclear if the LEEDCo project will pose greater or lesser bat fatalities than onshore facilities.

The Service is working with LEEDCo to develop a new radar and acoustic monitoring protocol that will evaluate bat activity within the proposed project area. These studies are anticipated to be completed in 2017. Until these studies are complete, we are unable to evaluate the potential risk to bats from the proposed project.

To date the only mechanism known to reduce bat mortality at wind turbines is to curtail turbines during nights of low wind speed, which is the period when bats are most susceptible to being struck. Should this facility be constructed, the Service requests that at a minimum, turbines should be curtailed (the blades should be oriented such that they do not catch the wind) until the manufacturer's cut-in speed is reached. If, based on the results of the acoustic or radar study, bat mortality is anticipated to be high a higher cut-in speed may be warranted during periods of time when bats are most at risk.

POST-CONSTRUCTION MONITORING:

In order to assess the actual impact of the project in migratory birds, bats, fish, and the aquatic environment, post-construction monitoring is critical. Further, one of the purposes of a small-scale demonstration project is to assess the viability and potential impacts of the project. This project should have a valid post-construction monitoring plan that is approved by both the ODNR and Service. LEEDCo recently provided the Service with several potential methods for assessing impacts. These are currently being reviewed by the Service and ODNR.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMMENTS:

The National Environmental Policy Act (NEPA) requires federal agencies to incorporate environmental considerations in their planning and decision-making through a systematic interdisciplinary approach. An Environmental Impact Statement (EIS) is required for any project subject to Federal control and responsibility that significantly affects the quality of the human environment (42 U.S.C. § 4332(C); 43 C.F.R. § 46.100(a)). Conversely, if impacts are not anticipated to be significant, an Environmental Assessment (EA) may be completed. Currently the DOE proposes to complete an EA. According to the CEQ NEPA regulations, the following are some of the issues that should be considered when evaluating whether a project's effect on the environment is significant:

a) *The degree to which the effects on the quality of the human environment are likely to be highly controversial (40 C.F.R. § 1508.27(b)(4)).* There is significant public interest in wind power and potential impacts from wind power on wildlife (particularly birds and bats). The Service has been contacted by multiple non-government entities regarding wildlife concerns over small wind projects near Lake Erie recently; we were subject to a lawsuit over a wind project's impact on bats in central Ohio several years ago; and one conservation group sent a notice of intent to sue over the NEPA analysis for a single turbine project on federal land in northwest Ohio in 2014. Overall, we anticipate a high degree of interest in this project, and substantial concerns from groups associated with conservation of wildlife resources. Further, because the extent of impacts to wildlife is uncertain (see additional discussion below), we anticipate more controversy than for a project on land.

b) *The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks (40 C.F.R. § 1508.27(b)(5)).* This project presents unique risks to migratory bats and migratory birds including the bald eagle due to the proximity of the project area to significant migratory bird and bat habitat and concentration areas, specifically the offshore waters of Lake Erie. Because the turbines will be sited in an open water environment, conventional post-construction mortality monitoring to determine impact of the project and birds and bats will be impossible to implement. Thus, innovative new methods for monitoring bird and bat mortality in the offshore environment will have to be developed and implemented, and their effectiveness is unknown. Regardless, it will be difficult to monitor and quantify the impact of the project on birds and bats.

c) *The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration (40 C.F.R. § 1508.27(b)(6)).* This will be the first installation of wind turbines in a freshwater ecosystem anywhere in the world. It will be the first installation of offshore wind anywhere in the Great Lakes, and likely only the second offshore wind facility in the western hemisphere. The manner in which this project is evaluated and permitted will be a model for future similar projects. LEEDCo calls this a "demonstration" project and has indicated to audiences in prior years that the intent of the demonstration project is to show that freshwater offshore wind power in the Great Lakes is possible and to provide a roadmap for future development. Although the current project is described as a pilot project, LEEDCo indicated in a December 12, 2012, "Media Advisory Notice" that the ultimate intent is to expand from an initial 20-30 megawatt demonstration project to a 1,000 MW build-out by 2020. Thus, it is not unreasonable to expect that, if the demonstration project is found to be economically viable, it may likely be expanded to a much larger project, itself, as well as serve as a model for other full-scale projects elsewhere in the Great Lakes and other areas in the U.S. Given the precedent-setting nature of this demonstration project and potential influence on potential future off-shore wind project development, we believe an EA is inadequate to fully address the potentially significant, precedent setting aspects of this project.

We believe that the three factors above indicate that the project warrants an EIS-level analysis. We recommend that the DOE conduct an EIS to document the significance of the proposed project on fish and wildlife resources.

This letter provides technical assistance only and does not serve as a completed section 7 consultation document. If project plans change, if portions of the proposed project were not evaluated, or if additional information on listed or proposed species or their critical habitat becomes available, it is our recommendation that you reinitiate coordination with this office. We recommend that the project be coordinated with the Ohio Department of Natural Resources due to the potential for the project to affect state listed species and/or state lands. Contact John

Kessler, Environmental Services Administrator, at (614) 265-6621 or at john.kessler@dnr.state.oh.us.

If you have questions, or if we can be of further assistance in this matter, please contact our office at (614) 416-8993 or ohio@fws.gov.

Sincerely,

Dan Everson
Field Supervisor

cc: Scudder Mackey, ODNR (via e-mail)
Kate Parsons, ODNR (via e-mail)
Jeff Gosse, USFWS Region 3 (via e-mail)

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993 / FAX (614) 416-8994

March 24, 2014

Mr. Klaus Lambeck
Ohio Power Siting Board
180 East Broad Street
Columbus, OH 43215-3793

TAILS: 31420-2009-TA-0721

Re: Icebreaker Wind Facility, 13-2033-EL-BGN

Dear Mr. Lambeck:

This is in reference to the Lake Erie Energy Development Corporation's ("LEEDCo") application to the Ohio Power Siting Board for a Certificate of Environmental Compatibility and Public Need (Certificate) for the proposed Icebreaker Wind Facility. The proposed project involves the installation of up to six 3.0 MW wind turbine generators, underground collection cables, and connection to an existing substation. The total generating capacity of the facility will not exceed 18 MW.

The project is located approximately seven to nine miles off the coast of Cleveland in Lake Erie. Approximately 60.6 acres (10.5 ac of permanent disturbance) of lakebed will be disturbed and 11 miles of interconnection cable will be needed. This project plans to connect to an existing substation in Cleveland. The majority of this project will occur within Lake Erie with only the substation interconnection occurring on land; no impacts to wetlands or forested area are anticipated.

The U.S. Fish and Wildlife Service (Service) received your letter requesting our review of the application for the informational completeness on February 10, 2014, and we submit this letter in response. The following comments are being provided pursuant to the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; BGEPA), the Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA), the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, 87 Stat. 884; ESA), the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742 d-l; 70 Stat. 1119), as amended.

The Service, LEEDCo, their representatives, and the Ohio Department of Natural Resources (ODNR) have been involved in discussions regarding this proposed project since 2008. We have participated in meetings, and engaged in numerous conference calls and emails regarding this project.

Unlike onshore facilities, the Service currently does not have standardized pre-construction monitoring protocols to assess impacts of offshore wind facilities. The Service worked closely with the ODNR in developing a pre-construction monitoring protocol for this offshore wind energy facility which was the first of its kind for the region. LEEDCo conducted the following pre-construction wildlife surveys requested by ODNR and the Service: bat acoustic monitoring April 1 – November 10, 2010; and radar monitoring April 1-May 31 and August 15-October 13, 2010. Two additional surveys were conducted; these were not part of the studies recommended by ODNR and the Service (avian acoustic surveys, and boat based nocturnal surveys). Due to the potential impacts to fisheries ODNR and the Service requested several surveys to assess the importance of the area as a fishery. LEEDCo has yet to complete these studies.

GENERAL COMMENTS:

Currently there are no offshore wind facilities in North America, additionally there are very few (potentially only 1) wind facilities sited in a freshwater environment world-wide. The LEEDCo project has always been, and continues to be, proposed as a "demonstration project" or "pilot-project." Information gathered from this project will be used to assess the feasibility of developing commercial-scale wind facilities in Lake Erie, or the Great Lakes as a whole. As such, it is essential to have scalable pre- and post-construction studies to evaluate potential impacts to fish and wildlife Trust resources. Within the documents provided as part of the OPSB application LEEDCo provided results from portions of the recommended pre-construction monitoring (e.g., bird and bat monitoring), but portions of the recommended pre-construction monitoring were not conducted at all (fisheries monitoring), and no post-construction studies were proposed to assess potential impacts to birds, bats, and fisheries. Therefore, the Service finds that this application is incomplete. More specific comments on various issues of concern to the Service are presented below.

MIGRATORY BIRDS

Migratory birds are a Federal Trust resource entrusted to the Service by the MBTA. The proposed project location is between 7-9 miles off the coast of Cleveland, thus lacks habitat for many species of birds that breed in Ohio. The site is approximately 3.5 miles from an area designated by The Audubon Society as the Cleveland Lakefront Important Bird Area (IBA). This area was selected as an IBA due to the large concentrations of waterfowl and gulls that congregate there during spring and fall migration (also wintering waterfowl, gulls, and eagles) (Ritzenthaler 2008). The waters around Cleveland provide important overwintering habitat for gulls (herring, ring-billed, Bonaparte's, great black-backed, etc.), ducks (greater and lesser scaup, red-breasted and common mergansers, goldeneye, bufflehead, redhead, canvasback), common loons and horned grebes. During winter flocks of over 10,000 birds are not uncommon near Cleveland and the maximum daily counts for red-breasted merganser in some years has reached 250,000 (Ritzenthaler 2008). Additionally, several locations (Wendy Park, Edgewater Park, Cleveland Lakefront Preserve, etc.) along the lakeshore are known for their large concentrations

of passerines during migration. Within the Avian Risk assessment it contends that "the Icebreaker site does not appear to be on a heavily used migration path for waterfowl or seabirds." While large numbers of birds may not feed within the area, they are likely to cross through the area to reach their overwintering areas near shore and they do congregate in large numbers within just a few miles of the project. Due to the lack of offshore wind facilities in North America several LEEDCo documents cite the experiences of Europe to draw information. Yet several European countries have banned offshore facilities from within 12 miles of the shoreline (Rein et al. 2013), this may be in part due to the congregations of waterfowl found near shore.

Thus, the Service believes that waterfowl are at risk of mortality and possibly displacement from the Icebreaker project. LEEDCo should develop a Bird and Bat Conservation Strategy (BBCS) that outlines minimization measures, monitoring methods, and adaptive management that will be implemented to protect these species.

The boat landing that will be at the base of each turbine may attract species such as double-crested cormorants, herring and ring-billed gulls. Herring gull, lesser black-backed gull, great black-backed gull fly within the rotor swept zone between 30-35% of the time (Furness 2013). Also, during the pelagic bird surveys that were conducted by ODNR large numbers of ring-billed and herring gulls were observed feeding on the bi-catch of commercial fishing vessels. It is unclear whether commercial fishing vessels will be using this area, which could increase incidences of bird collisions by increasing the number of birds in the area. Thus, waterbirds are at risk from the project and LEEDCo should address these species in the BBCS.

LEEDCo's Environmental Assessment states that between 4-13% migrants fly within the height of modern wind turbine rotors, and that tens- to hundreds of millions of birds migrate over Lake Erie. Based upon these numbers it would mean that between 400,000-13,000,000 songbirds fly at rotorswept height when flying over Lake Erie. Within the "Final Avian Risk Assessment 2013" it states that "Fatality numbers and species impacted at the offshore site are likely to be similar, on a per turbine basis, to those found at projects that have been studied in eastern North America." Post-construction studies at onshore Canadian wind facilities average 8.2±1.4 birds per turbine (Zimmerling et al. 2013) and 6.86 birds per turbine for the United States (Loss et al. 2013). If waterfowl and waterbird mortality rates will be similar to those of European facilities, as suggested in the Avian Risk Assessment (see below), and if baseline songbird mortality rates will be similar to onshore facilities, it's likely that total bird mortality on a per turbine basis may be greater than at onshore facilities due to the increased abundance of waterfowl and waterbirds near the turbines.

Mortality estimates from European offshore wind facilities.

- 0.01-1.2 birds/turbine (Winkelman 1989, 1992a, 1992b, 1992c, 1995)*
- 6 birds/turbine (Painter et al. 1999)*
- 4-23 birds/turbine (Everaert et al. 2001)

* These numbers may not be corrected for searcher efficiency and carcass removal (Langston and Pullan 2003).

As part of the review of this project the Ohio Ecological Services Field Office sent the Spring – Fall 2010 Avian and Bat Studies Report Lake Erie Wind Power Study (TetraTech 2012) to a team of individuals in our Regional Office that conducts radar monitoring of birds and bats. This group provided 11 pages of comments and questions related to the radar report to LEEDCo on November 15, 2013 (attached). The Service has yet to receive a response to these questions. Without clarification on these questions the Service is unable to assess the results of the radar monitoring report and thus we believe that this application is incomplete.

BATS

Less than a decade ago the biggest threats to bat populations were loss of hiberacula and destruction of summering habitat. Since then, the expansion of the wind industry and the spread of white-nose syndrome (WNS), a novel fungal disease rapidly spreading across the Midwest, have caused the death of millions of bats (USFWS 2012; Arnett and Baerwald 2013). Populations of cave bats have declined so significantly, mostly attributed to WNS, that the Service has proposed listing the northern long-eared bat (*Myotis septentrionalis*) as a federally endangered species[1]. The Service is also currently conducting status reviews for two additional species, the little brown bat (*Myotis lucifugus*) and tri-colored bat (*Perimyotis subflavus*). Both of which were documented acoustically offshore at during the LEEDCo study.

While the offshore environment does not appear to provide habitat for tree-roosting bats, presence of habitat does not seem to be a good predictor of bat mortality at wind turbines during fall migration. Bat mortality at some wind facilities in agricultural landscapes in the Midwest has been occurring at rates as high as 49 bats per megawatt per year (Good et al. 2011), and when this mortality rate is applied across all operating wind facilities in the Midwest, it results in substantial total bat mortality. Research has indicated that bat mortality at operating turbines can be significantly reduced by feathering the turbine blades at low wind speeds.

LEEDCo's Bat Risk Assessment states that "relatively small numbers of migratory bats are likely to encounter the project." Long distance migrants such as eastern red (*Lasiurus borealis*), hoary (*Lasiurus cinereus*), and silver-haired (*Lasionycteris noctivagans*) bats are known to cross large bodies of water and can be found far from shore (Pelletier et al. 2013). The report states that 3.7 passes/detector-night were recorded at the offshore location and compares that to what was recorded onshore in Cleveland (38.0 passes/detector-night) to conclude that impacts to bats from the Icebreaker project would be less than a comparable on-shore project.

[1] The proposed listing of northern long-eared bat, which was proposed in October of 2013, was not included in either the Bat Risk Assessment or the Summary of Sensitive Species. See "Endangered Species Comments" below.

The offshore acoustic monitoring conducted as part of LEEDCo's application detected bat activity at higher rates than during pre-construction monitoring that has occurred at 2 land-based operating wind facilities in Ohio. Timber Road and Blue Creek wind facilities in Paulding County, recorded 2.78 and 1.31 passes/detector-night respectively. Based upon this information it is unclear as to whether this offshore wind facilities will pose less of a threat to bats than onshore facilities. Additionally, there are several factors that confound the results of acoustic surveys. Since all offshore acoustic monitoring had to be conducted from the Cleveland Crib, acoustic monitoring sites were co-located with radar monitoring locations. Radar has been shown to reduce bat activity, potentially due to electromagnetic fields causing discomfort (Nicholls and Racey 2007). Large concentrations of insects were also observed swarming above the Cleveland Crib. Bats have been observed pausing during migration to take advantage of congregations of insects around offshore wind turbines (Ahlén et al. 2007, 2009). Thus there is a factor that may reduce bat activity, and one that may increase bat activity, therefore it is unknown if either influenced the number of detections recorded at this site. Regardless, 95% of the calls recorded were of the three species most susceptible to collisions with wind turbines. To date the only mechanism known to reduce bat mortality at wind turbines is to curtail turbines during nights of low wind speed, which is the period when bats are most susceptible to being struck.

Thus, the Service believes that bats are at risk from the project and LEEDCo should address these species in the BBCS. Should this facility be constructed, the Service requests that a condition be included within the Certificate requiring the curtailment of turbines at least up until the manufacturer's cut-in speed is reached at night during the fall migratory period. This measure should not affect energy generation, but may measurably reduce bat mortality.

ENDANGERED SPECIES COMMENTS:

The proposed project is located in Cuyahoga County, in Ohio. There are five species of birds or bats that are federally endangered, threatened, proposed, or candidate species that may occur in Cuyahoga County: Indiana bat (*Myotis sodalis*) Endangered, northern long-eared bat Proposed Endangered, Kirtland's warbler (*Setophaga kirtlandii*) Endangered, piping plover (*Charadrius melodus*) Endangered, and red knot (*Calidris canutus rufa*) Proposed Threatened.

Cuyahoga County has confirmed records for Indiana and northern long-eared bats. While northern long-eared bats may be relatively scarce in Ontario, as mentioned in the Bat Risk Assessment, they are captured at ~47% of mist-net sites in Ohio and comprise ~12% of the bats captured. Both of these species may travel several hundred miles between their summering habitat and winter hibernacula (Griffin 1945, Winhold and Kurta 2006).

While Indiana bats have been documented to fly over Lake Erie (Niver 2013, personal communication), given that no maternity colonies are known to occur in Canada, and that the majority of their hibernacula are to the south of the project area, it is unlikely that Indiana bats will encounter the LEEDCo project. Northern long-eared bats are a forest dwelling species,

feeding on insects gleaned from vegetation or in mid-air (Lee and McCracken 2004). Though historically abundant, the northern long-eared bat has rarely been found during mortality surveys at onshore wind facilities. Since this facility is not located near any forested area and because northern long-eared bats seem to be less susceptible to collision mortality from wind turbines it is unlikely that northern long-eared bats will encounter the LEEDCo project.

Piping plovers, red knots, and Kirtland's warblers all migrate through Ohio. Only the piping plover has historically nested within the state. The Great Lakes population of piping plover nests primarily in Michigan and consists of approximately 63 pairs of birds. Kirtland's warblers nest in young stands of Jack pines primarily in Central Michigan. Their current population is over 3,000 individuals (USFWS 2012). Red knots nest in the high arctic, and winter along both coasts of North America. While the vast majority of the red knot population migrates along the coastline, occasionally small numbers of birds have been found in Ohio, typically along marshes in the western basin of Lake Erie. The proposed location for the facility does not have suitable habitat for these species. Most observations of these species occur in the western basin of Lake Erie, where there is more stopover habitat. Finally, given the scale of the project it is the Service's believe at this time that it is unlikely these species will encounter the LEEDCo project.

BALD EAGLE COMMENTS:

Bald eagles are protected under the MBTA and are afforded additional legal protection under the BGEPA. BGEPA prohibits, among other things, the killing and disturbance of eagles. Due to the proposed project location and the distance this facility is from the shoreline, the Service believes that take of eagles is unlikely during the breeding, egg laying and incubation, chick rearing, and fledging periods. However, bald eagles winter along the shoreline of Lake Erie and are regularly observed along the lakeshore in Cuyahoga County (avianknowledge.net). In winter when ice forms along the shoreline it may force wintering birds closer to the proposed facility. Within the last several years Lake Erie has almost completely frozen over. As the ice builds along the shoreline it forces ducks, gulls, etc. further into the lake. Eagles, which will feed on fish and waterfowl, will congregate along the leading edge of the ice, or near open leads in the ice. Should the ice extend far enough, as it did this past winter, it may put waterfowl and eagles in close proximity to the turbines. Thus, bald eagles may be at risk from the Icebreaker project. The Service recommends that LEEDCo develop a BBCS to address this issue. If take of eagles cannot be avoided LEEDCo should work with the Service's Division of Migratory Birds to obtain an eagle take permit.

Within in the "Summary of Sensitive Species" the Applicant states that "the nearest [bald eagle] nest is located is located near Sandusky (Peterjohn and Rice 1991)", this information is outdated. In the 23 years since the original Breeding Bird Atlas was conducted the bald eagle population has expanding significantly. Ohio now has over 200 nesting pairs of bald eagles; the nearest known nest to the proposed project area is located in Cuyahoga County, approximately 11 miles away.

FISHERIES:

One of the responsibilities of the Service is to manage interjurisdictional fisheries, i.e., fisheries that are managed by more than one state or nation. The waters of Lake Erie are managed by four states (Michigan, Ohio, Pennsylvania, and New York), and Canada. A component of the pre-construction survey project developed jointly between ODNR and the Service were studies to assess the fisheries in the proposed project area. These studies have yet to be completed, thus this application should be deemed incomplete.

COORDINATION WITH THE U.S. ARMY CORPS OF ENGINEERS:

This project will require a section 10 permit of the River and Harbors Act and authorization under section 401 of the Clean Water Act. Both are administered by the U.S. Army Corps (Corps) of Engineers (Buffalo District). The Service reviews permit applications under these laws and works with the Corps to address fish and wildlife impacts. The Service will consult with the Corps under Section 7 of the ESA, if necessary, and will provide additional comments to the Corps under the National Environmental Policy Act.

POST-CONSTRUCTION MONITORING:

One of the purposes of a small-scale demonstration project is to assess the viability and potential impacts of the project. As such, if constructed this project should have a valid post-construction monitoring plan that is approved by both the ODNR and Service. Any and all results of post-construction mortality studies must be provided to both ODNR and the USFWS. This should be included as a condition of their Certificate.

The Service appreciates the opportunity to comment on this application, and looks forward to continued collaboration on this project. If you have questions, or if we may be of further assistance in this matter, please contact Keith Lott at extension 31 in this office.

Sincerely,

Mary Knapp

Mary Knapp, Ph.D.
Field Supervisor

Cc: Ms. Jennifer Norris, ODNR, DOW, Columbus, OH
Mr. Nathan Reardon, ODNR, REALM, Columbus, OH
Mr. Joe Loucek, OEPA
Mr. Joe Krawczyk, USACE, Buffalo, NY

Attachment: "Review of: Spring-Fall 2010 Avian and Bat Studies Report lake Erie Wind Power Study (Prepared by TetraTech, A. Svedlow et al.) by USFWS Region 3 Radar Team."

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Review of:

Spring – Fall 2010
Avian and Bat Studies Report
Lake Erie Wind Power Study

(Prepared by TetraTech, A. Svedlow et al.)

by USFWS Region 3 Radar Team*

Thank you for the opportunity to review this report. We are aware of the challenges that the authors have faced related to the logistics of this type of study. We have experienced many of these types of challenges ourselves. We continue to gain experience with the Merlin Avian Radar systems. To date we have collected data over 3 spring and 3 fall migration seasons. Data has been collected on the shorelines of Lakes Michigan, Huron, Erie and Ontario. Therefore we have experience with migration patterns on both north-south and east-west shorelines. During this time we have, through trial and error, become quite experienced in the capabilities and limitations of these types of systems. Although we are currently using radar that has S-band capability for both the VSR and HSR antennas, we also have experience (spring 2011) with the unit that TetraTech was employing during this study.

Our primary concern is that this study is likely to be considered a precedent for studies for larger offshore wind farms. Because there is no currently effective methodology for post-construction mortality surveys of offshore wind turbines, pre-construction surveys/reports must be robust in their methods, analysis, and conclusions. Because of our experience with this type of radar system, we feel we can adequately justify our comments, concerns, and recommendations for this study. These are reported below.

***Contact: Jeff Gosse, jeff_gosse@fws.gov, telephone: 612-713-5138**

Methods

- We would like to see the clutter maps from each site for both the VSR and HSR antennas and a series of TrackPlots (hourly summaries of targets) for each site and antenna in order to ascertain the degree of interference related to weather, sidelobes, building interference on the crib, waves, insects, etc., that may influence target counts.
- How were times with "clear air" determined? (Pg 12 and 17). Review of visual radar data (Trackplots) for HSR and VSR separately (with lines connecting each plot) over 15 minute increments is how we filter out rain, and would also be appropriate for invertebrates.
- Page 7: VSR orientation directly E/W may have reduced the radar's ability to track targets moving directly north due to the number of consecutive hits needed on a target to record it in the database. Slightly offsetting the E/W azimuth could have increased target time in the radar beam and possibly reduce the number of missed targets.
- Pages 8-10: The report assumes little or no insect clutter, although it contradicts this assumption at other times, but results from the spring offshore data seem to suggest that insects were tracked with very high target counts and low mean flight heights. Please explain methods used for reducing insect clutter that were used.
- What was the VSR offset? It is reported as 750-1750m on Pg ii and 250-1250 on Pg 11.
- What were the true dates of the onshore portion of the study, March 31-April 20, or March 31-April 30? Pg 6 vs Pg 12.
- Page 7: What was the true number of days with useable data when offshore, 11 or 13?
- How were initial settings established and did the settings remained unchanged through the season? Were any settings changed between Spring 2010 onshore, offshore, and Fall 2010 offshore?
- Please separate the VSR and HSR radars when referring to hours the radar was collecting data (Pg 12 and 17). Were data from both radars removed if one had issues with "clear air", insects, or wave clutter?

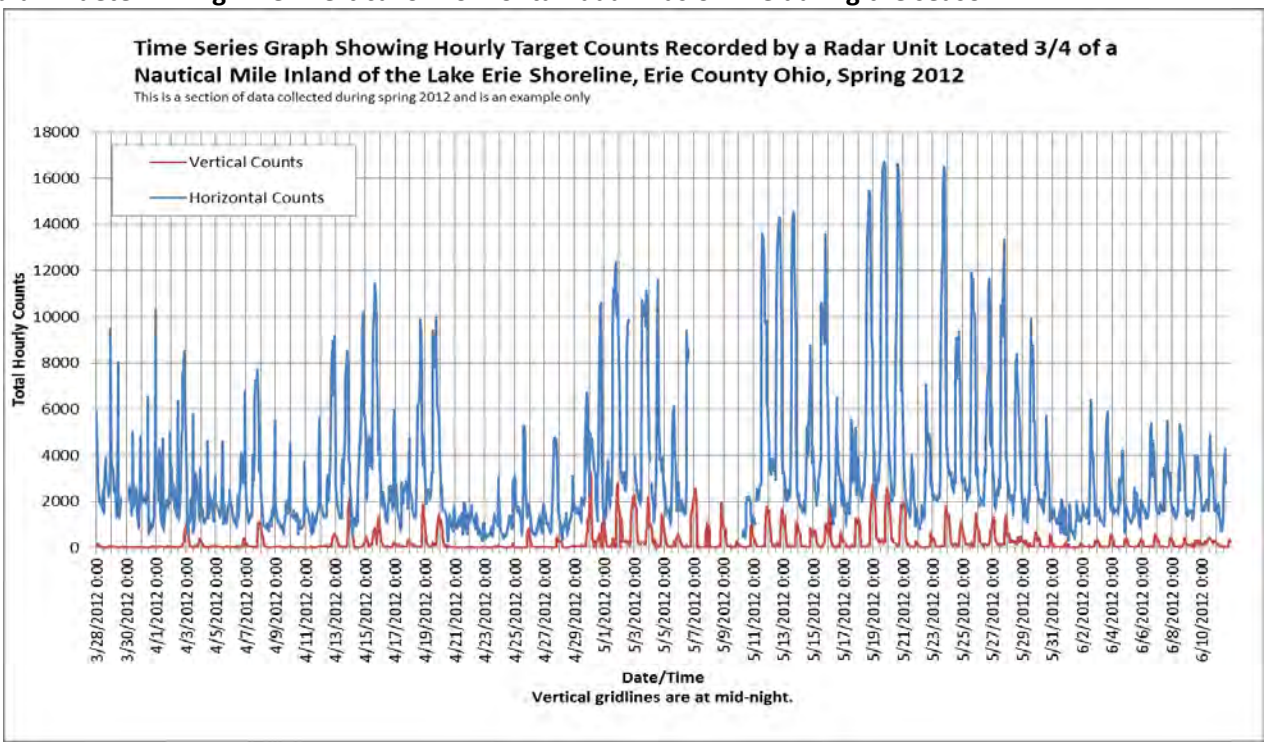
Analysis

- Survey effort (volume sampled) differed between areas below the RSZ, within the RSZ and above the RSZ. So reporting percentages below, within, and above are biased towards the area with higher effort (above the RSZ). Given the small amount of volume that occurs within and below the RSZ, a disproportionately large percentage of targets occurred within these high risk zones.

- Activity differs throughout the day and night and over the season, so reporting daily (24hr) or seasonal mean TPRs/heights/RSZ counts/percentages may mask times of higher risk (Pg 12-25).

- Timelines of radar data with VSR and HSR plotted hourly throughout the entire field season should be included in this report. This type of graph can help to distinguish between periods of migration and normal localized traffic. See example below.

Increases in vertical radar targets coincident with horizontal radar increases indicate migration, especially when the peak of activity is near midnight as illustrated below. Timelines can also be helpful in determining when vertical or horizontal radar was offline during the season.



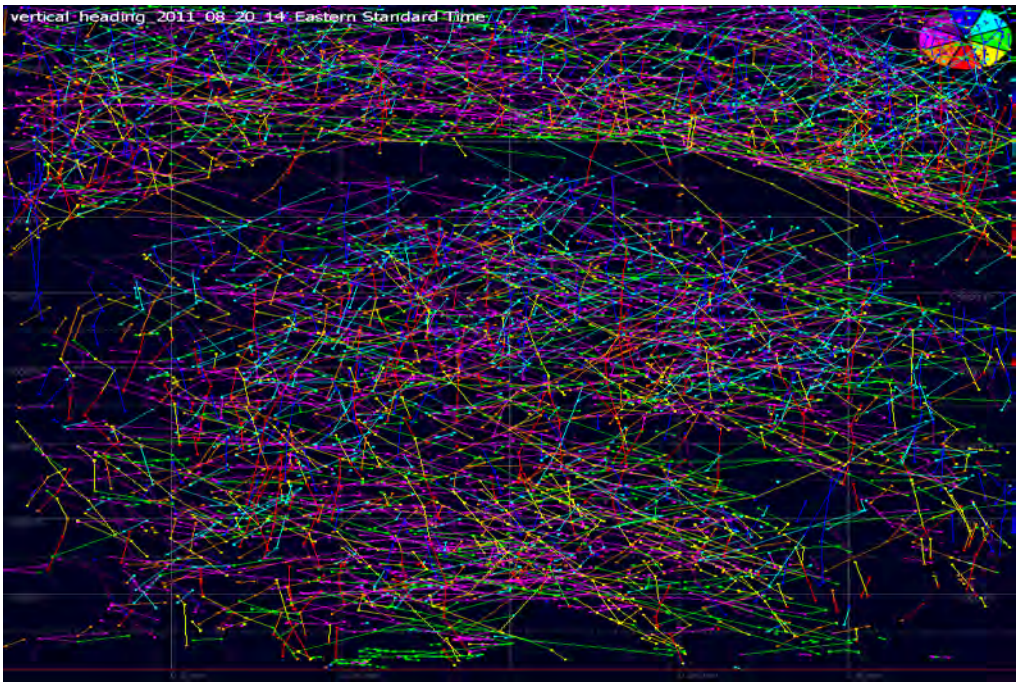
- Pp. 26 and 27, Figures 2.15, 2.16, and 2.17. Had the directional graphs been separated into four time periods (dawn, day, dusk, and night) we believe you would have seen more clearly what was occurring. Our data tends to show little directional movement during daylight (local movement), general north (spring) and south (fall) movement during night, and often a strong movement toward shore at dawn. By combining dawn and dusk with night, some of the nuances are lost and it is more difficult to understand what is occurring. The intermittent sampling may have also missed many of the strong migration pulses, also making the data more difficult to interpret.

- Caution should be used if using means as a metric for heights due to the potential for skewed distribution of targets. Medians, or preferably, 50m band graphs are much better at representing the data.
- Onshore data from the spring appears to only have captured 2 pulses of nocturnal migration in 11 nights of data collection (Pg 14). Mean TPR during this time would not reflect the migration pulses but be more reflective of the lulls in migration.
- Insect clutter can be reduced by manually editing it out. Cleaning the data this way may increase the number of hours of useable data and reveal times when vertebrates are feeding on insects and may be at risk.
- Below/in/above the RSZ are too broad of categories, as targets could be present just outside of the RSZ and be classified with targets much further away.
- Page 17: Times with high winds were excluded from the data analysis due to the resulting high amounts of wave clutter. Our data has shown that high winds can promote migration (depending on wind direction) and so migration pulses may have been thrown out.
- Your activity patterns were very unusual during the spring (Pg 13) when compared to the patterns we have seen with our radar data across the Great Lakes. The fall data matches more with what we would expect (Pg 21). Did the spring insect blooms and/or their potential to attract gulls and other birds have a large effect on the spring data?
- Page 9: Are rain tracks from virga events still included in the data? It is stated that these times are not thrown out. If the virga rain tracks are included that will bias the counts and height estimates; if they are removed then please state how they were identified and removed.
- Page 11: Why was 5.4m subtracted from the altitude measurements? We assume this is the height of the crib. If so, wouldn't the authors want to add 5.4m to each offshore target height? For example, if an offshore target is tracked at 20m, wouldn't the height actually be 25.4m? Adding or subtracting this value may move many targets from within the RSZ in the spring to above or below the RSZ.

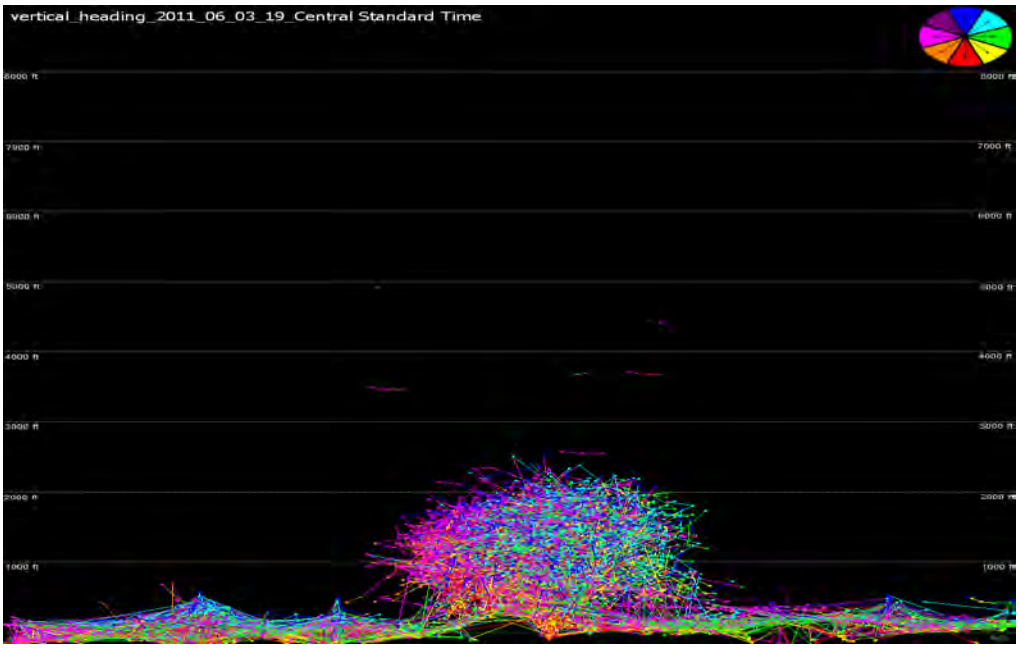
- Timelines of acoustic data, specifically bat passes, can also support driving factors of migration related to wind speed, precipitation, etc.

- Adequate pictorial examples of interference (waves, insects, rain) as well as high migration nights and observed phenomenon (e.g., reverse migration, directional patterns parallel to or going into shore) should be included in this report. Some examples are illustrated below:

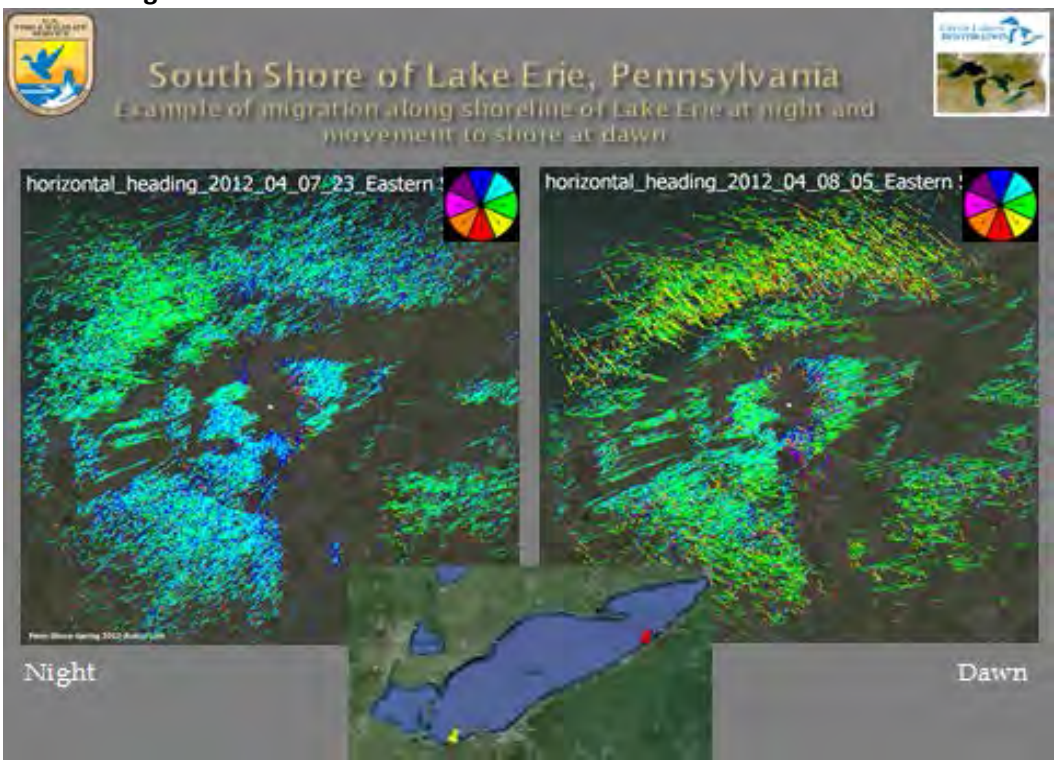
Rain Event on S-Band Vertical Radar. Note the random directionality of most plots. TrackPlots summarized at 15-minute intervals can easily be filtered out.



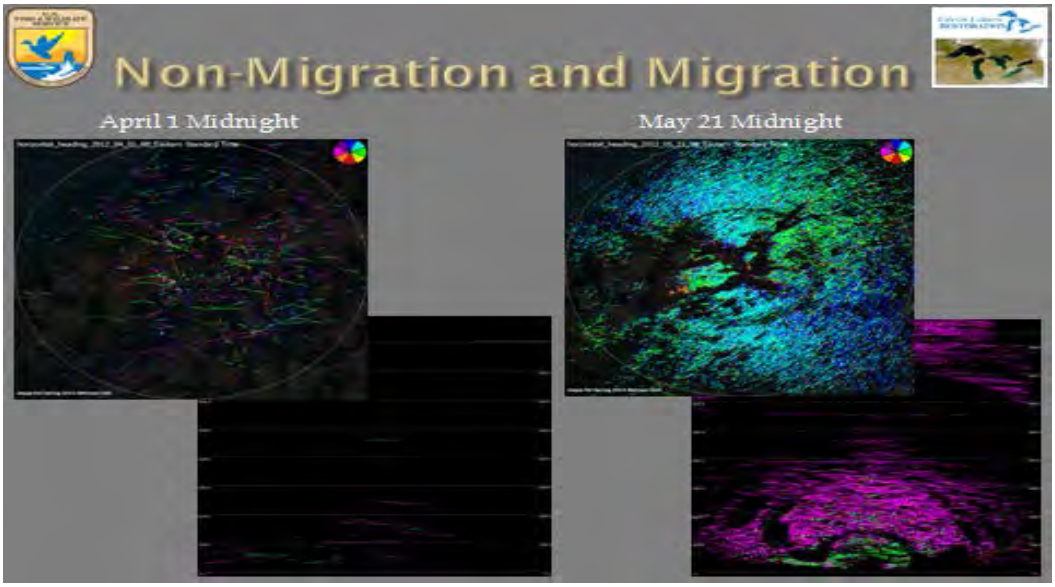
Insect Event on X-Band Vertical Radar. Episodes like this preclude any gathering of relevant data and must be filtered.



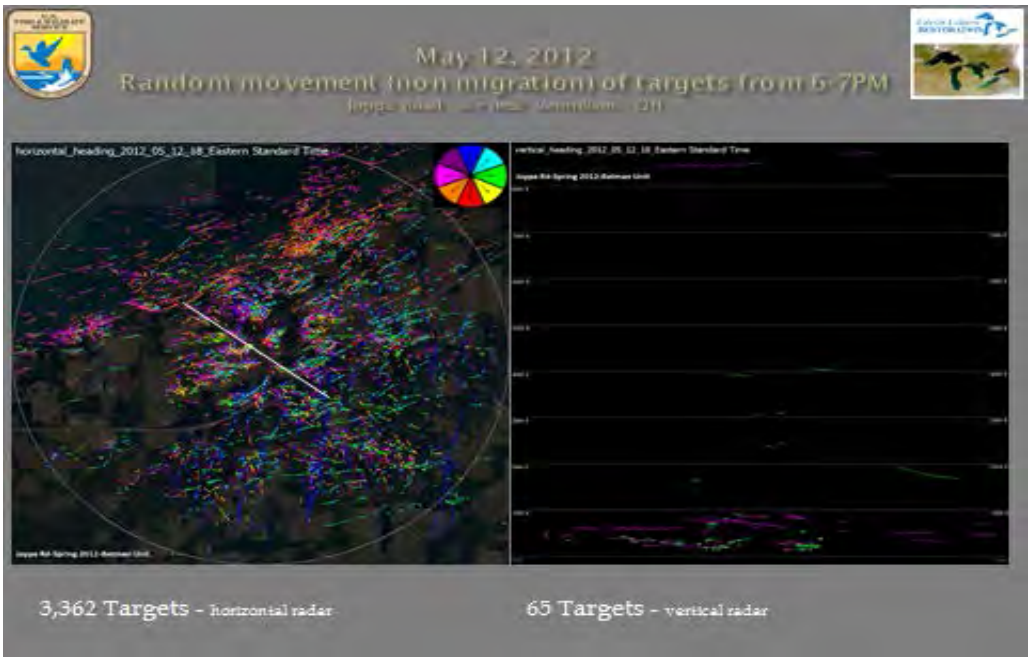
Migration along Lake Erie shoreline (left) and movement to shore at dawn (right). Compass rose color indicates direction of targets. Blue indicates north. In this example the green and light blue lines indicate northeast movement along the Lake Erie shoreline (left). The yellow/green lines indicate targets moving to the shoreline from open water (right) while onshore targets continue to move northeast at dawn.



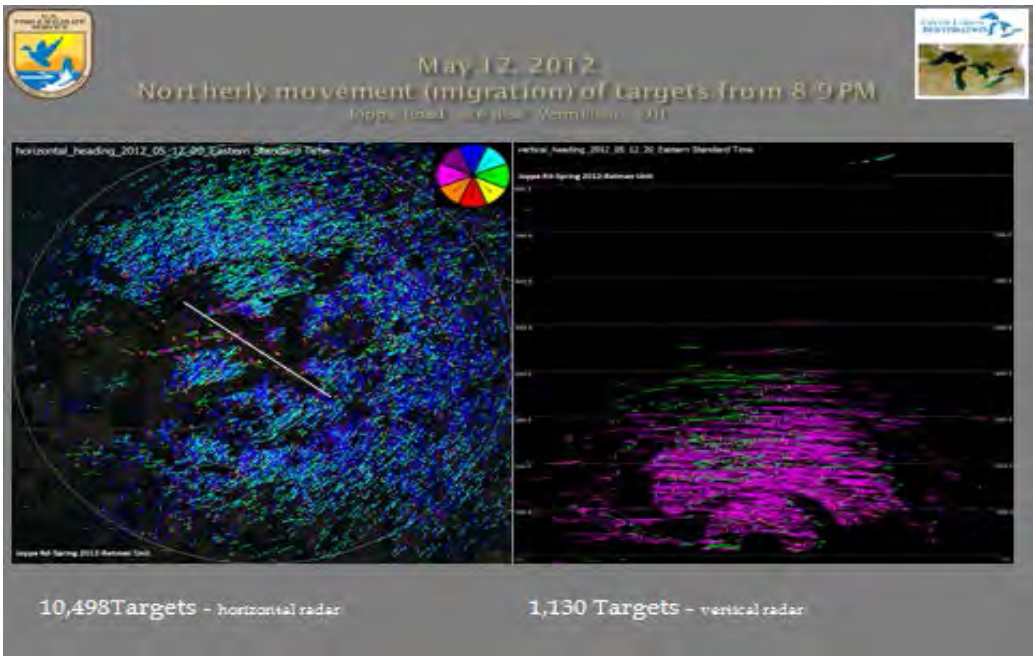
An example of target activity prior to and during spring migration. Horizontal scanning radar is at the top of the picture and vertical scanning radar is shown at the bottom of the picture. Although there is no indication of rain interference on April 1, strong winds in a direction not favorable to migration could also be responsible for low numbers of targets.



Random daytime (pre-sunset) movement of targets. Horizontal scanning radar on left shows random movements as portrayed by the various colored plots in relation to the compass rose. Blue indicates north direction. There is little high elevation target activity on the vertical scanning radar on the right.



Strong nighttime movement of targets. Horizontal scanning radar on left shows strong northern directionality of targets. The vertical scanning radar on left shows targets flying at higher elevations (up to 5,000') than the previous 6-7PM example.



Conclusions:

Given the complications the authors report for the radar portion of the study during the spring field season and the lack of timeline graphs, it is difficult to draw any conclusions regarding migration or potential risks to migrants from the proposed project. These complications include the loss of data at low elevation due to clutter during the onshore portion of the study, the mid-season shift to the offshore site, and the influence of insects and the Crib light source on TPR and height estimates. During both the spring and fall seasons there was substantial radar downtime that also complicates interpretation of the data. During the fall season, the data provided in the report seems to indicate that migration was occurring and, contrary to the author's conclusions, migrants were passing through the high risk zones (within and below the RSZ) at a high passage rate. Below are a few of the author's statements with our concerns bulleted:

Pg. 23: "*Pooled target counts from spring and fall within 50 m increments are presented in* ***Figure 2.12****. The vast majority of targets flew well below the RSZ, presumably near the surface of the lake*."

- There appears to be several problems with Figure 2.12. The figure is reported to depict the pooled targets for both spring and fall, yet a rough estimate of the total number of targets shown in the graphic is well below 2 million targets. According to appendix C.3 and C.5 there were nearly 7.5 million targets recorded during the spring and fall offshore portion of the study. The y-axis label indicates that the labels represent the "top of 50-meter increments" – so the 50-m band contains height values that range from 0.1 – 50 m. From our experience, this is consistent with how the DeTect SQL query bins height values. If true, then the most densely populated bin (the 50-m bin) includes heights that are within the RSZ and should be colored red. The y-axis extends up to 2800 m and then starts over at 1500 m. Reporting information in this manner is confusing and the spring and fall height profiles should be shown separately.

- Figure 2.7 and particularly Figure 2.12 indicates a very high number of targets occurring within or near the RSZ. This is without correcting for volume sampled and without knowing what the VSR clutter map looked like. These figures and the data they represent appear to disagree strongly with the text in the report.

Pg. 23: *"During periods of peak activity in spring most targets flew well below RSZ, . . ."*

Pg. 64-65: "*It is plausible that attraction to the rapidly flashing Crib lights could have attracted birds, bats, and insects, thereby causing higher than expected nighttime TPR recorded by the radar. Thus, higher than expected nighttime TPR could have been a result of lights attracting aerial vertebrates, as well as possibly insects, which can be seen with radar"*

- The light source was located at about 17 m above water level which coincides with the mean night flight height. Is seems that vertebrate and invertebrate targets that were

attracted to the light source also influenced the large number of targets recorded below the RSZ.

Pg. 28: "*However, it is evident from the fall TPRs that nocturnal migration was occurring, and at high rates, offshore, although most of these nocturnal migrants flew above the RSZ, as was evident from the mean altitudes that exceeded 300 m regularly during the night."*

- That mean altitudes exceeded 300 m regularly during the night does not indicate that most nocturnal targets flew above the RSZ (see comment above regarding Figures 2.7 and 2.12). Due to the distribution of migrant flight altitude the mean is a misleading indicator of central tendency. As a simple example, if the VSR counted 100 targets with 80 targets at 100m and 20 targets at 1000 m the mean height is at 280 m– so, while the mean might suggest that targets are at safe height, the reality is that 80% of the targets have passed through the RSZ.
- As well, reporting the TPR that is below, within, and above the RSZ is misleading in that the three categories do not represent the same sampling effort. Reporting the number of targets ***per altitude band*** that are below, within, and above the RSZ reduces the discrepancy in sampling effort among the three categories and is a more fair comparison. For example, Table 2.4 on pg 18 reports that at night during the fall season TPR below, within, and above the RSZ are 126.3, 638.5, and 929.3, respectively. The three categories contain 0.5, 3.5, and 52 altitude bands respectively (assuming they sampled to 2,800 m). Adjusting the TPR to account for this difference results in a TPR of 252.6, 182.4, and 17.9 respectively. (This method of stating TPRs would then be in closer agreement with what is observed in Figure 2.12.)

- Page 21: Are targets flying just below or above the RSZ really at little or no risk from turbines? Studies suggest that migrants adjust their flight height with different environmental conditions, so slight weather changes may cause high risk.
- Can valid conclusions be made from only ~250 hours of offshore radar data for each season when the migration season (Aug 1 – Nov 1) is 2208 hours long? This may cause pulses of high migrant activity to be missed and prevent analysis at the fine scale needed to observe patterns and asses times when migrants may be at risk. Did it really rain that much or was data removed for other reasons? The small proportion of useable data makes it difficult to adequately draw conclusions from this study. A breakdown of times due to equipment failure, weather, and other reasons for the reduced times of useable data would be helpful.
- Page 8: X band radar is much more affected by insects than S band and may not have led to accurate counts on the VSR and reduced the number of hours sampled with "clear air".
- An algorithm should be included to correct for the sample volume structure and density of targets (targets/1,000,000 m^3) per 50 m altitude band per hour of each biological period. Otherwise, RSZ numbers can be erroneously skewed and inaccurate.

- Our data suggests that there are correlations between weather and migrant activity for both acoustic monitors for bats and with the radar data. Sparse or intermittent data collection may be the reason that these correlations were not detected in the radar data for this project either due to pulses/favorable conditions being missed or sample size being too low.
- P19 and 20, Tables 2.9 and 2.10: Applying a straight regression line to TPR during the migration season seems meaningless. Migration builds and then decreases during the season and tends to look more like a bell curve than a straight regression.
- The report implies that most of the birds found offshore are gulls based upon visual observations. However such observations would not easily detect nocturnal passerines nor bats. Nocturnal directional movement would be indicative of migrants rather than gulls which are localized. A review of eBird data for Cuyahoga County indicates that many passerines such as warblers are observed during spring and fall migration periods indicating that they are passing through, either over the lake or along the shoreline.
- Currently in the literature, the use of cut-in speeds for the protection of bats seems to be the best proactive measure once turbines are in place. That, along with seasonal curtailment, could be used if it is determined that additional protection is needed once turbines are up and running. These will likely be included in a Section 7 consultation for the Indiana bat and northern long-eared bat if they occur in the development site.

Additional comments on other aspects of the study

<u>Bat Acoustics:</u>

- Page 63: The report mentions that the Crib lighting may attract bats/insects as a reason for high numbers of calls. Turbine lighting may play a similar role in attracting insects/bats. This relationship between offshore turbines and bats is discussed in the literature supporting the possibility of turbines attracting bats including suggestions that structures in large bodies of water generally attract emerging aquatic insects as well.
- Page 59: Even though activity offshore is less than activity onshore, the monitors still show there are bat species present offshore and they will be impacted by the turbines.
- Bat mortality caused by wind turbines is heaviest during fall migration. Since the acoustic monitoring portion failed to survey for bats in the fall season, this report falls short of adequately describing potential effects to bats by this project.
- Additional relevant information concerning bats and offshore behavior has been studied by Stantec Consulting Services Inc. The citation is: *Pelletier, S.K., K. Omland, K.S. Watrous, T.S. Peterson. 2013. Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities – Final Report. U.S. Dept of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2013-01163. 119 pp.*

Bird Acoustics:

- Without fall data, it is hard to make conclusions, especially since the radar data was so different between the seasons. (Pg 48)
- Boat surveys had few passerines (1) (Pg 33 and 36), but the acoustics said there were some detected (Pg 46).
- We use the same acoustic monitors and our maximum range is under 100m (not the 300m as reported on Pg 44).

Boat Based Surveys:

- This type of survey is biased due to human observers working from the surface of the water, timing of surveys (gulls/ducks/cormorants are more active at dawn/dusk to go between feeding grounds and passerines active at night when most difficult to detect), and infrequent schedule of surveys (once a week or so). This methodology also is biased due to the conditions surveys were performed in that may not have been optimal for migration.
- Data from the boat surveys for birds is used to claim that most/all activity seen on the radar in the area was gulls/cormorants/ducks. The methodology of the boat survey biased the counts towards large, low flying birds that are active around dawn and dusk as the detection at night of any birds is very difficult visually. The acoustic data shows that there were passerines flying over that the boat surveys missed, either due to the infrequent schedule that they were conducted on or due to the bias of the methods used. Fall acoustic data would have helped because the radar results were much more typical.

Comments from the November 12 Presentation

- Failed to address northern long-eared bat as a proposed species.
- Referred to 1 year of acoustic monitoring. It was actually one season.
- Would like to see the NEXRAD study, the distance between the radar site and the development site seems too close for optimum study.
- Focused primarily on avian fatalities. Most wind facilities have found higher bat than bird fatalities. This includes not only the Appalachian ridges but also multiple facilities in Wisconsin and at least one in northern Indiana.
- We question the appropriate use of the equation for predicting bird fatalities and also as referring to it as the Service's Model. The fact that it was utilized once by a Field Office does not make it the Service's.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993 / FAX (614) 416-8994

April 24, 2009

Mr. David Nash
McMahon DeGulis LLP
812 Huron Rd., Suite 650
Cleveland, OH 44115

Dear Mr. Nash:

This is in response to your recent e-mail regarding an Avian Distribution and Use Study for the proposed Great Lakes Wind Energy Center, Cleveland, Cuyahoga County, Ohio. Though many details have not yet been decided, it is likely that the project will include 3 or more turbines of undetermined size approximately 3 miles offshore of Cleveland, in Lake Erie. A Feasibility Study describing the project in depth is anticipated to be released publicly on April 30, 2009.

As you know, the U.S. Fish and Wildlife Service (Service) and Ohio Department of Natural Resources (ODNR) have been actively involved in working with wind power developers throughout the State of Ohio and the Great Lakes Region through venues such as the Ohio Wind Working Group and Great Lakes Wind Collaborative. Specifically regarding this project, the Service and ODNR have provided informal recommendations and suggestions at numerous meetings (most recently on March 27, 2009) and conference calls (most recently on April 13, 2009) over the past few years regarding fish and wildlife issues, lake habitat, and the permitting aspects of siting an offshore wind project in Lake Erie, one of Ohio's most significant natural resources.

As you are aware, offshore wind power development within the waters of the Great Lakes has not yet been developed, though several companies are considering it in both the U.S. and Canada. This project could very well be the first of its kind in the region, and as such could be precedent-setting in terms of providing pre-construction, construction, and operational standards for Great Lakes offshore wind. Similarly, because offshore wind power has not been accomplished in the Great Lakes, or even in North America, there are many issues that have yet to be addressed, and a pilot project would be a good opportunity to take a first look at such issues. As a self-proclaimed "pilot project," we have all agreed since the first inception that this project can and should serve as a model for other offshore projects, to show how to "do it the right way," and to make sure it is a "green energy" project in every sense of the phrase and not simply renewable energy. As such, we believe that we have been clear in our desire to work closely with the project proponents to avoid and minimize impacts on fish and wildlife and their habitat, and to monitor and respond to any impacts that may occur.

As discussed at the March 27, 2009 meeting, both the Service and ODNR believe it is necessary to take a comprehensive look at all the details of the proposed project, and to provide

recommendations on necessary surveys based on the development plan. At this time, we understand that a decision as to the number of turbines, their location, and their size has not yet been made. It will be difficult for us to fully evaluate the need for various surveys and methods without this critical information. Further, while we do believe that pre-construction bird surveys are a critical component of the wildlife surveys needed, fisheries, benthic, and bat studies will likely also be necessary. As mentioned at the meeting, based on the general project location, the project lies within a region designated as having "extensive" or "moderate-high" limiting factors based on ODNR's Wind Turbine Placement Favorability Analysis Map for offshore projects in Lake Erie (http://www.ohiodnr.com/LakeErie/WindEnergyRules/tabid/21234/Default.aspx). This indicates that multiple fish, wildlife, habitat, cultural, and/or historical issues exist in this region that must be addressed. In lieu of reviewing and recommending individual surveys at various times, we would prefer to recommend and comment on the suite of surveys necessary to fully evaluate the project at one time. Additionally, many of these surveys could be completed concurrently, possibly reducing total time and money spent on surveys for the project. For these reasons, we suggest a comprehensive look at all fish, wildlife and habitat issues, and a pre- and post-construction survey protocol that defines how each will be addressed, similar to how the Service and ODNR have been reviewing land-based wind power projects.

ODNR is in the process of developing a draft Lake Erie Open Water Sampling Protocol for Offshore Wind Power Siting. This document will include a broad suite of studies to address most natural resource issues associated with offshore wind power siting. For birds, this draft document recommends boat or aerial transects to identify waterfowl and waterbird use of the project site as well as avian and bat radar monitoring. Likewise, recommendations from the Service's Division of Migratory Birds also include both a transect and a radar component. The proposed Avian Distribution and Use Study lacks the radar study component. While we agree that this is a demonstration project and does not warrant the same level of study as a full-scale development, we believe that a radar component is required for the following reasons:

1) The Avian Risk Assessment Report and accompanying Analysis of WSR-88D Data to Assess Nocturnal Bird Migration Offshore of Cleveland, Ohio provided to our office for review several weeks ago contained a significant amount of useful information; however, the key limiting factors of this information and the inherent problems with using NEXRAD data for assessing the potential for avian impacts at wind power facilities are that the NEXRAD radar does not encompass the rotor-swept area, and that it is difficult to discern the vertical distribution of targets. Therefore, in order to assess nocturnal bird use and flight height within the project area, site-specific radar monitoring is necessary. Because this is a demonstration project, we would be willing to consider a modified scope of study versus what would be recommended for a full-scale offshore wind project. For example, we may use the NEXRAD analysis to identify peak migration times, and focus radar studies during those times.
2) There are real concerns that it will be difficult, if not impossible to accurately assess post-construction mortality at any offshore wind farm. Several methods have been tried in Europe, but so far they have been of limited scope and utility. In order for the State and Federal wildlife agencies to have a level of certainty that nocturnal migrating song birds will not be at significant risk from this proposed facility, we need site-specific information on the flight height and density of birds using the rotor-swept airspace.

3) Depending on the project area, impacts to bats may also be a concern. Bat activity within the project area could be assessed by radar coupled with acoustic monitoring and thermal imagery for validation purposes.

Another significant concern relative to the proposed Avian Distribution and Use Study is that the spring migration season, particularly for waterfowl, is already well underway. By the time that the study team is mobilized and the study, as proposed in the Avian Distribution and Use Study, begins, peak waterfowl migration will have passed. Based on recommendations from the Service's Division of Migratory Birds, the key times to monitor waterbirds and waterfowl in Lake Erie during spring is from the time that lake ice begins to thaw through May 10. Because there are potentially significant congregations of some waterfowl species within the project area during the migration season (for example, Lake Erie including the project area, supports continentally important populations of red-breasted merganser as documented within the Avian Risk Assessment Report, and by the Service's Division of Migratory Birds), we strongly believe that it is not appropriate to complete an abbreviated waterfowl survey in the spring. Instead, we recommend commencing the waterfowl and waterbird monitoring this fall, and continuing it into the spring of 2010 to obtain a solid understanding of bird use within the project area for the entirety of the migration season. Additionally, there is an option to combine the waterfowl surveys with ODNR's proposed aerial waterfowl surveys during fall of 2009 and spring of 2010, which will be funded by a Service grant, providing monetary savings to the project proponents.

While we understand that there is a desire to move this project forward quickly, based on the number of State and Federal permits that will be required to complete the project, including a Section 404 permit from the U.S. Army Corps of Engineers and accompanying NEPA review, a Section 401 permit from the Ohio Environmental Protection Agency, a Submerged Lands Lease and other permits from the Ohio Department of Natural Resources Coastal Management Program, and a Certificate of Environmental Compatibility and Public Need from the Ohio Power Siting Board, we believe there is ample time to complete these studies prior to when project construction begins. Again, as a first of its kind, we anticipate that the permitting process for this project will be comprehensive and will likely require a significant amount of time to complete. Wildlife (avian and bat), fish and habitat studies could be conducted concurrently with preparing and submitting project applications to State and Federal agencies for review and public notice. Failure to conduct comprehensive studies for this project will prolong the lack of information regarding potential impacts to wildlife. This will make developing a full-scale project more difficult and defeat the purpose of developing a pilot project.

In summary, the Service believes this project is a unique opportunity to take a close look at how fish, wildlife, and Great Lakes habitat may be impacted by a pilot wind power development. The pre-and post-construction monitoring that is designed for this project will likely serve as a model for future offshore wind power projects in the Great Lakes. In lieu of taking a piecemeal or rushed approach to recommending surveys for various fish, wildlife and habitat impacts, we recommend looking comprehensively at all environmental aspects of the project, and recommending both pre- and post-construction survey protocols that will address all concerns in a timely, efficient, and cost-effective manner. This is how we typically review on-shore wind power developments. We believe that the current Avian Distribution and Use Study is too limited in scope to provide the necessary information to appropriately evaluate this project. Additionally, we do not have all the project information necessary to recommend the most

effective survey protocol for fish, wildlife, and habitat. Finally, due to the numerous State and Federal permits required for this project, we do not believe that conducting a full fall/winter/spring bird use study focusing on key migration times would delay implementation of the project. In fact, the information that the Service is requesting will be critical in completing any NEPA document required for the Section 404 permit. Until a full project scope is ready, we are not in a position to recommend a full suite of fish, wildlife, and habitat pre- and post-construction studies; however, we are committed to making these recommendations in a timely manner when complete project information is available.

Thank you for the opportunity to review this proposal. We look forward to working with you and your partners to develop a fish, wildlife, and habitat survey protocol that suits the informational needs of the permitting agencies and balances those needs with the nature of a demonstration-scale project. If you have questions or would like to discuss this further, please contact Megan Seymour at extension 16 in this office.

Sincerely,

Mary Knapp

Mary Knapp, Ph.D.
Supervisor

cc: Keith Lott, ODNR, 2514 Cleveland Road East, Huron, OH 44839
Stuart Siegfried, PUCO, 180 E. Broad St., Columbus, OH 43215
Dave Leput, Buffalo District Corps of Engineers, Buffalo, NY
John Watkins, ODNR, Office of Coastal Management, Sandusky, OH

Attachment 2

U.S. Fish and Wildlife Service Avian Radar
Preliminary Data from Cleveland, Ohio, Early Fall 2017
October 2, 2017

Attachment 2 contains preliminary data from the U.S. Fish and Wildlife Service's (Service) avian radar unit located on the shore of Lake Erie in Cleveland, Ohio during fall 2017. The radar unit is actively collecting bird and bat fall migration data that may inform the analysis in the LEEDCo Project Icebreaker Draft EA.

Summary of Migration Timing, Direction, and Altitude

Below are visual summaries of the data analyzed to date (August 3 – September 5), showing the pulsed nature of migration using an hourly time series, a set of graphs showing the main direction of migrants in the four major biological periods (dawn, day, dusk, night), and graphs showing the volume-corrected density of migrants by altitude. These graphs should be taken as preliminary, as a large portion of the migratory season has not yet occurred and full analysis has not been completed. In addition, these data are being collected on the coastline, out of range of the project area. However, these findings do show a substantial amount of migratory activity, occurring in part from lake crossing movements, with substantial migrant traffic within or near the rotor-swept zone.

While data collection is ongoing, the data presented in this attachment are only from the first part of the fall 2017 migration season, when migration activity was only underway for about 2 weeks (Figures 1 and 2). This is the only data that was available for analysis at this point in time, however as the season progresses additional information will be obtained and analyzed. From our other radar survey locations across the Great Lakes, we observe that fall migration generally peaks around mid to late September (Horton et al. 2016, Rathbun et al. 2016). However, from August 3 – September 5 on the Cleveland shore we recorded large numbers of migrants moving towards shore, presumably crossing Lake Erie. The conservative estimate from the vertical scanning radar (VSR) indicates that even during this early migration period, 2,000-2,500 targets per kilometer per hour were moving through the area during the night. Depending on the night, many of these targets were moving in from over the water (Figure 3 and Attachment 2a). While our site is on shore, these targets had high densities within or just above the proposed rotor-swept zone.

Our radar units can record data out to 2 nautical miles (nm) from the unit, which is located on the shoreline of Lake Erie. Thus, we are able to see approximately 2 miles out across the lake. Within this offshore area, we see targets arriving from further out in the lake (Attachment 2a) and often continuing straight in towards land. We see no reason to believe that these migrants would have changed their path just before our radar unit observed them, leading us to believe that the targets have crossed over Lake Erie.

At the Cleveland site the data collected to date also show high migrant use along the shoreline of Lake Erie. However, this does not mean that there is no or low activity over the open water. Our radar units often recorded targets flying in from over the open water, and potentially landing in the near-shore area at dawn. These targets that arrive from over the lake are part of the reason that we find a concentration of migrants in the shoreline area.

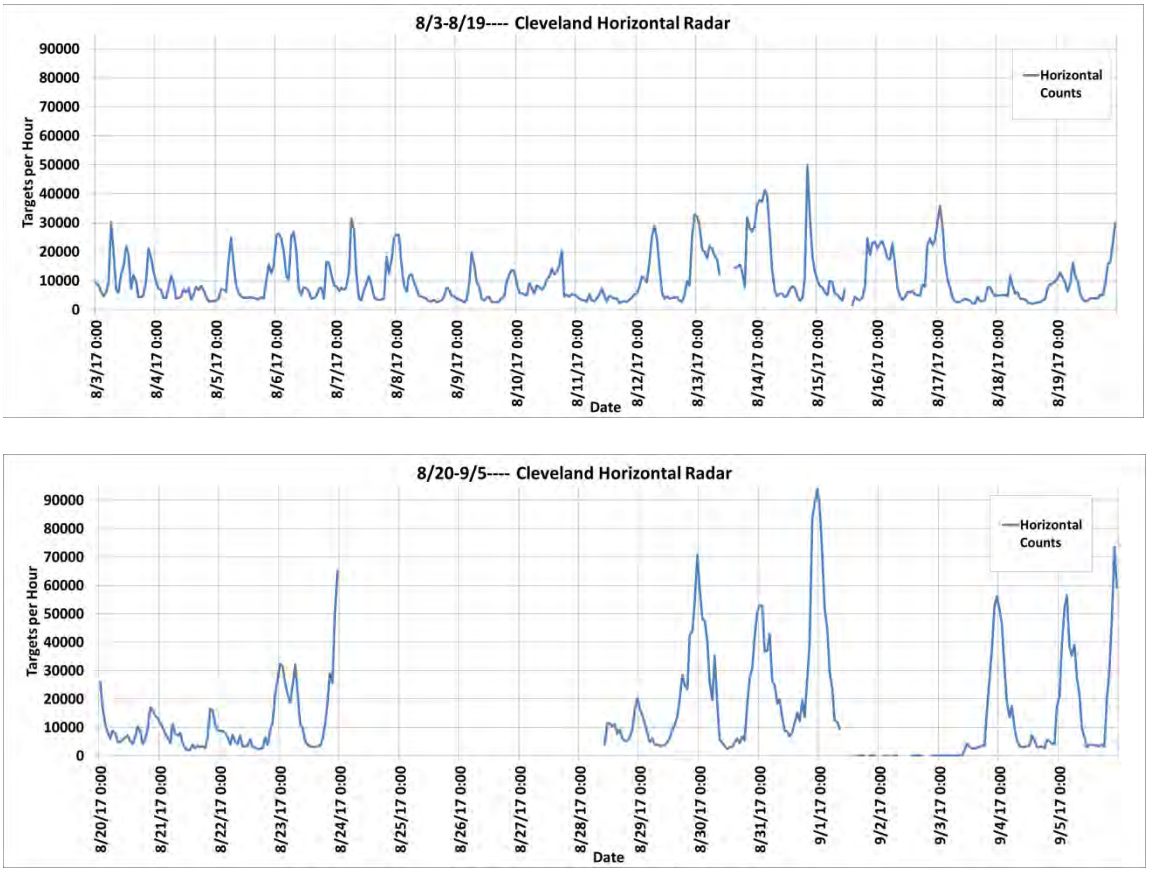


Figure 1. The above figure shows an hourly time series of radar targets on the Horizontal Scanning Radar (HSR) in Cleveland from August 3 to midnight September 6, 2017, with midnight centered on the vertical gray lines of the graph. Note the different scales between the Horizontal Scanning Radar (Figure 1) and Vertical Scanning Radar (VSR, Figure 2). The HSR covers a wider geographic area, but is sensitive to counting the same individual target multiple times or having area blocked by obstacles on the landscape. The VSR, while covering a smaller area, is less likely to have issues with multiple-counting or blockage, and provides a more conservative estimate. Spikes in targets per hour centered around midnight are indicative of migration events. Apparent migration events are indicated on August 13-17, 20, 23-24, August 30-September1 and September 4-6. The HSR was not operational from approximately 1:00 am August 25 until mid-day August 29 and again on mid-day September 2-4. The pulsed nature of these migration events necessitates continuous sampling. Gaps in the data represent time periods when the radar was down due to malfunction or time periods where large amounts of rain or other clutter occurred.

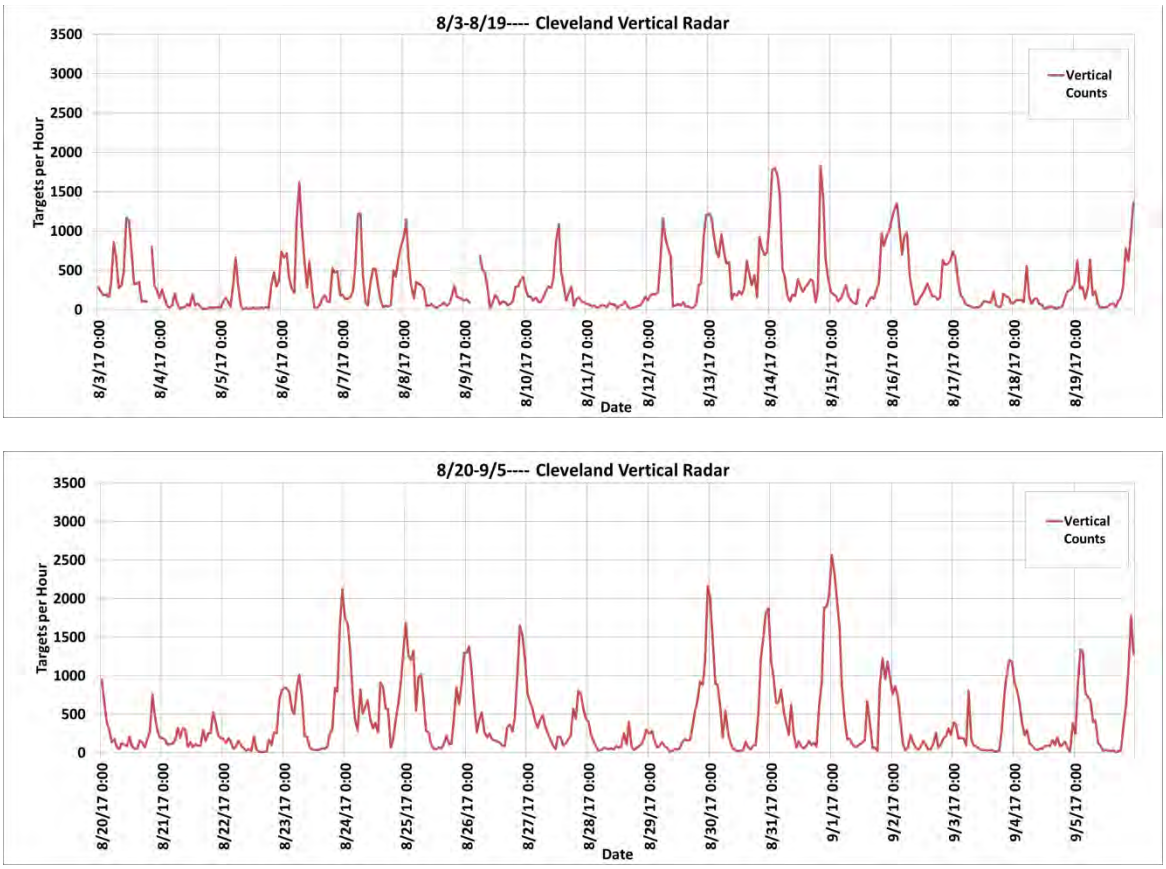


Figure 2. The above figure shows an hourly time series of radar targets on the Vertical Scanning Radar (VSR) in Cleveland from August 3 to midnight, September 6, 2017, with midnight centered on the vertical gray lines of the graph. Note the different scales between Horizontal Scanning Radar (HSR, Figure 1) and Vertical Scanning Radar (VSR). The HSR covers a wider geographic area, but is sensitive to counting the same individual target multiple times. The VSR, while covering a smaller area, is less likely to have issues with multiple-counting, and provides a more conservative estimate. Apparent migration events (indicated by increased targets centered around midnight) are indicated on August 8, August 13-17, August 23-27, August 30-September 2, and September4-6. High numbers of targets centered around midnight indicate nocturnal migration events. Gaps in the data represent time periods when the radar was down due to malfunction or time periods where large amounts of rain or other clutter occurred.

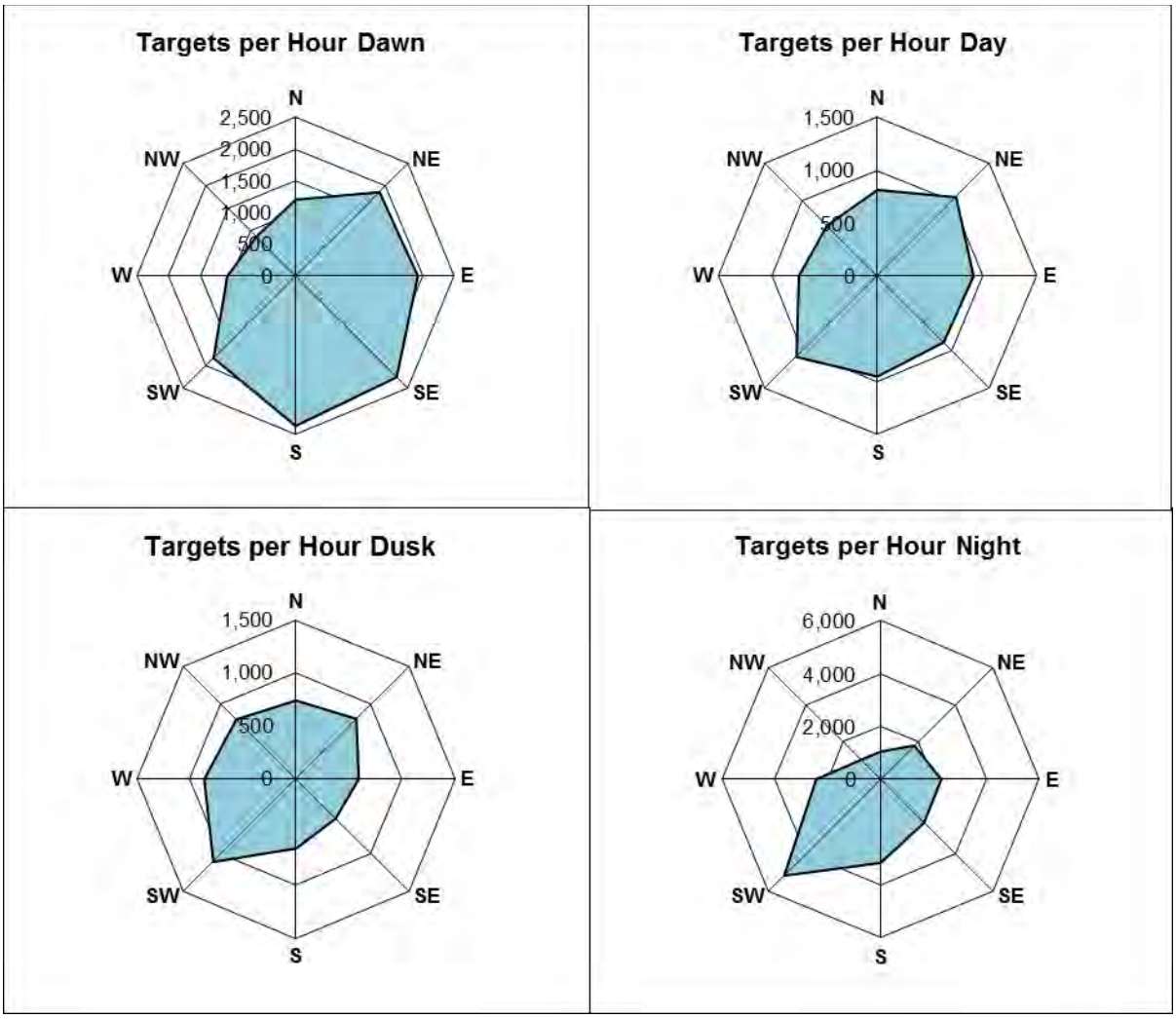


Figure 3. Rose graphs showing the flight direction of migrants during each biological period (dawn, day, dusk, and night) during early fall migration in Cleveland, Ohio. Note the different scales on the four graphs. Night movement shows a strong southwest direction, as well as a substantial southerly component. At dawn, directionality is consistent with migrants over water reorienting towards shore. As the data still constitutes early season movements, we expect there to be more migration nights added to the dataset and these directions may shift as the season goes on.

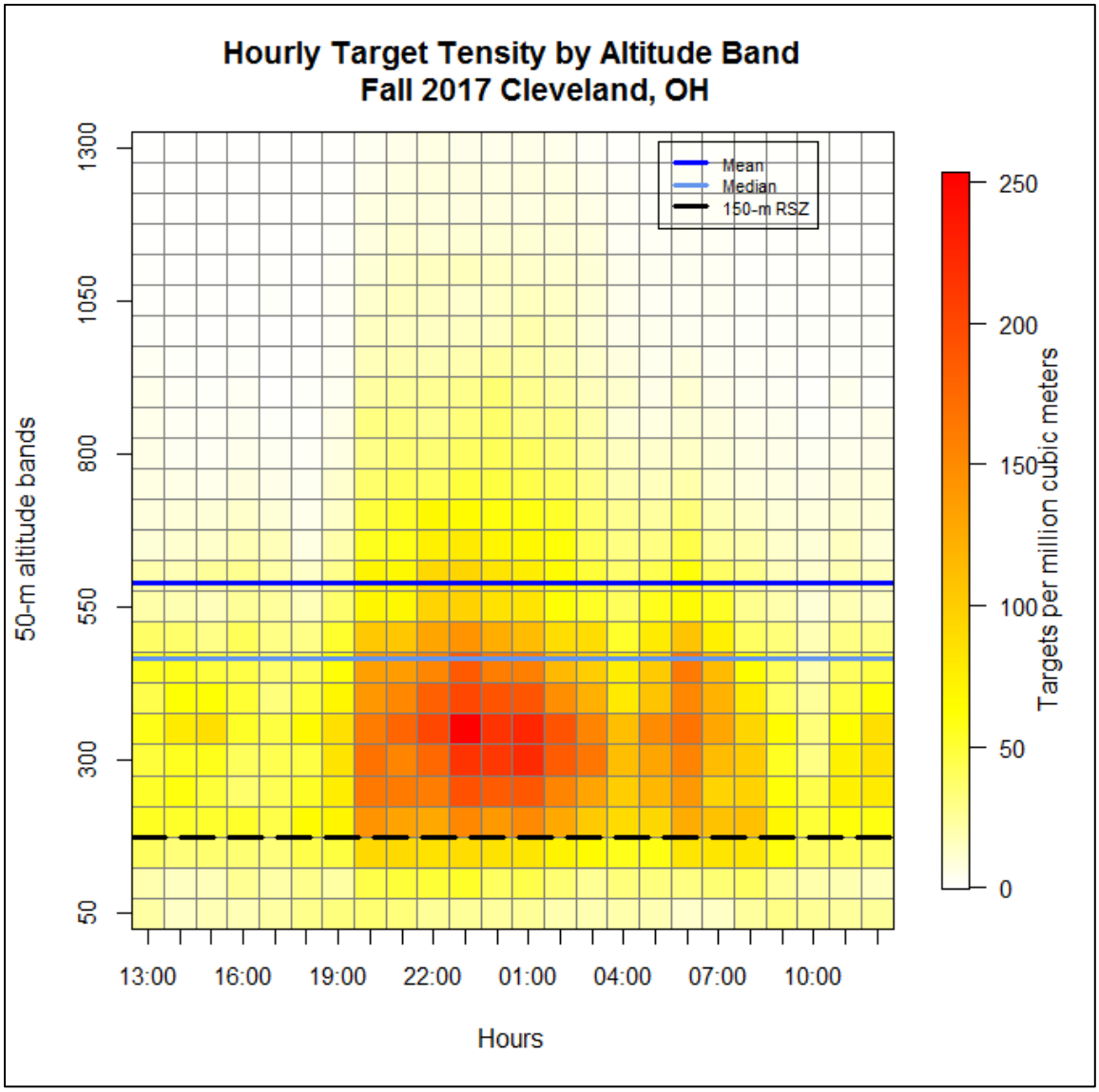


Figure 4: Heat map of target density by altitude and hour for early fall migration in Cleveland, Ohio. Hour is on the x-axis, centered on midnight (0:00), while altitude is on the y-axis, in 50-meter (m) bins. The label for each bin represents the top of that bin, so the 50 m bin is from 0-50 m. The radar data is truncated at 1300 m altitude for clarity, and target density is relatively low at altitudes of 1300-2800 m. Warmer colors indicate higher target density. Mean and median nocturnal flight altitudes are indicated by the dark and light blue lines, respectively. Note that these measures are affected by the upward-skewed distribution of targets, and both lie above the altitudes of maximum density. A rotor-swept zone of 150 meters is indicated by the dashed black line. These data provide a more precise view of migratory activity than the NEXRAD data presented in the EA, since 1) individual targets are tracked rather than reflection densities, and 2) 50 m bins are used rather than 300 m bins. Note also that the highest density is relatively close to the rotors-swept zone, and atmospheric conditions can raise or lower the center of density. In addition, due to clutter issues at our site and narrower beam width at low altitudes, we are likely underestimating the density of migrants at altitudes below 150m.

TrackPlots

Below are a series of 15 minute TrackPlots for the horizontal scanning radar (HSR) that is automatically generated by the radar software. These data have not undergone final editing and they may contain minor errors. Each line represents either a single flying bird, bat, or tight flock of these animals (target) detected by the radar unit over a 15 minute period. The images have been selected to demonstrate migrants engaged in overwater flight during moderate to high periods of migration.

The tracks overlay a satellite photo that accurately shows the location for this portion of Cleveland and Lake Erie with north corresponding to up in the image. The shoreline is shown as a white line overlaying the tracks and the radar location is depicted as a white dot near the center of the image. The color of the track identifies the direction of travel for each target as does the orientation of the line. The color wheel in the upper right of each image decodes the direction of travel with red being south; blue, north; green, east; and violet, west. Collectively, the images demonstrate large numbers of migrants approaching the shoreline from open water that most likely crossed the lake from the north shore. Date and time are embedded in the graphic in the top left corner starting with year, month, date, and beginning time of the recording in military time. The fourteen images below capture migration events with large or predominant lake-crossing components during 12 separate nights (August12-September 17), approximately 1/3 of nights in this timeframe. The image below was recorded on August 12, 2017 starting at 5:15 am (and extending through 5:30 am), Eastern Standard Time.

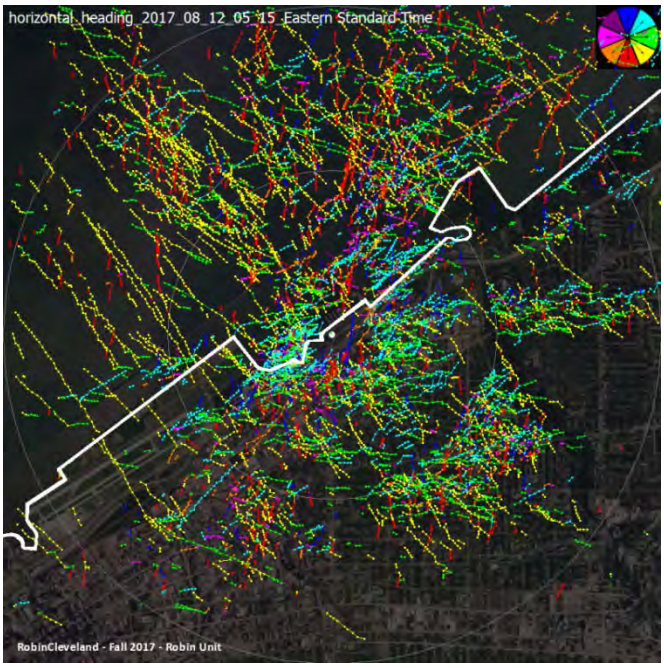


Figure 5. Moderate migration from offshore. Migration typically is decreasing at this time due to the approach of dawn.

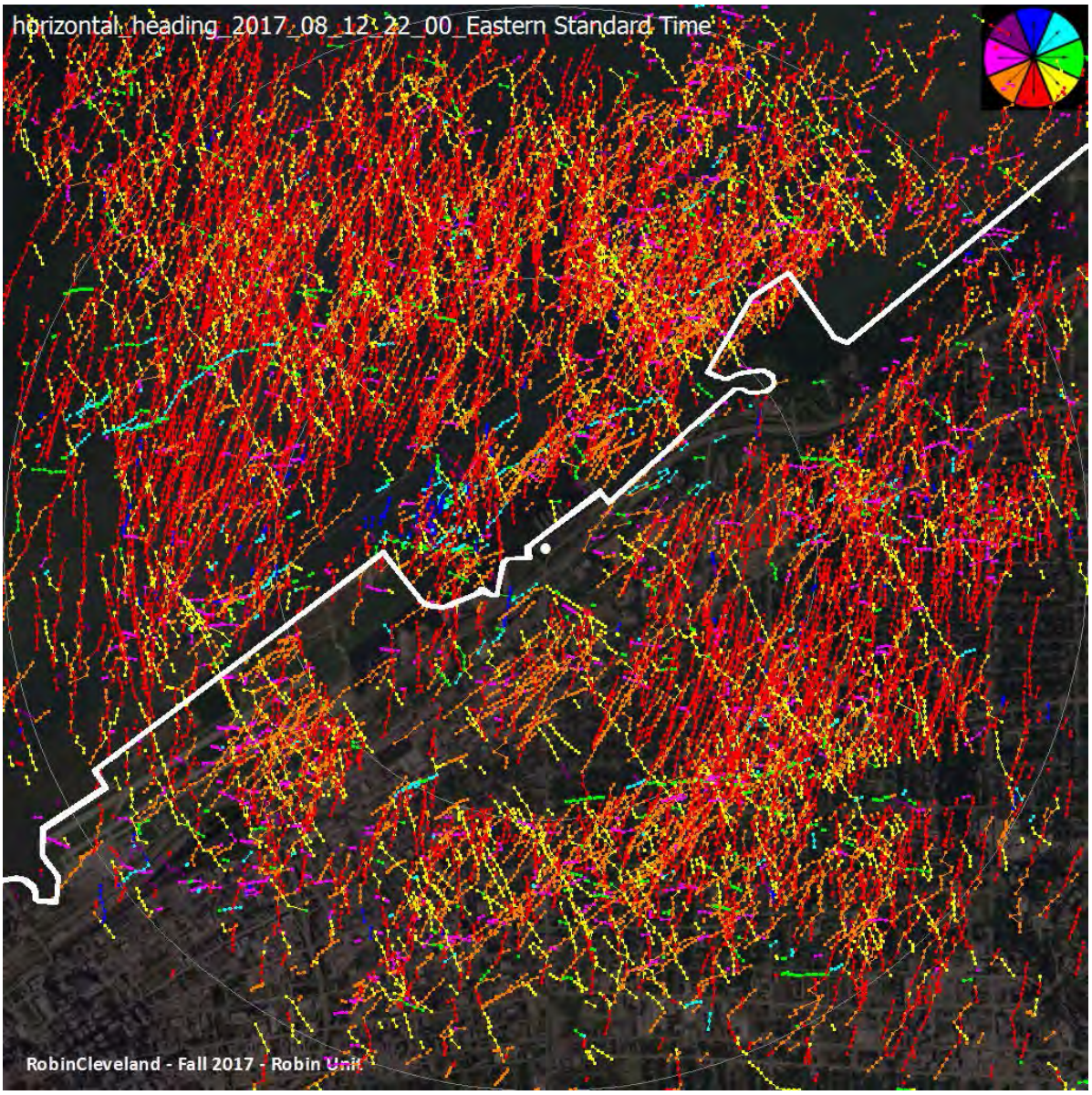


Figure 6. This graph depicts moderate migration coming from off-shore and moving to the south and south-southwest. Migration typically peaks within several hours of midnight, building from just after dusk and tapering off as dawn approaches.

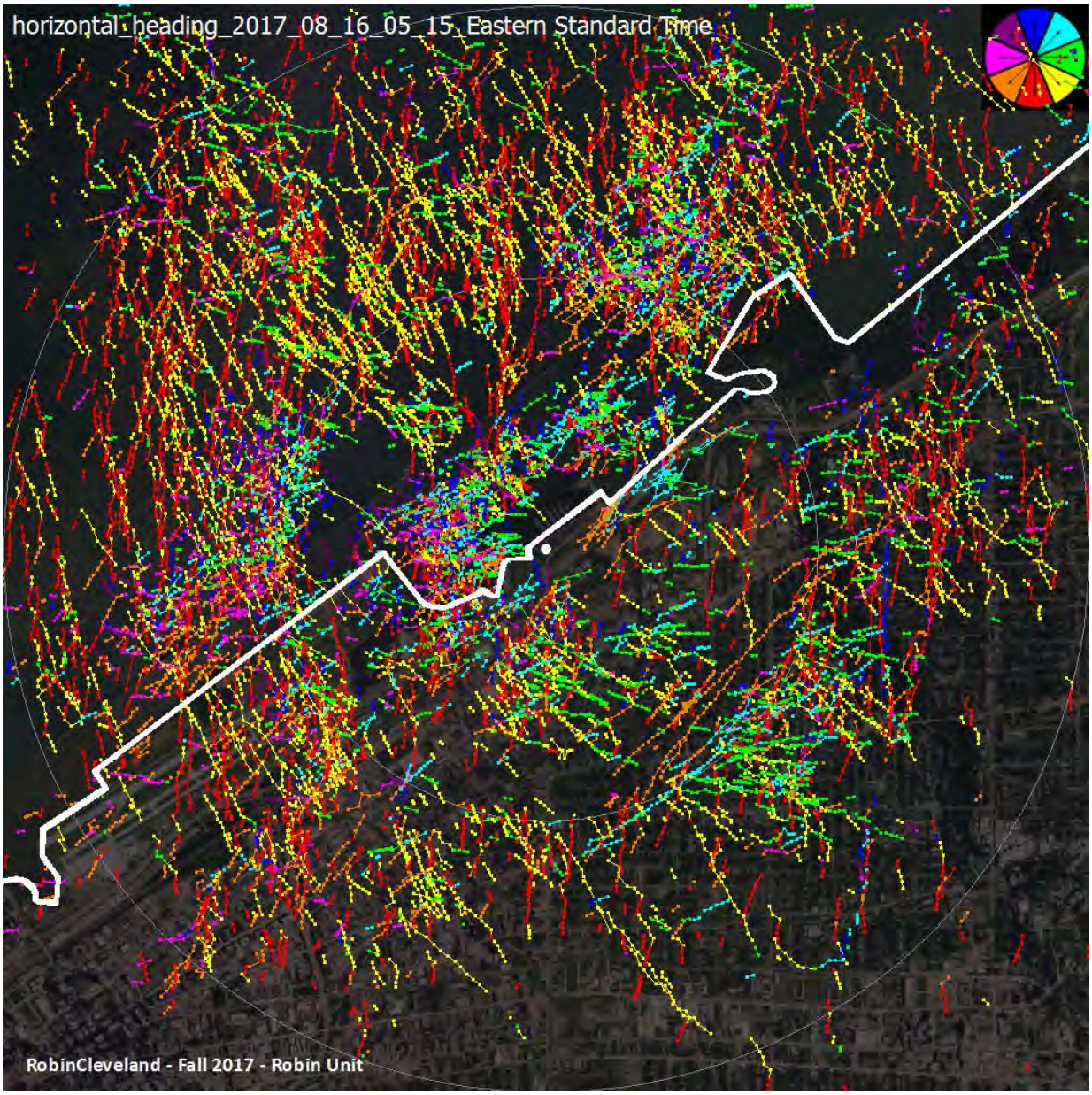


Figure 7. This graph depicts another example of moderate migration. Targets are flying towards shore before dawn.

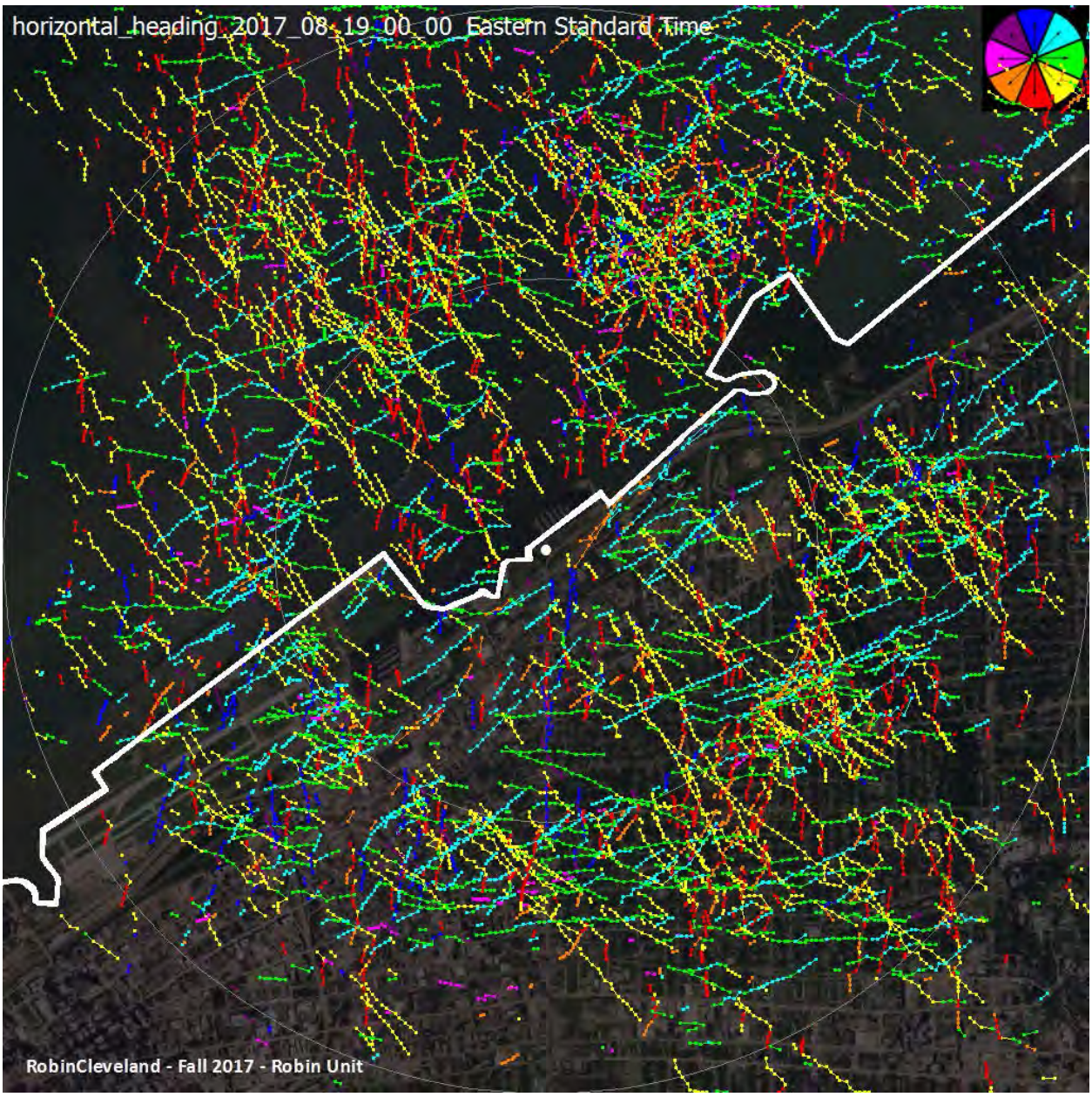


Figure 8. Light to moderate migration across Lake Erie, moving to the southeast and south, as well as parallel to shore to the northeast at midnight.

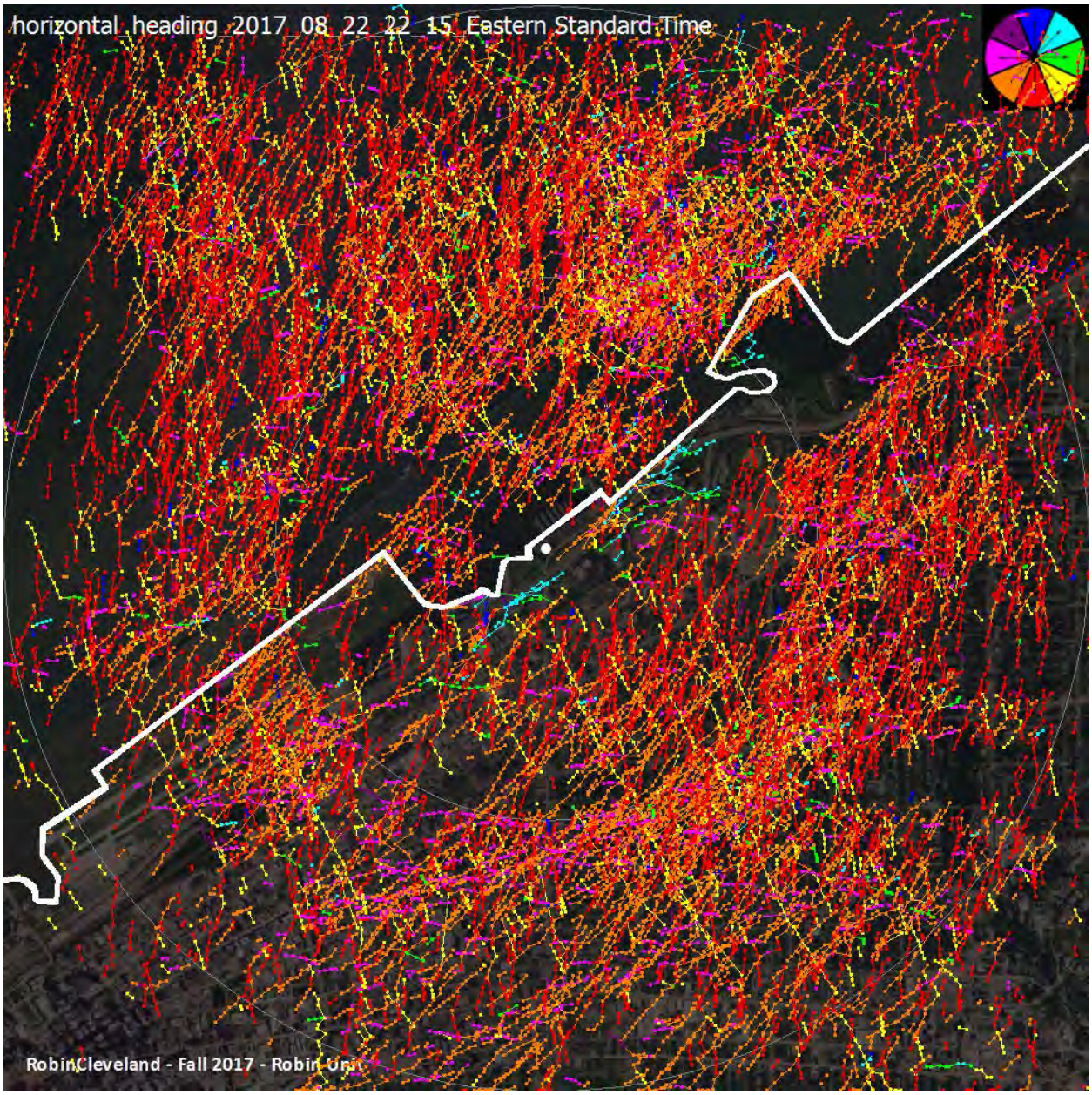


Figure 9. Heavy migration moving primarily in a south and southwest direction as midnight nears.

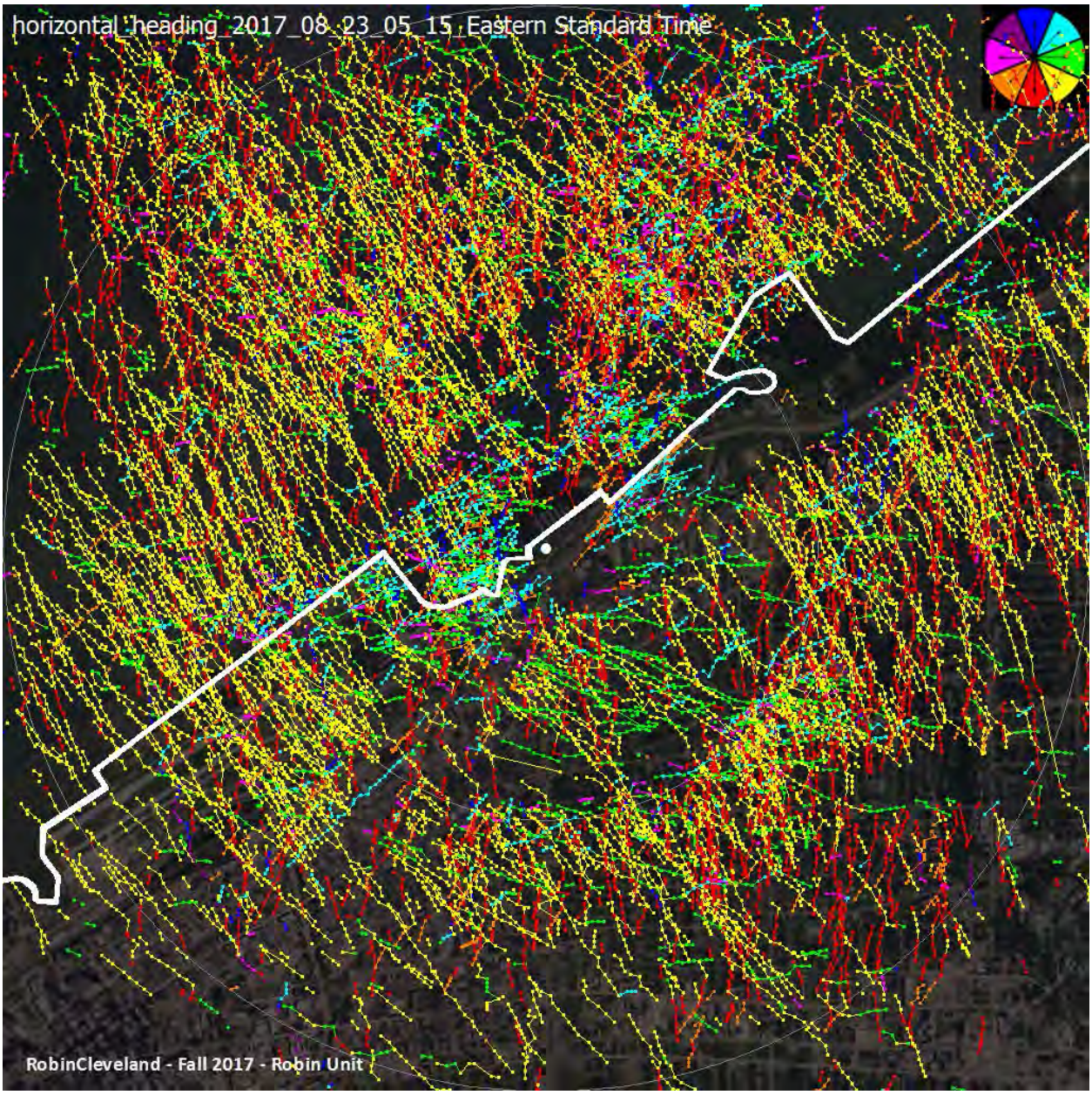


Figure 10. This graph depicts moderately heavy migration near dawn moving predominantly to the south and southeast.

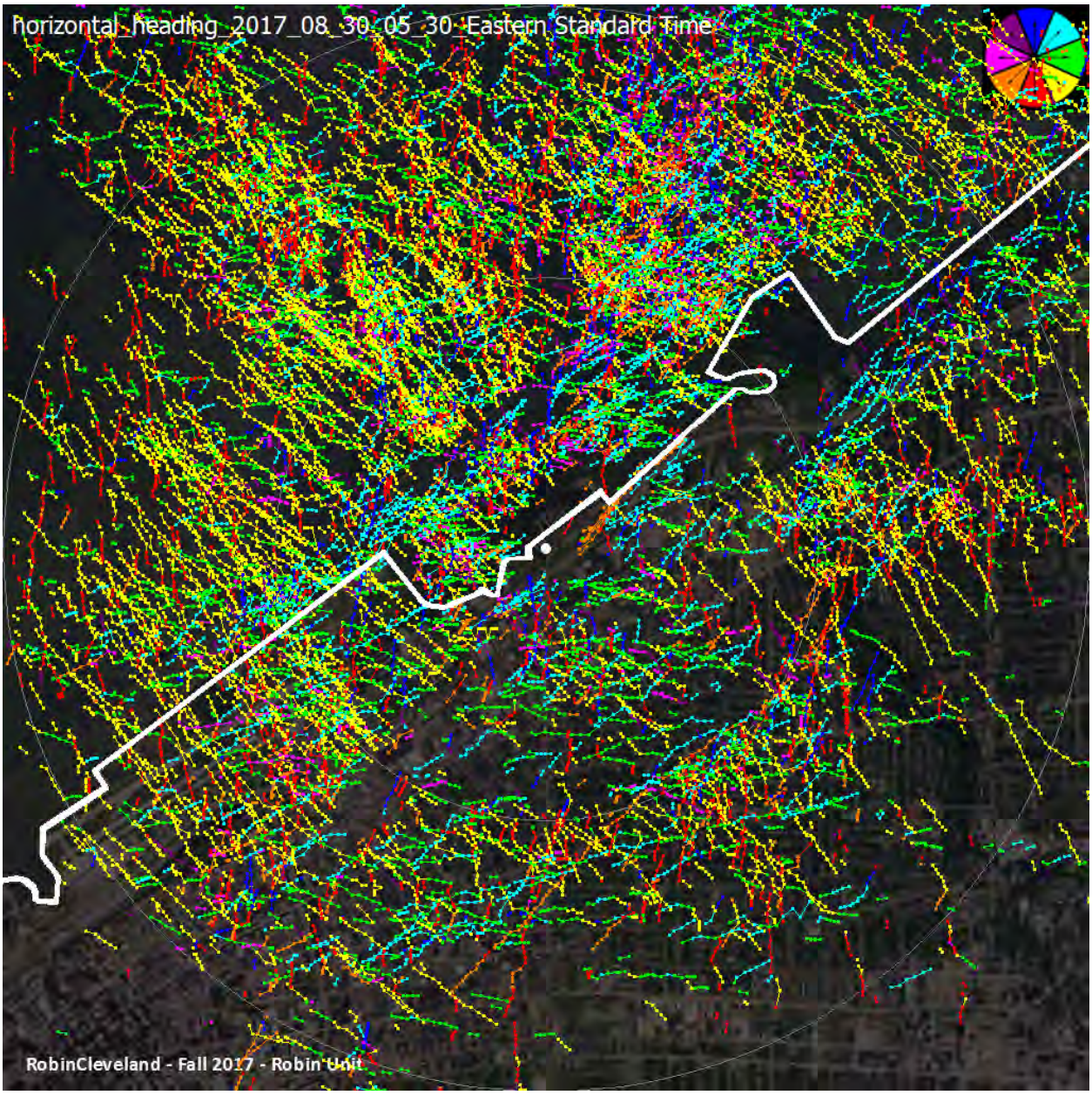


Figure 11. This graph depicts another example of moderate migration before dawn.

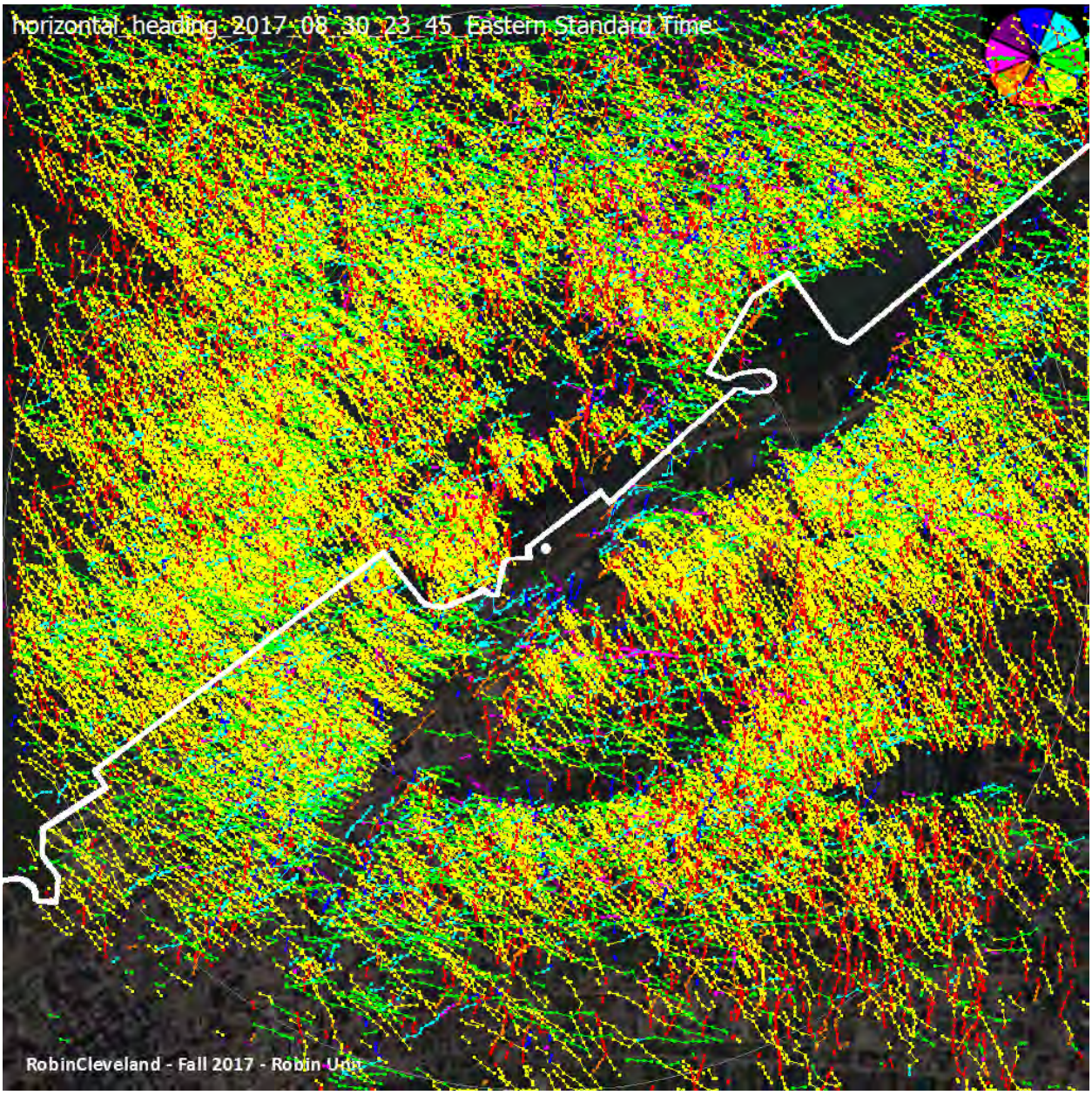


Figure 12. This graph depicts heavy migration just before midnight moving in a southeast direction.

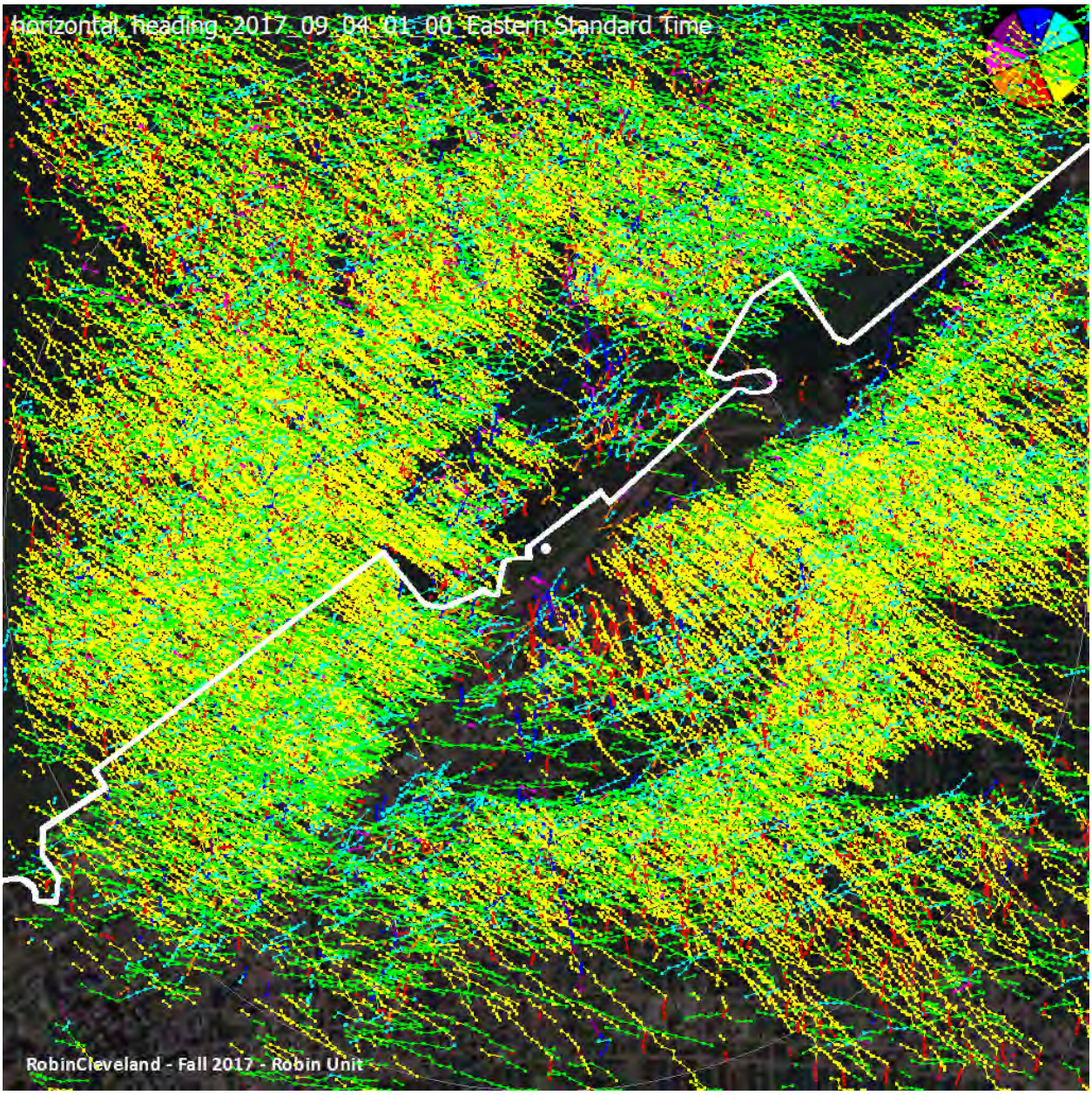


Figure 13. This graph depicts heavy migration an hour after midnight moving toward the southeast and east.

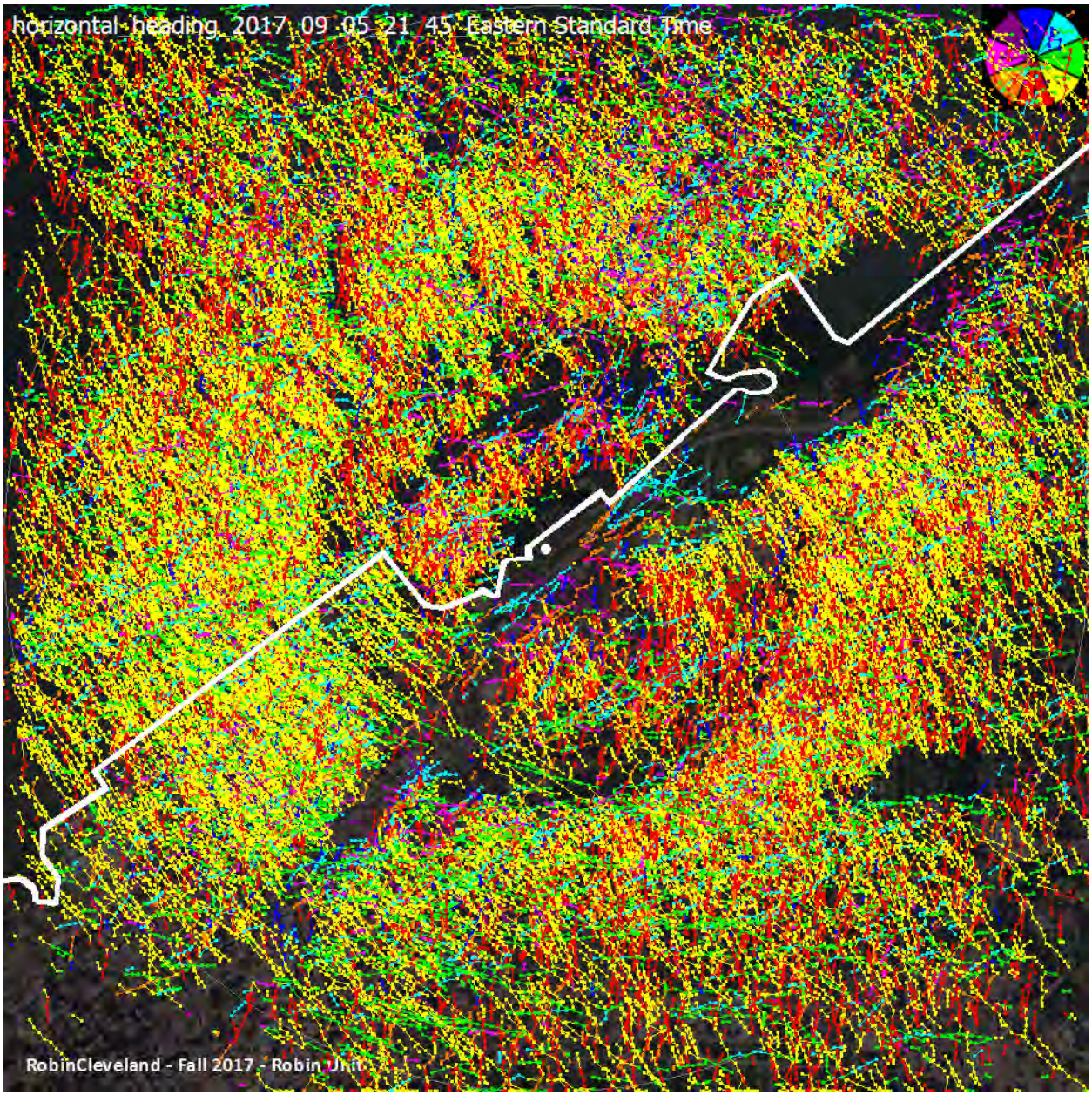


Figure 14. This graph depicts heavy migration in earlier part of the night moving generally southeast.

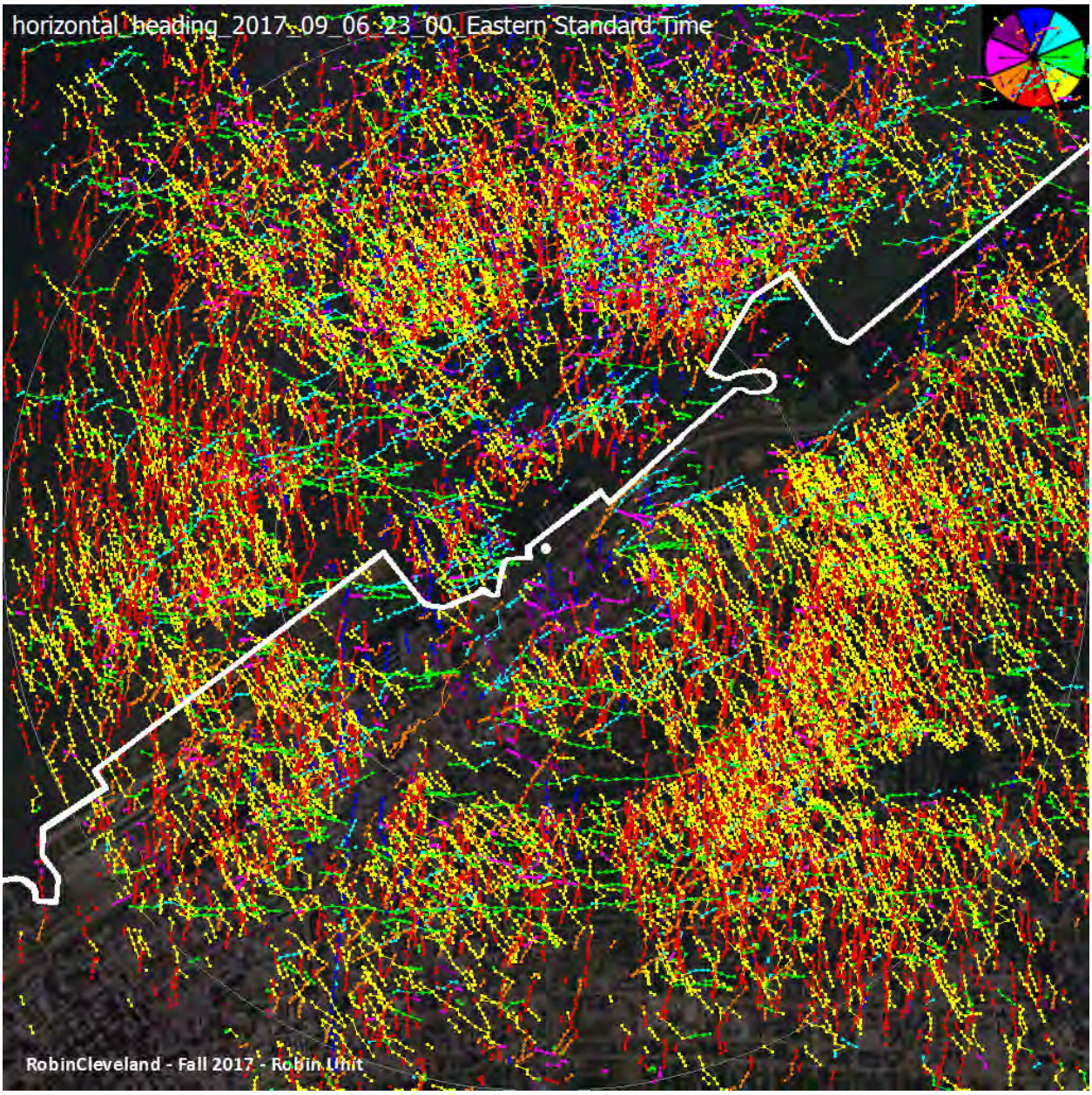


Figure 15. This graph depicts moderately heavy migration near the middle of the night with targets moving primarily south to southeast. Migration is pulsed and intensity varies from night to night.

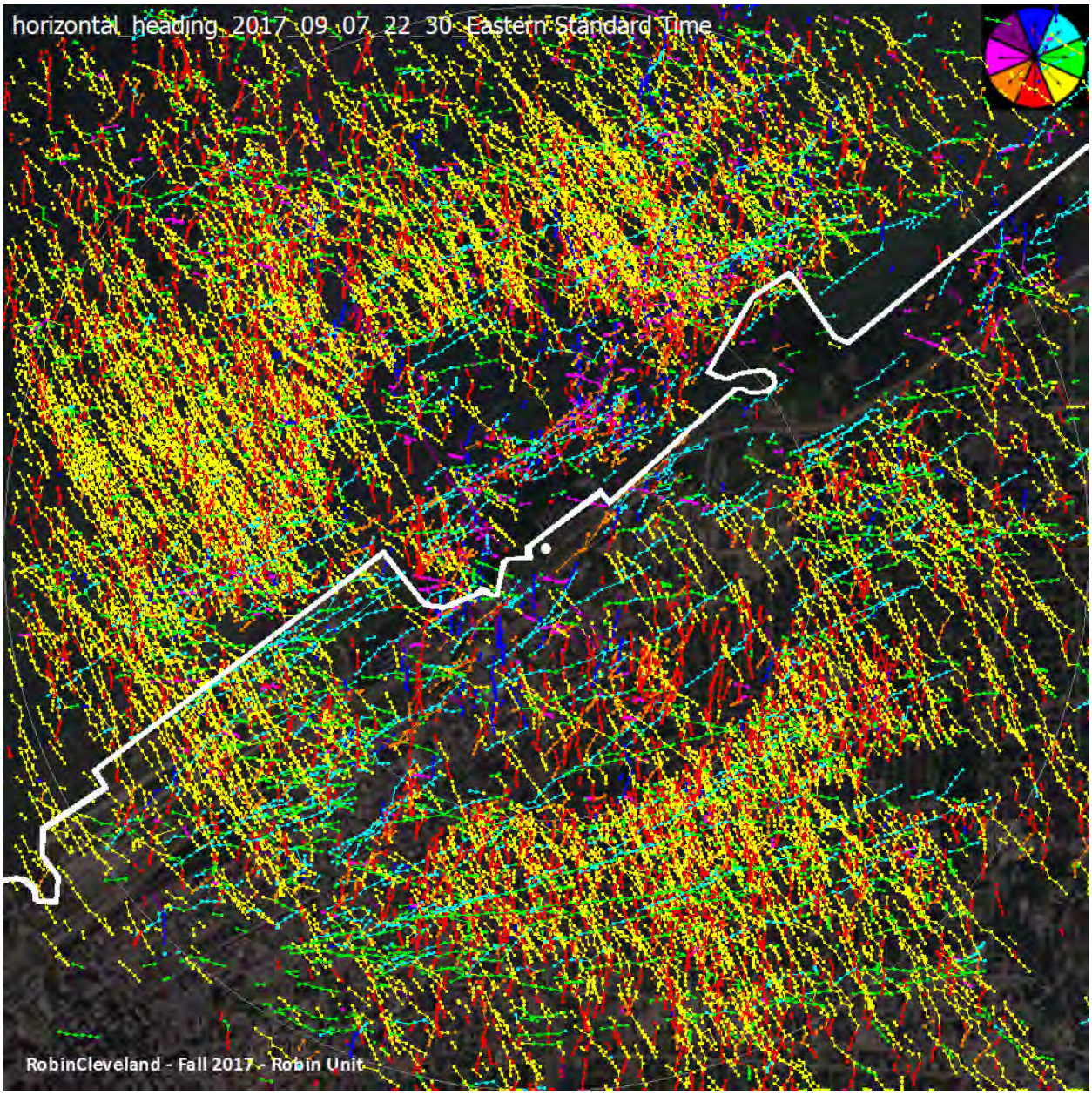


Figure 16. This graph depicts moderate to moderately heavy migration near the middle of the night.

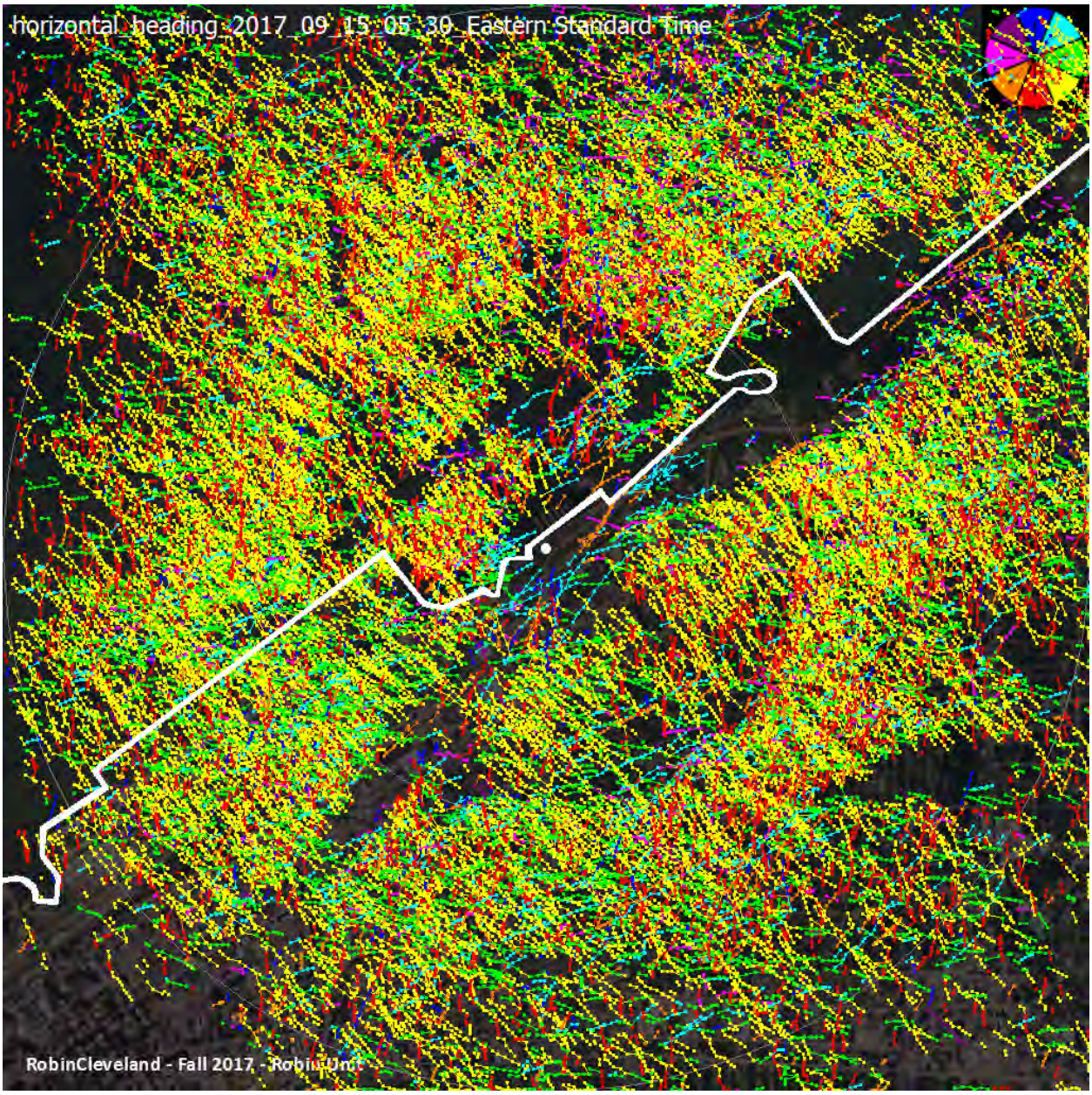


Figure 17. This graph depicts heavy migration to the southeast although getting closer to dawn. Migration varies by night, by time, and by time of season.

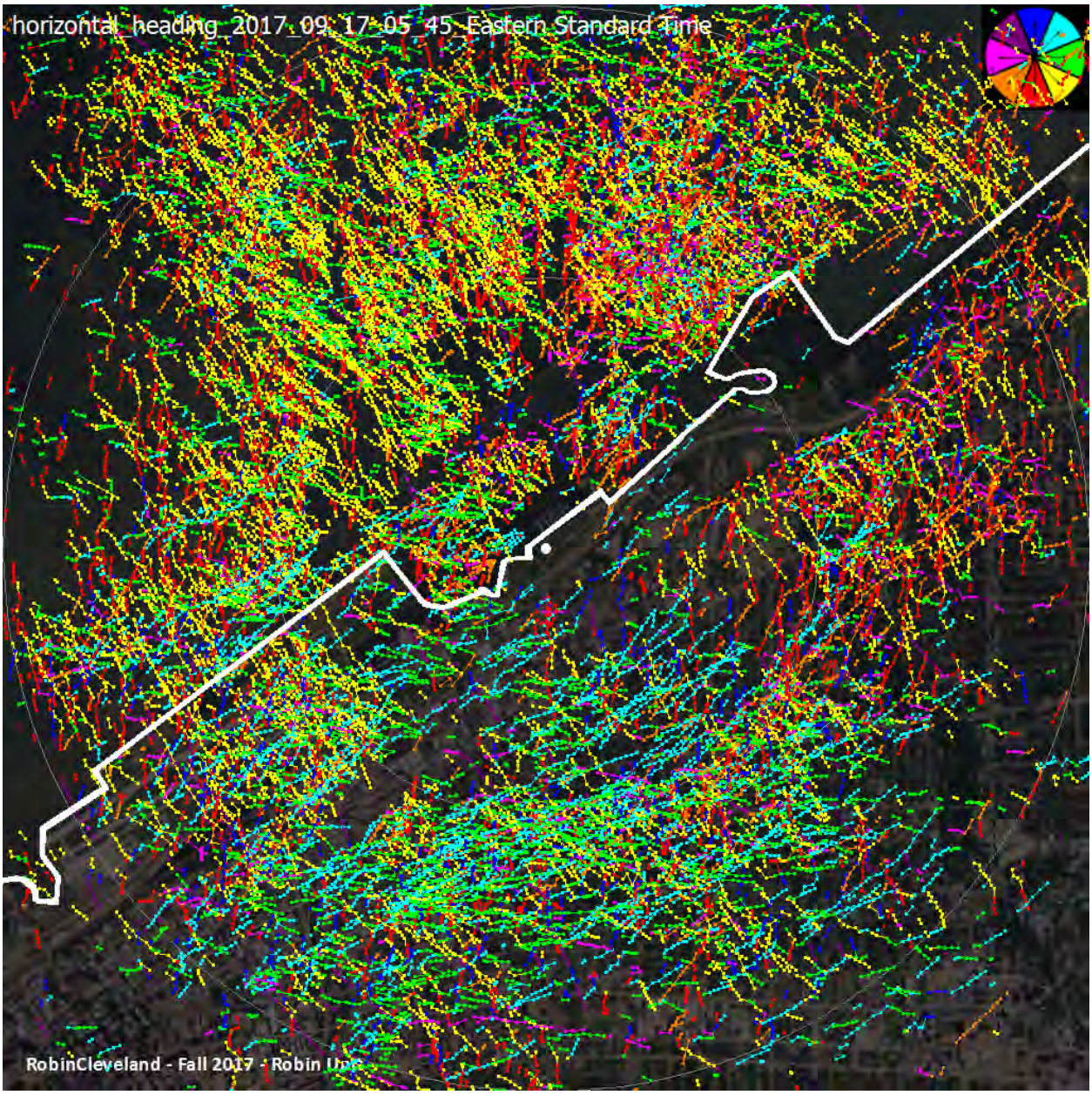
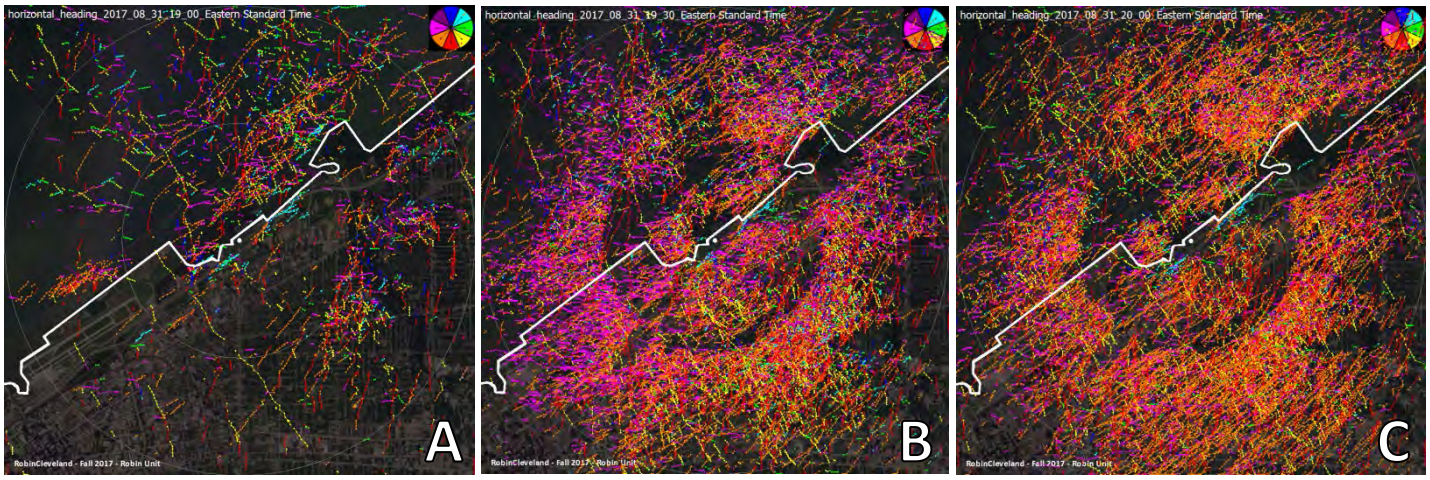
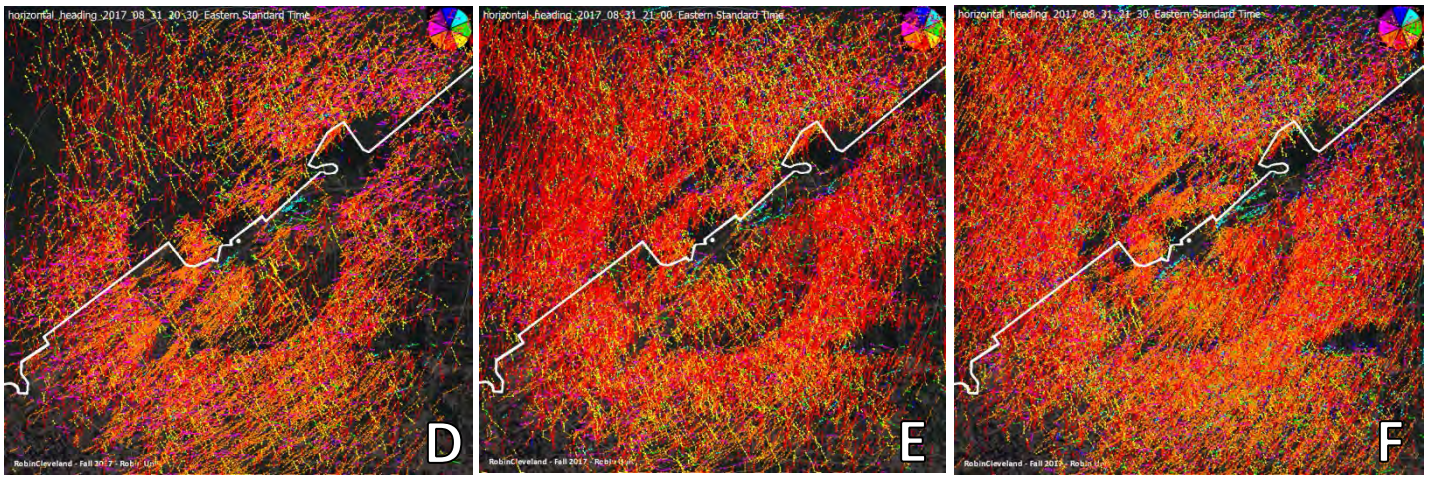


Figure 18. This graph depicts moderately high migration as dawn approaches. Note that while offshore migrants are moving mostly in a southeasterly direction, migrants on the left are tending to turn easterly after reaching shore and migrants on the right are tending to turn south or southwest after reaching shore.

South-bound Target Arrival at Cleveland



8:00pm EDT [Sunset at 8:01pm] 8:30pm 9:00pm



9:30pm 10:00pm 10:30pm

The plots above document the arrival of south-flying targets on the southern shore of Lake Erie (Cleveland radar site) approximately one and a half hours after sunset, and approximately one hour after the onset of migration on the night of August 31, 2017. Each plot represents 15 minutes of target tracking, beginning at the time listed. The white line represents the Cleveland shoreline and the radar location is a white dot at the center of each plot. Color indicates the direction of flight for each target, according to the color wheel at the top right of each plot: blue is north, green is east, red is south, and pink is west. Distance from our Cleveland site to the north shore of Lake Erie is approximately 80 km (50 miles). An average groundspeed of 61 kilometers per hour (17 m/s) has been recorded for migrants crossing large bodies of water (Bruderer and Liechti, 1998). Thus, migrants leaving at dusk should begin to arrive on shore approximately an hour and a half later, almost exactly the time elapsed observed (panels A and D).

A. Low activity at the time of sunset (8:01 pm EDT)
B. Migration begins in the half hour after sunset with flight to the west and southwest, and relatively low activity offshore (upper left of the plot)
C. Migration continues through the next half hour, mostly to the southwest, and heavier over land.
D. At 9:30, southern-moving (red) targets enter, particularly in the offshore portion of the plot.
E. In the next half-hour, south-bound target activity increases dramatically.
F. Heavy migration activity with predominant orientation to the south and southwest is evident throughout the plot.

Bruderer, B., & Liechti, F. (1998). Flight Behaviour of Nocturnally Migrating Birds in Coastal Areas: Crossing or Coasting. *Journal of Avian Biology*, *29*(4), 499-507

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