No evidence of large-scale fatality events at Ontario wind power projects

Lyle E. Friesen

It is a well-documented fact that birds collide with wind turbines, as they do with virtually all large human-made structures. However, large-scale avian mortality events at modern wind power projects (*i.e.* excluding old-generation projects in California such as those found in the Altamont Pass area) have been rare. Prior to 2011, only four multi-bird mortality events (conservatively defined as >three birds killed in one day at a single turbine) had been reported at the estimated 31,000 modern wind turbines operating across the United States, with the largest event involving 27 passerines at the Mountaineer facility in West Virginia in May 2003 (Kerlinger *et al.* 2010, 2011). In late 2011, a multi-bird mortality

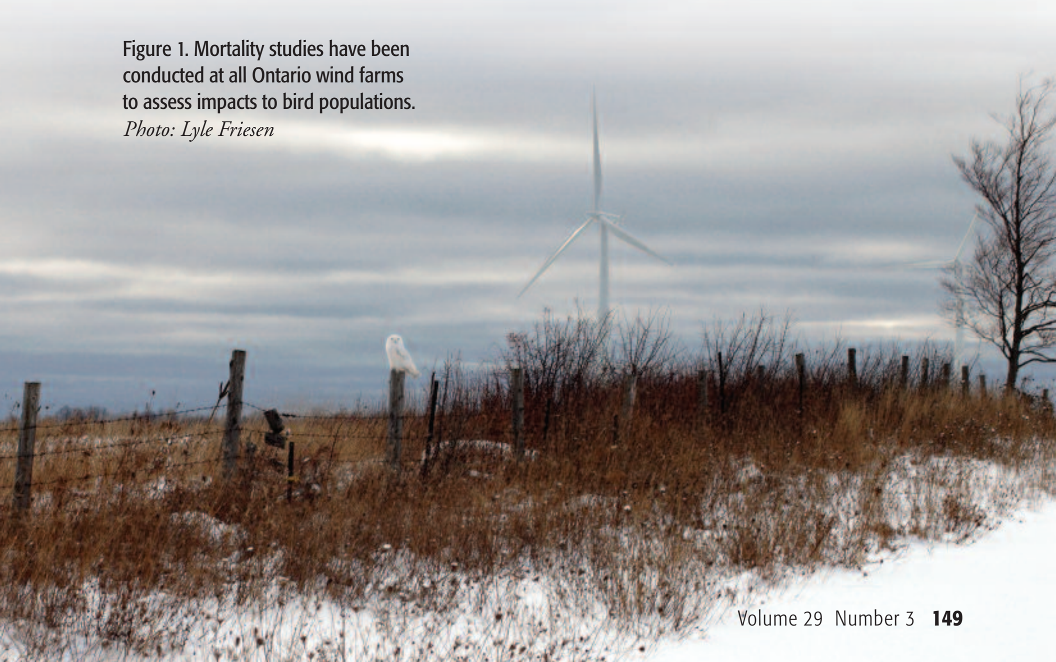

Figure 1. Mortality studies have been conducted at all Ontario wind farms to assess impacts to bird populations. *Photo: Lyle Friesen*

event occurred in West Virginia involving a much larger number of avian fatalities than had been reported previously. On 2–3 October, 484 birds perished at the 61-turbine AES Laurel Mountain facility; almost all were passerine migrants with Blackpoll Warblers (*Setophaga striata*) representing 64% of the casualties (Stantec 2011a).

The recent multi-fatality incident in West Virginia raises the question of whether something similar has been reported at wind energy facilities in Ontario. Fatality studies were conducted at 10 Ontario wind power projects (Figure 1) from 2006 to 2010 as part of follow-up monitoring requirements of the Canadian Environmental Assessment (CEA) Act. I examined each of the study reports (Table 1; all the reports are public documents accessible by request via the CEA Registry) to determine if multi-bird fatalities had occurred and if so, their number and frequency. All but one of the wind facilities is located in southern Ontario (the exception being the Prince Wind Power Project near Sault Ste. Marie) and all but one are located either along or within 10 km of a Great Lakes shoreline (the one exception being the Melancthon Wind Project near Shelburne). Facility size ranged from five to 133 turbines and the number of turbines searched at each facility ranged from five to 126. Turbine height ranged from 110 to 125 m (360 to 410 ft) and maximum turbine generating capacity ranged from 1.5 to 2.3 megawatts (MW). Turbine lighting at all but one of the facilities consisted of flashing red lights; the one exception was the Erie Shores facility which employed steady red lights. The study duration at the facilities varied from 10 weeks to over two years of continuous monitoring. The frequency of carcass searches at individual turbines ranged from once/week to five times/ week, with the most common frequency being twice/week; the one exception was at Erie Shores where the time between searches ranged from 3 to 24 days. The total number of individual turbine searches from the 10 studies combined was <33,000, with most being conducted during the bird migration periods in spring and fall.

The raw or uncorrected number of carcasses found at a facility ranged from three to 166/year, which translated into an average of 0.1 to 1.9 birds detected/ year at each of the turbines searched. The maximum number of avian carcasses found at a single turbine during one visit was three (European Starling [*Sturnus vulgaris*], Common Yellowthroat [*Geothlypis trichas*], and an unidentified passerine); this number was recorded on just one occasion after a three-day period between visits on 29 May 2009 at the Enbridge Wind Power Project. Two avian carcasses were found at a turbine during a single visit on seven occasions; the remaining dead birds were found as single individuals at searched turbines. The maximum number of bird carcasses found at a single facility during one visit was six (at a facility where 33 turbines were monitored per visit) when two carcasses apiece were found at three turbines after a three-day period between visits.

TABLE 1. Summary of avian mortality at 10 wind power projects in Ontario

Location	Study year	Number of turbines (total/study)	Study duration	Search interval	Total bird carcasses found	Corrected estimated fatalities/ MW/yr	Corrected estimated fatalities/ turbine/yr	Reference
Cruikshank	2009	5/5	22 weeks	2x/week	4	0.9	1.5	Stantec 2010a
Cruikshank	2010	5/5	13 weeks	2x/week	1	1.1	1.9	Stantec 2011b
Enbridge	2009	110/33	22 weeks	2x/week	43	2.0	3.4	Stantec 2010b
Enbridge	2010	110/33	13 weeks	2x/week	8	0.8	1.3	Stantec 2011c
Erie Shores	2006	66/66	52 weeks	3-24 days	30	1.7	2.5	James 2008
Erie Shores	2007	66/66	52 weeks	3-24 days	29	1.7	2.5	James 2008
Kingsbridge	2006	22/22	10 weeks	2x/week	3	0.3	0.6	Stantec 2008a
Melancthon	2007	45/45	12 weeks	2x/week	12	0.9	1.4	Stantec 2008b
Melancthon	2009	133/45	21 weeks	2x/week	63	3.0	4.5	Stantec 2010c
Melancthon	2010	133/45	21 weeks	2x/week	27	1.8	2.7	Stantec 2010d
Mohawk	2009	6/6	17 weeks	2x/week	5	1.8	3.0	Natural Resource Solutions 2010
Port Alma	2010	44/15	22 weeks	2x/week	22	2.4	5.6	Stantec 2011d
Prince	2008	126/126	28 weeks	3-5x/week	72	0.9	1.3	Natural Resource Solutions 2009
Ripley	2008	38/38	27 weeks	1-2x/week	31	1.5	3.0	Jacques Whitford Stantec 2009
Wolfe Island	2009/10	86/86	52 weeks	1-2x/week	166	5.8	13.4	Stantec 2010e Stantec 2010f
Wolfe Island	2010/11	86/86	52 weeks	1-2x/week	85	4.3	10.0	Stantec 2011e Stantec 2011f

The multitude of individual turbine searches coupled with the low raw carcass numbers provides strong evidence that the probability of large-scale avian mortality events at Ontario's wind energy facilities is very low. Raw numbers do not, of course, represent the true magnitude of bird mortality at these facilities. A corrected estimate in birds/MW/year requires adjustments for factors such as searcher efficiency, scavenging effects, area adjustments if the entire area around a turbine could not be searched due to dense vegetation or difficult terrain, and the production capacity (*i.e.* maximum MW size) of the turbines. The corrected avian mortality estimates for the 10 wind power projects in Ontario ranged from 0.3 to 5.8 birds/MW/year and all but one of the facilities reported fatality levels less than 3 birds/MW/year which is consistent with findings from the majority of 63 studies undertaken at wind energy facilities across the U.S. (Strickland *et al.* 2011) and with studies in Ontario of single turbines along the Lake Ontario shoreline (James 2003, James and Coady 2004). The mortality (*i.e.*, adverse) effects of the Wolfe Island Wind Project, which has reported the highest fatality levels to date in the province, are likely not significant with respect to local or regional populations of species, in part because the mortality is spread among at least 58 bird species.

The near absence of multi-fatality events and the low number of fatalities reported annually to date suggest that wind turbines are not a major concern with respect to the sustainability of migratory bird populations in Ontario (impacts to bats may be of much greater concern; see National Wind Coordinating Collaborative 2010). Other human-associated causes of avian

Figure 2. Haying is estimated to have a much greater impact on bird populations than collisions with wind turbines. *Photo: Lyle Friesen*

mortality have impacts that are orders of magnitude higher than those estimated for wind turbines (Machtans and Elliot 2011). An estimated 7000 birds were killed in Canada by wind turbines in 2010 (Pomeroy *et al.* 2011), with approximately 35% of the deaths occurring in Ontario (extrapolating based on the amount of installed wind-power capacity in Canada by province as of 2010 [CanWEA 2011]). By comparison, agricultural mowing, which is often common in and around wind power projects (Figure 2), is estimated to kill almost 10 million birds annually in Canada (Tews *et al.* 2011). Window strikes may claim over a million birds each year in Toronto alone (Fatal Light Awareness Program 2011) and over one billion birds annually across the U.S. (Sheppard 2011)

It is important to note that steady burning flood lights have played a crucial role in almost all the multi-fatality events reported at wind power projects in the U.S. At the Laurel Mountain AES facility in West Virginia, the fatalities were not caused by collision with turbines. Rather, the birds succumbed after being attracted to eight floodlights surrounding a battery storage unit. The birds, migrating at low altitude in conditions of high wind and thick fog, became disoriented by the dusk-to-dawn lighting at the battery substation, and either slammed into the building or circled around it to the point of exhaustion (Stantec 2011a). Standardized mortality searches at turbines throughout the facility immediately after the fatality event confirmed that no multi-bird fatality events had occurred anywhere but at the brightly illuminated battery storage unit. No further multi-bird fatality events occurred at the substation after the floodlights were extinguished (Stantec 2011a).

Steady burning flood lights around an electrical substation and three adjacent turbines were also implicated in the fatality events at the Mountaineer facility in 2003 (Kerlinger *et al.* 2010). An obvious solution to reducing avian mortality at wind energy facilities, and indeed at any large structure in urban and rural areas, is simply to turn off the floodlights (at a minimum, with seasonal shutdown during the bird migration seasons). If floodlighting is absolutely necessary for operational or safety reasons, an efficient lighting system should be installed that reduces light 'spill' in areas where lighting is not required (Sheppard 2011).

Wind turbines in North America are almost universally equipped with flashing red lights. This type of lighting, in the absence of lighting associated with ancillary structures (*e.g.*, substations), may be an important reason (along with their smaller heights and absence of guy wires) why turbines have much lower avian fatality rates and no large-scale fatality events compared to communication towers which often feature steady-burning lights (Kerlinger *et al.* 2010). Birds are both attracted to and disoriented by steady-burning lights although the mechanisms involved are poorly understood (Sheppard 2011). Collisions with wind turbines will increase as the number of wind power facilities increases in Ontario. Cumulative mortality levels can likely be kept relatively low by employing the wind turbine lighting system currently recommended by Transport Canada (flashing red beacon) and by limiting turbine heights to less than 150 m (Kerlinger *et al.* 2011).

The collective evidence to date suggests the risk to birds from wind energy projects is low relative to other anthropogenic factors and is unlikely to be causing significant population declines. However, wildlife, including many bird populations, is under increasing pressure worldwide because of rapidly expanding human populations and associated land-use activities. Not every area need be developed for wind energy, particularly those areas encompassing uncommon or unique habitats, or that have unusually high concentrations of wildlife including species at risk. It is also important that post-construction monitoring be continued as the number of wind energy facilities increases to allow for a broader assessment of possible cumulative and significant population impacts on birds and bats.

Acknowledgements

Chip Weseloh, John Fischer, Mike Cadman, Eleanor Zurbrigg, and Rob Read reviewed the manuscript and provided many valuable suggestions for improvement. Nicole Kopysh contributed information on lighting systems at many of the wind energy facilities.

Literature Cited

CanWEA. 2011. Powering Canada's future: Canada's current installed capacity. Canadian Wind Energy Association. Available online @http://www.canwea.ca/pdf/Canada%20Current%20Installed%20Capacity_e.pdf

Fatal Light Awareness Program. 2011. Available online @ http://www.flap.org/

Jacques Whitford Stantec. 2009. Ripley Wind Power Project post-construction monitoring report. November 2009. Prepared for Suncor Energy Products Inc., Calgary, Alberta. Jacques Whitford Stantec Limited, Markham, ON.

James, R.D. 2003. Bird observations at the Pickering wind turbine. Ontario Birds 21:84 – 97.

James, R.D. 2008. Erie Shores Wind Farm, Port Burwell, Ontario: fieldwork report for 2006 and 2007, during the first two years of operation. Prepared for Environment Canada, Ontario Ministry of Natural Resources, Erie Shores Wind Farm LP-McQuarrie North American, and AIM Power-Gen Corporation, Ontario, Canada.

James, R.D. and **G. Coady**. 2004. Bird monitoring at Toronto's Exhibition Place wind turbine. Ontario Birds 22:79 – 89.

Kerlinger, P., J. L. Gehring, W.P. Erickson, R. Curry, A. Jain, and **J. Guarnaccia**. 2010. Night migrant fatalities and obstruction lighting at wind turbines in North America. Wilson Journal of Ornithology 122:744 – 754.

Kerlinger, P, J. L. Gehring, and **R. Curry**. 2011. Understanding bird collisions at communication towers and wind turbines: status of impacts and research. Birding 43(1):44 – 51.

Machtans, C. and **R. Elliot**. 2011. Estimates of human related bird mortality from major sectors in Canada, and their biological relevance. Symposium introduction to the Society of Canadian Ornithologists annual meeting, August 6, 2011. Moncton, NB.

National Wind Coordinating Collaborative. 2010. Wind turbine interactions with birds, bats, and their habitats:a summary of research results and priority questions. Available online @ www.nationalwind.org.

Natural Resource Solutions. 2009. 2006, 2007, and 2008 bird and bat mortality monitoring, Prince Wind Power Project. Prepared for Brookfield Renewable Power, Tatineau, QC. Natural Resource Solutions, Inc., Waterloo, ON.

Natural Resource Solutions. 2010. Mohawk Point Wind Farm 2009 post-construction monitoring report. March 2010. Prepared for International Power Canada, Inc., Markham, ON. Natural Resource Solutions, Inc., Waterloo, ON.

Pomeroy, A., M. d'Entremont, R. and **C. Francis**. 2011. Avian collisions with wind turbines. Poster presentation to the Society of Canadian Ornithologists annual meeting, August 6, 2011. Moncton, NB.

Sheppard, C. 2011. Bird-friendly building design. American Bird Conservancy, The Plains, VA. Available online @ http://www.abcbirds.org/newsandreports/BirdFriendlyBuildingDesign.pdf

Stantec. 2008a. Kingsbridge 1 Wind Power Plant post-construction bird and bat monitoring report: 2007. January 2008. Stantec Consulting Ltd., Guelph, ON.

Stantec. 2008b. Melancthon I Wind Plant Post-Construction bird and bat monitoring report 2007. April 2008. Prepared for Canadian Hydro Developers, Inc. 34 Harvard Road, Guelph, ON. Stantec Consulting Ltd., Guelph, ON.

Stantec. 2010a. Cruickshank Wind Farm 2009 post-construction monitoring report. December 23, 2010. Prepared for Enbridge Ontario Wind Power LP, Kincardine, ON. Stantec Consulting Ltd., Markham, ON.

Stantec. 2010b. Enbridge Ontario Wind Power Project 2009 post-construction monitoring report. November 2010. Prepared for Enbridge Ontario Wind Power LP, Kincardine, ON. Stantec Consulting Ltd., Markham, ON.

Stantec. 2010c. Melancthon Ecopower® Centre post-construction bird and bat monitoring report: 2009. February 2010. Prepared for TransAlta Corporation, Guelph, ON. Stantec Consulting Ltd., Guelph, ON.

Stantec. 2010d. Melancthon Wind Plant post-construction bird and bat monitoring report: 2010. December 2010. Prepared for TransAlta Corporation, Guelph, ON. Stantec Consulting Ltd., Guelph, ON.

Stantec. 2010e. Wolfe Island Ecopower® Centre post-construction follow-up plan bird and bat resources, monitoring report no. 2, July – December 2009. March 2010. Stantec Consulting Ltd., Guelph, ON.

Stantec. 2010f. Wolfe Island Wind Plant post-construction follow-up plan: bird and bat resources, monitoring report no. 3, January – June 2010. Prepared for TransAlta Corporation's Canadian Renewable Energy Corporation. Stantec Consulting Ltd., Guelph, ON.

Stantec. 2011a. Bird mortality event at Laurel Mountain substation. October 25. Available online @ http://www.vawind.org/Assets/Docs/20111028/1152825335.pdf.

Stantec. 2011b. Cruickshank Wind Farm 2010 post-construction monitoring report. April 26, 2011. Prepared for Enbridge Ontario Wind Power LP, Kincardine, ON. Stantec Consulting Ltd., Markham, ON.

Stantec. 2011c. Enbridge Ontario Wind Power Project 2010 post-construction monitoring report. January 2011. Prepared for Enbridge Ontario Wind Power LP, Kincardine, ON. Stantec Consulting Ltd., Markham, ON.

Stantec. 2011d. Port Alma Wind Power Project post-construction bird and bat monitoring report: 2010. February 2011. Prepared for Kruger Energy Port Alma Limited Partnership. Stantec Consulting Ltd., Guelph, ON.

Stantec. 2011e. Wolfe Island Wind Plant post-construction follow-up plan: bird and bat resources. Monitoring report no. 4, July – December 2010. Prepared for TransAlta Corporation's Canadian Renewable Energy Corporation. Stantec Consulting Ltd., Guelph, ON.

Stantec. 2011f. Wolfe Island Wind Plant post-construction follow-up plan: bird and bat resources. Monitoring report no. 5, January – June 2011. Prepared for TransAlta Corporation's Canadian Renewable Energy Corporation. Stantec Consulting Ltd., Guelph, ON.

Strickland, M.D., E.B. Arnett, W.P. Erickson, D.H. Johnson, G.D. Johnson, M.L. Morrison, J.A. Shaffer, and **W. Warren-Hicks**. 2011. Comprehensive guide to studying wind energy/wildlife interactions. Prepared for the National Wind Coordinating Collaborative, Washington, D.C., USA. Available online @ http://www.nationalwind.org/

Tews, J., D.G. Bert, and **P. Mineau**. 2011. Avian mortality related to mechanical operations in agricultural landscapes in Canada. Symposium presentation to the Society of Canadian Ornithologists annual meeting, August 6, 2011. Moncton, NB.

Lyle Friesen, Canadian Wildlife Service, Environment Canada, Box 5050, Canada Centre for Inland Waters, Burlington, Ontario L7R 4A6. E-mail: lyle.friesen@ec.gc.ca