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Bird and Bat Monitoring at the McBride Lake Wind Farm, Alberta 2003-2004

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SUMMARY

As part of Vision Quest Windelectric's environmental monitoring program at the McBride Lake Wind Farm, we systematically searched for bird and bat carcasses for one year after the wind farm was commissioned. From July 2003 through June 2004, we conducted 69 surveys of the entire farm.

The McBride Lake Wind Farm is located 10 km south of Fort Macleod in southern Alberta. It comprised 114 turbines during our study. Individual turbines have 3 blades, with a rotor diameter of 47 m, mounted on a 50-m tubular steel tower.

Birds

The bird collision rate at the McBride Lake Wind Farm was low relative to rates reported elsewhere. The rate of 0.36 birds/turbine/year is about 6 times lower than the mean collision rate of 2.19 for turbines in the United States.

Of the 9 species of raptors we observed in the area, only Swainson's Hawks collided with turbines. Over the course of the year, we recovered 7 Swainson's Hawks around turbines. This is equivalent to a collision rate of 0.061 which is high relative to the average of 0.033 birds/turbine/year reported for all raptors at facilities in the United States.

This finding was unexpected, given the extremely low occurrence of collisions at the Castle River Wind Farm, located 45 km to the west. At Castle River, only 1 Red-tailed Hawk and 1 Kestrel were recovered at 64 turbines over a >2-year period. Although the Swainson's Hawk is not listed as a species of special management concern by the Committee on the Status of Endangered Wildlife in Canada, it is considered *Sensitive* in Alberta. We will continue to monitor Swainson's Hawk activity at the adjacent Blue Trail Wind Farm to gather more information on the potential vulnerability of this species to collisions with wind turbines

Other species of special management concern that were killed in collisions with turbines included Western Grebe (n = 1), Sharp-tailed Grouse (n = 2), and Short-eared Owl (n = 2). Collision rates were low for these species, and no trends in mortality were apparent.

Bats

During our carcass searches, we recovered 54 bats, including 47 hoary, 5 little brown, 1 big brown , and 1 silver-haired. None of those species is considered of special management concern either by the Committee on the Status of Endangered Wildlife of Canada (COSEWIC), or Alberta Sustainable Resource Development.

Our recovery rate of 0.47 bats/turbine/year was 2-5 times lower than those at 3 facilities in the United States. Because bat collisions with turbines only recently have become recognized as a potential concern, few comparative data exist.

Bats we recovered within the wind farm appeared healthy otherwise, and did not have any conditions that would have compromised their health and made them more vulnerable to collisions with turbines.

Hoary bats, which are migratory in southern Alberta, were the most-common species we recovered (87% of all bats; $n = 47$). This species also was the most common recovered at 3 wind farms in the western United States for which there are data. There may have been both resident and migratory little brown bats involved in the collisions. Silver-haired bats likely were migratory.

We did not locate hoary bat carcasses in spring when that species should have been moving northward. Migration routes in the province are not well understood, and the animals may use a different route in spring that does not take them through the region of the wind farm. Our finding of 3 adult male hoary bats was unexpected. Males of that species most commonly remain in the western United States during summer, and few are captured as far north as Alberta.

Authorities do not understand the significance to bat populations of mortality from turbine collisions. Vision Quest is currently assessing information needs on bat-turbine interactions relative to their facilities in southern Alberta. They are cooperating with a broader international effort coordinated by Bat Conservation International investigating the causes of bat collisions with turbines. They also have engaged Dr. Robert Barclay, University of Calgary, to begin on-site investigations of bat interactions with turbines at their facilities in southern Alberta. Currently, we are assessing potential scope of those studies and testing recording equipment to monitor bat activity.

ACKNOWLEDGMENTS

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Justin Thompson, Terry Kwas, and Jason Edworthy, Vision Quest, administered the project and provided encouragement throughout.

Simone Forget, Paul Attrell, Sylvia Hamilton, and Walter Hamilton assisted with some surveys.

Dr. Judit Smits, University of Saskatchewan, performed all necropsies.

Hal Jorgenson and Dave Willms, Vision Quest, and the rest of the Vision Quest crew at the McBride Lake Wind Farm, alerted us to carcasses they encountered, and made us feel welcome on-site.

Dr. Robert Barclay, University of Calgary, provided advice on bats and loaned us an ultrasonic detector to confirm the presence of bats around turbines.

Dr. Margo Pybus, Alberta Fish and Wildlife Division (AFWD), provided information on bats and bat behaviour.

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1.0 INTRODUCTION

As part of Vision Quest Windelectric's environmental monitoring program at the McBride Lake Wind Farm, we systematically searched for bird and bat carcasses for one year after the wind farm was commissioned.

From July 2003 through June 2004, we conducted 69 surveys of the entire farm. This report summarizes the results of those surveys and describes them in the context of current understanding of mortality at wind farms across North America.

2.0 STUDY AREA

The McBride Lake Wind Farm, operated by Vision Quest Windelectric, is located in southern Alberta, 10 km south of the town of Fort Macleod. The site is on a broad, relatively level plateau located within the Grassland Natural Region at the boundary of the Mixed Grass and Foothills Fescue subregions (ANHIC 1999). Land use is entirely agricultural. Forty-seven turbines (41%) are in native pasture that is grazed by cattle, and 67 turbines (59%) are in cropped fields (primarily wheat and barley).

Native pastures are dominated by grasses including needle grasses (*Stipa* spp.), wheat grasses (*Agropyron* spp.), rough fescue (*Festuca scabrella*), June grass (*Koeleria macrantha*), and blue grama (*Bouteloua gracilis*). Common Forbs include species such as yarrow (*Achillea millefolium*), three-flowered avens (*Geum triflorum*), vetches (*Astragalus* spp.), and northern bedstraw (*Galium boreale*). Scattered shrubs such as buckbrush (*Symphoricarpos occidentalis*) and prairie rose (*Rosa arkansana*) occur in sheltered areas or wet depressions.

Wildlife species present are those typically able to co-exist with grain farming and cattle grazing. Mammals include species such as mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), coyote (*Canis latrans*), Richardson's ground squirrel (*Spermophilus richardsonii*), and meadow vole (*Microtus pennsylvanicus*). Most common bats in the area include little brown (*Myotis lucifugus*), small-footed (*M. ciliolabrum*), and big brown (*Eptesicus fuscus*). Hoary (*Lasiurus cinereus*) and silver-haired bats (*Lasionycteris noctivagans*) move through the region during migration (July–September).

Characteristic breeding birds include waterfowl such as Mallard (*Anas platyrhynchos*), Blue-winged Teal (*Anas discors*), and Northern Shoveler (*Anas clypeata*); raptors including Swainson's Hawk (*Buteo swainsoni*), and Northern Harrier (*Circus cyaneus*); and other typical prairie species such as Sharp-tailed Grouse (*Tympanuchus phasianellus*) and Killdeer (*Charadrius vociferus*). Common passerines (perching bird) include Horned Lark (*Eremophila alpestris*), Clay-colored Sparrow (*Spizella pallida*), and Western Meadowlark (*Sturnella neglecta*). Nesting opportunities for waterfowl and raptors are limited by level terrain and scarcity of trees and standing water.

The wind farm is comprised of 114 Vestas model V47-660 set on 50-m high, tubular-steel towers, with a diameter-at- base of about 3 m. Each turbine has three blades, with a rotor diameter of 47 m. Blades turn at speeds of 28-30 revolutions per minute. Turbines in each array are separated by 200-250 m. Arrays are separated by 500-1000 m.

3.0 METHODS

Field Surveys

During each survey, we walked 4 parallel transects spaced at 30-m intervals to survey a strip about 120 m wide that extended the length of the array. Transects extended about 45 m beyond each end of the array. The search area extended 45 m on the prevailing upwind side (southwest) and 75 m on the prevailing downwind side (northeast) to account for carcasses that may have been carried by strong, prevailing westerly winds. On each survey, we also examined the original turbine located southeast of the farm, east of Highway 810.

Later in summer (August), after crops reached 40-50 cm in height, we revised the pattern to search within a 15-m-radius of the tower base in cropland. We would not have detected carcasses that may have fallen in tall crops outside that area. After harvest (late August), we resumed searching in the original pattern. To increase the likelihood of locating carcasses throughout the study, we asked site personnel to notify us of any bird or bat carcasses they observed while commissioning and maintaining turbines.

When we found carcasses, we chilled or froze them, depending on their condition, and shipped them as soon as possible (usually within 3 days) to the University of Saskatchewan for necropsy.

During all surveys, we noted all Swainson's hawks due to the relatively high collision rate with turbines, as described below. We recorded height relative to the turbines (above, at, or below rotor height), and habitat when first observed.

Necropsies/Pathology

Dr. Judit E. G. Smits, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, performed all necropsies and histopathology examinations. She confirmed species identification and sex of the specimens. She also determined age of individual bats, when possible, by examining cartilage development in the phalanges.

4.0 RESULTS

4.1 Field Surveys

We surveyed the entire wind farm 69 times between 4 July 2003 and 5 July 2004 to search for carcasses of birds and bats that had collided with turbines. Surveys were done weekly most of the year and twice weekly during bird migration periods in spring (May-June) and fall (September-October).

Birds

In 69 surveys of the 114 turbines at the McBride Lake Wind Farm between July 2003 and June 2004, we recovered 41 bird carcasses (Table 1). Birds included 2 grebes, 4 ducks, 7 hawks, 3 grouse/partridge, 1 coot, 1 gull, 2 owls, and 21 passerines (perching birds).

Table 1. Bird species recovered at turbines, McBride Lake Wind Farm, July 2003-June 2004.

Species	Scientific Name	Number
Eared Grebe	Podiceps nigricollis	1
Western Grebe	Aechmophorus occidentalis	1
Mallard	Anas platyrhynchos	1
Gadwall	Anas strepera	1
Canvasback	Athya valisineria	1
Bufflehead	Bucephala albeola	1
Swainson's Hawk	Buteo swainsoni	7
Gray Partridge	Perdix perdix	1
Sharp-tailed Grouse	Tympanuchus phasianellus	2
American Coot	Fulica americana	1
Unidentified Gull	-	1
Short-eared Owl	Asio flammeus	2
Ruby-crowed Kinglet	Regulus calendula	1
Horned Lark	Eremophila alpestris	4
European Starling	Sturnus vulgaris	5
Dark-eyes Junco	Juncl hyemalis	2
Unidentified Sparrow	-	3
Unidentified Passerine	-	6
Total		**41**

The carcass of 1 Common Raven (*Corvus corax*) that had been electrocuted, was recovered near the electrical substation located in the central portion of the wind farm near the end of Array D. The bird had apparently spanned the gap between 2 power lines. The skull of a Franklin's Gull (*Larus pipixcan*) was recovered by the meterological tower at the northwest end of Array L.

Rate of recovery of bird carcasses was 0.36 birds/turbine/year. Most birds were found during fall and spring (Figure 1).

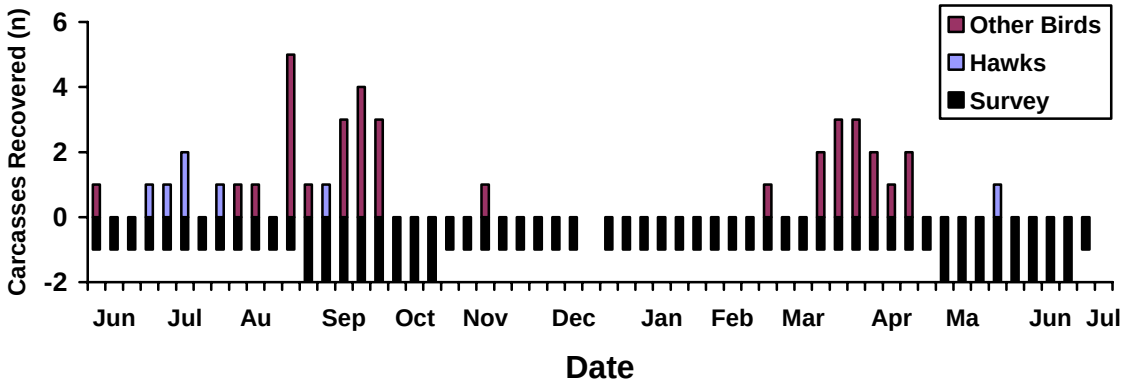

Figure 1. Timing of bird carcass recoveries, McBride Lake Wind Farm, July 2003-June 2004. Bars below data indicate number of surveys per week (blank = 0 surveys, short bar =1 survey, long bar = 2 surveys).

Bird carcasses were widely distributed away from the turbines (Figure 2), an average of 42.9 m from the turbine base (range = 1-105, SD = 29.1, median = 35 m).

No pattern of carcass distribution within the wind farm was apparent. Carcasses were recovered throughout the farm on all arrays except F, which comprised only 3 turbines. There was no relationship between habitat (cropland *vs.* native pasture) and all bird strikes ($\chi^2 = 0.143$, df = 1, P = 0.7055), passerine strikes ($\chi^2 = 0.073$, df = 1, P = 0.7867), or hawk strikes ($\chi^2 = 0.754$, df = 1, P = 0.3852).

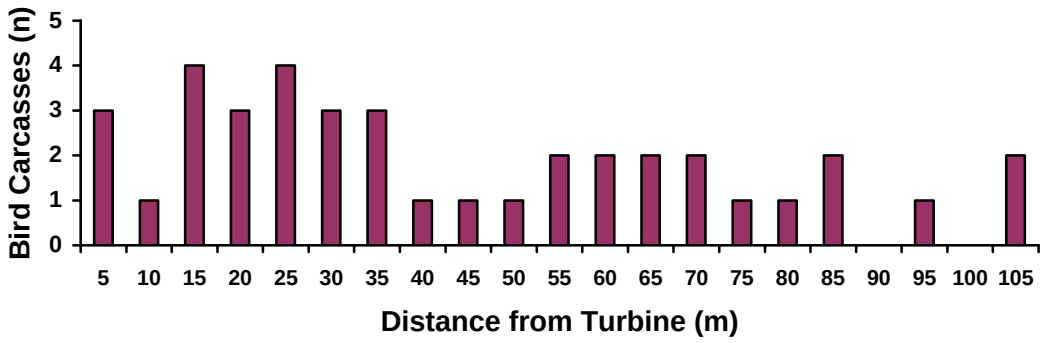

Figure 2. Distance of bird carcasses from turbines, McBride Lake Wind Farm, July 2003-June 2004.

Four species recovered are of special management concern including:

Western Grebe (n = 1) – Sensitive (ASRD 2000)
Swainson's Hawk (n = 7) – Sensitive (ASRD 2000)
Sharp-tailed Grouse (n = 2) – Sensitive (ASRD 2000)
Short-eared Owl (n = 2) – May Be At Risk (ASRD 2000);
Special Concern (COSEWIC 2004)

We recovered carcasses of 7 Swainson's Hawks during the 1-year monitoring period. Six were found in 2003 and 1 was found in 2004. All birds were either young-of-the-year or juveniles <2 years old. Of 116 observations of Swainson's Hawks within the wind farm in 2003-04, 20% were below rotor height, 40% were at rotor height, and the remaining 40% were above rotor height.

Necropsies

Most birds examined died as a result of blunt trauma to the body indicated by hemorrhaging, broken bones, and damage to the head and/or internal organs.

Bats

In 69 surveys of the 114 turbines at the McBride Lake Wind Farm between July 2003 and June 2004, we recovered 54 bat carcasses (Table 2). We recovered all bats between 4 August and 14 October, except for the single silver-haired bat found on 10 May 2004 (Figure 3). Hoary bats comprised 87% of all bats found.

Rate of recovery was 0.47 bats/turbine/year.

Table 2. Bat species recovered at turbines, McBride Lake Wind Farm, July 2003-June 2004.

Species	Scientific Name	Number
Little Brown Myotis	*Myotis lucifugus*	5
Big Brown Bat	*Eptesicus fuscens*	1
Hoary Bat	*Lasiurus cinereus*	47
Silver-haired bat	*Lasionycteris noctivagans*	1
Total		**54**

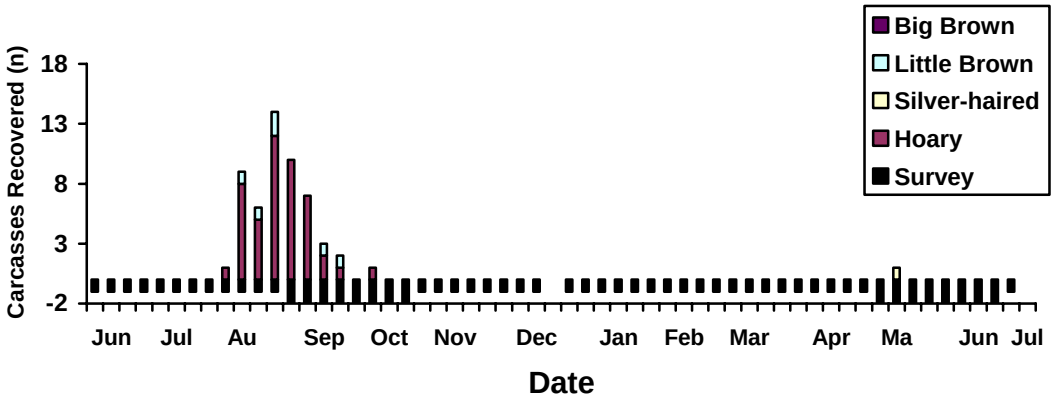

Figure 3. Timing of bat carcass recoveries, McBride Lake Wind Farm, July 2003-June 2004. Bars below data indicate number of surveys per week (blank = 0 surveys, short bar =1 survey, long bar = 2 surveys).

We recovered bat carcasses an average of 27.0 m (range = 0-61 m, SD = 14.4, median = 27 m) from the turbine base (Figure 4). Ninety percent of bats were recovered within 50 m of the turbines, and 67% (*n* = 36) were recovered NE, E, or SE of turbines (downwind of the prevailing winds).

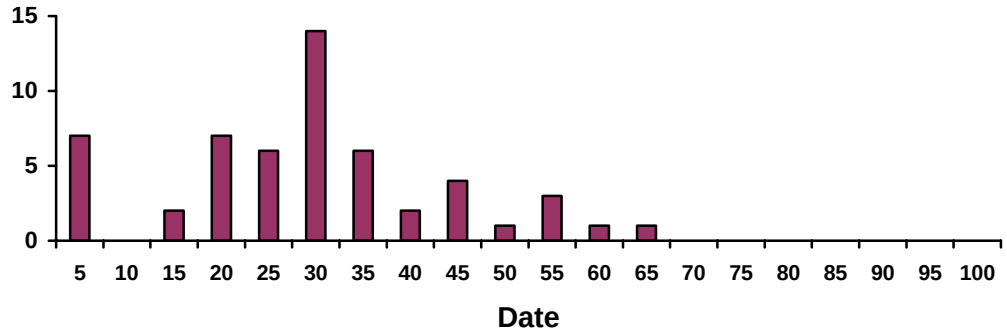

Figure 4. Distance of bat carcasses from turbines, McBride Lake Wind Farm, July 2003-June 2004.

As with birds, no pattern of carcass distribution within the wind farm was apparent. Bats were recovered throughout the farm on all arrays except F. We found bats at 42 of the 114 turbines, and no more than 3 at any one turbine. There was no relationship between habitat (cropland *vs.* native pasture) and bat strikes ($\chi^2 = 0.057$, df = 1, P = 0.8119). There are no other apparent topographic or habitat features that would influence bat activity within the wind farm.

All bats for which cause of death could be determined (n = 30) died as a result of severe trauma consistent with being struck by a turbine blade. Injuries included lacerations and bruising of the thorax or abdomen, multiple broken bones, severing of the spine, and, in extreme cases, decapitation or severing of the body. Many of the injuries were dorsal, on the backs of the animals.

Bats appeared otherwise healthy, with no obvious, chronic conditions that would make them more susceptible to collisions with turbines. Body condition (muscle mass and fat deposits) was fair to good, and stomachs were full of prey, indicating that the animals were feeding regularly. None of the 4 hoary bats tested showed evidence of rabies (based on immunohistochemistry using polyclonal antisera). No other evidence of disease involving the brain or abdominal

organs was apparent.

Numbers of adult and young-of-year hoary bats was about equal (Table 3). At least 3 adult male hoary bats were recovered.

Table 3. Age and sex of bats necropsied, McBride Lake Wind Farm, July 2003 – June 2004.

Hoary (n = 31)							**Little Brown** (n = 5)							**Silver-haired** (n = 1)					
Adult (n = 12)			Young-of-Year (n = 15)			U	Adult (n = 0)			Young-of-Year (n = 5)			U	Adult (n = 1)			Young-of-Year (n = 0)		
F	M	U	F	M	U		F	M	U	F	M	U		F	M	U	F	M	U
3	3	6	7	4	4	4	-	-	-	2	2	-	1	-	1	-	-	-	-

5.0 DISCUSSION

Birds

Our rate of recovery of 0.36 birds/ turbine/year, the McBride Lake Wind Farm was low relative to other sites. Of all studies conducted in the United States to 2000, mean mortality rates were 2.19 birds/turbine/year for all species, and 0.033 raptors/turbine/year (Erickson *et al.* 2001).

The low recovery rate of bird carcasses at the McBride Lake Wind Farm likely is representative of the actual collision rate. Ninety percent of all carcasses were within 70 m of turbines, well within our search area. We believe we observed most carcasses given the short, sparse vegetation present through most of the year. (However, we were more likely to overlook carcasses during a portion of August, after crops had grown to >40 cm tall.) In similar surveys elsewhere, search efficiency (proportion of carcasses recovered) averaged between 69% and 100% (Orloff and Flannery 1992; Tobin and Dolbeer 1990). We also believe scavenging of bird carcasses (carcass disappearance rate) was rare based on our relatively high recovery of bat carcasses (which we would expect to be scavenged at a similar rate), the infrequent presence of coyotes, behaviour of coyotes and other scavengers, and few carcass observations by on-site personnel.

Of the 4 species of special management concern, Swainson's Hawks presented the most concern. No trends in mortality were apparent for Western Grebe (1 killed), Sharp-tailed Grouse (2 killed), or Short-eared Owl (2 killed). Monitoring of a Sharp-tailed Grouse lek (dancing ground) indicated similar numbers of birds present before and after construction (Brown and Hamilton in prep.). One of the Short-eared Owls was located >100 m from turbines, immediately next to Highway 810, and may have been struck by a passing vehicle rather than killed by a turbine strike (although this could not be confirmed through necropsy).

Mortality of 7 Swainson's Hawks at the wind farm was unexpected. In comparison, only 2 raptors were recovered at the Castle River Wind Farm during a 2-year period (Brown and Hamilton in prep.). Neither of those birds was a Swainson's Hawk, although that species was the most common in the area. All birds collected during this study at McBride Lake were either young-of-the-year or juveniles, <2 years old, indicating that inexperience of the birds may have played a role.

Because of the relatively high rate of mortality, we observed Swainson's Hawks and recorded their behaviour throughout the year. The relatively high proportion observed flying at rotor height (40%) may indicate that this species may be prone to collisions. The greater the time spent in airspace at rotor height, the greater the potential for turbine strikes.
We had intended to closely monitor Swainson's Hawk activity within the wind farm in 2004;

however, few birds were present. Two nests within the wind farm were occupied by Ferruginous Hawks (*Buteo regalis*) in 2004. Ferruginous Hawks return on spring migration 1-2 months before Swainson's arrive and commonly displace Swainson's pairs. We closely monitored activity at the Ferruginous Hawk nests. Both pairs fledged 3 young in 2004. Surveys of nearby turbines indicated that no Ferruginous Hawks were killed as a result of turbine strikes. We will continue to monitor Swainson's Hawk activity at the adjacent Blue Trail Wind Farm to gather more information on the potential vulnerability of this species to collisions with wind turbines.

Bats

Our recovery rate of bats of 0.47 bats/turbine/year was 2-5 times lower than those at 3 facilities in the United States, as reported by Strickland (2001). In Oregon, Minnesota, Wyoming, and Washington, carcass recovery rates were 0.74, 2.3, and 2.48, bats/turbine/year, respectively. Because bat collisions with turbines only recently have become recognized as a potential concern, very few comparative data exist.

Provincial populations of the bat species we recovered, little brown, big brown, hoary, and silver-haired, are considered secure (ASRD 2000).

Bats we recovered within the wind farm appeared healthy otherwise, and did not demonstrate any conditions that may have made them more vulnerable to collisions with turbines by compromising their health. Rabies has been detected in hoary and little brown bats in Alberta (Pybus 1994); however, the 4 bats we tested were negative for rabies. Stomachs full of prey, good fat reserves, and good muscle condition also indicated bats were feeding normally, and generally were healthy.

There is no information on mechanisms of bat collisions with wind turbines. Bats were active at operational wind speeds, and injuries were consistent with the animals being hit by blades. Bats may echolocate in a cone that is too small to detect turbine blades through the full sweep of the blade's rotation. As a single blade moves into a bat's path, the animal may not perceive it until it is too late to avoid collision. This scenario is consistent with mortality of both adult bats and young-of-year at turbines. Flight experience and ability related to age would not be factors if the bats were hit by blades sweeping into their paths from beyond sonar range.

Other factors may be involved. Bats echolocate less when migrating than feeding, and may be more susceptible to collisions with turbines during migration (Keeley *et al.* 2001). Any ultrasonic sounds produced by turbines could interfere with echolocation, and may even be attractive (M. Pybus, AFWD, pers. commun.). Moths attracted to the turbines by light or heat may, in turn, attract hunting bats, although bats are presumed to feed less than usual when

migrating.

Hoary bats were the most-common species we recovered (63% of all bats; $n = 24$). In Alberta, hoary bats migrate northward in spring (May and June) from wintering areas in the southern United States and Mexico, spend summer in boreal forests of northern Alberta, and return southward in fall (August and September) (Barclay 1993; Pybus 1994). Hoary bats we recovered likely were migrating when they were killed; we did not begin to recover hoary bat carcasses until August. At other wind farms located in Oregon, Wyoming, and Minnesota, hoary bats also were the species most commonly found at turbines, ranging from 58-84% of all bat carcasses recovered (Strickland 2001).

We did not locate any hoary bat carcasses in spring when that species should have been moving northward. Migration routes in the province are not well understood, and the animals may use a different route in spring that does not take them through the region of the wind farm (M. Pybus, AFWD, pers. commun.).

Our finding of male adult hoary bats was unexpected. Males of that species most commonly remain in the western United States during summer (Pybus 1994). Few are captured as far north as Alberta (Barclay 1993).

We do not know if hoary bats were summer residents in our study area. Some individuals may stay to rear young rather than continue northward; however, no information exists regarding population densities, or even occurrence, of hoary bats in southern Alberta during summer (Barclay 1993).

Little brown bats and the big brown bat we recovered may have been a combination of resident and migratory individuals. Little brown is the most common species in Alberta (Pybus 1994), and is found throughout the province during summer. In fall, little brown bats migrate to the mountains to hibernate in caves or other suitable features, such as mines (Barclay 1993; Pybus 1994). Big brown bats hibernate in buildings or caves, usually in the vicinity of their summer range (Pybus 1994).

Authorities do not understand the significance to bat populations of mortality from turbine collisions. Some little brown bats killed may have been summer residents. Hoary and silver-haired bats likely were migratory. We do not know numbers of bats killed relative to their respective populations.

Vision Quest is cooperating with an international program coordinated by Bat Conservation International to assess bat mortality at wind energy facilities. Better understanding of bat collisions with turbines may be useful in future siting of wind farms to help avoid prime areas for

bat foraging and migration. Vision Quest also has engaged Dr. Robert Barclay, University of Calgary, to begin on-site investigations of bat interactions with turbines at their facilities in southern Alberta. Currently, we are assessing potential scope of those studies and testing recording equipment to monitor bat activity.

Searcher Efficiency/Scavenging Rates

The greatest potential sources of bias in our results are searcher efficiency (the proportion of existing carcasses located during a survey) and loss of carcasses to scavengers. We began developing methods to assess searchers' ability to detect carcasses, and to measure loss of carcasses to scavengers. To assess searcher efficiency, we placed bird and bat carcasses at locations unknown to the searcher along an array. Initial results indicate that searchers find over 70% of birds, and about 60% of bat carcasses; however, these trials involved a small sample size of carcasses (n = 16), and must be expanded and repeated before conclusions are possible.

Scavenging rates also must be accounted for. We saw very few scavengers such as coyotes during our surveys and, when snow cover was present, tracks indicated that the coyotes and other potential scavengers, moved directly through the study area. Very few tracks were seen around turbine bases, indicating the animals were not patrolling the wind farm in search of carcasses. Similarly, other potential scavengers, primarily Common Ravens (*Corvus corax*), Richardson's Ground Squirrels (*Spermophilus richardsonii*), and Thirteen-lined Ground Squirrels (*S. tridecemlineatus*), did not focus activity around tower bases. We reduced potential losses to scavengers by surveying 1-2 times per week compared with surveys often done every 2 weeks elsewhere (e.g., Ericson *et al.* 2001).

To assess scavenging rates, we will mark (at a distance) and leave carcasses used for searcher efficiency trials. We will then return to the site daily to record presence/absence of the carcasses and any signs of scavengers. Results will also be used to derive collision rates from carcass recovery rates.

6.0 CONCLUSIONS

Turbines at the McBride Lake Wind Farm were not a major hazard to birds during our study.

Our recovery rate of 0.36 birds/turbine/year (41 bird carcasses during 69 surveys over 12 months) is well below the average for all species of 2.19 birds/turbine/year killed at wind turbines throughout the United States (Erickson *et al.* 2001).

We recovered carcasses of 7 Swainson's Hawks that had collided with turbines (6 in 2003, and 1 in 2004). Given results from the nearby Castle River Wind Farm, this level of mortality was unexpected. Birds were young-of-the-year or juveniles, hatched the year previously indicating that inexperience may have contributed to collisions. The reduced number of collisions in 2004 indicated that this level of mortality may not occur every year. We will continue to monitor Swainson's Hawk activity in the region at the adjacent Blue Trail Wind Farm, proposed to be built in 2005.

We recovered 53 bat at the McBride Lake Wind Farm in 2003-2004. Migrating hoary bats comprised 87% (n = 47) of all carcasses recovered. We do not know the significance of this mortality to bat populations. Our estimated collision rate of 0.47 bats/turbine/year is 2-5 times lower than that reported for similar facilities in the western United Stated. Vision Quest is currently cooperating with an international program, coordinated by Bat Conservation International, to investigate bat collisions with wind turbines that may eventually allow a better understanding of those collisions and effective mitigation through better siting of wind farms to help avoid prime areas for bat foraging and migration. Vision Quest has also engaged Dr. Robert Barclay, University of Calgary, to begin on-site investigations of bat interactions with turbines at their facilities in southern Alberta.

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