Bird Monitoring at Toronto's Exhibition Place Wind Turbine

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In December of 2002, a modern, tall wind turbine was installed at Exhibition Place close to the lakeshore, in downtown Toronto. This was a joint venture of Toronto Hydro and WindShare, with the cooperation of Exhibition Place. By the close of 2003, this turbine had generated more than one million kilowatt hours of electricity for the city. This paper presents the results of a bird monitoring program undertaken in 2003 to assess the potential impact of the turbine on bird populations.

The turbine is a Dutch LW 52 Lagerwey 750 kw horizontal axis model, with a tower standing 94 m high. The variable pitch blades are 24 m long, and rotate at a maximum rate of 27 rpm. The generator is quiet enough that it would not interfere with normal conversation right below it. The distant songs and calls of White-throated and White-crowned Sparrows (see Appendix 1 for scientific names of birds) were audible when standing right below the turbine. The blades swish through the air, but make little more noise at ground level than the wind would be making in the trees. The noise of the blades, however, might be loud enough higher in the air to alert birds at close range to the presence of potential danger.

The turbine is at the western end of Exhibition Place, almost due south of the end of Dufferin Street, and just north of Lakeshore Boulevard. The turbine is surrounded by paved roadways and parking lots, and the open lawns with planted trees and shrubs of the Exhibition Place grounds. Buildings are 50 m to the northeast, just more than 50 m to the northwest, and about 70 m to the east. The open water of Lake Ontario lies about 100 m south, beyond Lakeshore Boulevard. Within 50 m of the tower are mainly open lawns that were kept closely mowed, and paved roadways. Immediately around the turbine was a circle of bark mulch. There were only a couple of small shrubby patches that would have been more difficult to search. Part of the lawn was overshadowed by the canopies of larger trees. About 15 percent of this area could not be searched directly because of a chain link fence separating the Exhibition Place from Lakeshore Boulevard. The lawns beyond the fence could be scanned from inside the fence.

PROCEDURES

Direct visual searches covered a 50 m

Figure 1: Exhibition Place wind turbine, Toronto, Ontario. Photo by *Toronto Hydro Corporation*.

radius around the turbine (except beyond the fence as noted). Searches started just after dawn and lasted about one hour each. The searcher (Coady) walked a pattern that covered the area at intervals of 5 m or less. The early start minimized the potential loss of any dead birds to diurnal scavengers such as crows, gulls, or squirrels, and avoided the possibility that people might find something.

Searches in spring were conducted twice a week over five weeks, from 27 April to 31 May. Autumn searches were three times a week for six weeks, 18 August to 27 September. Searches were spaced to get fairly even coverage (less so in spring), but were random with respect to weather. Many different conditions from full sun to light rain, and from calm to strong winds, were encountered. Notes were made about live birds and potential scavengers near the turbine.

A "removal by predators" study was conducted in conjunction with the searches, to assess potential losses of dead birds to predators prior to their being found on searches. In total, 50 dead birds were placed out within 50 m of the tower, 17 in spring and 33 in autumn. Thirty-one were small (warbler-sparrow size), 17 were medium-sized (thrush-jay size), and three were larger (woodcock-gull size). All birds were removed after a week or more, when no longer of much interest to a predator because of the state of decay.

RESULTS

Living birds

In total, 44 species of birds were noted on the ground or in trees and shrubbery near the ground, in or near the search area. The most numerous were Canada Goose, Ring-billed Gull, European Starling, Common Grackle, and House Sparrow. The most numerous and frequent were Ring-billed Gulls in parking lots, on lawns, or on nearby breakwaters, at almost every visit. They were found foraging on the lawns around the turbine at least a dozen times, with as many as 46 present. Through the weeks the exhibition was operating, they were attracted to the grounds every day.

European Starlings and Common Grackles were present almost every day. Starlings were observed gathering nest materials on the lawns below the operating turbine, and no doubt foraged close by every day. Canada Geese were close to the turbine on at least half the visits in the autumn, with as many as 31 present.

Less commonly seen species close to or on the ground included Rock Pigeon, American Crow, Golden-crowned Kinglet, Ruby-crowned Kinglet, American Robin, Cedar Waxwing, Chipping Sparrow, White-throated Sparrow, White-crowned Sparrow, Red-winged Blackbird, Brown-headed Cowbird, House Finch, and American Goldfinch. A pair of Red-winged Blackbirds nested in the shrubbery below the turbine blades.

Least often seen at or near the ground were Ruby-throated Hummingbird, Downy Woodpecker, Northern Flicker, Warbling Vireo, Red-eyed Vireo, Blue Jay, White-breasted Nuthatch, Brown Creeper, House Wren, Swainson's Thrush,

Hermit Thrush, Northern Mockingbird, Brown Thrasher, Tennessee Warbler, Yellow Warbler, Chestnut-sided Warbler, Magnolia Warbler, Black-throated Blue Warbler, Yellow-rumped Warbler, Blackburnian Warbler, Bay-breasted Warbler, Black-and-white Warbler, American Redstart, Ovenbird, Canada Warbler, and Song Sparrow.

On two occasions, Coady visited the Toronto Islands following a morning search at the turbine. On these occasions there were many wood-warblers seen on the islands, several hundred in one instance. But, only one species of wood-warbler had been noted in the trees near the turbine on each of these days. Numbers of wood-warblers were always small near the turbine.

In addition to birds seen on or near the ground, 22 species were noted flying near the turbine, at the height of the blades, when in operation. The most commonly seen were Ring-billed Gull, European Starling, Chimney Swift, American Crow, and Rock Pigeon. Flocks of Ring-billed Gulls arriving to forage on lawns and parking lots soon after dawn always took a flight path that clearly avoided coming close to the turbine. As with gulls, approaching Canada Geese took a flight path that avoided direct approach, going around the turbine before landing. They had obviously also adapted to the presence of the turbine prior to the start of this study.

A flock of Bobolinks was observed flying directly at the rotating blades, but easily changed course at close range and flew around. A group of 15 Chimney Swifts was cruising about foraging for some time one day, but they seemed well aware of the turbine and avoided coming too close. A single Red-breasted Nuthatch apparently flew right between the blades turning at about 20 rpm and was unharmed.

Other species seen flying near the turbine at blade height were Mallard, Double-crested Cormorant, Black-crowned Night-Heron, American Kestrel, Killdeer, *Calidris* sandpiper sp., Herring Gull, Great Black-backed Gull, Common Nighthawk, Northern Flicker, Tree Swallow, Cliff Swallow, Barn Swallow, Common Grackle, and American Goldfinch.

Scavengers/predators

The mammalian predators seen in the vicinity of the turbine were mainly Grey Squirrels (*Sciurus carolinensis*), as many as 15 in one day in autumn, and seen almost every day. There were as many as three free-roaming house cats (*Felis catus*) seen in the vicinity. Raccoons (*Procyon lotor*) were seen twice. Striped Skunks (*Mephitis mephitis*) were possible, though none were seen. The only one of these species regularly likely to be attracted to the open lawns and roadways of the turbine area would be the squirrels.

Few people were seen close to the tower in early morning. More were likely close-by during the 24th

of May celebrations or during the Canadian National Exhibition (CNE), but few people will pick up dead animals anyway. Dogs (*Canis familiaris*) were a possibility, though few were normally close, and they can be very inefficient at removing dead birds (James 2003).

Potential avian scavengers most likely were Ring-billed Gulls, present on many days and walking on the grass. Crows were also a possibility, but were fewer and typically passing at a distance.

Removal by predators study

Although fewer birds were placed out in spring, proportionately more were removed then, at a time when there were far fewer gulls and crows present. This suggests the squirrels were the main agent, at a time when their alternate food supply may have been scarce. Only 3 of 17 (18%) were removed within a week of placement.

In the autumn, when searches were more frequent, only one of 33 birds (3%) went missing within the 2 to 3 days before a second visit was made. However, 3 of 33 (9%) went missing within one week. This was at a time when gulls in particular were more numerous and squirrels were also more numerous, with young of the year. Apparently the squirrels were now more interested in seeds and nuts. Gulls, crows, and Raccoons were probably well supplied with junk food at the exhibition for part of the time, and apparently had more readily available food elsewhere. Given the potential number of scavengers present, particularly squirrels, there was relatively little scavenging.

If we consider all birds removed within one week of placement, only 12% were removed. This is probably a higher rate than should be used for the autumn period, at a time when most casualties might be expected (more nocturnal migrants than in spring), since searches were more frequent (only 3% went missing between searches). Search efficiency trials were not undertaken, since the area searched was almost all short grass or pavement that could be searched very easily. Even if something was overlooked one day, it probably would have been found on the next visit.

Avian mortality

The searches found one dead bird in spring and one in the autumn period. Both could have been local residents and not migrants. In spring, it was a European Starling on 14 May, and in autumn, an immature American Robin on 30 August.

DISCUSSION

Given the ground conditions, search efficiency was probably very high. Experience elsewhere has shown that under such conditions even individual feathers are readily found (James 2003). Nocturnal migrants are considered to be at greatest risk of collision with tall structures (although still at low risk

at structures less than 150 m high) as they are travelling in low light conditions. The chances of a collision with a wind turbine in daylight, even in coastal situations, is virtually zero (Crockford 1992, Pearson 1992, Winkelman 1995). The searches were conducted during periods of heaviest nocturnal migration, and were more frequent in autumn when inexperienced young of the year greatly enhanced numbers of nocturnal bird migrants.

None of the larger birds placed out were touched. If any larger bird had been hit by the turbine, it is probable that it would have been eaten in place, and remains would have been readily visible. This was the result with larger birds found by scavengers at the Pickering turbine. If the number of birds found dead (two) is adjusted by a predator removal rate of 12% (using all that disappeared within a week, both spring and autumn) and further adjusted by the 15% of the area that could not be searched directly, the total projected mortality is still fewer than three birds. The mortality estimate, assuming all mortality did occur during the study period, would probably not have exceeded three birds. If any additional mortality did occur outside the study period, it is unlikely to have been more than one additional bird.

Although mortality monitoring did not span the entire year, it covered the time of the year when mortality is most likely to occur. This is the period of heaviest migration of small nocturnal migrants. Michael Mesure (pers. comm.) of Fatal Light Awareness Program has pointed out that the ten top species in tall building kills in Toronto usually suffer the greatest mortality in October after the surveys at Exhibition Place had finished. However, several of the species of heaviest mortality at tall buildings are warblers, the vast majority of which have already left the province by the end of September. Why the remaining smaller numbers should be more susceptible in October is uncertain.

Other species suffering high mortality in October at tall buildings are later migrants. However, there is but a single flashing red light on the Exhibition Place wind turbine at night, and this is unlikely to compare with lighted tall buildings as an attractant to birds. Also, there were very few nocturnal migrants attracted to Exhibition Place compared to the Toronto Islands, because there is little habitat of interest at Exhibition Place. The study at the Pickering wind turbine (James 2003) did continue through October and November and no additional mortality of nocturnal migrants was recorded.

Mesure also indicated that most of these migrants killed in October at buildings were daytime casualties (86% in 2003). This clearly indicates that it is windows, and not just obstacles, that are the primary agent of mortality. Windows are not a factor at the wind turbine.

It seems unlikely to us that the later migrants would have suffered any mortality at the Exhibition Place wind turbine.

Many of the diurnal raptor migrants also pass through Toronto in October and November. However, these birds are moving in daylight with good visibility, conditions under which collisions with anything other than glass are highly unlikely. Many birds, particularly larger ones, are known to avoid flying within about 50 m of towers, particularly if there are moving parts (Faanes 1987, James 2003, this study). Even though diurnal migrants may be abundant in areas near communications towers, they are almost totally absent from tower kills where tens of thousands of nocturnal migrants are killed (Avery et al. 1978). Buteos and American Kestrels, for example, were commonly observed flying at turbine blade heights in a Minnesota wind farm (73 turbines) and none were known to have been killed through 20 months of continuous monitoring (Osborne et al. 1998).

Mesure has also pointed out that Ring-billed Gulls usually just grab small birds and depart, leaving no trace such as feathers, evident with mammalian predation. However, while gulls regularly foraged on lawns and parking lots adjacent to the search area, they did not ordinarily come into the search area. They typically avoided the turbine, as they also did at Pickering (James 2003). They certainly were not a factor in removing placed-out birds through September. They are much more likely to be a removal factor where they have learned there is a more constant supply of food, such as at tall downtown buildings.

The mortality experienced at the wind turbine is only a tiny fraction of the numbers of birds regularly occurring in the area. The local birds seemed well aware of the turbine and lived around it much as usual. Nocturnal migrants were probably relatively few in the immediate vicinity because of the built-up nature of the area. The mortality is closer to that of individual houses where birds hit windows at a rate of between one and 10 per year on average, and much higher at some rural area homes surrounded by trees (Klem 1990, Dunn 1993).

The level of mortality experienced at the Exhibition Place wind turbine is absolutely insignificant when compared with the thousands of birds killed annually in Toronto at tall buildings (Evans Ogden 1996; www.flap.org). Each of the free-roaming cats seen are capable of killing as many as 1000 small animals per year, including birds (Coleman and Temple 1993). Each free-roaming cat in Toronto probably kills more birds per year than the Exhibition Place wind turbine did in 2003.

Although mortality at the turbine is likely to vary from year to year, it is unlikely to exceed the low level of 2003 by any significant

amount and could be lower. Large mortality events at wind turbines in North America have never been reported, and they are unlikely in future (Erickson et al. 2001). The Exhibition Place wind turbine will not have a significant direct impact on bird populations, but could have a very significant indirect impact through providing clean energy to the city.

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Appendix 1: Scientific names of bird species.

Double-crested Cormorant, *Phalacrocorax auritus*
Black-crowned Night-Heron, *Nycticorax nycticorax*
Canada Goose, *Branta canadensis*
Mallard, *Anas platyrhynchos*
American Kestrel, *Falco sparverius*
Killdeer, *Charadrius vociferus*
American Woodcock, *Scolopax minor*
Ring-billed Gull, *Larus delawarensis*
Herring Gull, *Larus argentatus*
Great Black-backed Gull, *Larus marinus*
Rock Pigeon, *Columba livia*
Common Nighthawk, *Chordeiles minor*
Chimney Swift, *Chaetura pelagica*
Ruby-throated Hummingbird, *Archilochus colubris*
Downy Woodpecker, *Picoides pubescens*
Northern Flicker, *Colaptes auratus*
Warbling Vireo, *Vireo gilvus*
Red-eyed Vireo, *Vireo olivaceus*
Blue Jay, *Cyanocitta cristata*
American Crow, *Corvus brachyrhynchos*
Tree Swallow, *Tachycineta bicolor*
Cliff Swallow, *Petrochelidon pyrrhonota*
Barn Swallow, *Hirundo rustica*
Red-breasted Nuthatch, *Sitta canadensis*
White-breasted Nuthatch, *Sitta carolinensis*
Brown Creeper, *Certhia americana*
House Wren, *Troglodytes aedon*
Golden-crowned Kinglet, *Regulus satrapa*
Ruby-crowned Kinglet, *Regulus calendula*
Swainson's Thrush, *Catharus ustulatus*
Hermit Thrush, *Catharus guttatus*
American Robin, *Turdus migratorius*
Northern Mockingbird, *Mimus polyglottos*
Brown Thrasher, *Toxostoma rufum*
European Starling, *Sturnus vulgaris*
Cedar Waxwing, *Bombycilla cedrorum*
Tennessee Warbler, *Vermivora peregrina*
Yellow Warbler, *Dendroica petechia*
Chestnut-sided Warbler, *Dendroica pensylvanica*
Magnolia Warbler, *Dendroica magnolia*
Black-throated Blue Warbler, *Dendroica caerulescens*
Yellow-rumped Warbler, *Dendroica coronata*
Blackburnian Warbler, *Dendroica fusca*
Bay-breasted Warbler, *Dendroica castanea*
Black-and-white Warbler, *Mniotilta varia*
American Redstart, *Setophaga ruticilla*
Ovenbird, *Seiurus aurocapilla*
Canada Warbler, *Wilsonia canadensis*
Chipping Sparrow, *Spizella passerina*
Song Sparrow, *Melospiza melodia*
White-throated Sparrow, *Zonotrichia albicollis*
White-crowned Sparrow, *Zonotrichia leucophrys*
Bobolink, *Dolichonyx oryzivorus*
Red-winged Blackbird, *Agelaius phoeniceus*
Common Grackle, *Quiscalus quiscula*
Brown-headed Cowbird, *Molothrus ater*
House Finch, *Carpodacus mexicanus*
American Goldfinch, *Carduelis tristis*
House Sparrow, *Passer domesticus*

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OFO Annual Convention and Banquet
Oakville, Ontario
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