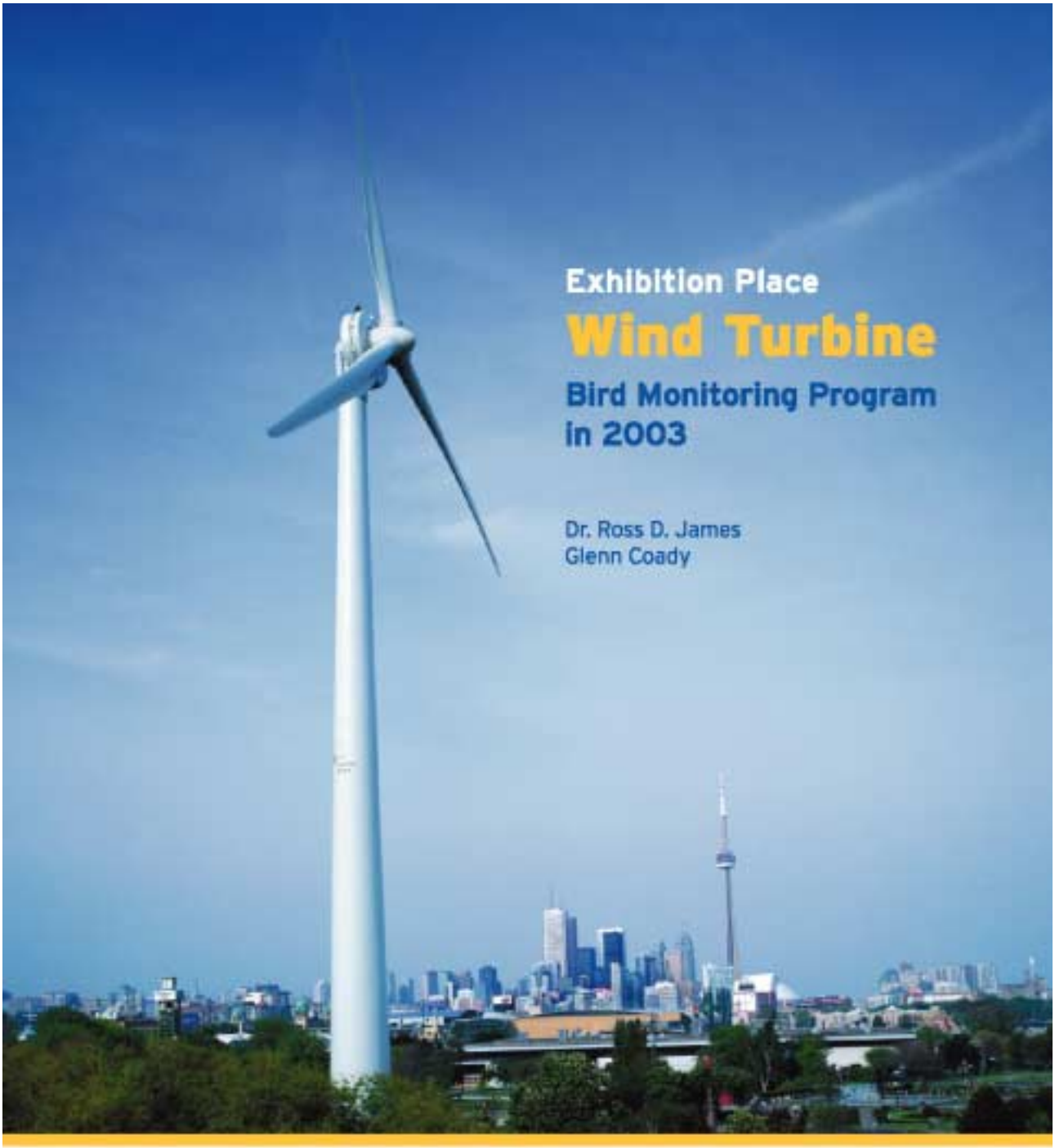

Exhibition Place
Wind Turbine
Bird Monitoring Program in 2003

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Report to Toronto Hydro Energy Services Inc.
and WindShare - December 2003

WindShare

toronto hydro energy services

Exhibition Place Wind Turbine
Report on Bird Monitoring in 2003

Table of Contents

Executive Summary

In late 2002, a 94 m high, 750 kW wind turbine was installed at the western end of the Canadian National Exhibition grounds in Toronto. It was placed in an area surrounded immediately by paved roadways, and mown lawns with a number of trees and a few shrubs. Beyond that to the north the buildings and roadways of the CNE grounds, and the city of Toronto form the main environment. To the south is the Lakeshore Boulevard and Lake Ontario.

Searches were made twice a week over a 5-week period in late April and May, and three times a week over a 6-week period mid August to the end of September. The searches covered a 50 m radius around the turbine, except for a part in the south excluded by a fence. Fifty dead birds were also placed out to estimate the predator removal rate. Since the area was largely clear of vegetation, searching was anticipated to be very efficient.

Only two dead birds were found, one in spring and one in autumn. Both species involved were probably local resident birds. With the relatively low predator removal rate, much lower in autumn when mortality might be expected to be highest, and when searches were more frequent, it is probable that no birds were missed by the searcher. The total mortality for the year is unlikely to have exceeded three birds.

Local birds appeared to have adapted easily to the presence of the turbine, and simply avoided it. The rate of mortality is absolutely insignificant when compared to the thousands that are killed each year in Toronto at tall buildings. The study indicates clearly that the wind turbine at the CNE is not going to have any significant impact on bird populations.

Introduction

This report presents the results of a monitoring program at the Canadian National Exhibition (CNE) around the wind turbine installed there as a joint venture of Toronto Hydro and WindShare in December 2002. The purpose of the monitoring program was to estimate the bird mortality associated with the presence of this turbine. The program operated in the main migration seasons for small nocturnal migrants, both spring and autumn, when there was the greatest potential for avian mortality.

The Study Site

The wind turbine was placed toward the western end of the CNE grounds, almost due south of the end of Dufferin Street, and just north of Lakeshore Boulevard. The turbine is surrounded by the paved roadways, and open lawns with planted trees and shrubs, of the CNE grounds. The CNE buildings are to the north and east of the turbine, and farther to the north is the city itself. About 100 m to the south, beyond the Lakeshore Boulevard, is the open water of Lake Ontario. Ontario Place, jutting out into the lake, lies just to the east of the site.

Within a 50 m radius of the wind turbine there are mainly open lawns and paved roadways. The lawns are mowed most places, with only a couple small shrubby patches that would have been more difficult to search. Part of the lawn area was overshadowed by the canopies of larger trees, that could be attractive to birds. However, there was also open lawn area that attracted gulls and other ground foraging birds. There was a building just 50 m to the northeast, one just more than 50 m to the northwest, and the smaller Scadding Cabin about 70 m to the east. To the south of the tower, about 26 m from it was a high chain link fence separating the CNE grounds from the busy Lakeshore Boulevard. Thus, an entire 50 m radius could not be searched. The lawns between the fence and the road could be scanned from inside the fence, but were not walked. Overall about 15 % of the total area within 50 m could not be directly searched.

The Turbine

The wind turbine is a Lagerwey LW 52, 750 kW model, with a tower standing 94 m high. The variable pitch blades are 24 m long. The rotation speed is 27 rpm at maximum speed. The generator is very quiet, and not disturbing when standing below. The blades sweeping through the air create the main relatively quiet sound, not loud enough to interfere with normal conversation. The noise could, however, alert closely flying birds to the presence of potential harm.

Procedures

Monitoring

Direct visual searches covered a 50 m radius around the turbine (except along the south edge as noted). The searches started just after dawn and lasted about one hour each time. 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 gulls and squirrels, or avoided the possibility that people might find something.

Searches in spring were conducted twice a week from 27 April to 31 May (10 searches). In the autumn searches were three times a week from 18 August to 27 September (18 searches). Searches were spaced to get as even a coverage as possible (less even in spring), but were random with respect to weather conditions. Weather did not inhibit searches and many different conditions were encountered, from full sun to continuous light rain, from calm to strong winds. Notes were also made on birds seen in the area, and of any potential predators that might remove birds.

Predator Removal Study

This study was conducted to assess the potential for removal of dead birds by predators prior to their being found on searches. Dead birds were placed out within 50 m of the turbine on a variety of ground covers. A total of 50 birds was placed out, 17 in spring and 33 in autumn. Thirty one of the birds were small (warbler-sparrow size), 16 were medium size (jay–thrush size), and 3 were larger (woodcock-gull size). All birds were removed after a week or more, by the searcher, when no longer of much interest to a predator because of the state of decay.

Results

Bird Behaviour

Many birds were seen in the area of the wind turbine in the course of the monitoring. One of the most numerous and frequent was Ring-billed Gull. They were in the parking lots and on lawns, or on nearby breakwaters at almost every visit. They were found foraging on the lawn close to the turbine about a dozen times, with as many as 46 birds present. They were also seen flying about close to the turbine at the height of the blades at least 10 times. Hundreds were often in offshore areas, and could easily have come ashore. Through the weeks when the exhibition was operating, they were attracted to the grounds on every day. Flocks arriving daily to forage on lawns and parking lots soon after dawn always took a flight path that clearly avoided coming close to the turbine. They flew either east or west of the turbine until they were north it before landing nearby to the north.

European Starlings and Common Grackles were about the turbine most days. Starlings were observed gathering nest material below the operating turbine, and no doubt foraged on the lawns close by every day. A pair of Red-winged Blackbirds also nested in the shrubbery below the operating turbine.

Canada Geese were close to the turbine on at least half the visits in the autumn, and as many as 31 were seen foraging on the lawns below the turbine blades. As with gulls, the geese took a flight path that clearly avoided a direct approach to the turbine,

going around it before landing. They had obviously adapted to the presence of the turbine prior to the present study.

A flock of Bobolinks were observed on one occasion flying directly at the operating turbine, but easily changed course at close range and flew around it.

In total, 44 species were noted on the ground or in the bushes and trees around the base of the turbine. Table 1 lists the species seen, the number of times each was seen in the monitoring area, and the maximum number seen.

On two occasions the searcher visited the Toronto Islands following the morning search at the turbine. On these occasions there were many wood warblers seen on the islands, several hundred in one instance. On these two days only one species of warbler was noted about the turbine each time. Although 12 species of wood warblers were seen while monitoring, the numbers were always small.

In addition to birds seen on or near the ground, 22 species were noted flying near the turbine blades when in operation, and at the height of the blades. The most common species were Ring-billed Gull, European Starling, Chimney Swift, American Crow, and Rock Pigeon. In one instance 15 Chimney Swifts were cruising about foraging for some time. They appeared to be well aware of the turbine and purposely avoided coming too close. A single Red-breasted Nuthatch apparently flew right through the operating turbine blades moving at 20 rpm and came to no harm. Table 2 lists the species seen flying in the vicinity of the turbine blades, at the height of the blades, the number of times each was seen, and the maximum number seen.

Table 1. Birds seen on the ground, or in shrubs and trees within 50 m of the CNE wind turbine tower in spring and autumn search periods in 2003. Numbers following the names indicate the minimum number of times each was seen on 28 visits followed by the maximum number seen.

Canada Goose, *Branta canadensis* 8 – 31
Ring-billed Gull, *Larus delawarensis* 11 – 46
Rock Pigeon, *Columba livia* 9 – 6
Ruby-throated Hummingbird, *Archilochus colubris* 1 – 1
Downy Woodpecker, *Picoides pubescens* 1 –1
Northern Flicker, *Colaptes auratus* 2 – 2
Warbling Vireo, *Vireo gilvus* 1 – 1
Red-eyed Vireo, *Vireo olivaceus* 1 – 1
Blue Jay, *Cyanocitta cristata* 1 – 3
American Crow, *Corvus brachyrhynchos* 6 – 9
White-breasted Nuthatch, *Sitta carolinensis* 2 – 1
Brown Creeper, *Certhia americana* 1 – 1
House Wren, *Troglodytes aedon* 1 – 1
Golden-crowned Kinglet, *Regulus satrapa* 1 – 8
Ruby-crowned Kinglet, *Regulus calendula* 4 – 3
Swainson's Thrush, *Catharus ustulatus* 1 – 1
Hermit Thrush, *Catharus guttatus* 1 – 1
American Robin, *Turdus migratorius* 14 – 6
Northern Mockingbird, *Mimus polyglottos* 2 – 1
Brown Thrasher, *Toxostoma rufum* 1 – 1
European Starling, *Sturnus vulgaris* 13 – 20+
Cedar Waxwing, *Bombycilla cedrorum* 5 – 13
Tennessee Warbler, *Vermivora peregrina* 2 – 1
Yellow Warbler, *Dendroica petechia* 1 – 1
Chestnut-sided Warbler, *Dendroica pensylvanica* 1 – 1
Magnolia Warbler, *Dendroica magnolia* 2 – 1
Black-throated Blue Warbler, *Dendroica caerulescens* 1 – 1
Yellow-rumped Warbler, *Dendroica coronata* 3 – 1
Blackburnian Warbler, *Dendroica fusca* 1 – 1
Bay-breasted Warbler, *Dendroica castanea* 1 – 1
Black-and-white Warbler, *Mniotilta varia* 1 – 1
American Redstart, *Setophaga ruticilla* 1 – 1
Ovenbird, *Seiurus aurocapilla* 1 – 1
Canada Warbler, *Wilsonia canadensis* 1 – 1
Chipping Sparrow, *Spizella passerina* 3 – 2
Song Sparrow, *Melospiza melodia* 1 – 1
White-throated Sparrow, *Zonotrichia albicollis* 5 – 6
White-crowned Sparrow, *Zonotrichia leucophrys* 3 – 5
Red-winged Blackbird, *Agelaius phoeniceus* 7 – 4
Common Grackle, *Quiscalus quiscula* 14 – 11
Brown-headed Cowbird, *Molothrus ater* 3 – 3
House Finch, *Carpodacus mexicanus* 4 – 2
American Goldfinch, *Carduelis tristis* 7 – 4
House Sparrow, *Passer domesticus* 7 – 26

Table 2. Bird species seen in the air flying close to the CNE wind turbine at turbine blade height, in spring and autumn of 2003. The numbers following the names indicate the minimum number of times each was seen, followed by the maximum number seen.

Canada Goose 2 – 11
Mallard, *Anas platyrhynchos* 1 – 3
Double-crested Cormorant, *Phalacrocorax auritus* 2 – 14
Black-crowned Night-Heron, *Nycticorax nycticorax* 1 – 1
American Kestrel, *Falco sparverius* 2 – 1
Killdeer, *Charadrius vociferus* 2 – 1
Sandpiper sp? *Calidris* sp. 1 – 11
Ring-billed Gull 10 – 10
Herring Gull, *Larus argentatus* 4 – 2
Great Black-backed Gull, *Larus marinus* 1 – 1
Rock Pigeon 6 – 2
Common Nighthawk, *Chordeiles minor* 2 – 1
Chimney Swift, *Chaetura pelagica* 9 – 15
Northern Flicker 1 – 1
American Crow 7 – 2
Tree Swallow, *Tachycineta bicolor* 1 – 2
Cliff Swallow, *Petrochelidon pyrrhonota* 2 – 18
Barn Swallow, *Hirundo rustica* 2 – 2
Red-breasted Nuthatch, *Sitta canadensis* 1 – 1
European Starling 8 – 27
Common Grackle 2 – 6
American Goldfinch 2 – 5

Predators

The mammalian predators seen in the vicinity of the turbine were mainly gray squirrels – as many as 15 on one day in autumn – and seen most every day. There were as many as 3 feral cats seen on a few occasions. Raccoons were seen twice. People walking or jogging were not likely to have removed birds, except perhaps during periods when the CNE was in operation or during the 24th of May celebrations when there were many more people about. But, most people would not pick up a dead bird anyway. The few people seen early in the morning were generally at some distance from the turbine. Dogs were a possibility, although relatively few would likely be in the area normally, and they can be very inefficient at finding dead birds (James 2003). Skunks were a possibility although none were seen.

The avian predators most likely to be active were the Ring-billed Gulls that were about on many days and walking on the grass some days. Crows were also a possibility, but were much less numerous.

Predator Removal Study

Although fewer birds were placed out in the spring, more were removed then, at a time when there were far fewer gulls and crows hanging about. Of the 17 birds placed out in spring, only 2 disappeared before the second visit, but the interval varied from 2 to 7 days. Three more were still present after 2 days, but later disappeared. One other was still present on a second visit after 5 days, and subsequently disappeared. A sixth bird was also present after 5 days and two visits, but was partly consumed at that time. In total 6 of 17 birds (35 %) placed out in spring were found by predators and removed within 10 days. However, only three (18 %) were removed within one week.

In the autumn, when visits were more frequent, only one of 33 birds (3 %) went missing within 2 – 3 days before a second visit was made. One disappeared between 3 and 5 days of being placed out, and one between 5 and 8 days of placement. With the more frequent searches in autumn there was never a gap between searches of more than 3 days. The chances of a predator removing a bird in a 2 – 3 day period after being place out was only 3 %. Thus the chances of any bird being hit by the turbine and being removed in the same 2 – 3 day period search intervals should not have been any greater.

With the difference in search frequency in spring and autumn, it is difficult to compare results from the two periods. The smaller removal rate in autumn suggests that even though there were more predators about, other food was more readily available to the predators. Squirrels now were busy with nuts, while gulls, crows, and raccoons were probably well fed by junk food at the CNE grounds, or had more easily available food elsewhere.

If we consider only birds that disappeared within a week, of those that were there for at least a week (3 of 11 in spring, and 3 of 33 in autumn), the predator removal rate would be 12 %. This is probably high for the autumn when most casualties might be

expected. However, it is also possible that any one bird casualty, if present, could have been overlooked one day and not found until later if still present. A search efficiency study was not done because the grass was maintained closely cut and could be searched very efficiently. Only a few shrubby places could have offered much concealment.

Avian Mortality

The searches in spring found only one dead bird, a European Starling on 14 May. A large bruise on the right pectoral muscles and extensive hemorrhaging in the heart-lung area indicated a strong blunt blow to the body, probably delivered by a turbine blade.

Searches in the autumn also found only one dead bird, an immature American Robin on 30 August. The skull was smashed across the width, leaving a deep trough across the head, suggesting a blade hit across it.

Both of those could well have been local resident species, and not birds on migration.

Projected Total Avian Mortality

The conditions on the ground, with bare pavement and mown lawns for the most part, suggest that search efficiency was probably very high. Experience elsewhere has indicated that under such conditions even individual feathers are readily found (R. James, pers. obs.).

Searches were most frequent at the time of year when casualties were most likely – in the autumn migration period, when young birds of the year greatly enhance numbers of birds on migration, and when many more birds are moving through the area. Nocturnal migrants are considered to be at highest risk (although still a very low risk), as they are travelling during relatively low light conditions at night (Crockford 1992, Pearson 1992, Winkelman 1995). None of the larger birds placed out in the predator removal study 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 all large birds placed out at the Pickering turbine (R. James, pers. obs.).

Predators found and removed more birds in spring, and autumn removal was small. Even if we use a predator removal rate of 12 % (all that disappeared within a week), it is unlikely that more than one additional casualty might have been expected (2 birds adjusted by removal rate – 12 % - and the proportion of the area not searched – 15 %). The expected number of casualties would still be below 3 birds if we adjusted the one spring casualty by all six that disappeared (35 %) and added the one in autumn adjusted by all three that disappeared (9 %).

The chances of a collision at a wind turbine in daylight in good weather are virtually zero, and the greatest risk to birds is at times of heaviest nocturnal migration, and even then it is only in times of bad weather when some mortality (a tiny fraction of

the passing birds) might occur (Crockford 1992, Pearson 1992, Winkelman 1995). Yet during the main migration season for small birds, only two birds were found dead. The projected total mortality for the period is less than 3 birds. It is very unlikely that for the entire year the total mortality exceeded 3 or 4 birds.

Impact of the CNE Wind Turbine on Bird Populations

The mortality monitoring, although not spanning the entire year, covered the times of the year when mortality was likely to occur at all. The mortality estimate, assuming all mortality did occur during the study periods, would probably not have exceeded three birds all year. This mortality 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, and none were impacted. The mortality experienced is closer to that of individual houses where birds hit windows at a rate of between one and ten per year (and much higher at some houses)(Klem 1990, Dunn 1993).

The level of mortality experienced at the wind turbine in 2003 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 feral cats seen are capable of killing as many as 1000 small animals per year, including birds (Coleman and Temple 1993) and each would have killed more than the wind turbine, probably far more. Every free roaming cat in Toronto probably kills more birds per year than the CNE wind turbine killed.

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. Large mortality events at wind turbines in North America have never been reported and they are unlikely in future (Erickson et al. 2001). The CNE wind turbine will not have a significant impact on bird populations.

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