A Study of the Potential Effects of a Small Wind Turbine on Bird and Bat Mortality at Tom Ridge Environmental Center Erie, Pennsylvania

A Report Prepared for Pennsylvania Department of Conservation and Natural Resources

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INTRODUCTION

In 2006 the Pennsylvania Department of Conservation and Natural Resources (DCNR) elected to place a 10 kW wind turbine at Tom Ridge Environmental Center (TREC) and six other environmental centers within the commonwealth for the purpose of enhancing public education about alternative energy sources. The 120 ft. unit was erected in early May, 2007 (Fig. 1, 2). Because there is evidence of bird and bat kills at some sites with much larger generating turbines (mW) (e.g., http://www.abcbirds.org/conservationissues/threats/energyproduction/wind.html) the DCNR wanted to know if there was reason to be concerned about erecting smaller units. A survey for literature that addressed this issue revealed no formal studies and only a few anecdotal reports which indicated that they do not present a threat to birds and bats (e. g.,www.bergey.com/; http://www.awea.org/smallwind/faq_general.html#Dosmallwindturbineskillbirds).

An investigation of the effect of the wind turbine unit at TREC on bird and bat mortality was initiated in fall, 2006 and continued through spring, 2008. Besides monitoring for carcasses of birds and bats in the vicinity of the tower, the study determined what species of birds and bats occurred in the immediate area and evidence of their activity near the tower. This report provides an overview of the study and its results while specific investigations on bird and bat activities at the site continue to be analyzed for subsequent publication.

THE STUDY AREA

The TREC is located on a bluff near Lake Erie (42.1098^{o}N, 80.1538^{o}W) near the entrance to Presque Isle State Park (PISP), Erie County, Pennsylvania. Its location

occupies the site of a former outdoor movie theater. To its north the terrain drops steeply into Scott Run which drains into Presque Isle Bay. Deciduous trees and shrubs dominate the vegetation of the slope and a narrow band of trees occur on the lip of the bluff (Fig. 3, 4). A seven acre parking lot designed to accommodate several hundred vehicles and landscaped with young native trees, shrubs, and herbaceous plants occupies space to the south of TREC, while the wind turbine stands on a grassy knoll approximately 35 yards to the southeast of the building (Fig. 1).

METHODS

Survey of birds

Two types of bird surveys were conducted. One was through direct observations with identifications made by either sight or song recognition. Observations were made as the surveyor slowly walked through the area over a period of one hour per visit. Multiple visits were made monthly from October, 2006 through early October, 2007 (Table 1). Besides the identification of species present their activity and habitat usage were also recorded (Table 2).

The other survey involved the recording of the night flight calls of migrating birds through the use of microphones mounted on the roof of TREC (Figs. 5, 6) during the periods of 1 June-11 October, 2007 and 17 April-16 June, 2008. The calls were recorded and stored on computers for later analysis (Fig.7). The construction of microphones followed the general design presented by Old Bird (2005). Four of these microphones were placed on the roof for monitoring in 2007. In spring, 2008 the monitoring was switched to one microphone mounted on the top of the TREC observation tower and one on the theater roof.

Survey of bats

The presence of bats was determined at night by recording their ultrasound calls through the use of an AR 125 Ultrasonic Receiver (Binary Acoustic Technology) and laptop computer. The system was programmed to turn on each night near sunset and to turn off near sunrise. Recordings were made from 5 June-29 October, 2007 and 20 April-15 July, 2008. The system was mounted approximately 8 ft. off ground under the protection of a loading port roof at TREC and was approximately 28 yards from the base of the tower. The detector was contained within weather proof housing and was aimed to collect high frequency sounds from an area between the port and the wind turbine (Fig. 8).

Search for carcasses

Searches for carcasses of birds and bats was initiated on 25 May, 2007 and continued on a nearly daily basis through 7 July 2008 when the study ended (DCNR employees continue to monitor the site daily as of this writing). The search area included the mowed grassy area around the turbine tower and part of the adjacent parking lot (Fig. 1). Its perimeter was roughly a radius of 30 yards from the tower base. The survey was conducted by walking along lines approximately 10 ft. apart in early morning and sometimes at night to help ensure that specimens were not removed by scavengers before the morning check. Nocturnal surveys, requiring approximately 1 hour per visit, were conducted May and June, 2007 on the following dates and times: 11:00 pm---June 1,2,4,8,9,11,12,14-17,24-28; 11:30 pm---May 25,27,30,31, June 1; 3:00 am---May 29, June 1,2,14,16,19-22. Because May and June are months of heavy migration, the morning surveys occurred at sunrise to mitigate the possibility of carcasses being removed by scavengers. Otherwise, morning surveys were generally conducted between the hours of 7:00 and 8:00 am.

The possible presence of scavengers was monitored with an infra-red motion sensing camera (Silent Image, Model RM30) installed near the facility in such a way as to cover a portion of area between the bluff and tower. It was operational on 14 nights from 29 May through 30 June, 2007.

RESULTS

One bird, a common grackle (*Quiscalus quiscula*) was found dead in the search area on 2 July, 2008 and sent to the Pennsylvania Game Commission for evaluation. The cause of its demise is undetermined but no external injuries were noted. No other bird or bat carcasses were noted throughout this study.

The survey camera was limited to scanning roughly one quarter of the total area being surveyed for carcasses. During the 14 nights of running it recorded a white-tailed deer (*Odocolieus virginianus*) on 29 May, a raccoon (*Procyon lotor*) on 12 June, and a woodchuck (*Marmota monax*) on 22 June. Throughout the study raccoons and striped skunks (*Mephitis mephitis*) were occasionally noted by the author and anecdotal reports of the presence of these species in the vicinity were given by employees of TREC. No other potential scavengers such as fox and feral cats were seen at the site.

Over 250 species of birds have been reported being present at Presque Isle State Park (McWilliams and Brauning, 1999), and because of the close proximity of TREC to PISP it is probable that at some time many of these could be present or at least fly over the study area. Our inventory of the site revealed the presence of at least 83 species, of which 19 species gave evidence of using the general area of the site during the period of reproduction (Table 1). A small colony of bank swallows (*Riparia iparia*) nested in a bank close to the tower during summer 2007 and 2008 (Fig. 9). Many individuals of this species were often observed aerial feeding on a regular basis at the height of the turbine

and close to it. During the survey approximately 35 percent of all bird species were in flight and 12 percent were observed at heights of 75 feet or greater. The majority were observed feeding or resting in vegetation or ground (Table 1).

Unfortunately, the sensitivity of the four microphones installed to record nocturnal flight calls appear to have been enough different to prevent comparisons between them (Lanzone, et. al., 2007). However, based primarily on results from one microphone, number 1 (Fig. 5), the number of calls averaged highest just prior to sunrise and were lowest in early night hours. In fall, 2007 the peak in call rates occurred in mid September and tapered to few by 11 October. A mix of sparrows, warblers, and thrushes made up the vast majority of the calls. Recordings for spring, 2008 are still being analyzed and preliminary results show that from mid-April through mid-June there was a steady movement of migrant songbirds (warblers, sparrows and thrushes) over the site (Lanzone, in prep). Calls were recorded every night from 18 April through 12 June but the number of calls recorded dropped to just 1-7 per night after 24 May. The highest number of calls recorded in one night was the night of 1 May with 200 calls. An average of 34 calls was recorded 18 April-24 May. Additional calls of unidentified shore birds were recorded in low numbers in May and June as well.

Nightly activity of bats was recorded at the site beginning in mid-April and ended in mid- October. Bat activity was recorded nightly From 5 June until 29 October, 2007. Nightly recordings were resumed on 19 April, 2008 and continued through 7 July, 2008. The six species that were tentatively identified through call identification include hoary bat (*Lasiurus cinereus*), red bat (*Lasiuris borealis*), silver-haired bat (*Lasionycteris noctivagans*), eastern pipistrell (*Pipistrellus subflavus*), big brown bat (*Eptesicus fuscus*),

and little brown bat (*Myotis lucifugus*). The identity confirmation and activity of these species during the periods of recordings is currently under study (Andersen, in prep).

DISCUSSION

Evidence from this study suggests that the probability of bird and bat mortalities being caused by collisions with small monopod wind turbines is low. The apparent absence of multiple deaths of birds or bats at the other six sites (H. Leslie, pers. comm.) supports this evidence. At the TREC site a diversity of songbirds are using the area daily without turbine related casualties (Table 1, 2) and the same is apparent with bats that are active nightly during their seasonal occurrence (Andersen, in prep).

That some birds and bats may have been killed by colliding with the unit but not found during daily surveys is possible. The confirmation of the presence of raccoon and striped skunk at the site on occasion suggests that carcasses could have been scavenged by these mammals. However, on the few occasions that skunk were known to be present they would be searching the ground for grubs and other invertebrates. When observed, the raccoons always appeared to be in transit rather than searching for food. Although the elevation of flight for migrating birds at night was not ascertained for the site, it is generally shown that they are above 100 meters (see Barclay, et al, 2007). An exception may be when very low clouds would cause them to fly lower. Such conditions were not recorded at the site during this investigation. Diurnal bird flight often is at much lower levels as witnessed at the site. However, our observations recorded no collisions with the tower or turbine blades during the day. Migrating bats tend to fly lower than birds and those individuals recorded throughout the spring and summer seasons while flying in the vicinity of the tower were generally at tower height or lower because the maximum range of the detector being used is estimated to be approximately 125 ft. (Donovan T., et. al,

2007). As with birds during daylight the bats apparently avoided collisions with the facility.

A study of the effects of wind tower heights and blade sizes on rates of bird and bat mortalities found that towers shorter than 65 m caused relatively few deaths (Barclay, E. F., et al., 2007). This, along with the apparent lack of the reports of multiple deaths associated with small wind turbines supports our findings.

Table 1. Dates for bird surveys at TREC and numbers of species observed at key points of sighting.

Date	Parking Lot	Lawn[1]	Ravine/Edge[2]	Overhead High[3]	Overhead Low[4]
10/23/2006	[5]0	2	6	1	2
10/27/2006	0	0	0	1	1
10/30/2006	0	1	9	0	5
11/6/2006	0	2	9	0	2
11/15/2006	3	0	3	0	2
11/20/2006	0	1	2	1	0
11/27/2006	2	0	5	2	4
12/4/2006	1	1	8	2	5
12/11/2006	1	5	12	1	3
12/19/2006	1	0	6	0	1
1/2/2007	3	1	4	0	2
1/15/2007	2	1	8	2	3
1/28/2007	0	0	4	0	1
2/12/2007	2	0	5	0	1
2/19/2007	1	0	6	1	0
2/26/2007	2	1	8	0	1
3/5/2007	2	0	7	2	3
3/12/2007	2	1	9	9	9
3/13/2007	0	0	0	9	11
3/20/2007	3	1	11	4	7
3/21/2007	1	0	1	2	7
3/22/2007	0	0	0	8	10
3/24/2007	0	0	0	1	1
3/26/2007	3	4	10	5	24
4/9/2007	5	3	12	2	3
4/16/2007	1	2	5	3	4
4/22/2007	5	10	16	1	3
4/23/2007	0	1	1	13	16
4/29/2007	3	3	13	2	6
5/7/2007	7	6	19	5	7
5/14/2007	7	6	14	3	9
5/28/2007	5	2	19	3	6
6/11/2007	3	4	15	3	6
6/18/2007	11	6	11	5	8
6/24/2007	6	5	16	3	3
7/2/2007	5	5	15	1	5
7/9/2007	4	2	10	1	4
7/23/2007	6	4	9	2	7
8/1/2007	9	6	12	3	4
8/6/2007	4	1	9	2	3
8/13/2007	6	2	4	2	6
8/21/2007	5	5	8	3	4
8/27/2007	10	3	6	3	5
9/10/2007	4	3	10	2	5
9/17/2007	1	1	9	6	2
9/23/2007	3	1	9	2	6
9/24/2007	3	0	6	0	2
10/15/2007	5	2	14	2	2
10/22/2007	2	1	8	3	1
Summed	149	105	403	126	232
	0.14679803	0.103448276	0.397044335	0.124137931	0.228571429
Approx usage	15%	10%	40%	12%	23%

[1]all grassy areas adjacent to TREC; [2]tree line and general area of Scott Run; [3]above the top of TREC observation tower (approx. 75 ft.); [4]below the top of TREC observation tower; [5]number or species observed during 1hr. of observation

Table 2. Bird Species Observed at TREC, 23 October 2006-22 October 2007

Double-crested Cormorant
Great Blue Heron
Canada Goose
Wood Duck
Mallard
Northern Pintail
Unidentified Waterfowl
Turkey Vulture[1]
Black Vulture[1]
Osprey[1]
Bald Eagle[1]
Northern Harrier[1]
Sharp-shinned Hawk[1]
Cooper's Hawk[1]
Unidentified Accipiter[1]
Red-shouldered Hawk[1]
Broad-winged Hawk[1]
Red-tailed Hawk[1]
Rough-legged Hawk[1]
Unidentified Buteo[1]
American Kestrel[1]
Merlin[1]
Peregrine Falcon[1]
Wild Turkey[2]
Killdeer[3]
Ring-billed Gull
Herring Gull
Unidentified Gull/Tern
Mourning Dove
Chimney Swift
Ruby-throat Hummingbird
Red-bellied Woodpecker
Yellow-bellied Sapsucker
Downy Woodpecker[3]
Hairy Woodpecker
Northern Flicker
Pileated Woodpecker
Eastern Phoebe[3]
Eastern Wood-Pewee
Great Crested Flycatcher
Unidentified Flycatcher
Warbling Vireo
Red-eyed Vireo
Purple Martin
Tree Swallow
Barn Swallow
Bank Swallow[3]
Blue Jay[3]
American Crow[3]
Common Raven[1]
Black-capped Chickadee[3]
Tufted Titmouse[3]
White-breasted Nuthatch
Red-breasted Nuthatch
Brown Creeper
Carolina Wren
House Wren[3]
Winter Wren
Golden-crowned Kinglet
Ruby-crowned Kinglet
Eastern Bluebird[3]
Wood Thrush
Swainson's Thrush
Hermit Thrush
American Robin[3]
Gray Catbird[3]
Brown Thrasher
Cedar Waxwing
European Starling[3]
Yellow Warbler[3]
Wilson's Warbler
Scarlet Tanager
Northern Cardinal[3]
Rose-breasted Grosbeak
Eastern Towhee
American Tree Sparrow
Chipping Sparrow[3]
Field Sparrow
Song Sparrow[3]
White-throated Sparrow
White-crowned Sparrow
Dark-eyed Junco
Red-winged Blackbird
Eastern Meadowlark
Common Grackle
Brown-headed Cowbird[3]
Baltimore Oriole[3]
House Finch[3]
American Goldfinch
House Sparrow[3]

[1]Species observed and identified on one or more of the following dates: 3/22, 3/26, 4/23, 2007 (J. McWilliams, pers. com.).
[2]Species in **bold** were observed during the potential breeding season of May- mid-August.
[3]Evidence of site usage for breeding (e.g., nests, fledglings) was identified for these species.

Fig. 1 The TREC parking lot and adjacent site of the wind turbine tower.

Fig. 2 The tower under consctuction May 5, 2007

Fig. 3 The wooded edge of Scott Run

Fig. 4. Wooded edge of Scott Run behind TREC

Fig. 5. Number 1 microphone attached to the roof of TREC near the west end of the building.

Fig. 6. The white bucket contains Number 4 microphone located on the roof of TREC at the SE end of the building.

Fig. 7. The monitoring station for microphones placed on the TREC roof.

Fig. 8. The ultrasound bat detector and laptop computer mounted on the TREC port. The arrow points to the weather proof housing containing the detector.

Fig. 9. Nests of bank swallows located on a cliff just east of the tower.

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