POST-CONSTRUCTION WILDLIFE MONITORING AT THE ATLANTIC CITY UTILITIES AUTHORITY-JERSEY ATLANTIC WIND POWER FACILITY

PERIODIC REPORT COVERING WORK CONDUCTED
BETWEEN 20 JULY AND 31 DECEMBER 2007

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Two Gateway Center (8th Floor)
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INTRODUCTION

The following narrative briefly describes activities New Jersey Audubon Society (NJAS) engaged in during a post-construction wildlife monitoring study conducted from 20 July - 31 December 2007 at the Jersey Atlantic Wind, LLC (JAW)/Atlantic City Utilities Authority (ACUA) wind power facility. This document and attachments satisfies project reporting requirements described in the Memorandum of Understanding (MOU) between NJAS and JAW. Furthermore, the activities described herein conform to task descriptions outlined in the Scope of Work defined as part of said MOU.

GOALS AND OBJECTIVES

The goal of this project is to evaluate incidents of bird and bat mortality at JAW/ACUA wind wind power facility and assess relationships between mortality and flight dynamics (e.g., magnitude, altitude, direction). Specifically, our objectives are to (1) document mortality at the facility, (2) quantify nightly magnitude of bird/bat passage through the project area (3) quantify altitudes and flight tracks relative to the height and rotor swept area of the wind turbines (4) investigate correlations between mortality and flight dynamics and (5) investigate meteorological conditions that may affect these response variables. To accomplish these objectives we will use ground based surveys to monitor mortality at the project sites and a dual marine radar system to monitor the various measures of flight behavior. This two-pronged approach is rarely used in evaluating potential impacts of wind turbines on birds and bats.

METHODS

Nocturnal Flight Monitoring using Radar

We used two 25 kW Furuno X-band marine radars (frequency = 9410 GHz, wavelength = 3 cm, model # FAR2127BB, Furuno Electric Company, Nishinomiya, Japan) operating simultaneously to monitor various measures of flight behavior and dynamics (Figure 1). Each radar is fitted with standard 6.5' open array antenna, which produces a fan-shaped electromagnetic beam 1.23˚ x 20˚. The radars' pulse lengths can be set from 0.07 - 1.2 μsec and detection ranges from 0.125 - 96 nautical miles (nm). For both radars we used a 0.15 μsec pulse length and a 1.0 nm detection range. Short pulse lengths provide better target resolution and more accurate location and distance estimates. Similarly, short detection ranges result in improved resolution of small passerine or bat-sized targets. Additionally, data we collected during previous studies suggest that small target detection drops off markedly between 0.75 and 1.0 nm from the radar. The radar features color-coded target representation that indicates return signal strength. This allows for discrimination of weak reflectors that could be insects. The radar units also are equipped with integrated global positioning systems (GPS) and target tracking feature that allows us to determine each target's coordinates and quantify target flight directions.

One radar unit operated with the antenna rotating in the horizontal plane, describing a 360˚ arc every 2.5 seconds. Data collected in this mode provided target density (i.e., targets/unit volume) and passage rate (targets/km/hr) estimates (Figure 2). The second radar's antenna rotated in the vertical plane. This is accomplished by mounting the antenna turning unit perpendicular to the ground (Figure 1). In this mode, the radar monitors the altitudinal distribution of targets and passage density/rates. The antenna sweeps from the eastern to the western horizons, describing a

180˚ arc above radar level (arl), 20º wide (Figure 3). To avoid spurious target propagation, the radar does not transmit when the antenna is pointing toward the ground. We anticipated that the radar's orientation (i.e., facing northward, antenna sweeping approximately east to west) would maximize the number of target detections along the predominantly north/south axis of bird migration.

Each radar's processor unit was connected directly to a computer equipped with a PCI frame grabber circuit board. Using proprietary scheduling software, we automatically captured a user-defined number of consecutive radar sweep images as bitmap files at any interval and for any period.

Radar data collection typically followed a "five days on," "two days off" sampling protocol. We collected five consecutive radar sweep images, every 10 min, continuously for five consecutive days (~720 images/night/radar). We chose 10 min intervals because we believe this insures total turnover of targets between samples. If minimum target air speed is 20 mph, then it will take 6 min to cross the widest part of our sample area (i.e., two nautical miles).

Collision Incident Monitoring

We conducted systematic searches on the ACUA facility for birds and bats that apparently collided with on-site wind turbines. Searches were conducted around each turbine site (Figure 4) by a single, trained NJAS staff person and consisted of walking in parallel transects 5 m apart within an overall search area of 130 m x 120 m (i.e., 15,600 m^2/turbine) centered on each turbine tower (Figure 5). Search areas and transects were laid out in a geographic information system (GIS) and marked on site using a global positioning system (GPS) and rangefinder. Low lying marsh areas within a turbine's search area were not surveyed because tidal inundation regularly prevented access to these sections (Figure 6). To some extent this was the case at all turbine sites except at turbine #3 (Figure 6). If a building fell within the search area, rooftops were surveyed when accessible. Clarifying and mixing ponds, and other water bodies were also surveyed using walkways, gangways and dikes to gain access. Collision incident estimates will be corrected for the proportion of the total area around each turbine that was searched.

Searches were conducted at each turbine sampling plot every other day (i.e., typically Mondays, Wednesdays, Fridays) and started approximately 1 hour after sunrise to insure sufficient illumination for detecting potential collision victims. To reduce the chance of turbine plots regularly being surveyed at the same time of day, the order they were searched was alternated systematically on each survey day as was the starting transect at each turbine. While walking each transect, the searcher used the unaided eye to conduct the survey, alternately scanning an area that extended for 2.5 m on either side of his/her track.

The observer recorded start and end times for surveys at each turbine and meteorological conditions (e.g., cloud cover, wind direction and velocity). When an apparent collision incident was encountered, the observer performed a thorough investigation and documentation of the incident. This included assigning an incident number, recording its location using a GPS, assessing the condition of the carcass (e.g., intact, scavenged, feather spot) and recording the

date and time. A range finder and compass were used to determine distance and bearing from the tower.

Carcasses are photographed in the position they are found using a digital camera. When possible, carcasses are identified to species, age and gender. Additionally, the observer performed an examination to determine the nature and extent of any injuries, and whether any scavenging or insect infestation occurred. When dismemberment was evident, the observer searched the vicinity to locate all body parts. In situations involving avian species, all loose feathers were collected in order to avoid identifying the feathers as an additional kill during the next survey of the tower.

With respect to birds, feathers or clumps of feathers with flesh attached were recorded as fatalities. Loose feathers were not considered fatalities unless we found several primary or tail feathers together that would represent more than would be expected to be lost during normal molting. Small feathers (e.g., body contour, down) were also not recorded, since these most likely were lost as a result of normal preening or molt.

Carcasses were placed plastic bags (i.e., one/bag) that were labeled with date, species, tower number, and incident report number. Carcasses were temporarily stored in a cooler and then transferred the same day to an ultra cold freezer at NJAS's Center for Research and Education to be stored at -35° C. When carcasses were found at times and locations outside of standardized surveys conducted as part of this study, they were processed as above but classified as an "incidental" find.

If an injured animal is found, the searcher will record the same data collected for a carcass, noting however, that it was an injury and not a fatality. The searcher will then attempt to capture and restrain the animal in a manner that avoids either further injury to the animal or injury to the surveyor. Once secured, the animal will be transported to a wildlife rehabilitator or veterinarian as soon as the daily survey is completed.

Observer Efficiency and Carcass Removal Evaluation

The fact that estimates of animal fatalities at wind power generating facilities can be affected dramatically by differences in observer efficiency and from carcass removal by a variety of scavengers is widely acknowledged (Morrison 2002). Consequently, estimates of total bird or bat fatalities can only be determined after correcting for searcher and carcass removal biases.

Observer efficiency is generally affected by vegetation type and height, bird size and decomposition state. Throughout this study, we will conduct searcher efficiency trials in the vegetation types typical of the tower farms, using a variety of carcass sizes. Carcasses of various types (i.e., bird, bat) and sizes will be placed at random locations throughout turbine sample sites (Figure 3) at densities that are similar to those recorded during standardized collision incident surveys. Each carcass will be discretely marked so that it can be identified as part of an observer efficiency trial. Observers conducting standard carcass searches will not know when efficiency trials are being conducted. The number and location of trial carcasses found during standard carcass searches will be recorded and compared with the number placed.

To assess carcass removal rates, we will randomly place carcasses of various types and sizes in areas outside the carcass search areas to avoid confusing trial carcasses with actual communications tower fatalities. Carcasses will be checked for approximately 30 days, checking every day for the first 7-10 days and less often (e.g., every other day) later in the trial.

To the extent possible, searcher efficiency and carcass removal trials will be conducted concurrently. That is, carcasses will be placed on the study site 1-2 hours before the observer arrives on the study site. Observers will complete the survey and determine the proportion of carcasses detected in the observer efficiency trial. Carcasses used in the trial will remain on the study site for inclusion in a carcass removal trial.

Estimates of mortality will be adjusted (i.e., C_{corr}) using the following equation and calculations suggested by Strickland et al. (2000) that incorporate estimates of observer efficiency and carcass removal by scavengers,

$$C_{corr} = \frac{A * I * C}{(a * t * p)},$$

where A is the total search area around each turbine, I is the interval between searches in days, C is the total number of collision incidents detected during a particular period, a is the mean area searched around each turbine, t is the mean time interval a collision victim remains in the study area before being removed and p is the searcher efficiency. We will calculate the variance in the corrected collision estimate using the variance of a product formula (Goodman 1960) and the variance of a ratio formula (Cochran 1977).

Point Count Surveys

We conducted systematic point count surveys to determine abundance and distribution of residents and transient birds. These data will provide an index of general site use patterns that can be used as a backdrop for understanding patterns of collision incidnets.

Surveys began at sunrise and were conducted at five points, each randomly selected within the general area of a turbine. We followed standard point count data collection protocols which included recording observations in 2-, 3-, and 5- minute sampling periods, and recording distance and direction of each detection. sta surveys (minimum twice/week).

SUMMARY OF TASKS ACCOMPLISHED

Nocturnal Flight Monitoring using Radar

1. On 20 July we began four days of testing to identify the best location and orientation for the dual marine radar system at the ACUA site.
    a. Despite extensive testing of different locations and orientations we were unable to eliminate ground clutter and interference resulting from the turbines and other reflective structures on the ACUA site (Figure 7).
    b. Tests resulted in locating the radar system at 39°23.02'N, 74°26.93'W, in the NW sector of the study site, near Turbine #2 (Figure 1). We believe this location is

least susceptible to ground clutter and interference.

2. On the evening of 25 July we began data collection. Typically, we collected data following a schedule of five days on, two days off through 4 December with occassional slight deviations (Table 1). Afterwards, we reduced our radar survey (~two days/ week to reflect reduced migration traffic in December.
    a. Through the reporting period, we collected data on 96 days, for approximately 24 hours/day.
    b. This results in approximately 720 data images per day, per radar. Approximately 69,120 images/radar were collected during the reporting period.

Collision Incident Monitoring

1. On 30 July 2007, we began laying out transects for collision incident surveys. We used a GPS and rangefinder to mark the corners of survey areas around each turbine and mark the survey transects in each turbine's survey area.
2. This preliminary work was completed on 5 August and collision incident surveys commenced on 6 August 2007
3. Surveys were conducted Mondays, Wednesdays and Fridays in each of 20 weeks of the reporting period through the week of 17 December.
    a. During these surveys, NJAS's observer detected 31 dead bats (Table 2) and 9 dead birds (Table 3), one of which was not attributed to a collision with a wind turbine
    b. Two observer efficiency and scavenger removal trials were conducted during the reporting period.
    c. These data presented in this report represent raw counts of collision incidents and are not corrected for proportion of survey area covered, observer detectability or carcass removal.

Point Count Surveys

1. Starting the week of 6 August 2007, NJAS's observer conducted weekly point counts to determine the abundance and distribution of birds on the ACUA study site.
2. Results of these surveys are shown in Table 4.

Table 1. Number of days and hours of radar sampling conducted at Atlantic County Utilities Authority (ACUA) wind power facility between 25 July and 24 December 2007. Also, approximate number of data images collected per radar during each sampling bout.

Date Started	Date Ended	Number of days	Approximate hours	Number of data images/radar
07/25/07	07/30/07	6	144	4320
08/02/07	08/05/07	4	96	2880
08/08/07	08/12/07	5	120	3600
08/15/07	08/19/07	5	120	3600
08/22/07	08/26/07	5	120	3600
08/29/07	09/02/07	5	120	3600
09/05/07	09/09/07	5	120	3600
09/12/07	09/16/07	5	120	3600
09/19/07	09/23/07	5	120	3600
09/26/07	09/30/07	5	120	3600
10/03/07	10/07/07	5	120	3600
10/10/07	10/14/07	5	120	3600
10/17/07	10/21/07	5	120	3600
10/24/07	10/28/07	5	120	3600
11/02/07	11/05/07	4	96	2880
11/09/07	11/12/07	4	96	2880
11/17/07	11/20/07	4	96	2880
11/27/07	12/04/07	8	192	5760
12/10/07	12/11/07	2	48	1440
12/17/07	12/18/07	2	48	1440
12/27/07	12/28/07	2	48	1440
Total		96	2304	69120

Table 2. Bat species found during searches conducted three days per week around wind turbines conducted at the Atlantic City Utilities Authority wind power facility from 10 August - 31 December 2007. Cause of death is presumed the result of collision with a wind turbine unless otherwise noted.

Date	Time	Turbine	Species	ID #	Easting	Northing	Condition*	Comments
08/10/07	0810	T1	Red Bat	BAT001	547318	4359321	I	
08/10/07	0825	T1	Red Bat	BAT002	547357	4359313	I	
08/13/07	0932	T4	Red Bat	BAT003	547413	4359138	I	
08/13/07	1000	T4	Red Bat	BAT004	547344	4359341	I	
08/20/07	0740	T1	Red Bat	BAT005	547354	4359300	I	
08/20/07	1010	T3	Red Bat	BAT006	547593	4359199	I	
08/20/07	1045	T4	Red Bat	BAT007	547408	4359098	I	
08/20/07	1050	T4	Hoary Bat	BAT008	547416	4359099	I	
08/22/07	0843	T3	Hoary Bat	BAT009	547582	4359212	I	
08/22/07	1018	T1	Hoary Bat	BAT010	547329	4359329	I	
08/27/07	0815	T1	Red Bat	BAT011	547339	4359321	I	
08/27/07	0945	T5	Red Bat	BAT012	547749	4359368	I	
08/27/07	1100	T3	Red Bat	BAT013	547572	4359179	I	
08/31/07	0750	T2	Red Bat	BAT014	547511	4359518	D	Desiccated, likely present for some time.
08/31/07	0857	T3	Red Bat	BAT015	547579	4359142	D	Desiccated, likely present for some time.
09/03/07	1043	T2	Red Bat	BAT016	547527	4359511	D	
09/05/07	0857	T2	Red Bat	BAT017	547530	4359488	D	Desiccated, likely present for some time.
09/10/07	0750	T4	Red Bat	BAT018	547457	4359130	I	On solar panel @ 3m bearing 358 degrees.
09/14/07	0855	T3	Hoary Bat	BAT019	547534	4359232	O	Squashed on asphalt road.
09/14/07	0905	T3	Hoary Bat	BAT020	547550	4359234	I	
09/14/07	0945	T3	Red Bat	BAT021	547592	4359170	P	Possibly mowed, not scavenged.
09/14/07	1023	T4	Red Bat	BAT022	547422	4359086	I	
09/14/07	1040	T4	Red Bat	BAT023	547417	4359136	I	
09/17/07	0755	T3	Red Bat	BAT024	547530	4359213	I	
09/17/07	0757	T3	Red Bat	BAT025	547531	4359211	I	
09/17/07	0958	T1	Hoary Bat	BAT027	547344	4359327	I	
09/17/07	1103	T5	Red Bat	BAT029	547765	4359358	I	
09/19/07	0953	T5	Red Bat	BAT030	547748	4359358	I	Somewhat desiccated. Missed prev survey?
10/01/07	1053	T3	Red Bat	BAT031	-	-	D	Desiccated, likely present for some time.
10/18/02	1103	T2	Hoary Bat	BAT032	547503	4359525	I	
10/31/07	1130	T2	Red Bat	BAT033	547515	4359505	D	Desiccated, likely present for some time.

* I = Intact, P = partial, S = scavenged, D = desiccated, O = other

Table 3. Avian species found during searches conducted three days per week around wind turbines at the Atlantic City Utilities Authority wind power faciility from 10 August - 31 December 2007. Cause of death is presumed the result of collision with a wind turbine unless otherwise noted.

Date	Time	Turbine	Species	ID #	Easting	Northing	Condition*	Comments
08/06/07	1010	T3	Laughing Gull	DB001	547568	4359243	I	
08/15/07	0914	T3	Osprey	DB002	547592	4359226	I	
08/20/07	0827	T2	Peregrine Falcon	DB003	547520	4359561	I	
08/22/07	0745	T5	Laughing Gull	DB004	547736	4359417	P	Wing & leg intact. Possibly dismembered by turbine.
09/12/07	0843	T3	Unidentified shorebird	DB005	547553	4359225	S	Keel & wings only
10/29/07	1105	T3	Ruby-crowned Kinglet	DB006	547551	4359183	I	
11/09/07	0955	T4	Swamp Sparrow	DB007	547430	4359044	I	
11/12/07	0930	-	Hooded Merganser	-	547510	4358927	I	Not a turbine kill. Found below wires along road.
12/05/07	1025	T3	American Woodcock	DB008	547619	4359228	I	

* I = Intact, P = partial, S = scavenged

Table 4. Results of weekly point count surveys conducted at the Atlantic City Utilities Authority wind power facility from 27 August - 19 December 2007. Surveys commenced at sunrise and were conducted along transects laid out in close proximity to each turbine site. Starting location was rotated weekly to avoid time of day effects. Data were recorded for separately for two distinct five minute sample periods. Observer noted approximate distance of bird from observation location and inidcated when birds were flying through sampling space.

				0-5 Min			6-10 Min				
Date	Turbine	Start Time	Species	0-25 m	25-50 m	>50 m	0-25 m	25-50 m	>50 m	Fly-by	Total birds counted
08/27/07	T1	0621	Black-crowned Night Heron	0	0	0	0	0	0	1	1
08/27/07	T1	0621	European Starling	0	0	2	0	0	0	0	2
08/27/07	T1	0621	Fish Crow	0	0	0	0	0	0	1	1
08/27/07	T1	0621	Herring Gull	0	0	0	0	0	0	4	4
08/27/07	T1	0621	Laughing Gull	0	0	0	0	0	0	27	27
08/27/07	T2	0636	Black-crowned Night Heron	0	0	0	0	0	0	1	1
08/27/07	T2	0636	Forster's Tern	0	0	0	0	0	0	2	2
08/27/07	T2	0636	Great Egret	0	1	0	0	0	0	0	1
08/27/07	T2	0636	Greater Yellowlegs	0	1	0	0	0	0	0	1
08/27/07	T2	0636	Herring Gull	0	0	0	0	0	0	1	1
08/27/07	T2	0636	Laughing Gull	5	1	0	0	0	0	51	57
08/27/07	T2	0636	Least Sandpiper	1	0	0	0	0	0	0	1
08/27/07	T2	0636	Osprey	0	0	0	0	0	1	0	1
08/27/07	T2	0636	Red-winged Blackbird	0	0	0	0	0	3	0	3
08/27/07	T2	0636	Salt Marsh Sharp-tailed Sp.	1	0	0	0	0	0	0	1
08/27/07	T2	0636	Semipalmated Plover	0	1	0	0	0	0	0	1
08/27/07	T2	0636	Semipalmated Sandpiper	8	6	0	0	0	0	0	14
08/27/07	T2	0636	Short-billed Dowitcher	0	1	0	0	0	0	0	1
08/27/07	T2	0636	Snowy Egret	0	0	0	0	0	0	1	1
08/27/07	T5	0649	Black-crowned Night Heron	0	2	4	0	0	0	0	6
08/27/07	T5	0649	Blue-winged Teal	0	1	0	0	0	0	0	1
08/27/07	T5	0649	Common Yellowthroat	1	0	0	0	0	0	0	1
08/27/07	T5	0649	Forster's Tern	0	1	0	0	1	0	0	2
08/27/07	T5	0649	Gray Catbird	0	0	0	1	0	0	0	1
08/27/07	T5	0649	Great Egret	0	0	1	0	0	0	0	1
08/27/07	T5	0649	Herring Gull	0	1	0	0	0	0	0	1
08/27/07	T5	0649	Killdeer	0	1	0	0	0	0	0	1
08/27/07	T5	0649	Laughing Gull	15	18	0	5	4	0	11	53
08/27/07	T5	0649	Lesser Yellowlegs	0	0	0	0	1	0	0	1
08/27/07	T5	0649	Mallard	6	7	5	0	0	0	0	18
08/27/07	T5	0649	Northern Shoverler	0	2	0	0	0	0	0	2
08/27/07	T5	0649	Osprey	0	0	0	0	0	0	1	1
08/27/07	T5	0649	Red-winged Blackbird	0	0	45	2	3	0	0	50
08/27/07	T5	0649	Snowy Egret	0	0	0	0	1	0	1	2

Table 4. continued

08/27/07	T5	0649	Song Sparrow	1	1	0	0	0	0	0	2
08/27/07	T5	0649	Spotted Sandpiper	0	0	1	0	0	0	0	1
08/27/07	T3	0702	Baltimore Oriole	0	0	0	1	0	0	0	1
08/27/07	T3	0702	Double-crested Cormorant	0	0	0	0	0	0	1	1
08/27/07	T3	0702	European Starling	0	0	2	0	0	6	0	8
08/27/07	T3	0702	Gray Catbird	0	0	0	0	1	0	0	1
08/27/07	T3	0702	Killdeer	0	0	0	0	0	1	0	1
08/27/07	T3	0702	Laughing Gull	0	0	0	0	0	0	4	4
08/27/07	T3	0702	Northern Cardinal	0	1	0	0	0	0	0	1
08/27/07	T3	0702	Red-winged Blackbird	0	0	0	0	0	0	5	5
08/27/07	T3	0702	Song Sparrow	0	0	0	0	1	0	0	1
08/27/07	T4	0716	Barn Swallow	0	0	0	1	0	0	0	1
08/27/07	T4	0716	European Starling	0	0	54	0	0	0	0	54
08/27/07	T4	0716	House Finch	0	0	0	0	0	0	1	1
08/27/07	T4	0716	Laughing Gull	0	0	0	0	0	0	18	18
08/27/07	T4	0716	Northern Cardinal	0	0	1	0	0	0	0	1
08/27/07	T4	0716	Osprey	0	0	0	0	0	0	1	1
09/05/07	T2	0630	Forster's Tern	0	0	0	0	0	0	1	1
09/05/07	T2	0630	Great Blue Heron	0	0	0	0	0	0	1	1
09/05/07	T2	0630	Great Egret	0	0	0	0	0	0	4	4
09/05/07	T2	0630	Greater Yellowlegs	0	0	0	1	0	0	0	1
09/05/07	T2	0630	Laughing Gull	15	5	8	0	0	0	0	28
09/05/07	T2	0630	Laughing Gull	0	0	0	0	0	0	122	122
09/05/07	T2	0630	Marsh Wren	0	0	0	1	0	0	0	1
09/05/07	T2	0630	Semipalmated Sandpiper	0	0	0	0	2	0	0	2
09/05/07	T2	0630	Snowy Egret	0	0	0	0	0	0	20	20
09/05/07	T2	0630	Tri-colored Heron	0	0	0	0	0	0	1	1
09/05/07	T5	0644	American Black Duck	0	0	1	0	0	0	0	1
09/05/07	T5	0644	Black-crowned Night Heron	0	2	6	0	0	0	2	10
09/05/07	T5	0644	Canada Goose	0	0	5	0	0	0	0	5
09/05/07	T5	0644	Gray Catbird	0	1	0	0	0	0	0	1
09/05/07	T5	0644	Herring Gull	0	0	8	0	0	0	1	9
09/05/07	T5	0644	Laughing Gull	1	5	53	0	0	16	0	75
09/05/07	T5	0644	Mallard	0	12	0	0	0	0	36	48
09/05/07	T5	0644	Mourning Dove	0	0	0	0	0	0	1	1
09/05/07	T5	0644	Northern Shoverler	0	0	4	0	0	0	0	4
09/05/07	T5	0644	Red-winged Blackbird	5	3	0	0	0	0	0	8
09/05/07	T5	0644	Snowy Egret	0	0	0	0	0	0	1	1
09/05/07	T5	0644	Song Sparrow	0	0	0	2	0	0	0	2
09/05/07	T5	0644	Spotted Sandpiper	0	0	0	0	1	0	0	1

Table 4. Continued

09/05/07	T5	0644	Yellow Warbler	0	0	0	1	0	0	0	1
09/05/07	T3	0658	European Starling	0	8	0	0	0	25	15	48
09/05/07	T3	0658	Gray Catbird	1	0	0	0	0	0	0	1
09/05/07	T3	0658	Laughing Gull	0	0	0	0	0	0	19	19
09/05/07	T3	0658	Mourning Dove	0	0	0	0	0	0	2	2
09/05/07	T3	0658	Northern Mockingbird	1	0	0	0	0	0	0	1
09/05/07	T3	0658	Red-winged Blackbird	0	0	0	0	0	0	24	24
09/05/07	T4	0712	American Robin	1	0	0	0	0	0	1	2
09/05/07	T4	0712	Common Yellowthroat	1	1	0	0	0	0	0	2
09/05/07	T4	0712	Double-crested Cormorant	0	0	0	0	0	0	1	1
09/05/07	T4	0712	European Starling	0	0	35	0	3	0	16	54
09/05/07	T4	0712	Great Black-backed Gull	0	0	0	0	0	0	1	1
09/05/07	T4	0712	Laughing Gull	0	0	0	0	0	0	21	21
09/05/07	T4	0712	Mourning Dove	0	0	7	0	0	0	0	7
09/05/07	T4	0712	Red-winged Blackbird	0	0	0	0	0	0	18	18
09/05/07	T4	0712	Song Sparrow	0	0	0	0	0	1	0	1
09/05/07	T1	0726	Herring Gull	0	0	0	0	0	0	1	1
09/05/07	T1	0726	Laughing Gull	0	0	0	0	0	0	27	27
09/05/07	T1	0726	Red-winged Blackbird	0	1	0	0	0	0	3	4
09/05/07	T1	0726	Song Sparrow	0	1	0	0	0	0	0	1
09/12/07	T5	0636	American Black Duck	0	5	0	0	0	0	0	5
09/12/07	T5	0636	Black-crowned Night Heron	0	0	6	0	0	0	0	6
09/12/07	T5	0636	Blue-winged Teal	0	1	0	0	0	0	0	1
09/12/07	T5	0636	Great Egret	0	0	0	0	0	0	1	1
09/12/07	T5	0636	Herring Gull	0	2	0	0	0	0	1	3
09/12/07	T5	0636	Laughing Gull	1	14	24	0	4	0	74	117
09/12/07	T5	0636	Mallard	0	24	0	0	0	0	0	24
09/12/07	T5	0636	Mourning Dove	0	0	0	0	0	1	0	1
09/12/07	T5	0636	Northern Shoverler	0	7	0	0	0	0	0	7
09/12/07	T5	0636	Red-winged Blackbird	2	0	0	3	0	0	0	5
09/12/07	T5	0636	Semipalmated Sandpiper	0	1	0	0	0	0	0	1
09/12/07	T5	0636	Song Sparrow	2	0	0	0	0	0	0	2
09/12/07	T3	0650	European Starling	0	0	0	0	35	0	2	37
09/12/07	T3	0650	Fish Crow	0	0	0	0	0	0	1	1
09/12/07	T3	0650	Laughing Gull	0	0	0	0	0	0	16	16
09/12/07	T3	0650	Mourning Dove	0	1	0	0	0	1	0	2
09/12/07	T3	0650	Northern Cardinal	0	0	0	0	1	0	0	1
09/12/07	T3	0650	Northern Waterthrush	1	0	0	0	0	0	0	1
09/12/07	T4	0704	American Kestrel	0	0	0	0	0	0	1	1
09/12/07	T4	0704	American Robin	1	0	0	0	0	0	0	1

Table 4. Continued

09/12/07	T4	0704	Bobolink	0	0	0	0	0	0	2	2
09/12/07	T4	0704	Double-crested Cormorant	0	0	0	0	0	0	1	1
09/12/07	T4	0704	European Starling	65	0	340	0	0	0	0	405
09/12/07	T4	0704	Killdeer	0	0	0	0	0	1	0	1
09/12/07	T4	0704	Laughing Gull	0	0	0	0	0	0	17	17
09/12/07	T4	0704	Mourning Dove	1	2	2	0	0	0	0	5
09/12/07	T4	0704	Snowy Egret	0	0	0	0	0	0	2	2
09/12/07	T4	0704	Yellow Warbler	0	1	0	0	0	0	0	1
09/12/07	T1	0717	American Robin	1	0	0	0	0	0	0	1
09/12/07	T1	0717	European Starling	0	3	3	0	0	5	0	11
09/12/07	T1	0717	Herring Gull	0	0	1	0	0	0	2	3
09/12/07	T1	0717	Laughing Gull	0	0	0	0	0	0	38	38
09/12/07	T1	0717	Red-winged Blackbird	0	0	0	0	1	0	1	2
09/12/07	T1	0717	Snowy Egret	0	0	0	0	0	0	2	2
09/12/07	T2	0733	Common Grackle	0	0	0	0	0	0	1	1
09/12/07	T2	0733	Forster's Tern	0	0	0	0	0	0	2	2
09/12/07	T2	0733	Great Blue Heron	0	0	0	0	0	0	1	1
09/12/07	T2	0733	Greater Yellowlegs	0	0	0	0	1	0	0	1
09/12/07	T2	0733	Herring Gull	0	0	1	0	0	0	0	1
09/12/07	T2	0733	Laughing Gull	0	42	45	0	0	0	58	145
09/12/07	T2	0733	Least Sandpiper	0	0	0	0	0	0	1	1
09/12/07	T2	0733	Little Blue Heron	0	0	0	0	1	0	0	1
09/12/07	T2	0733	Semipalmated Sandpiper	0	3	0	0	1	0	0	4
09/12/07	T2	0733	Snowy Egret	0	0	2	0	0	0	0	2
09/19/07	T3	0642	Caspian Tern	0	0	0	0	0	0	1	1
09/19/07	T3	0642	Herring Gull	0	0	0	0	0	0	2	2
09/19/07	T3	0642	Laughing Gull	0	0	0	0	0	0	14	14
09/19/07	T3	0642	Northern Cardinal	0	0	0	0	0	1	0	1
09/19/07	T3	0642	Northern Mockingbird	0	0	0	0	1	0	0	1
09/19/07	T4	0655	American Goldfinch	0	0	0	0	0	0	1	1
09/19/07	T4	0655	Canada Goose	0	0	0	0	0	0	3	3
09/19/07	T4	0655	European Starling	5	11	0	0	0	0	3	19
09/19/07	T4	0655	Fish Crow	1	2	0	0	0	0	1	4
09/19/07	T4	0655	Laughing Gull	0	0	0	0	0	0	9	9
09/19/07	T4	0655	Northern Cardinal	0	0	1	0	0	0	0	1
09/19/07	T4	0655	Red-winged Blackbird	0	0	0	1	0	0	0	1
09/19/07	T1	0708	European Starling	0	0	0	0	0	0	5	5
09/19/07	T1	0708	Gray Catbird	1	0	0	0	0	0	0	1
09/19/07	T1	0708	Laughing Gull	0	0	0	0	0	0	45	45

Table 4. Continued

09/19/07	T1	0708	Snowy Egret	0	0	0	0	0	0	1	1
09/19/07	T2	0723	European Starling	0	0	0	0	0	0	13	13
09/19/07	T2	0723	Forster's Tern	0	0	0	0	0	0	2	2
09/19/07	T2	0723	Great Blue Heron	0	1	0	0	0	0	0	1
09/19/07	T2	0723	Herring Gull	0	1	0	0	0	0	8	9
09/19/07	T2	0723	Laughing Gull	0	8	21	0	0	64	99	192
09/19/07	T2	0723	Red-winged Blackbird	0	0	0	0	0	0	2	2
09/19/07	T2	0723	Snowy Egret	0	1	0	0	0	0	1	2
09/19/07	T5	0736	Black-crowned Night Heron	0	4	9	0	0	0	0	13
09/19/07	T5	0736	Gray Catbird	2	0	0	0	0	0	0	2
09/19/07	T5	0736	Great Egret	0	1	1	0	0	0	0	2
09/19/07	T5	0736	Herring Gull	0	0	6	0	0	0	0	6
09/19/07	T5	0736	Laughing Gull	4	58	148	0	12	0	18	240
09/19/07	T5	0736	Mallard	0	3	5	0	0	0	0	8
09/19/07	T5	0736	Red-winged Blackbird	0	0	0	2	0	1	0	3
09/19/07	T5	0736	Snowy Egret	0	0	5	0	0	0	0	5
09/19/07	T5	0736	Song Sparrow	2	0	0	0	0	0	0	2
09/19/07	T5	0736	Tri-colored Heron	0	0	1	0	0	0	0	1
09/19/07	T5	0736	Yellow Warbler	0	0	0	4	0	0	0	4
09/26/07	T4	0649	Belted Kingfisher	0	0	0	0	0	0	1	1
09/26/07	T4	0649	Black-throated Green Warbler	0	0	0	0	0	1	0	1
09/26/07	T4	0649	Common Grackle	0	0	0	0	0	0	36	36
09/26/07	T4	0649	European Starling	0	0	0	4	1	0	15	20
09/26/07	T4	0649	Herring Gull	0	0	0	0	0	0	1	1
09/26/07	T4	0649	Laughing Gull	0	0	0	0	0	0	22	22
09/26/07	T4	0649	Red-winged Blackbird	0	0	0	0	0	0	13	13
09/26/07	T4	0649	Snowy Egret	0	0	0	0	0	0	5	5
09/26/07	T1	0702	European Starling	0	0	2	0	0	13	1	16
09/26/07	T1	0702	Fish Crow	0	0	0	0	1	0	0	1
09/26/07	T1	0702	Laughing Gull	0	0	0	0	0	0	27	27
09/26/07	T2	0717	Double-crested Cormorant	0	0	0	0	0	0	3	3
09/26/07	T2	0717	Forster's Tern	0	0	0	0	0	0	1	1
09/26/07	T2	0717	Greater Yellowlegs	0	1	0	0	0	0	0	1
09/26/07	T2	0717	Herring Gull	0	0	0	0	0	0	7	7
09/26/07	T2	0717	Laughing Gull	0	25	159	0	0	0	181	365
09/26/07	T2	0717	Mallard	0	0	0	0	0	0	6	6
09/26/07	T2	0717	Ring-billed Gull	0	0	1	0	0	0	0	1
09/26/07	T2	0717	Snowy Egret	1	1	0	0	0	0	20	22
09/26/07	T5	0731	American Black Duck	0	2	0	0	0	0	0	2

Table 4. continued

09/26/07	T5	0731	Black-crowned Night Heron	0	3	5	0	0	0	1	9
09/26/07	T5	0731	Double-crested Cormorant	0	0	0	0	0	0	1	1
09/26/07	T5	0731	Gadwall	0	4	0	0	0	0	0	4
09/26/07	T5	0731	Great Blue Heron	0	1	0	0	0	0	0	1
09/26/07	T5	0731	Herring Gull	0	0	115	0	0	0	0	115
09/26/07	T5	0731	Laughing Gull	64	0	240	0	0	0	17	321
09/26/07	T5	0731	Mallard	0	12	0	0	0	0	0	12
09/26/07	T5	0731	Northern Shoverler	0	18	0	0	0	0	0	18
09/26/07	T5	0731	Ring-billed Gull	1	0	1	0	0	0	0	2
09/26/07	T5	0731	Song Sparrow	0	0	0	1	0	0	0	1
09/26/07	T5	0731	Yellow Warbler	1	1	0	0	0	0	0	2
09/26/07	T3	0744	American Robin	1	0	0	0	0	0	0	1
09/26/07	T3	0744	Blackpoll Warbler	1	0	0	0	0	0	0	1
09/26/07	T3	0744	Common Grackle	0	0	0	0	0	0	1	1
09/26/07	T3	0744	European Starling	0	0	23	0	0	0	0	23
09/26/07	T3	0744	European Starling	0	0	0	0	0	0	30	30
09/26/07	T3	0744	Herring Gull	0	0	0	0	0	0	3	3
09/26/07	T3	0744	Laughing Gull	0	0	0	0	0	0	9	9
09/26/07	T3	0744	Northern Cardinal	0	1	0	0	0	0	0	1
09/26/07	T3	0744	Red-winged Blackbird	0	0	0	0	0	0	1	1
10/03/07	T1	0655	Laughing Gull	0	0	0	0	0	0	35	35
10/03/07	T2	0710	Clapper Rail	0	0	0	0	1	0	0	1
10/03/07	T2	0710	Greater Yellowlegs	0	1	0	0	0	0	0	1
10/03/07	T2	0710	Herring Gull	0	0	0	0	0	0	3	3
10/03/07	T2	0710	Laughing Gull	3	5	4	0	2	0	101	115
10/03/07	T2	0710	Ring-billed Gull	0	1	0	0	0	0	0	1
10/03/07	T2	0710	Saltmarsh Sharp-tailed Sparrow	0	1	0	0	0	0	0	1
10/03/07	T2	0710	Snowy Egret	0	1	0	0	1	0	2	4
10/03/07	T5	0724	American Black Duck	0	0	7	0	0	0	0	7
10/03/07	T5	0724	Black-crowned Night Heron	0	1	1	0	1	0	0	3
10/03/07	T5	0724	Black-throated Green Warbler	0	0	0	0	0	0	1	1
10/03/07	T5	0724	Gadwall	0	2	0	0	0	0	0	2
10/03/07	T5	0724	Green-winged Teal	0	1	0	0	0	0	0	1
10/03/07	T5	0724	Herring Gull	0	5	19	0	0	0	1	25
10/03/07	T5	0724	Laughing Gull	0	160	220	0	0	0	19	399
10/03/07	T5	0724	Mallard	0	8	12	0	0	0	0	20
10/03/07	T5	0724	Marsh Wren	1	0	0	0	0	0	0	1
10/03/07	T5	0724	Northern Shoverler	0	6	6	0	0	0	0	12
10/03/07	T5	0724	Red-winged Blackbird	3	0	0	0	1	0	0	4

Table 4. continued

10/03/07	T5	0724	Song Sparrow	3	0	0	0	0	0	0	3
10/03/07	T5	0724	Yellow Warbler	1	0	0	0	0	0	0	1
10/03/07	T3	0738	Greater Yellowlegs	0	0	1	0	0	0	0	1
10/03/07	T3	0738	Herring Gull	0	0	0	0	0	0	2	2
10/03/07	T3	0738	Laughing Gull	0	0	0	0	0	0	22	22
10/03/07	T3	0738	Northern Cardinal	0	1	0	0	0	0	0	1
10/03/07	T3	0738	Palm Warbler	0	0	0	0	1	0	0	1
10/03/07	T3	0738	Red-winged Blackbird	0	45	0	0	0	0	0	45
10/03/07	T4	0751	European Starling	0	0	0	0	0	28	0	28
10/03/07	T4	0751	Laughing Gull	0	0	0	0	0	0	10	10
10/03/07	T4	0751	Red-winged Blackbird	6	16	0	0	6	0	38	66
10/03/07	T4	0751	Snowy Egret	0	0	0	0	0	0	1	1
10/03/07	T4	0751	Song Sparrow	0	0	0	0	1	0	0	1
10/10/07	T2	0702	Black-beliied Plover	0	0	0	0	0	0	1	1
10/10/07	T2	0702	Black-crowned Night Heron	0	0	1	0	0	0	0	1
10/10/07	T2	0702	Double-crested Cormorant	0	0	0	0	0	0	9	9
10/10/07	T2	0702	Herring Gull	0	0	0	0	0	0	3	3
10/10/07	T2	0702	Laughing Gull	5	7	6	0	0	0	344	362
10/10/07	T2	0702	Ring-billed Gull	0	0	0	0	0	0	1	1
10/10/07	T2	0702	Snowy Egret	0	0	2	0	0	0	1	3
10/10/07	T2	0702	Song Sparrow	0	1	0	0	0	0	0	1
10/10/07	T5	0716	American Black Duck	0	0	0	0	5	0	0	5
10/10/07	T5	0716	American Wigeon	0	1	0	0	0	0	0	1
10/10/07	T5	0716	Black-crowned Night Heron	0	25	8	0	0	0	0	33
10/10/07	T5	0716	Double-crested Cormorant	0	0	0	0	0	0	1	1
10/10/07	T5	0716	European Starling	0	0	0	0	0	0	6	6
10/10/07	T5	0716	Gadwall	0	2	0	0	0	0	0	2
10/10/07	T5	0716	Green-winged Teal	0	4	0	0	0	0	0	4
10/10/07	T5	0716	Herring Gull	0	3	0	0	0	12	3	18
10/10/07	T5	0716	Laughing Gull	0	35	0	0	0	110	47	192
10/10/07	T5	0716	Little Blue Heron	0	1	0	0	1	0	0	2
10/10/07	T5	0716	Mallard	0	15	0	0	0	0	0	15
10/10/07	T5	0716	Marsh Wren	1	0	0	0	0	0	0	1
10/10/07	T5	0716	Northern Shoverler	0	24	0	0	0	0	0	24
10/10/07	T5	0716	Red-winged Blackbird	0	3	4	0	0	0	0	7
10/10/07	T5	0716	Ring-billed Gull	0	4	0	0	0	3	0	7
10/10/07	T5	0716	Snowy Egret	0	0	0	0	0	8	0	8
10/10/07	T5	0716	Tri-colored Heron	0	1	0	0	0	0	0	1
10/10/07	T5	0716	Yellow-crowned Night Heron	0	1	0	0	0	0	0	1

Table 4. continued

10/10/07	T3	0730	Blackpoll Warbler	0	0	0	0	1	0	0	1
10/10/07	T3	0730	European Starling	0	0	27	0	0	0	6	33
10/10/07	T3	0730	Great Egret	0	0	1	0	0	0	0	1
10/10/07	T3	0730	Herring Gull	0	0	0	0	0	0	1	1
10/10/07	T3	0730	Laughing Gull	0	0	0	0	0	0	24	24
10/10/07	T3	0730	Northern Cardinal	0	1	0	0	0	0	0	1
10/10/07	T3	0730	Red-winged Blackbird	0	0	2	0	0	0	1	3
10/10/07	T3	0730	Snowy Egret	0	0	0	0	0	0	10	10
10/10/07	T4	0744	Black-throated Green Warbler	0	0	0	0	0	5	3	8
10/10/07	T4	0744	European Starling	0	79	0	0	0	0	0	79
10/10/07	T4	0744	Great Egret	0	0	0	0	0	0	1	1
10/10/07	T4	0744	Laughing Gull	0	0	0	0	0	0	21	21
10/10/07	T4	0744	Mourning Dove	0	1	0	0	0	0	0	1
10/10/07	T4	0744	Red-winged Blackbird	0	0	2	0	1	0	0	3
10/10/07	T4	0744	Ruby-crowned Kinglet	1	0	0	0	0	0	0	1
10/10/07	T1	0758	Common Yellowthroat	1	0	0	0	0	0	0	1
10/10/07	T1	0758	Double-crested Cormorant	0	0	0	0	0	0	4	4
10/10/07	T1	0758	Herring Gull	0	0	0	0	0	0	1	1
10/10/07	T1	0758	Laughing Gull	0	0	0	0	0	0	28	28
10/10/07	T1	0758	Red-winged Blackbird	0	0	0	0	0	0	2	2
10/10/07	T1	0758	Snowy Egret	0	0	0	0	0	0	3	3
10/10/07	T1	0758	Song Sparrow	1	0	0	0	0	0	0	1
10/17/07	T5	0709	American Black Duck	0	27	0	0	0	0	0	27
10/17/07	T5	0709	American Wigeon	0	6	0	0	0	0	0	6
10/17/07	T5	0709	Black-crowned Night Heron	0	9	0	0	0	0	0	9
10/17/07	T5	0709	Brant	0	16	0	0	0	0	0	16
10/17/07	T5	0709	European Starling	0	0	0	1	0	0	0	1
10/17/07	T5	0709	Gadwall	0	2	0	0	0	0	0	2
10/17/07	T5	0709	Herring Gull	0	6	0	0	3	0	2	11
10/17/07	T5	0709	Laughing Gull	0	3	0	0	2	0	0	5
10/17/07	T5	0709	Mallard	0	38	0	0	0	0	0	38
10/17/07	T5	0709	Northern Shoverler	0	12	0	0	0	0	0	12
10/17/07	T5	0709	Red-winged Blackbird	0	0	0	0	3	0	0	3
10/17/07	T5	0709	Ring-billed Gull	0	0	0	0	1	0	0	1
10/17/07	T5	0709	Song Sparrow	1	0	0	0	0	0	0	1
10/17/07	T5	0709	Yellow-rumped Warbler	0	1	0	0	0	0	0	1
10/17/07	T3	0723	Brown Creeper	1	0	0	0	0	0	0	1
10/17/07	T3	0723	Golden-crowned Kinglet	1	3	0	1	0	0	0	5
10/17/07	T3	0723	Herring Gull	0	0	0	0	0	0	2	2

Table 4. continued

10/17/07	T3	0723	Laughing Gull	0	0	0	0	0	0	1	1
10/17/07	T3	0723	Yellow-rumped Warbler	2	3	0	1	1	0	0	7
10/17/07	T4	0736	Double-crested Cormorant	0	0	0	0	0	0	1	1
10/17/07	T4	0736	Golden-crowned Kinglet	0	1	1	0	1	0	0	3
10/17/07	T4	0736	Gray Catbird	1	0	0	0	0	0	0	1
10/17/07	T4	0736	Great Black-backed Gull	0	0	0	0	0	0	1	1
10/17/07	T4	0736	Herring Gull	0	1	0	0	0	0	1	2
10/17/07	T4	0736	Laughing Gull	0	0	0	0	0	0	5	5
10/17/07	T4	0736	Northern Mockingbird	1	0	0	0	0	0	0	1
10/17/07	T4	0736	Red-winged Blackbird	1	0	1	0	0	0	0	2
10/17/07	T4	0736	Red-winged Blackbird	0	0	0	0	0	0	1	1
10/17/07	T4	0736	Ring-billed Gull	0	0	0	0	0	0	1	1
10/17/07	T4	0736	Savannah Sparrow	3	0	0	0	0	0	0	3
10/17/07	T4	0736	Snowy Egret	0	0	0	0	0	0	1	1
10/17/07	T4	0736	Song Sparrow	1	0	0	1	1	0	0	3
10/17/07	T4	0736	Swamp Sparrow	1	0	0	0	0	0	0	1
10/17/07	T1	0749	European Starling	12	6	0	0	0	0	0	18
10/17/07	T1	0749	Herring Gull	0	0	0	0	0	0	4	4
10/17/07	T1	0749	Killdeer	0	0	1	0	0	0	0	1
10/17/07	T1	0749	Laughing Gull	0	0	0	0	0	0	2	2
10/17/07	T1	0749	Mourning Dove	2	0	0	0	0	0	0	2
10/17/07	T1	0749	Northern Mockingbird	1	0	0	0	0	0	0	1
10/17/07	T1	0749	Red-winged Blackbird	22	10	0	0	0	2	0	34
10/17/07	T2	0804	American Black Duck	0	0	0	0	0	0	1	1
10/17/07	T2	0804	Brant	0	0	0	0	0	2	0	2
10/17/07	T2	0804	Canada Goose	0	0	0	0	0	0	10	10
10/17/07	T2	0804	Double-crested Cormorant	0	0	0	0	1	0	2	3
10/17/07	T2	0804	Great Blue Heron	0	0	0	0	0	1	0	1
10/17/07	T2	0804	Greater Yellowlegs	0	1	0	0	0	0	0	1
10/17/07	T2	0804	Herring Gull	0	1	0	0	0	0	14	15
10/17/07	T2	0804	Laughing Gull	0	10	0	0	0	0	7	17
10/17/07	T2	0804	Osprey	0	0	0	0	0	0	1	1
10/17/07	T2	0804	Ring-billed Gull	0	1	0	0	0	0	7	8
10/31/07	T3	0724	Herring Gull	0	0	0	0	0	0	2	2
10/31/07	T3	0724	Northern Mockingbird	0	0	1	0	0	0	0	1
10/31/07	T3	0724	Red-winged Blackbird	0	0	0	0	0	0	11	11
10/31/07	T3	0724	Ruby-crowned Kinglet	0	0	0	0	1	0	0	1
10/31/07	T3	0724	Swamp Sparrow	0	0	0	0	1	0	0	1
10/31/07	T3	0724	Yellow-rumped Warbler	0	1	0	0	3	0	0	4

Table 4. continued

10/31/07	T3	0724	Yellow-rumped Warbler	0	0	0	0	0	0	2	2
10/31/07	T4	0737	Herring Gull	0	0	0	0	0	0	6	6
10/31/07	T4	0737	Mourning Dove	0	0	0	0	0	0	1	1
10/31/07	T4	0737	Red-winged Blackbird	0	1	1	0	0	0	0	2
10/31/07	T4	0737	Song Sparrow	5	0	0	0	0	0	0	5
10/31/07	T4	0737	Swamp Sparrow	0	0	0	0	1	0	0	1
10/31/07	T4	0737	Yellow-rumped Warbler	0	0	0	0	0	0	1	1
10/31/07	T1	0750	European Starling	0	1	8	0	0	0	0	9
10/31/07	T1	0750	Herring Gull	0	1	0	0	0	0	3	4
10/31/07	T1	0750	Laughing Gull	0	0	0	0	0	0	1	1
10/31/07	T1	0750	Northern Mockingbird	0	0	0	0	0	1	0	1
10/31/07	T1	0750	Red-winged Blackbird	0	0	0	0	0	0	3	3
10/31/07	T1	0750	Ruby-crowned Kinglet	0	0	0	1	0	0	0	1
10/31/07	T1	0750	Song Sparrow	0	0	1	0	0	0	0	1

Figure 1. Dual radar system with horizontally and vertically oriented antennas that operate simultaneously. This system allows for data collection on passage (horizontal and vertical), altitude (vertical) and flight direction (horizontal).

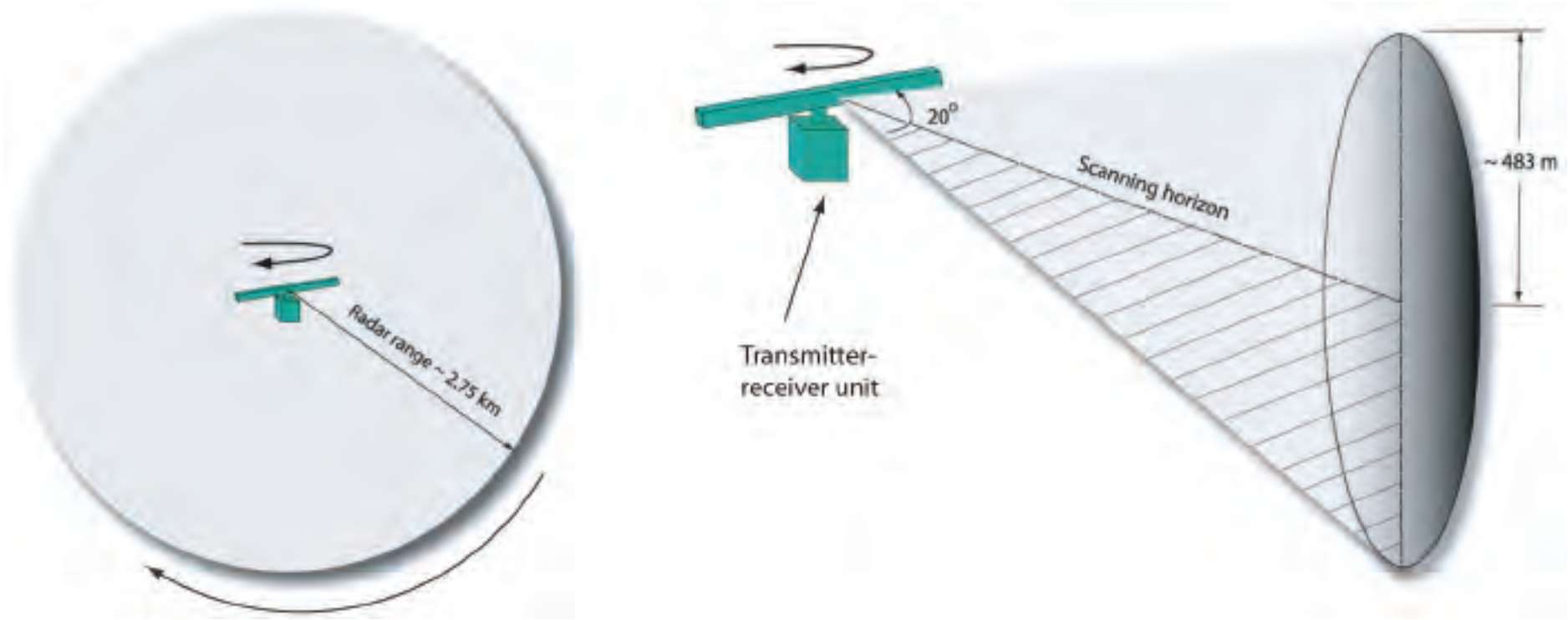

Figure 2. Graphical depiction of scanning operation of horizontally-oriented radar. In this orientation, the antenna rotates in a plane parallel to the ground resulting in a 360o scan with a that samples 10o above and below the scanning horizon. With the radar's range set to 1nautical mile (1.85 km, 6076 ft) which is the effective detection range for small passerines with 25 kW radar) it samples up to 483 m arl (above radar level) and ~4.0 km3 of air space. Data collected in "horizontal" scanning mode can be used to estimate (1) target flight direction and speed and (2) target passage magnitude.

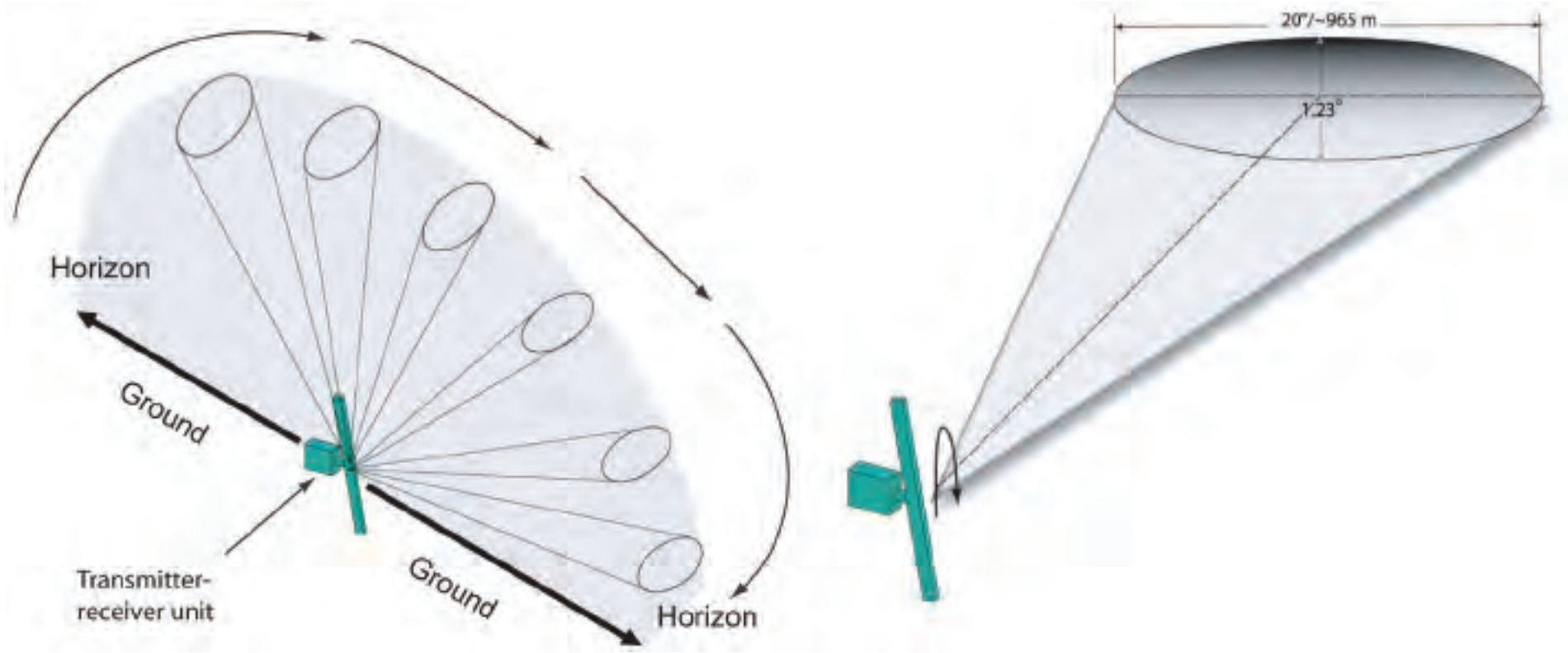

Figure 3. Graphical depiction of scanning operation of vertically-oriented radar. In this orientation, the transmitter-receiver unit is mounted perpendicular to the ground so that the radar antenna's rotation results in a 180o, horizon-to-horizon scan (radar does not transmit when antenna is oriented groundward). When the radar's range is set to 0.75 nm (1.4 km, 4557 ft) it samples ~0.98 km3 of air space. Data collected in "vertical" scanning mode can be used to estimate (1) target altitude and (2) target passage magnitude.

Figure 4. Atlantic City Utilities Authority (ACUA) study site showing the location of five wind turbines, carcass search area boundaries and location of dual marine radar system. Turbine (T) locations are numbered 1-5.

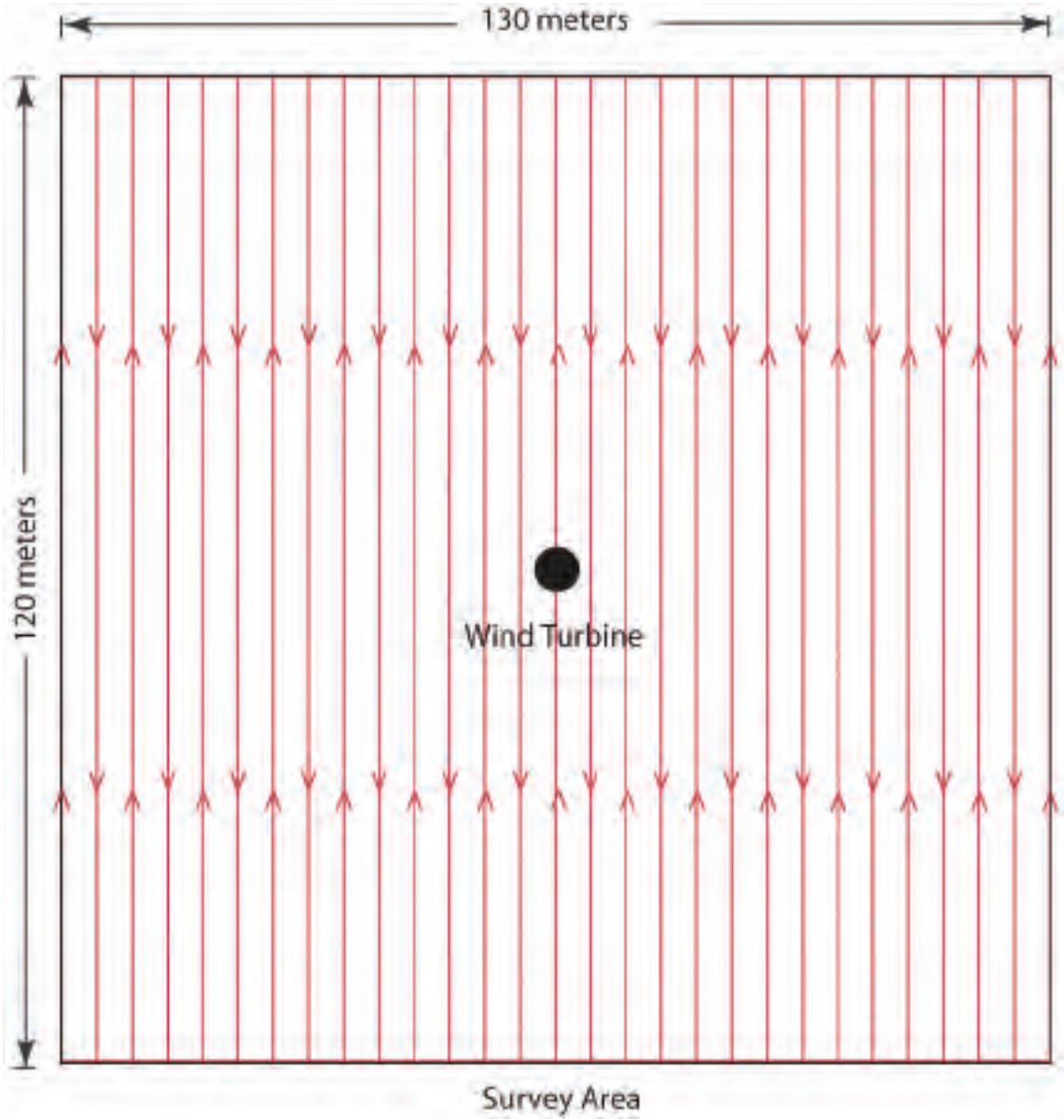

Figure 5. Schematic of the transect layout for carcass search surveys. Transects are spaced approximately 5 meters apart. The survey plot is oriented to maximize the searchable area. While walking each transect, the searcher used the unaided eye to conduct the survey, alternately scanning an area that extended for 2.5 m on either side of his/her track.

Figure 6. Atlantic City Utilities Authority (ACUA) study site showing actual survey areas (shaded in light blue) used during collision incident surveys. Low lying marsh areas within a turbine's search area were not surveyed because tidal inundation regularly prevented access to these sections. To some extent this was the case at all turbine sites except at turbine #3. If a building fell within the search area, rooftops were surveyed when accessible. Clarifying and mixing ponds, and other water bodies were also surveyed using walkways, gangways and dikes to gain access. Collision incident estimates will be corrected for the proportion of the total area around each turbine that was searched.

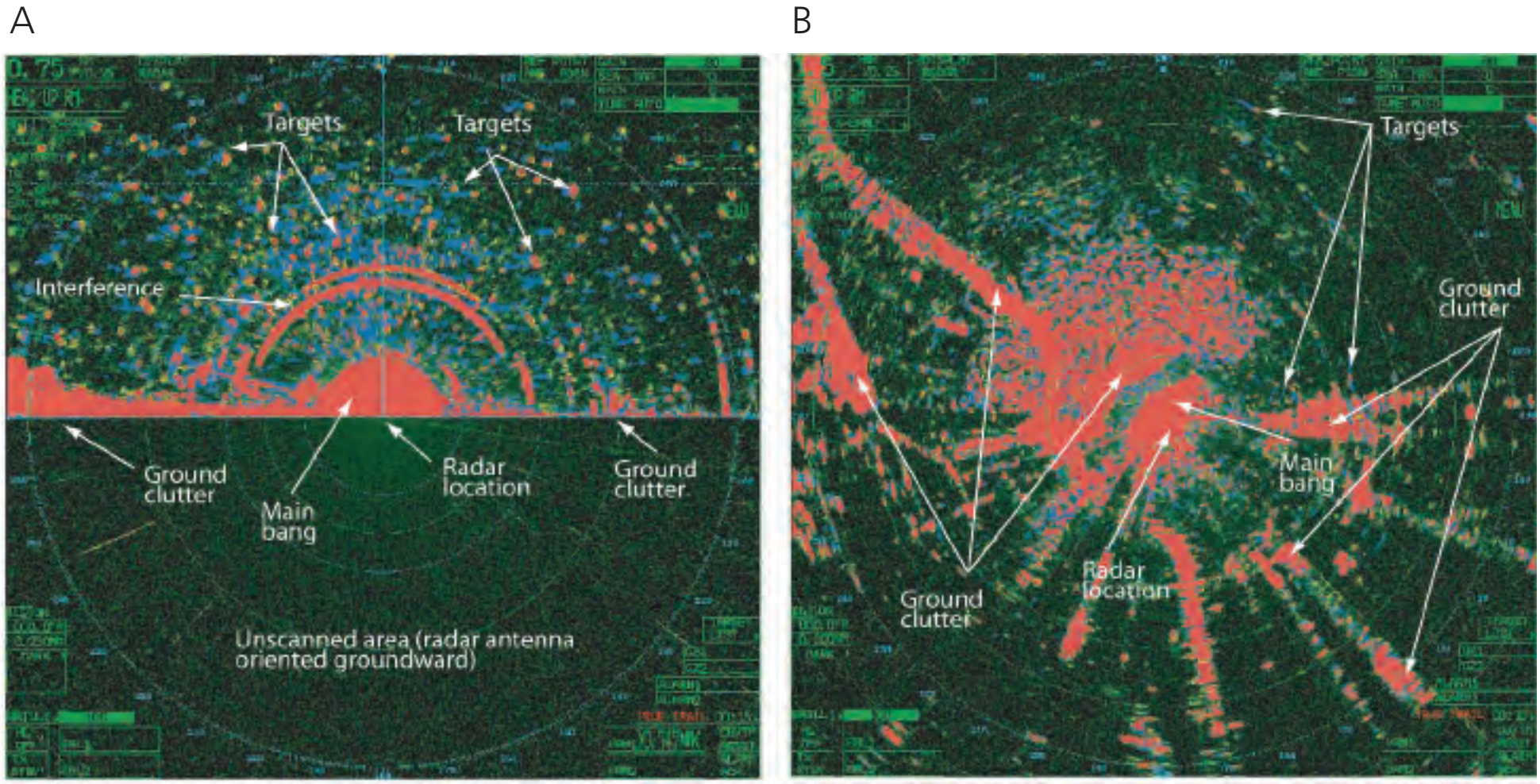

Figure 7. (A) Data images from vertically-oriented and (B) horizontally-oriented radars collected at the Atlantic City Utilities Authority (ACUA) study site on 31 August 2007 at ~2300 EST. Radar displays targets using an RGB color scale to represent 29 reflectance levels (i.e., amount of energy reflected by target).

Greens → Yellows → Reds = low → moderate → high reflectance values

Target tracking (shown in blue) can be used to estimate target velocity and flight direction. Circular areas of red at the center of each data image is referred to as the "main bang." The main bang is an inherent property of all radars representing the radar's noise range and thus occludes target detection in this region. Irregularly shaped red areas, referred to as ground clutter, are typically large, stationary features (e.g., buildings, turbines, marsh) in the radar's field of view that reflect electromagnetic energy. Similar to the main bang region, these features occlude target detection.