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Eagle Nest, Roost and Foraging Area Monitoring at Exelon's Conowingo and Muddy Run Reservoirs

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EAGLE NEST, ROOST, AND FORAGING AREA MONITORING AT EXELON'S CONOWINGO AND MUDDY RUN RESERVOIRS

Interim report submitted to
Exelon Corporation

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Background

The waters of the lower Susquehanna River support several power generating stations including Exelon Corporation's Muddy Run Hydroelectric Station, Peach Bottom Atomic Power Plant, and Conowingo Hydroelectric Station. This section of the Susquehanna is rich in birdlife with over 200 species documented in the area. The Lower Susquehanna Gorge was identified in 2002 as a candidate for recognition as an Important Bird Area (PA Audubon). The first Bald Eagle Sanctuary was established in 1936 to protect an active eagle nest on Mt Johnson Island, across from the Peach Bottom Plant (Abbott 1959).

Bald Eagles from populations along the Atlantic coast congregate in the upper Chesapeake Bay and lower Susquehanna River with some of the largest numbers concentrating around the lower portion of the Susquehanna River (Buehler et al 1987, Buehler et al 1991, Watts et al 2007). Eagle populations have grown exponentially in the Chesapeake Bay resulting in a large increase in the number of eagles foraging and roosting around the Conowingo reservoir and dam system (Watts et al 2007, Watts et al 2008). Satellite telemetry data from an ongoing study of eagles at Aberdeen Proving Ground has revealed significant use of Conowingo by eagles in the upper Bay (Watts and Mojica *in press*). This telemetry data may be used to delineate communal roosts and key foraging areas. Ground work is needed to determine the relationship between use of communal roosts and foraging areas by birds with transmitters and the broader eagle population.

Identification of communal roosts and foraging areas is important for successful eagle management under the USFWS's National Eagle Management Guidelines. Though the Bald Eagle was removed from the federal Endangered Species List in 2007, it remains protected by the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) and Migratory Bird Treaty Act (16 U.S.C. 703-712). Bald Eagles are listed as state threatened in Pennsylvania and are on the state watch list in Maryland.

Objectives

The objectives of the project were:

1. To use aerial surveying to document the status, distribution and productivity of nesting Bald Eagles
2. To delineate eagle roosts and foraging areas using satellite telemetry
3. To monitor eagle roosts and foraging areas with ground surveys.

Study Area

All forested components of the Conowingo and Muddy Run reservoir systems were surveyed for evidence of nesting Bald Eagles. The survey covered all shoreline inland 1.5 km from US 40 at the mouth of the Susquehanna to PA Route 372 at the north end of the Conowingo Reservoir and Muddy Run Reservoir (approximately 50 miles of shoreline).

Methods

Nesting and Productivity Surveys

All major waterways and tributaries associated with the study area were surveyed for breeding Bald Eagles. In March 2010, a high-wing Cessna 172 aircraft was used to systematically overfly the land surface, at an altitude of approximately 100 m above tree canopy, to detect eagle nests. Flights were flown to systematically move between the shoreline and a distance of approximately 1.5 km inland from to cover the most probable breeding locations for Bald Eagles. Detected nests were plotted on 7.5 min topographic maps, assigned a unique numeric code, and plotted in ArcGIS 9.3. Final nest codes will be assigned by Maryland Department of Natural Resources and Pennsylvania Game Commission. Each nest was examined to determine its structural condition, the type and condition of nest tree, and the condition of the surrounding landscape. Following national conventions (USFWS 2007), a breeding territory was considered “occupied” if a pair of birds was observed in association with the nest and there was evidence of recent nest maintenance (e.g., well-formed cup, fresh lining, and structural maintenance). Nests were considered “active” if a bird was observed in an incubating posture or if eggs or young were detected in the nest. A “productive” nest has young present until fledging age (11-14 weeks old). All active Bald Eagle nests were rechecked in May 2010 for productivity. A Cessna 172 aircraft was used to fly low over nests, allowing observers to examine nest contents. All eaglets were counted and aged by sight.

Eagle Roost and Foraging Areas

Delineation

GPS-Satellite telemetry data were compiled from 67 Bald Eagles tagged in the Chesapeake Bay during August 2007 – February 2010 (Watts and Mojica 2009). Thirty-nine of these eagles roosted at night in the study area with a total of 1,864 GPS locations included in the analysis. A nearest neighbor clustering script in Crimestat III (Levine 2004) was used to delineate the roost boundaries with a minimum convex polygon (MCP; see example Figure 1). This analysis searched for spatially clustered GPS locations which indicated communal roosts (Watts and Mojica *in press*). Daytime GPS locations were also analyzed in Crimestat to delineate concentrated foraging areas within the study area. Seasonal use and variation was evaluated.

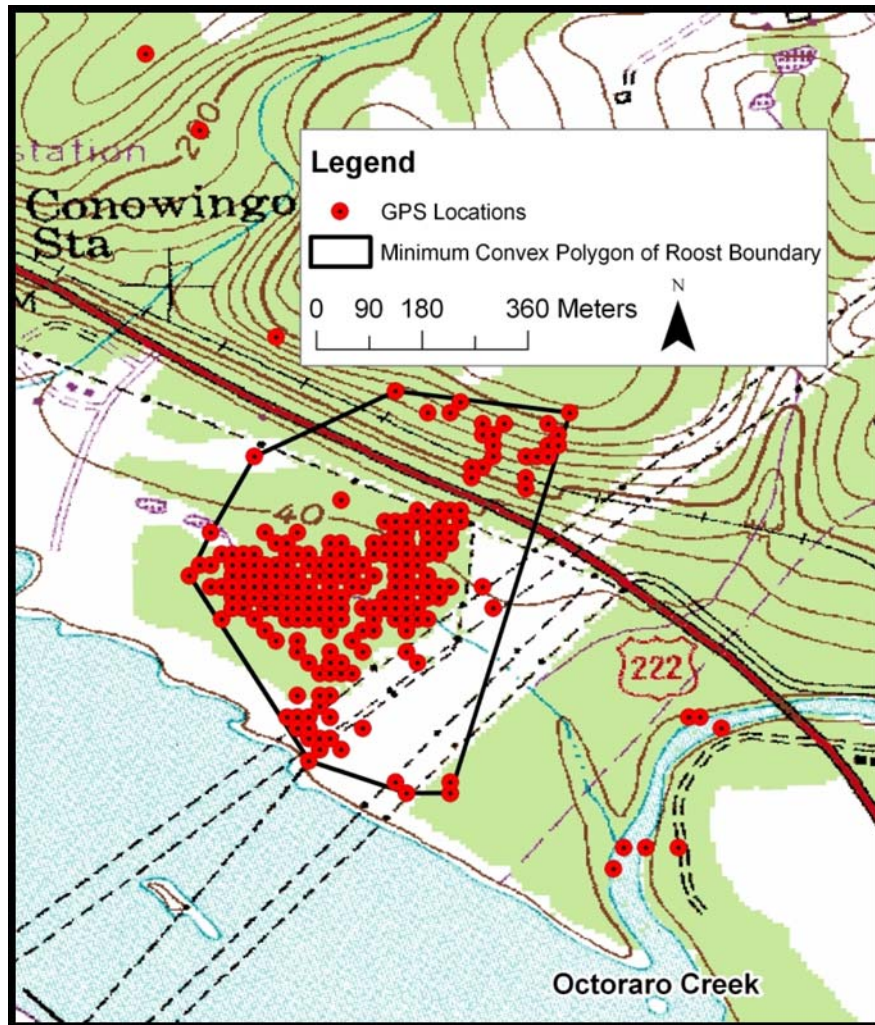


Figure 1. A Minimum Convex Polygon was drawn around roost locations recorded by GPS-transmitters. The polygon represents the boundary of the communal roost. The roost in the figure is Roost 1 located downstream of Conowingo Dam.

Monitoring

A subsample of communal roosts and foraging areas was selected for follow-up ground surveys. Dawn and dusk roost surveys and daytime shoreline surveys of foraging areas were conducted to determine the magnitude of use. The first set of surveys were completed July-October 2010. The second round of surveys will occur January-March 2011.

Roost Surveys: Communal roosts were identified from existing satellite data and a subset of 12 roosts was selected for surveying based on ground access and year-round use by eagles. One observer counted and aged eagles as they entered the roost at dusk or exited at dawn. Dawn surveys began 45 minutes before civil twilight and ended 30 minutes after sunrise. Dusk surveys began 2 hours before civil twilight and ended when it became too dark to see (approximately civil twilight). When both sets of surveys are complete, ground observations of roosts will be compared to existing satellite data to develop a relationship between the data for evaluating roost use by transmitted and non-transmitted eagles.

Shoreline Surveys: A subset of the shoreline was surveyed each week to assess the overall eagle population using the Conowingo dam and reservoir system. Observers counted, aged, and mapped eagles from observation points along the shoreline. When surveys are complete, this data will be mapped and compared with satellite telemetry data to delineate high use shoreline perching and foraging habitat for eagles. Survey locations were limited by ground accessible observation points along the shorelines.

Results

Nesting and Productivity Surveys

Twelve occupied breeding territories were documented in the study area during spring 2010 (Figure 2). Eleven nests were active and these produced 15 eagle nestlings (Table 1). Reproductive rates were 1.25 chicks/occupied territory and 1.36 chicks/active nest.

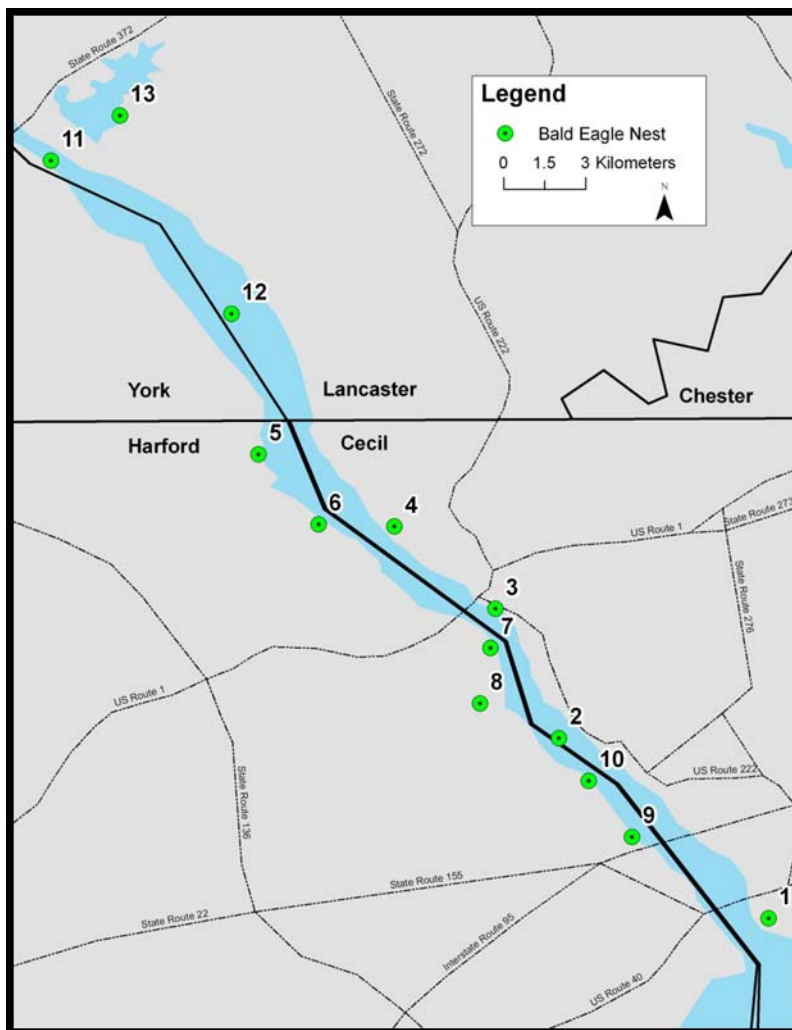


Figure 2. Bald Eagle nests located in 2010 along the Susquehanna River in Pennsylvania and Maryland.

Table 1. Eagle nests surveyed on the lower Susquehanna River in 2010. Coordinates for nests are listed in Appendix A.

Nest	Tree	Quad	Location	Occup.	Active	Prod.
1	Cell tower	Havre de Grace	Perryville Substation	Y	Y	2
2	Hardwood tree	Aberdeen	Robert Island	Y	N	0
3	Electrical tower	Conowingo Dam	Conowingo Dam	Y	Y	0
4	Oak tree	Conowingo Dam	Pilot Station	N	N	0
5	Oak tree	Conowingo Dam	N of Broad Creek	Y	Y	2
6	Beech tree	Conowingo Dam	Gazebo House	Y	Y	0
7	Oak tree	Conowingo Dam	S of Conowingo Dam	Y	Y	1
8	Hardwood tree	Conowingo Dam	Buck Branch	Y	Y	2
9	Poplar tree	Havre de Grace	Susquehanna SP	Y	Y	2
10	Sycamore tree	Aberdeen	Lapidum	Y	Y	2
11	Beech tree	Holtwood	Upper Bear Island	Y	Y	0
12	Electrical tower	Holtwood	Fulton Power Plant	Y	Y	1
13	Hardwood	Holtwood	Muddy Run	Y	Y	3 ^a

^a Productivity data for this nest provided by D. Gross, Pennsylvania Game Department.

Eagle Roost and Foraging Areas

Delineation

Nineteen communal roosts were identified in the study area (Figure 3). They ranged from high-use roosts near Conowingo Dam and Muddy Run Reservoir, to smaller low-use roosts scattered on the river shoreline. Foraging areas were delineated along shorelines of Muddy Run Reservoir, Conowingo Pond, and Susquehanna River. Coordinates for roosts are listed in Appendix B.

Monitoring

Roost use varied between individual roost and between weeks (see example, Figure 5). A total of 1,250 eagles were counted in communal roosts during the July-October 2010 survey period (Table 2, Appendix C).

Figure 3. Bald Eagle communal roosts delineated on the lower Susquehanna River.

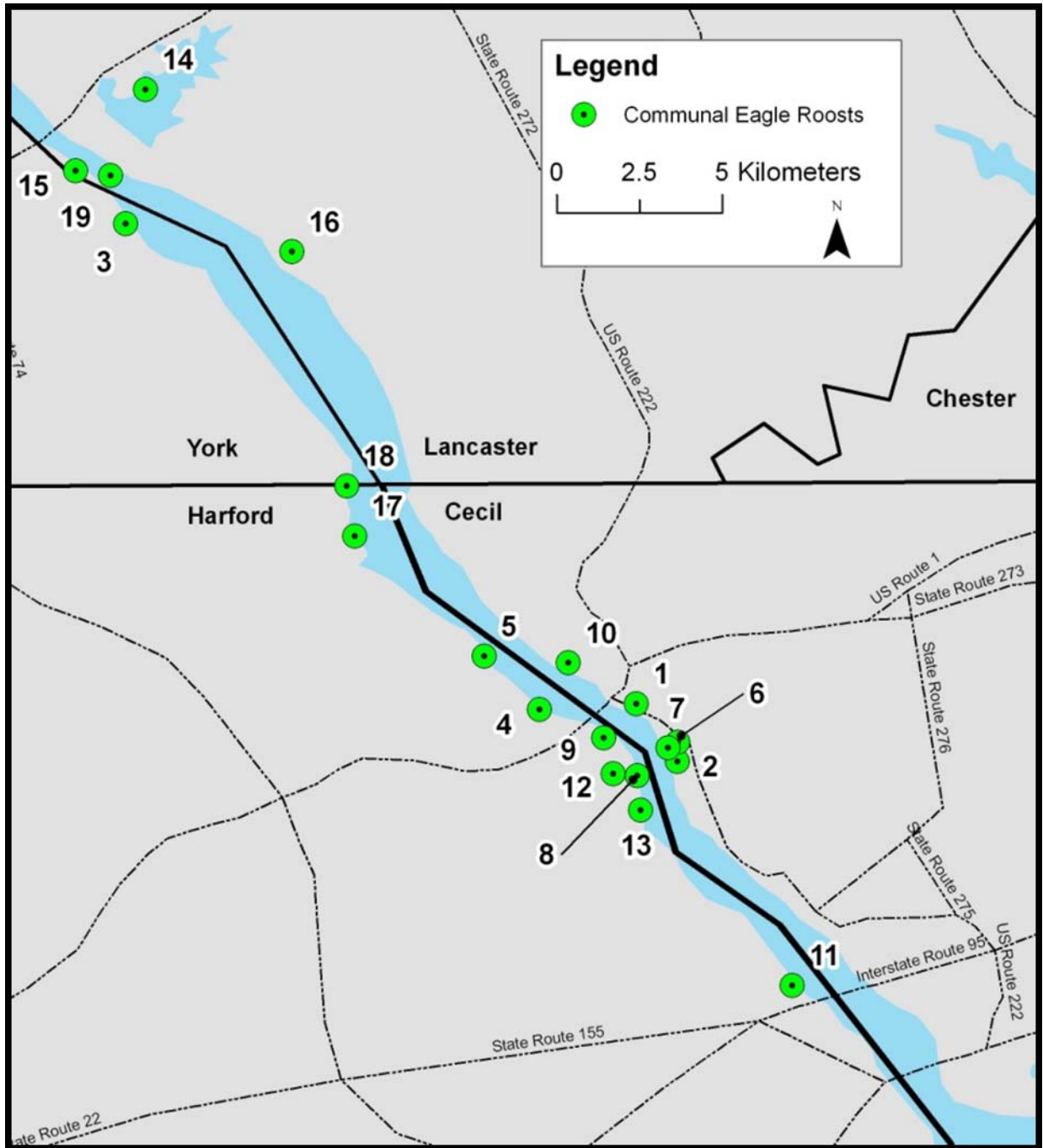




Figure 4. Left: Adult Bald Eagle fitted with transmitter in January 2008 in Harford Co, MD. Photographed at Conowingo Dam by Robert Lin in December 2008. Bottom left: Transmission tower adjacent to roost 14 on Muddy Run Reservoir with 47 roosting Bald Eagles. Bottom right: Surveyors Beth Dzula (top) at Susquehannock State Park and Libby Mojica (bottom) at Muddy Run Reservoir.

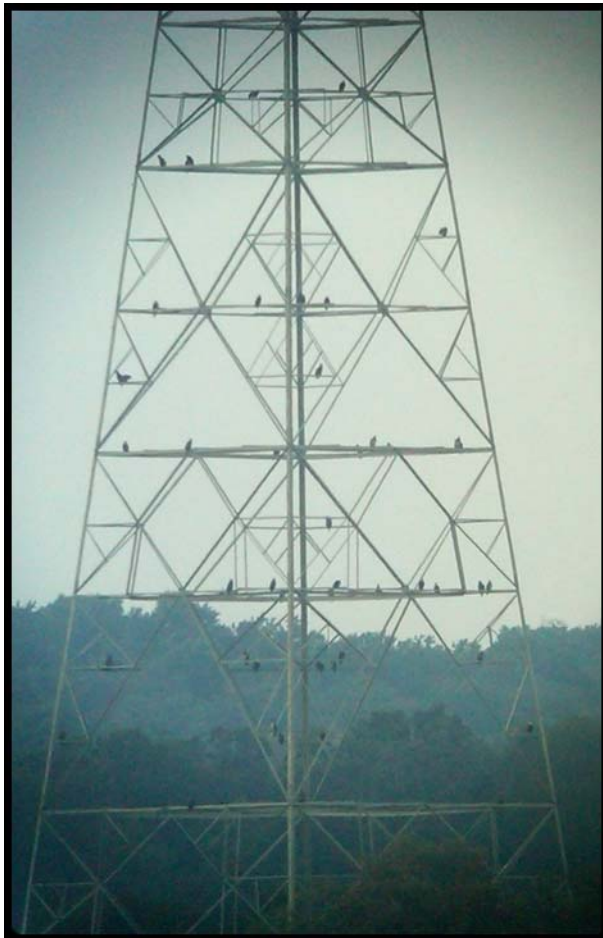


Figure 5. Count of eagles in roost 14 at Muddy Run Reservoir during ground surveys July-October 2010.

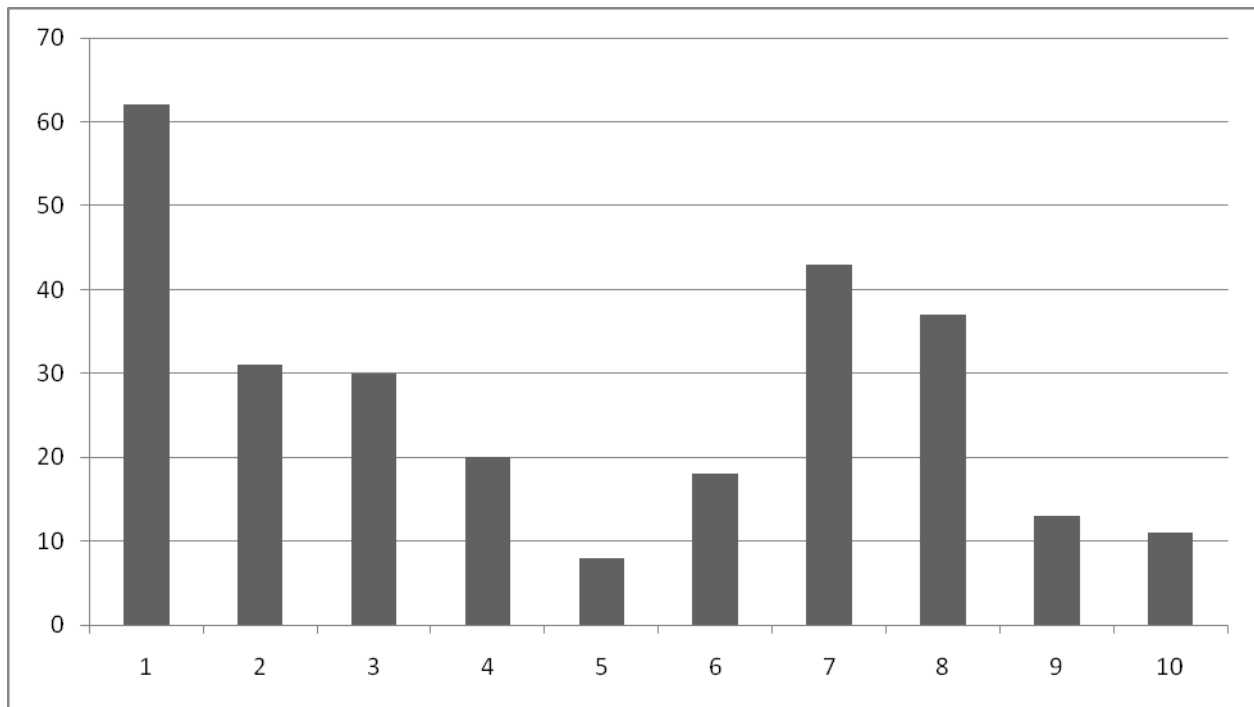


Table 2. Number of individual eagles observed in each of the 12 roosts surveyed by week.

Roost	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Total Observations
1	98	82	52	47	39	105	26	19	49	82	599
2&7 ^a	4	6	8	3	2	3	6	6	7	7	52
3	8	0	6	1	0	0	2	4	0	0	21
4	5	1	2	3	3	0	8	--- ^b	0	16	38
5	0	2	2	2	1	0	4	--- ^b	6	3	20
9	2	4	2	5	0	1	3	7	0	7	31
10	3	1	1	1	2	3	2	--- ^b	3	0	16
11	14	17	36	6	8	9	6	8	7	7	118
14	62	31	30	20	8	18	43	37	13	11	273
15	2	0	3	2	0	2	1	0	0	11	21
17	4	0	2	1	2	0	0	--- ^b	1	0	10
19	13	2	12	0	4	4	6	7	3	0	51
Total	215	146	156	91	69	145	107	88	89	144	1250

^a Roosts 2 and 7 were surveyed jointly because close proximity of the roosts made separation of observations between roosts difficult.

^b Four roost surveys were cancelled during an extensive weather system in week 8.

Discussion and Future Work

The lower Susquehanna River in the upper Chesapeake Bay is an important breeding, foraging, and roosting area for Bald Eagles. The shoreline forests along the Conowingo Reservoir, Muddy Run Reservoir, and the Susquehanna River downstream of Conowingo Dam provide habitat that supports 12 pairs of breeding Bald Eagles and thousands of foraging and roosting Bald Eagles each year.

Jan-Mar 2011 Ten weeks of roost and foraging area surveys. Finalize nest codes with state biologists.

Apr-Jun 2011 Analysis of roost and foraging data with telemetry

August 2011 Final report

Acknowledgements

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Appendix A. Bald Eagle nest coordinates in WGS 1984.

Nest	Tree	Quad	Location	Latitude	Longitude
1	Cell tower	Havre de Grace	Perryville Substation	39.55776	-76.07447
2	Hardwood tree	Aberdeen	Robert Island	39.61716	-76.14355
3	Electrical tower	Conowingo Dam	Conowingo Dam	39.65979	-76.16452
4	Oak tree	Conowingo Dam	Pilot Station	39.68692	-76.19777
5	Oak tree	Conowingo Dam	N of Broad Creek	39.71076	-76.24259
6	Beech tree	Conowingo Dam	Gazebo House	39.68768	-76.22283
7	Oak tree	Conowingo Dam	S of Conowingo Dam	39.64688	-76.16607
8	Hardwood tree	Conowingo Dam	Buck Branch	39.62858	-76.16959
9	Poplar tree	Havre de Grace	Susquehanna SP	39.58456	-76.11948
10	Sycamore tree	Aberdeen	Lapidum	39.60310	-76.13372
11	Beech tree	Holtwood	Upper Bear Island	39.80755	-76.31106
12	Electrical tower	Holtwood	Fulton Power Plant	39.75708	-76.25157
13	Hardwood tree	Holtwood	Muddy Run	39.82247	-76.28828 ^a

^aCoordinates for this nest provided by D. Gross, Pennsylvania Game Department.

Appendix B. Mid-point coordinates for Bald Eagle communal roosts. Coordinates are in WGS 1984.

Roost	Latitude	Longitude
1	39.66217	-76.16338
2	39.64643	-76.15228
3	39.79283	-76.30243
4	39.66064	-76.18978
5	39.67518	-76.20484
6	39.65178	-76.15210
7	39.65023	-76.15480
8	39.64256	-76.16318
9	39.65288	-76.17223
10	39.67328	-76.18185
11	39.58558	-76.12101
12	39.64316	-76.16975
13	39.63322	-76.16224
14	39.82925	-76.29698
15	39.80718	-76.31599
16	39.78512	-76.25716
17	39.70784	-76.24005
18	39.72146	-76.24227
19	39.80587	-76.30643

Appendix C. Weekly roost count data for individual eagle roosts monitored during July-October 2010. In week 8, an extensive weather system forced cancellation of surveys at 4 roosts.

Roost	Week	DATE	Time Period	Juvenile	Adult	Unknown Age	TOTAL
1	1	7/28/2010	Morning	63	35	0	98
	2	8/4/2010	Evening	57	25	0	82
	3	8/12/2010	Morning	13	6	33	52
	4	8/19/2010	Evening	41	6	0	47
	5	8/26/2010	Morning	8	1	30	39
	6	9/2/2010	Evening	81	24	0	105
	7	9/9/2010	Evening	22	4	0	26
	8	9/16/2010	Morning	8	2	9	19
	9	9/22/2010	Evening	32	17	0	49
	10	10/7/2010	Evening	56	26	0	82
2&7	1	7/28/2010	Morning	1	1	2	4
	2	8/4/2010	Evening	4	2	0	6
	3	8/12/2010	Morning	4	3	1	8
	4	8/19/2010	Evening	2	1	0	3
	5	8/26/2010	Morning	2	0	0	2
	6	9/2/2010	Evening	0	3	0	3
	7	9/9/2010	Evening	5	1	0	6
	8	9/16/2010	Morning	6	0	0	6
	9	9/22/2010	Evening	3	4	0	7
	10	10/7/2010	Evening	2	5	0	7
3	1	7/27/2010	Evening	1	6	1	8
	2	8/3/2010	Morning	0	0	0	0
	3	8/13/2010	Evening	2	4	0	6
	4	8/19/2010	Morning	0	0	1	1
	5	8/25/2010	Evening	0	0	0	0
	6	9/2/2010	Morning	0	0	0	0
	7	9/8/2010	Morning	2	0	0	2
	8	9/15/2010	Evening	3	1	0	4
	9	9/23/2010	Morning	0	2	0	0
	10	10/6/2010	Evening	0	0	0	0
4	1	7/28/2010	Morning	1	4	0	5
	2	8/5/2010	Morning	0	0	1	1
	3	8/11/2010	Evening	0	2	0	2
	4	8/20/2010	Morning	1	2	0	3
	5	8/26/2010	Evening	3	0	0	3
	6	9/1/2010	Evening	0	0	0	0
	7	9/9/2010	Morning	2	6	0	8
	8	9/16/2010		---	---	---	---
	9	9/23/2010	Evening	0	0	0	0
	10	10/7/2010	Morning	2	12	2	16

Roost	Week	DATE	Time Period	Juvenile	Adult	Unknown Age	TOTAL
5	1	7/28/2010	Morning	0	0	0	0
	2	8/5/2010	Morning	1	1	0	2
	3	8/12/2010	Morning	0	2	0	2
	4	8/20/2010	Morning	0	2	0	2
	5	8/26/2010	Evening	0	1	0	1
	6	9/1/2010	Evening	0	0	0	0
	7	9/9/2010	Morning	2	1	1	4
	8	9/16/2010		---	---	---	---
	9	9/23/2010	Evening	3	2	1	6
	10	10/7/2010	Morning	1	2	0	3
9	1	7/28/2010	Morning	0	2	0	2
	2	8/4/2010	Evening	1	3	0	4
	3	8/12/2010	Morning	0	2	0	2
	4	8/19/2010	Evening	4	1	0	5
	5	8/26/2010	Morning	0	0	0	0
	6	9/2/2010	Evening	1	0	0	1
	7	9/9/2010	Evening	0	3	0	3
	8	9/16/2010	Morning	6	0	1	7
	9	9/22/2010	Evening	0	0	0	0
	10	10/7/2010	Evening	2	5	0	7
10	1	7/28/2010	Morning	0	0	3	3
	2	8/5/2010	Morning	0	1	0	1
	3	8/12/2010	Morning	1	0	0	1
	4	8/20/2010	Morning	0	0	1	1
	5	8/26/2010	Evening	0	0	2	2
	6	9/1/2010	Evening	0	0	3	3
	7	9/9/2010	Morning	1	1	0	2
	8	9/16/2010		---	---	---	---
	9	9/23/2010	Evening	1	2	0	3
	10	10/7/2010	Morning	0	0	0	0
11	1	7/31/2010	Morning	6	6	2	14
	2	8/8/2010	Evening	5	11	1	17
	3	8/14/2010	Morning	16	15	5	36
	4	8/22/2010	Evening	2	4	0	6
	5	8/26/2010	Morning	4	4	0	8
	6	9/2/2010	Evening	5	4	0	9
	7	9/9/2010	Evening	3	3	0	6
	8	9/16/2010	Morning	2	2	4	8
	9	9/22/2010	Evening	4	2	1	7
	10	10/7/2010	Evening	2	5	0	7
14	1	7/27/2010	Evening	49	12	1	62
	2	8/5/2010	Morning	20	8	3	31
	3	8/11/2010	Evening	23	7	0	30
	4	8/20/2010	Morning	2	2	16	20
	5	8/25/2010	Evening	5	3	0	8
	6	9/2/2010	Morning	1	1	16	18

Roost	Week	DATE	Time Period	Juvenile	Adult	Unknown Age	TOTAL
14	7	9/8/2010	Evening	37	6	0	43
	8	9/15/2010	Evening	35	2	0	37
	9	9/23/2010	Morning	9	4	0	13
	10	10/6/2010	Evening	8	3	0	11
15	1	7/27/2010	Evening	0	1	1	2
	2	8/3/2010	Morning	0	0	0	0
	3	8/13/2010	Evening	1	2	0	3
	4	8/19/2010	Morning	1	1	0	2
	5	8/25/2010	Evening	0	0	0	0
	6	9/2/2010	Morning	2	0	0	2
	7	9/8/2010	Evening	0	1	0	1
	8	9/15/2010	Evening	0	0	0	0
	9	9/23/2010	Morning	0	0	0	0
	10	10/6/2010	Evening	8	3	0	11
17	1	7/31/2010	Evening	1	3	0	4
	2	8/8/2010	Evening	0	0	0	0
	3	8/14/2010	Morning	1	1	0	2
	4	8/21/2010	Morning	0	1	0	1
	5	8/26/2010	Evening	1	1	0	2
	6	9/1/2010	Evening	0	0	0	0
	7	9/9/2010	Morning	0	0	0	0
	8	9/16/2010		---	---	---	---
	9	9/23/2010	Evening	1	0	0	1
	10	10/7/2010	Morning	0	0	0	0
19	1	7/27/2010	Evening	9	4	0	13
	2	8/3/2010	Morning	0	0	2	2
	3	8/13/2010	Evening	8	4	0	12
	4	8/19/2010	Morning	0	0	0	0
	5	8/25/2010	Evening	1	3	0	4
	6	9/2/2010	Morning	2	2	0	4
	7	9/8/2010	Evening	4	2	0	6
	8	9/15/2010	Evening	3	4	0	7
	9	9/23/2010	Morning	2	1	0	3
	10	10/6/2010	Evening	0	0	0	0