Breeding Birds of Eagle Creek Park Summer 2006

Prepared by James B. Cole

the Audubon Indiana Important Bird Areas Program

Misc. Publ. No. 2, The Amos W. Butler Audubon Society, Inc.

2007

Introduction

Eagle Creek Park in Indianapolis, Indiana, is often regarded by birdwatchers and naturalists alike as a critical locale in central Indiana for breeding, migrant, and overwintering bird populations. Eagle Creek Park undoubtedly supports a diversity of avian taxa throughout the year that is unparalleled in other locations in Marion County and central Indiana, thanks to the property's location, large size, diversity of habitats, and the existence of a large body of water (Eagle Creek Reservoir).

The park has been scoured by a legion of committed birders since the early 1970s. The occurrence of rare birds, as well as the status and distribution of many common species, has been documented in a host of field note publications and birding guides. For instance, as articulated in these publications, few properties in the greater Indianapolis area can rival Eagle Creek Park's populations of neotropical passerines during northbound and southbound migrations, while the reservoir simultaneously can host flocks of resting waterfowl and waterbirds (White 1999). Concerning rare birds, the park produced Indiana's only record of Ross's Gull, a species typically found in the high Arctic. The park almost annually supports a few species that are uncommon to rare in the state away from the deep waters of Lake Michigan. Examples of unusual birds found on Eagle Creek Reservoir in recent years include Surf Scoter, Long-tailed Duck, Red-throated Loon, Red-necked Grebe, and Sabine's Gull (Brock 2006).

Although some prior anecdotal and qualitative information exists concerning the breeding birds of Eagle Creek Park, a formal inventory of the nesting avifauna had not been undertaken since the property's inception. To remedy this lack of documentation, during May and June 2006 Mike Alrichs, Angie Cole, Steve Housefield, Andrew Mertz, and the author conducted a point count survey within the property, covering 62 survey stations in all. From this sampling regime, statistics were derived concerning the relative abundance of nesting species, the status of endangered and threatened species, and the distribution of breeding birds within the park; such information is presented in the text, figures, and tables incorporated in the following pages.

Those involved in the 2006 Eagle Creek Park survey hope that the efforts and resultant data serve a purpose beyond the fulfillment of an intellectual curiosity about the property's birdlife. Most significantly, this initial study can serve as an important tool for park board members and in the management of Indy Parks, particularly in analysis of land use and development options. Knowledge of the status and location of several state-listed species (e.g., Cerulean and Hooded Warblers) within the park should be valuable when planning recreational uses and infrastructure on the property.

Eagle Creek Park also is listed as a property for consideration with Audubon's Important Bird Areas (IBA) Program. The data obtained by this inventory will prove to be a critical reference for its evaluation in this conservation initiative. Finally, the volunteers involved with the 2006 Eagle Creek survey hope that this report will encourage other central Indiana birders to be continually engaged in avian monitoring projects. Such "citizen scientist" efforts can provide crucial data for conservation and property stewardship efforts at many important bird habitats in the greater Indianapolis area.

Property Description

Eagle Creek Park, a large municipal park owned and managed by the City of Indianapolis, is located in the northwestern corner of Marion County. In general terms, the park's boundaries are defined by Interstate 65 (east), 56th Street (south), Wilson Road (north), and the Marion-Hendricks County border (west); however, much aquatic habitat, represented by the Eagle Creek Reservoir, extends past the southern terminus represented by 56th Street. Several smaller parcels of land managed as part of Eagle Creek Park exist outside of this described perimeter (Figure 1). Because of access and other logistical constraints, the efforts of this survey were confined to the area north of 56th Street.

Encompassed within Eagle Creek Park's boundaries are approximately 5,300 acres, making the property the largest park

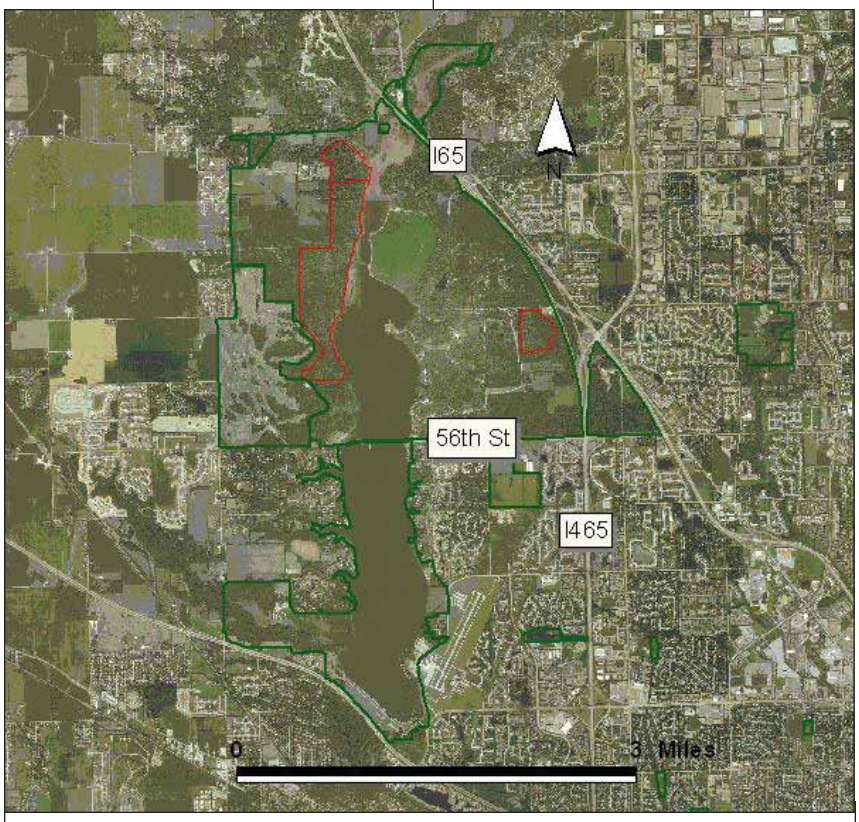

Figure 1. Aerial view of Eagle Creek Park

in Indianapolis and one of the largest municipally-owned parks in the United States. This acreage includes 3,900 acres of various upland and wetland habitats and 1,400 acres of open water, mostly comprised of Eagle Creek Reservoir. The reservoir, which is orientated in a nearly perfect north-south direction, bifurcates Eagle Creek Park into two distinct, asymmetrical portions; hereafter, these two areas will be referred to as the 'Eagle Creek Park segment' or 'EA segment' for the property east of the reservoir, and the 'Eagle's Crest segment' or 'EC' on the western side.

A mosaic of habitats is found on both sides of the property. These habitats include deciduous forest, coniferous woodlots, early successional areas, scrub-shrub, restored prairie, riparian woods, and wetlands. Of these, second growth deciduous woodlands are the most prevalent habitat type. Many of the habitats found in Eagle Creek Park are fragmented and have been degraded by various recreation-based anthropogenic structures such as trails, buildings, parking areas, and playgrounds. These developments are concentrated more strongly in the EA segment, which is the area that supports the majority of park visitors.

Despite the demands for such anthropogenic developments and recreational facilities, the confines of Eagle Creek Park include several preserves protected by conservation easements and natural areas undergoing critical habitat restoration. For instance, two state-designated nature preserves exist within the park's boundaries — Eagle's Crest Nature Preserve (240 acres) and Spring Pond Nature Preserve (43 acres). Additionally, the western portion of the park includes the Scott Starling Sanctuary (60 acres), which is the site of several important restoration and ecological research projects.

Survey Methodology

Considering the acreage encompassed by the boundaries of Eagle Creek Park and the consequent logistical demands of conducting comprehensive inventories, a point count protocol was selected to sample the populations of breeding birds within the property. The terminology for point count methodologies is summarized in numerous articles, including Ralph (1981). In general, an avian point count census uses fixed locations (i.e. stations) within the survey area at which to count all species and individuals of birds present for a predetermined time period.

To establish the locations of the counting stations for the 2006 Eagle Creek Park survey, points were randomly stratified (i.e. distributed with a predetermined distance) throughout the property north of 56th Street. A 400-meter grid was placed over topographic maps of the Eagle Creek Park area. A single point was placed randomly within each cell. Since the goal of the survey was to establish relative abundance of species and, through future iterations, estimates of population trends for the entire park, the stations were configured without regard for habitat type (Ralph et al. 1995). Additionally, to help ensure that individual birds on nesting territories were not detected at different stations (counted more than once), points were placed at least 250 meters apart, a distance that accommodates or exceeds the maximum detection distance for most species (Figure 2).

Given the spatial separation of the stations and the sometimes difficult terrain that needed to be navigated between the points, a 10-minute count period was used at each point to help provide adequate sampling time intervals (Buskirk & McDonald 1995), with cumulative subtotals recorded at the end of each 3- and 6-minute interval. All individual birds were recorded on a standard field data form. Distance estimates between the observer and the detected bird were documented. Individual birds primarily were detected and identified aurally (i.e. by song or call notes), although seen birds were also noted. Consequently, the data is not limited to territorial or singing males, although this demography constitutes the majority of the records.

Volunteers visited the count stations and conducted surveys from the last week of May until the end of June 2006. Typically, during a count day the first station was visited at or near dawn (typically 6–6:30 a.m.). Point counts continued to be made until late morning (typically 11:30 a.m.), after which time bird vocalizations diminished greatly. Surveys were not conducted during rain, excessive wind, or other climatic/meteorological conditions that inhibit visual or auditory detection.

In all, 62 points were surveyed at Eagle Creek Park during May and June 2006. Stations EA28, EA34, and EA40, each located in a small parcel of land between I65 and I465, were not sampled because of difficulties with property access (Figure 2). Considering the number of stations visited and the sampling period for each (10 minutes), plus the number of volunteers involved with the inventory work, over 22 hours of surveying time was contributed during the 2006 summer breeding season. However, this number does not include a considerable number of hours spent traveling to count sites and compiling the resultant data.

Results

The immediate objectives of the 2006 Eagle Creek Park Breeding Bird Survey were to (1) establish species presence/absence, (2) determine relative abundance of the species present, (3) specify habitat and locality preferences (i.e. distribution) of species, and (4) inventory endangered or threatened species. The number of points surveyed (n=62) and the allotted sampling time per station (10 minutes) assured that these aims would be adequately met, although it is recommended that the survey be repeated in future nesting seasons to provide further statistical support of the final three objectives (Geupel & Warkentin 1995). Such efforts would also allow analysis of other significant factors, including population trends for breeding species.

The following subsections offer an analysis of the four major objectives listed above. Tables referenced in the text can be found in the final pages of the report.

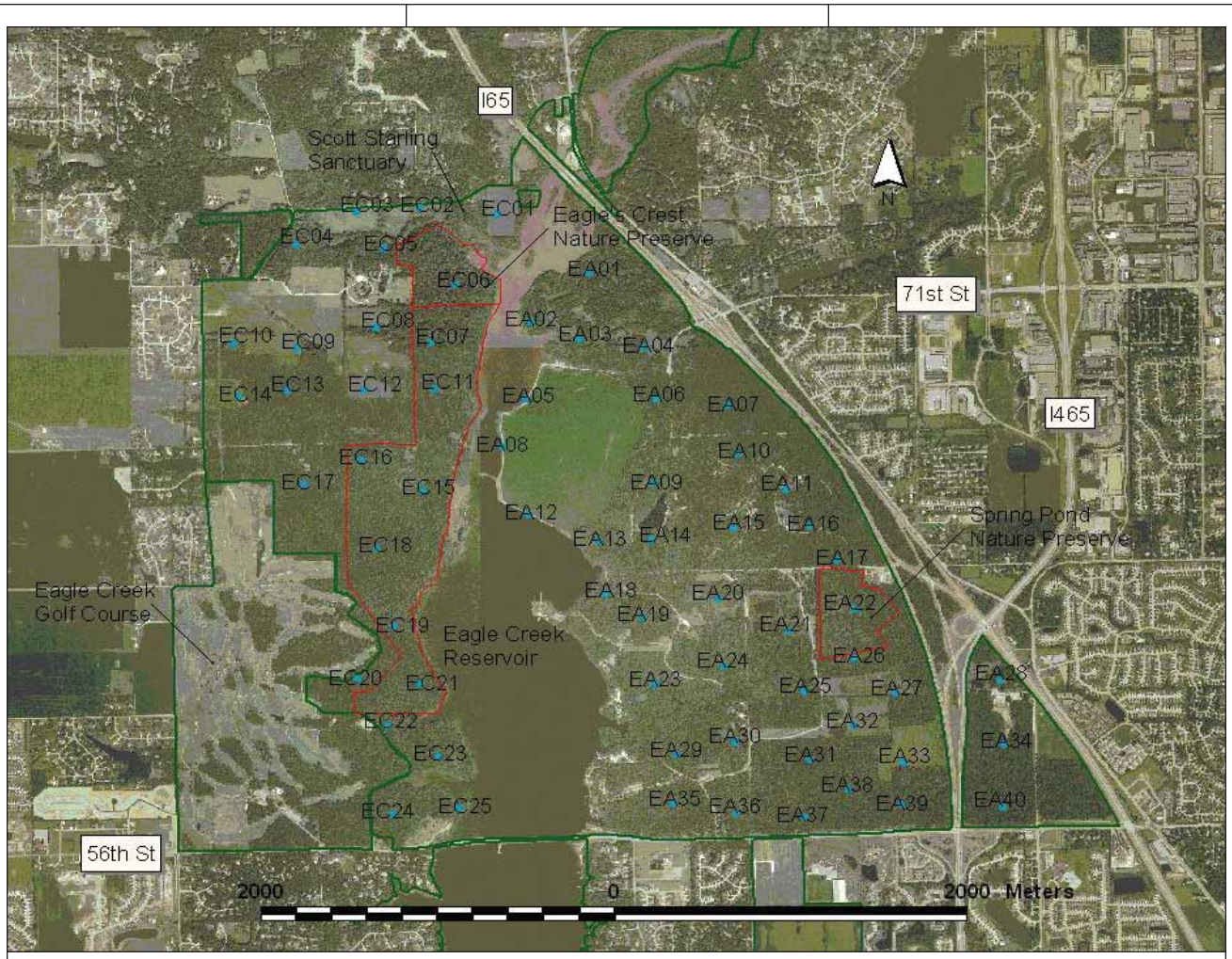

Figure 2. Locations of survey points

1. Species present

In all, 80 avian species were detected in the course of the survey (Table 2). The presence of each was established while sampling was being conducted at one or more stations, with the exception of Black-billed Cuckoo, which volunteers detected while traveling between points in Eagle's Crest Nature Preserve. Considering this species' scarcity within the state (Castrale et al 1998), the presence of this bird is quite notable and thus was included in the tabulation.

The listing also includes birds seen flying past or over the point count stations. For obvious reasons, such observations are not included in the following tables, which establish relative abundance for birds within the survey area. The omission of these observations eliminates the potential problem of double-counting individuals. A few species heard or seen during the counts have never been documented as nesting in the state. Thus, they were considered to be late northbound migrants and were not included in Table 2. Examples include Swainson's Thrush and Tennessee Warbler.

The type of point count regime used, although effective for monitoring diurnal landbirds, is not very conducive for detecting the presence of other taxa such as crepuscular/nocturnal birds and secretive marshbirds. Examples of such species that are known to nest at Eagle Creek Park and which were not found with the implemented monitoring effort include Great Horned Owl and Pied-billed Grebe. Temporal considerations also precluded the discovery of avifauna such as American Woodcock, a species that likely breeds within Eagle Creek Park but which nests earlier in the spring than when the survey was conducted.

Unfortunately, despite the rigorous methodology implemented in this survey, the number of species detected within Eagle Creek is not easily compared to bird lists generated for similar properties. Very few, if any, modern published reports exist for surveys conducted in the region via point count protocol. Perhaps the most convenient comparison is with the previous cycle of the state's breeding bird atlas, in which priority blocks of approximately 9.5 mi2 (6,080 acres) were distributed evenly throughout the state and surveyed by volunteers for the presence and activity of nesting avifauna, including the aforementioned early season and nocturnal breeders. For the central Indiana region, the average number of species detected in the priority blocks was

61.0 (Castrale et al. 1998). Although this is not a scrupulous statistical comparison, these numbers do show that Eagle Creek Park is a significant reservoir of breeding bird diversity when compared to the greater extent of central Indiana.

Notable, too, was the presence of several endangered and threatened species at the park during the breeding season. Four species that were detected are listed on the Indiana Department of Natural Resources' (IDNR) registry of birds of special concern — Red-shouldered Hawk, Cerulean Warbler, Black-and-white Warbler, and Hooded Warbler. Most significantly, during the previous cycle of Indiana's breeding bird atlas, none of the latter three species was listed as potential or confirmed breeding species in Marion County (Castrale et al. 1998).

When the continental scale and the respective conservation lists, such as the Partners in Flight (PIF) Landbird Conservation Plan and National Audubon Society's (NAS) WatchList, are considered, the number of critical species supported by Eagle Creek Park becomes even more significant. A total of seven species from the PIF and NAS lists were detected during the survey — Willow Flycatcher, Wood Thrush, Blue-winged Warbler, Prairie Warbler, Cerulean Warbler, Prothonotary Warbler, and Kentucky Warbler. The number of individuals observed and their relative abundance will be discussed in the following subsections.

2. Relative Abundance

As previously stated, birds that were detected at a station only as fly-overs were not included in calculations of relative abundance. This condition was implemented to help guarantee that birds such as aerial-foraging Chimney Swifts were not double-counted while ensuring, with some certainty, that the species recorded were on nesting territory within the survey area. Exceptions to the latter condition most definitely occurred, a primary example of which was the presence of Great Blue Heron at several of the stations. This species was included in the calculations because Eagle Creek Park provides important hunting grounds for this water-loving bird, and at least one heronry is located upstream of the reservoir. Similarly, swallows detected near known nesting locations (i.e. Tree Swallows at or near their nest boxes) were included in the calculation.

Despite these caveats, this effort was not meant to be an atlas of breeding birds or spot-mapping project (i.e. nests were not sought as confirmation that the species was part of the area's breeding avifauna). We determined that the most practical condition to use in compiling data was to exclude individuals deemed to be in transit. Unfortunately, this precluded six species from inclusion in the tabulation of relative abundance. Every Cooper's Hawk, Rock Pigeon, Barred Owl, Chimney Swift, and Common Grackle was seen flying over or near a station, in addition to the previously mentioned incidental record of Black-billed Cuckoo. Each of these species likely breeds within the confines of Eagle Creek Park, but it is an unfortunate yet necessary compromise of the point count methodology that they not be included in relative abundance indices.

As documented in Table 3, when all stations (n=62) surveyed within the park were analyzed, the 10 most abundant species, in descending order, were: Northern Cardinal (0.98 birds/point), Red-eyed Vireo (0.87), Tufted Titmouse (0.65), Indigo Bunting (0.56), Carolina Chickadee (0.55), Carolina Wren (0.53), Eastern Wood-Pewee (0.5), Red-bellied Woodpecker (0.47), Wood Thrush (0.45), and Acadian Flycatcher (0.44). Although these species are considered fairly common to abundant in Indiana during the breeding season (Castrale et al. 1995), the relative abundance of two species, Wood Thrush and Acadian Flycatcher, are important given the declining population trend of each (Roth et al. 1996, Whitehead 2002). Wood Thrush is included on the Audubon WatchList and is included as both a species of regional and continental concern in the Partners in Flight planning documents, while Acadian Flycatcher is listed as part of PIF's species of regional concern.

Because one of the principle goals of the survey was to determine the occurrence of endangered and threatened species within Eagle Creek Park, a separate register was created to express the relative abundance of such avifauna (Table 4). Using the inclusion of the various conservation listings (IDNR, Audubon, and/or PIF) as a unified criterion, the 10 most common 'conservation' species within the entire survey area were Wood Thrush (0.45 birds/point), Acadian Flycatcher (0.44), Field Sparrow (0.32), Great Crested Flycatcher (0.31), Willow Flycatcher (0.16), Yellow-breasted Chat (0.13), Yellow-billed Cuckoo (0.11), Cerulean Warbler (0.11), Louisiana Waterthrush (0.11), and Kentucky Warbler (0.097). Of these species, and for all of the avifauna found in the park, the most significant index was for Cerulean Warbler, a species that has suffered precipitous population declines over the past century (Hamel 2000). A more thorough discussion of the status of critical species is found in subsection 4.

When the park is divided into eastern and western portions (the aforementioned EA and EC segments, respectively), the Eagle's Crest (western) section establishes itself as the more important place for critical bird species. Only four of the 19 species included collectively in the IDNR, Audubon, and PIF lists found during the survey were more abundant in the main Eagle Creek Park (eastern) segment — Northern Flicker, Willow Flycatcher, Brown Thrasher, and Prairie Warbler. Furthermore, eight of these 19 critical species were completely undetected in the EA section. A more thorough evaluation of the avifaunal differences between the two major segments and individual stations will be discussed in the following subsection.

Again, an important aspect to consider when evaluating the indices of relative abundance is the fact that the information presented here represents only the first iteration of a breeding bird survey for Eagle Creek Park via a point count methodology. Geupel and Warkentin (1995) suggest that between one and two years worth of data needs to be collected to make an accurate assessment of relative abundance when implementing this survey regime, so it is likely that the quantitative results, especially for the tier composed of the more common species, will display some deviation as future inventories are conducted and the results are tabulated.

3. Habitat and Locality Preference of Detected Species

A significant benefit of implementing a point count methodology for surveying the breeding birds at Eagle Creek Park is the ability to measure, analyze, and eventually trend bird occurrence at specific locations within the study area. Table 5 offers a summary of bird species richness and abundance for the points surveyed.

A Shannon's index has been calculated for each station. Shannon's index is the most widely used metric for analyzing bird diversity because it reflects both species richness (number of species detected) and evenness of distribution among species present (Nur 1999). In general terms, a station must support two conditions to yield a relatively high Shannon's index: (1) a high number of species present and (2) an equal or near equal number of individuals detected when compared to the number of species (i.e. evenness of distribution). Such points will yield a greater Shannon's index than stations with lesser species richness and distribution. For the purposes of this survey and report, the greater the Shannon index is at a given point, the higher its ecological value.

Using these parameters, several stations immediately emerge in prominence, as does the Eagle's Crest segment in its entirety when compared collectively to the main Eagle Creek Park segment. For instance, when sorted by the Shannon index, eight of the 10 most outstanding points are located in the EC portion of the survey area (in descending order): EC02 (Shannon index of 3.314), EC05 (3.216), EC03 (3.148), EC17 (3.144), EA18 (3.045), EC19 (3.032), EC20 (2.986), EC15 (2.942), EA32 (2.926), and EC22 (2.889). General locations of the points listed in Table 5 can be referenced from Figure 2, or for specific coordinates, Table 1 can be used.

When the data was sorted for the number of species detected at each station, the outcome was similar. The most significant points, in descending order, are EC02 (29 species), EC05 (26), EC03 (26), EC17 (25), EC19 (22), EA18 (21), EC20 (21), EC15 (20), EC01 (20), EA32 (19), and EC22 (19). With the exception of EC01, which is included in the top tier of points only when the number of species present is considered, the most important stations as determined by the combined criteria of Shannon index and species richness are identical, albeit in different sorted orders. If the points also are evaluated for the presence of species of conservation concern, the stations that appear as most important are very similar to those listed via the preceding two criteria; this analysis will be more fully discussed in the next subsection. To help illustrate the trend provided by these criteria, the most notable stations, as evaluated by the Shannon index and species richness, are plotted in Figure 3.

Although this study did not include research and statistical modeling of bird distribution with respect to habitat specifics (e.g., regression analyses), some logical conclusions can be drawn regarding

Figure 3. Locations of highest species richness and diversity

the relatively high species richness and Shannon indices at these points. Most obvious is the fact that three of the top 10 stations (EC02, EC03, and EC05) are within or near the Scott Starling Sanctuary. If points are evaluated solely by number of species present, EC01 also would be included in this list. Several factors help concentrate bird diversity and abundance in this parcel. First, the sanctuary contains a mosaic of distinct habitats, such as restored prairie, shrub-scrub, early successional fields, and riparian woods, which border one another. The proximity of the habitats and the resultant edges help concentrate birds with different environmental preferences into this singular landscape. For instance, at EC02 the detected species included Wood Duck, Blue-winged Warbler, Scarlet Tanager, and Orchard Oriole, which are species typical of riparian forest, shrub/scrub, deciduous forest, and open woodlots, respectively (Castrale et al. 1998).

The second parameter of success at the points within the Scott Starling Sanctuary may be the recently conducted ecological restoration and enhancement. The increase in overall vegetative diversity likely increases foraging opportunities and nesting substrate for breeding birds and should consequently yield greater avian diversity and abundance. This supposition is speculative, and a study empirically correlating vegetative restoration with changes in bird diversity within Eagle Creek Park would make a fascinating research topic and provide a much needed statistical evaluation of the biological feedback from restoration activities. It should be noted that several points on the eastern side of the park, such as EA04 and EA33, are located near current or future vegetative and habitat enhancements; therefore, future iterations of this survey may provide more detail on the success of restoration efforts within the park as applied to bird conservation.

Also notable from the landscape perspective is that four of the 10 most significant stations were within late second-growth or mature forest stands (Table 1) — EC05, EC 19, EC20, and EC22. Species richness and evenness were significant at these locales, as was the presence of species of regional and continental concern. Such examples of conservation-priority species (i.e. birds included on the aforementioned conservation lists) found at these points included Acadian Flycatcher, Wood Thrush, Cerulean Warbler, and Kentucky Warbler. Considering the majority of acreage within Eagle Creek Park is wooded, the prevalence of forest-dependent birds could be enhanced further with adequate habitat and landscape-level management. Allowing second-growth stands to age, eradicating invasive vegetation, and minimizing disturbances to and fragmentation of forest habitats within the park, such as that imposed by construction for anthropogenic features, would undoubtedly help increase the amount of acreage available to breeding forest-dependent birds.

4. Inventory of Endangered/ Threatened Species

The stations at which species of state conservation concern (IDNR endangered list) and of continental concern (Audubon and PIF lists) were detected are illustrated in Figures 4 and 5, respectively. It should be noted that the icons listed at the point count stations indicate only presence of a species and not abundance for each. For instance, most stations at which Wood Thrush was detected yielded several singing males of this species, yet only a single cross is placed at the points. Table 5 provides a full reference for the number of individuals detected for the conservation species at each point.

As briefly mentioned in the preceding pages, when considering the population decline of the Cerulean Warbler throughout the eastern United States and its threatened status and limited distribution in Indiana, the presence of seven singing male Cerulean Warblers in the western segment of Eagle Creek Park is certainly one of the most critical findings of the survey. This talley likely represents the second-largest breeding population of these endangered birds for a property in Marion County, a contingent exceeded only by the 16 Cerulean Warbler territories found at Fort Harrison State Park in 2004 (Don Gorney, unpublished data).

Cerulean Warblers were detected at four stations, with EC05, EC06, and EC19 reporting two singing males each (Figure 4). Habitat typifying these points was late second-growth to mature deciduous forests with steep hillsides or ravines. Further, the age of these stands created some naturally occurring treefalls around the survey points that served to create breaks in an otherwise closed canopy. This habitat description conforms to the documented preferences of breeding Cerulean Warblers (Hamel 2000) and provides some evidence for the need to manage various forest stands within Eagle Creek Park for late second-growth and mature forest conditions.

Other critical species that were found to frequent the forests of Eagle Creek Park included Kentucky Warbler, a species of continental conservation concern, and Hooded Warbler, a species listed on IDNR's registry of birds of special concern. Notably, Kentucky Warbler was found on only one priority block during previous Marion County breeding bird atlasing efforts, while Hooded Warbler was completely absent from the county (Castrale et al. 1998). Total numbers of individuals recorded for each species at Eagle Creek Park were six and five, respectively. Again, both species were more abundant in the western segment of the survey area than in the eastern, with four of the six locations for Kentucky Warbler occurring on the Eagle's Crest side and all of the Hooded Warblers being recorded there (Figures 4 and 5).

Although only a singleton was recorded, the presence of a singing male Black-and-white Warbler at EC07 was notable (Figure 4). This species was not recorded during the last breeding bird atlas in Indiana and was found only as a potential nesting species in two priority blocks in the six counties surrounding Marion County (Castrale et al. 1998).

Additionally, several species of conservation concern dependent on shrub/scrub habitat occurred within the survey, including Blue-winged Warbler. This species is infrequently encountered during the breeding season throughout most of Indiana, with the exception of the forested areas in south-central and

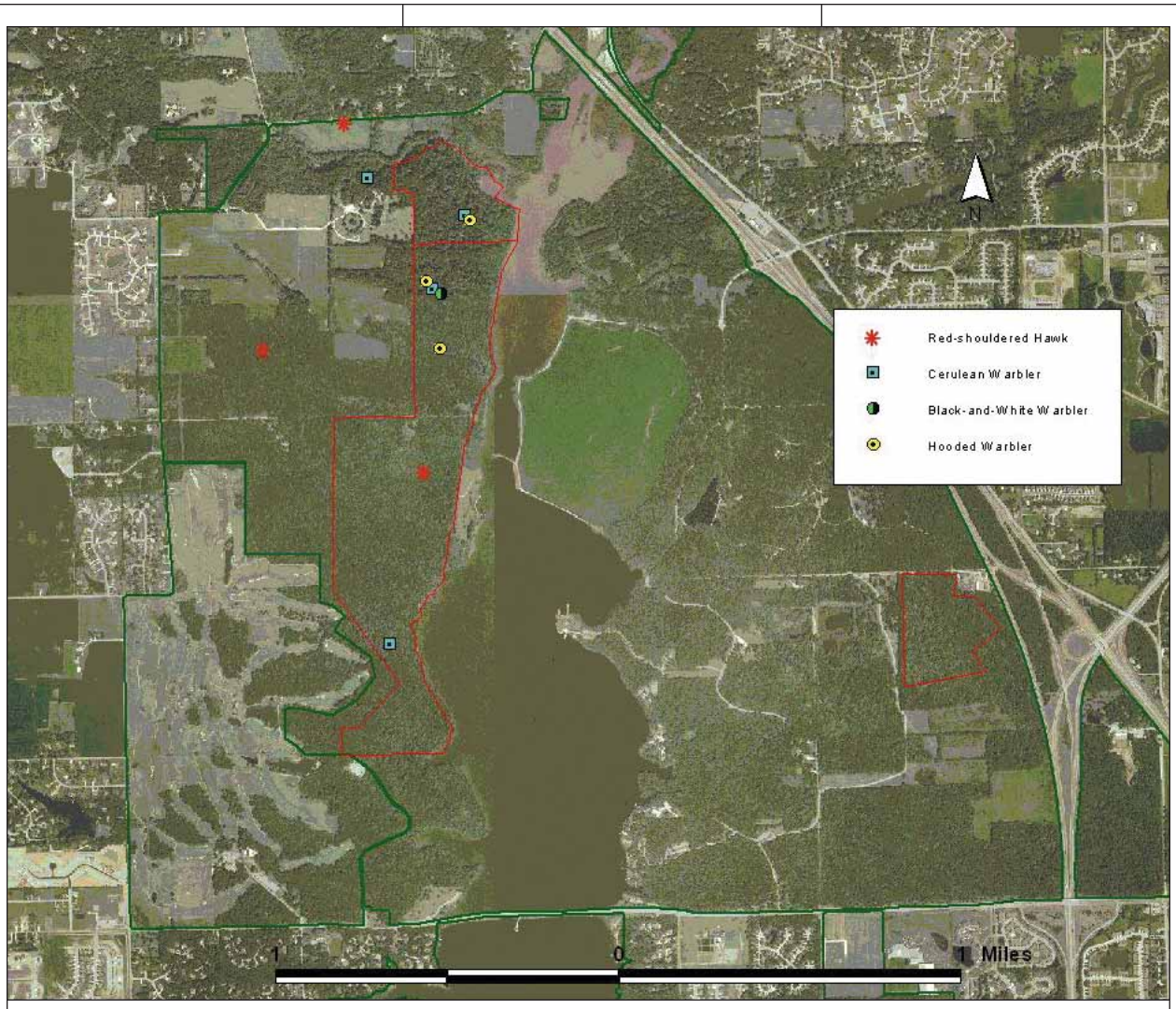

Figure 4. Locations of detected species of state conservation concern

southeastern Indiana (Castrale et al. 1998). Consequently, the concentration of four Blue-winged Warblers in the central portion of the Scott Starling Sanctuary alone is quite impressive (Figure 5). Considering the amount of brush habitat available in the northeastern and southeastern quadrant of Eagle Creek Park, it is likely that the distribution of this species could expand with proper management and restoration techniques.

Conclusion

Eagle Creek Park provides some of the most significant acreage and habitat in the greater Indianapolis area for breeding landbirds. But the comparative differences in species richness and abundance between the western and eastern sections of the park are remarkable. As indicated above, the points sampled at the Scott Starling Sanctuary and Eagle's Crest locales consistently provided the highest numbers of species present, individuals detected, and Shannon indices. This certainly provides some empirical evidence that the restoration and habitat maintenance in the western half of the park has created some important breeding bird habitat and that Indy Parks should continue to employ the current protective measures within the sanctuary and nature preserve to protect this essential reservoir of central Indiana birds.

Further, consideration should be granted for applying such conservation principles in a more robust manner in the eastern portion of Eagle Creek. Although restoration practices and habitat management may not be practical in

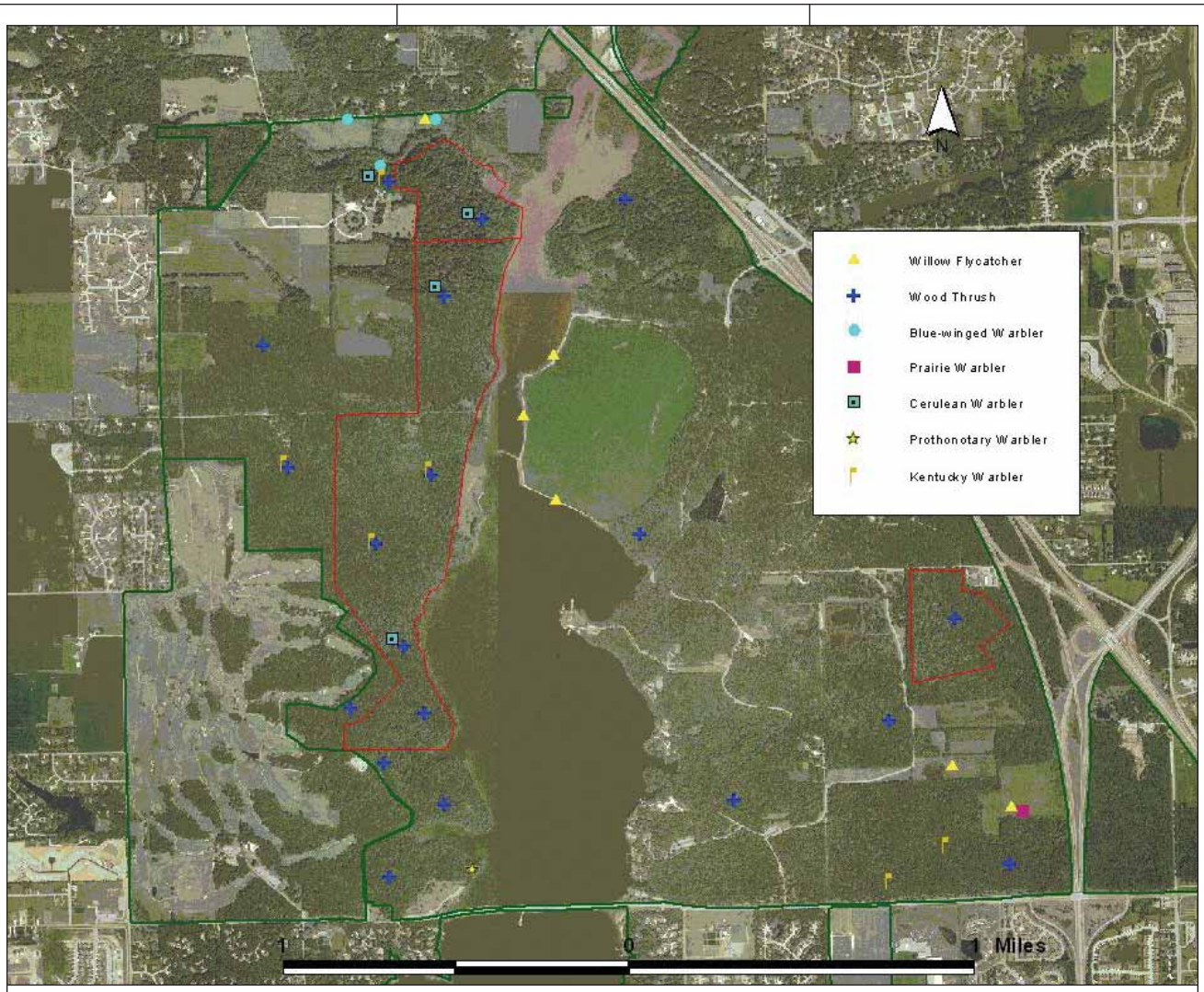

Figure 5. Locations of detected species of continental conservation concern

certain sections of the park when current recreational usage and demands are considered, protective actions could be initiated in areas of Eagle Creek Park that have demonstrated a concentrated potential for significant bird diversity and abundance. According to the results of this survey, EA18 and EA32 are two such locales. These areas should be protected from anthropogenic construction or recreational disturbance.

Several substantial portions of the eastern section of Eagle Creek Park are not currently subjected to heavy recreational demands. These areas should be assessed for future restorative and conservation actions. Exotic plant removal, native vegetative restoration, limited trail access, and ensuring a lack of disturbance are examples of procedures that could be implemented in such places. Areas on the northern side (EA01-EA04) and southeastern side (EA31-EA33 and EA35-EA39) of the park were found to contain little recreational infrastructure and related visitation; consequently, these points could be studied for possible habitat restoration and enhancement projects. To some degree, this work already has been initiated near EA04 by the Indy Parks Land Stewardship Department. Future iterations of this survey can provide feedback regarding this habitat work as applied to breeding bird populations. If successful, this current habitat project could be applied to the larger suggested areas.

Table 1. Locations and General Habitat Descriptions of Survey Points

Point ID	Latitude	Longitude	Elevation (feet)	Habitat
EA01	39.88256	-86.30041	804	Second growth forest
EA02	39.87993	-86.30416	800	Second growth forest (disturbed)
EA03	39.87904	-86.30092	796	Shrub/scrub
EA04	39.87856	-86.29672	821	Meadow and second growth wooded edge
EA05	39.87587	-86.30454	791	Shrub/scrub (coffer dam)
EA06	39.87581	-86.29597	846	Second growth forest
EA07	39.87542	-86.29126	857	Second growth forest
EA08	39.87332	-86.30613	797	Shrub/scrub (coffer dam)
EA09	39.87137	-86.29615	834	Second growth forest
EA10	39.87283	-86.29063	856	Second growth forest
EA11	39.87103	-86.28745	862	Second growth forest
EA12	39.86976	-86.30441	791	Shrub/scrub (coffer dam)
EA13	39.86834	-86.29984	823	Second growth forest
EA14	39.86839	-86.29641	832	Second growth forest
EA15	39.86897	-86.29088	858	Second growth forest
EA16	39.86908	-86.28586	856	Second growth forest
EA17	39.86726	-86.28408	856	Second growth forest
EA18	39.86555	-86.29946	840	Second growth forest
EA19	39.86428	-86.29704	850	Second growth forest (disturbed)
EA20	39.86521	-86.29196	856	Shrub/scrub
EA21	39.8635	-86.28726	853	Shrub/scrub
EA22	39.86462	-86.28294	846	Second growth forest
EA23	39.86071	-86.29622	839	Second growth forest
EA24	39.86164	-86.29158	855	Second growth forest
EA25	39.86028	-86.28636	850	Second growth forest
EA26	39.86203	-86.283	840	Second growth forest
EA27	39.86013	-86.28027	840	Shrub/scrub
EA29	39.85695	-86.29482	842	Second growth forest
EA30	39.85764	-86.29094	853	Early second growth forest (with scrub)
EA31	39.85666	-86.28599	845	Second growth forest
EA32	39.85842	-86.28306	843	Shrub/scrub
EA33	39.85651	-86.27982	835	Grassland
EA35	39.85436	-86.29501	839	Early second growth forest (with scrub)
EA36	39.85383	-86.29088	846	Second growth forest (disturbed)
EA37	39.85358	-86.28643	840	Second growth forest (disturbed)
EA38	39.85505	-86.28345	837	Second growth forest (disturbed)
EA39	39.85421	-86.27995	836	Second growth forest (disturbed)
EC01	39.88564	-86.30632	807	Restored prairie and forest edge
EC02	39.88603	-86.3114	793	Shrub/scrub
EC03	39.88589	-86.31566	801	Shrub/scrub
EC04	39.88417	-86.31972	880	Second growth forest (disturbed)
EC05	39.88389	-86.31389	825	Late second growth forest (riparian)
EC06	39.88194	-86.30917	850	Late second growth forest (ravine)
EC07	39.87889	-86.31083	857	Late second growth forest (ravine)
EC08	39.87972	-86.31444	867	Reforestation plot with forest edge
EC09	39.87861	-86.31972	877	Agricultural field with forest edge
EC10	39.87889	-86.32389	880	Second growth forest

Table 1. Locations and General Habitat Descriptions of Survey Points (cont.)

Point ID	Latitude	Longitude	Elevation (feet)	Habitat
EC11	39.87639	-86.31056	857	Second growth forest
EC12	39.87639	-86.31528	863	Reforestation plot with forest edge
EC13	39.87639	-86.32028	872	Second growth forest
EC14	39.87611	-86.32361	868	Reforestation plot with forest edge
EC15	39.87111	-86.31139	826	Second growth forest
EC16	39.87264	-86.31547	829	Early second growth forest (with scrub)
EC17	39.87147	-86.31928	833	Second growth forest
EC18	39.86806	-86.31444	844	Second growth forest
EC19	39.86389	-86.31337	809	Mature forest
EC20	39.86111	-86.31583	825	Late second growth forest
EC21	39.86083	-86.31167	829	Second growth forest
EC22	39.85861	-86.31389	845	Late second growth forest
EC23	39.85694	-86.31056	837	Second growth forest
EC24	39.85389	-86.31361	853	Second growth forest
EC25	39.85417	-86.30917	791	Second growth forest (near reservoir)

Table 2. Species Detected During the Survey

Canada Goose
Wood Duck
Mallard
Great Blue Heron
Green Heron
Turkey Vulture
Cooper's Hawk
Red-shouldered Hawk
Killdeer
Rock Pigeon
Mourning Dove
Black-billed Cuckoo
Yellow-billed Cuckoo
Barred Owl
Chimney Swift
Ruby-throated Hummingbird
Belted Kingfisher
Red-bellied Woodpecker
Downy Woodpecker
Hairy Woodpecker
Northern Flicker
Pileated Woodpecker
Eastern Wood-Pewee
Acadian Flycatcher
Willow Flycatcher
Eastern Phoebe
Great Crested Flycatcher
Eastern Kingbird
White-eyed Vireo
Yellow-throated Vireo
Warbling Vireo
Red-eyed Vireo
Blue Jay
American Crow
Tree Swallow
Northern Rough-winged Swallow
Barn Swallow
Carolina Chickadee
Tufted Titmouse
White-breasted Nuthatch
Carolina Wren
House Wren
Blue-gray Gnatcatcher
Eastern Bluebird
Wood Thrush
American Robin
Gray Catbird
Brown Thrasher
European Starling
Cedar Waxwing
Blue-winged Warbler
Northern Parula
Yellow Warbler
Yellow-throated Warbler
Prairie Warbler
Cerulean Warbler
Black-and-white Warbler
American Redstart
Prothonotary Warbler
Louisiana Waterthrush
Kentucky Warbler
Common Yellowthroat
Hooded Warbler
Yellow-breasted Chat
Summer Tanager
Scarlet Tanager
Eastern Towhee
Chipping Sparrow
Field Sparrow
Song Sparrow
Northern Cardinal
Rose-breasted Grosbeak
Indigo Bunting
Red-winged Blackbird
Common Grackle
Brown-headed Cowbird
Orchard Oriole
Baltimore Oriole
House Finch
American Goldfinch

Table 3. Relative Abundance (RA) for All Species

Species	No. Observed	RA, All (N=62)	RA, East (N=37)	RA, West (N=25)
Canada Goose	3	0.048	0.081	0
Wood Duck	3	0.048	0	0.12
Mallard	2	0.003	0.054	0
Great Blue Heron	3	0.048	0.081	0
Green Heron	3	0.048	0.054	0.04
Turkey Vulture	2	0.032	0.054	0
Red-shouldered Hawk	2	0.032	0	0.08
Killdeer	1	0.016	0.027	0
Mourning Dove	1	0.016	0.027	0
Yellow-billed Cuckoo	7	0.11	0.054	0.2
Ruby-throated Hummingbird	3	0.048	0	0.12
Belted Kingfisher	1	0.016	0	0.04
Red-bellied Woodpecker	29	0.47	0.24	0.8
Downy Woodpecker	15	0.24	0.16	0.36
Hairy Woodpecker	5	0.081	0	0.2
Northern Flicker	5	0.081	0.11	0.04
Pileated Woodpecker	9	0.15	0.054	0.28
Eastern Wood-Pewee	31	0.5	0.38	0.68
Acadian Flycatcher	27	0.44	0.22	0.76
Willow Flycatcher	10	0.16	0.24	0.04
Eastern Phoebe	2	0.032	0.027	0.04
Great Crested Flycatcher	19	0.31	0.24	0.4
Eastern Kingbird	6	0.097	0	0.24
White-eyed Vireo	11	0.18	0.16	0.2
Yellow-throated Vireo	10	0.16	0.11	0.24
Warbling Vireo	3	0.048	0.027	0.4
Red-eyed Vireo	54	0.87	0.54	1.4
Blue Jay	27	0.44	0.41	0.48
American Crow	15	0.24	0.38	0.04
Tree Swallow	12	0.19	0.11	0.32
No. Rough-winged Swallow	5	0.081	0	0.2
Barn Swallow	5	0.081	0.027	0.16
Carolina Chickadee	34	0.55	0.43	0.72
Tufted Titmouse	40	0.65	0.65	0.64
White-breasted Nuthatch	17	0.27	0.3	0.24
Carolina Wren	33	0.53	0.38	0.76
House Wren	17	0.27	0.22	0.36
Blue-gray Gnatcatcher	13	0.21	0.054	0.44
Eastern Bluebird	7	0.11	0.027	0.24
Wood Thrush	28	0.45	0.16	0.88
American Robin	26	0.42	0.46	0.36
Gray Catbird	12	0.19	0.24	0.12
Brown Thrasher	2	0.032	0.054	0
European Starling	1	0.016	0.027	0
Cedar Waxwing	7	0.11	0.081	0.16
Blue-winged Warbler	4	0.065	0	0.16
Northern Parula	15	0.24	0.027	0.56
Yellow Warbler	7	0.11	0.14	0.08
Yellow-throated Warbler	4	0.065	0.054	0.08
Prairie Warbler	1	0.016	0.027	0
Cerulean Warbler	7	0.11	0	0.28
Black-and-white Warbler	1	0.016	0	0.04
American Redstart	1	0.016	0.027	0
Prothonotary Warbler	1	0.016	0	0.04
Louisiana Waterthrush	7	0.11	0	0.28
Kentucky Warbler	6	0.097	0.054	0.16
Common Yellowthroat	14	0.23	0.11	0.4
Hooded Warbler	5	0.081	0	0.2
Yellow-breasted Chat	8	0.13	0.11	0.16
Summer Tanager	7	0.11	0	0.28
Scarlet Tanager	27	0.44	0.24	0.72
Eastern Towhee	17	0.27	0.16	0.44
Chipping Sparrow	2	0.032	0	0.08
Field Sparrow	20	0.32	0.11	0.64
Song Sparrow	9	0.15	0.11	0.2
Northern Cardinal	61	0.98	0.48	1.24
Rose-breasted Grosbeak	2	0.032	0.054	0
Indigo Bunting	35	0.56	0.24	1.04
Red-winged Blackbird	8	0.13	0.16	0.08
Brown-headed Cowbird	23	0.37	0.027	0.88
Orchard Oriole	1	0.016	0	0.04
Baltimore Oriole	6	0.097	0.14	0.04
House Finch	1	0.016	0	0.04
American Goldfinch	13	0.21	0.11	0.36

Table 4. Relative Abundance for Species of Conservation Concern

Species	No. Observed	RA, All (N=62)	RA, East (N=37)	RA, West (N=25)	Conservation Listing
Red-shouldered Hawk	2	0.032	0	0.08	IDNR-SC
Yellow-billed Cuckoo	7	0.11	0.054	0.2	PIF-RC
Northern Flicker	5	0.081	0.11	0.04	PIF-RC
Acadian Flycatcher	27	0.44	0.22	0.76	PIF-RC
Willow Flycatcher	10	0.16	0.24	0.04	AW-Y, PIF-CC, PIF-RC
Great Crested Flycatcher	19	0.31	0.24	0.4	PIF-RC
Wood Thrush	28	0.45	0.16	0.88	AW-Y, PIF-CC, PIF-RC
Brown Thrasher	2	0.032	0.054	0	PIF-RC
Blue-winged Warbler	4	0.065	0	0.16	AW-Y, PIF-CC
Prairie Warbler	1	0.016	0.027	0	AW-Y, PIF-CC
Cerulean Warbler	7	0.11	0	0.28	IDNR-SC, AW-R, PIF-CC, PIF-RC
Black-and-white Warbler	1	0.016	0	0.04	IDNR-SC
Prothonotary Warbler	1	0.016	0	0.04	AW-Y, PIF-CC, PIF-RC
Louisiana Waterthrush	7	0.11	0	0.28	PIF-RC
Kentucky Warbler	6	0.097	0.054	0.16	AW-Y, PIF-CC, PIF-RC
Hooded Warbler	5	0.081	0	0.2	IDNR-SC
Yellow-breasted Chat	8	0.13	0.11	0.16	PIF-RC
Field Sparrow	20	0.32	0.11	0.64	PIF-RC
Orchard Oriole	1	0.016	0	0.04	PIF-RC

AW-R: Audubon WatchList — Red Species (Global Priority)
AW-Y: Audubon WatchList — Yellow Species (Continental Priority)
IDNR-SC: Indiana Department of Natural Resource — Species of Special Concern
PIF-CC: Partners in Flight — Species of Continental Concern
PIF-RC: Partners in Flight — Species of Regional Concern

References

Brock, K. J. 2006. Brock's Birds of Indiana (CD). The Amos W. Butler Audubon Society, Inc., Indianapolis, IN.

Buskirk, W. H. and J. L McDonald. 1995. Comparison of point count sampling regimes for monitoring forest birds. In Ralph, C. J., J. R. Sauer, and S. Droege (eds.). Monitoring bird populations by point counts. USDA For. Serv. Gen. Tech. Rep. PSW-GTR-149, Albany, CA.

Castrale, J. S., E. M. Hopkins, and C. E. Keller. 1998. Atlas of Breeding Birds of Indiana. Indiana Department of Natural Resources, Indianapolis, IN.

Geupel, G. R. and I. Warkentin. 1995. Field methods for monitoring population parameters of landbirds in Mexico. In Wilson, M. and S. Saeder (eds.), Conservation of Neotropical Migrant Birds in Mexico. Maine Agric. & For. Exp. Stn. Misc. Publ. 727, Orono, ME.

Hamel, P. 2000. Cerulean Warbler *(Dendroica cerulea)*. In The Birds of North America, No. 582 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Phila. Acad. Nat. Sci., Philadelphia, PA.

Indiana Department of Natural Resources. 2004. Rare and endangered animals of Indiana. (Available at http://www.in.gov/dnr/fishwild/endangered/rare.pdf)

National Audubon Society. 2002. The 2002 Audubon WatchList. (Available at http://audubon2.org/webapp/watchlist/viewWatchlist.jsp)

Nur, N., S. L. Jones, and G. R. Geupel. 1999. A statistical guide to data analysis of avian monitoring programs. U.S. Dept. Interior, Fish and Wildlife Service, BTP-R6001-1999, Washington, DC.

Partners in Flight. 2005. Species assessment internet data set. (Available at http://www.rmbo.org/pif/downloads/downloads.html)

Ralph, C. J. 1981. Terminology used in estimating numbers of birds. In Ralph, C. J. and J. M. Scott (eds.). Estimating Numbers of Terrestrial Birds. Studies in Avian Biology 6: 577-578.

Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Inigio-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K.V. Rosenberg, C. M. Rustay, J. S. Wendt, and T. C. Will. 2004. Partners in Flight North American Landbird Consrevation Plan. Cornell Laboratory of Ornithology. Ithaca, NY.

Roth. 1996. Wood Thrush *(Hylocichla mustelina)*. In The Birds of North America, No. 582 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Phila. Acad. Nat. Sci., Philadelphia, PA.

Whitehead, D. R. 2002. Acadian Flycatcher *(Empidonax virescens)*. In The Birds of North America, No. 582 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Phila. Acad. Nat. Sci., Philadelphia, PA.

White, M. 1999. National Geographic Guide to Birdwatching Sites, Eastern U.S. National Geographic Society, Washington, DC.

Acknowledgements

The author would like to thank Mike Alrichs, Angie Cole, Steve Housefield, and Andrew Mertz for graciously donating their time, talent, and energy to conduct the surveys. Without their help this report would not have been possible. The author also thanks Bill Murphy, who patiently edited several versions of this manuscript and provided helpful comments and advice on the text and writing style, and Donna McCarty, who lent her expertise in the graphic design of the final report.

Table 5. Evaluation of Point Count Station Richness and Diversity

Station	Species	Indi-viduals	Shannon Index	Conservation Species (#)
EA01	8	9	2.043	GCFL (1); WOTH (1)
EA02	16	17	2.752	GCFL (1); YBCH (1); FISP (1)
EA03	14	15	2.616	NOFL (1); YBCH (1); FISP (1)
EA04	13	13	2.565	
EA05	11	13	2.311	NOFL (1); WIFL (3)
EA06	9	9	2.197	
EA07	5	5	1.609	GCFL (1)
EA08	11	13	2.352	WIFL (2)
EA09	6	6	1.792	
EA10	7	7	1.946	
EA11	13	13	2.565	
EA12	10	11	2.272	WIFL (1)
EA13	8	8	2.079	GCFL (1); WOTH (1)
EA14	8	8	2.079	ACFL (1)
EA15	12	12	2.485	GCFL (1)
EA16	6	6	1.792	GCFL (1)
EA17	7	7	1.946	NOFL (1); ACFL (1)
EA18	21	21	3.045	YBCU (1); GCFL (1); ACFL (1)
EA19	8	9	2.043	
EA20	17	17	2.833	BRTH (1)
EA21	11	11	2.398	
EA22	12	12	2.485	WOTH (1)
EA23	7	7	1.946	ACFL (1)
EA24	9	9	2.197	ACFL (1)
EA25	6	6	1.792	WOTH (1)
EA26	6	6	1.792	
EA27	12	12	2.485	
EA29	5	5	1.609	ACFL (1); WOTH (1)
EA30	10	11	2.272	FISP (1)
EA31	13	13	2.565	YBCU (1); ACFL (1); GCFL (1)
EA32	19	20	2.926	NOFL (1); WIFL (2); GCFL (1); YBCH (1)
EA33	16	16	2.773	WIFL (1); BRTH (1); PRAW (1); YBCH (1); FISP (1)
EA35	7	7	1.946	
EA36	6	6	1.792	
EA37	8	8	2.079	KEWA (1)
EA38	12	12	2.485	ACFL (1); KEWA (1)
EA39	8	10	2.025	WOTH (1)
EC01	20	14	2.711	GCFL (1); FISP (2)
EC02	29	36	3.314	WIFL (1); GCFL (1); FISP (1); BWWA (1); YBCH (2); OROR (1)
EC03	26	39	3.148	RSHA (1); BWWA (2); YBCH (2); FISP (3)
EC04	10	15	2.211	GCFL (1)
EC05	26	30	3.216	ACFL (2); GCFL (1); WOTH (2); BWWA (1); CEWA (2); LOWA (1); KEWA (1); YBCH (1)
EC06	16	21	2.714	ACFL (2); WOTH (2); CEWA (2); HOWA (2)
EC07	13	18	2.428	ACFL (1); WOTH (2); CEWA (1); BAWW (1); LOWA (1); HOWA (1)
EC08	9	25	1.707	FISP (3)
EC09	8	16	1.841	EAKI (6); FISP (2)
EC10	11	14	2.342	FISP (1)
EC11	5	6	1.561	HOWA (2)
EC12	15	26	2.447	FISP (2)
EC13	12	14	2.441	RSHA (1); ACFL (1); GCFL (1); WOTH (1)
EC14	7	14	1.81	FISP (3)
EC15	20	25	2.942	RSHA (1); ACFL (1); GCFL (1); WOTH (2); KEWA (1)
EC16	18	23	2.834	ACFL (1); LOWA (1)
EC17	25	34	3.144	ACFL (1); WOTH (1); LOWA (1); KEWA (1)
EC18	17	29	2.758	YBCU (2); ACFL (3); WOTH (2); LOWA (2); KEWA (1)
EC19	22	31	3.032	YBCU (1); ACFL (2); GCFL (1); WOTH (2); CEWA (2)
EC20	21	28	2.986	ACFL (1); GCFL (1); WOTH (2)
EC21	12	18	2.37	GCFL (1); WOTH (3)
EC22	19	24	2.889	YBCU (1); NOFL (1); ACFL (2); GCFL (1); WOTH (1)
EC23	11	18	2.274	ACFL (2); WOTH (1)
EC24	13	19	2.434	YBCU (1); WOTH (2)
EC25	10	13	2.245	PROW (1)

RSHA: Red-shouldered Hawk
YBCU: Yellow-billed Cuckoo
NOFL: Northern Flicker
ACFL: Acadian Flycatcher
WIFL: Willow Flycatcher
GCFL: Great Crested Flycatcher
WOTH: Wood Thrush
BRTH: Brown Thrasher
BWWA: Blue-winged Warbler
PRAW: Prairie Warbler
CEWA: Cerulean Warbler
BAWW: Black-and-white Warbler
PROW: Prothonotary Warbler
LOWA: Louisiana Waterthrush
KEWA: Kentucky Warbler
HOWA: Hooded Warbler
YBCH: Yellow-breasted Chat
FISP: Field Sparrow
OROR: Orchard Oriole

Amos W. Butler Audubon Society, Inc.
P.O. Box 80024
Indianapolis, IN 46280
317-767-4690
www.amosbutleraudubon.org

James Cole
Indiana Important Bird Areas Coordinator
135 York Drive
Carmel, IN 46032
317-569-0546
jcole@audubon.org