

FINAL REPORT

AN AVIFAUNAL BASELINE ANALYSIS FOR KINGS MOUNTAIN NATIONAL MILITARY PARK

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Introduction

Depending on one's perspective, the avifauna of Kings Mountain National Military Park (KIMO) is either unremarkable or quite striking. With regard to the former, I recorded 119 species as occurring within the park's boundaries at least at some time of the year. This total held few surprises, based on published species range distributions, and was comprised of about 95% of all expected species, as based on published ranges.

However, I was repeatedly struck by the low numbers of individuals of most species and the virtual absence of some that the park, on initial inspection, would be expected to contain. I speculate about the reasons for this low density of individuals below.

Methods

Data Collection

Basic Method - I conducted this survey over the course of two years, from mid-March 2003 through mid-April 2005. On most visits I was aided by one of my graduate students, Rachel Greene, but I also worked alone and Rachel made two visits without me. Our methods were straightforward. We used the Point Count method as presented in Nur et al. (1999) although we initially planned to use the Variable Circular Plot technique (Buckland 1987); however, the limitations of the latter process, especially estimating distances in some habitats, caused us soon to change to the Point Count procedure.

Schedule, Sampling Techniques and Survey Area - We visited the park either weekly or biweekly over the course of the survey for a total of 57 visits (Appendix 1). Because of competing demands on my time no data were taken for the month of June in either year. The total time spent collecting data was 167.83 hours. The average time per daily sample was 176.68 minutes (= 2 hr 57

min) (s.d. = 54.14, range 70-300 minutes). The overwhelming majority of trips began in the early morning (54/57 = 94.7%) with the remainder being night/evening trips to look for nocturnal and crepuscular species. Diurnal trips typically began within 30 minutes of sunrise; evening trips began within about 60 minutes of sundown. Over the entire study only two trips were curtailed by inclement weather but no visit was less than 70 minutes duration.

We sampled every 500 meters along established trails throughout the park; these stations were also marked using a Garmin 45 GPS unit but, in general, landmarks were sufficient for finding the locations on subsequent trips. We walked at a pace of about 100 meters per minute and so the stations thus established also tended to be 5 minutes apart. At each sampling site we counted the total number of individuals of each species encountered, either visually or via vocalizations, for 5 minutes. Occasionally, in order to make sure we had identified a particularly difficult individual (a fall plumaged warbler, for example) we would stay another 5 minutes before moving on. In such cases we noted the extended time as well as the purpose for lingering.

Although the majority of our effort was spent in the park proper, we did not constrain our observations solely to the park's property. We also took data from contiguous areas in Kings Mountain State Park and from private lands along the other borders.

Other Observers. Some records were reported by other observers. These people include Steve Fields, Curator of Natural History, Museum of York County, Rock Hill, SC and Jim Sorrow, South Carolina Department of Natural Resources as well as some park employees. I used these records both as evidence of the existence of a species in the sample area and, when possible, to calculate Encounter Rate estimates (see the "Analysis" section for the definition of "Encounter Rate".)

Data Collecting - Data were taken by hand on paper. Each data sheet recorded the beginning and end of a day's session, weather conditions, the route taken, the start and stop times at each station as well as the numbers of each species heard and seen at the station.

Our counts were designed to be conservative. If we heard a call and then saw an individual that could have been responsible for the vocalization we counted the two instances as one bird unless a second individual also presented itself. To minimize recounting the same individuals at subsequent stations, we monitored the movements of birds observed. If they traveled in the same direction as the next station we assumed that individuals encountered at the next stop were the same as those just counted; if, on the other hand, the number of individuals at the next stop was greater we counted only those above the previous count as new individuals. In practice, we rarely faced such ambiguous situations.

Analysis

Encounter Rates (ER) - Although the data were taken in a fashion that allows any of a series of analyses (e.g., species richness, species diversity and community similarity [Nur et al., 1999]) for the purposes of this report I have used the data to generate relative encounter rates for each species. That is, if one were to walk along the same routes we took, what is the relative rate with which one would expect to detect an individual of a particular species at the appropriate time of year? Such a measure is a gauge of relative abundance.

This method is consistent with the relative abundance estimate technique discussed by Nur et al. (1999) because my averaging numbers of individuals detected over repeated visits to established sampling stations still results in a single value for each species. (See "Calculating Encounter Rates" below.) However, my use of ER was mathematically necessary because we could not maintain a strict visitation schedule and some periods were more heavily sampled than others. ER can be converted to other measures and it has several advantages: It gives a mean value for each species, which allows a species by species comparison within the park, and it also gives a relative measure of likelihood of encountering a given species (again, assuming the proper time of year.)

Occurrence: Terms and Definitions - Before determining the ER, I took each species and placed it into one of four categories: permanent resident, summer resident, winter resident or migrant, based primarily on information gleaned from current field guides, especially The National Geographic Field Guide to the Birds of North America, Fourth Edition (Anonymous, 2002). That book has the most up-to-date range maps of any source. I also used material from such other sources as Bent's Life Histories of North American Birds series (Bent, various dates), the Migratory Bird Research site at the Patuxent Wildlife Research Center (www.mbr-pwrc.usgs.gov/) and specialty books (e.g., Cleere and Nurney, 1998; Curson et al., 1994; Dunn et al., 1997). In some instances I also used my personal experience and records with various species in the region as a guide, especially with regard to expected time of arrival/departure for some migrants or seasonal residents.

Birds were considered to be **Permanent Residents** if they were present in all months of the year. **Summer Residents** were those species that breed in the park but that did not reside in all months. **Winter Residents** were those expected to be consistently present between October and May but that did not breed in the park. **Migrants** pass through the park on the way to or from breeding grounds and are typically present for a month or so at most but may

occur for only a week or two. Some are expected in both the spring (March through May) and the fall (late August through October) but others primarily occur in only one of those periods.

In cases where the published accounts differed from our observations I relied on our data. For example, the Black-billed Cuckoo is not presently known to summer in the region according to my sources. However, at least three birds were present during summer 2004.

Calculating Encounter Rates: For each species I tallied the number of birds seen at all stations on each visit as well as the amount of time we spent in the park that day. I summed all the sightings and divided by the total time available for the sightings. This gave me the rate of detections for a given species per hour. For example, for the Eastern Bluebird, we recorded a total of 31 encounters over the two years. Because this species is a diurnal permanent resident, I divided 31 individuals by all diurnal observation hours (159.92) and got an ER of 0.194 bird/hour.

In cases where a bird was either a summer resident, a winter resident or a migrant or was nocturnal I reduced the divisor to the appropriate amount of time available. Thus, for the White-throated Sparrow, a winter resident expected to be present only from October through March, I divided 31 observed individuals by 75 hours, the total time I spent in the park over those months, for an ER of 0.413 bird/hour.

Some species are expected only during fractions of a month; this is especially true for most migrants. Ignoring that detail could give an artificially reduced expected encounter rate. To get as fine-grained a measure as possible, in cases where a species was expected for only part of a month, I only used times for those weeks that covered the expected time of occurrence. The Great Crested Flycatcher is an example. It is a summer resident and occurs from mid-April to mid-August. Therefore, I used all the times for the months of May through July but only the final two weeks of April and the first two of August to compute the total time available for encountering this species.

Results

Number of Species Encountered. We tallied 119 species over the course of the study (Table 1). Of these, 50 (42.4%) were permanent residents, 36 (30.3%) were summer residents, 14 (11.86%) were winter residents and 19 (16.1%) were migrants (Table 2). We include the Northern Bobwhite based on a report by a NPS employee, although we did not see or hear any individuals. Because that account did not report numbers of individuals seen we did not produce an encounter rate for this species. On the other hand, we did calculate an encounter rate for the Whip-poor-will, as reported by Jim Sorrow and Steve Fields because they reported how long they were in the field and how many birds (1) they heard.

Our total is 64.3% of the species (119/185) in the Microsoft Excel list on file with the park (Chris Revels, pers comm.) However, the park's list is a bit unrealistic. It includes many species whose ranges may technically cover the area but for which the park would have few if any attractions. For example, the park contains no habitat appropriate for Bald Eagles and so the lone individual of that species (09 April 2004) was doubtlessly a fly-over. A comparable situation applies to the lone sighting of an Osprey (05 April 2003), a bird that requires large bodies of water in which to fish. Similarly, there is little in the park that would attract marsh-dwelling species such as rails, coots and moorhens or those requiring vast open areas such as extensive fields or beachfronts. Moreover, listing as possible species such habitat specialists as Bachmann's Sparrow unrealistically inflated the list of likely species.

Two particularly overestimated groups are the shorebird families known as plovers (Charadriidae) and sandpipers (Scolopacidae). The park's list includes three plovers, only one of which, the killdeer, is even a remote possibility; we did see a lone killdeer probably because there are still open fields in areas surrounding the park and killdeer are relatively common in the region. Other plovers, however, are unlikely to be attracted to the region. Of the sandpipers on the park's list, we recorded both the American Woodcock and Common Snipe. However, there are 13 other sandpiper species most of which would only be expected along marine beaches. The spotted sandpiper is possible as an uncommon spring migrant.

In addition, the park's list also failed to include several species that are expected and that we did see. Chief among these are the Chimney Swift, the Brown-headed Nuthatch and the House Finch.

If we reduce the list to those with a historic record of occurrence in the region and for which the park has appropriate habitat, our total amounts to 84.4 % of species reasonably expected to occur (119/141).

Species That Were Expected or Conceivably Could Occur in the Park but Were Not Found. There are 35 species that might reasonably be expected in the park but that we didn't detect (Table 3). Among the more striking absences are the Loggerhead Shrike, a thrush called the Veery, the Blue Grosbeak and the Orchard Oriole. However, all of the species in Table 3 are either rare or there is little in the way of appropriate habitat in the park for them, although some locations in the surrounding areas likely support populations of them.

Encounter Rates. Encounter rates varied from a low of 0.006 bird/hour for several species to a high of 2.616 for the Red-eyed Vireo. Overall, the most commonly detected species in the park were the Red-eyed Vireo, Tufted Titmouse (2.570) and Carolina Chickadee (2.195) (See Table 4).

In contrast, several species were found on only one occasion. None of these was absolutely unexpected. Perhaps the most unusual was the White-crowned Sparrow which was seen early in the project (19 April 2003); its presence put it just slightly east of its known winter range. I am certain of the identification because I am quite familiar with the species from my years on the West Coast.

As a group, Wood Warblers (Parulidae), provided the greatest number of species seen on only a single occasion. This high number of single-day sightings is due to at least two factors. First, they comprise a large family and most species are only migrants in our region. Second, the family also contains several species of conservation concern. Together, these factors conspire to make encounters with many of them unlikely. Examples of single day sightings of wood warblers include Blue-winged (26 September 2003), Cape May (03 October 2003), Cerulean (19 September 2004), Chestnut-sided (26 April 2003), Kentucky (26 April 2003) and Nashville Warblers (30 October 2004) along with the Louisiana Waterthrush (06 May 2004), despite its name, a member of the same family. The last-mentioned species actually breeds in our area and presumably in KIMO but we never found a nest; its sister species, the Northern Waterthrush is only a migrant here but it was seen on twice as many occasions (19 April 2003 and 13 May 2004.)

Other species seen on only a single occasion are less explicable. Given the habitat and the presumably large numbers of perching sites, I am surprised that we only recorded one Common Nighthawk or one Whip-poor-will over the two years. Their encounter rate values were both 0.211 but those numbers may be inflated because nocturnal sampling was only a small portion of the overall effort.

Discussion

Agreement Between Expected Species and Our Results. There is high agreement (about 85%) between our data and what field guides and other sources suggest should be present at appropriate times of the year in the park. However, there is still a 15% shortfall and I can identify several potential reasons for the lack of complete concordance. First, most of the species we did not find (Table 3) are rare in the region. For example, the Loggerhead Shrike is expected as a permanent resident but it is now very rare all over the US. It is on the list of "South Carolina Rare, Threatened & Endangered Bird Inventory" as a "Species of Special Concern" (Watson, 2004; see Appendix 2). The Rusty Blackbird, a possible winter resident, is also now quite rare and is on the list of the "US Fish and Wildlife Service Species of Conservation Concern in the Piedmont" (Watson, 2004; see Appendix 3).

On the other hand, although several species are reasonably common in the surrounding region, KIMO does not provide sufficient tracts of appropriate habitat to attract or hold them. Such species include the swallows, several species of which can be seen in surrounding open areas such as farm land. KIMO has a fairly extensive canopy cover and provides virtually no such open expanses closer to ground level. Swallows might be expected to fly over the park occasionally between their preferred open pastures and fields but not to use the park in any substantial way. In fact, this argument would also apply to the Eastern Kingbird, the Horned Lark, the American Pipit, the Vesper, Savannah and Grasshopper Sparrows, as well as the previously-mentioned Loggerhead Shrike.

Aquatic habitats are also quite limited in KIMO; therefore, such birds as the Swamp Sparrow and the Rusty Blackbird, species associated with swamps and wet woodlands, are unlikely to be attracted by the park's holdings. Again, this is the primary reason the park's list of potential species present is a bit unrealistic; it includes such heavily water-dependent groups as herons, gulls, terns and rails.

Finally, many of the other "missing" species, such as the Veery, are migrants. In fact, 40% (14/35) of the species expected but not encountered would be purely migratory in our region. Migrants often travel over large fronts and are consequently "dilute" in occurrence in most areas unless funneled through a region by topography such as narrow passes, high mountains or straits. There is no evidence for such a funnel effect in our region of the Piedmont and so for many migrants it is a hit-or-miss proposition as to whether they will pass through a particular location.

As a compounding variable, there must be appropriate habitat to attract and hold the migrating birds. For such species as LeConte's Sparrow, such areas (open fields) are, once again, not available in the park.

Although the Veery would be expected only during migration others such as the Blue Grosbeak and the Orchard Oriole would be summer residents. For these two and several other species, I am not sure why they are not present at least in low numbers. The Grosbeak uses habitats similar to those employed by the Indigo Bunting, which was a bird we found in and around KIMO; still, it remains that, while we were alert for Blue Grosbeaks, we found none.

It is my experience in the region that while the Orchard Oriole is clearly found here, it is not very commonly encountered. It is associated with water and the streamside along Kings Creek on the north side of the park should provide it with appropriate tree cover near water but we never saw or heard any members of this species in or around KIMO.

As a group, the wood warblers (Parulidae) are well-represented, at least on an encountered/not encountered basis. Of the 29 species on the park's list, we saw 23 (79.3%). Most species ($14/23 = 60.9\%$) were recorded only during migration. As such, KIMO may act as an important way-station for these and other small, Neotropical migrant species.

Similarly, woodpeckers (Picidae) are also well-represented; all 7 species expected were encountered although the red-headed woodpecker was only seen once. There are 3-4 breeding pairs of the Pileated Woodpecker that use the park and presumably bred within it or at least in the lands nearby. Numbers of the other species seem reasonably healthy, based on encounter rates (see below.)

Relative Encounter Rates and Their Utility. The measure of relative abundance used here, encounter rate (individuals/hour), is derived from standard sampling procedures based on the Circular Plot Method. It is not a perfect method as it does not take into account an animal's size – large species are typically low in number compared with smaller species. Still, with such understanding operating in the background, we can use these relative frequency numbers to compare species in the park and between KIMO and other sites. We can also use them to monitor changes in occurrence over time within the park.

Relative Encounter Rates and Expected Levels of Occurrence. As stated earlier, several species were expected to occur in higher numbers than we encountered. These include the Eastern Towhee, Gray Catbird, Brown Thrasher and Cedar Waxwings. The obvious explanation for their low numbers is a lack of appropriate habitat since they are otherwise reasonably common birds elsewhere in the region. What is different about KIMO?

Our working hypothesis is that recent fire management techniques may play a role in reducing the numbers of these species. The burn plan calls for fires from

March through May to remove understory and to manage for canopy (US Dept of Interior, 1999). These fires are scheduled for the times that the Towhee, Catbird and Thrasher would be expected to nest. (The Waxwing is a Winter Resident only.) Such a burn plan would severely affect such species because they have their nests in the understory. In addition, all of the three nesting species are ground feeders; in fact, the Towhee specializes in ground-feeding.

Similarly, such a burn plan would likely affect vines, cedars, hollies and several other fruit-producing plants. The Waxwing, and to a lesser extent the Thrasher and Catbird, feed heavily on such fruits. Again, the fire regime may reduce the number of such plants and therefore resources for these particular bird species.

Unfortunately, the present fire management program went into effect before a baseline assessment of bird species in KIMO had been produced. Thus, there is no way to compare the species assemblage or their relative numbers before the management plan was initiated. However, to try to get a handle on the question of whether the plan has affected bird species differentially, my graduate student, Rachel Greene, is using it as the basis for her Master's thesis. She is comparing the occurrences of bird species in KIMO with the same species in both Kings Mountain State Park (KMSP) and Crowders Mountain State Park (CMSP). The two state parks provide control groups with regard to KIMO's fire program. CMSP also has a burn program but sets its fires earlier in the year (North Carolina Department of Environment, Health and Natural Resources. 1999); it acts as the "positive control". KMSP has no burn program and thus acts as the "negative control". We have not analyzed all the data from these efforts, however, and so we cannot tell at present whether our hypothesis is supported or refuted.

TABLE 1. Bird Species Recorded in Kings Mountain National Military Park Over the Course of this Survey Arranged in Phylogenetic Order and with Seasonal Occurrence and Conservation Status Information.

Occurrence Symbols: **M** = Migrant; **PM** = Permanent Resident;
SR = Summer Resident; **WR** = Winter Resident

Conservation Status (From Watson, 2004):

SCE = SC List of Endangered Species
SCS = SC List of Species of Special Concern
USFW = US Fish and Wildlife Species of Conservation
Concern in the Piedmont.

Ciconiiformes - Herons, Storks, New World Vultures and relatives

Ardeidae – Herons

Great Blue Heron (Ardea herodias) **PM**

Cathartidae – New World Vultures

Turkey Vulture (Cathartes aura) **PM**

Black Vulture (Coragyps atratus) **PM**

Anseriformes – Ducks, Geese and Swans

Anatidae

Canada Goose (Branta canadensis) **PM**

Mallard (Anas platyrhynchos) **WR(?)**

Wood Duck (Aix sponsa) **PM**

Falconiformes - Diurnal Birds of Prey

Accipitridae

Bald Eagle (Haliaeetus leucocephalus) **PM, SCE**

Northern Harrier (Circus cyaneus) **WR**

Sharp-shinned Hawk (Accipiter striatus) **WR**

Cooper's Hawk (Accipiter cooperii) **PM**

Red-shouldered Hawk (Buteo lineatus) **PM**

Broad-winged Hawk (Buteo platypterus) **SR**

Red-tailed Hawk (Buteo jamaicensis) **PM**

Pandionidae

Osprey (Pandion haliaetus) **PM**

Galliformes – Quails, Pheasants and Turkeys

Odontophoridae

Northern Bobwhite (Colinus virginianus) **PM, SCS**

Phasianidae

Wild Turkey (Meleagris gallopavo) **PM**

Charadriiformes - Shorebirds, Gulls and relative

Charadriidae

Killdeer (Charadrius vociferus) **PM**

Scolopacidae

Common Snipe (Gallinago gallinago) **M**

American Woodcock (Scolopax minor) **PM**

Columbiformes - Pigeons and Doves

Columbidae

Rock Dove (Columba livia) **PM**

Mourning Dove (Zenaida macroura) **PM**

Cuculiformes – Cuckoos

Cuculidae

Yellow-billed Cuckoo (Coccyzus americanus) **SR**

Black-billed Cuckoo (Coccyzus erythrophthalmus) **SR**

Strigiformes – Owls

Strigidae

Great Horned Owl (Bubo virginianus) **PM**

Barred Owl (Strix varia) **PM**

Eastern Screech Owl (Otus asio) **PM**

Caprimulgiformes - Nightjars and relatives

Caprimulgidae

Chuck-will's-widow (Caprimulgus carolinensis) **SR, USFW**

Whip-poor-will (Caprimulgus vociferus) **SR, USFW**

Common Nighthawk (Chordeiles minor) **SR**

Apodiformes - Swifts and Hummingbirds

Apodidae

Chimney Swift (Chaetura pelagica) **SR**

Trochilidae

Ruby-throated Hummingbird (Archilochus colubris) **SR**

Coraciiformes - Rollers, Kingfishers and relatives

Alcedinidae

Belted Kingfisher (Ceryle alcyon) **PM**

Piciformes - Woodpeckers, Toucans and relatives

Picidae

Red-bellied Woodpecker (Melanerpes carolinus) **PM**

Northern Flicker (Colaptes auratus) **PM**

Red-headed Woodpecker (Melanerpes erythrocephalus) **PM**

Yellow-bellied Sapsucker (Sphyrapicus varius) **WR**

Downy Woodpecker (Picoides pubescens) **PM**

Hairy Woodpecker (Picoides villosus) **PM**

Pileated Woodpecker (Dryocopus pileatus) **PM**

Passeriformes - Perching Birds

Tyranidae - Flycatchers

Great Crested Flycatcher (Myiarchus crinitus) **SR**

Eastern Wood-Pewee (Contopus virens) **SR**

Eastern Phoebe (Sayornis phoebe) **PM**

Acadian Flycatcher (Empidonax virescens) **SR**

Corvidae – Jays and Crows

Blue Jay (Cyanocitta cristata) **PM**

American Crow (Corvus brachyrhynchos) **PM**

Paridae – Titmice and Chickadees

Tufted Titmouse (Baeolophus bicolor) **PM**

Carolina Chickadee (Parus carolinensis) **PM**

Certhiidae - Creepers

Brown Creeper (Certhia americana) **WR**

Sittidae – Nuthatches

White-breasted Nuthatch (Sitta carolinensis) **PM**

Red-breasted Nuthatch (Sitta canadensis) **WR**

Brown-headed Nuthatch (Sitta pusilla) **PM**

Troglodytidae - Wrens

House Wren (Troglodytes aedon) **SR**

Winter Wren (Troglodytes troglodytes) **WR**

Carolina Wren (Thryothorus ludovicianus) **PM**

Muscicapidae – Old World Thrushes

Golden-crowned Kinglet (Regulus satrapa) **SR**

Ruby-crowned Kinglet (Regulus calendula) **SR**

Blue-gray Gnatcatcher (Polioptila caerulea) **SR**

Turdidae – New World Thrushes

Eastern Bluebird (Sialia sialis) **PM**

Wood Thrush (Hylocichla mustelina) **SR, USFW**

Gray-cheeked Thrush (Catharus minimus) **M**

Hermit Thrush (Catharus guttatus) **WR**

American Robin (Turdus migratorius) **PM**

Mimidae – Mimic Thrushes

Gray Catbird (Dumatella carolinensis) **SR**

Northern Mockingbird (Mimus polyglottos) **PM**

Brown Thrasher (Toxostoma rufum) **SR**

Bombycillidae – Waxwings

Cedar Waxwing (Bombycilla cedrorum) **WR**

Sturnidae – Starlings

European Starling (Sturnus vulgaris) **PM**

Vireonidae – Vireos

White-eyed Vireo (Vireo griseus) **SR**

Yellow-throated Vireo (Vireo flavifrons) **SR**

Blue-headed Vireo (Vireo solitarius) **PM**

Red-eyed Vireo (Vireo olivaceus) **SR**

Warbling Vireo (Vireo gilvus) **M**

Parulidae – Wood Warblers

Prothonotary Warbler (Protonaria citrea) **SR, USFW**

Blue-winged Warbler (Vermivora pinus) **M**

Tennessee Warbler (Vermivora peregrina) **M**

Nashville Warbler (Vermivora ruficapilla) **M**

Northern Parula (Parula americana) **SR**

Black-and-white Warbler (Mniotilta varia) **SR**

Black-throated Blue Warbler (Dendroica caerulescens) **M**

Cerulean Warbler (Dendroica cerulean) **M, USFW**

Blackburnian Warblers (Dendroica fusca) **M**

Chestnut-sided Warbler (Dendroica pennsylvanica) **M**

Cape May Warbler (Dendroica tigrina) **M**

Magnolia Warbler (Dendroica magnolia) **M**

Yellow-rumped Warbler (Dendroica coronata) **WR**

Black-throated Green Warbler (Dendroica virens) **M**

Yellow-throated Warbler (Dendroica dominica) **SR**

Prairie Warbler (Dendroica discolor) **SR, USFW**

Bay-breasted Warbler (Dendroica castanea) **M**

Blackpoll Warbler (Dendroica striata) **M**

Pine Warbler (Dendroica pinus) **PM**

Palm Warbler (Dendroica palmarum) **WR/M(?)**

Yellow Warbler (Dendroica petechia) **M**

Mourning Warbler (Opornis philadelphia) **M**

Kentucky Warbler (Opornis formosus) **SR, USFW**

Hooded Warbler (Wilsonia citrina) **SR**

Worm-eating Warbler (Helminthos vermivorus) **M**

Ovenbird (Seiurus aurocapillus) **SR**

Louisiana Waterthrush (Seiurus motacilla) **SR**

Northern Waterthrush (Seiurus novaboracensis) **M**

Common Yellowthroat (Geothlypis trichas) **SR**

American Redstart (Setophaga ruticilla) **M**

Thraupidae – Tanagers

Scarlet Tanager (Piranga olivacea) **SR**

Summer Tanager (Piranga rubra) **SR**

Cardinalidae – Grosbeaks, Cardinals and Buntings

Rose-breasted Grosbeak (Pheucticus ludovicianus) **M**

Northern Cardinal (Cardinalis cardinalis) **PM**

Indigo Bunting (Passerina cyanea) **SR**

Emberizidae – Towhees and Sparrows

Eastern Towhee (Pipilo erythrophthalmus) **PM**

Song Sparrow (Melospiza melodia) **PM**

Field Sparrow (Spizella pusilla) **PM**

Chipping Sparrow (Spizella passerina) **PM**

Dark-eyed Junco (Junco hyemalis) **WR**

White-throated Sparrow (Zonotrichia albicollis) **WR**

White-crowned Sparrow (Zonotrichia leucophrys) **WR**

Icteridae – Blackbirds

Brown-headed Cowbird (Molothrus ater) **PM**

Eastern Meadowlark (Sturnella magna) **PM**

Common Grackle (Quiscalus quiscula) **PM**

Fringillidae – Finches

American Goldfinch (Carduelis tristis) **PM**

Purple Finch (Carpodacus purpureus) **WR**

House Finch (Carpodacus mexicanus) **PM**

Table 2. Species Encountered at KIMO Over the Course of this Survey Arranged by Time of Presence Each Year.

Permanent Residents (50 Species):

Great Blue Heron	Eastern Phoebe
Turkey Vulture	Blue Jay
Black Vulture	American Crow
Canada Goose	Tufted Titmouse
Wood Duck	Carolina Chickadee
Bald Eagle	White-breasted Nuthatch
Red-shouldered Hawk	Brown-headed Nuthatch
Red-tailed Hawk	Carolina Wren
Osprey	Eastern Bluebird
Northern Bobwhite	Wood Thrush
Wild Turkey	American Robin
Killdeer	Northern Mockingbird
American Woodcock	European Starling
Rock Dove	Blue-headed Vireo
Mourning Dove	Pine Warbler
Great Horned Owl	Northern Cardinal
Barred Owl	Eastern Towhee
Eastern Screech Owl	Song Sparrow
Belted Kingfisher	Field Sparrow
Red-bellied Woodpecker	Chipping Sparrow
Northern Flicker	Brown-headed Cowbird
Red-headed Woodpecker	Eastern Meadowlark
Downy Woodpecker	Common Grackle
Hairy Woodpecker	American Goldfinch
Pileated Woodpecker	House Finch

Summer Residents (36 Species):

Cooper's Hawk
Broad-winged Hawk
Yellow-billed Cuckoo
Black-billed Cuckoo
Chuck-will's-widow
Whip-poor-will
Common Nighthawk
Chimney Swift
Ruby-throated Hummingbird
Great Crested Flycatcher
Eastern Wood-Pewee
Acadian Flycatcher
House Wren
Golden-crowned Kinglet
Ruby-crowned Kinglet
Blue-gray Gnatcatcher
Wood Thrush
Gray Catbird

Brown Thrasher
White-eyed Vireo
Yellow-throated Vireo
Red-eyed Vireo
Prothonotary Warbler
Northern Parula
Black-and-white Warbler
Yellow-throated Warbler
Prairie Warbler
Kentucky Warbler
Hooded Warbler
Worm-eating Warbler
Ovenbird
Louisiana Waterthrush
Common Yellowthroat
Scarlet Tanager
Summer Tanager
Indigo Bunting

Winter Residents (14 Species):

Mallard
Sharp-shinned Hawk
Yellow-bellied Sapsucker
Brown Creeper
Winter Wren
Red-breasted Nuthatch
Hermit Thrush
Cedar Waxwing
Yellow-rumped Warbler
Palm Warbler (?)
Dark-eyed Junco
White-throated Sparrow
White-crowned Sparrow
Purple Finch

Migrants (19 Species):

Gray-cheeked Thrush
Blue-winged Warbler
Tennessee Warbler
Nashville Warbler
Black-throated Blue Warbler
Cerulean Warbler
Blackburnian Warblers
Chestnut-sided Warbler
Cape May Warbler
Magnolia Warbler
Black-throated Green Warbler
Bay-breasted Warbler
Blackpoll Warbler
Yellow Warbler
Mourning Warbler
Northern Waterthrush
American Redstart
Rose-breasted Grosbeak

Table 3. Species Reasonably Expected to Occur in KIMO But That We Did Not Record in the Course of This Study (35 Species).

<u>Species</u>	<u>Probable Time of Occurrence/Status in Region</u>
Peregrine Falcon	Very Rare Migrant
Merlin	Very Rare Migrant
American Kestrel	Rare Permanent Resident
Barn Owl	Rare Permanent Resident
Willow Flycatcher	Very Rare Migrant
Eastern Kingbird	Uncommon Summer Resident
Horned Lark	Rare Winter Resident
Purple Martin	Uncommon Summer Resident
Tree Swallow	Uncommon Migrant
Cliff Swallow	Uncommon Summer Resident
Northern Rough-winged Swallow	Uncommon Summer Resident
Barn Swallow	Uncommon Summer Resident
Marsh Wren	Very Rare Migrant
Sedge Wren	Very Rare Migrant
Veery	Uncommon Migrant
American Pipit	Rare Winter Resident
Loggerhead Shrike	Rare Permanent Resident
Orange-crowned Warbler	Rare Migrant
Connecticut Warbler	Very Rare Migrant
Swainson's Warbler	Rare Migrant
Wilson's Warbler	Very Rare Migrant
Yellow-breasted Chat	Uncommon Summer Resident
Blue Grosbeak	Uncommon Summer Resident
Vesper Sparrow	Uncommon Winter Resident
Fox Sparrow	Rare Winter Resident
Savannah Sparrow	Uncommon Winter Resident
LeConte's Sparrow	Rare Migrant
Grasshopper Sparrow	Uncommon Permanent Resident
Henslow's Sparrow	Very Rare Migrant
Swamp Sparrow	Rare Winter Resident
Rusty Blackbird	Very Rare Winter Resident
Orchard Oriole	Uncommon Summer Resident
Baltimore Oriole	Uncommon Migrant
Pine Siskin	Uncommon Winter Resident
House Sparrow	Uncommon Permanent Resident

Table 4. Relative Rates of Occurrence by Species (Arranged Alphabetically).

<u>Species</u>	<u>(Encounters/Hours of Obs.)</u>	<u>Relative Encounter Rate</u>
Bluebird, Eastern	(31/159.92)	0.194
Bobwhite, Northern	--(See text)--	
Bunting, Indigo	(6/ 46.38)	0.129
Cardinal, Northern	(100/159.92)	0.625
Catbird, Gray	(1/ 58.11)	0.017
Chickadee, Carolina	(351/159.92)	2.195
Chuck-will's-widow	(2/ 4.75)	0.421
Cowbird, Brown	(17/159.92)	0.106
Creeper, Brown	(5/ 75.00)	0.067
Crow, American	(173/159.92)	1.082
Cuckoo, Black-billed	(8/ 66.72)	0.120
Cuckoo, Yellow-billed	(22/ 84.92)	0.259
Dove, Mourning	(76/159.92)	0.474
Dove, Rock	(1/159.92)	0.006
Duck, Wood	(1/159.92)	0.006
Eagle, Bald	(1/159.92)	0.006
Finch, House	(2/159.92)	0.013
Finch, Purple	(17/ 66.32)	0.273
Flicker, Northern	(32/159.92)	0.200
Flycatcher, Acadian	(9/ 27.73)	0.325
Flycatcher, Great Crested	(16/ 50.51)	0.317
Gnatcatcher, Blue-gray	(40/ 66.72)	0.600
Goldfinch, American	(149/159.92)	0.932
Goose, Canada	(17/159.92)	0.016
Grackle, Common	(35/159.92)	0.219
Grosbeak, Rosebreasted	(14/ 47.93)	0.292
Harrier, Northern	(1/ 54.17)	0.018
Hawk, Broad-winged	(8/112.40)	0.071
Hawk, Cooper's	(1/159.92)	0.006
Hawk, Red-shouldered	(1/159.92)	0.069
Hawk, Red-tailed	(4/159.92)	0.025
Hawk, Sharp-shinned	(2/132.63)	0.016
Heron, Great Blue	(3/159.92)	0.019
Hummingbird, Ruby-throated	(9/100.40)	0.090
Jay, Blue	(165/159.92)	1.032
Junco, Dark-eyed	(60/ 74.75)	0.806
Killdeer	(1/159.92)	0.006
Kingfisher, Belted	(3/159.92)	0.019
Kinglet, Golden-crowned	(81/ 84.48)	0.959
Kinglet, Ruby-crowned	(95/120.46)	0.789

Table3 (Cont.)

Mallard	(2/107.30)	0.019
Meadowlark, Eastern	(1/159.92)	0.006
Mockingbird, Northern	(3/159.92)	0.019
Nighthawk, Common	(1/ 4.75)	0.211
Nuthatch, Brown-headed	(12/159.92)	0.075
Nuthatch, Red-breasted	(2/ 75.00)	0.027
Nuthatch, White-breasted	(129/159.92)	0.807
Osprey	(1/159.92)	0.006
Ovenbird	(8/ 41.48)	0.193
Owl, Barred	(2/ 6.87)	0.291
Owl, Eastern Screech	(2/ 6.87)	0.291
Owl, Great Horned	(1/ 6.87)	0.146
Parula, Northern	(20/ 62.23)	0.312
Phoebe, Eastern	(22/159.92)	0.138
Redstart, American	(8/ 54.16)	0.148
Robin, American	(215/159.92)	1.344
Sapsucker, Yellow-bellied	(33/ 87.68)	0.376
Snipe, Common	(2/ 38.46)	0.052
Sparrow, Chipping	(15/159.92)	0.094
Sparrow, Field	(2/159.92)	0.013
Sparrow, Song	(12/159.92)	0.075
Sparrow, White-crowned	(1/ 75.00)	0.013
Sparrow, White-throated	(31/ 75.00)	0.413
Swift, Chimney	(36/ 89.57)	0.402
Tanager, Scarlet	(41/ 70.79)	0.579
Tanager, Summer	(53/ 70.79)	0.749
Thrasher, Brown	(5/129.99)	0.038
Thrush, Gray-cheeked	(4/ 38.46)	0.104
Thrush, Hermit	(47/ 94.56)	0.497
Thrush, Wood	(32/ 79.52)	0.402
Titmouse, Tufted	(411/159.92)	2.570
Towhee, Eastern	(12/159.92)	0.075
Turkey, Wild	(21/159.92)	0.131
Vireo, Blue-headed	(44/159.92)	0.275
Vireo, Red-eyed	(189/ 72.24)	2.616
Vireo, Warbling	(1/ 76.74)	0.013
Vireo, White-eyed	(10/ 66.72)	0.159
Vireo, Yellow-throated	(13/ 87.85)	0.148
Vulture, Black	(10/159.92)	0.063
Vulture, Turkey	(61/159.92)	0.381
Warbler, Bay-breasted	(7/ 65.66)	0.107
Warbler, Black-and-white	(56/112.40)	0.498

Table3 (Cont.)

Warbler, Blackburnian	(4/ 54.66)	0.073
Warbler, Blackpoll	(7/ 38.44)	0.182
Warbler, Black-throated Blue	(14/ 52.58)	0.266
Warbler, Black-throated Green	(14/ 68.43)	0.205
Warbler, Blue-winged	(2/ 47.08)	0.042
Warbler, Cape May	(1/ 53.98)	0.028
Warbler, Cerulean	(1/ 7.60)	0.132
Warbler, Chestnut-sided	(1/ 35.98)	0.028
Warbler, Hooded	(16/ 64.64)	0.248
Warbler, Kentucky	(1/ 72.24)	0.014
Warbler, Magnolia	(7/ 47.93)	0.146
Warbler, Mourning	(5/ 32.88)	0.152
Warbler, Nashville	(3/ 32.88)	0.091
Warbler, Northern Parula (See Parula, Northern)		
Warbler, Palm	(2/ 76.17)	0.026
Warbler, Pine	(130/159.92)	0.813
Warbler, Prairie	(3/ 75.84)	0.040
Warbler, Prothonotary	(26/ 50.51)	0.515
Warbler, Tennessee	(4/ 35.98)	0.111
Warbler, Worm-eating	(3/ 37.33)	0.080
Warbler, Yellow	(6/ 33.01)	0.182
Warbler, Yellow-rumped	(60/103.13)	0.582
Warbler, Yellow-throated	(4/ 60.51)	0.066
Waterthrush, Louisiana	(1/ 81.88)	0.012
Waterthrush, Northern	(3/ 51.73)	0.058
Waxwing, Cedar	(4/102.25)	0.040
Whip-poor-will	(1/ 4.75)	0.211
Woodcock, American	(1/159.92)	0.006
Woodpecker, Downy	(39/159.92)	0.244
Woodpecker, Hairy	(15/159.92)	0.094
Woodpecker, Pileated	(91/159.92)	0.569
Woodpecker, Red-bellied	(191/159.92)	1.194
Woodpecker, Red-headed	(1/159.92)	0.006
Wood-Pewee, Eastern	(24/ 70.79)	0.339
Wren, Carolina	(251/159.92)	1.570
Wren, House	(1/ 72.24)	0.014
Wren, Winter	(3/ 93.10)	0.032
Yellowthroat, Common	(1/ 84.92)	0.012

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APPENDIX 1: Dates of Park Visits and Time Spent Recording Data.

<u>DATE</u>	<u>TIME (HR:MIN)</u>	<u>TOTAL MINUTES</u>
22 Mar 2003	5:00	300
05 Apr 2003	2:38	158
19 Apr 2003	3:54	236
26 Apr 2003	4:40	280
17 May 2003	2:56	176
12 July 2003	4:23	263
14 Aug 2003	2:45	165
12 Sept 2003	2:31	151
19 Sept 2003	3:47	227
26 Sept 2003	3:10	190
03 Sept 2003	2:10	130
10 Oct 2003	2:29	149
17 Oct 2003	1:52	112
31 Oct 2003	2:05	125
07 Nov 2003	2:20	140
14 Nov 2003	2:09	129
21 Nov 2003	1:15	75
08 Jan 2004	3:29	209
16 Jan 2004	1:55	155
23 Jan 2004	1:50	110
30 Jan 2004	3:55	255
13 Feb 2004	2:19	139
22 Feb 2004	1:10	79
05 Mar 2004	2:12	132
12 Mar 2004	1:37	97
13 Mar 2004	2:57	177
19 Mar 2004	2:15	135
26 Mar 2004	2:41	161
02 Apr 2004	4:24	264
09 Apr 2004	3:12	192
16 Apr 2004	3:13	193
23 Apr 2004	2:59	179
30 Apr 2004	3:53	233
06 May 2004	3:52	232
13 May 2004	4:17	257
09 July 2004	4:11	251
16 July 2004	3:55	235
23 July 2004	4:10	250
06 Aug 2004	4:08	248

28 Aug 2004	2:05	125
11 Sep 2004	3:00	180
19 Sep 2004	2:55	175
24 Sep 2004	2:49	169
16 Oct 2004	2:55	175
30 Oct 2004	3:10	190
19 Nov 2004	2:16	136
04 Dec 2004	3:15	195
08 Jan 2005	3:00	180
14 Jan 2005	2:23	143
28 Jan 2005	2:09	129
04 Feb 2005	2:08	128
18 Feb 2005	2:10	130
05 Mar 2005	2:30	150
11 Mar 2005	2:16	136
15 Mar 2005	2:24	144
26 Mar 2005	2:52	172
09 Apr 2005	3:54	234

APPENDIX 2: Species of Concern. South Carolina Rare, Threatened &
Endangered Bird Inventory (Watson 2004)

ENDANGERED

Peregrine Falcon
Bachman's Warbler
Bewick's Wren
Eskimo Curlew
Ivory-billed Woodpecker
Kirtland's Warbler
Red-cockaded Woodpecker
Bald Eagle
Swallow-tailed Kite
Wood Stork
Piping Plover

THREATENED

Common Ground-Dove
Least Tern
Wilson's Plover

SPECIAL CONCERN

American Bittern
Little Blue Heron
Glossy Ibis
Black Skimmer
American Oystercatcher
Gull-billed Tern
Black Rail
Purple Gallinule
American Kestrel (breeding population only)
Northern Bobwhite
Barn Owl
Black-throated Green Warbler (coastal "Wayne's" race)
Loggerhead Shrike
Painted Bunting
Henslow's Sparrow
Loggerhead Shrike

APPENDIX 3: US Fish and Wildlife Service Species of Conservation Concern in the
Piedmont (From Watson, 2004)

Peregrine Falcon
Black Rail
Upland Sandpiper
Chuck-will's-widow
Whip-poor-will
Bewick's Wren
Wood Thrush
Prairie Warbler
Cerulean Warbler
Prothonotary Warbler
Swainson's Warbler
Kentucky Warbler
Bachman's Sparrow
Henslow's Sparrow
Rusty Blackbird