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## Songbird Inventory for Arkansas Post National Memorial

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# A Songbird Inventory for Arkansas Post National Memorial

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## Abstract

Two geographically separate units of Arkansas Post National Memorial were surveyed via fixed-radius plots to document songbird species composition, richness, and diversity by migratory status and nesting guild. At the Memorial Unit, 60 species were recorded with the Brown-headed Cowbird, Red-winged Blackbird, and Northern Cardinal being most common. Individuals of these three species comprised 30% of the total number of birds recorded despite representing only 5% of the species encountered. About 2½ times more resident birds were recorded than migratory birds. However, species richness and diversity of resident and migratory species were similar. The number of individuals, species richness, and diversity of canopy nesting species were greater than other nesting guilds. At the Osotouy Unit, 42 species were recorded with the most common species encountered being the Indigo Bunting, Carolina Wren, and Yellow-billed Cuckoo. Individuals of these 3 species comprised 30% of the total number of birds recorded despite representing only 7% of the species encountered. About 50% fewer resident birds were recorded than migratory birds. Migratory birds represented approximately 40% more species than resident birds. Likewise, diversity was greater for migratory species than for resident species. As in the Memorial Unit, the number of individuals, species richness, and diversity of canopy-nesting species were greater than other nesting guilds. No federal or state threatened or endangered species were documented, but 8 species currently tracked by the Arkansas Natural Heritage Commission were documented. These results have implications for future park management activities, particularly in respect to potential development plans at the Osotouy Unit.

## Introduction

Congress passed the National Parks Omnibus Management Act in 1998 in response to concerns about the condition of natural resources within the national parks. The act requires each park to gather baseline inventory data on pertinent natural resources, data that will provide a pivotal step toward establishing an effective monitoring program furthering the ability to effectively manage and protect park resources and abide by the National Park Service (NPS) mission statement. The NPS responded with the Natural Resource Challenge program, including the establishment of biome-based inventory and monitoring networks (NPS, 1999). The Heartland Network, as part of the NPS Inventory and Monitoring program, has undertaken inventories of vascular plants and vertebrates within 15 parks in 8 midwestern states. Stemming from this challenge and a concern regarding the status of songbird populations at Arkansas Post National Memorial, an inventory was deemed necessary to establish baseline data of songbirds within the park.

Arkansas Post National Memorial, including the Osotouy Unit, provides refuge to numerous species of songbirds. Songbirds are an ecologically important faunal group that can be influenced by structural and floristic habitat alterations that may result from a variety of naturally occurring ecosystem processes and/or management activities (Wiens, 1989). Songbirds help facilitate seed and fungi dispersal, help control insect numbers, play essential roles in food web dynamics, and can create habitat for other wildlife species through excavation of cavities (Hunter,

1999). In addition to their ecological values, nongame birds are important as a recreational resource to millions of people who watch and feed birds (U.S. Dept. of the Interior, 2002). Neotropical migratory birds are of particular research interest due to recent evidence of long-term population declines in many species (Finch, 1991; Robbins et al., 1989).

An inventory of bird species is a necessary first step toward understanding how songbird populations relate to natural and cultural resources and associated management activities at the park, and will also help the park better manage resources and predict the possible impacts of management decisions on avian species (an important component of the National Environmental Policy Act). It will also provide managers with information about future research, such as fecundity surveys on species of concern. Additionally, an inventory of bird species establishes a baseline for future monitoring efforts aimed at detecting population/species composition trends. Thus, the objective for this inventory was the assessment of species composition, richness, evenness, and diversity of migrant and resident species.

## Study Area

Arkansas Post National Memorial is made up of 2 units, the Memorial and Osotouy Units. Both units are located in the southeastern portion of Arkansas County, Arkansas. The units are not contiguous and are separated by 8.0 km. The Memorial Unit is located 11.2 km south of Gillett, and the Osotouy Unit is located approximately 12.8 km from the community of Tichnor. The Memorial Unit (157.6 ha) is a

peninsula surrounded by Moore and Post bayous along the north/northwest border and Post Lake, a backwater of the Arkansas River, on the north and northeastern border. The Osotouy Unit (145.8 ha) is bordered on the southwest by an old oxbow of the Arkansas River, Lake Dumond, and on the south by the White River National Wildlife Refuge. Remaining boundaries are adjacent to private land.

Both the Memorial and Osotouy Units are characterized by a terrace landscape, flat terrain, and various stands of upland and lowland hardwoods, interspersed with bayous and swamps. The Memorial Unit consists of a mosaic of successional seres within forested vegetation types that roughly follow a gradient from bottomland forest types that occupy mesic sites to upland types that occupy more xeric sites. This mosaic combined with maintained lawns, trails, and roads creates a diverse and fragmented environment. Forest composition at the Osotouy Unit is similar to that at the Memorial Unit. However, fewer successional seres are present, though some portions of the Osotouy Unit have been logged or are under cultivation. Land immediately adjacent to both units is either under agricultural cultivation or has been logged.

### Methods

Arkansas Post National Memorial was surveyed to determine current songbird species composition from 9 June – 7 August 2003 via fixed radius census plots. Fourteen 50-m fixed-radius bird census plots were established at the Memorial Unit, whereas 8 were established at the Osotouy Unit due to its more homogenous landcover. Plots were located to provide an adequate sample of bird species that occur in the various vegetation types. However, the size of vegetation areas at both units precluded replication within those areas. Plots were situated to provide easy access for future monitoring purposes (i.e., along roads and trails). At the Memorial Unit, the interspersed and juxtaposition of a variety of vegetation types along with maintained lawns, trails, and roads provided a landscape with numerous edges and little continuity. Thus, placement of census points along roads and trails was reasonable for this particular landscape. Each point was recorded (Lat/Lon) using a eTrex Vista Global Positioning System (GPS) portable hand-held unit with WAAS enabled accuracy less than 3m.

Each plot was sampled using a 5-minute count of all songbirds heard or seen. All counts were conducted within 3.5 hours of sunrise on days with little or no rain and with winds < 6 kph. Plots were sampled 3 times each by 2 observers on different days; thus, each plot was sampled a total of 6 times. Species that do not breed in the area, species for which point sampling is an inappropriate sampling methodology, and flyovers were recorded but not used in the analyses. Species nomenclature follows the American

Ornithologist Union Checklist for North American Birds (2004).

Mean numbers of individuals, species richness (number of species), diversity (Shannon diversity index), and evenness (Pielou's J) were computed for all breeding birds combined and for each of the following subsets: residents, migrants (short- and long-distance combined), canopy nesters, cavity nesters, ground nesters, and shrub nesters. Species associated with multiple nesting preferences were included in each of the appropriate nesting guilds for analysis. Resident and migratory means were compared using an independent t-test. Nesting guild means were compared using a one-way ANOVA and Tukey's mean separation test. All analyses were conducted using SPSS 13.0 (SPSS, Inc., 2004).

### Results

**Memorial Unit.**—A total of 1,153 individual birds ( $\bar{x} = 164/\text{day}$ ) representing 60 species ( $\bar{x} = 32/\text{day}$ ) was recorded (Tables 1 and 2). The most common species encountered was the Brown-headed Cowbird (*Molothrus ater*), followed by the Red-winged Blackbird (*Agelaius phoeniceus*) and the Northern Cardinal (*Cardinalis cardinalis*). Individuals of these 3 species comprised 30% of the total number of birds recorded despite representing only 5% of the species encountered.

About 2<sup>1/2</sup> times more resident birds ( $\bar{x} = 116$  individuals/day) were recorded than migratory birds ( $\bar{x} = 48$  individuals/day) (Table 2). A similar number of resident ( $\bar{x} = 17$ ) and migratory ( $\bar{x} = 16$ ) species were encountered (Table 2). Likewise, diversity was similar for resident ( $\bar{x} = 2.4/\text{day}$ ) and migratory ( $\bar{x} = 2.4/\text{day}$ ) species (Table 2). However, evenness was greater for migratory species ( $\bar{x} = 0.88/\text{day}$ ) than for resident species ( $\bar{x} = 0.85/\text{day}$ ) (Table 2).

An average of 78 canopy-nesting birds was recorded per day, compared to an average of 32 cavity nesters, 56 shrub nesters, and 12 ground nesters (Table 3). Additionally, an average of 16 canopy-nesting species was encountered per day (Table 3). This was approximately twice as many species as that recorded for cavity nesters ( $\bar{x} = 9$ ) and shrub nesters ( $\bar{x} = 8$ ) and 8 times greater than the number of recorded ground nesting species ( $\bar{x} = 2$ ) (Table 3). Diversity ( $\bar{x} = 2.4/\text{day}$ ) of canopy nesting species was also greater than diversity of other nesting guilds (Table 3). Cavity nesters were the second most diverse group ( $\bar{x} = 1.8/\text{day}$ ), followed by shrub ( $\bar{x} = 1.4/\text{day}$ ) and ground ( $\bar{x} = 0.5/\text{day}$ ) nesters (Table 3). Evenness ( $\bar{x} = 0.88/\text{day}$ ) of canopy nesting species was similar to that of cavity nesters ( $\bar{x} = 0.84/\text{day}$ ) and greater than shrub ( $\bar{x} = 0.70/\text{day}$ ) or ground ( $\bar{x} = 0.59/\text{day}$ ) nesters (Table 3).

**Osotouy Unit.**—A total of 472 individual birds ( $\bar{x} = 74/\text{day}$ ) representing 42 species ( $\bar{x} = 19/\text{day}$ ) was recorded (Tables 4 and 5). The most common species encountered



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as the Indigo Bunting (*Passerina cyanea*), followed by the Carolina Wren (*Thryothorus ludovicianus*) and the Yellow-billed Cuckoo (*Coccyzus americanus*). Individuals of these three species comprised 30% of the total number of birds recorded despite representing only 7% of the species encountered.

About 50% fewer resident birds ( $\bar{x}$  = 28 individuals/day) were recorded than migratory birds ( $\bar{x}$  = 46 individuals/day) (Table 5). Migratory birds represented approximately 40% more species ( $\bar{x}$  = 11/day) than resident birds ( $\bar{x}$  = 8/day) (Table 5). Likewise, diversity was greater for migratory species ( $\bar{x}$  = 2.2/day) than for resident species ( $\bar{x}$  = 1.8/day) (Table 5). However, evenness values for migratory ( $\bar{x}$  = 0.90/day) and resident ( $\bar{x}$  = 0.89/day) species were similar (Table 5).

An average of 40 canopy-nesting birds was recorded per day, compared to 13 cavity nesters, 21 shrub nesters, and 8 ground nesters (Table 6). Additionally, an average of 10 canopy-nesting species was encountered per day (Table 6). This was approximately twice as many species as that recorded for cavity nesters ( $\bar{x}$  = 4) and shrub nesters ( $\bar{x}$  = 5) and 5 times greater than the number of recorded ground nesting species ( $\bar{x}$  = 2) (Table 6). Diversity of canopy nesting species ( $\bar{x}$  = 2.1/day) was also greater than diversity of other nesting guilds (Table 6). Shrub nesters were the second most diverse group ( $\bar{x}$  = 1.3/day), followed by cavity ( $\bar{x}$  = 1.1/day) and ground ( $\bar{x}$  = 0.2/day) nesters (Table 6). Evenness was least for ground nesting species ( $\bar{x}$  = 0.58/day) but was similar among canopy ( $\bar{x}$  = 0.91/day), cavity ( $\bar{x}$  = 0.79/day), and shrub ( $\bar{x}$  = 0.81/day) nesters (Table 6).

Eight species currently tracked by the Arkansas Natural Heritage Commission (2002) were documented. These include 2 that are currently being inventoried: Common Moorhen (*Gallinula chloropus*) and Purple Gallinule (*Porphyrio martinica*); 2 that are being monitored: Great Blue Heron (*Ardea herodias*) and Double-crested Cormorant (*Phalacrocorax auritus*); and 4 that are on the watch list: Yellow Warbler (*Dendroica petechia*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), Hairy Woodpecker (*Picoides villosus*), and Blue-winged Warbler (*Vermivora pinus*).

### Discussion

The composition and structure of the bird communities found at both units are dissimilar. Numerically, bird species richness and diversity was greater at the Memorial Unit compared to the Osotouy Unit for both resident and

migratory birds as well as for all nesting guilds. The 2 most common species at the Memorial Unit were the Brown-headed Cowbird and the Red-winged Blackbird. In contrast, the 2 most common species at the Osotouy Unit were the Indigo Bunting and the Carolina Wren. These differences in bird communities are likely the result of differences in the composition, structure, and patterns of vegetation. However, because the bird surveys were conducted relatively late in the breeding season (9 June – 7 August), it is possible that a few uncommon species were not detected or were under-represented.

At the Memorial Unit, the interspersed and juxtaposition of a variety of vegetation types along with maintained lawns, trails, and roads characterize a diverse and fragmented landscape with numerous edges. This variety of habitats provides for a diverse bird community. However, combined with a close proximity to agricultural fields, the diverse, fragmented habitat also creates an ideal environment for the Brown-headed Cowbird (Temple and Cary, 1988; Wilcove, 1985; Yahner and Scott, 1988). The prevalence of the Brown-headed Cowbird raises a concern about the level of nest parasitism occurring at the unit. If nest parasitism is high nest success rates could be low and thus this unit could potentially represent a population sink for some bird species (Robbins et al., 1989).

Though the Osotouy Unit is in relatively close proximity to agricultural fields and bodies of water, it represents a less diverse and less fragmented environment. Thus, the number and diversity of bird species is less than those found at the Memorial Unit. However, the Brown-headed Cowbird represented only 0.4% of the birds encountered at Osotouy. In the future, any development at Osotouy should consider possible ramifications of changes to habitat, particularly in respect to fragmentation that could result in an increase in nest parasitism by Brown-headed Cowbirds.

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Table 1. List of birds recorded at the Memorial Unit of Arkansas Post National Memorial, June – August 2003.

Common Name	Scientific Name	# of Individuals	% Total
Brown-headed Cowbird	<i>Molothrus ater</i>	163	14.1
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	108	9.4
Northern Cardinal	<i>Cardinalis cardinalis</i>	86	7.5
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	59	5.1
Carolina Wren	<i>Thryothorus ludovicianus</i>	59	5.1
Eastern Wood Peewee <sup>4</sup>	<i>Contopus virens</i>	55	4.8
Yellow-billed Cuckoo <sup>4</sup>	<i>Coccyzus americanus</i>	51	4.4
Mourning Dove	<i>Zenaida macroura</i>	46	4.0
Tufted Titmouse	<i>Baeolophus bicolor</i>	38	3.3
Common Grackle	<i>Quiscalus quiscula</i>	36	3.1
Carolina Chickadee	<i>Poecile carolinensis</i>	36	3.1
Northern Rough-winged Swallow <sup>1</sup>	<i>Stelgidopteryx serripennis</i>	35	3.0
Acadian Flycatcher <sup>4</sup>	<i>Empidonax virescens</i>	31	2.7
Great Egret <sup>1</sup>	<i>Ardea alba</i>	30	2.6
Northern Mockingbird	<i>Mimus polyglottos</i>	28	2.4
Summer Tanager <sup>4</sup>	<i>Piranga rubra</i>	25	2.2
Fish Crow	<i>Corvus ossifragus</i>	21	1.8
Blue-gray Gnatcatcher <sup>4</sup>	<i>Polioptila caerulea</i>	21	1.8
Blue Jay <sup>4</sup>	<i>Cyanocitta cristata</i>	19	1.6
Downy Woodpecker	<i>Picoides pubescens</i>	18	1.6
Baltimore Oriole <sup>4</sup>	<i>Icterus galbula</i>	15	1.3
American Crow <sup>4</sup>	<i>Corvus brachyrhynchos</i>	15	1.3
Cattle Egret <sup>3</sup>	<i>Bubulcus ibis</i>	14	1.2
Barn Swallow <sup>1</sup>	<i>Hirundo rustica</i>	10	0.9
Hairy Woodpecker	<i>Picoides villosus</i>	9	0.8

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Table 1. Continued.

Common Name	Scientific Name	# of Individuals	% Total
Wood Thrush <sup>4</sup>	<i>Hylocichla mustelina</i>	9	0.8
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	8	0.7
Eastern Bluebird <sup>4</sup>	<i>Sialia sialis</i>	8	0.7
Northern Parula <sup>4</sup>	<i>Parula americana</i>	8	0.7
Great-crested Flycatcher <sup>4</sup>	<i>Myiarchus crinitus</i>	6	0.5
Indigo Bunting <sup>4</sup>	<i>Passerina cyanea</i>	6	0.5
Brown Thrasher	<i>Toxostoma rufum</i>	6	0.5
White-eyed Vireo <sup>4</sup>	<i>Vireo griseus</i>	6	0.5
Orchard Oriole <sup>4</sup>	<i>Icterus spurius</i>	5	0.4
Prothonotary Warbler <sup>4</sup>	<i>Protonotaria citrea</i>	5	0.4
Northern Flicker	<i>Colaptes auratus</i>	5	0.4
Common Moorhen <sup>1</sup>	<i>Gallinula chloropus</i>	4	0.3
Eastern Kingbird <sup>4</sup>	<i>Tyrannus tyrannus</i>	4	0.3
Mallard <sup>3</sup>	<i>Anas platyrhynchos</i>	4	0.3
American Robin	<i>Turdus migratorius</i>	4	0.3
Yellow Warbler <sup>4</sup>	<i>Dendroica petechia</i>	4	0.3
Double-crested Cormorant <sup>2</sup>	<i>Phalacrocorax auritus</i>	3	0.3
Pileated Woodpecker	<i>Dryocopus pileatus</i>	3	0.3
Purple Gallinule <sup>1</sup>	<i>Porphyrio martinica</i>	3	0.3
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	3	0.3
Blue Grosbeak <sup>4</sup>	<i>Guiraca caerulea</i>	2	0.2
Belted Kingfisher <sup>1</sup>	<i>Ceryle alcyon</i>	2	0.2
European Starling	<i>Sturnus vulgaris</i>	2	0.2
Great Blue Heron <sup>1</sup>	<i>Ardea herodias</i>	2	0.2
Ovenbird <sup>2</sup>	<i>Seiurus aurocapillus</i>	2	0.2

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Table 1. Continued.

Common Name	Scientific Name	# of Individuals	% Total
Red-eyed Vireo <sup>4</sup>	<i>Vireo olivaceus</i>	2	0.2
Chimney Swift <sup>3</sup>	<i>Chaetura pelagica</i>	1	0.1
Blue-winged Warbler <sup>2</sup>	<i>Vermivora pinus</i>	1	0.1
Horned Lark	<i>Eremophila alpestris</i>	1	0.1
Kentucky Warbler <sup>4</sup>	<i>Oporornis formosus</i>	1	0.1
Barred Owl <sup>1</sup>	<i>Strix varia</i>	1	0.1
Pine Warbler	<i>Dendroica pinus</i>	1	0.1
American Redstart <sup>4</sup>	<i>Setophaga ruticilla</i>	1	0.1
Red-shouldered Hawk <sup>3</sup>	<i>Buteo lineatus</i>	1	0.1
Gray Catbird <sup>4</sup>	<i>Dumetella carolinensis</i>	1	0.1
<b>Total</b>		<b>1,153</b>	<b>100%</b>

<sup>1</sup> Inappropriate sampling technique.

<sup>2</sup> Non-breeding migrant.

<sup>3</sup> Recorded only as a flyover.

<sup>4</sup> Breeding, migratory species (short- or long-distance).

Table 2. Mean number per day (SD) of individuals and species, and mean diversity and evenness per day (SD) by migratory status for birds recorded at the Memorial Unit of Arkansas Post National Memorial, June – August 2003.

Variable	All Species	Migratory Status		p <sup>1</sup>
		Resident	Migrant	
Individuals	164.2 (13.64)	116.0 (13.34)	48.2 (4.92)	<0.001
Species	32.3 (3.62)	16.8 (2.32)	15.5 (1.76)	0.288
Diversity	2.990 (0.0587)	2.377 (0.0801)	2.410 (0.1004)	0.560
Evenness	0.862 (0.0240)	0.845 (0.0303)	0.881 (0.0195)	0.033

<sup>1</sup>Probability associated with independent t-test of H<sub>0</sub>:  $\bar{x}$  resident =  $\bar{x}$  migrant and H<sub>A</sub>:  $\bar{x}$  resident  $\neq$   $\bar{x}$  migrant.

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Table 3. Mean number per day (SD) of individuals and species, and mean diversity and evenness per day (SD) by nesting guild for birds recorded at the Memorial Unit of Arkansas Post National Memorial, June – August 2003.

Variable	Nesting Guild			
	Canopy	Cavity	Shrub	Ground
Individuals	78.2 A <sup>1</sup> (10.87)	31.7 B (3.72)	56.2 C (9.79)	11.7 D (2.16)
Species	16.0 A (2.10)	8.8 B (0.98)	8.0 B (1.27)	2.3 C (1.03)
Diversity	2.434 A (0.0610)	1.821 B (0.0927)	1.436 C (0.0977)	0.456 D (0.3189)
Evenness	0.881 A (0.0323)	0.838 A (0.0162)	0.695 B (0.0339)	0.585 B (0.1373)

<sup>1</sup>Means in the same row followed by the same letter are not significantly different ( $P < 0.05$ ).

Table 4. List of birds recorded at the Osotouy Unit of Arkansas Post National Memorial, June – August 2003

Common Name	Scientific Name	# of Individuals	% Total
Indigo Bunting <sup>4</sup>	<i>Passerina cyanea</i>	61	12.9
Carolina Wren	<i>Thryothorus ludovicianus</i>	43	9.1
Yellow-billed Cuckoo <sup>4</sup>	<i>Coccyzus americanus</i>	42	8.9
Northern Cardinal	<i>Cardinalis cardinalis</i>	42	8.9
Eastern Wood Peewee <sup>4</sup>	<i>Contopus virens</i>	33	7.0
Wood Thrush <sup>4</sup>	<i>Hylocichla mustelina</i>	30	6.4
Acadian Flycatcher <sup>4</sup>	<i>Empidonax virens</i>	29	6.1
Mourning Dove	<i>Zenaida macroura</i>	24	5.1
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	21	4.4
Summer Tanager <sup>4</sup>	<i>Piranga rubra</i>	19	4.0
White-eyed Vireo <sup>4</sup>	<i>Vireo griseus</i>	14	3.0
Blue Jay <sup>4</sup>	<i>Cyanocitta cristata</i>	13	2.8
Blue Grosbeak <sup>4</sup>	<i>Guiraca caerulea</i>	12	2.5
Tufted Titmouse	<i>Baeolophus bicolor</i>	12	2.5



Table 4. Continued.

Common Name	Scientific Name	# of Individuals	% Total
Red-eyed Vireo <sup>4</sup>	<i>Vireo olivaceus</i>	8	1.7
Great Egret <sup>1</sup>	<i>Ardea alba</i>	8	1.7
Carolina Chickadee	<i>Poecile carolinensis</i>	7	1.5
Northern Flicker	<i>Colaptes auratus</i>	5	1.1
Prothonotary Warbler <sup>4</sup>	<i>Protonotaria citrea</i>	5	1.1
Downy Woodpecker	<i>Picoides pubescens</i>	4	0.8
Fish Crow	<i>Corvus ossifragus</i>	3	0.6
Red-shouldered Hawk <sup>3</sup>	<i>Buteo lineatus</i>	3	0.6
Pileated Woodpecker	<i>Dryocopus pileatus</i>	3	0.6
Common Yellow-throat <sup>4</sup>	<i>Geothlypis trichas</i>	2	0.4
Cattle Egret <sup>3</sup>	<i>Bubulcus ibis</i>	2	0.4
Brown-headed Cowbird	<i>Molothrus ater</i>	2	0.4
Northern Mockingbird	<i>Mimus polyglottos</i>	2	0.4
Wild Turkey <sup>1</sup>	<i>Meleagris gallopavo</i>	2	0.4
Ruby-throated Hummingbird <sup>4</sup>	<i>Archilochus colubris</i>	2	0.4
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	2	0.4
Ovenbird <sup>2</sup>	<i>Seiurus aurocapillus</i>	2	0.4
Great Blue Heron <sup>1</sup>	<i>Ardea herodias</i>	2	0.4
Northern Bobwhite <sup>1</sup>	<i>Colinus virginianus</i>	2	0.4
Blue-gray Gnatcatcher <sup>4</sup>	<i>Polioptila caerulea</i>	2	0.4
Kentucky Warbler <sup>4</sup>	<i>Oporornis formosus</i>	2	0.4
Chipping Sparrow <sup>4</sup>	<i>Spizella passerina</i>	1	0.2
Double-crested Cormorant <sup>2</sup>	<i>Phalacrocorax auritus</i>	1	0.2
Hairy Woodpecker	<i>Picoides villosus</i>	1	0.2
Red-tailed Hawk <sup>1</sup>	<i>Buteo jamaicensis</i>	1	0.2

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Table 4. Continued.

Common Name	Scientific Name	# of Individuals	% Total
Brown Thrasher	<i>Toxostoma rufum</i>	1	0.2
Eastern Phoebe	<i>Sayornis phoebe</i>	1	0.2
American Crow	<i>Corvus brachyrhynchos</i>	1	0.2
Total		472	100%

<sup>1</sup> Inappropriate sampling technique.<sup>2</sup> Non-breeding migrant.<sup>3</sup> Recorded only as a flyover.<sup>4</sup> Breeding, migratory species (short- or long-distance).

Table 5. Mean number per day (SD) of individuals and species, and mean diversity and evenness per day (SD) by migratory status for birds recorded at the Osotouy Unit of Arkansas Post National Memorial, June – August 2003.

Variable	All Species	Migratory Status		P <sup>1</sup>
		Resident	Migrant	
Individuals	73.5 (5.24)	28.0 (4.82)	45.5 (6.35)	<0.001
Species	19.3 (1.86)	8.2 (1.84)	11.2 (1.33)	0.009
Diversity	2.695 (0.0851)	1.841 (0.2145)	2.163 (0.0963)	0.012
Evenness	0.911 (0.0105)	0.885 (0.0300)	0.899 (0.0138)	0.187

<sup>1</sup> Probability associated with independent t-test of H<sub>0</sub>:  $\bar{x}$  resident =  $\bar{x}$  migrant and H<sub>A</sub>:  $\bar{x}$  resident  $\neq$   $\bar{x}$  migrant.

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Table 6. Mean number per day (SD) of individuals and species, and mean diversity and evenness per day (SD) by nesting guild for birds recorded at the Osotouy Unit of Arkansas Post National Memorial, June – August 2003.

Variable	Nesting Guild			
	Canopy	Cavity	Shrub	Ground
Individuals	39.8 A <sup>1</sup> (3.06)	12.7 B (2.73)	21.0 C (2.76)	7.7 D (1.63)
Species	9.7 A (0.82)	4.3 B (1.63)	5.2 B (0.75)	1.5 C (0.55)
Diversity	2.069 A (0.1025)	1.119 B (0.4170)	1.328 B (0.1689)	0.200 C (0.2268)
Evenness	0.913 A (0.0194)	0.793 A (0.0803)	0.811 A (0.0477)	0.578 B (0.1300)

<sup>1</sup>Means in the same row followed by the same letter are not significantly different ( $P < 0.05$ ).

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