



Landbird Community Monitoring at Horseshoe Bend National Military Park

2012 Data Summary

Natural Resource Data Series NPS/SECN/NRDS—2016/1013



ON THE COVER
Blue-gray gnatcatcher (*Polioptila caerulea*)
Photo courtesy of Rachel Holzman

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Executive Summary

Birds are an important component of park ecosystems. Due to their high body temperature, rapid metabolism, and high ecological position in most food webs, birds are also good indicators of the effects of local and regional ecosystem changes. Patterns in the community composition, distribution, and occurrence of breeding birds provide a metric for assessing ecological integrity and sustainability in southeastern U. S. ecosystems. Further, trends in these attributes in relation to activities occurring at Horseshoe Bend National Military Park (e.g., management actions, natural disturbance, invasive-species treatment) will improve our understanding of the effects of various management actions and other stressors on the condition of park resources.

This report summarizes data collected during implementation of the SECN landbird community monitoring protocol (Byrne et al. 2014) at Horseshoe Bend National Military Park in 2012.

1. Automated recording devices collected bird detection/non-detection data from 28 of the 30 spatially balanced random locations within the park.
2. Approximately 1,940 minutes of recordings were collected May–June, to represent a closed population, and were evaluated to detect the presence of vocalizing birds.

3. Fifty-five species of birds were detected during the sampling effort.
4. Monitoring efforts resulted in the addition of three new species to the official species list for the park: bald eagle, Canada goose, and cliff swallow.
5. Northern cardinal, red-eyed vireo, tufted titmouse, northern parula, American crow, Carolina chickadee, and Carolina wren were the most frequently occurring and widely distributed species (i.e., occurring at 80% or more of all sampling locations). Blue-gray gnatcatcher, blue jay, hooded warbler, red-bellied woodpecker, summer tanager, Acadian flycatcher, and great crested flycatcher were also widely distributed across the park, occurring at 70% or more of all sampling locations.
6. The full dataset, and associated metadata, can be acquired from the NPS data store at the Integrated Resource Management Applications portal (<https://irma.nps.gov/App/Portal/Home>).

Introduction

Overview

Birds play several critical roles in park ecosystems. They occupy and interact with several trophic levels of the food web, including their role as both predator and prey. Among their many functions, birds regulate rodent populations (Ims and Andreassen 2000), regulate insect populations (Mols and Visser 2002), and scavenge dead animals (Pain et al. 2003). Some avian species aid in pollination of wild and cultivated crop plants (Stiles 1978) and provide mechanisms for seed dispersal (Howe and Smallwood 1982). Bird guano contains nutrients necessary for many vegetation communities (Wootton 1991). Management activities aimed at preserving habitat for bird populations (e.g., neotropical migrants) frequently have the added benefit of preserving entire ecosystems and their attendant ecosystem services (Karr 1991, Maurer and Heywood 1993).

A wide range of stressors affect bird communities, and birds often respond quickly to environmental stressors, perturbations, or changes. Therefore, characteristics of the bird community at a park are good indicators of the extent of the impact of those stressors on park lands. Many bird species have been extensively studied; their biology and life histories are well defined and their habitat-use patterns have been identified. Consequently, the composition, richness and diversity, and distribution of bird communities provide substantial insight into the ecological condition of park resources. Information about the landbird community also provides derivative information about other characteristics of the park and surrounding area (e.g., vegetation community types, extent of fragmentation).

Because many birds are primarily diurnal, visible and vocal, and attractive, they are a major point of interest for many park visitors and for the general public. Birds have a strong public appeal and are the recreational focus for many park visitors. Birdwatching has a substantial and positive impact on the U.S. economy, contributing well over \$100 billion annually (Carver 2013), and it is one of the most popular recreational activities pursued by Americans (Cordell et al. 2007).

Over 400 species of birds, representing 61 families, use Southeast Coast Network (SECN) parks annually for breeding, wintering, or as a migratory stopover area. The high bird diversity in the Southeast Coast Network exists because of the juxtaposition of SECN parks within the Atlantic Flyway. Many SECN parks occur in a highly fragmented landscape, and because the network encompasses inland and coastal areas, it provides a wide range of bird habitat types.

This report summarizes data collected with the SECN landbird community monitoring protocol (Byrne et al. 2014). Protocol objectives that are addressed in this report include:

- a) Determine the species richness and diversity of the landbird community at each park,
- b) Determine the frequency of detection of selected landbirds, and
- c) Determine the distribution of landbirds within park lands.

Study Area

Horseshoe Bend National Military Park (HOBE) consists of 2,040 acres (826 hectares) situated in Alabama near the southern end of the Piedmont Plateau (Figure 1). It contains low rolling hills, which reach elevations from 600 to 711 feet (183–217 meters) above sea level. Park lands were extensively cultivated from 1832 until the establishment of the park in 1959 and are in various stages of ecological succession. The land has undergone some minor changes in the intervening 175 years since the battle. In many places, pines have displaced the climax hardwoods that existed in 1814. The vegetation has been altered by human settlement, logging, and the introduction of non-native species. The timbered lands once used for agriculture have reverted to forests or remained as open fields. The forest type is mesic beech-oak-hickory with some loblolly pine. Drier areas and ridge tops are dominated by loblolly pine, with scattered longleaf pine along the northern one-third of the park. The understory is relatively open and dominated by sapling American elm (*Ulmus americana*), blueberries (*Vaccinium* spp.), Carolina silverbell (*Halesia carolina*), muscadines (*Vitis* spp.), and ferns. The condition of wildlife species was basically unknown upon acquisition of the park, and it was later realized that feral dogs and cats had extirpated many species. Enforcement of resource laws concerning flora and fauna has allowed a diversity of wildlife species to re-establish throughout the park. The park not only contains many species of plants endemic to the Piedmont region, but also species associated with the Southeastern and Southern Coastal Plains, as well as avian species of conservation concern. The hydrologic regime of the Tallapoosa River, 3.5 miles (5.6 kilometers) of which are within the park boundary, is dam-controlled upstream of the park by Alabama Power Company. The release schedule is determined by hydroelectric needs and bears no relationship to natural flows, more resembling a “trickle or torrent” that affects both natural resources and the cultural landscape. The U.S. Fish and Wildlife Service is currently seeking to accelerate reauthorization of the dam in order to negotiate a flow regime less detrimental to river ecology.

Horseshoe Bend National Military Park has 119 known bird species (Appendix A-1; NPSpecies 2015).

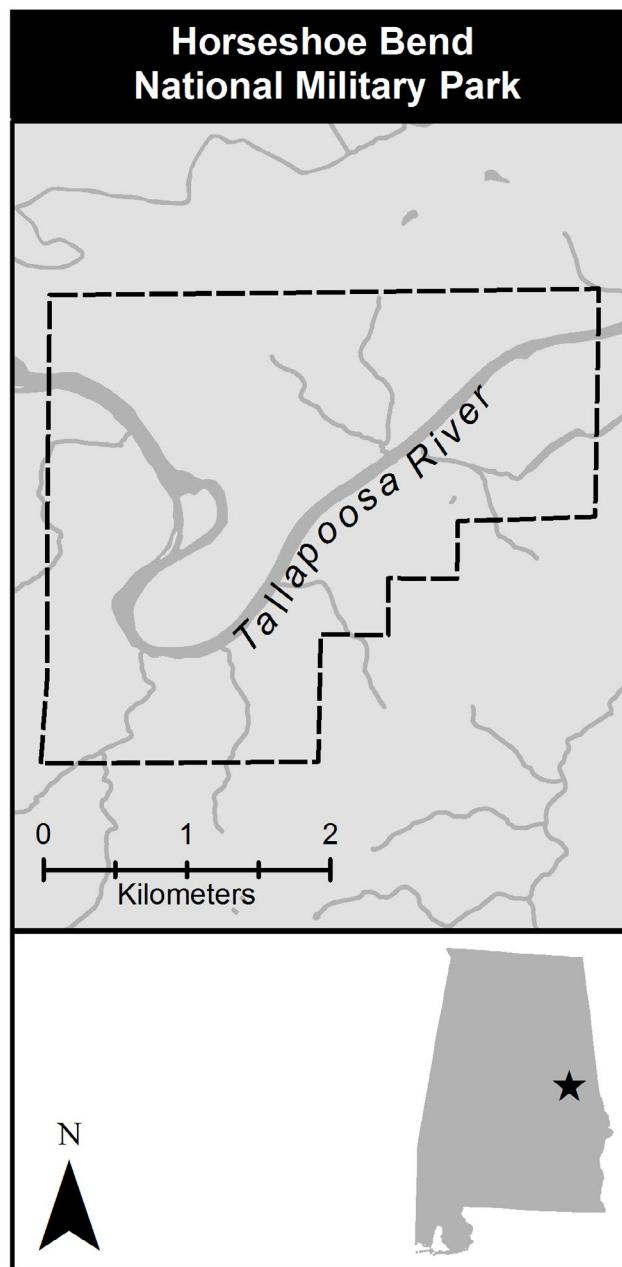


Figure 1. Location of Horsehoe Bend National Military Park.

Methods

Sampling Design

The sampling design and sampling-location selection is detailed in Appendix B of the SECN landbird community monitoring protocol (Byrne et al. 2014) and in the sampling-location selection standard operating procedure #1.1.01 (Byrne 2012). In summary, the administrative boundary was used as the sampling frame to allow for park-wide inference. The sampling frame was divided into a systematic 0.5-hectare grid superimposed over the entire sampling frame (i.e., park boundary); the center point of each grid cell served as the potential sampling location. A spatially balanced sample was drawn from this grid using the Reversed Randomized Quadrant-Recursive Raster (RRQRR) algorithm (Theobald et al. 2007). Alternate points were used when specified selection criteria (e.g., safety issues, accessibility) were not met. A sample size of 30 was chosen based on consideration of the park size, hypothesized variability, and logistical issues; however, the final sample size was 28 due to the failure of two devices.

Taxonomic Standards

Taxonomy and nomenclature follow that set forth in the Integrated Taxonomic Information System (ITIS; <http://www.itis.gov/>). The National Park Service uses the online application NPSpecies (<https://irma.nps.gov/npspecies>) to document “our knowledge about the occurrence and status of species on National Park Service lands,” including maintenance of species lists for NPS properties. The taxonomy and nomenclature in NPSpecies is periodically updated with the most current ITIS catalog. As noted on the ITIS webpage, the system intends not to “serve as a forum for cutting-edge taxonomic classifications,” but rather to use “classifications that have gained broad acceptance in the taxonomic literature and by professionals who work with the taxa.”

All bird vocalizations are identified to the finest resolution possible in the taxonomic hierarchy. Only vocalizations identified to the species level are used in the analyses presented herein.

Data Collection

Automatic recording devices (ARDs) were deployed at 30 sampling locations March–June, 2012. ARDs are deployed at the center point of each 0.5-hectare grid cell (i.e., the sampling location) and are programmed to record from

07:30 – 07:42 and 08:00 – 08:12 (i.e., 12 minutes) every five days for a period of 77 days (Byrne et al. 2014). This schedule results in 20 discrete sampling events for each sampling location. Species occurrences were derived from analyzing five recordings collected May–June at each sampling location, which represents a closed population.

Manual Evaluation of Recordings

Ambient / background noise influences detectability in auditory avian surveys (Alldredge et al. 2007, Simons et al. 2008, Pacifici et al. 2008, Simons et al. 2009). To minimize the impact of background noise on detectability, three strategies are applied to all recordings: (1) omit recordings with a background noise level above approximately 45dB, if possible, (2) quantify background noise categorically, and (3) use existing software tools to remove or minimize the influence of frequency ranges that are exclusive to the background noise and outside the frequency range of target vocalizations (Byrne et al. 2014). In general, sounds with a sound pressure level greater than 45 dB preclude hearing birds located over 100 meters (328 feet [ft]) from the observer. To provide a frame of reference, the approximate loudness of a watch or clock ticking is 20 dB, a quiet whisper is 30 dB, a steady and heavy rain is 50 dB, and normal conversation is 60 dB.

High levels of background noise can make it difficult to discern vocalizations, and this limits the researcher’s ability to adequately detect and classify bird vocalizations. Therefore, the background noise level for each recording was classified a priori, and an index score ranging from one (low) to three (high) was assigned. Each three-minute segment (i.e., 0–3, 3–6, 6–9, and 9–12) of the recordings was a priori categorized according to background noise level (i.e., 1=low, 2=moderate, and 3=high), and an average noise score was calculated for the entire 12-minute recording. In general, the background noise level of the recording was defined as follows: (a) “low” characterizes a recording in which the vocalizations are clear and distinct, the vocalizations are the primary source of sound, and background noise is a low-volume muffle; (b) “moderate” characterizes a recording with uniform loudness of less than 45dB, in which vocalizations are identifiable and some are clear and distinct while others blend into the background noise, which may contain a low- to medium-speed wind or light rain, distant traffic, or rustling vegetation; or (c) “high” characterizes a recording in

Horseshoe Bend National Military Park

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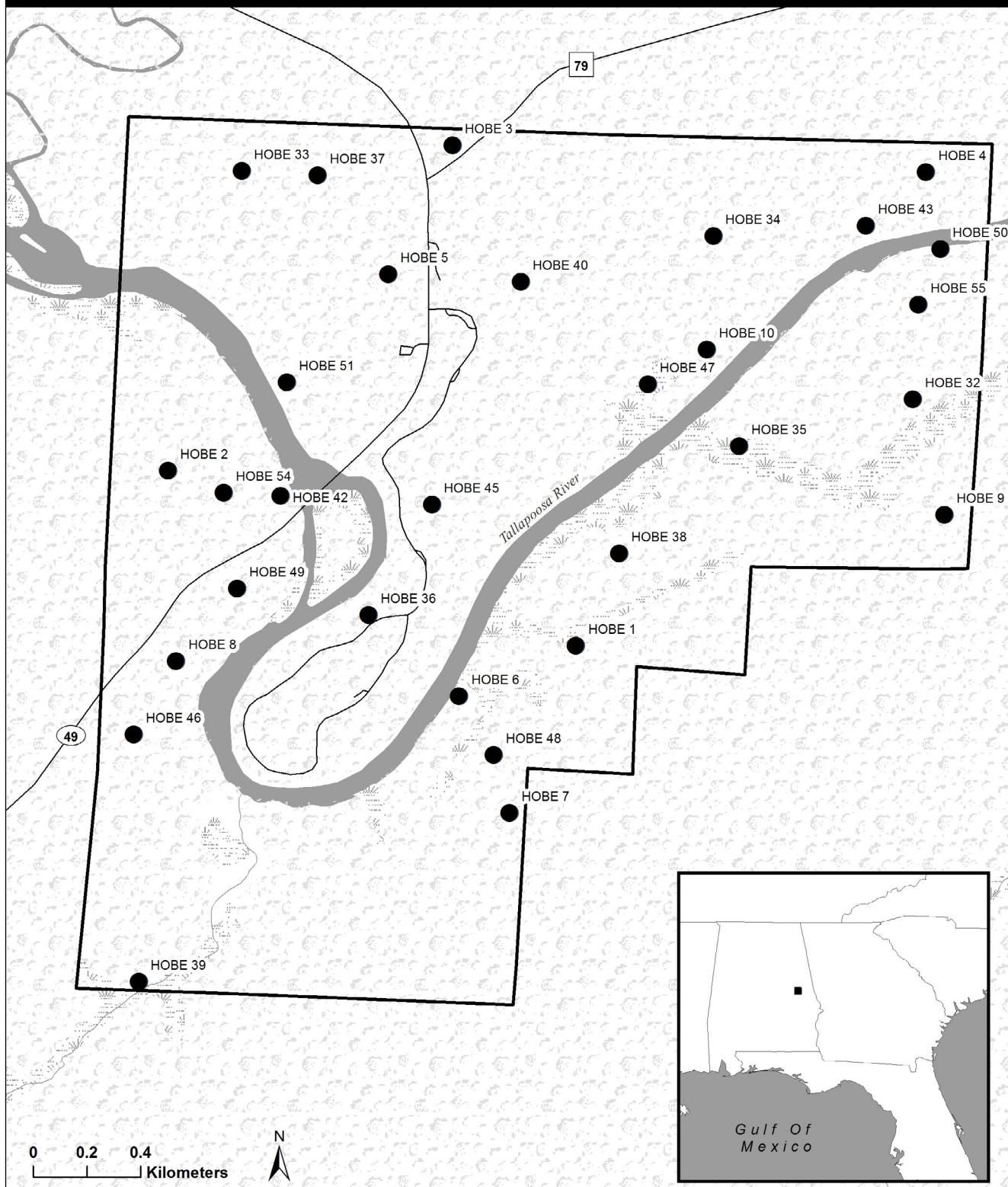


Figure 2. Landbird-community monitoring sampling locations at Horseshoe Bend National Military Park in 2012.

which background noise is the dominant sound, above 45dB, and some vocalizations are difficult to separate from the background noise.

Examples of background noise in recordings in the “high” category include proximate automobile traffic, high winds in vegetation, insects (e.g., cicadas), frog choruses, trains, heavy rain, or thunderstorms. If both the alternate and primary recordings have similar background noise issues, then the next consecutive sampling event (i.e., next day) is reviewed. This process continues until five monitoring events within the May to mid-June window with the lowest noise levels are selected for evaluation for each sampling location. If all recordings from a sampling location have a substantial amount of background noise, the required number of recordings to meet our analysis objectives will continue to be analyzed such that sample size and replicates are not lost, and background noise is categorized as previously mentioned to be later used as an explanatory variable when modeling detectability. The methodology, implemented as part of Byrne et al. (2014), was designed specifically to create an alternate recording for each day of monitoring. This facilitates the screening process and minimizes the influence of anomalous sound events that could impede or preclude species detection.

All recordings were evaluated by one trained observer, with several years of birding experience, astute at vocalization identification, whose skills were reviewed and tested. The observer performed the evaluation by listening to the recordings while simultaneously examining spectrograms in Song Scope software (Wildlife Acoustics, Inc.). The observer spent approximately one hour analyzing each 12-minute recording, including the time spent clarifying uncertain identifications with a digital library of vocalizations, online resources, or confirmation with other expert birders. All identifiable birds in each recording were documented. Some vocalizations were unidentifiable due to background noise or distance from the sampling location.

A total of 162 recordings from 28 sampling locations were evaluated (1,944 minutes total).

Data Analysis

Data in this report represent one year and are summarized in three general but closely linked categories: composition, richness, and distribution. Appendix B depicts all species detected by sampling location, and Appendix C depicts individual-species distribution maps.

Composition

Measures of community composition are often good indicators of abiotic variability, disturbance, or other stressors. Summaries related to composition include the total number of species detected (i.e., species richness) and naïve occupancy. Species richness is simply the number of native species detected, and is presented for the ARD method. Naïve occupancy is the percentage of the sampling locations where a species was detected at least once, without adjusting for probability of detection (i.e., detectability). Naïve occupancy is also referred to as frequency of occurrence. Naïve occupancy provides insight into the distribution of a species across a park and whether the species can be considered common or uncommon. Species with high values occur at more locations than those with low values.

Richness

Species richness is a major component of species diversity. Magurran (2004) defines diversity as “the variety and abundance of species in a defined unit of study.” Diversity is a community property that is related to trophic structure, productivity, stability (McIntosh 1967, McNaughton 1977), immigration/emigration (Colwell and Lees 2000), and ecological condition (i.e., ecological integrity, as defined by Karr and Chu 1995). Species diversity consists of two components: the number of species (i.e., species richness) and the relative abundance of those species (i.e., species evenness/dominance) within a defined community (Margalef 1958, Lloyd and Ghelardi 1964, Pielou 1966). The methodology implemented by the Southeast Coast Network does not collect abundance data; therefore, the analysis focuses on species richness estimation of the landbird community. Further, the term community refers to the assemblage of species populations that occur together in space and time (Begon et al. 1986), and we consider the all taxa-species populations that occur at a park as the community, as per the conceptual ecological models presented in our monitoring plan (see Chapter 2 in DeVivo et al. 2008).

Species richness and diversity is presented in the form of indices. Because richness and diversity indices respond differently to various mechanisms that influence community change, several indices must be used to adequately characterize richness and diversity in SECN parks (Haedrick 1975, Boyle et al. 1984). Based on characteristics of the SECN dataset and careful appraisal of the advantages and disadvantages of several richness indices, the selected richness indices are presented in Table 1, including notes on

value interpretation. Because observed species richness (i.e., S_{obs}) is an underestimate (i.e., influenced by detectability, observer error) of true species richness, richness indices more closely approximate true species richness for a defined area. In this analysis, richness estimates are based only on landbird observations identified to the species level, and detections/occurrences of non-native species were not included in the calculations.

Distribution

Understanding changes in the distribution of landbirds is integral to informed management of species and their

requisite habitats. Changes in species distributions over time provide useful information at both the local and landscape scale regarding how species respond to large-scale influences such as changing land use, climate, hydrology, or habitat availability and condition. Shifting species distributions alter species interactions and the food-web structure, thereby producing cascading effects on ecosystem processes (Montoya and Raffaelli 2010). Distribution maps for all bird species detected are presented in Appendix C.

Table 1. Incidence-based species richness indices used in this analysis, corresponding symbol, community attribute that the index reflects, range of index values, and notes on each index.

Index	Symbol	Community Attribute	Index Citation	Notes
Native Species Richness	S_{obs}	Richness	n/a	Value is a positive integer that indicates the number of native species in the sample. Intuitive. Good discriminant ability if sampling effort is comparable; sensitive to sample size, the occurrence of rare species, or those with low detectability; does not account for relative abundances.
Chao 2	Chao2	Richness	Chao (1984) Chao (1987)	Values indicate an estimate of total species richness (including species not present in the sample); incidence-based estimate; works well with dataset containing several infrequent observations.
Incidence-based Coverage	ICE	Richness	Lee and Chao (1994) Chazdon et al. (1998)	Values indicate an estimate of total species richness (including species not present in the sample); incidence-based estimate.
Jackknife 1	Jack1	Richness	Burnham and Overton (1978) Burnham and Overton (1979) Heltshe and Forrester (1983)	Values indicate an estimate of total species richness (including species not present in the sample); incidence-based estimate; the higher the value the higher the species richness. This procedure requires no assumptions regarding the data distribution.
Jackknife 2	Jack2	Richness	Smith and van Bell (1984)	Values indicate an estimate of species richness; incidence-based estimate.
Bootstrap	Boot	Richness	Smith and van Bell (1984)	Values indicate an estimate of species richness; incidence-based estimate.

Results

Composition

Northern cardinal, red-eyed vireo, tufted titmouse, northern parula, American crow, Carolina chickadee, and Carolina wren were the most frequently occurring and widely distributed species (i.e., occurring at 80% or more of all sampling locations). Blue-gray gnatcatcher, blue jay, hooded warbler, red-bellied woodpecker, summer tanager, Acadian flycatcher, and great crested flycatcher were also widely distributed across the park, occurring at 70% or more of all

sampling locations. Several species were detected at only one sampling location (i.e., uncommon), including bald eagle, Canada goose, eastern bluebird, eastern phoebe, orchard oriole, brown thrasher, cliff swallow, blue grosbeak, great blue heron, red-tailed hawk, chipping sparrow, and prairie warbler (Table 2). The occurrence of bald eagle, Canada goose, and cliff swallow were new records for the park and will be added to the species list (Table 3).

Table 2. Naïve occupancy estimates (i.e., proportion of sampling locations in which a species was detected) for birds at Horseshoe Bend National Military Park in 2012.

Common Name	Scientific Name	Naïve Occupancy
Northern Cardinal	<i>Cardinalis cardinalis</i>	0.90
Red-eyed Vireo	<i>Vireo olivaceus</i>	0.90
Tufted Titmouse	<i>Baeolophus bicolor</i>	0.90
Northern Parula	<i>Parula americana</i>	0.87
American Crow	<i>Corvus brachyrhynchos</i>	0.83
Carolina Chickadee	<i>Poecile carolinensis</i>	0.83
Carolina Wren	<i>Thryothorus ludovicianus</i>	0.80
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	0.77
Blue Jay	<i>Cyanocitta cristata</i>	0.73
Hooded Warbler	<i>Wilsonia citrina</i>	0.73
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	0.73
Summer Tanager	<i>Piranga rubra</i>	0.73
Acadian Flycatcher	<i>Empidonax virescens</i>	0.70
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	0.70
Pine Warbler	<i>Dendroica pinus</i>	0.63
Yellow-throated Vireo	<i>Vireo flavifrons</i>	0.60
Downy Woodpecker	<i>Picoides pubescens</i>	0.53
Brown-headed Cowbird	<i>Molothrus ater</i>	0.50
Wood Thrush	<i>Hylocichla mustelina</i>	0.50
Pileated Woodpecker	<i>Dryocopus pileatus</i>	0.43
Scarlet Tanager	<i>Piranga olivacea</i>	0.43
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	0.43
Red-shouldered Hawk	<i>Buteo lineatus</i>	0.37
Louisiana Waterthrush	<i>Seiurus motacilla</i>	0.33
Kentucky Warbler	<i>Oporornis formosus</i>	0.30
White-eyed Vireo	<i>Vireo griseus</i>	0.30
Mourning Dove	<i>Zenaida macroura</i>	0.23
Common Yellowthroat	<i>Geothlypis trichas</i>	0.20
Indigo Bunting	<i>Passerina cyanea</i>	0.17
Northern Flicker	<i>Colaptes auratus</i>	0.17
Purple Martin	<i>Progne subis</i>	0.17
Yellow-breasted Chat	<i>Icteria virens</i>	0.17
Yellow-throated Warbler	<i>Dendroica dominica</i>	0.17

Common Name	Scientific Name	Naïve Occupancy
Brown-headed Nuthatch	<i>Sitta pusilla</i>	0.13
American Goldfinch	<i>Carduelis tristis</i>	0.10
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	0.10
Eastern Wood-Pewee	<i>Contopus virens</i>	0.10
Hairy Woodpecker	<i>Picoides villosus</i>	0.10
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	0.10
Fish Crow	<i>Corvus ossifragus</i>	0.07
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	0.07
White-breasted Nuthatch	<i>Sitta carolinensis</i>	0.07
Wild Turkey	<i>Meleagris gallopavo</i>	0.07
Bald Eagle	<i>Haliaeetus leucocephalus</i>	0.03
Blue Grosbeak	<i>Guiraca caerulea</i>	0.03
Brown Thrasher	<i>Toxostoma rufum</i>	0.03
Canada Goose	<i>Branta canadensis</i>	0.03
Chipping Sparrow	<i>Spizella passerina</i>	0.03
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	0.03
Eastern Bluebird	<i>Sialia sialis</i>	0.03
Eastern Phoebe	<i>Sayornis phoebe</i>	0.03
Great Blue Heron	<i>Ardea herodias</i>	0.03
Orchard Oriole	<i>Icterus spurius</i>	0.03
Prairie Warbler	<i>Dendroica discolor</i>	0.03
Red-tailed Hawk	<i>Buteo jamaicensis</i>	0.03

Table 3. New bird species detected at Horseshoe Bend National Military Park during 2012 monitoring efforts and recommended NPSpecies classifications.

Common Name	Abundance	Residency	Nativity	Pest	Management Priority	Exploitation Concerns
Bald Eagle	Unknown	Unknown	Native	No	No	No
Canada Goose	Unknown	Unknown	Native	No	No	No
Cliff Swallow	Unknown	Unknown	Native	No	No	No

Richness

The native species richness for landbirds at Horseshoe Bend National Military Park in 2012 was 55. Species richness indices were based only on native species, and confidence intervals for each index were estimated with a bootstrap procedure. Richness indices were similar, ranging from 66.57 to 74.14 (Table 4). Observed species richness differs from the estimated true species richness (i.e., all of the richness indices combined) by approximately 8%, suggesting the results of the current monitoring effort closely approximate true species richness.

Distribution

Distribution maps for all species detected are presented in Appendix C (Figures C-1 – C-55) and indicate the sampling location(s) in which each species occurred. Northern cardinal, red-eyed vireo, tufted titmouse, northern parula,

American crow, Carolina chickadee, and Carolina wren were the most frequently occurring and widely distributed species (i.e., occurring at 80% or more of all sampling locations). Blue-gray gnatcatcher, blue jay, hooded warbler, red-bellied woodpecker, summer tanager, Acadian flycatcher, and great crested flycatcher were also widely distributed across the park, occurring at 70% or more of all sampling locations. Several species were detected at only one sampling location (i.e., uncommon), including bald eagle, Canada goose, eastern bluebird, eastern phoebe, orchard oriole, brown thrasher, cliff swallow, blue grosbeak, great blue heron, red-tailed hawk, chipping sparrow, and prairie warbler. Approximately 75% of detected species occurred at 10% or less of all sampling locations.

Table 4. Species richness indices for birds at Horseshoe Bend National Military Park, 2012.

Index	Symbol	Value	Lower 95% CI	Upper 95% CI	Value Interpretation
Native Spp. Richness	S_{obs}	55.00	47.88	62.12	Number of native species detected; Species richness at the park is considered to be moderate
Chao 2	Chao2	72.36	59.37	123.95	Estimated true species richness; Considered to be moderate. Large confidence interval (variability)
Incidence-based Coverage	ICE	66.59	63.34	69.84	Estimated true species richness; Considered to be moderate
Jackknife 1	Jack1	66.57	58.67	74.47	Estimated true species richness; Considered to be moderate
Jackknife 2	Jack2	74.14	69.65	78.63	Estimated true species richness; Considered to be moderate
Bootstrap	Boot	60.08	58.47	61.69	Estimated true species richness; Considered to be moderate

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Appendix A—Species List

Table A-1. Birds known to occur at Horseshoe Bend National Military Park based upon records in NPSpecies (2015) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	ARD 2012
Accipitriformes	Accipitridae	<i>Accipiter cooperii</i>	Cooper's Hawk	X	
Accipitriformes	Accipitridae	<i>Buteo jamaicensis</i>	Red-tailed Hawk	X	X
Accipitriformes	Accipitridae	<i>Buteo lineatus</i>	Red-shouldered Hawk	X	X
Accipitriformes	Accipitridae	<i>Buteo platypterus</i>	Broad-winged Hawk	X	
Accipitriformes	Accipitridae	<i>Circus cyaneus</i>	Northern Harrier	X	
Accipitriformes	Cathartidae	<i>Cathartes aura</i>	Turkey Vulture	X	
Accipitriformes	Cathartidae	<i>Coragyps atratus</i>	Black Vulture	X	
Anseriformes	Anatidae	<i>Aix sponsa</i>	Wood Duck	X	
Apodiformes	Apodidae	<i>Chaetura pelasgica</i>	Chimney Swift	X	
Apodiformes	Trochilidae	<i>Archilochus colubris</i>	Ruby-throated Hummingbird	X	X
Caprimulgiformes	Caprimulgidae	<i>Caprimulgus carolinensis</i>	Chuck-will's-Widow	X	
Charadriiformes	Laridae	<i>Larus delawarensis</i>	Ring-billed Gull	X	
Charadriiformes	Scolopacidae	<i>Actitis macularia</i>	Spotted Sandpiper	X	
Columbiformes	Columbidae	<i>Zenaida macroura</i>	Mourning Dove	X	X
Coraciiformes	Alcedinidae	<i>Megaceryle alcyon</i>	Belted Kingfisher	X	
Cuculiformes	Cuculidae	<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	X	X
Falconiformes	Falconidae	<i>Falco sparverius</i>	American Kestrel	X	
Galliformes	Odontophoridae	<i>Colinus virginianus</i>	Northern Bobwhite	X	
Galliformes	Phasianidae	<i>Meleagris gallopavo</i>	Wild Turkey	X	X
Gaviiformes	Gaviidae	<i>Gavia immer</i>	Common Loon	X	
Passeriformes	Bombycillidae	<i>Bombycilla cedrorum</i>	Cedar Waxwing	X	
Passeriformes	Cardinalidae	<i>Cardinalis cardinalis</i>	Northern Cardinal	X	X
Passeriformes	Cardinalidae	<i>Guiraca caerulea</i>	Blue Grosbeak	X	X
Passeriformes	Cardinalidae	<i>Passerina cyanea</i>	Indigo Bunting	X	X
Passeriformes	Cardinalidae	<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak	X	
Passeriformes	Corvidae	<i>Corvus brachyrhynchos</i>	American Crow	X	X
Passeriformes	Corvidae	<i>Corvus ossifragus</i>	Fish Crow	X	X
Passeriformes	Corvidae	<i>Cyanocitta cristata</i>	Blue Jay	X	X
Passeriformes	Emberizidae	<i>Junco hyemalis</i>	Dark-eyed Junco	X	
Passeriformes	Emberizidae	<i>Melospiza melodia</i>	Song Sparrow	X	
Passeriformes	Emberizidae	<i>Passerella iliaca</i>	Fox Sparrow	X	
Passeriformes	Emberizidae	<i>Pipilo erythrorththalmus</i>	Eastern Towhee	X	X
Passeriformes	Emberizidae	<i>Spizella passerina</i>	Chipping Sparrow	X	X
Passeriformes	Emberizidae	<i>Spizella pusilla</i>	Field Sparrow	X	
Passeriformes	Emberizidae	<i>Zonotrichia albicollis</i>	White-throated Sparrow	X	
Passeriformes	Fringillidae	<i>Carduelis pinus</i>	Pine Siskin	X	
Passeriformes	Fringillidae	<i>Carduelis tristis</i>	American Goldfinch	X	X
Passeriformes	Fringillidae	<i>Carpodacus mexicanus</i>	House Finch	X	
Passeriformes	Fringillidae	<i>Carpodacus purpureus</i>	Purple Finch	X	
Passeriformes	Fringillidae	<i>Coccothraustes vespertinus</i>	Evening Grosbeak	X	
Passeriformes	Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow	X	
Passeriformes	Hirundinidae	<i>Progne subis</i>	Purple Martin	X	X
Passeriformes	Hirundinidae	<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow	X	

Table A-1 (continued). Birds known to occur at Horseshoe Bend National Military Park based upon records in NPSpecies (2015) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	ARD 2012
Passeriformes	Icteridae	<i>Agelaius phoeniceus</i>	Red-winged Blackbird	X	
Passeriformes	Icteridae	<i>Euphagus carolinus</i>	Rusty Blackbird	X	
Passeriformes	Icteridae	<i>Icterus spurius</i>	Orchard Oriole	X	X
Passeriformes	Icteridae	<i>Molothrus ater</i>	Brown-headed Cowbird	X	X
Passeriformes	Icteridae	<i>Quiscalus quiscula</i>	Common Grackle	X	
Passeriformes	Icteridae	<i>Sturnella magna</i>	Eastern Meadowlark	X	
Passeriformes	Mimidae	<i>Dumetella carolinensis</i>	Gray Catbird	X	
Passeriformes	Mimidae	<i>Mimus polyglottos</i>	Northern Mockingbird	X	
Passeriformes	Mimidae	<i>Toxostoma rufum</i>	Brown Thrasher	X	X
Passeriformes	Motacillidae	<i>Anthus rubescens</i>	American Pipit	X	
Passeriformes	Paridae	<i>Baeolophus bicolor</i>	Tufted Titmouse	X	X
Passeriformes	Paridae	<i>Poecile carolinensis</i>	Carolina Chickadee	X	X
Passeriformes	Parulidae	<i>Dendroica coronata</i>	Yellow-rumped Warbler	X	
Passeriformes	Parulidae	<i>Dendroica discolor</i>	Prairie Warbler	X	X
Passeriformes	Parulidae	<i>Dendroica dominica</i>	Yellow-throated Warbler	X	X
Passeriformes	Parulidae	<i>Dendroica fusca</i>	Blackburnian Warbler	X	
Passeriformes	Parulidae	<i>Dendroica magnolia</i>	Magnolia Warbler	X	
Passeriformes	Parulidae	<i>Dendroica palmarum</i>	Palm Warbler	X	
Passeriformes	Parulidae	<i>Dendroica palmarum</i>	Palm Warbler	X	
Passeriformes	Parulidae	<i>Dendroica pensylvanica</i>	Chestnut-sided Warbler	X	
Passeriformes	Parulidae	<i>Dendroica pinus</i>	Pine Warbler	X	X
Passeriformes	Parulidae	<i>Dendroica virens</i>	Black-throated Green Warbler	X	
Passeriformes	Parulidae	<i>Geothlypis trichas</i>	Common Yellowthroat	X	X
Passeriformes	Parulidae	<i>Helminthorus vermiculus</i>	Worm-eating Warbler	X	
Passeriformes	Parulidae	<i>Icteria virens</i>	Yellow-breasted Chat	X	X
Passeriformes	Parulidae	<i>Limnothlypis swainsonii</i>	Swainson's Warbler	X	
Passeriformes	Parulidae	<i>Mniotilla varia</i>	Black-and-white Warbler	X	
Passeriformes	Parulidae	<i>Oporornis formosus</i>	Kentucky Warbler	X	X
Passeriformes	Parulidae	<i>Parula americana</i>	Northern Parula	X	X
Passeriformes	Parulidae	<i>Protonotaria citrea</i>	Prothonotary Warbler	X	
Passeriformes	Parulidae	<i>Seiurus aurocapillus</i>	Ovenbird	X	
Passeriformes	Parulidae	<i>Seiurus motacilla</i>	Louisiana Waterthrush	X	X
Passeriformes	Parulidae	<i>Seiurus noveboracensis</i>	Northern Waterthrush	X	
Passeriformes	Parulidae	<i>Setophaga ruticilla</i>	American Redstart	X	
Passeriformes	Parulidae	<i>Vermivora celata</i>	Orange-crowned Warbler	X	
Passeriformes	Parulidae	<i>Vermivora ruficapilla</i>	Nashville Warbler	X	
Passeriformes	Parulidae	<i>Wilsonia citrina</i>	Hooded Warbler	X	X
Passeriformes	Polioptilidae	<i>Polioptila caerulea</i>	Blue-gray Gnatcatcher	X	X
Passeriformes	Regulidae	<i>Regulus calendula</i>	Ruby-crowned Kinglet	X	
Passeriformes	Regulidae	<i>Regulus satrapa</i>	Golden-crowned Kinglet	X	
Passeriformes	Sittidae	<i>Sitta carolinensis</i>	White-breasted Nuthatch	X	X
Passeriformes	Sittidae	<i>Sitta pusilla</i>	Brown-headed Nuthatch	X	X
Passeriformes	Sturnidae	<i>Sturnus vulgaris</i>	European Starling	X	
Passeriformes	Thraupidae	<i>Piranga olivacea</i>	Scarlet Tanager	X	X
Passeriformes	Thraupidae	<i>Piranga rubra</i>	Summer Tanager	X	X

Table A-1 (continued). Birds known to occur at Horseshoe Bend National Military Park based upon records in NPSpecies (2015) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	ARD 2012
Passeriformes	Troglodytidae	<i>Thryothorus ludovicianus</i>	Carolina Wren	X	X
Passeriformes	Troglodytidae	<i>Troglodytes aedon</i>	House Wren	X	
Passeriformes	Troglodytidae	<i>Troglodytes troglodytes</i>	Winter Wren	X	
Passeriformes	Turdidae	<i>Catharus fuscescens</i>	Veery	X	
Passeriformes	Turdidae	<i>Catharus guttatus</i>	Hermit Thrush	X	
Passeriformes	Turdidae	<i>Hylocichla mustelina</i>	Wood Thrush	X	X
Passeriformes	Turdidae	<i>Sialia sialis</i>	Eastern Bluebird	X	X
Passeriformes	Turdidae	<i>Turdus migratorius</i>	American Robin	X	
Passeriformes	Tyrannidae	<i>Contopus virens</i>	Eastern Wood-Pewee	X	X
Passeriformes	Tyrannidae	<i>Empidonax minimus</i>	Least Flycatcher	X	
Passeriformes	Tyrannidae	<i>Empidonax virescens</i>	Acadian Flycatcher	X	X
Passeriformes	Tyrannidae	<i>Myiarchus crinitus</i>	Great Crested Flycatcher	X	X
Passeriformes	Tyrannidae	<i>Sayornis phoebe</i>	Eastern Phoebe	X	X
Passeriformes	Tyrannidae	<i>Tyrannus tyrannus</i>	Eastern Kingbird	X	
Passeriformes	Vireonidae	<i>Vireo flavifrons</i>	Yellow-throated Vireo	X	X
Passeriformes	Vireonidae	<i>Vireo griseus</i>	White-eyed Vireo	X	X
Passeriformes	Vireonidae	<i>Vireo olivaceus</i>	Red-eyed Vireo	X	X
Passeriformes	Vireonidae	<i>Vireo solitarius</i>	Blue-headed Vireo	X	
Passeriformes	Vireonidae	<i>Vireo solitarius</i>	Blue-headed Vireo	X	
Pelecaniformes	Ardeidae	<i>Ardea alba</i>	Great Egret	X	
Pelecaniformes	Ardeidae	<i>Ardea herodias</i>	Great Blue Heron	X	X
Pelecaniformes	Ardeidae	<i>Butorides virescens</i>	Green Heron	X	
Pelecaniformes	Ardeidae	<i>Egretta caerulea</i>	Little Blue Heron	X	
Piciformes	Picidae	<i>Colaptes auratus</i>	Northern Flicker	X	X
Piciformes	Picidae	<i>Dryocopus pileatus</i>	Pileated Woodpecker	X	X
Piciformes	Picidae	<i>Melanerpes carolinus</i>	Red-bellied Woodpecker	X	X
Piciformes	Picidae	<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	X	X
Piciformes	Picidae	<i>Picoides pubescens</i>	Downy Woodpecker	X	X
Piciformes	Picidae	<i>Picoides villosus</i>	Hairy Woodpecker	X	X
Piciformes	Picidae	<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	X	
Strigiformes	Strigidae	<i>Bubo virginianus</i>	Great Horned Owl	X	
Strigiformes	Strigidae	<i>Megascops asio</i>	Eastern Screech Owl	X	
Strigiformes	Strigidae	<i>Strix varia</i>	Barred Owl	X	

Appendix B—Species Detection Matrix

Table B-1. All species detected at each sampling location at Horseshoe Bend National Military Park in 2012. Refer to Figure 2 for labeled sampling locations.

Species	01	02	03	04	05	06	07	08	09	10	32	33	34	35	36	37	38	39	43	45	46	47	48	49	50	51	54	55
Acadian Flycatcher	X	X		X	X	X	X	X	X	X	X	X	X	X			X		X	X	X	X	X	X	X	X		
American Crow		X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
American Goldfinch			X																							X	X	
Bald Eagle	X																											
Blue Grosbeak																										X		
Blue Jay	X	X	X	X	X	X	X		X	X	X	X		X	X		X		X	X	X	X			X	X	X	
Blue-gray Gnatcatcher		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Brown Thrasher		X																										
Brown-headed Cowbird			X	X		X	X			X		X			X	X			X	X			X	X	X	X	X	
Brown-headed Nuthatch		X	X					X									X											
Canada Goose																												X
Carolina Chickadee	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	
Carolina Wren	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	
Chipping Sparrow																										X		
Cliff Swallow																										X		
Common Yellowthroat			X			X				X	X								X							X		
Downy Woodpecker		X		X			X	X	X	X	X					X	X	X		X		X		X	X	X	X	
Eastern Bluebird																												X
Eastern Phoebe	X																											
Eastern Towhee		X			X																							X
Eastern Wood-Pewee		X															X											
Fish Crow		X																										
Great Blue Heron																	X											
Great Crested Flycatcher		X	X	X	X	X		X	X		X	X					X	X		X	X	X	X	X	X	X	X	
Hairy Woodpecker										X							X			X								
Hooded Warbler	X	X	X	X		X		X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X	
Indigo Bunting			X																	X		X				X	X	
Kentucky Warbler				X	X					X	X	X			X						X	X	X		X		X	
Louisiana Waterthrush					X				X	X				X						X	X	X			X	X	X	
Mourning Dove			X							X	X				X		X			X	X	X						
Northern Cardinal	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		

↑

Species	01	02	03	04	05	06	07	08	09	10	32	33	34	35	36	37	38	39	43	45	46	47	48	49	50	51	54	55
Northern Flicker								X														X	X			X	X	
Northern Parula	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Orchard Oriole																											X	
Pileated Woodpecker		X	X				X	X			X		X			X	X		X	X	X	X	X	X	X	X	X	
Pine Warbler	X	X	X				X	X	X		X	X	X			X	X		X	X	X	X	X	X	X	X	X	
Prairie Warbler				X																						X	X	
Purple Martin		X														X						X	X				X	
Red-bellied Woodpecker		X		X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Red-eyed Vireo	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Red-headed Woodpecker		X		X		X																						
Red-shouldered Hawk					X			X		X	X			X			X			X	X				X	X	X	
Red-tailed Hawk						X																						
Ruby-throated Hummingbird								X																			X	
Scarlet Tanager		X	X	X	X	X						X	X				X		X		X	X	X				X	
Summer Tanager		X	X	X	X		X	X	X		X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	
Tufted Titmouse	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
White-breasted Nuthatch												X		X														
White-eyed Vireo	X		X			X			X							X				X			X		X	X		
Wild Turkey																					X	X						
Wood Thrush	X	X		X	X					X		X	X	X	X	X	X	X				X	X	X	X		X	
Yellow-billed Cuckoo		X				X				X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	
Yellow-breasted Chat			X	X		X												X									X	
Yellow-throated Vireo	X	X				X		X	X	X		X		X	X	X	X	X		X	X	X	X	X	X	X	X	
Yellow-throated Warbler									X	X										X					X	X		
Red-tailed Hawk			X				X																					
Red-winged Blackbird								X					X															
Summer Tanager	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X		
Swainson's Warbler						X	X	X	X		X		X			X											X	
Tufted Titmouse	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Veery																												X
White-breasted Nuthatch		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
White-eyed Vireo	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X				X		
Willow Flycatcher																												X
Wood Thrush													X			X												

Species	01	02	03	04	05	06	07	08	09	10	32	33	34	35	36	37	38	39	43	45	46	47	48	49	50	51	54	55
Worm-eating Warbler													X															
Yellow-billed Cuckoo	X	X				X	X							X	X													
Yellow-breasted Chat						X																						
Yellow-throated Vireo		X		X	X		X			X	X	X	X	X	X	X	X		X			X						
Yellow-throated Warbler	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X			X		

Appendix C—Species Distribution Maps

Ordered alphabetically by common name

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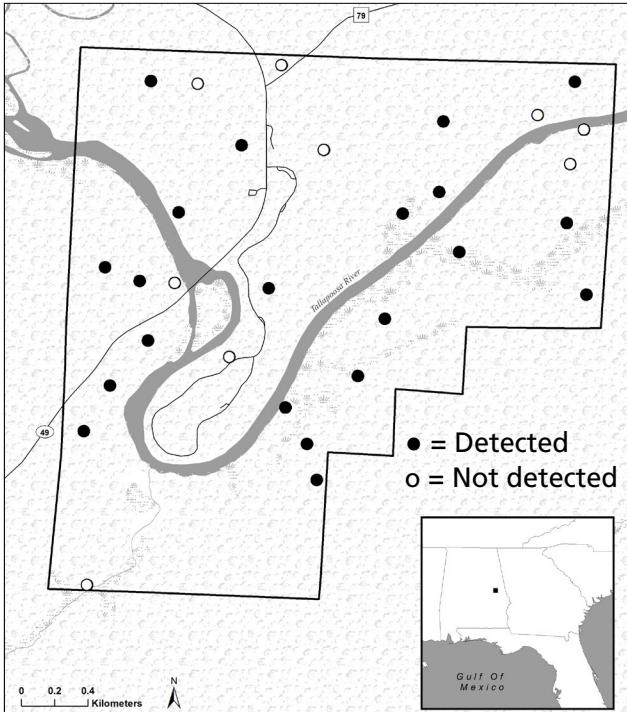


Figure C-1. Sampling locations where Acadian flycatcher (*Empidonax virescens*) was detected at Horseshoe Bend National Military Park, 2012.

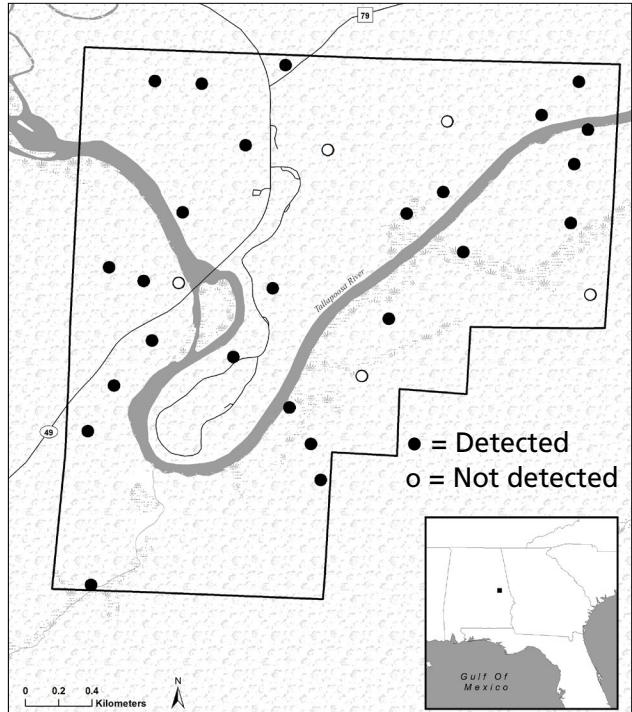


Figure C-2. Sampling locations where American crow (*Corvus brachyrhynchos*) was detected at Horseshoe Bend National Military Park, 2012.

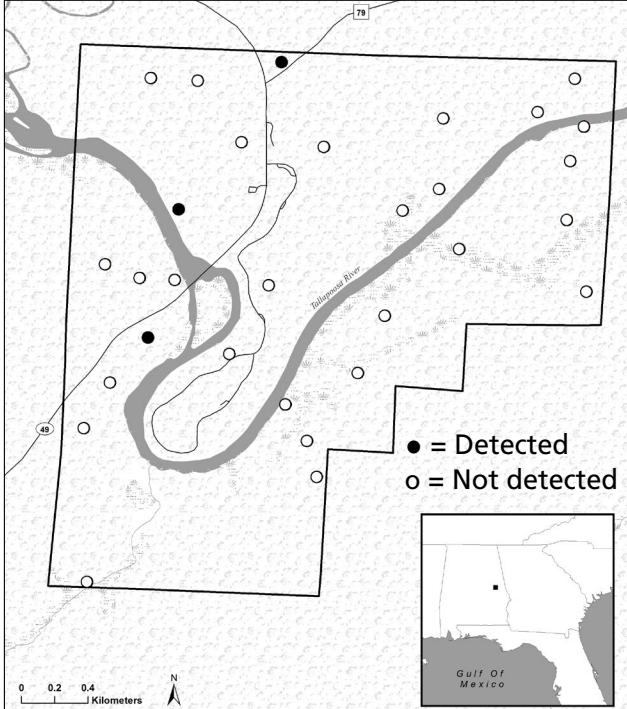


Figure C-3. Sampling locations where American goldfinch (*Carduelis tristis*) was detected at Horseshoe Bend National Military Park, 2012.

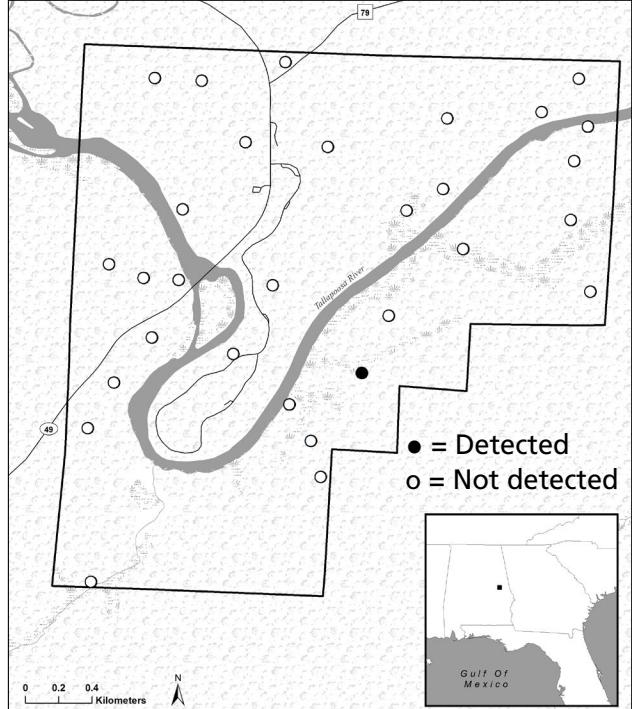


Figure C-4. Sampling locations where bald eagle (*Haliaeetus leucocephalus*) was detected at Horseshoe Bend National Military Park, 2012.

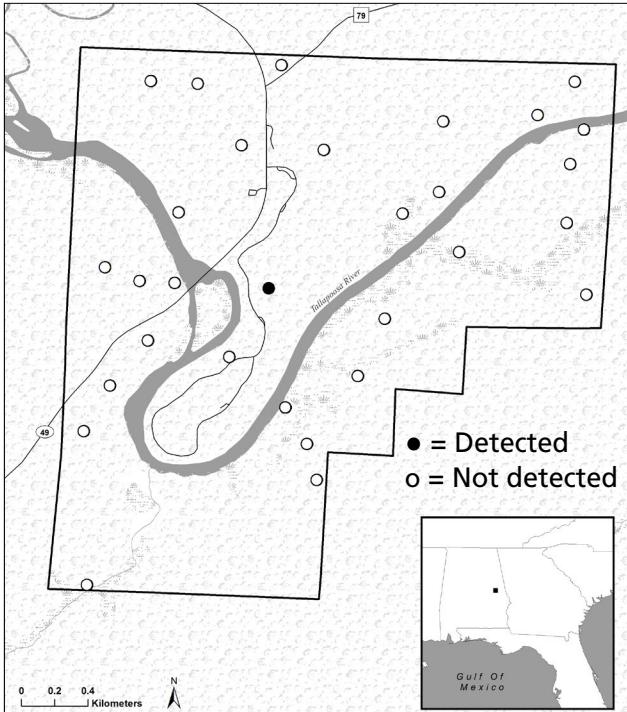


Figure C-5. Sampling locations where blue grosbeak (*Guiraca caerulea*) was detected at Horseshoe Bend National Military Park, 2012.

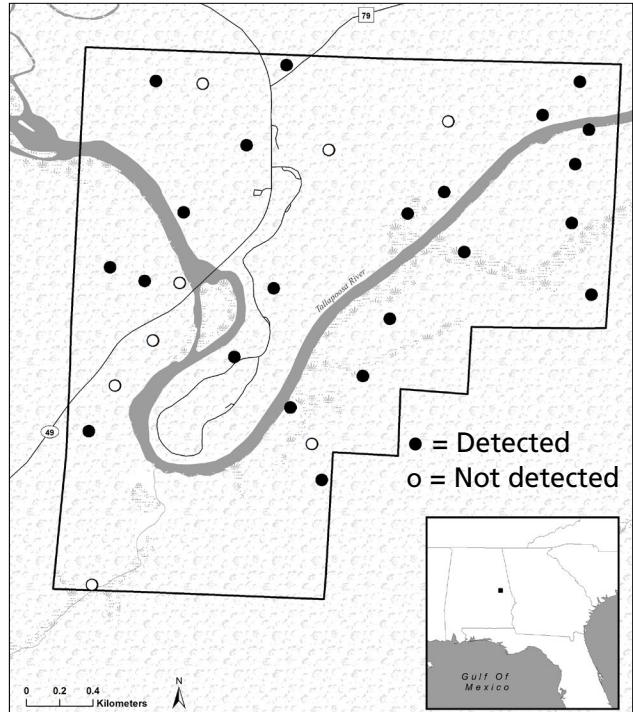


Figure C-6. Sampling locations where blue jay (*Cyanocitta cristata*) was detected at Horseshoe Bend National Military Park, 2012.

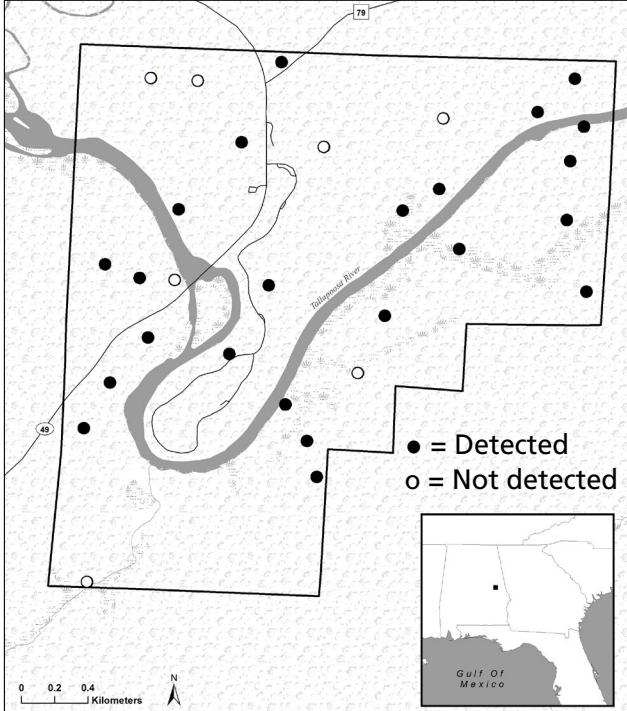


Figure C-7. Sampling locations where blue-gray gnatcatcher (*Polioptila caerulea*) was detected at Horseshoe Bend National Military Park, 2012.

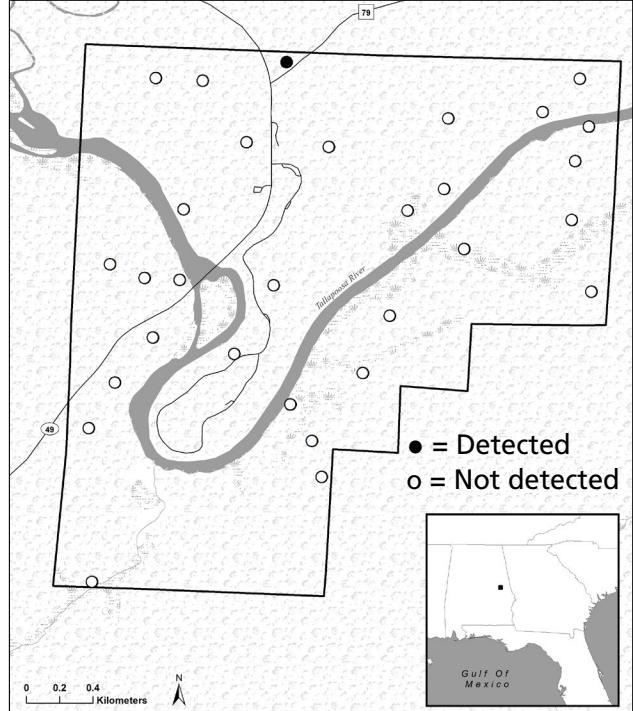


Figure C-8. Sampling locations where brown thrasher (*Toxostoma rufum*) was detected at Horseshoe Bend National Military Park, 2012.

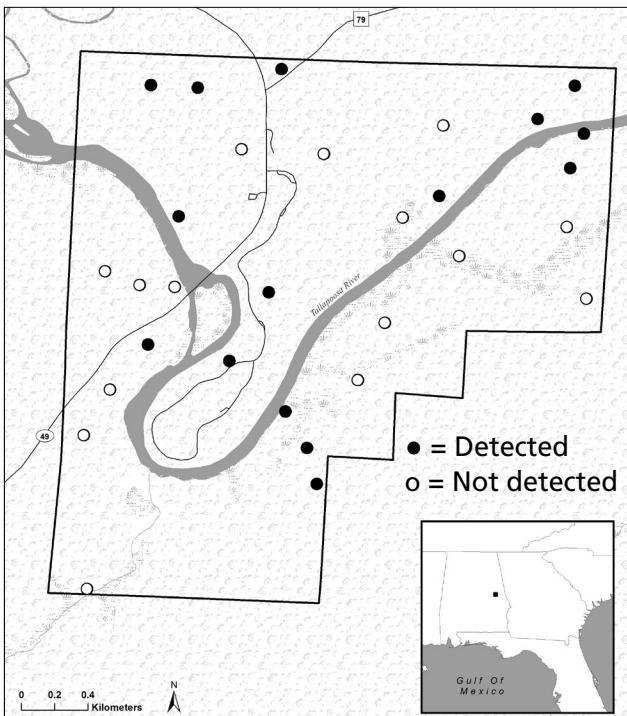


Figure C-9. Sampling locations where brown-headed cowbird (*Molothrus ater*) was detected at Horseshoe Bend National Military Park, 2012.

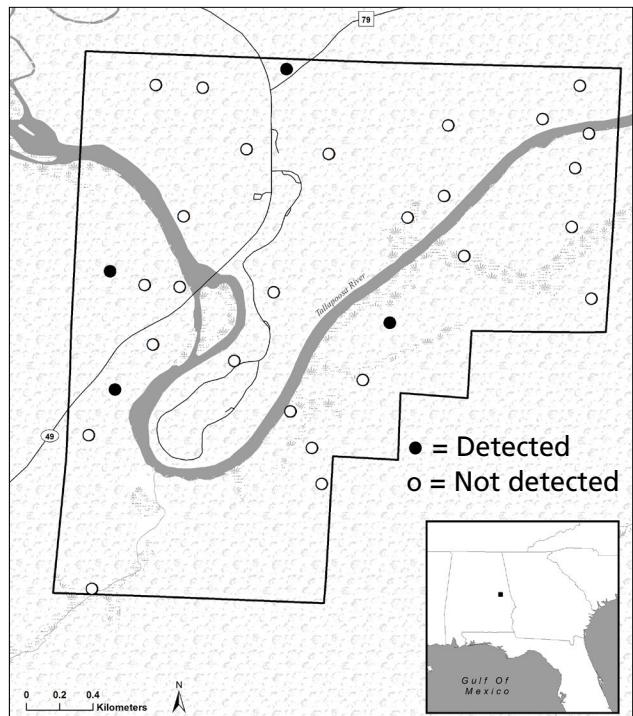


Figure C-10. Sampling locations where brown-headed nuthatch (*Sitta pusilla*) was detected at Horseshoe Bend National Military Park, 2012.

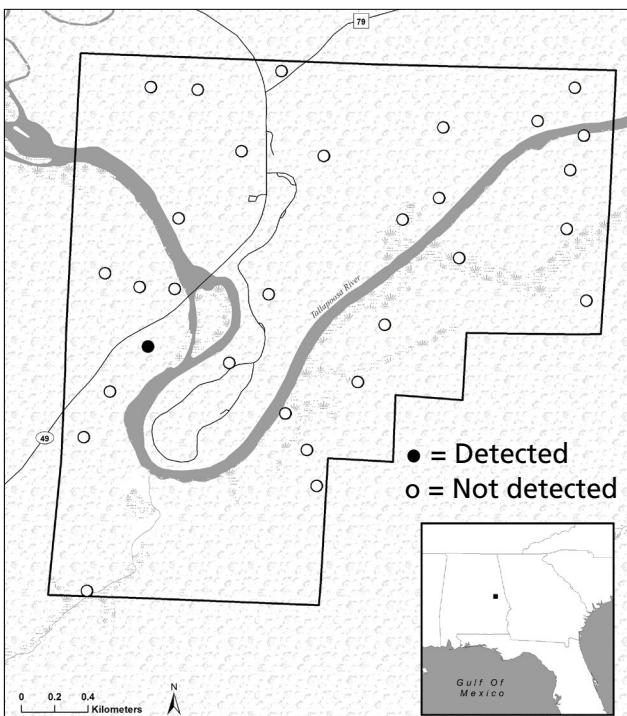


Figure C-11. Sampling locations where Canada goose (*Branta canadensis*) was detected at Horseshoe Bend National Military Park, 2012.

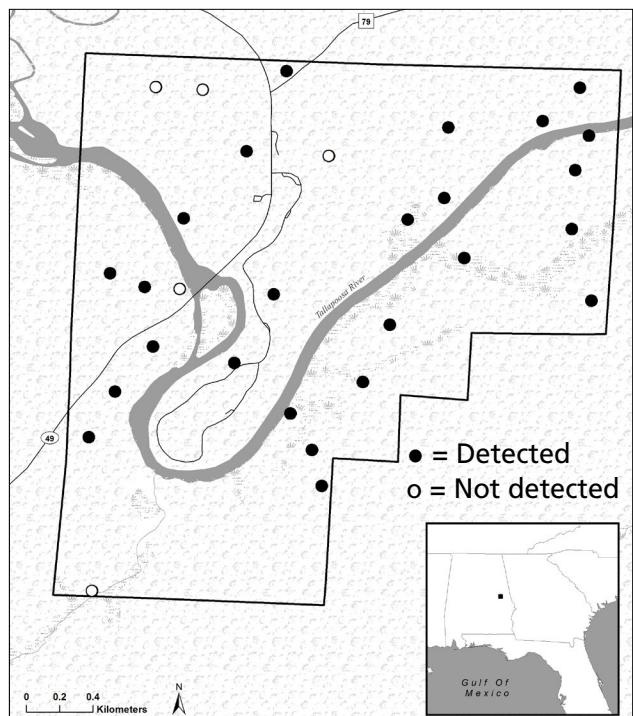


Figure C-12. Sampling locations where Carolina chickadee (*Poecile carolinensis*) was detected at Horseshoe Bend National Military Park, 2012.

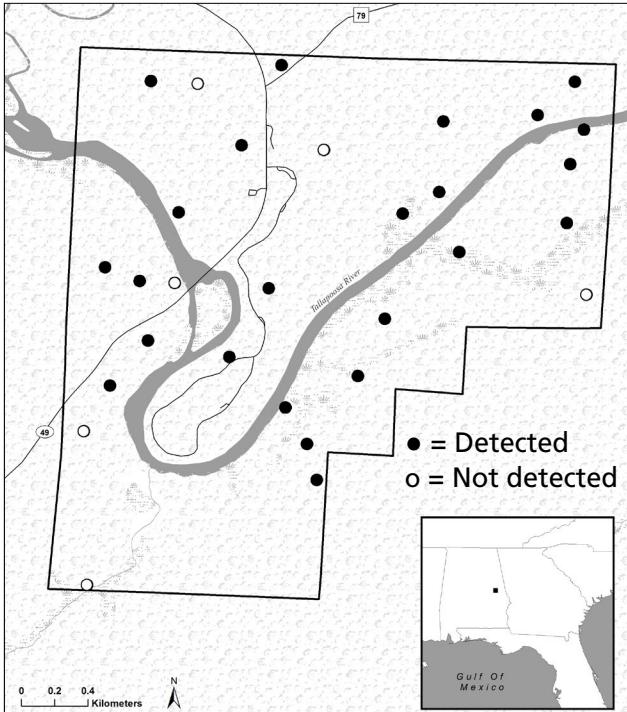


Figure C-13. Sampling locations where Carolina wren (*Thryothorus ludovicianus*) was detected at Horseshoe Bend National Military Park, 2012.

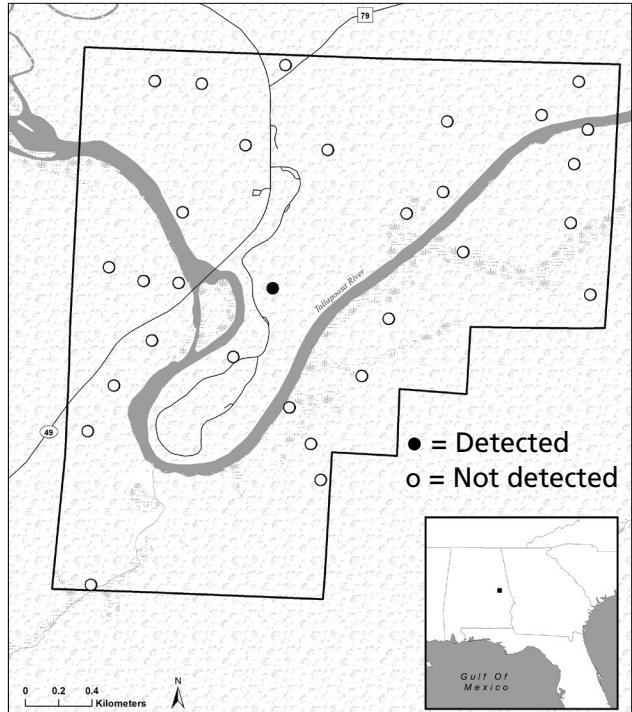


Figure C-14. Sampling locations where chipping sparrow (*Spizella passerina*) was detected at Horseshoe Bend National Military Park, 2012.

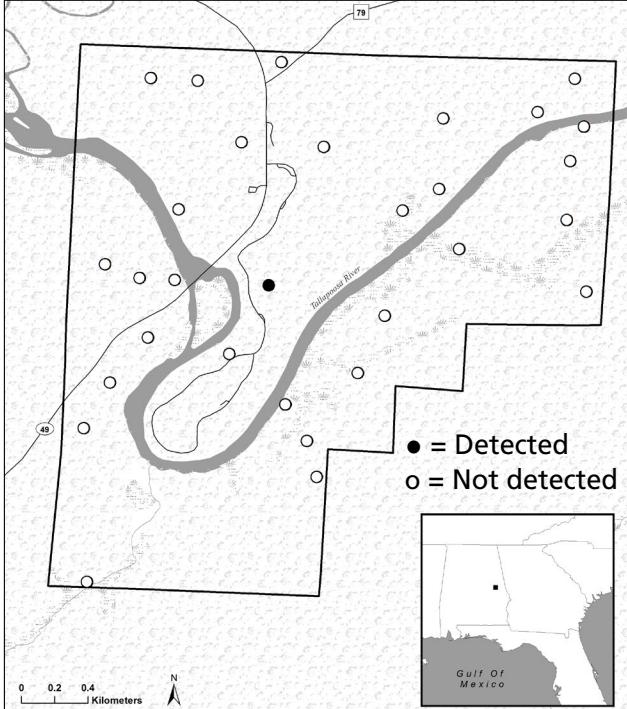


Figure C-15. Sampling locations where cliff swallow (*Petrochelidon pyrrhonota*) was detected at Horseshoe Bend National Military Park, 2012.

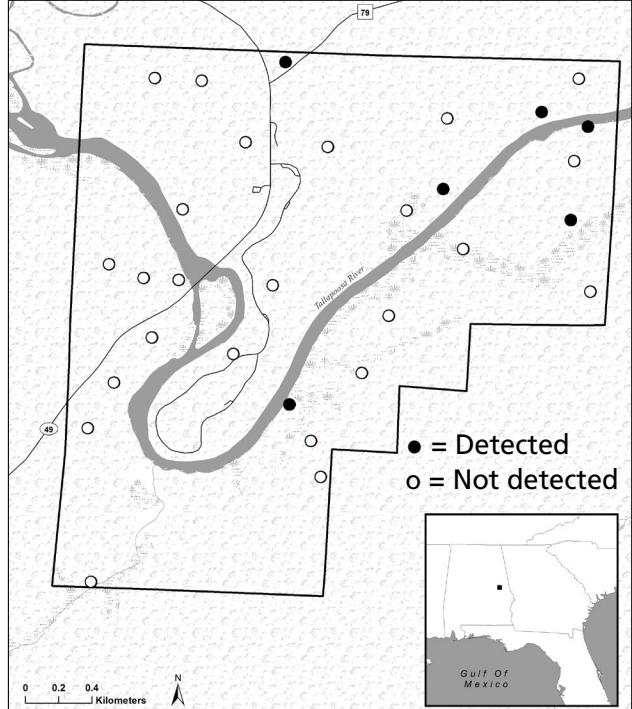


Figure C-16. Sampling locations where common yellowthroat (*Geothlypis trichas*) was detected at Horseshoe Bend National Military Park, 2012.

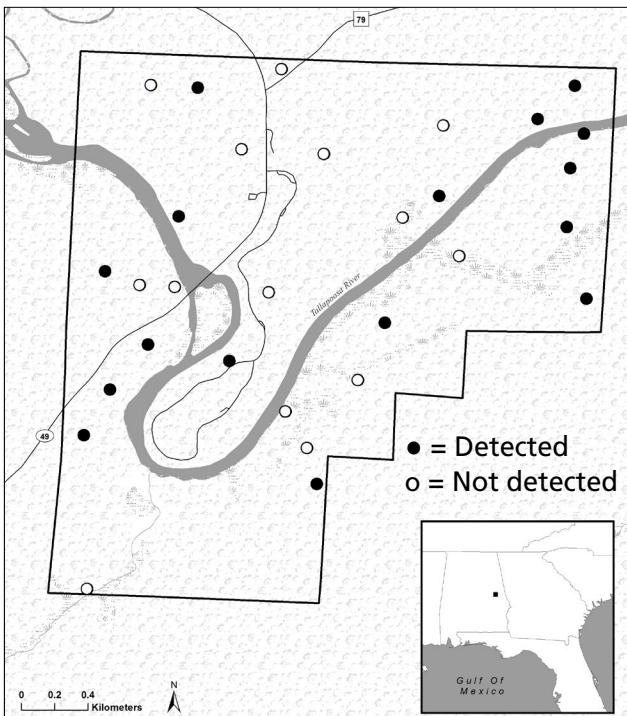


Figure C-17. Sampling locations where downy woodpecker (*Picoides pubescens*) was detected at Horseshoe Bend National Military Park, 2012.

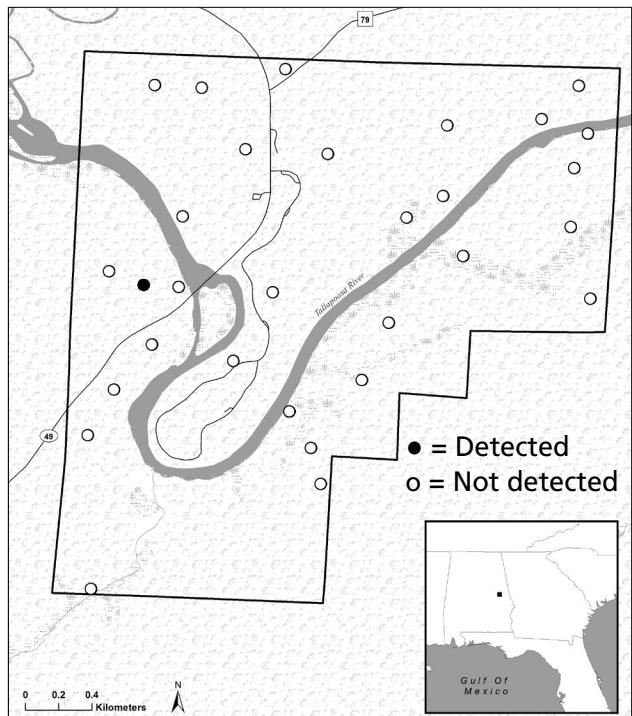


Figure C-18. Sampling locations where eastern bluebird (*Sialia sialis*) was detected at Horseshoe Bend National Military Park, 2012.

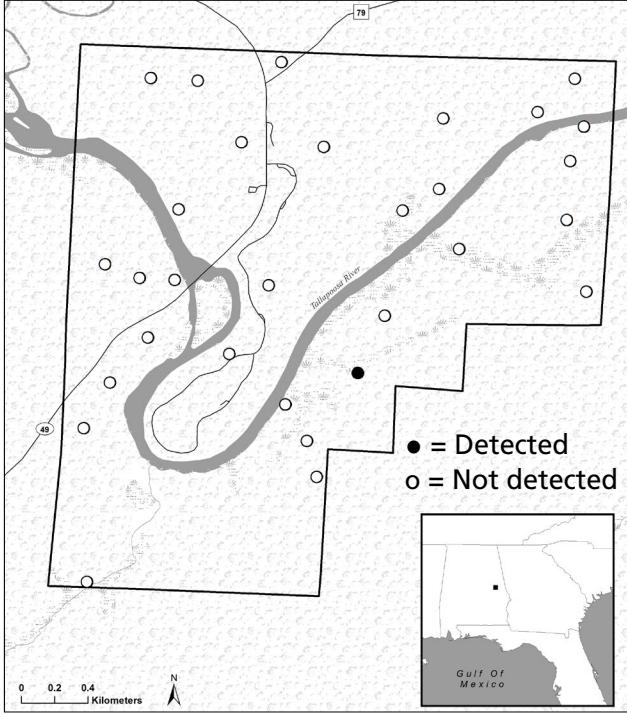


Figure C-19. Sampling locations where eastern phoebe (*Sayornis phoebe*) was detected at Horseshoe Bend National Military Park, 2012.

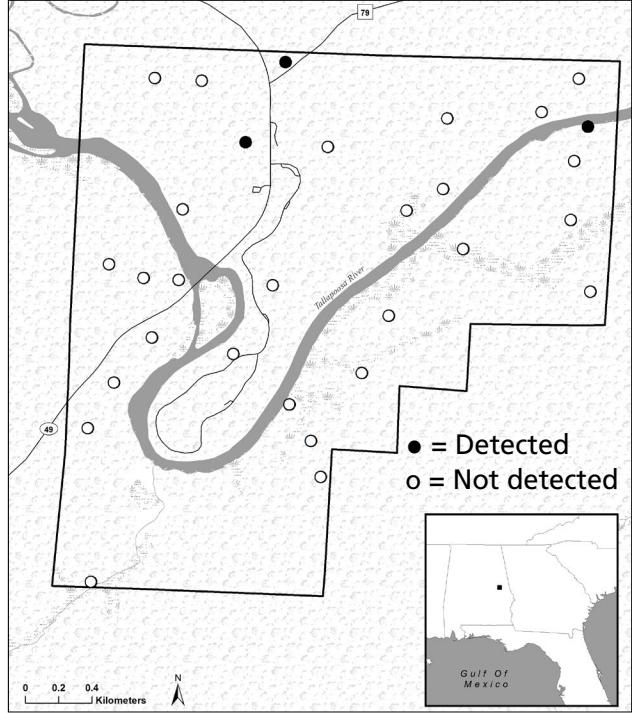


Figure C-20. Sampling locations where eastern towhee (*Pipilo erythrorthalmus*) was detected at Horseshoe Bend National Military Park, 2012.

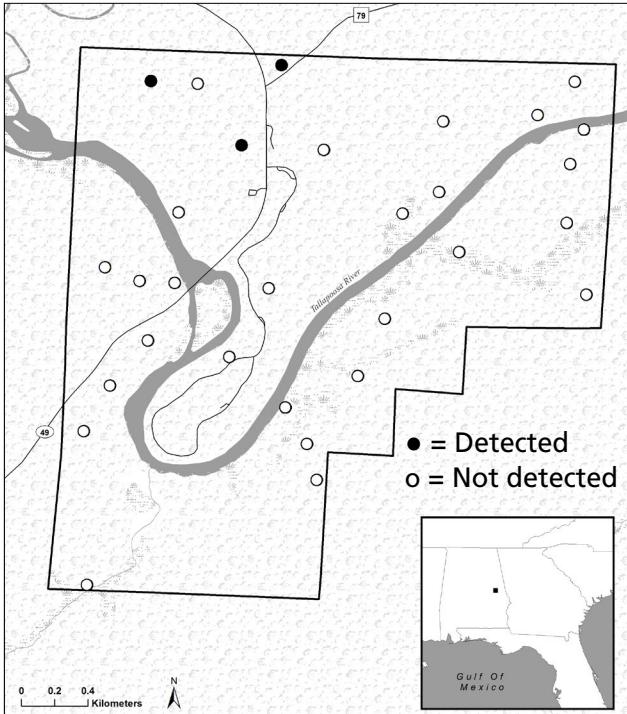


Figure C-21. Sampling locations where eastern wood-peewee (*Contopus virens*) was detected at Horseshoe Bend National Military Park, 2012.

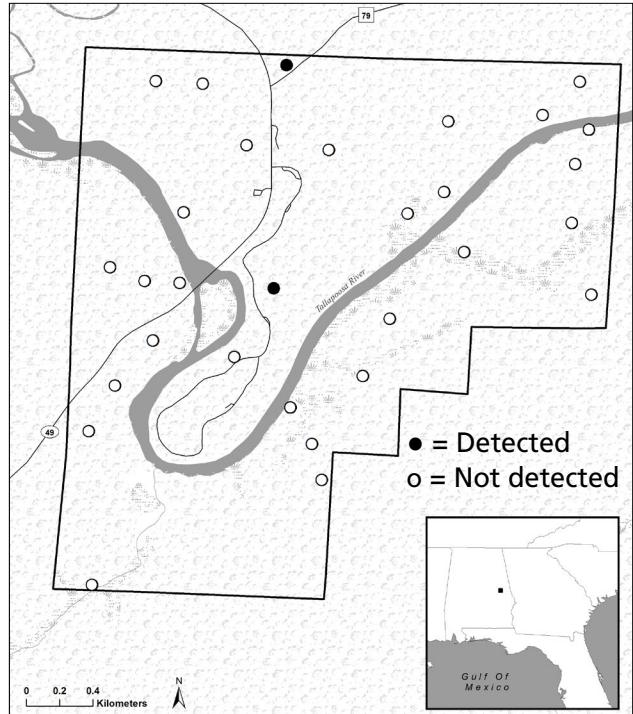


Figure C-22. Sampling locations where fish crow (*Corvus ossifragus*) was detected at Horseshoe Bend National Military Park, 2012.

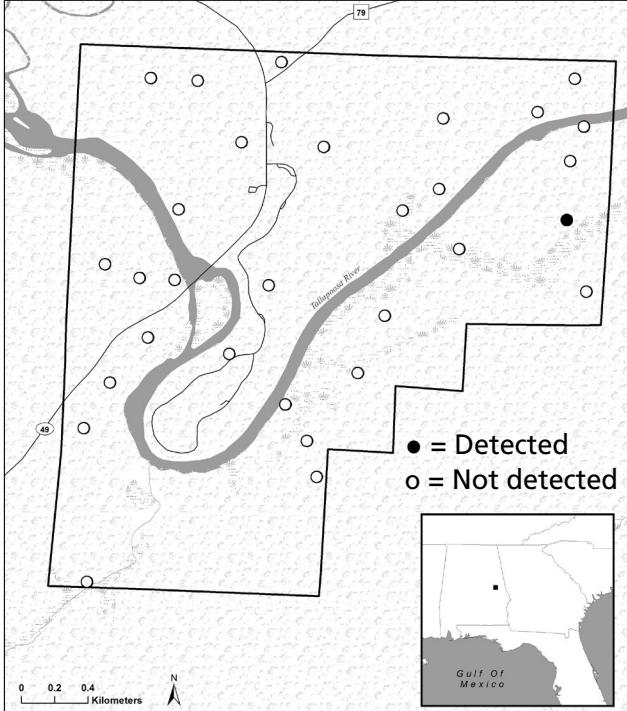


Figure C-23. Sampling locations where great blue heron (*Ardea herodias*) was detected at Horseshoe Bend National Military Park, 2012.

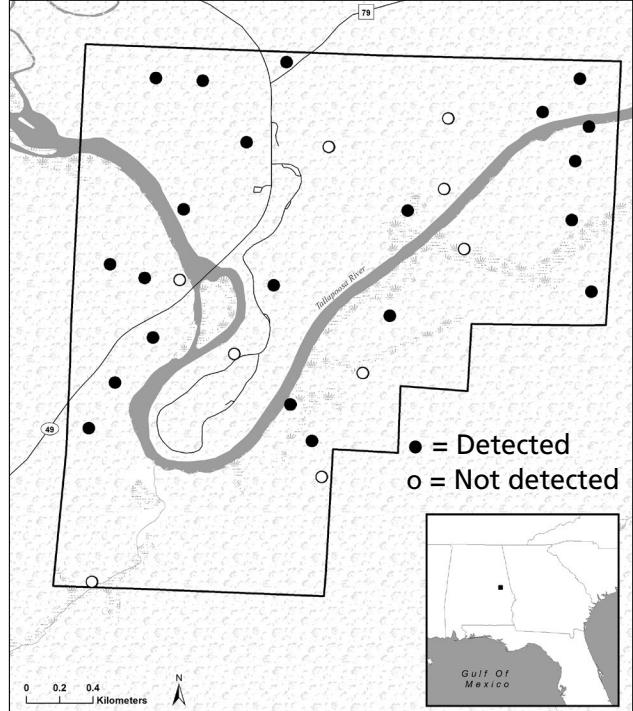


Figure C-24. Sampling locations where great crested flycatcher (*Myiarchus crinitus*) was detected at Horseshoe Bend National Military Park, 2012.

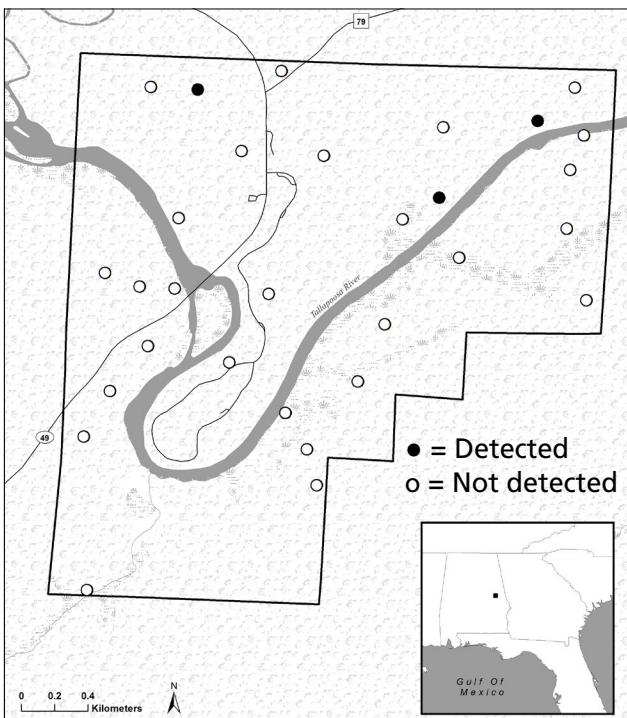


Figure C-25. Sampling locations where hairy woodpecker (*Picoides villosus*) was detected at Horseshoe Bend National Military Park, 2012.

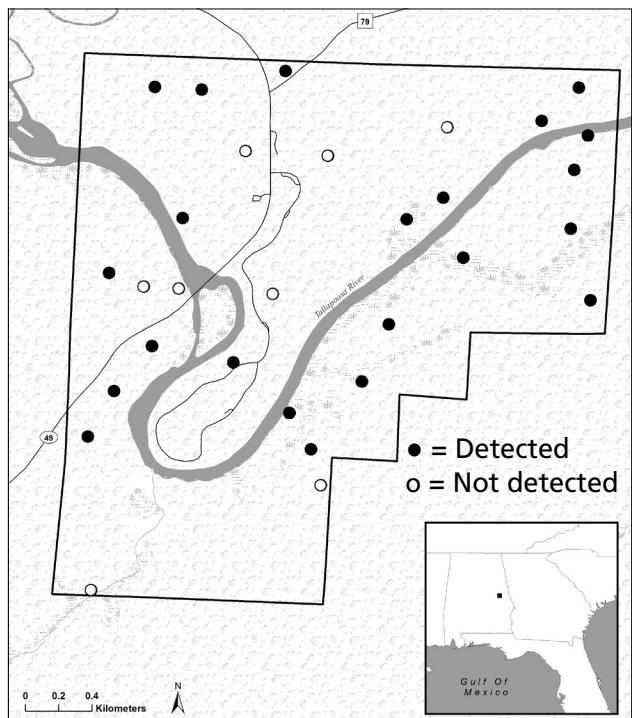


Figure C-26. Sampling locations where hooded warbler (*Wilsonia citrina*) was detected at Horseshoe Bend National Military Park, 2012.

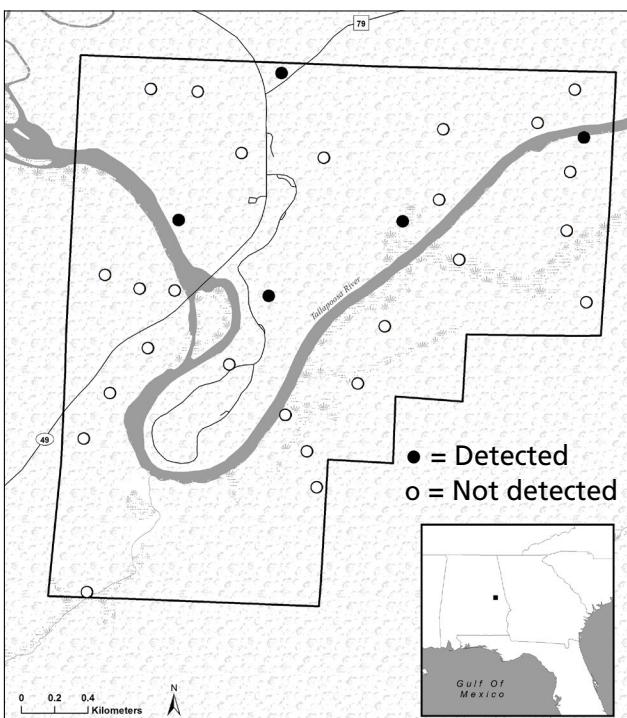


Figure C-27. Sampling locations where indigo bunting (*Passerina cyanea*) was detected at Horseshoe Bend National Military Park, 2012.

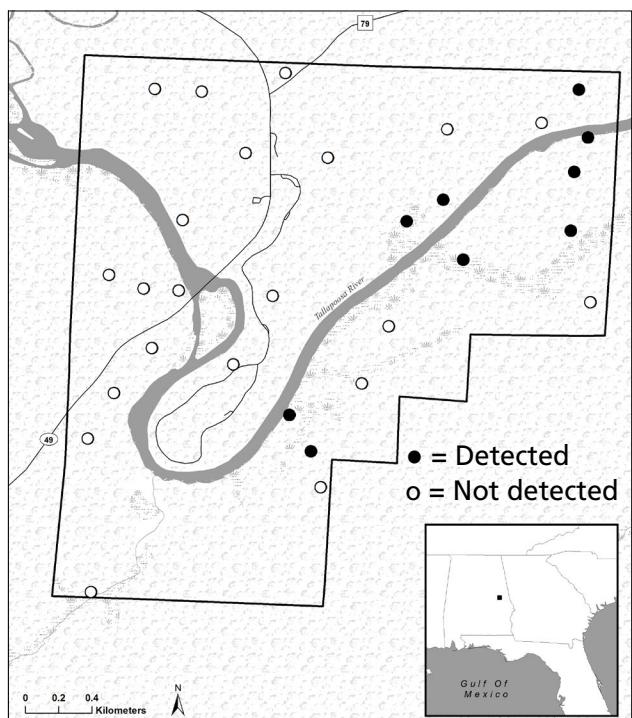


Figure C-28. Sampling locations where Kentucky warbler (*Oporornis formosus*) was detected at Horseshoe Bend National Military Park, 2012.

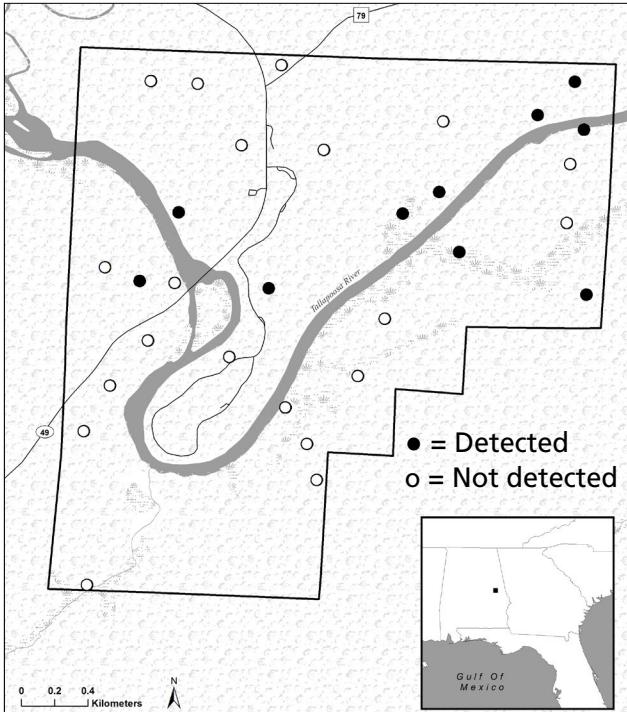


Figure C-29. Sampling locations where Louisiana waterthrush (*Seiurus motacilla*) was detected at Horseshoe Bend National Military Park, 2012.

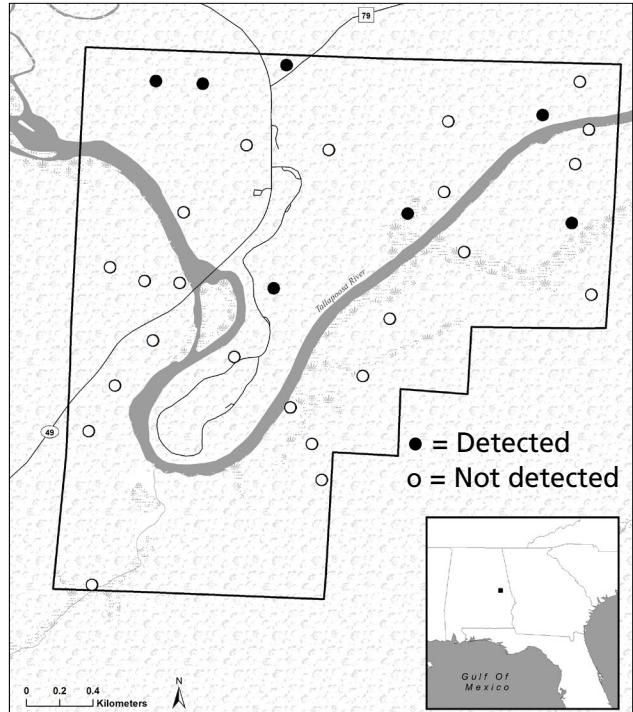


Figure C-30. Sampling locations where mourning dove (*Zenaida macroura*) was detected at Horseshoe Bend National Military Park, 2012.

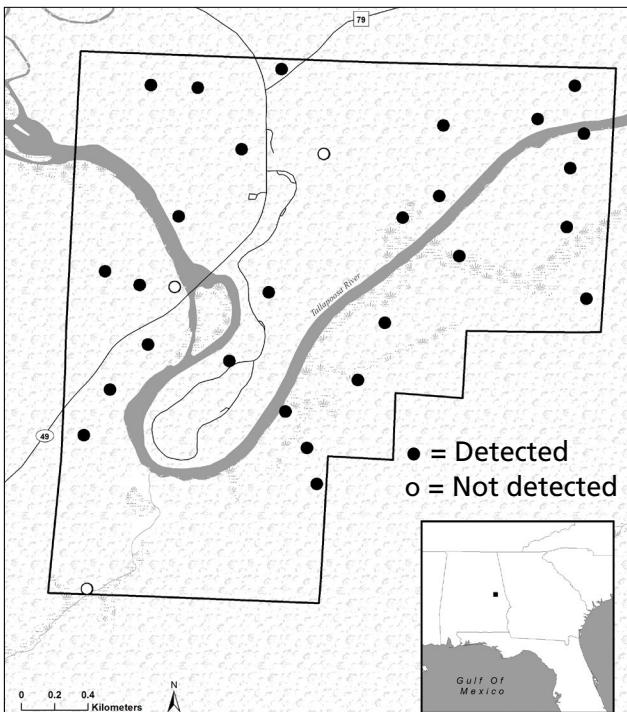


Figure C-31. Sampling locations where northern cardinal (*Cardinalis cardinalis*) was detected at Horseshoe Bend National Military Park, 2012.

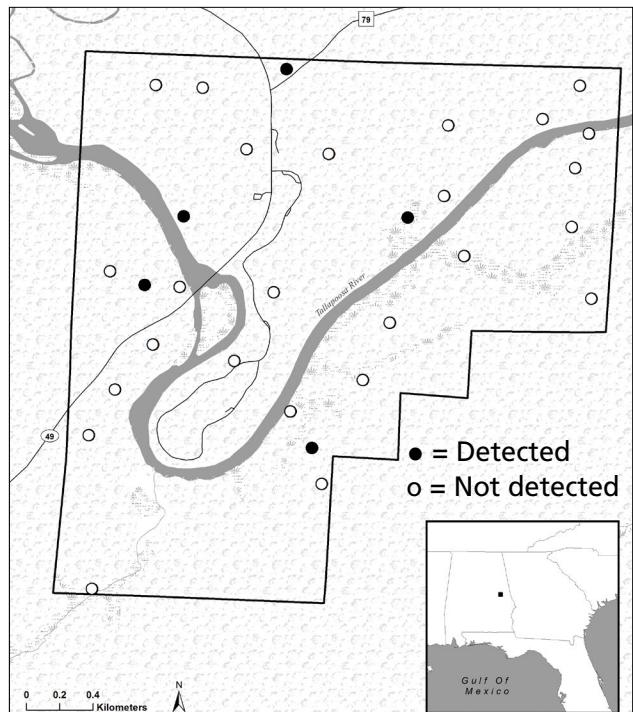


Figure C-32. Sampling locations where northern flicker (*Colaptes auratus*) was detected at Horseshoe Bend National Military Park, 2012.

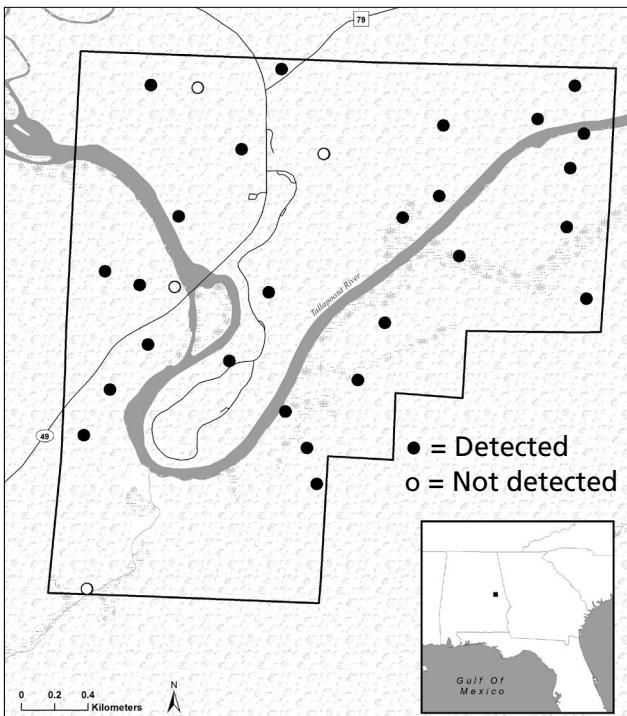


Figure C-33. Sampling locations where northern parula (*Parula americana*) was detected at Horseshoe Bend National Military Park, 2012.

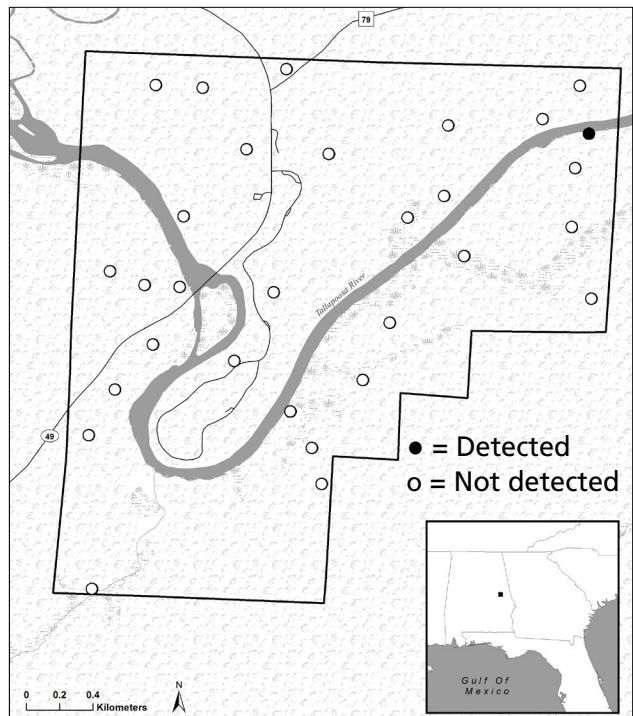


Figure C-34. Sampling locations where orchard oriole (*Icterus spurius*) was detected at Horseshoe Bend National Military Park, 2012.

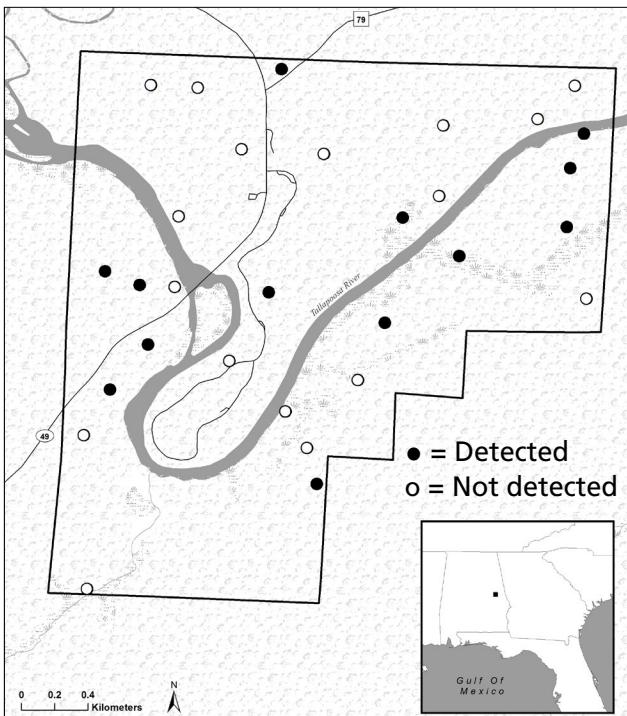


Figure C-35. Sampling locations where pileated woodpecker (*Dryocopus pileatus*) was detected at Horseshoe Bend National Military Park, 2012.

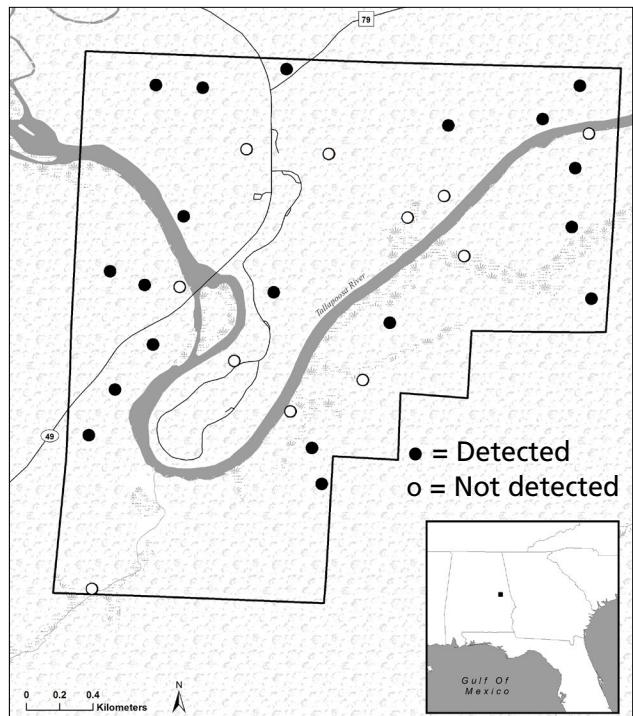


Figure C-36. Sampling locations where pine warbler (*Dendroica pinus*) was detected at Horseshoe Bend National Military Park, 2012.

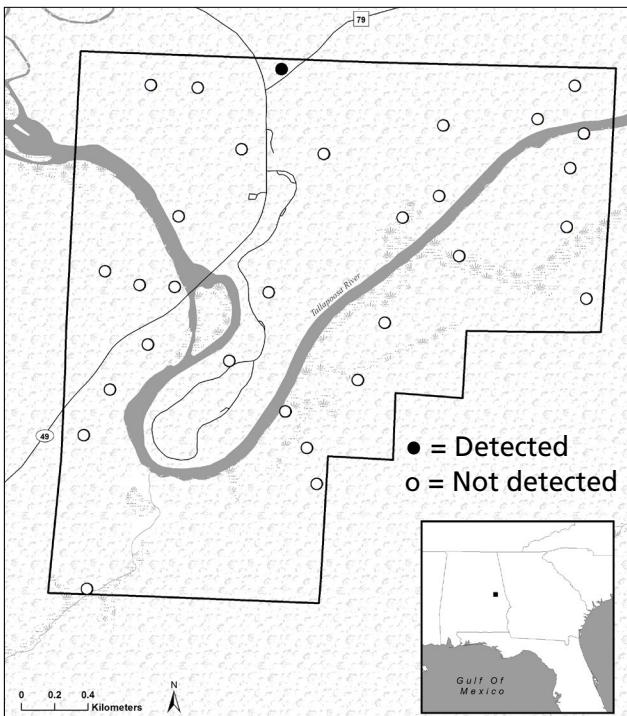


Figure C-37. Sampling locations where prairie warbler (*Dendroica discolor*) was detected at Horseshoe Bend National Military Park, 2012.

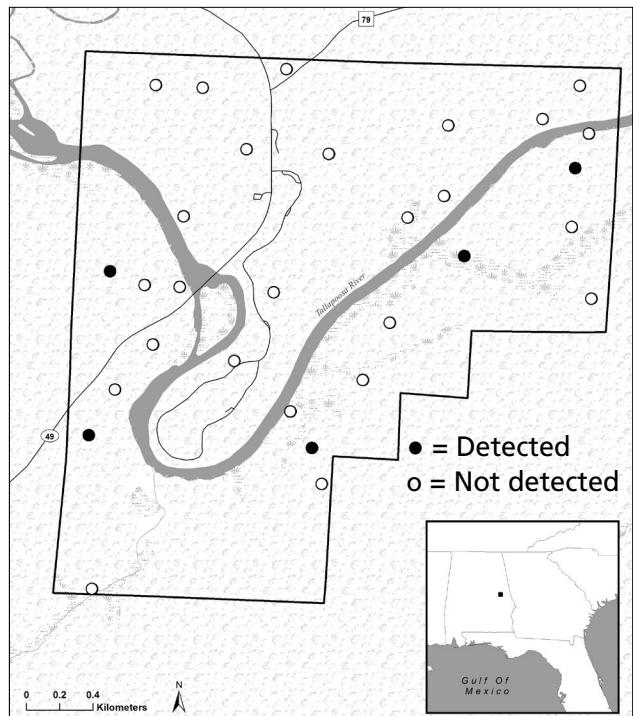


Figure C-38. Sampling locations where purple martin (*Progne subis*) was detected at Horseshoe Bend National Military Park, 2012.

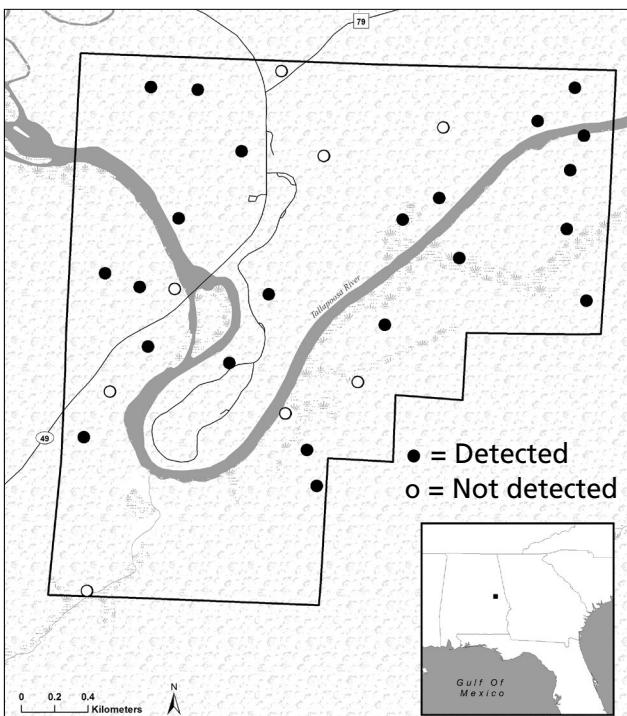


Figure C-39. Sampling locations where red-bellied woodpecker (*Melanerpes carolinus*) was detected at Horseshoe Bend National Military Park, 2012.

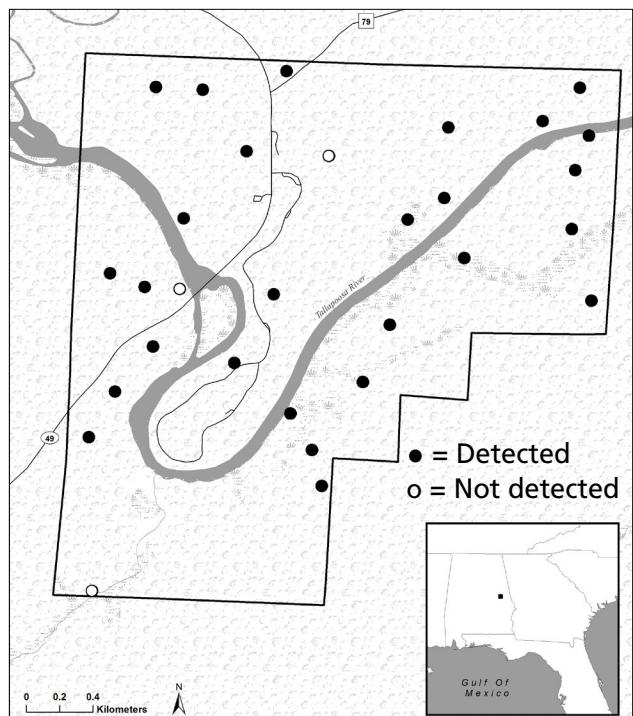


Figure C-40 Sampling locations where red-eyed vireo (*Vireo olivaceus*) was detected at Horseshoe Bend National Military Park, 2012.

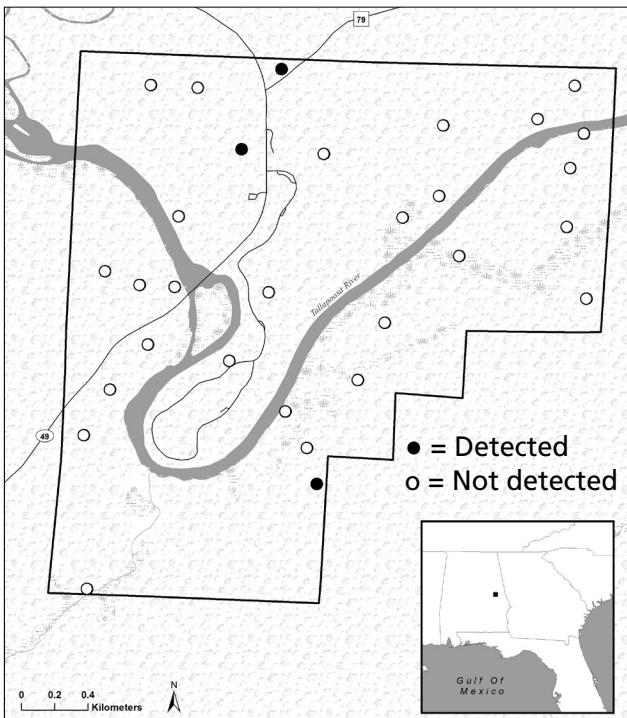


Figure C-41. Sampling locations where red-headed woodpecker (*Melanerpes erythrocephalus*) was detected at Horseshoe Bend National Military Park, 2012.

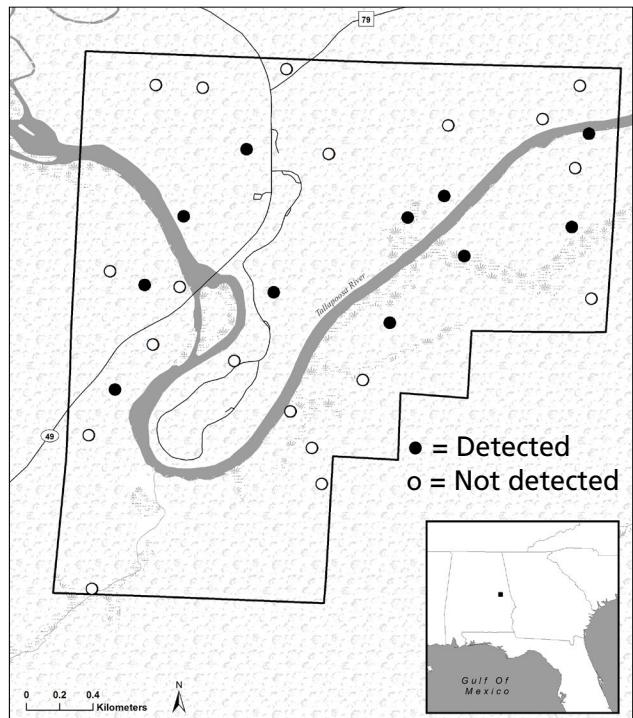


Figure C-42. Sampling locations where red-shouldered hawk (*Buteo lineatus*) was detected at Horseshoe Bend National Military Park, 2012.

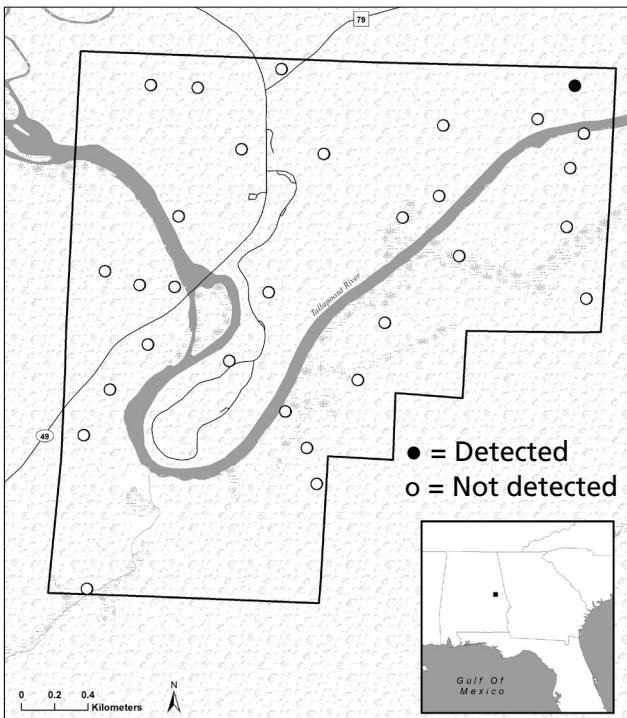


Figure C-43. Sampling locations where red-tailed hawk (*Buteo jamaicensis*) was detected at Horseshoe Bend National Military Park, 2012.

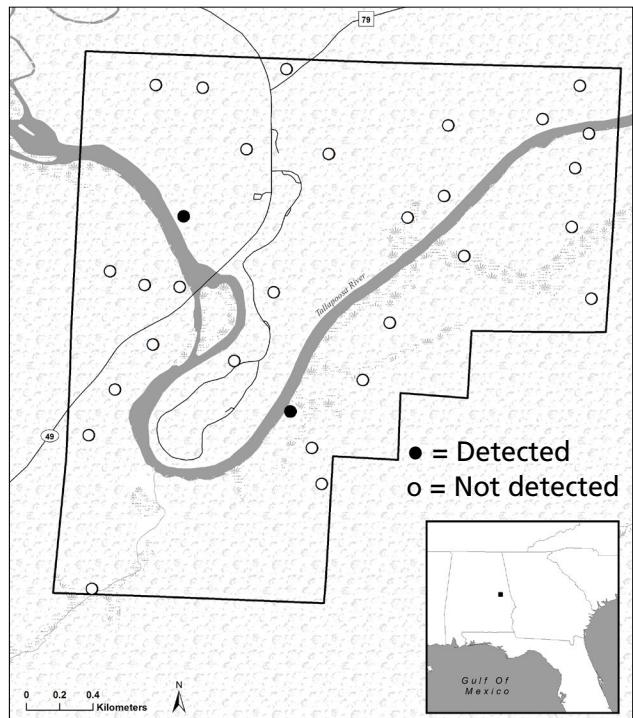


Figure C-44. Sampling locations where ruby-throated hummingbird (*Archilochus colubris*) was detected at Horseshoe Bend National Military Park, 2012.

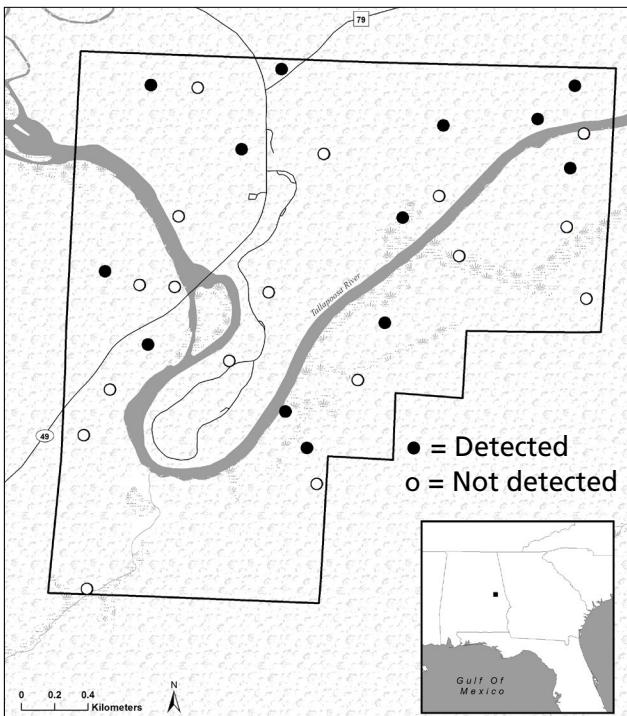


Figure C-45. Sampling locations where scarlet tanager (*Piranga olivacea*) was detected at Horseshoe Bend National Military Park, 2012.

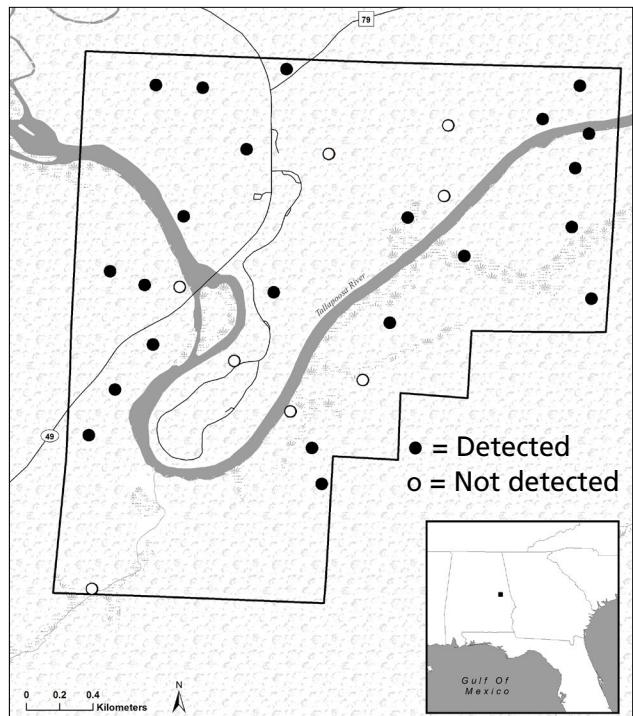


Figure C-46. Sampling locations where summer tanager (*Piranga rubra*) was detected at Horseshoe Bend National Military Park, 2012.

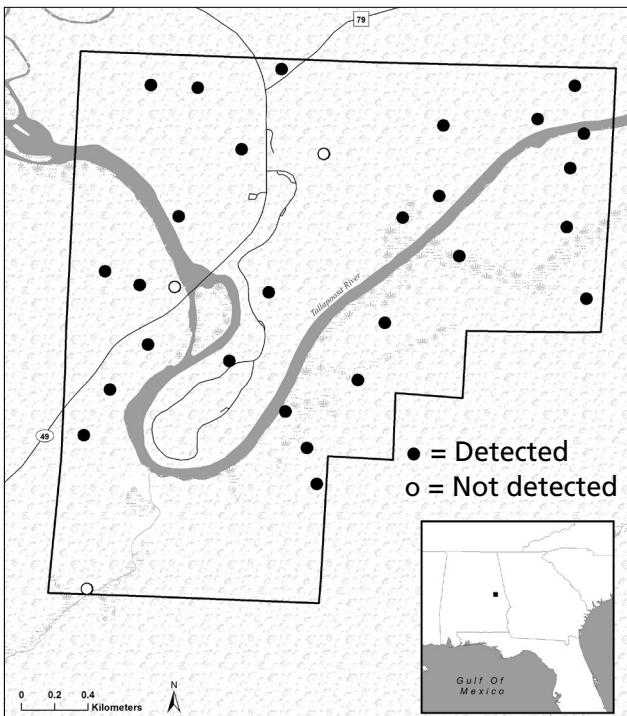


Figure C-47. Sampling locations where tufted titmouse (*Baeolophus bicolor*) was detected at Horseshoe Bend National Military Park, 2012.

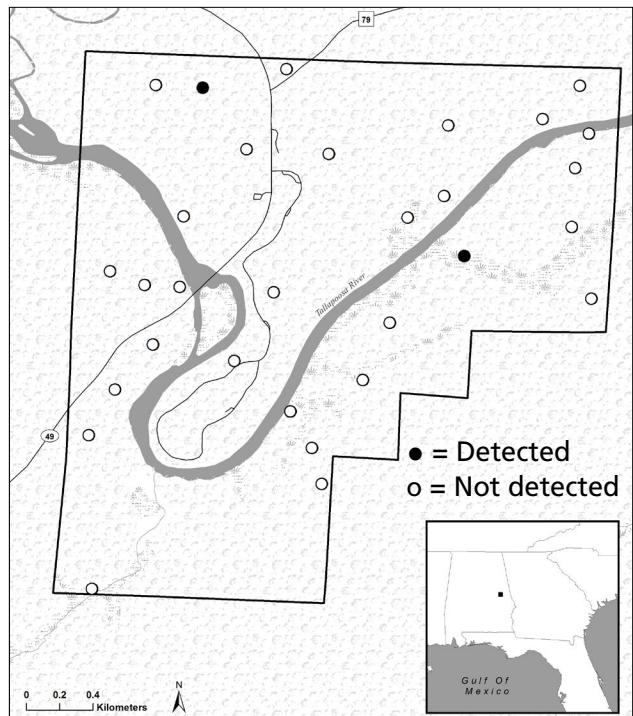


Figure C-48. Sampling locations where white-breasted nuthatch (*Sitta carolinensis*) was detected at Horseshoe Bend National Military Park, 2012.

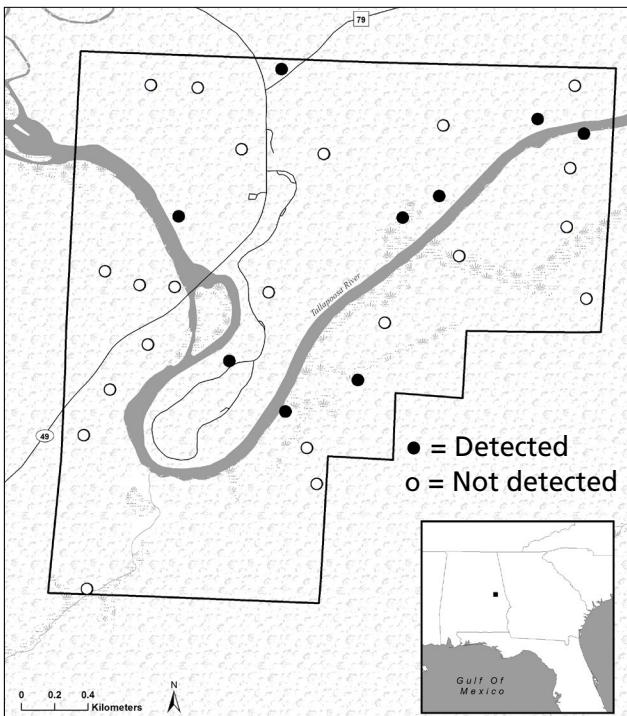


Figure C-49. Sampling locations where white-eyed vireo (*Vireo griseus*) was detected at Horseshoe Bend National Military Park, 2012.

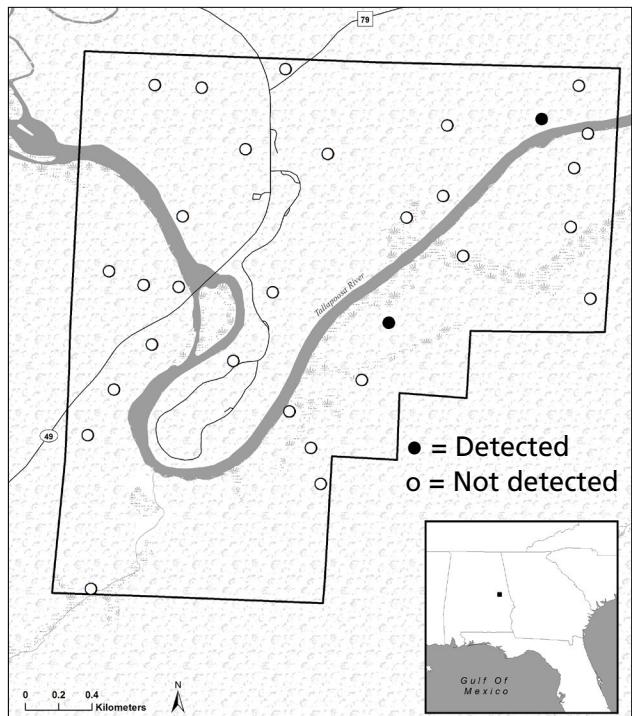


Figure C-50. Sampling locations where wild turkey (*Meleagris gallopavo*) was detected at Horseshoe Bend National Military Park, 2012.

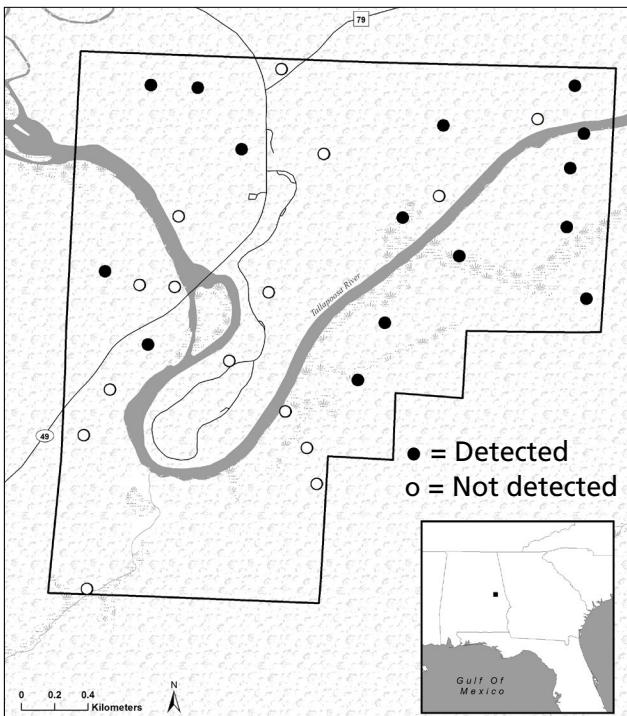


Figure C-51. Sampling locations where wood thrush (*Hylocichla mustelina*) was detected at Horseshoe Bend National Military Park, 2012.

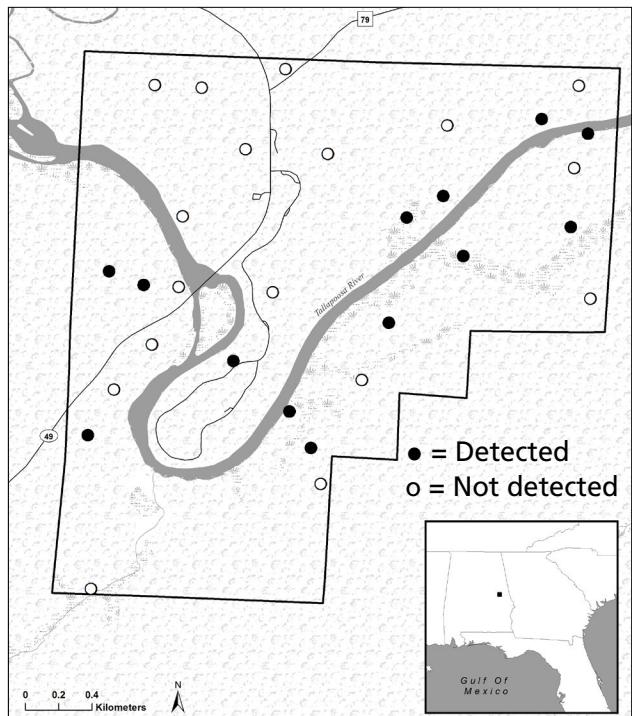


Figure C-52. Sampling locations where yellow-billed cuckoo (*Coccyzus americanus*) was detected at Horseshoe Bend National Military Park, 2012.

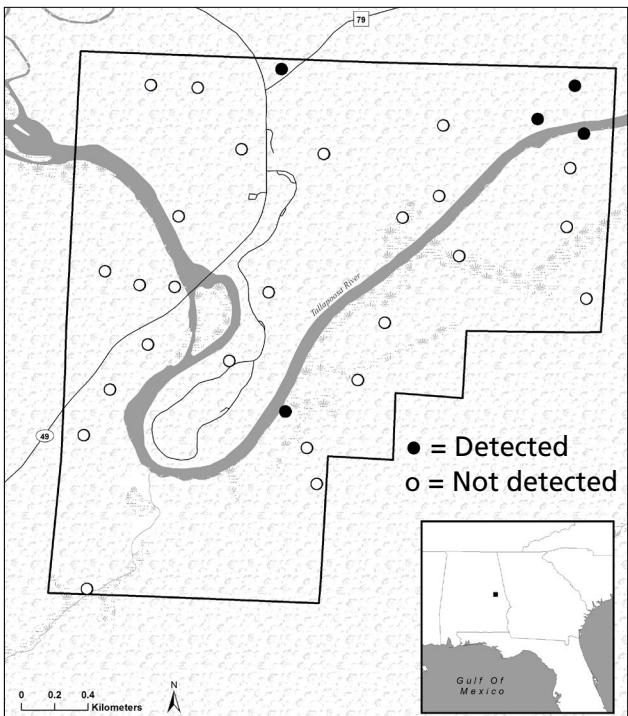


Figure C-53. Sampling locations where yellow-breasted chat (*Icteria virens*) was detected at Horseshoe Bend National Military Park, 2012.

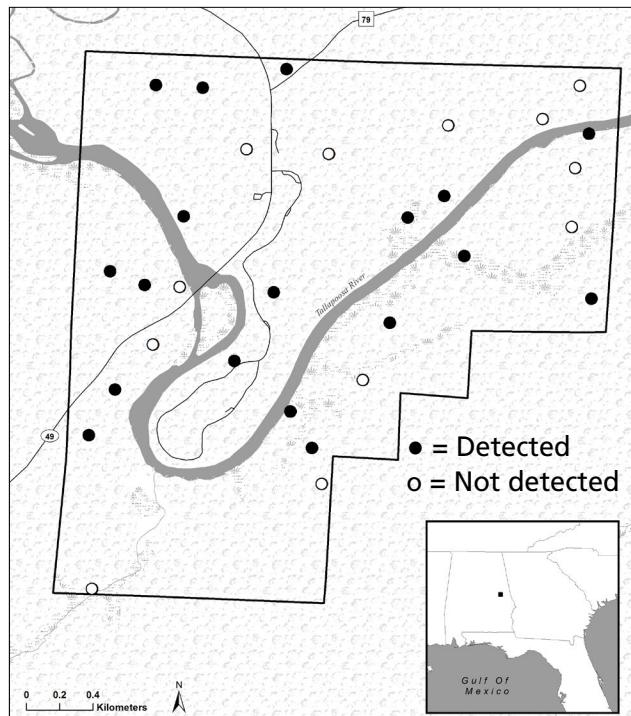


Figure C-54. Sampling locations where yellow-throated vireo (*Vireo flavifrons*) was detected at Horseshoe Bend National Military Park, 2012.

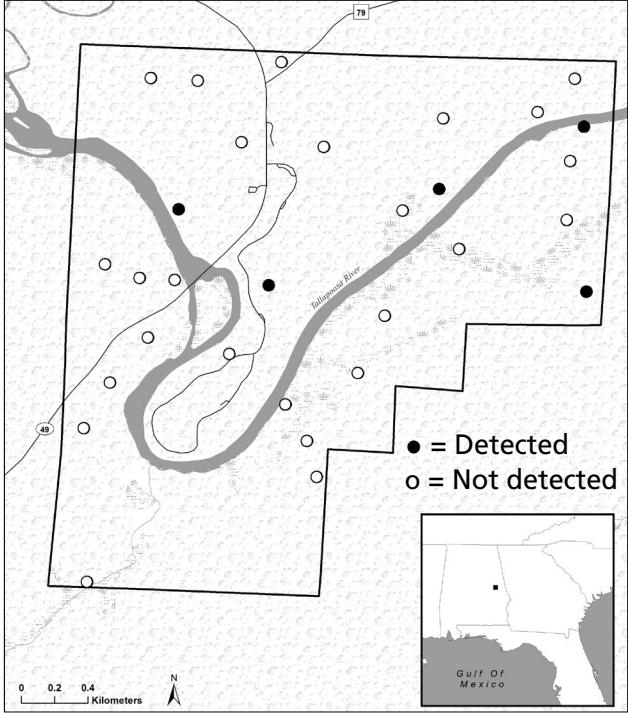


Figure C-55. Sampling locations where yellow-throated warbler (*Dendroica dominica*) was detected at Horseshoe Bend National Military Park, 2012.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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National Park Service
U.S. Department of the Interior



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