



Landbird Community Monitoring at Cumberland Island National Seashore

2012 Data Summary

Natural Resource Data Series NPS/SECN/NRDS—2016/1011



ON THE COVER

Northern parula (*Parula americana*)

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 Cumberland Island National Seashore (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 seashore resources.

This report summarizes data collected during implementation of the SECN landbird community monitoring protocol (Byrne et al. 2014) at Cumberland Island National Seashore in 2012.

1. Automated recording devices collected bird detection/non-detection data (i.e., presence/absence) from 30 out of 31 spatially balanced random locations at the seashore.
2. Approximately 1,700 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. Northern cardinal, Carolina wren, white-eyed vireo, blue-gray gnatcatcher, northern parula, and tufted titmouse were the most frequently occurring and widely distributed species (i.e., occurring at 90% or more of all sampling locations). Yellow-throated warbler, red-bellied woodpecker, and summer tanager were also widely distributed across the seashore, occurring at 80% or more of all sampling locations.
5. One non-native species, house finch, was detected during the sampling effort.
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

Cumberland Island National Seashore (CUIS) is on the Georgia coast between St. Andrews Sound and the mouth of the St. Marys River. At 17.5 miles (28.2 kilometers) long, Cumberland Island is one of the largest and most diverse islands on the Atlantic Coast (Figure 1). Almost half of the seashore's 36,415 total acres (14,737 hectares) is *Spartina* spp.-dominated salt marsh community. These areas also include mud flats and six tidal creeks, which provide the habitat for a diverse assemblage of marine fauna. The terrestrial areas of the seashore consist of Virginia live oak/cabbage palm (*Sabal palmetto*) maritime forests, extensive dune systems, interdunal wetlands, freshwater ponds and wetlands, and mixed-pine/hardwood forests in the northern part of the seashore. The island is known for nesting loggerhead sea turtles (*Caretta caretta*), shorebirds, undeveloped dune fields, maritime forest ecosystems, and historic structures, and hosts 18 federally listed species. Cumberland Island National Seashore was established in 1972 to preserve the scenic, scientific, and historical values of the island as well as to provide public outdoor recreational uses to its visitors. Specified areas of Cumberland Island are also part of the South Atlantic-Carolinian Biosphere Reserve and will be permanently protected in a primitive state. Approximately 4,000 hectares (9,886 acres) of the northern portion of the island are a designated wilderness area. This unspoiled environment, once prevalent on all the barrier islands, provides a unique opportunity to experience the flora and fauna of a natural coastal ecosystem.

Cumberland Island National Seashore has 307 known bird species (Appendix A-1; NPSpecies 2015).

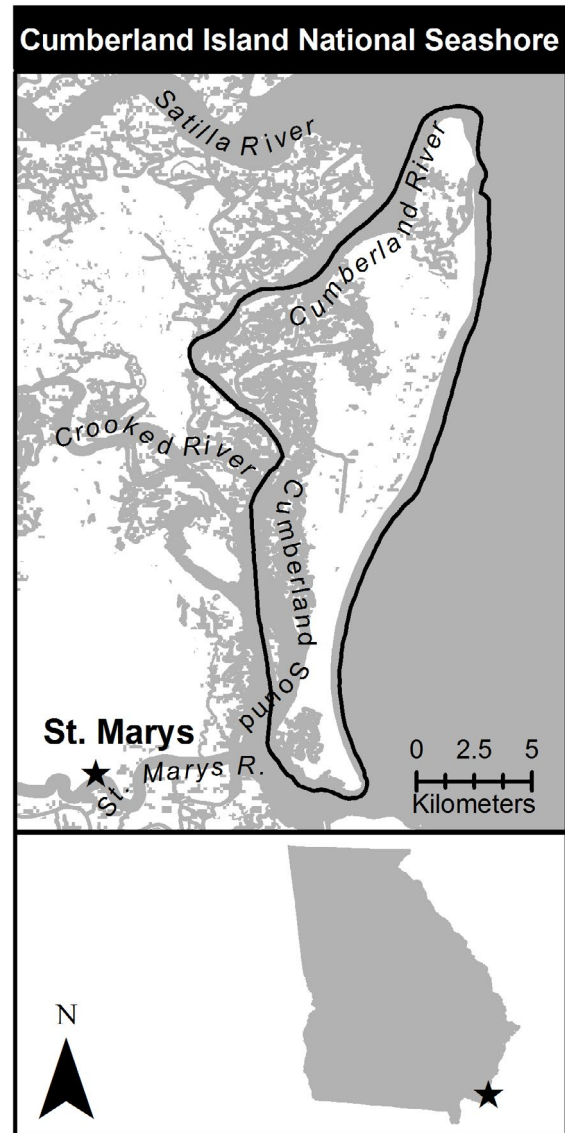


Figure 1. Location of Cumberland Island National Seashore.

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 seashore-wide inference. The sampling frame was divided into a systematic 0.5-hectare grid superimposed over the entire sampling frame (i.e., seashore 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 31 was chosen based on consideration of the seashore size, hypothesized variability, and logistical issues; however, the final sample size was 30.

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 31 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

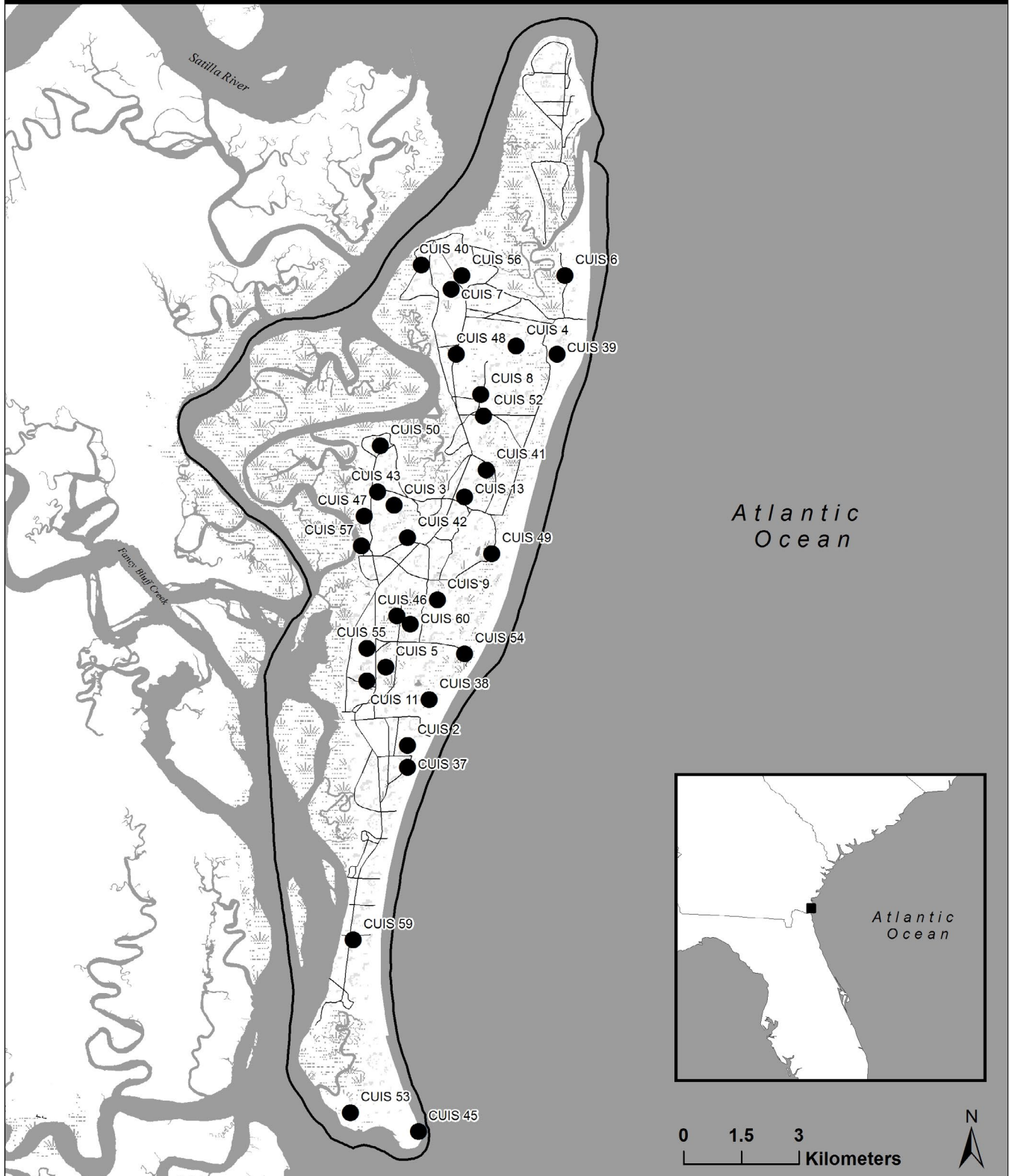


Figure 2. Landbird-community monitoring sampling locations at Cumberland Island National Seashore in 2012.

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 145 recordings from 30 sampling locations were evaluated (1,740 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) Helshe 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, Carolina wren, white-eyed vireo, blue-gray gnatcatcher, northern parula, and tufted titmouse were the most frequently occurring and widely distributed species (i.e., occurring at 90% or more of all sampling locations).

Yellow-throated warbler, red-bellied woodpecker, and summer tanager were also widely distributed across the

seashore, occurring at 80% or more of all sampling locations. Several species were detected at only one sampling location (i.e., uncommon), including black-throated blue warbler, eastern phoebe, fish crow, great blue heron, northern flicker, northern mockingbird, prairie warbler, wild turkey, willet and yellow-billed cuckoo. One non-native species, the house finch, was also detected during the sampling effort (Table 2).

Table 2. Naïve occupancy estimates (i.e., proportion of sampling locations in which a species was detected) for birds at Cumberland Island National Seashore in 2012.

Common Name	Scientific Name	Naïve Occupancy
Northern Cardinal	<i>Cardinalis cardinalis</i>	0.97
Carolina Wren	<i>Thryothorus ludovicianus</i>	0.94
White-eyed Vireo	<i>Vireo griseus</i>	0.94
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	0.90
Northern Parula	<i>Parula americana</i>	0.90
Tufted Titmouse	<i>Baeolophus bicolor</i>	0.90
Yellow-throated Warbler	<i>Dendroica dominica</i>	0.87
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	0.84
Summer Tanager	<i>Piranga rubra</i>	0.81
Carolina Chickadee	<i>Poecile carolinensis</i>	0.77
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	0.74
Downy Woodpecker	<i>Picoides pubescens</i>	0.61
Blue Jay	<i>Cyanocitta cristata</i>	0.58
Pine Warbler	<i>Dendroica pinus</i>	0.52
Yellow-throated Vireo	<i>Vireo flavifrons</i>	0.52
Brown-headed Nuthatch	<i>Sitta pusilla</i>	0.42
Pileated Woodpecker	<i>Dryocopus pileatus</i>	0.42
Red-shouldered Hawk	<i>Buteo lineatus</i>	0.39
Brown-headed Cowbird	<i>Molothrus ater</i>	0.35
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	0.35
Mourning Dove	<i>Zenaida macroura</i>	0.35
Red-eyed Vireo	<i>Vireo olivaceus</i>	0.32
Acadian Flycatcher	<i>Empidonax virescens</i>	0.26
Chimney Swift	<i>Chaetura pelagica</i>	0.23
Brown Thrasher	<i>Toxostoma rufum</i>	0.19
Painted Bunting	<i>Passerina ciris</i>	0.19
Eastern Wood-Pewee	<i>Contopus virens</i>	0.16
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	0.16
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	0.13
American Crow	<i>Corvus brachyrhynchos</i>	0.10
Boat-tailed Grackle	<i>Quiscalus major</i>	0.10
Common Nighthawk	<i>Chordeiles minor</i>	0.10
Common Yellowthroat	<i>Geothlypis trichas</i>	0.10
Eastern Bluebird	<i>Sialia sialis</i>	0.10
Osprey	<i>Pandion haliaetus</i>	0.10

Common Name	Scientific Name	Naïve Occupancy
Yellow-breasted Chat	<i>Icteria virens</i>	0.10
American Goldfinch	<i>Carduelis tristis</i>	0.06
Common Grackle	<i>Quiscalus quiscula</i>	0.06
Green Heron	<i>Butorides virescens</i>	0.06
Hooded Warbler	<i>Wilsonia citrina</i>	0.06
House Finch	<i>Carpodacus mexicanus</i>	0.06
Laughing Gull	<i>Larus atricilla</i>	0.06
Loggerhead Shrike	<i>Lanius ludovicianus</i>	0.06
Purple Martin	<i>Progne subis</i>	0.06
Royal Tern	<i>Sterna maxima</i>	0.06
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	0.03
Eastern Phoebe	<i>Sayornis phoebe</i>	0.03
Fish Crow	<i>Corvus ossifragus</i>	0.03
Great Blue Heron	<i>Ardea herodias</i>	0.03
Northern Flicker	<i>Colaptes auratus</i>	0.03
Northern Mockingbird	<i>Mimus polyglottos</i>	0.03
Prairie Warbler	<i>Dendroica discolor</i>	0.03
Wild Turkey	<i>Meleagris gallopavo</i>	0.03
Willet	<i>Catoptrophorus semipalmatus</i>	0.03
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	0.03

Richness

The native species richness for landbirds at Cumberland Island National Seashore 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 60.31 to 68.69 (Table 3). Observed species richness differs from the estimated true species richness (i.e., all of the richness indices combined) by approximately 14%, suggesting that further surveys would likely improve the estimate of 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, Carolina wren, white-eyed vireo, blue-gray gnatcatcher, northern parula, and tufted titmouse were the most frequently occurring and widely distributed species (i.e., occurring at 90% or more of all sampling locations). Yellow-throated warbler, red-bellied woodpecker, and summer tanager were also widely distributed across the seashore, occurring at 80% or more of all sampling locations. Several species were detected at only one sampling location (i.e., uncommon), including black-throated blue warbler, eastern phoebe, fish crow, great blue heron, northern flicker, northern mockingbird, prairie warbler, wild turkey, willet and yellow-billed cuckoo. Only one non-native species, the house finch, was detected during the sampling effort. Approximately 84% of detected species occurred at 10% or less of all sampling locations.

Table 3. Species richness indices for birds at Cumberland Island National Seashore, 2012.

Index	Symbol	Value	Lower 95% CI	Upper 95% CI	Value Interpretation
Native Spp. Richness	S_{obs}	55.00	55.02	59.98	Number of native species detected; Species richness at the seashore is considered to be moderate
Chao 2	Chao2	62.31	56.86	83.66	Estimated true species richness; Considered to be moderate
Incidence-based Coverage	ICE	64.78	61.02	68.54	Estimated true species richness; Considered to be moderate
Jackknife 1	Jack1	65.63	58.10	73.16	Estimated true species richness; Considered to be moderate
Jackknife 2	Jack2	68.69	65.14	72.24	Estimated true species richness; Considered to be moderate
Bootstrap	Boot	60.31	58.72	61.90	Estimated true species richness; Considered to be moderate

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Appendix A—Species List

Table A-1. Birds known to occur at Cumberland Island National Seashore 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>Accipiter striatus</i>	Sharp-shinned Hawk	X	
Accipitriformes	Accipitridae	<i>Aquila chrysaetos</i>	Golden Eagle	X	
Accipitriformes	Accipitridae	<i>Buteo jamaicensis</i>	Red-tailed Hawk	X	
Accipitriformes	Accipitridae	<i>Buteo lagopus</i>	Rough-legged Hawk	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	Accipitridae	<i>Haliaeetus leucocephalus</i>	Bald Eagle	X	
Accipitriformes	Accipitridae	<i>Ictinia mississippiensis</i>	Mississippi Kite	X	
Accipitriformes	Cathartidae	<i>Cathartes aura</i>	Turkey Vulture	X	
Accipitriformes	Cathartidae	<i>Coragyps atratus</i>	Black Vulture	X	
Accipitriformes	Pandionidae	<i>Pandion haliaetus</i>	Osprey	X	X
Anseriformes	Anatidae	<i>Aix sponsa</i>	Wood Duck	X	
Anseriformes	Anatidae	<i>Anas acuta</i>	Northern Pintail	X	
Anseriformes	Anatidae	<i>Anas americana</i>	American Wigeon	X	
Anseriformes	Anatidae	<i>Anas clypeata</i>	Northern Shoveler	X	
Anseriformes	Anatidae	<i>Anas crecca</i>	Green-winged Teal	X	
Anseriformes	Anatidae	<i>Anas discors</i>	Blue-winged Teal	X	
Anseriformes	Anatidae	<i>Anas fulvigula</i>	Mottled Duck	X	
Anseriformes	Anatidae	<i>Anas penelope</i>	Eurasian Wigeon	X	
Anseriformes	Anatidae	<i>Anas platyrhynchos</i>	Mallard	X	
Anseriformes	Anatidae	<i>Anas rubripes</i>	American Black Duck	X	
Anseriformes	Anatidae	<i>Anas strepera</i>	Gadwall	X	
Anseriformes	Anatidae	<i>Aythya affinis</i>	Lesser Scaup	X	
Anseriformes	Anatidae	<i>Aythya americana</i>	Redhead	X	
Anseriformes	Anatidae	<i>Aythya collaris</i>	Ring-necked Duck	X	
Anseriformes	Anatidae	<i>Aythya marila</i>	Greater Scaup	X	
Anseriformes	Anatidae	<i>Aythya valisineria</i>	Canvasback	X	
Anseriformes	Anatidae	<i>Branta bernicla</i>	Brant	X	
Anseriformes	Anatidae	<i>Branta canadensis</i>	Canada Goose	X	
Anseriformes	Anatidae	<i>Bucephala albeola</i>	Bufflehead	X	
Anseriformes	Anatidae	<i>Bucephala clangula</i>	Common Goldeneye	X	
Anseriformes	Anatidae	<i>Chen caerulescens</i>	Snow Goose	X	
Anseriformes	Anatidae	<i>Cygnus columbianus</i>	Tundra Swan	X	
Anseriformes	Anatidae	<i>Dendrocygna bicolor</i>	Fulvous Whistling-Duck	X	
Anseriformes	Anatidae	<i>Lophodytes cucullatus</i>	Hooded Merganser	X	
Anseriformes	Anatidae	<i>Melanitta fusca</i>	White-winged Scoter	X	
Anseriformes	Anatidae	<i>Melanitta nigra</i>	Black Scoter	X	
Anseriformes	Anatidae	<i>Melanitta perspicillata</i>	Surf Scoter	X	
Anseriformes	Anatidae	<i>Mergus merganser</i>	Common Merganser	X	
Anseriformes	Anatidae	<i>Mergus serrator</i>	Red-breasted Merganser	X	
Anseriformes	Anatidae	<i>Oxyura jamaicensis</i>	Ruddy Duck	X	
Anseriformes	Anatidae	<i>Somateria spectabilis</i>	King Eider	X	

Table A-1 (continued). Birds known to occur at Cumberland Island National Seashore based upon records in NPSpecies (2015) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	ARD 2012
Apodiformes	Apodidae	<i>Chaetura pelagica</i>	Chimney Swift	X	X
Apodiformes	Trochilidae	<i>Archilochus colubris</i>	Ruby-throated Hummingbird	X	
Caprimulgiformes	Caprimulgidae	<i>Caprimulgus carolinensis</i>	Chuck-will's-widow	X	
Caprimulgiformes	Caprimulgidae	<i>Chordeiles minor</i>	Common Nighthawk	X	X
Charadriiformes	Alcidae	<i>Alca torda</i>	Razorbill	X	
Charadriiformes	Alcidae	<i>Alle alle</i>	Dovekie	X	
Charadriiformes	Charadriidae	<i>Charadrius melodus</i>	Piping Plover	X	
Charadriiformes	Charadriidae	<i>Charadrius montanus</i>	Mountain Plover	X	
Charadriiformes	Charadriidae	<i>Charadrius semipalmatus</i>	Semipalmated Plover	X	
Charadriiformes	Charadriidae	<i>Charadrius vociferus</i>	Killdeer	X	
Charadriiformes	Charadriidae	<i>Charadrius wilsonia</i>	Wilson's Plover	X	
Charadriiformes	Charadriidae	<i>Pluvialis dominica</i>	American Golden-Plover	X	
Charadriiformes	Charadriidae	<i>Pluvialis squatarola</i>	Black-bellied Plover	X	
Charadriiformes	Haematopodidae	<i>Haematopus palliatus</i>	American Oystercatcher	X	
Charadriiformes	Laridae	<i>Anous stolidus</i>	Brown Noddy	X	
Charadriiformes	Laridae	<i>Chlidonias niger</i>	Black Tern	X	
Charadriiformes	Laridae	<i>Larus argentatus</i>	Herring Gull	X	
Charadriiformes	Laridae	<i>Larus atricilla</i>	Laughing Gull	X	X
Charadriiformes	Laridae	<i>Larus delawarensis</i>	Ring-billed Gull	X	
Charadriiformes	Laridae	<i>Larus fuscus</i>	Lesser Black-backed Gull	X	
Charadriiformes	Laridae	<i>Larus glaucoides</i>	Iceland Gull	X	
Charadriiformes	Laridae	<i>Larus hyperboreus</i>	Glaucous Gull	X	
Charadriiformes	Laridae	<i>Larus marinus</i>	Great Black-backed Gull	X	
Charadriiformes	Laridae	<i>Larus philadelphia</i>	Bonaparte's Gull	X	
Charadriiformes	Laridae	<i>Rissa tridactyla</i>	Black-legged Kittiwake	X	
Charadriiformes	Laridae	<i>Rynchops niger</i>	Black Skimmer	X	
Charadriiformes	Laridae	<i>Sterna anaethetus</i>	Bridled Tern	X	
Charadriiformes	Laridae	<i>Sterna antillarum</i>	Least Tern	X	
Charadriiformes	Laridae	<i>Sterna caspia</i>	Caspian Tern	X	
Charadriiformes	Laridae	<i>Sterna forsteri</i>	Forster's Tern	X	
Charadriiformes	Laridae	<i>Sterna fuscata</i>	Sooty Tern	X	
Charadriiformes	Laridae	<i>Sterna hirundo</i>	Common Tern	X	
Charadriiformes	Laridae	<i>Sterna maxima</i>	Royal Tern	X	X
Charadriiformes	Laridae	<i>Sterna nilotica</i>	Gull-billed Tern	X	
Charadriiformes	Laridae	<i>Sterna sandvicensis</i>	Sandwich Tern	X	
Charadriiformes	Laridae	<i>Xema sabini</i>	Sabine's Gull	X	
Charadriiformes	Recurvirostridae	<i>Himantopus mexicanus</i>	Black-necked Stilt	X	
Charadriiformes	Recurvirostridae	<i>Recurvirostra americana</i>	American Avocet	X	
Charadriiformes	Scolopacidae	<i>Actitis macularia</i>	Spotted Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Arenaria interpres</i>	Ruddy Turnstone	X	
Charadriiformes	Scolopacidae	<i>Bartramia longicauda</i>	Upland Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Calidris alba</i>	Sanderling	X	
Charadriiformes	Scolopacidae	<i>Calidris alpina</i>	Dunlin	X	
Charadriiformes	Scolopacidae	<i>Calidris bairdii</i>	Baird's Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Calidris canutus</i>	Red Knot	X	

Table A-1 (continued). Birds known to occur at Cumberland Island National Seashore based upon records in NPSpecies (2015) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	ARD 2012
Charadriiformes	Scolopacidae	<i>Calidris fuscicollis</i>	White-rumped Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Calidris himantopus</i>	Stilt Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Calidris maritima</i>	Purple Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Calidris mauri</i>	Western Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Calidris melanotos</i>	Pectoral Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Calidris minutilla</i>	Least Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Calidris pusilla</i>	Semipalmated Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Catoptrophorus semipalmatus</i>	Willet	X	X
Charadriiformes	Scolopacidae	<i>Gallinago gallinago</i>	Common Snipe	X	
Charadriiformes	Scolopacidae	<i>Limnodromus griseus</i>	Short-billed Dowitcher	X	
Charadriiformes	Scolopacidae	<i>Limnodromus scolopaceus</i>	Long-billed Dowitcher	X	
Charadriiformes	Scolopacidae	<i>Limosa fedoa</i>	Marbled Godwit	X	
Charadriiformes	Scolopacidae	<i>Numenius americanus</i>	Long-billed Curlew	X	
Charadriiformes	Scolopacidae	<i>Numenius phaeopus</i>	Whimbrel	X	
Charadriiformes	Scolopacidae	<i>Phalaropus fulicaria</i>	Red Phalarope	X	
Charadriiformes	Scolopacidae	<i>Phalaropus lobatus</i>	Red-necked Phalarope	X	
Charadriiformes	Scolopacidae	<i>Phalaropus tricolor</i>	Wilson's Phalarope	X	
Charadriiformes	Scolopacidae	<i>Scolopax minor</i>	American Woodcock	X	
Charadriiformes	Scolopacidae	<i>Tringa flavipes</i>	Lesser Yellowlegs	X	
Charadriiformes	Scolopacidae	<i>Tringa melanoleuca</i>	Greater Yellowlegs	X	
Charadriiformes	Scolopacidae	<i>Tringa solitaria</i>	Solitary Sandpiper	X	
Charadriiformes	Scolopacidae	<i>Tryngites subruficollis</i>	Buff-breasted Sandpiper	X	
Charadriiformes	Stercorariidae	<i>Stercorarius parasiticus</i>	Parasitic Jaeger	X	
Charadriiformes	Stercorariidae	<i>Stercorarius pomarinus</i>	Pomarine Jaeger	X	
Ciconiiformes	Ciconiidae	<i>Mycteria americana</i>	Wood Stork	X	
Columbiformes	Columbidae	<i>Columbina passerina</i>	Common Ground-Dove	X	
Columbiformes	Columbidae	<i>Streptopelia decaocto</i>	Eurasian Collared-Dove	X	
Columbiformes	Columbidae	<i>Zenaida asiatica</i>	White-winged Dove	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
Cuculiformes	Cuculidae	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo	X	
Falconiformes	Falconidae	<i>Falco columbarius</i>	Merlin	X	
Falconiformes	Falconidae	<i>Falco peregrinus</i>	Peregrine Falcon	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	
Gaviiformes	Gaviidae	<i>Gavia stellata</i>	Red-throated Loon	X	
Gruiformes	Aramidae	<i>Aramus guarauna</i>	Limpkin	X	
Gruiformes	Gruidae	<i>Grus canadensis</i>	Sandhill Crane	X	
Gruiformes	Rallidae	<i>Coturnicops noveboracensis</i>	Yellow Rail	X	
Gruiformes	Rallidae	<i>Fulica americana</i>	American Coot	X	
Gruiformes	Rallidae	<i>Gallinula chloropus</i>	Common Moorhen	X	
Gruiformes	Rallidae	<i>Laterallus jamaicensis</i>	Black Rail	X	

Table A-1 (continued). Birds known to occur at Cumberland Island National Seashore based upon records in NPSpecies (2015) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	ARD 2012
Gruiformes	Rallidae	<i>Porphyryla martinica</i>	Purple Gallinule	X	
Gruiformes	Rallidae	<i>Porzana carolina</i>	Sora	X	
Gruiformes	Rallidae	<i>Rallus elegans</i>	King Rail	X	
Gruiformes	Rallidae	<i>Rallus limicola</i>	Virginia Rail	X	
Gruiformes	Rallidae	<i>Rallus longirostris</i>	Clapper Rail	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	
Passeriformes	Cardinalidae	<i>Passerina ciris</i>	Painted Bunting	X	X
Passeriformes	Cardinalidae	<i>Passerina cyanea</i>	Indigo Bunting	X	
Passeriformes	Certhiidae	<i>Certhia americana</i>	Brown Creeper	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>Aimophila aestivalis</i>	Bachman's Sparrow	X	
Passeriformes	Emberizidae	<i>Ammodramus henslowii</i>	Henslow's Sparrow	X	
Passeriformes	Emberizidae	<i>Ammodramus leconteii</i>	Le Conte's Sparrow	X	
Passeriformes	Emberizidae	<i>Ammodramus maritimus</i>	Seaside Sparrow	X	
Passeriformes	Emberizidae	<i>Ammodramus savannarum</i>	Grasshopper Sparrow	X	
Passeriformes	Emberizidae	<i>Calamospiza melanocorys</i>	Lark Bunting	X	
Passeriformes	Emberizidae	<i>Calcarius lapponicus</i>	Lapland Longspur	X	
Passeriformes	Emberizidae	<i>Chondestes grammacus</i>	Lark Sparrow	X	
Passeriformes	Emberizidae	<i>Junco hyemalis</i>	Dark-eyed Junco	X	
Passeriformes	Emberizidae	<i>Melospiza georgiana</i>	Swamp Sparrow	X	
Passeriformes	Emberizidae	<i>Melospiza lincolni</i>	Lincoln's Sparrow	X	
Passeriformes	Emberizidae	<i>Melospiza melodia</i>	Song Sparrow	X	
Passeriformes	Emberizidae	<i>Passerculus sandwichensis</i>	Savannah Sparrow	X	
Passeriformes	Emberizidae	<i>Passerella iliaca</i>	Fox Sparrow	X	
Passeriformes	Emberizidae	<i>Pipilo erythrophthalmus</i>	Eastern Towhee	X	X
Passeriformes	Emberizidae	<i>Plectrophenax nivalis</i>	Snow Bunting	X	
Passeriformes	Emberizidae	<i>Poecetes gramineus</i>	Vesper Sparrow	X	
Passeriformes	Emberizidae	<i>Spizella pallida</i>	Clay-colored Sparrow	X	
Passeriformes	Emberizidae	<i>Spizella passerina</i>	Chipping Sparrow	X	
Passeriformes	Emberizidae	<i>Spizella pusilla</i>	Field Sparrow	X	
Passeriformes	Emberizidae	<i>Zonotrichia albicollis</i>	White-throated Sparrow	X	
Passeriformes	Emberizidae	<i>Zonotrichia leucophrys</i>	White-crowned 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	X
Passeriformes	Fringillidae	<i>Carpodacus purpureus</i>	Purple Finch	X	
Passeriformes	Fringillidae	<i>Loxia curvirostra</i>	Red Crossbill	X	
Passeriformes	Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow	X	
Passeriformes	Hirundinidae	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow	X	
Passeriformes	Hirundinidae	<i>Progne subis</i>	Purple Martin	X	X
Passeriformes	Hirundinidae	<i>Riparia riparia</i>	Bank Swallow	X	

Table A-1 (continued). Birds known to occur at Cumberland Island National Seashore based upon records in NPSpecies (2015) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	ARD 2012
Passeriformes	Hirundinidae	<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow	X	
Passeriformes	Hirundinidae	<i>Tachycineta bicolor</i>	Tree Swallow	X	
Passeriformes	Icteridae	<i>Agelaius phoeniceus</i>	Red-winged Blackbird	X	X
Passeriformes	Icteridae	<i>Cassidix major</i>	Boat-tailed Grackle	X	X
Passeriformes	Icteridae	<i>Dolichonyx oryzivorus</i>	Bobolink	X	
Passeriformes	Icteridae	<i>Euphagus carolinus</i>	Rusty Blackbird	X	
Passeriformes	Icteridae	<i>Icterus galbula</i>	Baltimore Oriole	X	
Passeriformes	Icteridae	<i>Icterus spurius</i>	Orchard Oriole	X	
Passeriformes	Icteridae	<i>Molothrus ater</i>	Brown-headed Cowbird	X	X
Passeriformes	Icteridae	<i>Quiscalus major</i>	Boat-tailed Grackle	X	X
Passeriformes	Icteridae	<i>Quiscalus quiscula</i>	Common Grackle	X	X
Passeriformes	Icteridae	<i>Sturnella magna</i>	Eastern Meadowlark	X	
Passeriformes	Icteridae	<i>Sturnella neglecta</i>	Western Meadowlark	X	
Passeriformes	Icteridae	<i>Xanthocephalus xanthocephalus</i>	Yellow-headed Blackbird	X	
Passeriformes	Laniidae	<i>Lanius ludovicianus</i>	Loggerhead Shrike	X	X
Passeriformes	Mimidae	<i>Dumetella carolinensis</i>	Gray Catbird	X	
Passeriformes	Mimidae	<i>Mimus polyglottos</i>	Northern Mockingbird	X	X
Passeriformes	Mimidae	<i>Toxostoma rufum</i>	Brown Thrasher	X	X
Passeriformes	Motacillidae	<i>Anthus rubescens</i>	American Pipit	X	
Passeriformes	Motacillidae	<i>Anthus spragueii</i>	Sprague's 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 caerulescens</i>	Black-throated Blue Warbler	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 kirtlandii</i>	Kirtland's 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 petechia</i>	Yellow Warbler	X	
Passeriformes	Parulidae	<i>Dendroica pinus</i>	Pine Warbler	X	X
Passeriformes	Parulidae	<i>Dendroica striata</i>	Blackpoll Warbler	X	
Passeriformes	Parulidae	<i>Dendroica tigrina</i>	Cape May Warbler	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>Helmitheros vermivorus</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>Mniotilta varia</i>	Black-and-white Warbler	X	
Passeriformes	Parulidae	<i>Oporornis agilis</i>	Connecticut Warbler	X	
Passeriformes	Parulidae	<i>Oporornis formosus</i>	Kentucky Warbler	X	
Passeriformes	Parulidae	<i>Parula americana</i>	Northern Parula	X	X

Table A-1 (continued). Birds known to occur at Cumberland Island National Seashore based upon records in NPSpecies (2015) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	ARD 2012
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	
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 chrysoptera</i>	Golden-winged Warbler	X	
Passeriformes	Parulidae	<i>Vermivora peregrina</i>	Tennessee Warbler	X	
Passeriformes	Parulidae	<i>Vermivora pinus</i>	Blue-winged Warbler	X	
Passeriformes	Parulidae	<i>Vermivora ruficapilla</i>	Nashville Warbler	X	
Passeriformes	Parulidae	<i>Wilsonia canadensis</i>	Canada Warbler	X	
Passeriformes	Parulidae	<i>Wilsonia citrina</i>	Hooded Warbler	X	X
Passeriformes	Parulidae	<i>Wilsonia pusilla</i>	Wilson's Warbler	X	
Passeriformes	Passeridae	<i>Passer domesticus</i>	House Sparrow	X	
Passeriformes	Poliophtilidae	<i>Poliophtila 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 canadensis</i>	Red-breasted Nuthatch	X	
Passeriformes	Sittidae	<i>Sitta carolinensis</i>	White-breasted Nuthatch	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	
Passeriformes	Thraupidae	<i>Piranga rubra</i>	Summer Tanager	X	X
Passeriformes	Troglodytidae	<i>Cistothorus palustris</i>	Marsh Wren	X	
Passeriformes	Troglodytidae	<i>Cistothorus platensis</i>	Sedge Wren	X	
Passeriformes	Troglodytidae	<i>Thryomanes bewickii</i>	Bewick's Wren	X	
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>Catharus minimus</i>	Gray-cheeked Thrush	X	
Passeriformes	Turdidae	<i>Catharus ustulatus</i>	Swainson's Thrush	X	
Passeriformes	Turdidae	<i>Hylocichla mustelina</i>	Wood Thrush	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 flaviventris</i>	Yellow-bellied Flycatcher	X	
Passeriformes	Tyrannidae	<i>Empidonax minimus</i>	Least Flycatcher	X	
Passeriformes	Tyrannidae	<i>Empidonax traillii</i>	Willow 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>Pyrocephalus rubinus</i>	Vermilion Flycatcher	X	
Passeriformes	Tyrannidae	<i>Sayornis phoebe</i>	Eastern Phoebe	X	X
Passeriformes	Tyrannidae	<i>Tyrannus dominicensis</i>	Gray Kingbird	X	

Table A-1 (continued). Birds known to occur at Cumberland Island National Seashore based upon records in NPSpecies (2015) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	ARD 2012
Passeriformes	Tyrannidae	<i>Tyrannus tyrannus</i>	Eastern Kingbird	X	
Passeriformes	Tyrannidae	<i>Tyrannus verticalis</i>	Western 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 philadelphicus</i>	Philadelphia 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>Botaurus lentiginosus</i>	American Bittern	X	
Pelecaniformes	Ardeidae	<i>Bubulcus ibis</i>	Cattle Egret	X	
Pelecaniformes	Ardeidae	<i>Butorides virescens</i>	Green Heron	X	X
Pelecaniformes	Ardeidae	<i>Egretta caerulea</i>	Little Blue Heron	X	
Pelecaniformes	Ardeidae	<i>Egretta rufescens</i>	Reddish Egret	X	
Pelecaniformes	Ardeidae	<i>Egretta thula</i>	Snowy Egret	X	
Pelecaniformes	Ardeidae	<i>Egretta tricolor</i>	Tricolored Heron	X	
Pelecaniformes	Ardeidae	<i>Ixobrychus exilis</i>	Least Bittern	X	
Pelecaniformes	Ardeidae	<i>Nyctanassa violacea</i>	Yellow-crowned Night-Heron	X	
Pelecaniformes	Ardeidae	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	X	
Pelecaniformes	Pelecanidae	<i>Pelecanus erythrorhynchos</i>	American White Pelican	X	
Pelecaniformes	Pelecanidae	<i>Pelecanus occidentalis</i>	Brown Pelican	X	
Pelecaniformes	Threskiornithidae	<i>Ajaia ajaja</i>	Roseate Spoonbill	X	
Pelecaniformes	Threskiornithidae	<i>Eudocimus albus</i>	White Ibis	X	
Pelecaniformes	Threskiornithidae	<i>Plegadis falcinellus</i>	Glossy Ibis	X	
Phaethontiformes	Phaethontidae	<i>Phaethon lepturus</i>	White-tailed Tropicbird	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 borealis</i>	Red-cockaded Woodpecker	X	
Piciformes	Picidae	<i>Picoides pubescens</i>	Downy Woodpecker	X	X
Piciformes	Picidae	<i>Picoides villosus</i>	Hairy Woodpecker	X	
Piciformes	Picidae	<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	X	
Podicipediformes	Podicipedidae	<i>Podiceps auritus</i>	Horned Grebe	X	
Podicipediformes	Podicipedidae	<i>Podiceps grisegena</i>	Red-necked Grebe	X	
Podicipediformes	Podicipedidae	<i>Podilymbus podiceps</i>	Pied-billed Grebe	X	
Procellariiformes	Hydrobatidae	<i>Oceanites oceanicus</i>	Wilson's Storm-Petrel	X	
Procellariiformes	Procellariidae	<i>Calonectris diomedea</i>	Cory's Shearwater	X	
Procellariiformes	Procellariidae	<i>Puffinus griseus</i>	Sooty Shearwater	X	
Procellariiformes	Procellariidae	<i>Puffinus lherminieri</i>	Audubon's Shearwater	X	
Strigiformes	Strigidae	<i>Aegolius acadicus</i>	Northern Saw-whet Owl	X	
Strigiformes	Strigidae	<i>Asio flammeus</i>	Short-eared Owl	X	
Strigiformes	Strigidae	<i>Asio otus</i>	Long-eared Owl	X	
Strigiformes	Strigidae	<i>Athene cunicularia</i>	Burrowing Owl	X	
Strigiformes	Strigidae	<i>Bubo scandiacus</i>	Snowy Owl	X	

Table A-1 (continued). Birds known to occur at Cumberland Island National Seashore based upon records in NPSpecies (2015) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	ARD 2012
Strigiformes	Strigidae	<i>Bubo virginianus</i>	Great Horned Owl	X	
Strigiformes	Strigidae	<i>Strix varia</i>	Barred Owl	X	
Strigiformes	Tytonidae	<i>Tyto alba</i>	Barn Owl	X	
Suliformes	Anhingidae	<i>Anhinga anhinga</i>	Anhinga	X	
Suliformes	Fregatidae	<i>Fregata magnificens</i>	Magnificent Frigatebird	X	
Suliformes	Phalacrocoracidae	<i>Phalacrocorax auritus</i>	Double-crested Cormorant	X	
Suliformes	Phalacrocoracidae	<i>Phalacrocorax carbo</i>	Great Cormorant	X	
Suliformes	Sulidae	<i>Morus bassanus</i>	Northern Gannet	X	

Appendix B—Species Detection Matrix

Table B-1. Species detected at each sampling location at Cumberland Island National Seashore in 2012. Refer to Figure 2 for labeled sampling locations.

Species	02	03	04	05	06	07	09	11	13	37	38	39	40	41	42	43	45	46	47	48	49	50	52	53	54	55	56	57	59	60
Acadian Flycatcher		X		X				X	X				X	X		X										X				
American Crow	X		X									X																		
American Goldfinch						X																							X	
Black-throated Blue Warbler																X														
Blue Jay			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	X	X	X
Boat-tailed Grackle													X					X										X		
Brown Thrasher	X											X					X		X				X	X						
Brown-headed Cowbird					X				X		X	X					X		X					X	X		X	X	X	
Brown-headed Nuthatch	X	X		X	X			X	X			X			X	X			X	X							X	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
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	X	X	X
Chimney Swift	X					X						X	X			X												X	X	
Common Grackle																		X			X									
Common Nighthawk					X							X					X													
Common Yellowthroat																		X		X								X		
Downy Woodpecker	X	X			X	X		X	X				X	X	X	X		X	X		X	X	X	X	X	X	X		X	
Eastern Bluebird						X															X							X		
Eastern Phoebe																													X	
Eastern Towhee		X	X	X	X			X				X					X			X					X	X		X		
Eastern Wood-Pewee		X						X								X			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	X	X	X
Green Heron					X													X												
Hooded Warbler			X				X																							
House Finch																									X			X		
Laughing Gull																X	X													
Loggerhead Shrike													X																	X
Mourning Dove	X					X		X			X	X						X	X			X		X		X			X	

[illegible]

Appendix C—Species Distribution Maps

Ordered alphabetically by common name

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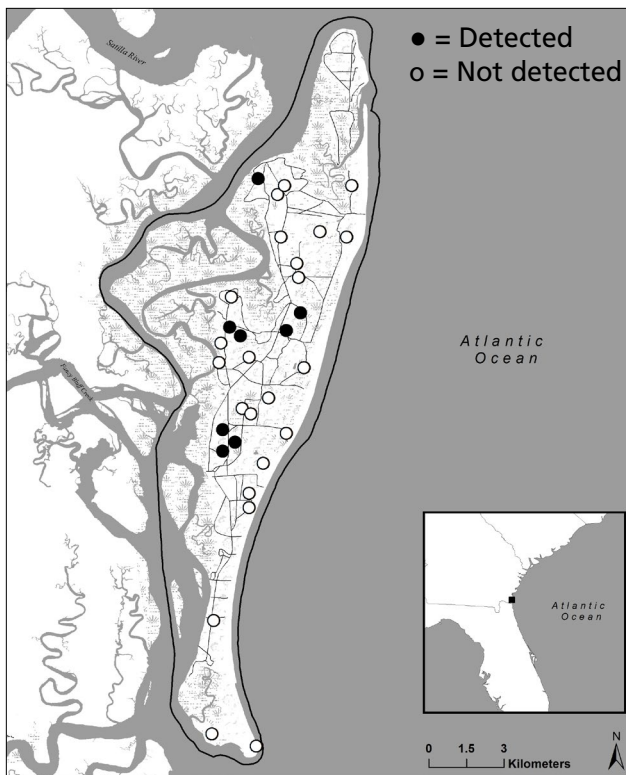


Figure C-1. Sampling locations where Acadian flycatcher (*Empidonax vireescens*) was detected at Cumberland Island National Seashore, 2012.

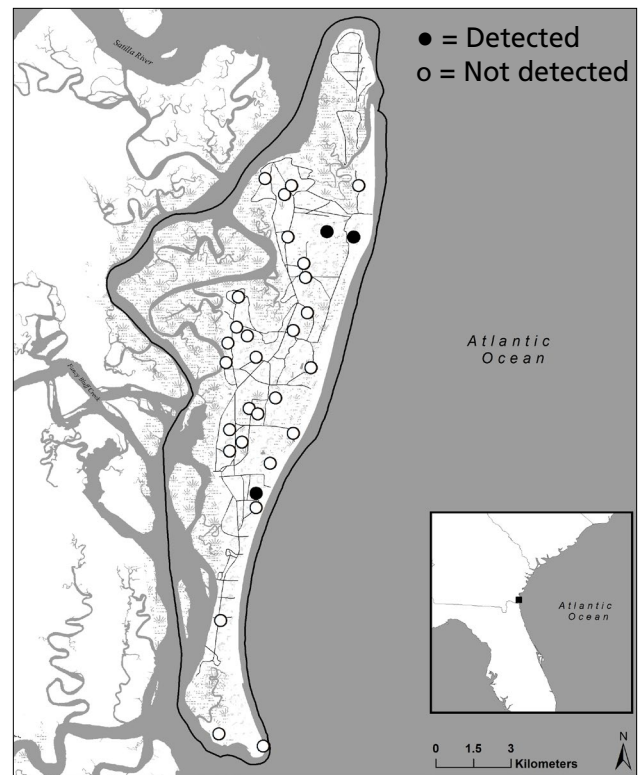


Figure C-2. Sampling locations where American crow (*Corvus brachyrhynchos*) was detected at Cumberland Island National Seashore, 2012.

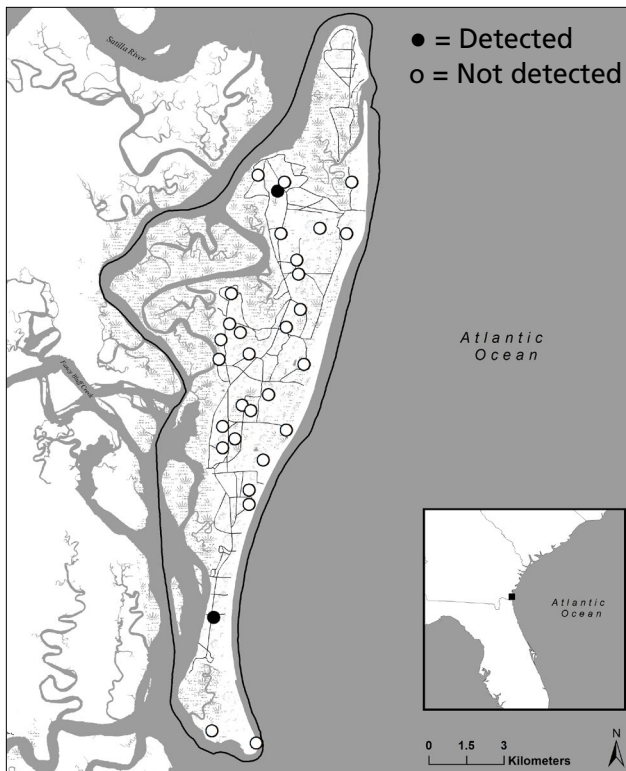


Figure C-3. Sampling locations where American goldfinch (*Carduelis tristis*) was detected at Cumberland Island National Seashore, 2012.

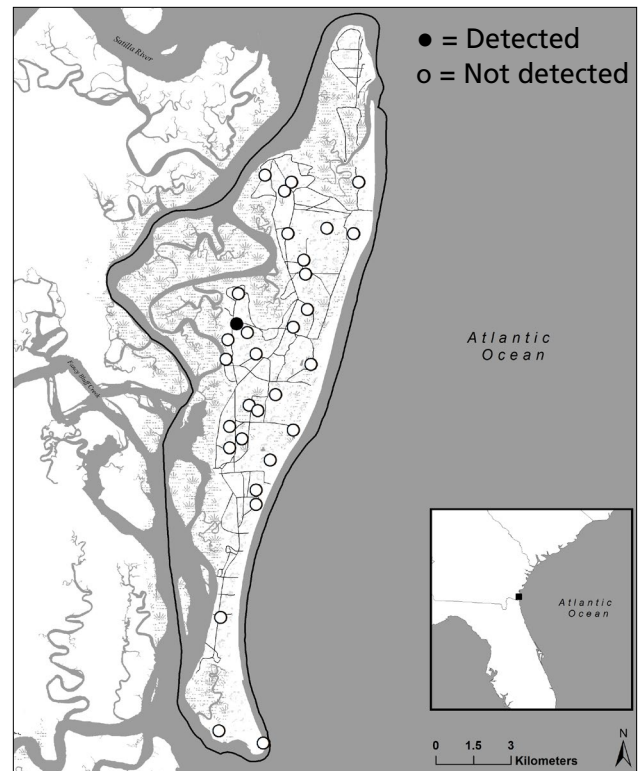


Figure C-4. Sampling locations where black-throated blue warbler (*Dendroica caerulescens*) was detected at Cumberland Island National Seashore, 2012.

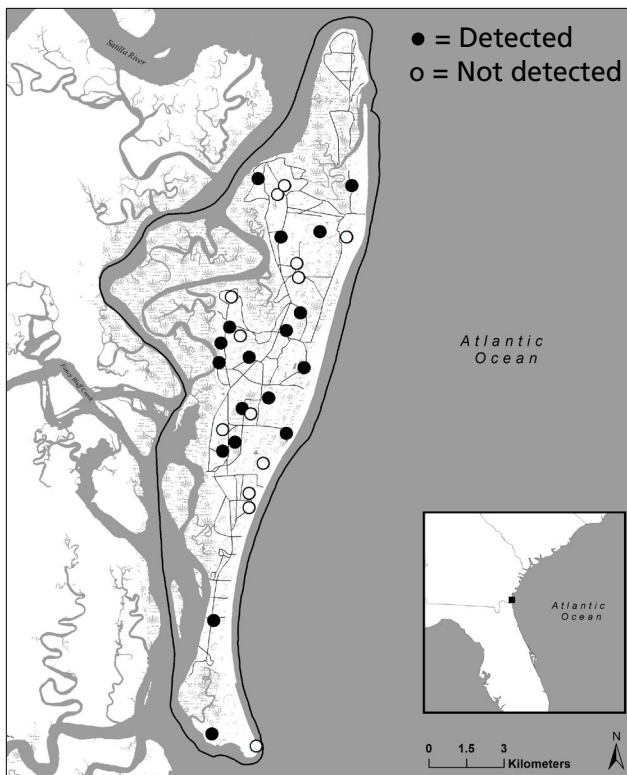


Figure C-5. Sampling locations where blue jay (*Cyanocitta cristata*) was detected at Cumberland Island National Seashore, 2012.

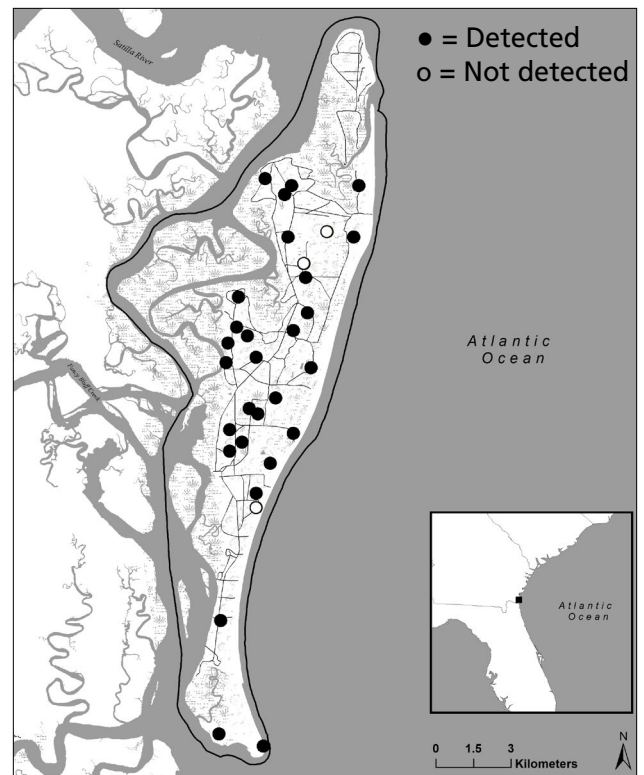


Figure C-6. Sampling locations where blue-gray gnatcatcher (*Polioptila caerulea*) was detected at Cumberland Island National Seashore, 2012.

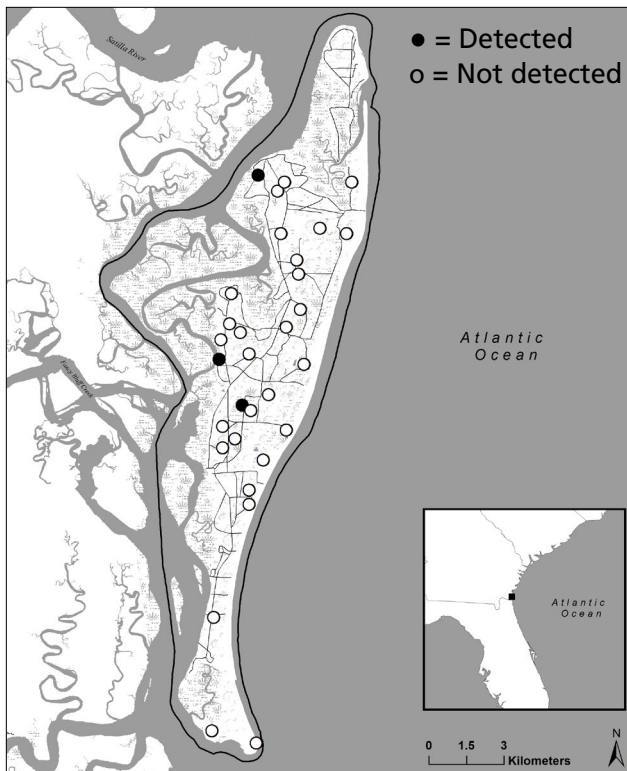


Figure C-7. Sampling locations where boat-tailed grackle (*Quiscalus major*) was detected at Cumberland Island National Seashore, 2012.

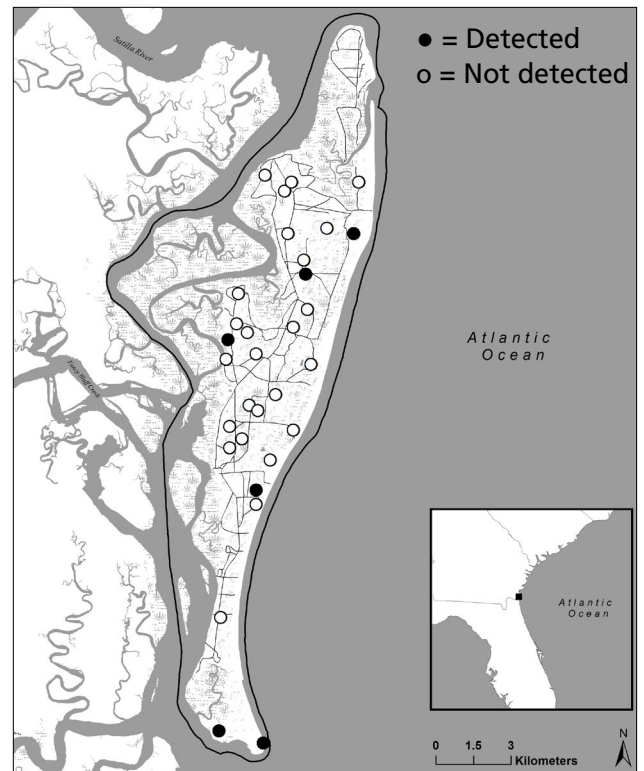


Figure C-8. Sampling locations where brown thrasher (*Toxostoma rufum*) was detected at Cumberland Island National Seashore, 2012.

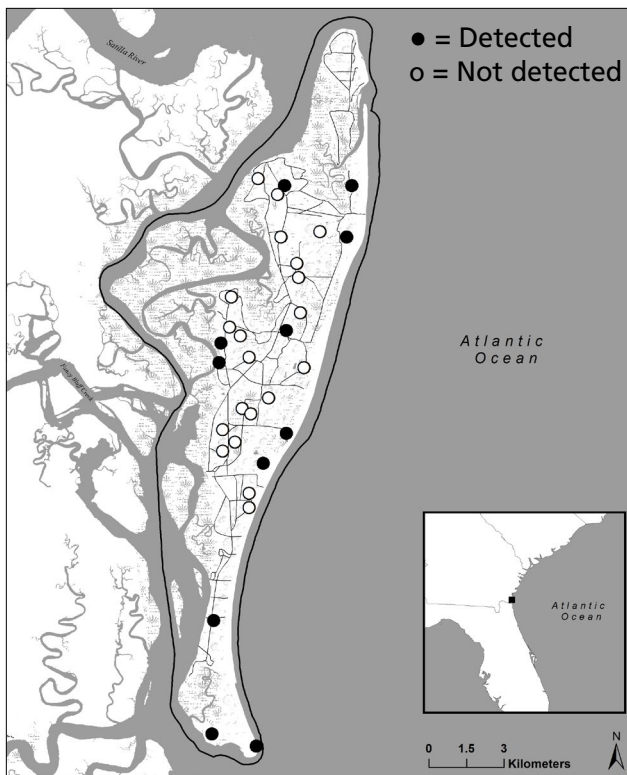


Figure C-9. Sampling locations where brown-headed cowbird (*Molothrus ater*) was detected at Cumberland Island National Seashore, 2012.

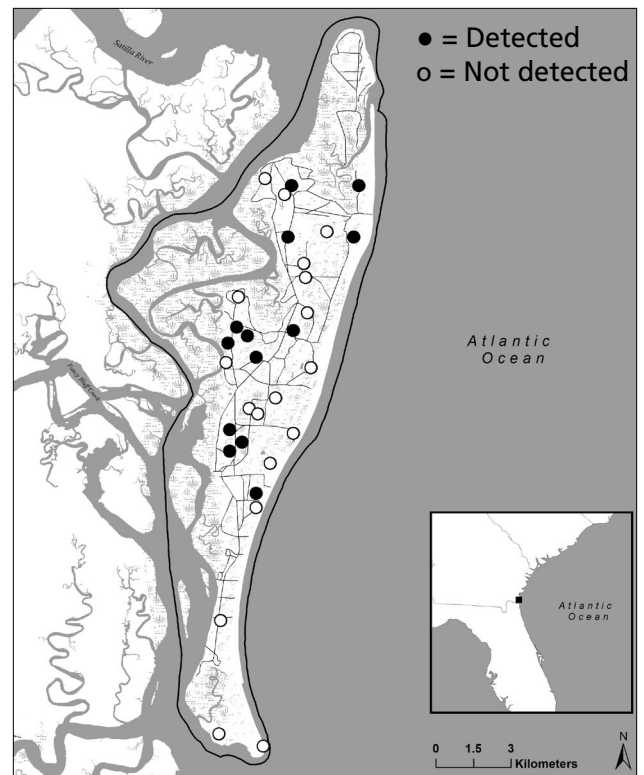


Figure C-10. Sampling locations where brown-headed nuthatch (*Sitta pusilla*) was detected at Cumberland Island National Seashore, 2012.

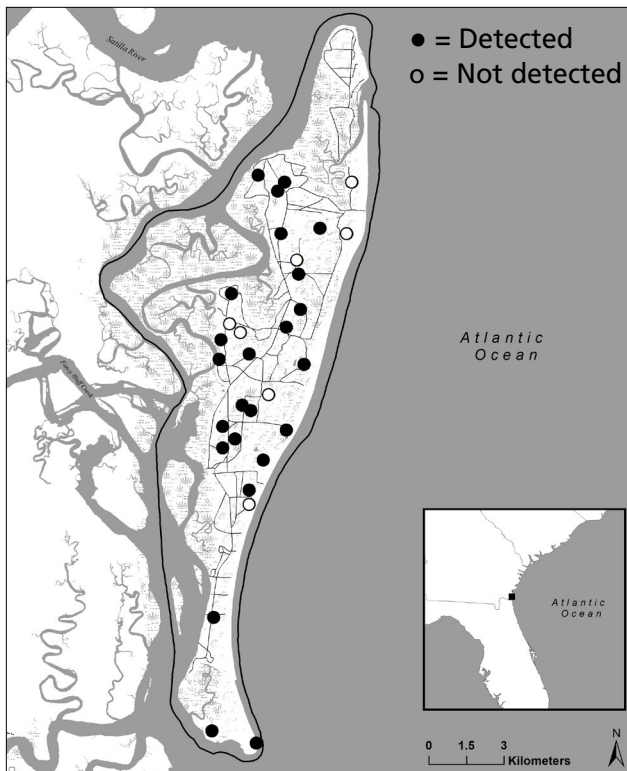


Figure C-11. Sampling locations where Carolina chickadee (*Poecile carolinensis*) was detected at Cumberland Island National Seashore, 2012.

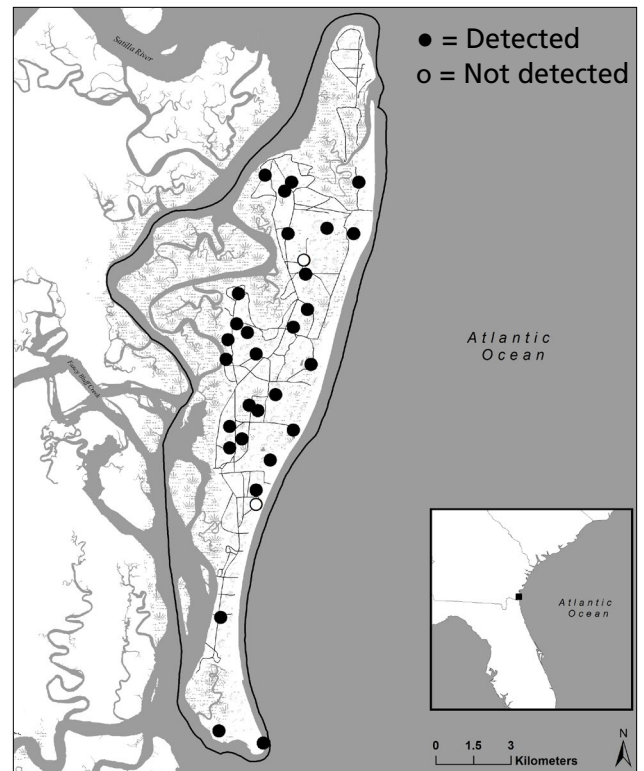


Figure C-12. Sampling locations where Carolina wren (*Thryothorus ludovicianus*) was detected at Cumberland Island National Seashore, 2012.

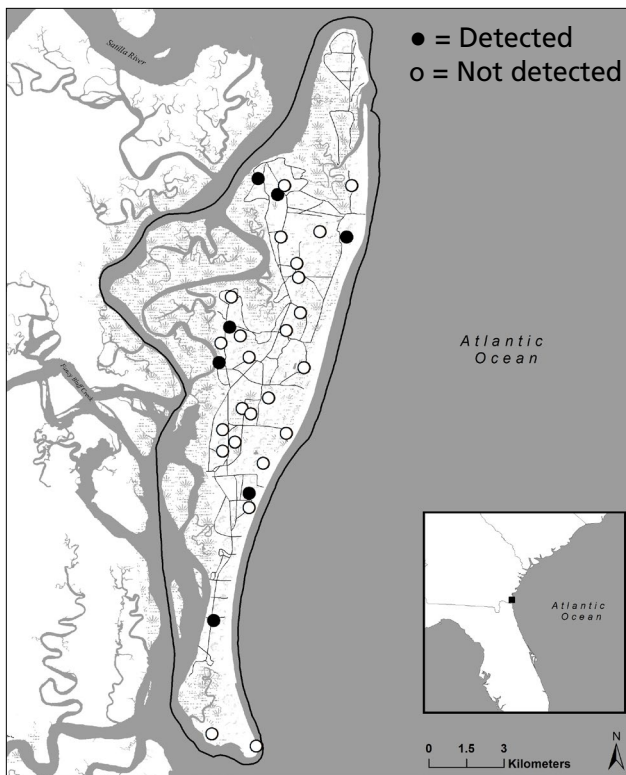


Figure C-13. Sampling locations where chimney swift (*Chaetura pelagica*) was detected at Cumberland Island National Seashore, 2012.

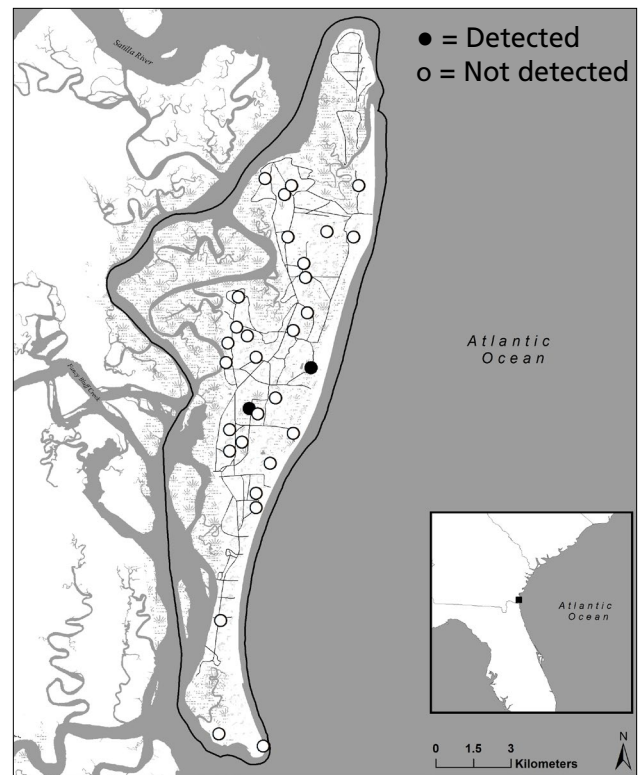


Figure C-14. Sampling locations where common grackle (*Quiscalus quiscula*) was detected at Cumberland Island National Seashore, 2012.

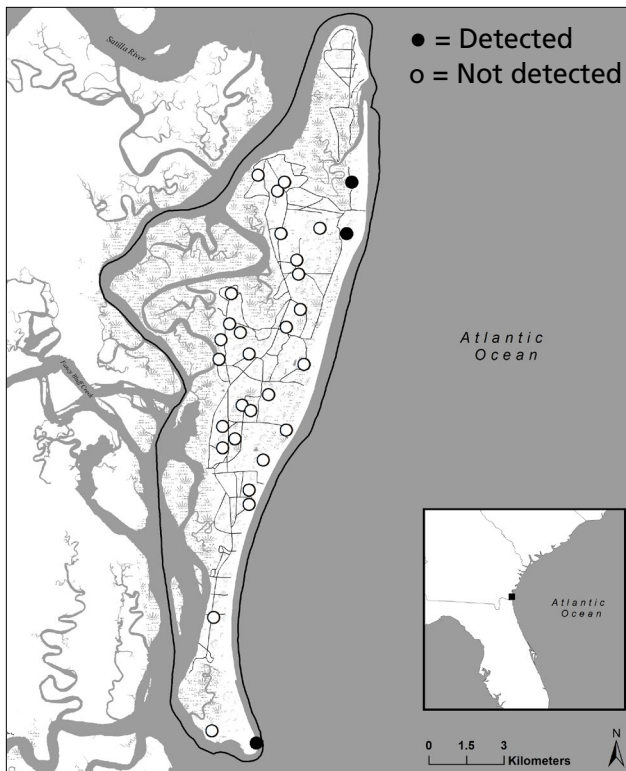


Figure C-15. Sampling locations where common nighthawk (*Chordeiles minor*) was detected at Cumberland Island National Seashore, 2012.

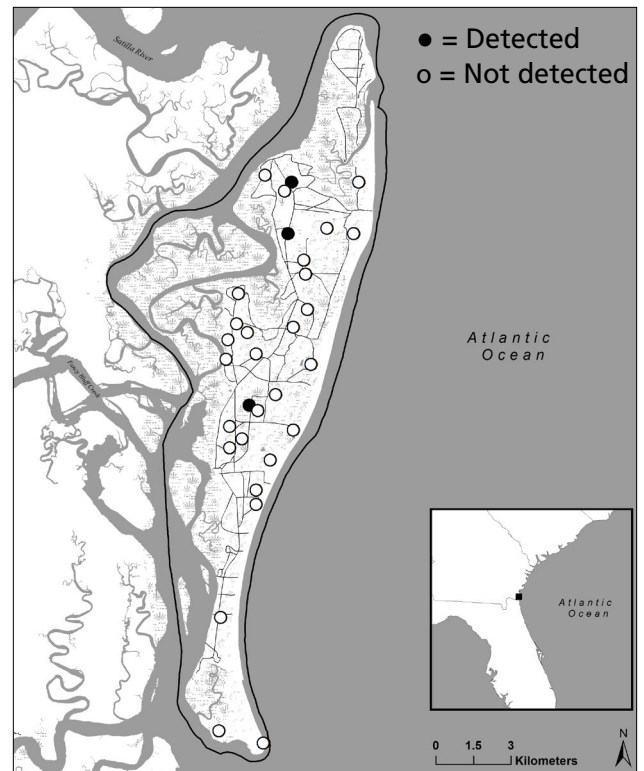


Figure C-16. Sampling locations where common yellowthroat (*Geothlypis trichas*) was detected at Cumberland Island National Seashore, 2012.

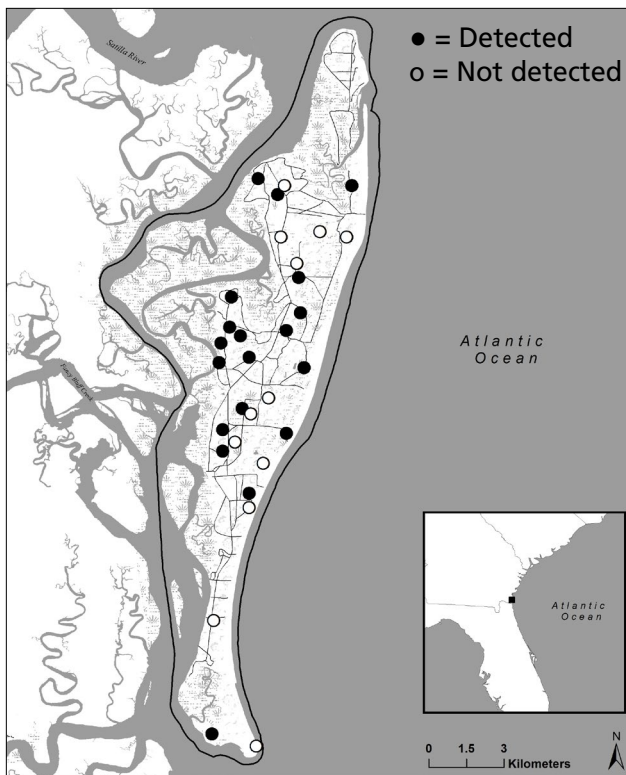


Figure C-17. Sampling locations where downy woodpecker (*Picoides pubescens*) was detected at Cumberland Island National Seashore, 2012.

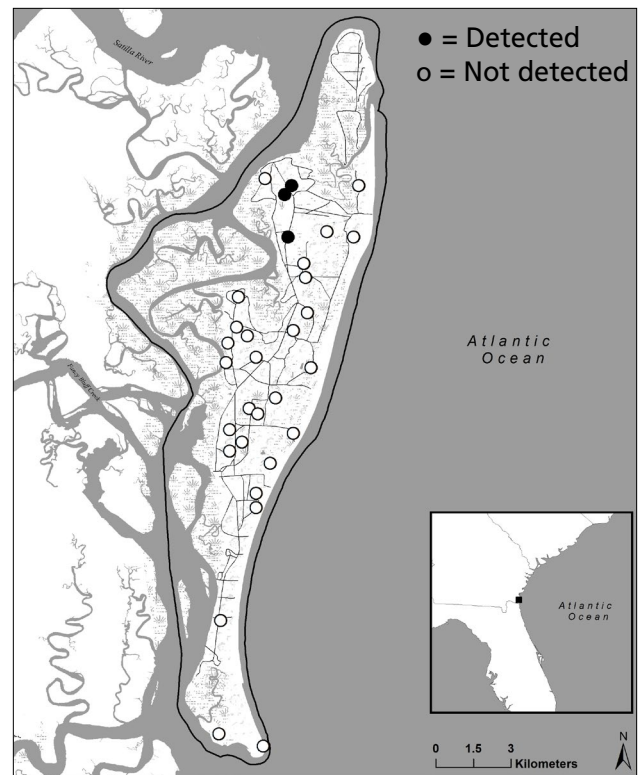


Figure C-18. Sampling locations where eastern bluebird (*Sialia sialis*) was detected at Cumberland Island National Seashore, 2012.

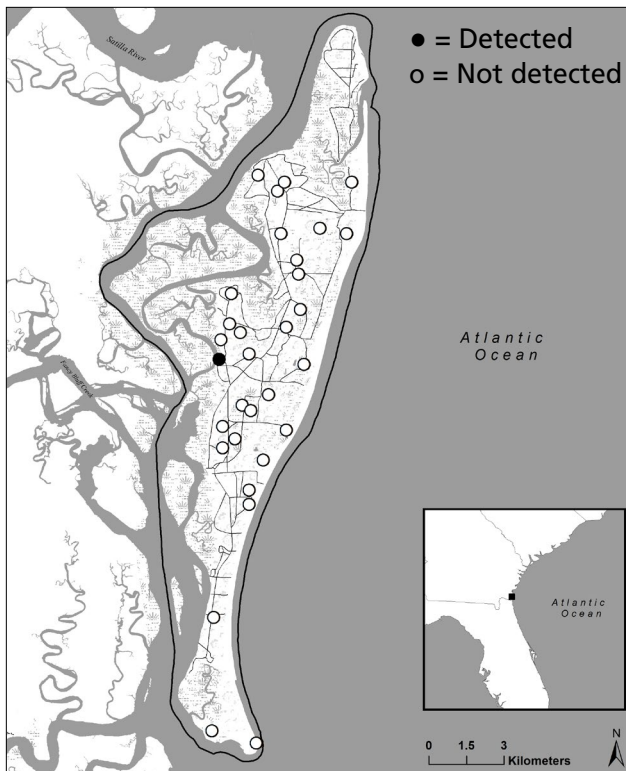


Figure C-19. Sampling locations where eastern phoebe (*Sayornis phoebe*) was detected at Cumberland Island National Seashore, 2012.

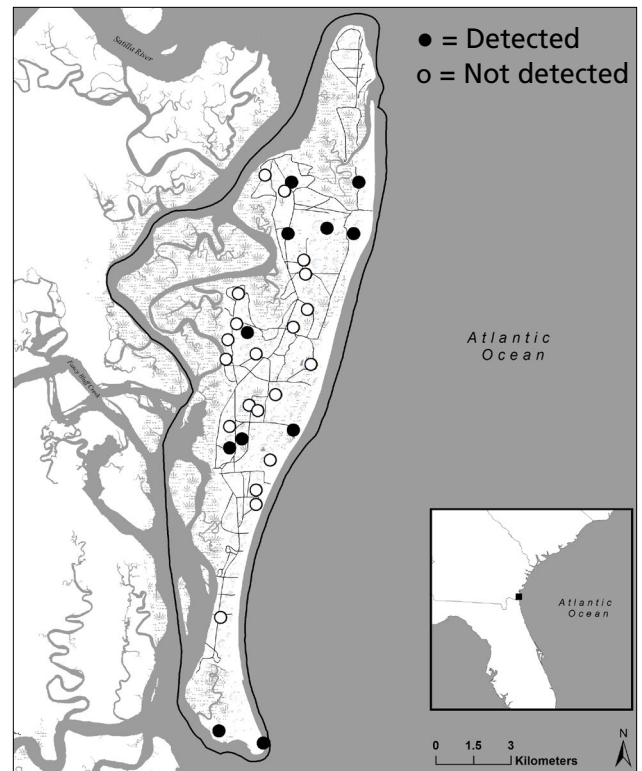


Figure C-20. Sampling locations where eastern towhee (*Pipilo erythrophthalmus*) was detected at Cumberland Island National Seashore, 2012.

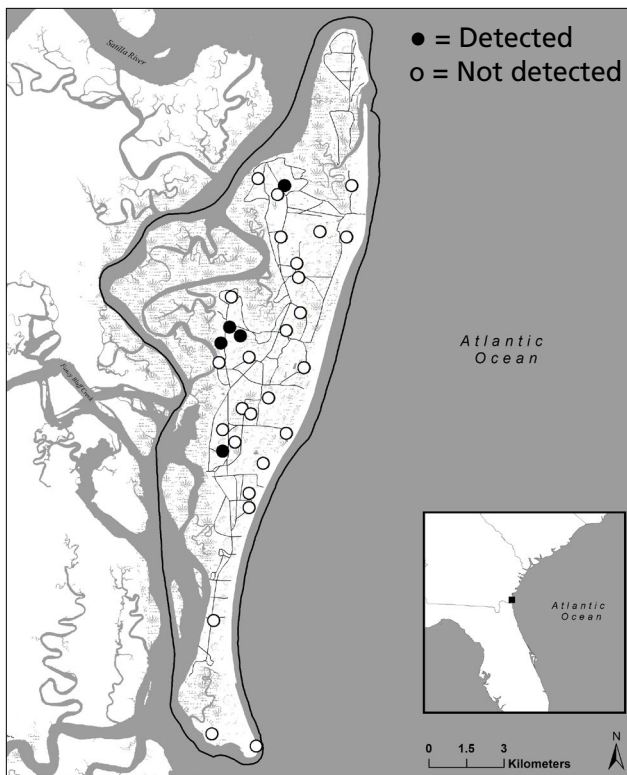


Figure C-21. Sampling locations where eastern wood-pewee (*Contopus virens*) was detected at Cumberland Island National Seashore, 2012.

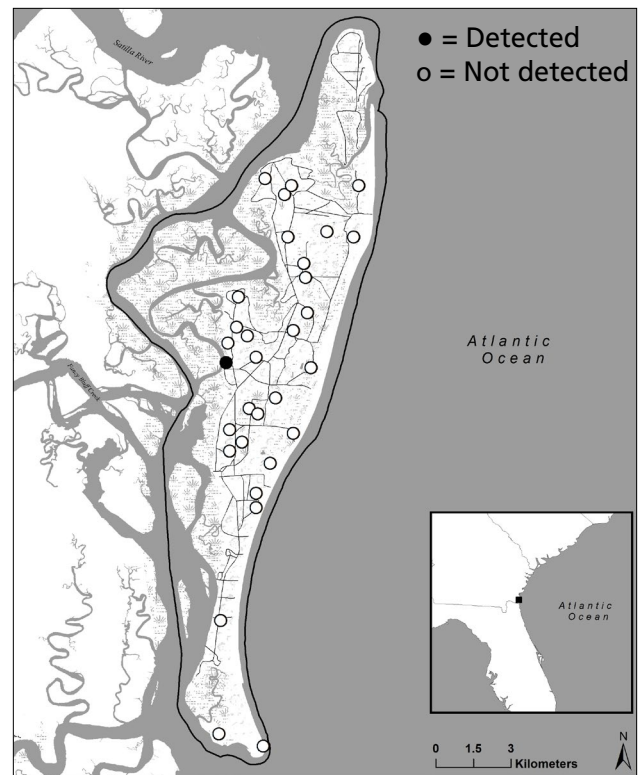


Figure C-22. Sampling locations where fish crow (*Corvus ossifragus*) was detected at Cumberland Island National Seashore, 2012.

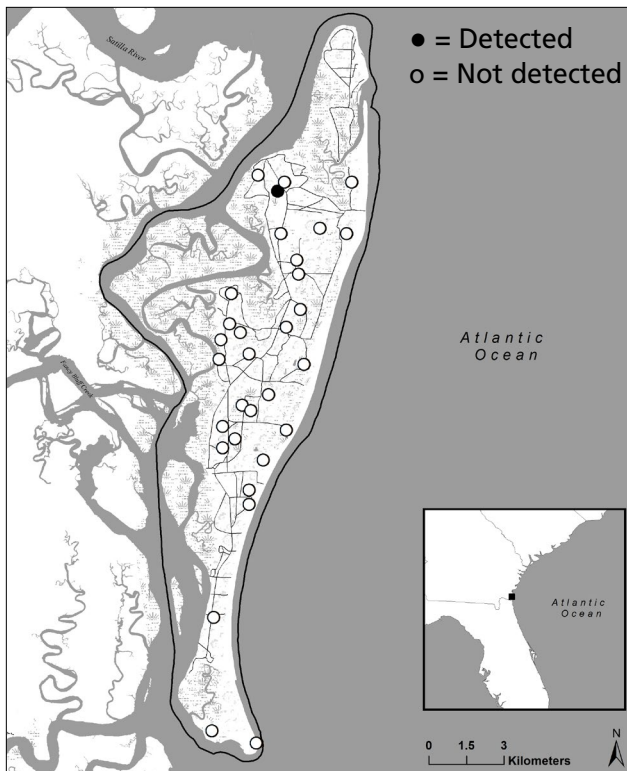


Figure C-23. Sampling locations where great blue heron (*Ardea herodias*) was detected at Cumberland Island National Seashore, 2012.

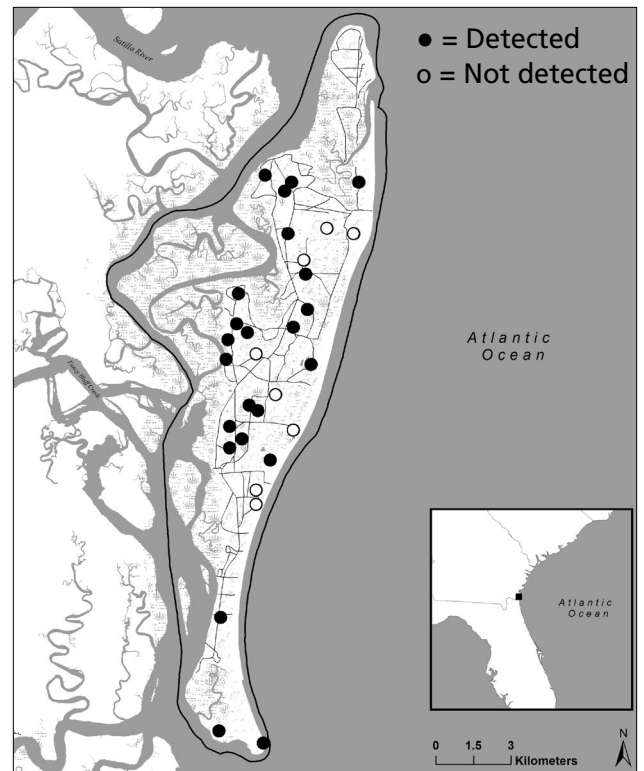


Figure C-24. Sampling locations where great crested flycatcher (*Myiarchus crinitus*) was detected at Cumberland Island National Seashore, 2012.

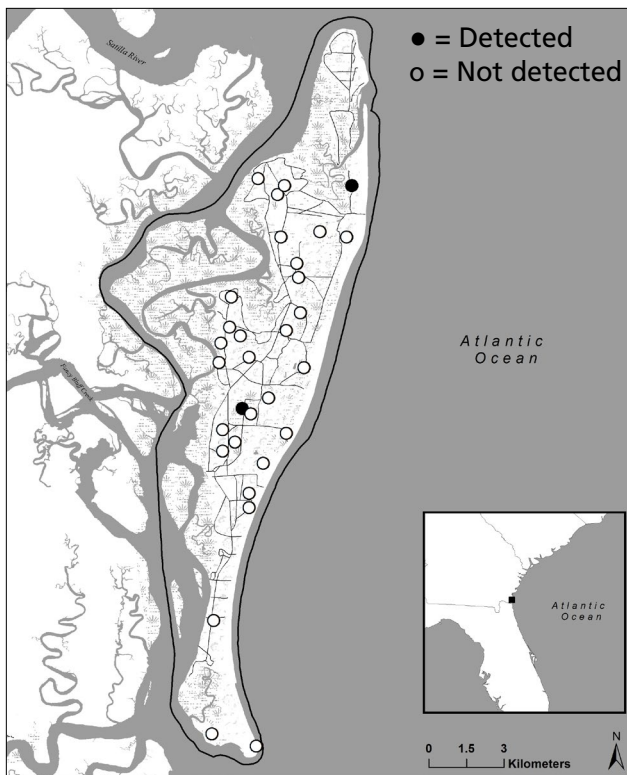


Figure C-25 Sampling locations where green heron (*Butorides virescens*) was detected at Cumberland Island National Seashore, 2012.

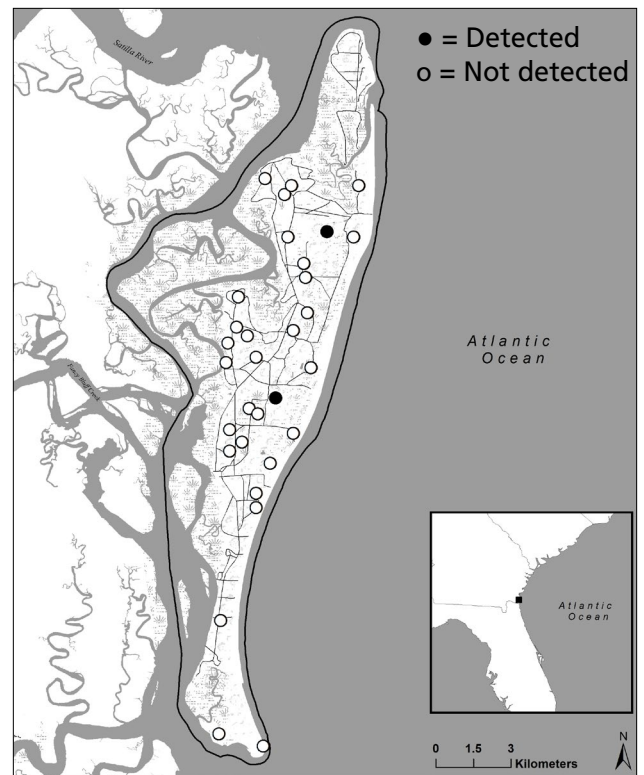


Figure C-26. Sampling locations where hooded warbler (*Wilsonia citrina*) was detected at Cumberland Island National Seashore, 2012.

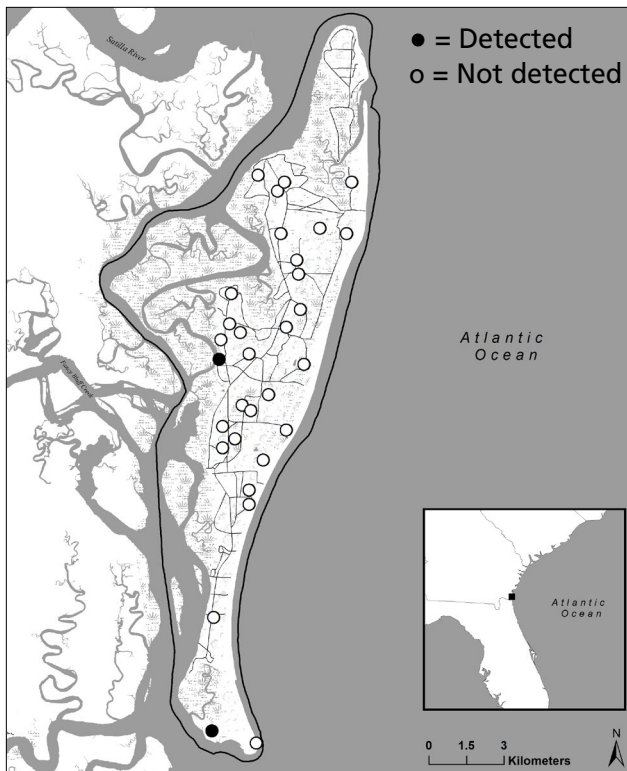


Figure C-27. Sampling locations where house finch (*Carpodacus mexicanus*) was detected at Cumberland Island National Seashore, 2012.

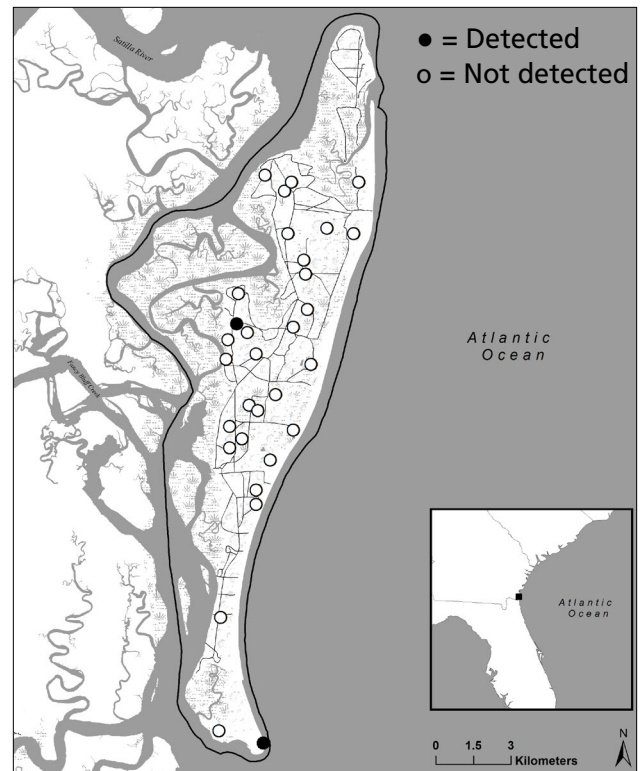


Figure C-28. Sampling locations where laughing gull (*Larus atricilla*) was detected at Cumberland Island National Seashore, 2012.

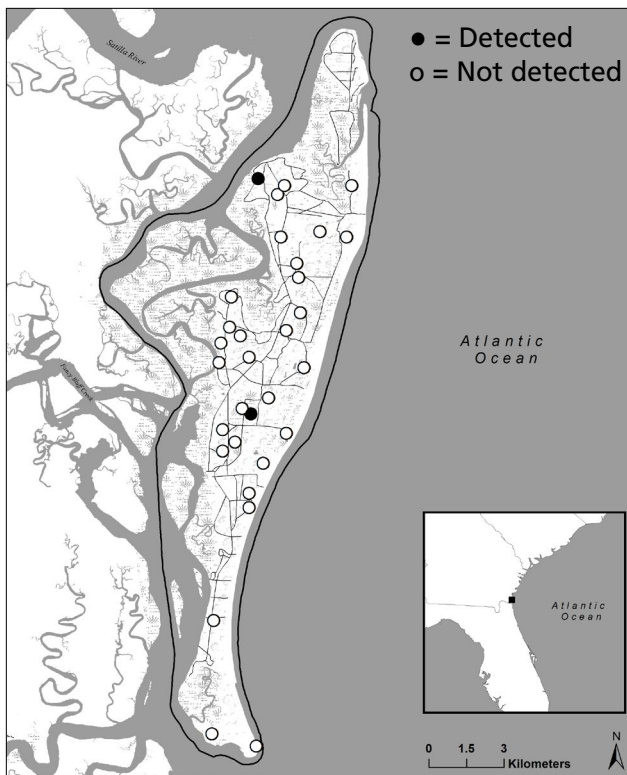


Figure C-29. Sampling locations where loggerhead shrike (*Lanius ludovicianus*) was detected at Cumberland Island National Seashore, 2012.

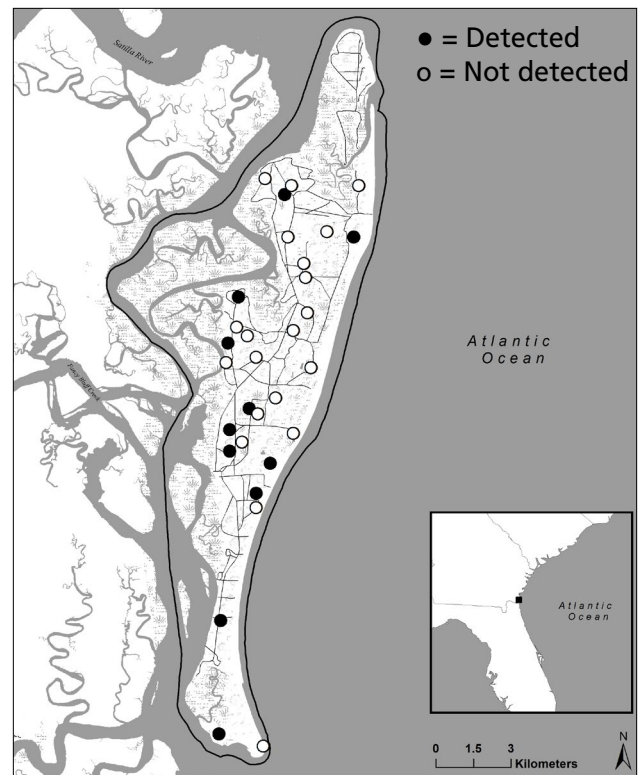


Figure C-30. Sampling locations where mourning dove (*Zenaida macroura*) was detected at Cumberland Island National Seashore, 2012.

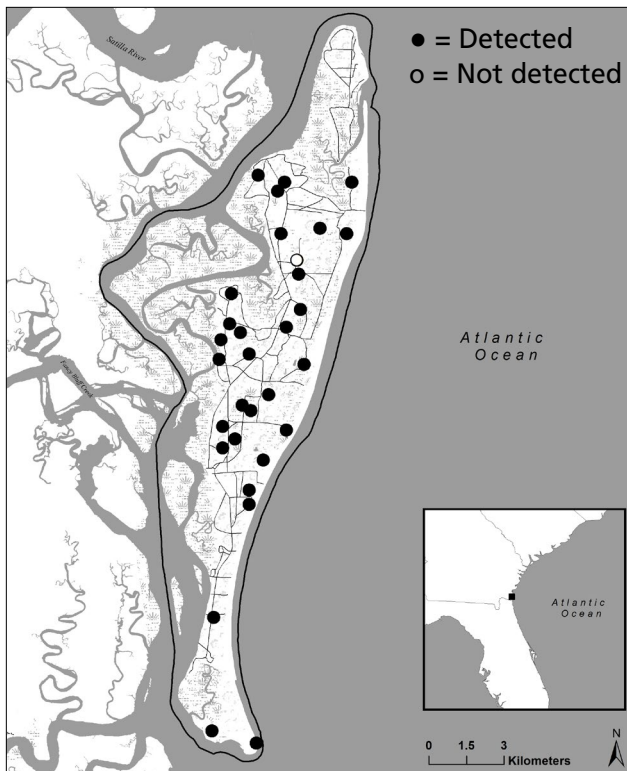


Figure C-31. Sampling locations where northern cardinal (*Cardinalis cardinalis*) was detected at Cumberland Island National Seashore, 2012.

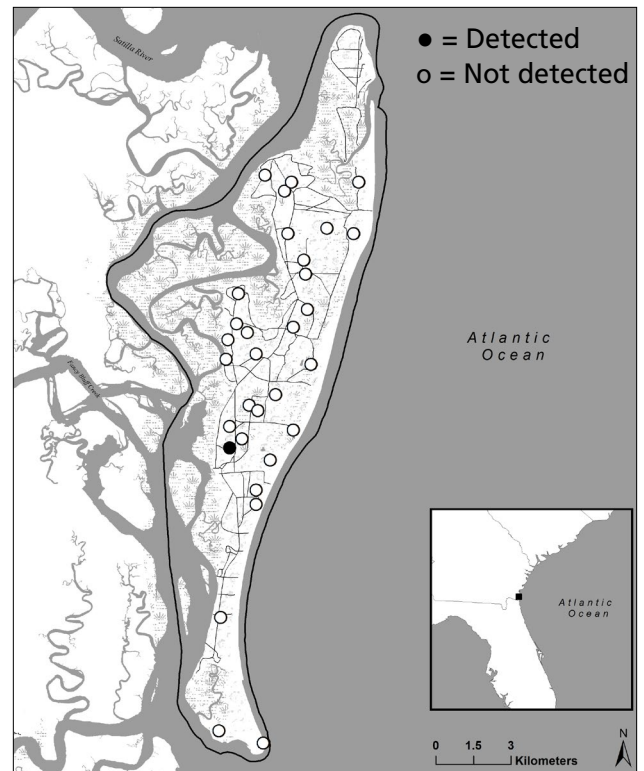


Figure C-32. Sampling locations where northern flicker (*Colaptes auratus*) was detected at Cumberland Island National Seashore, 2012.

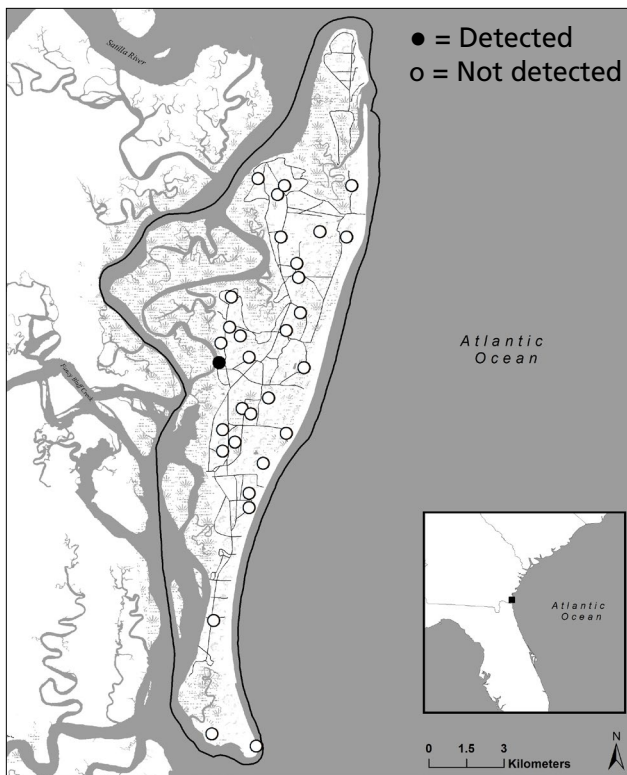


Figure C-33. Sampling locations where northern mockingbird (*Mimus polyglottos*) was detected at Cumberland Island National Seashore, 2012.

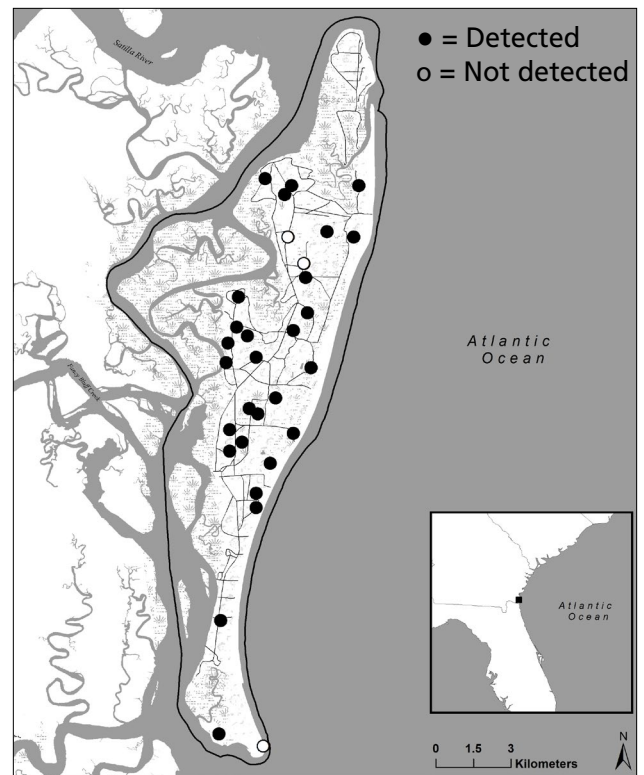


Figure C-34. Sampling locations where northern parula (*Parula americana*) was detected at Cumberland Island National Seashore, 2012.

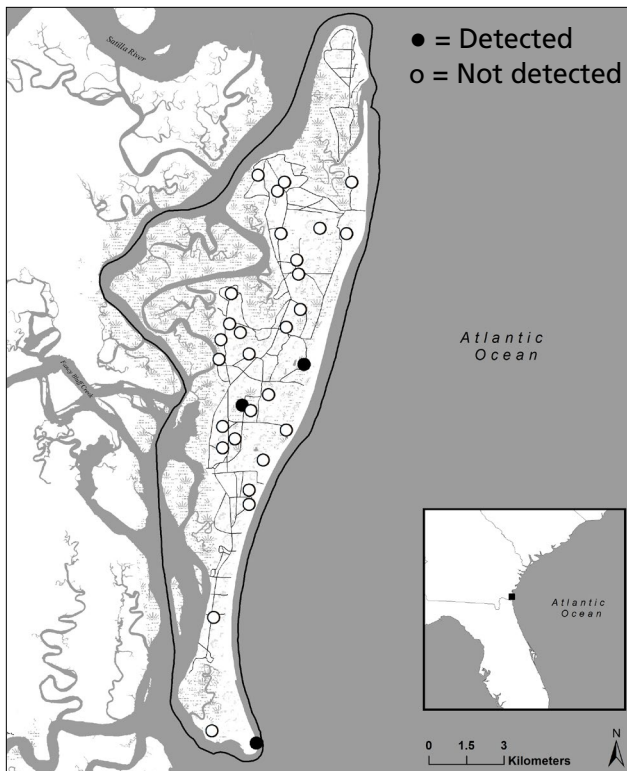


Figure C-35. Sampling locations where osprey (*Pandion haliaetus*) was detected at Cumberland Island National Seashore, 2012.

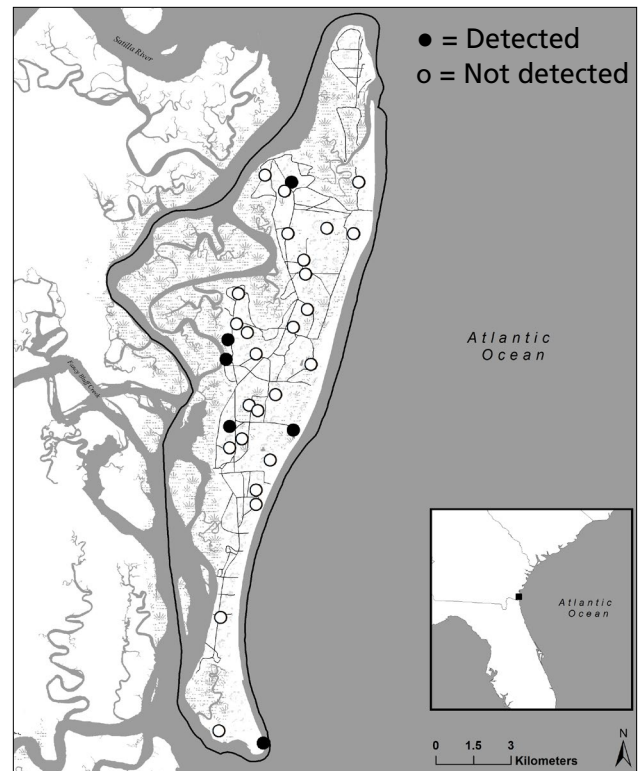


Figure C-36. Sampling locations where painted bunting (*Passerina ciris*) was detected at Cumberland Island National Seashore, 2012.

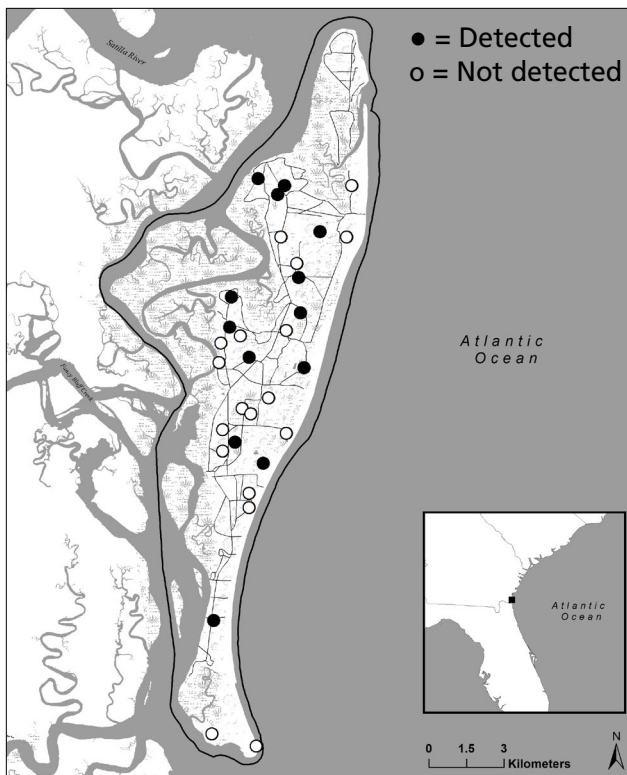


Figure C-37. Sampling locations where pileated woodpecker (*Dryocopus pileatus*) was detected at Cumberland Island National Seashore, 2012.

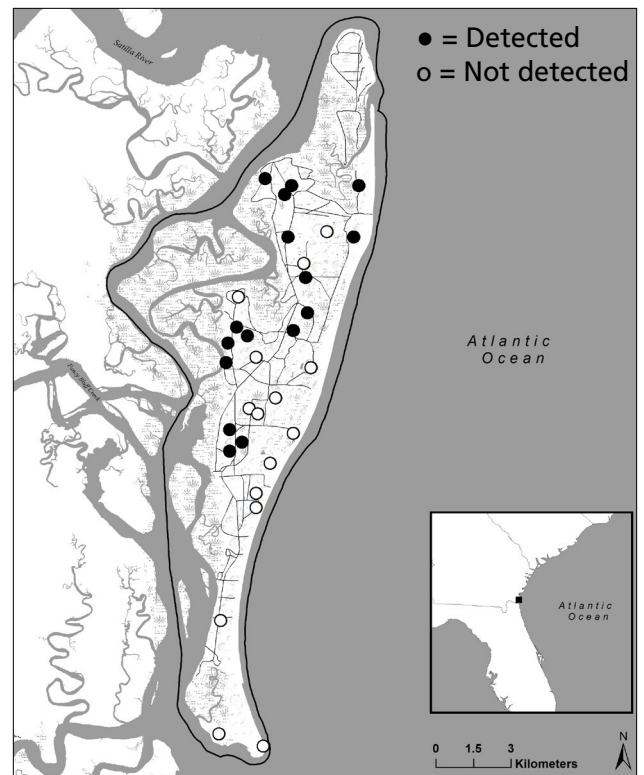


Figure C-38. Sampling locations where pine warbler (*Dendroica pinus*) was detected at Cumberland Island National Seashore, 2012.

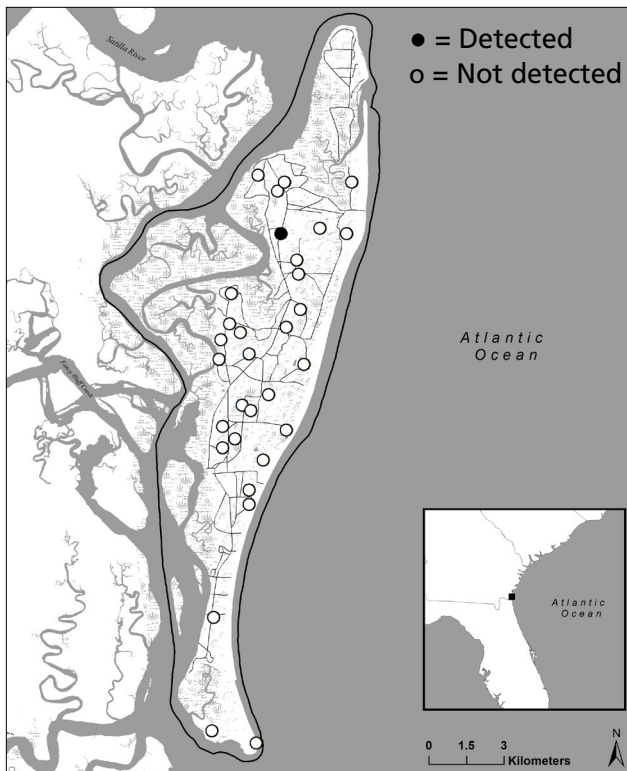


Figure C-39. Sampling locations where prairie warbler (*Dendroica discolor*) was detected at Cumberland Island National Seashore, 2012.

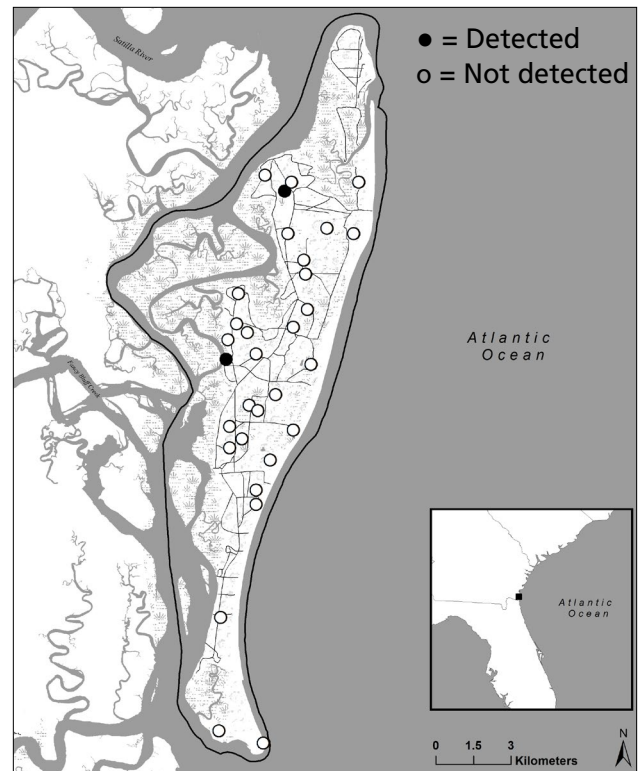


Figure C-40. Sampling locations where purple martin (*Progne subis*) was detected at Cumberland Island National Seashore, 2012.

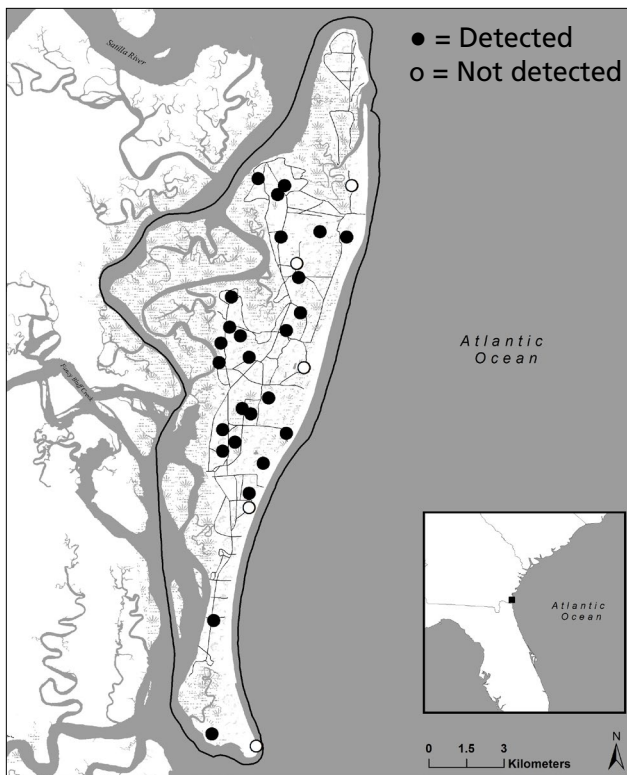


Figure C-41. Sampling locations where red-bellied woodpecker (*Melanerpes carolius*) was detected at Cumberland Island National Seashore, 2012.

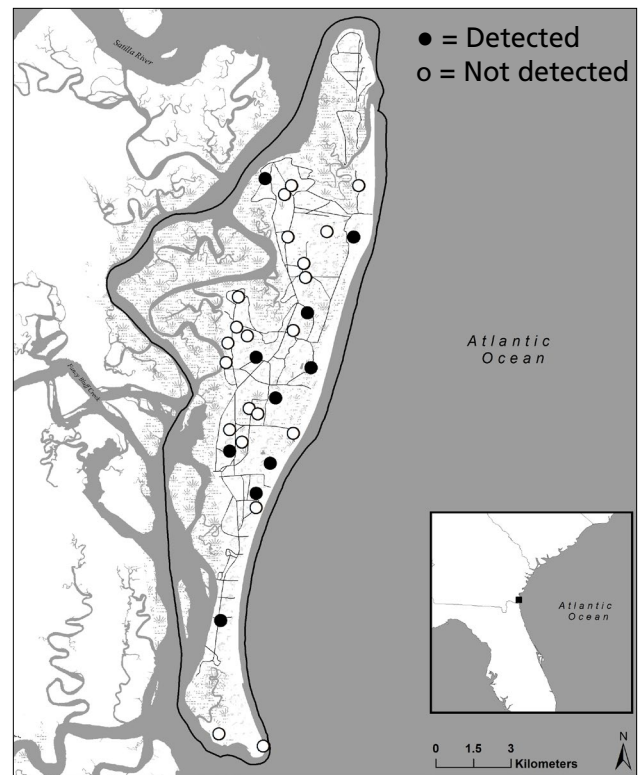


Figure C-42 Sampling locations where red-eyed vireo (*Vireo olivaceus*) was detected at Cumberland Island National Seashore, 2012.

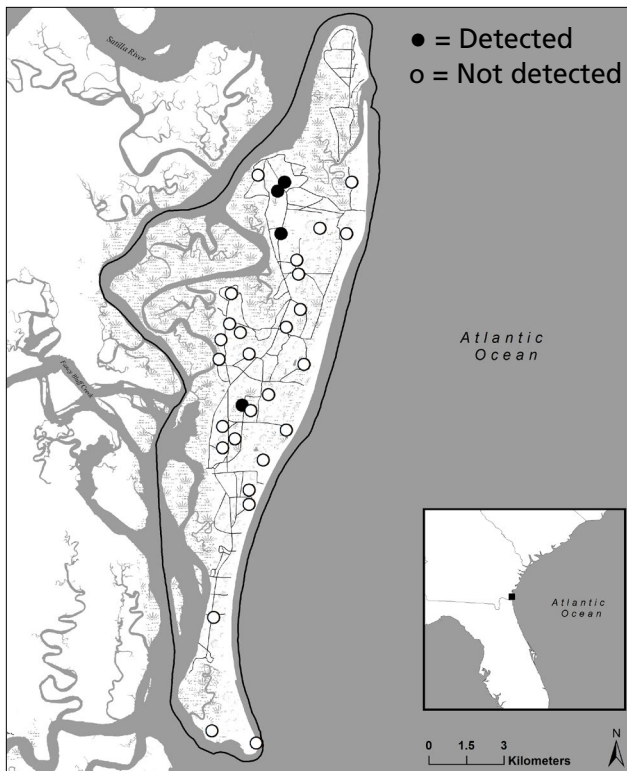


Figure C-43. Sampling locations where red-headed woodpecker (*Melanerpes erythrocephalus*) was detected at Cumberland Island National Seashore, 2012.

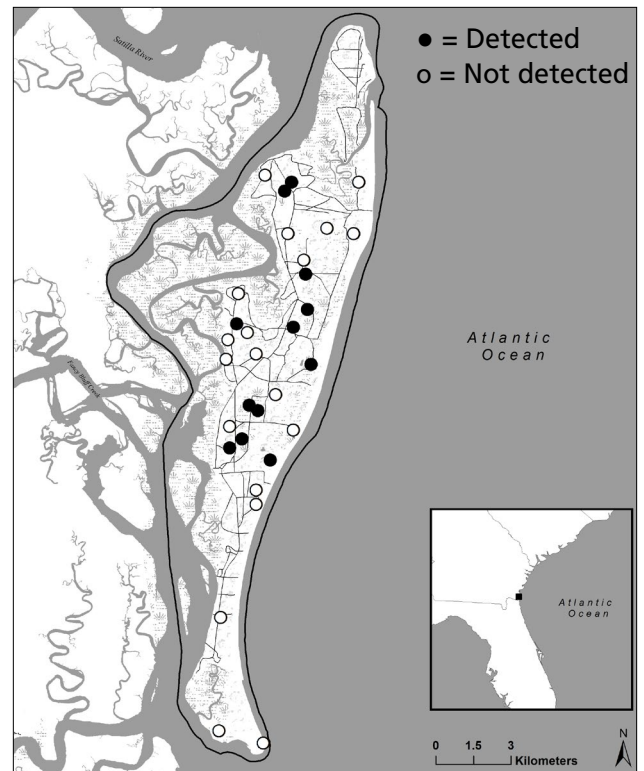


Figure C-44. Sampling locations where red-shouldered hawk (*Buteo lineatus*) was detected at Cumberland Island National Seashore, 2012.

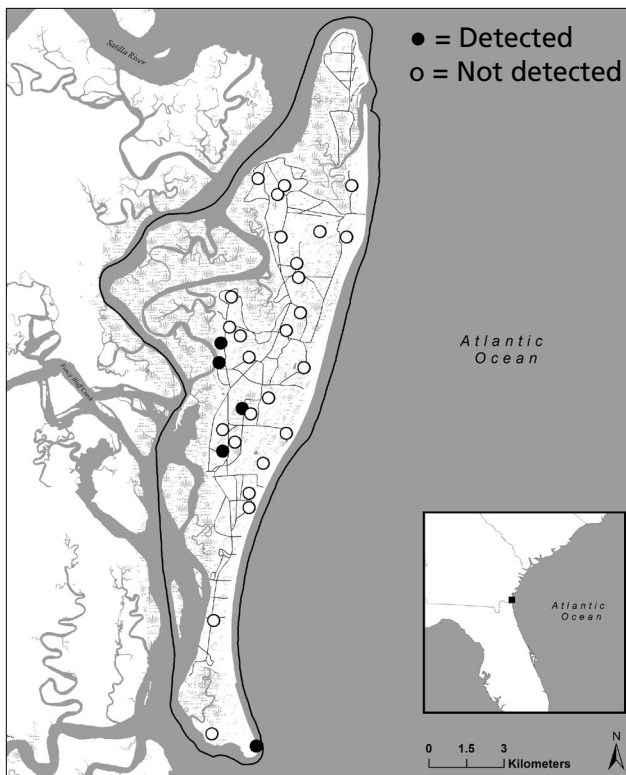


Figure C-45. Sampling locations where red-winged blackbird (*Agelaius phoeniceus*) was detected at Cumberland Island National Seashore, 2012.

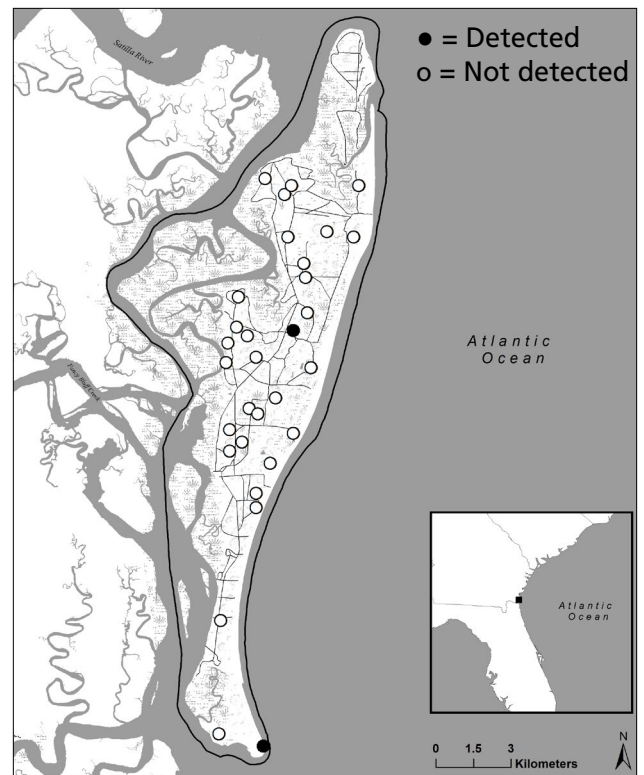


Figure C-46. Sampling locations where royal tern (*Sterna maxima*) was detected at Cumberland Island National Seashore, 2012.

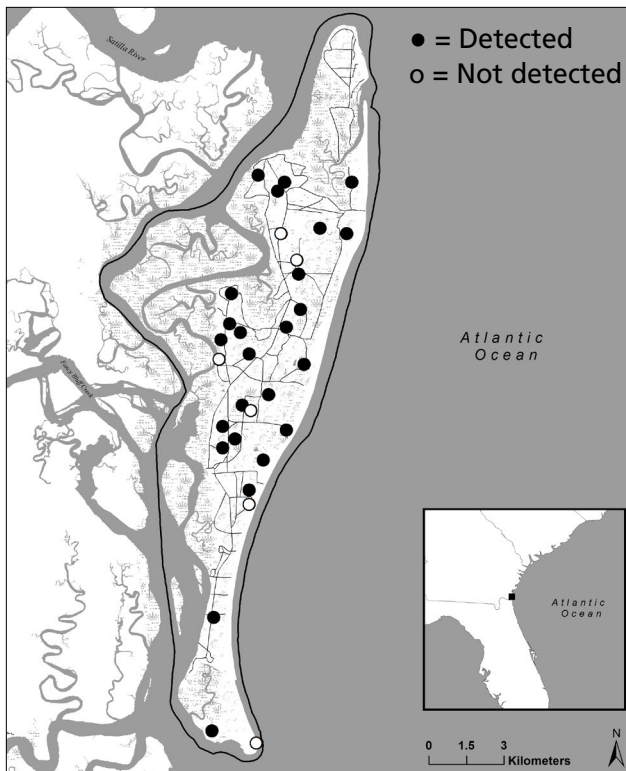


Figure C-47. Sampling locations where summer tanager (*Piranga rubra*) was detected at Cumberland Island National Seashore, 2012.

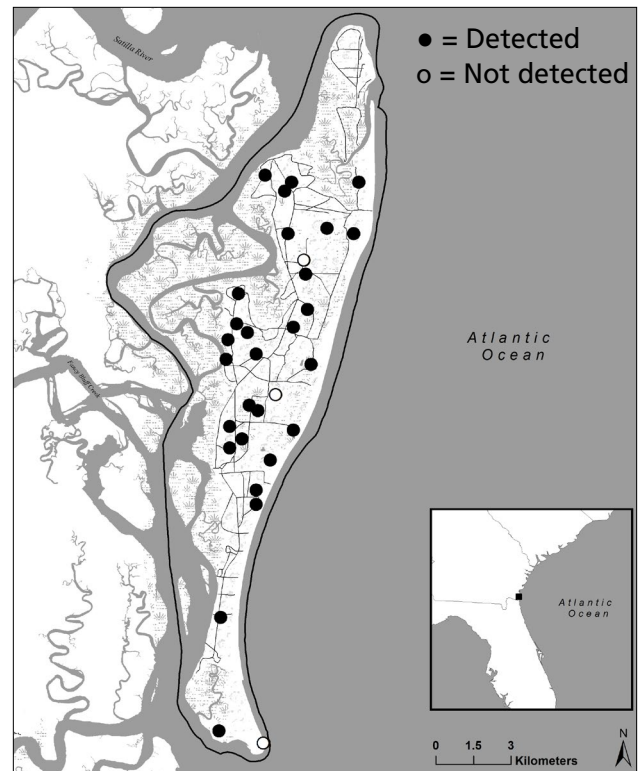


Figure C-48. Sampling locations where tufted titmouse (*Baeolophus bicolor*) was detected at Cumberland Island National Seashore, 2012.

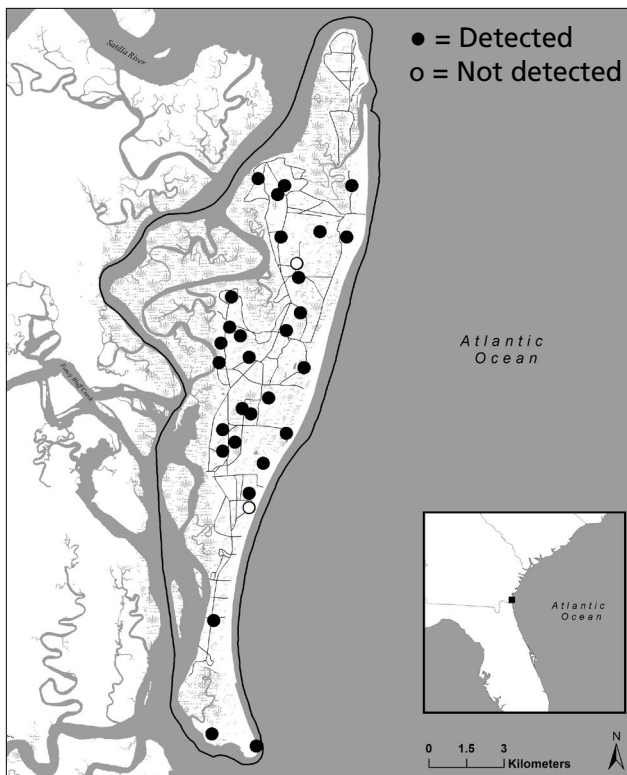


Figure C-49. Sampling locations where white-eyed vireo (*Vireo griseus*) was detected at Cumberland Island National Seashore, 2012.

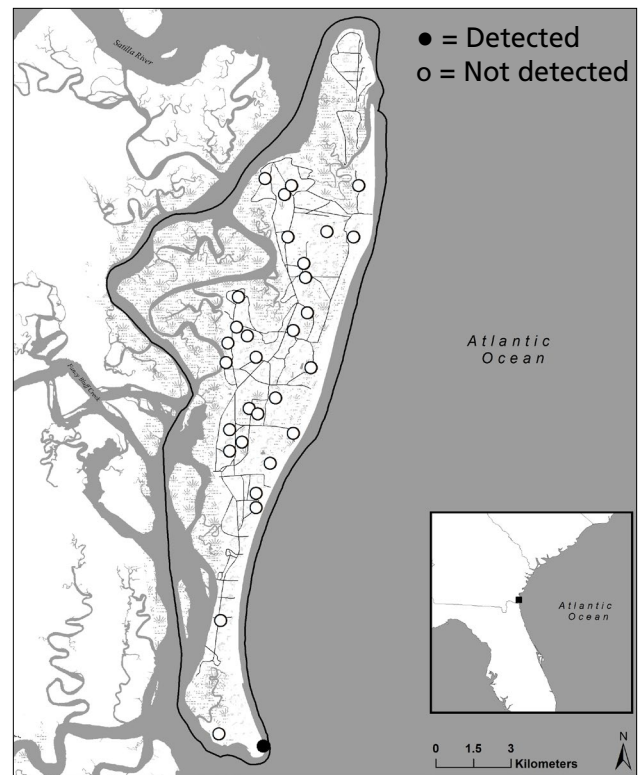


Figure C-50. Sampling locations where wild turkey (*Meleagris gallopavo*) was detected at Cumberland Island National Seashore, 2012.

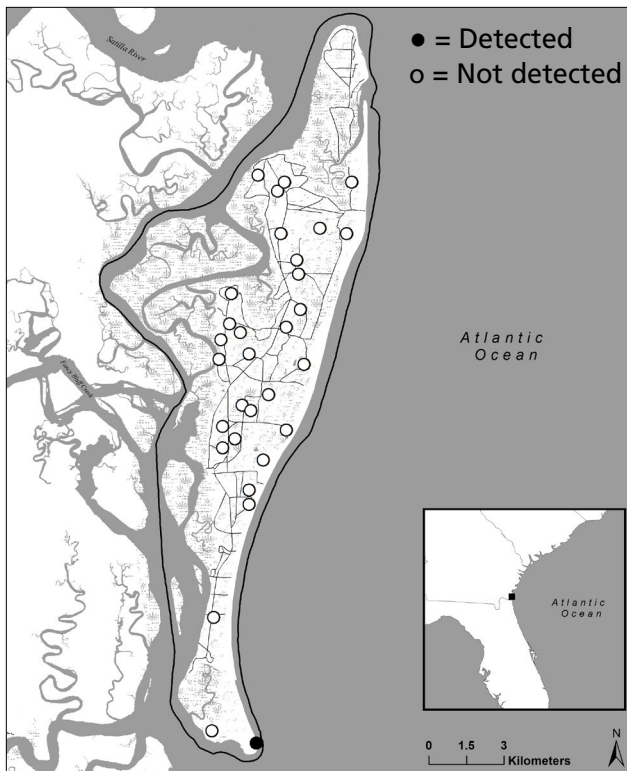


Figure C-51. Sampling locations where willet (*Catoptrophorus semipalmatus*) was detected at Cumberland Island National Seashore, 2012.

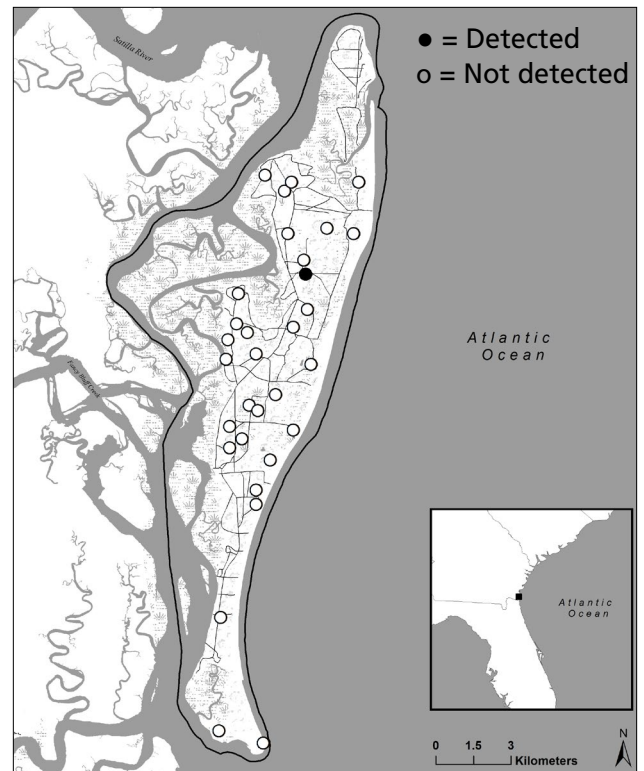


Figure C-52. Sampling locations where yellow-billed cuckoo (*Coccyzus americanus*) was detected at Cumberland Island National Seashore, 2012.

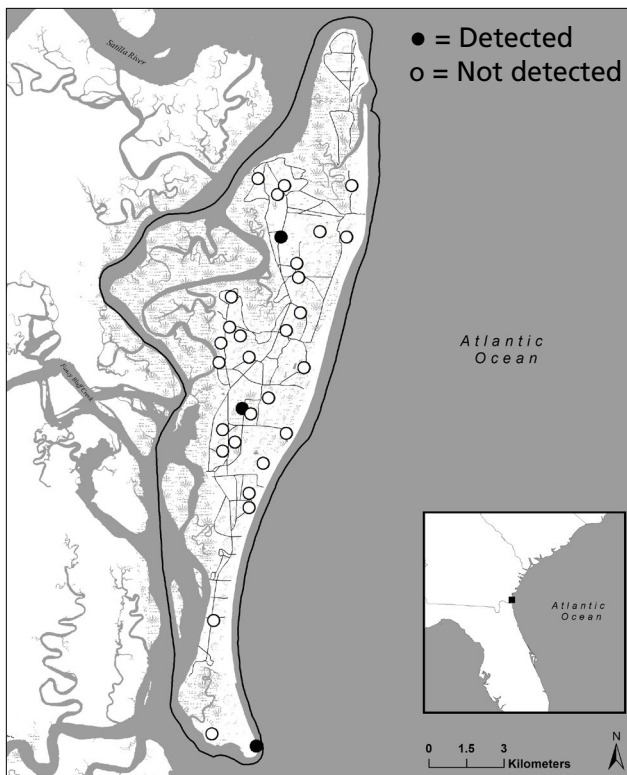


Figure C-53. Sampling locations where yellow-breasted chat (*Icteria virens*) was detected at Cumberland Island National Seashore, 2012.

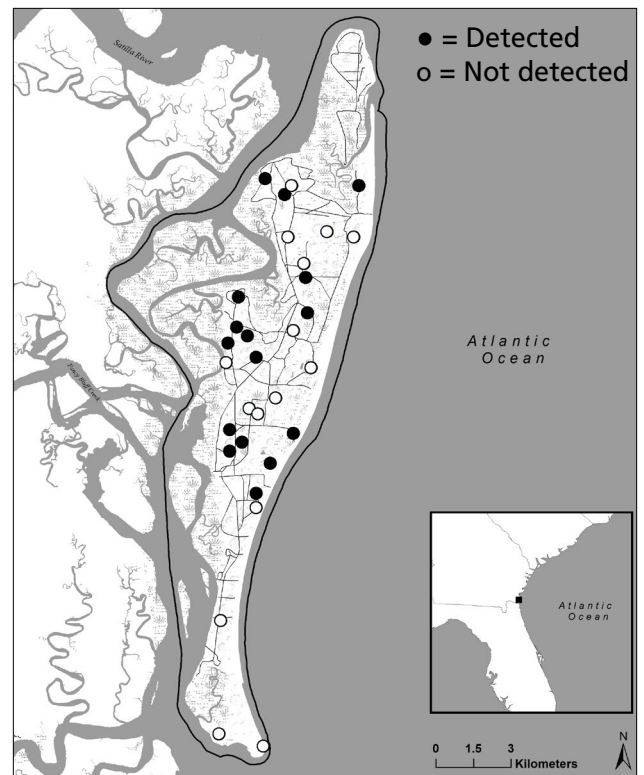


Figure C-54. Sampling locations where yellow-throated vireo (*Vireo flavifrons*) was detected at Cumberland Island National Seashore, 2012.

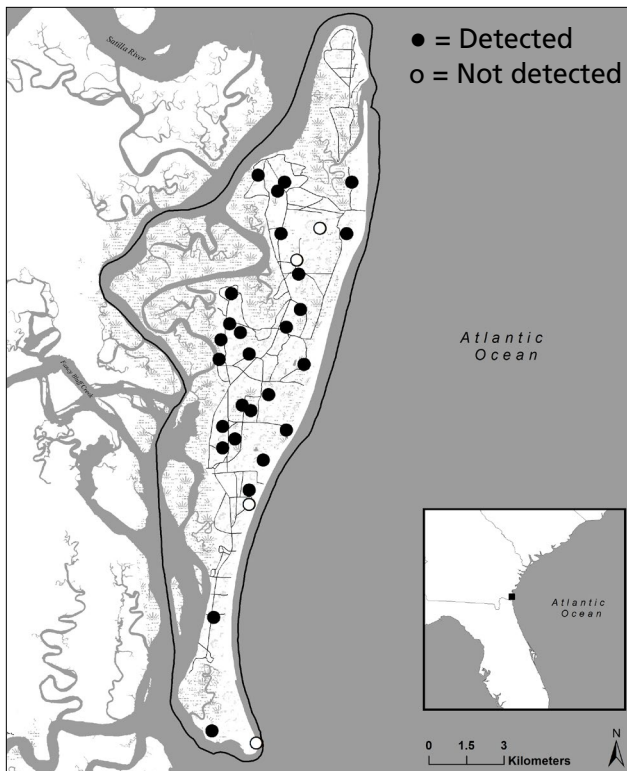


Figure C-55. Sampling locations where yellow-throated warbler (*Dendroica dominica*) was detected at Cumberland Island National Seashore, 2012.

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