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Natural Resource Stewardship and Science

Landbird Community Monitoring at Canaveral National Seashore

2014 Data Summary

Natural Resource Data Series NPS/SECN/NRDS—2016/1054



ON THE COVER
Loggerhead shrike (*Lanius ludovicianus*)
Photo courtesy of Rachel Holzman

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The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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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 Ocmulgee National Monument (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 monument resources.

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

- Automated recording devices collected bird detection/non-detection data (i.e., presence/absence) from 29 spatially balanced random locations at the park.
- Approximately 1,700 minutes of recordings were collected from May–June, to represent a closed population, and were evaluated for the presence of vocalizing birds.
- Seventy-eight native bird species were detected, including two non-native species: European starling and house finch.
- Monitoring efforts provided the first documented occurrences of four new species at the park and additions to the official species list: Bicknell's thrush, Carolina chickadee, eastern bluebird, and white-breasted nuthatch.
- Results suggest that species richness of birds is high at the park.
- Carolina wren, northern cardinal, eastern towhee, and red-bellied woodpecker were the most frequently occurring and widely distributed species at the park, occurring at least 93% of sampling locations.
- The full dataset and metadata are available 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, species richness, species 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).

More than 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 SECN is due to several factors; parks have a wide range of bird habitat types that are often fragmented and encompass both inland and coastal regions, in addition to their location within the Atlantic Flyway.

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 how frequently the selected landbirds are detected, and

c) Determine the distribution of landbirds within park lands.

Study Area

Canaveral National Seashore (CANA) is located on the east coast of central Florida (Figure 1). The park is approximately 23,067 hectares (57,000 acre [ac]), including Mosquito Lagoon, with the southern portion jointly managed by the National Park Service and the U.S. Fish and Wildlife Service's (USFWS) Merritt Island National Wildlife Refuge. The natural resources at the seashore include a diverse assemblage of wildlife, vegetation communities, geophysical features, and natural processes that reflect the complexity of the land/lagoon/sea interface of east–central Florida. Mosquito Lagoon, extending along the backside of the Canaveral NS barrier island, is the northernmost part of the Indian River Lagoon and designated an Estuary of National Significance by the Environmental Protection Agency (EPA) and an Outstanding Florida Water by the State of Florida. The lagoon acts as an important nursery area for a wide variety of wildlife species.

Unlike many barrier islands, the seashore has a less-complex dune system (i.e., primary and secondary) separating the lagoon from the ocean, and generally consists of a single primary dune averaging 3.7 meters (12 feet [ft]) in height. The distribution and juxtaposition of vegetation community types at the park generally follows subtle variations in topography, a salinity gradient, and differences in hydrologic properties. Predominant vegetation communities at the park include coastal dune/coastal strand, dominated by saw palmetto (*Serenoa repens*), seagrape (*Coccoloba uvifera*), Simpson's stopper (*Myrcianthes fragrans*), and wax myrtle (*Morella cerifera*). Hardwood hammock, mangroves, salt marsh, scrub oak (*Quercus* spp.), and pine flatwoods (*Pinus elliottii* and *P. palustris*) intersperse with a variety of freshwater wetland habitats, resulting in a unique and complex mosaic with a correspondingly high species diversity in many taxa.

Canaveral National Seashore has 279 known bird species (Appendix A Table A-1; NPSpecies 2015).

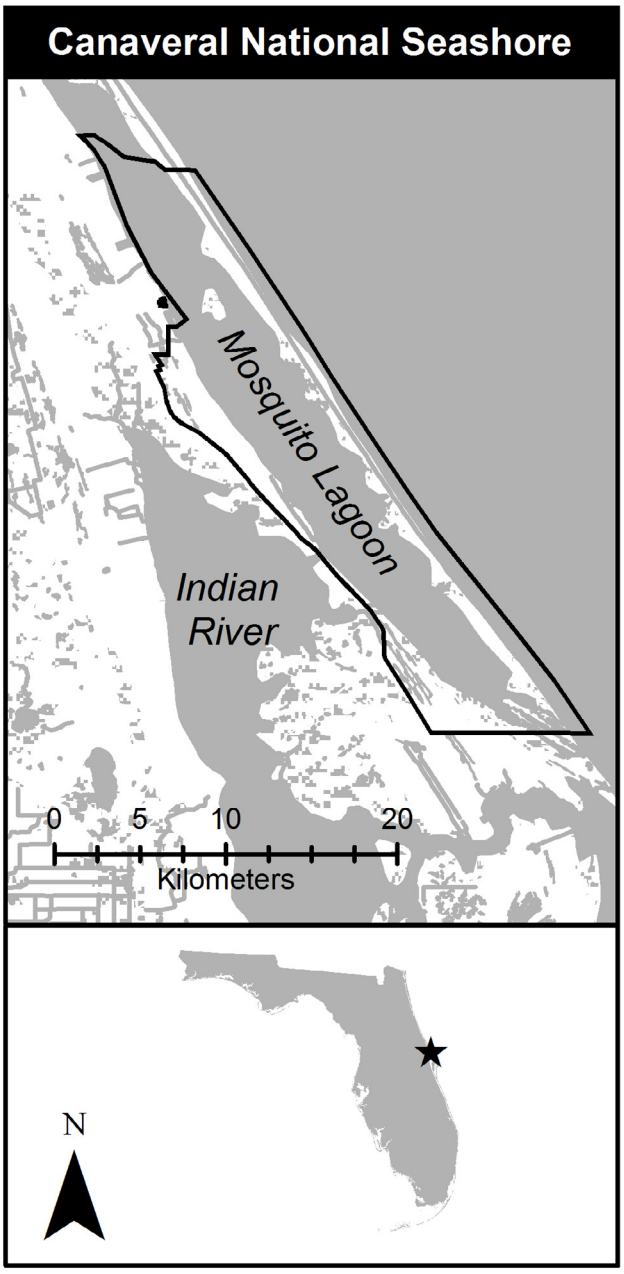


Figure 1. Location of Canaveral National Seashore.

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 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 park size, hypothesized variability, and logistical issues (Figure 2); however, the final sample size was 29 due to the failure of one device.

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 possible resolution 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 all sampling locations March–June 2014. 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 08:00 – 08:12 (i.e., 12 minutes) every other day for a period of 77 days (Byrne et al. 2014). This schedule results in the collection of 39 discrete sampling events across the spring migratory period and breeding season for each sampling location. Currently, however, our analysis efforts focus on the time period that most accurately approximates a closed population of breeding birds. Therefore, species occurrences are derived from analyzing five recordings collected from May–June at each sampling location.

Manual Evaluation of Recordings

Ambient/background noise influences detectability in auditory avian surveys (Alldredge et al. 2007, Simons et al. 2007, 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 45 decibels (dB), 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. 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 45 dB, in which vocalizations are identifiable and some are clear and distinct while others

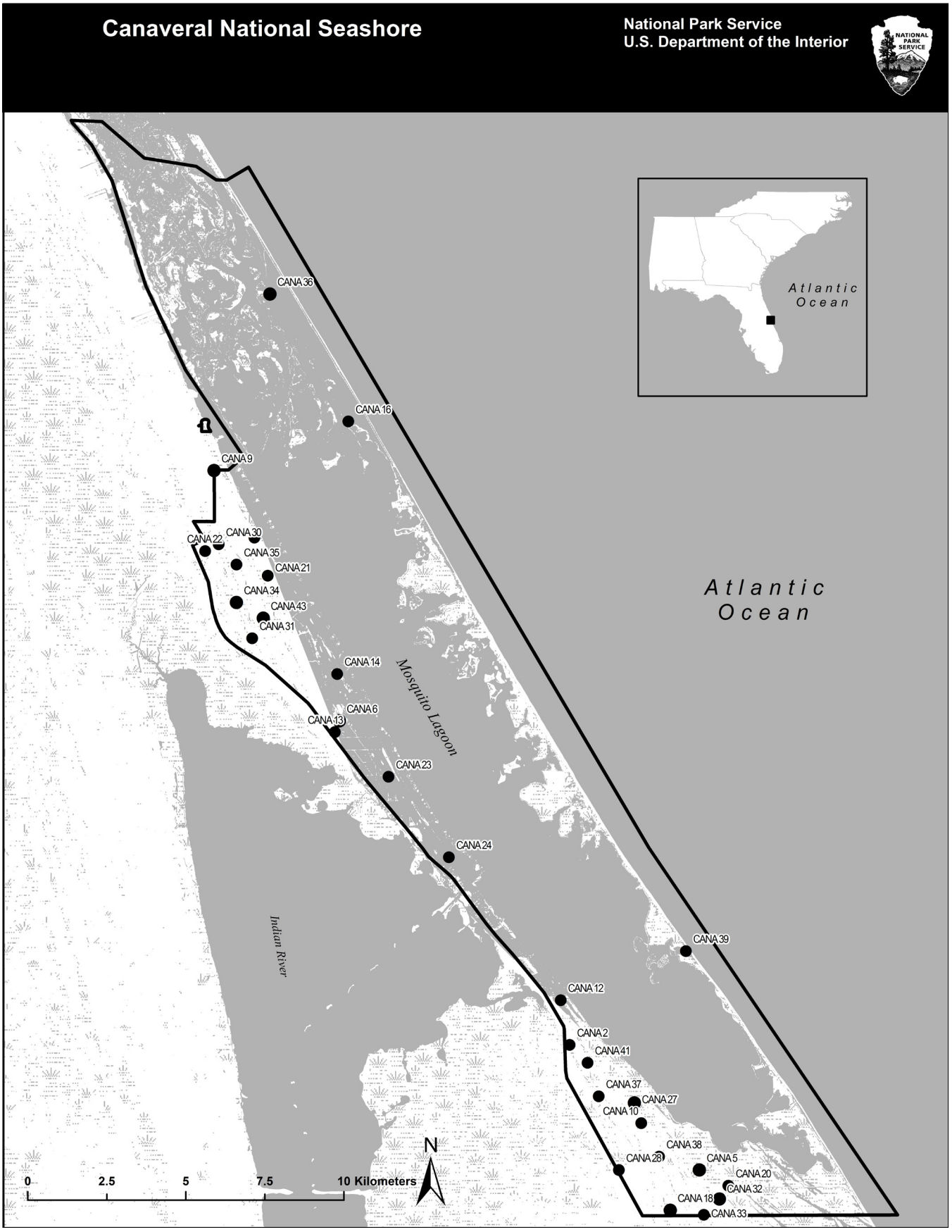


Figure 2. Landbird-community monitoring sampling locations at Canaveral National Seashore, 2014.

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 which background noise is the dominant sound, above 45 dB, 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.

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. These results were derived from the manual evaluation of 1668 minutes from 139 recordings.

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 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.

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 (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 reflected by index, 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

Carolina wren, northern cardinal, red-bellied woodpecker, eastern towhee, and mourning dove were the most frequently occurring (i.e., highest naïve occupancy) species, detected at 90% or more sampling locations (Table 2). Park-wide community composition is heterogeneous, with almost two-thirds of the species detected occurring at five or fewer locations. Two non-native species were detected, the European starling and house finch. The occurrences of four species, Bicknell's thrush, Carolina chickadee, eastern bluebird, and white-breasted nuthatch, 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 Canaveral National Seashore, 2014.

Common Name	Scientific Name	Proportion of Sites Where Observed
Carolina wren	*Thryothorus ludovicianus*	1.00
Northern cardinal	*Cardinalis cardinalis*	1.00
Red-bellied woodpecker	*Melanerpes carolinus*	0.93
Eastern towhee	*Pipilo erythrophthalmus*	0.93
Mourning dove	*Zenaida macroura*	0.86
Red-winged blackbird	*Agelaius phoeniceus*	0.83
Tufted titmouse	*Baeolophus bicolor*	0.83
Northern bobwhite	*Colinus virginianus*	0.79
Great crested flycatcher	*Myiarchus crinitus*	0.72
Pileated woodpecker	*Dryocopus pileatus*	0.72
White-eyed vireo	*Vireo griseus*	0.72
Common yellowthroat	*Geothlypis trichas*	0.66
Blue-gray gnatcatcher	*Polioptila caerulea*	0.55
Blue jay	*Cyanocitta cristata*	0.52
House finch	*Haemorhous mexicanus*	0.45
Killdeer	*Charadrius vociferus*	0.45
Barn swallow	*Hirundo rustica*	0.38
Downy woodpecker	*Picoides pubescens*	0.38
Red-shouldered hawk	*Buteo lineatus*	0.38
Boat-tailed grackle	*Quiscalus major*	0.34
Pine warbler	*Setophaga pinus*	0.34
Gray catbird	*Dumetella carolinensis*	0.31
Red-eyed vireo	*Vireo olivaceus*	0.31
Northern flicker	*Colaptes auratus*	0.28
Northern mockingbird	*Mimus polyglottos*	0.28
Fish crow	*Corvus ossifragus*	0.24
Common grackle	*Quiscalus quiscula*	0.21
Florida scrub-jay	*Aphelocoma coerulescens*	0.21
Northern parula	*Setophaga americana*	0.21
Brown-headed cowbird	*Molothrus ater*	0.17
Cedar waxwing	*Bombycilla cedrorum*	0.17

Table 2 (continued). Naïve occupancy estimates (i.e., proportion of sampling locations in which a species was detected) for birds at Canaveral National Seashore, 2014.

Common Name	Scientific Name	Proportion of Sites Where Observed
Eastern meadowlark	*Sturnella magna*	0.17
Willet	*Catoptrophorus semipalmatus*	0.17
American crow	*Corvus brachyrhynchos*	0.14
Common nighthawk	*Chordeiles minor*	0.14
Eastern bluebird	*Sialia sialis*	0.14
Greater yellowlegs	*Tringa melanoleuca*	0.14
Osprey	*Pandion haliaetus*	0.14
Purple martin	*Progne subis*	0.14
Red-headed woodpecker	*Melanerpes erythrocephalus*	0.14
Bald eagle	*Haliaeetus leucocephalus*	0.10
Belted kingfisher	*Megaceryle alcyon*	0.10
Black-necked stilt	*Himantopus mexicanus*	0.10
Common ground-dove	*Columbina passerina*	0.10
Green heron	*Butorides virescens*	0.10
Bicknell's thrush	*Catharus bicknelli*	0.07
Black-throated blue warbler	*Setophaga caerulescens*	0.07
Clapper rail	*Rallus longirostris*	0.07
Eastern screech owl	*Megascops asio*	0.07
Great blue heron	*Ardea herodias*	0.07
Mottled duck	*Anas fulvigula*	0.07
Summer tanager	*Piranga rubra*	0.07
American goldfinch	*Spinus tristis*	0.03
American oystercatcher	*Haematopus palliatus*	0.03
American redstart	*Setophaga ruticilla*	0.03
Black-and-white warbler	*Mniotilta varia*	0.03
Brown thrasher	*Toxostoma rufum*	0.03
Canada goose	*Branta canadensis*	0.03
Carolina chickadee	*Poecile carolinensis*	0.03
Chimney swift	*Chaetura pelagica*	0.03
Dunlin	*Calidris alpina*	0.03
Eastern kingbird	*Tyrannus tyrannus*	0.03
Eastern phoebe	*Sayornis phoebe*	0.03
European starling	*Sturnus vulgaris*	0.03
Great horned owl	*Bubo virginianus*	0.03
Hairy woodpecker	*Picoides villosus*	0.03
Loggerhead shrike	*Larus atricilla*	0.03
Orchard oriole	*Icterus spurius*	0.03
Prairie warbler	*Setophaga discolor*	0.03
Red-tailed hawk	*Buteo jamaicensis*	0.03
Royal tern	*Sterna maxima*	0.03
Ruby-throated hummingbird	*Archilochus colubris*	0.03

Table 2 (continued). Naïve occupancy estimates (i.e., proportion of sampling locations in which a species was detected) for birds at Canaveral National Seashore, 2014.

Common Name	Scientific Name	Proportion of Sites Where Observed
Sandhill crane	*Grus canadensis*	0.03
White-breasted nuthatch	*Sitta carolinensis*	0.03
Wood duck	*Aix sponsa*	0.03
Worm-eating warbler	*Helmitheros vermivorus*	0.03
Yellow-throated vireo	*Vireo flavifrons*	0.03
Yellow-throated warbler	*Setophaga dominica*	0.03

Table 3. New bird species detected at Canaveral National Seashore in 2014 and recommended NPS species classifications.

Common Name	Abundance	Residency	Nativity	Pest	Management Priority	Exploitation Concerns
Bicknell's thrush	Unknown	Migrantory	Native	No	Yes	No
Carolina chickadee	Unknown	Resident	Native	No	No	No
Eastern bluebird	Unknown	Resident	Native	No	No	No
White-breasted nuthatch	Unknown	Migrantory	Native	No	No	No

Richness

Native species richness for landbirds at Canaveral National Seashore in 2014 was 76. Species richness indices were based on native species, and confidence intervals for each index were estimated with a bootstrap procedure. Most richness indices were similar, ranging from 100.1 to 119.1, with the Boot index as an outlier at 86.2 (Table 4). Observed species richness differs from the estimated true species richness (i.e., all of the richness indices combined) by approximately 25%, suggesting the results of the current monitoring effort underestimated true species richness.

Distribution

Distribution maps for all detected species are presented in Appendix C and indicate the sampling location(s) in which each species occurred. Carolina wren, northern cardinal, red-bellied woodpecker, eastern towhee, and mourning dove were the most widely distributed species occurring at 90% or more sampling locations. Approximately two-thirds of species detected occurred at five or fewer locations.

Table 4. Species richness estimates for birds at Canaveral National Seashore, 2014.

Index	Symbol	Value	Lower 95% CI	Upper 95% CI	Value Interpretation
Native Spp. Richness	Sobs	76	65.7	86.3	Number of native species detected; Species richness at the park is considered to be high
Chao 2	Chao2	119.1	91.2	198.1	Estimated true species richness; Considered to be high
Incidence-based Coverage	ICE	104.2	103.3	105.1	Estimated true species richness; Considered to be high
Jackknife 1	Jack1	100.1	98.6	101.6	Estimated true species richness; Considered to be high
Jackknife 2	Jack2	117.1	116.1	118.1	Estimated true species richness; Considered to be high
Bootstrap	Boot	86.2	85.8	86.6	Estimated true species richness; Considered to be high

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Appendix A—Species List

Table A-1. Birds known to occur at Canaveral National Seashore based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Accipitriformes	Accipitridae	*Accipiter cooperii*	Cooper's hawk	X	
Accipitriformes	Accipitridae	*Accipiter striatus*	Sharp-shinned hawk	X	
Accipitriformes	Accipitridae	*Buteo jamaicensis*	Red-tailed hawk	X	X
Accipitriformes	Accipitridae	*Buteo lineatus*	Red-shouldered hawk	X	X
Accipitriformes	Accipitridae	*Buteo platypterus*	Broad-winged hawk	X	
Accipitriformes	Accipitridae	*Buteo swainsoni*	Swainson's hawk	X	
Accipitriformes	Accipitridae	*Circus cyaneus*	Northern harrier	X	
Accipitriformes	Accipitridae	*Elanoides forficatus*	American swallow-tailed kite	X	
Accipitriformes	Accipitridae	*Haliaeetus leucocephalus*	Bald eagle	X	X
Accipitriformes	Cathartidae	*Cathartes aura*	Turkey vulture	X	
Accipitriformes	Cathartidae	*Coragyps atratus*	Black vulture	X	
Accipitriformes	Pandionidae	*Pandion haliaetus*	Osprey	X	X
Anseriformes	Anatidae	*Aix sponsa*	Wood duck	X	X
Anseriformes	Anatidae	*Anas acuta*	Northern pintail	X	
Anseriformes	Anatidae	*Anas americana*	American wigeon	X	
Anseriformes	Anatidae	*Anas clypeata*	Northern shoveler	X	
Anseriformes	Anatidae	*Anas crecca*	Green-winged teal	X	
Anseriformes	Anatidae	*Anas discors*	Blue-winged teal	X	
Anseriformes	Anatidae	*Anas fulvigula*	Mottled duck	X	X
Anseriformes	Anatidae	*Anas penelope*	Eurasian wigeon	X	
Anseriformes	Anatidae	*Anas platyrhynchos*	Mallard	X	
Anseriformes	Anatidae	*Anas rubripes*	American black duck	X	
Anseriformes	Anatidae	*Anas strepera*	Gadwall	X	
Anseriformes	Anatidae	*Aythya affinis*	Lesser scaup	X	
Anseriformes	Anatidae	*Aythya americana*	Redhead	X	
Anseriformes	Anatidae	*Aythya collaris*	Ring-necked duck	X	
Anseriformes	Anatidae	*Aythya marila*	Greater scaup	X	
Anseriformes	Anatidae	*Aythya valisineria*	Canvasback	X	
Anseriformes	Anatidae	*Branta bernicla*	Brant	X	
Anseriformes	Anatidae	*Branta canadensis*	Canada goose	X	X
Anseriformes	Anatidae	*Bucephala albeola*	Bufflehead	X	
Anseriformes	Anatidae	*Bucephala clangula*	Common goldeneye	X	
Anseriformes	Anatidae	*Chen caerulescens*	Snow goose	X	
Anseriformes	Anatidae	*Clangula hyemalis*	Oldsquaw	X	
Anseriformes	Anatidae	*Dendrocygna bicolor*	Fulvous whistling-duck	X	
Anseriformes	Anatidae	*Lophodytes cucullatus*	Hooded merganser	X	
Anseriformes	Anatidae	*Melanitta fusca*	White-winged scoter	X	
Anseriformes	Anatidae	*Melanitta nigra*	Black scoter	X	
Anseriformes	Anatidae	*Melanitta perspicillata*	Surf scoter	X	

Table A-1 (continued). Birds known to occur at Canaveral National Seashore based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Anseriformes	Anatidae	*Mergus serrator*	Red-breasted merganser	X	
Anseriformes	Anatidae	*Oxyura jamaicensis*	Ruddy duck	X	
Apodiformes	Apodidae	*Chaetura pelagica*	Chimney swift	X	X
Apodiformes	Trochilidae	*Archilochus colubris*	Ruby-throated hummingbird	X	X
Caprimulgiformes	Caprimulgidae	*Caprimulgus carolinensis*	Chuck-will's-widow	X	
Caprimulgiformes	Caprimulgidae	*Caprimulgus vociferus*	Whip-poor-will	X	
Caprimulgiformes	Caprimulgidae	*Chordeiles minor*	Common nighthawk	X	X
Charadriiformes	Charadriidae	*Charadrius melodus*	Piping plover	X	
Charadriiformes	Charadriidae	*Charadrius semipalmatus*	Semipalmated plover	X	
Charadriiformes	Charadriidae	*Charadrius vociferus*	Killdeer	X	X
Charadriiformes	Charadriidae	*Charadrius wilsonia*	Wilson's plover	X	
Charadriiformes	Charadriidae	*Pluvialis squatarola*	Black-bellied plover	X	
Charadriiformes	Haematopodidae	*Haematopus palliatus*	American oystercatcher	X	X
Charadriiformes	Laridae	*Chlidonias niger*	Black tern	X	
Charadriiformes	Laridae	*Larus argentatus*	Herring gull	X	
Charadriiformes	Laridae	*Larus atricilla*	Laughing gull	X	
Charadriiformes	Laridae	*Larus delawarensis*	Ring-billed gull	X	
Charadriiformes	Laridae	*Larus marinus*	Great black-backed gull	X	
Charadriiformes	Laridae	*Larus philadelphia*	Bonaparte's gull	X	
Charadriiformes	Laridae	*Rissa tridactyla*	Black-legged kittiwake	X	
Charadriiformes	Laridae	*Rynchops niger*	Black skimmer	X	
Charadriiformes	Laridae	*Sterna anaethetus*	Bridled tern	X	
Charadriiformes	Laridae	*Sterna antillarum*	Least tern	X	
Charadriiformes	Laridae	*Sterna caspia*	Caspian tern	X	
Charadriiformes	Laridae	*Sterna dougallii*	Roseate tern	X	
Charadriiformes	Laridae	*Sterna forsteri*	Forster's tern	X	
Charadriiformes	Laridae	*Sterna fuscata*	Sooty tern	X	
Charadriiformes	Laridae	*Sterna hirundo*	Common tern	X	
Charadriiformes	Laridae	*Sterna maxima*	Royal tern	X	X
Charadriiformes	Laridae	*Sterna nilotica*	Gull-billed tern	X	
Charadriiformes	Laridae	*Sterna sandvicensis*	Sandwich tern	X	
Charadriiformes	Recurvirostridae	*Himantopus mexicanus*	Black-necked stilt	X	X
Charadriiformes	Recurvirostridae	*Recurvirostra americana*	American avocet	X	
Charadriiformes	Scolopacidae	*Actitis macularia*	Spotted sandpiper	X	
Charadriiformes	Scolopacidae	*Arenaria interpres*	Ruddy turnstone	X	
Charadriiformes	Scolopacidae	*Bartramia longicauda*	Upland sandpiper	X	
Charadriiformes	Scolopacidae	*Calidris alba*	Sanderling	X	
Charadriiformes	Scolopacidae	*Calidris alpina*	Dunlin	X	X
Charadriiformes	Scolopacidae	*Calidris canutus*	Red knot	X	
Charadriiformes	Scolopacidae	*Calidris fuscicollis*	White-rumped sandpiper	X	
Charadriiformes	Scolopacidae	*Calidris himantopus*	Stilt sandpiper	X	

Table A-1 (continued). Birds known to occur at Canaveral National Seashore based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Charadriiformes	Scolopacidae	*Calidris mauri*	Western sandpiper	X	
Charadriiformes	Scolopacidae	*Calidris melanotos*	Pecotral sandpiper	X	
Charadriiformes	Scolopacidae	*Calidris minutilla*	Least sandpiper	X	
Charadriiformes	Scolopacidae	*Calidris pusilla*	Semipalmated sandpiper	X	
Charadriiformes	Scolopacidae	*Catoptrophorus semipalmatus*	Willet	X	X
Charadriiformes	Scolopacidae	*Gallinago gallinago*	Common snipe	X	
Charadriiformes	Scolopacidae	*Limnodromus griseus*	Short-billed dowitcher	X	
Charadriiformes	Scolopacidae	*Limosa fedoa*	Marbled godwit	X	
Charadriiformes	Scolopacidae	*Numenius americanus*	Long-billed curlew	X	
Charadriiformes	Scolopacidae	*Numenius phaeopus*	Whimbrel	X	
Charadriiformes	Scolopacidae	*Phalaropus lobatus*	Red-necked phalarope	X	
Charadriiformes	Scolopacidae	*Phalaropus tricolor*	Wilson's phalarope	X	
Charadriiformes	Scolopacidae	*Scolopax minor*	American woodcock	X	
Charadriiformes	Scolopacidae	*Tringa flavipes*	Lesser yellowlegs	X	
Charadriiformes	Scolopacidae	*Tringa melanoleuca*	Greater yellowlegs	X	X
Charadriiformes	Scolopacidae	*Tringa solitaria*	Solitary sandpiper	X	
Charadriiformes	Stercorariidae	*Stercorarius parasiticus*	Parasitic jaeger	X	
Charadriiformes	Stercorariidae	*Stercorarius pomarinus*	Pomarine jaeger	X	
Ciconiiformes	Ciconiidae	*Mycteria americana*	Wood stork	X	
Columbiformes	Columbidae	*Columba livia*	Rock dove	X	
Columbiformes	Columbidae	*Columbina passerina*	Common ground-dove	X	X
Columbiformes	Columbidae	*Zenaida macroura*	Mourning dove	X	X
Coraciiformes	Alcedinidae	*Megaceryle alcyon*	Belted kingfisher	X	X
Cuculiformes	Cuculidae	*Coccyzus americanus*	Yellow-billed cuckoo	X	
Cuculiformes	Cuculidae	*Coccyzus erythropthalmus*	Black-billed cuckoo	X	
Cuculiformes	Cuculidae	*Crotophaga ani*	Smooth-billed ani	X	
Falconiformes	Falconidae	*Falco columbarius*	Merlin	X	
Falconiformes	Falconidae	*Falco peregrinus*	Peregrine falcon	X	
Falconiformes	Falconidae	*Falco sparverius*	American kestrel	X	
Galliformes	Odontophoridae	*Colinus virginianus*	Northern bobwhite	X	X
Galliformes	Phasianidae	*Meleagris gallopavo*	Wild turkey	X	
Gaviwiformes	Gaviidae	*Gavia immer*	Common loon	X	
Gaviiformes	Gaviidae	*Gavia stellata*	Red-throated loon	X	
Gruiformes	Aramidae	*Aramus guarauna*	Limpkin	X	
Gruiformes	Gruidae	*Grus canadensis*	Sandhill crane	X	X
Gruiformes	Rallidae	*Fulica americana*	American coot	X	
Gruiformes	Rallidae	*Gallinula chloropus*	Common moorhen	X	
Gruiformes	Rallidae	*Laterallus jamaicensis*	Black rail	X	
Gruiformes	Rallidae	*Porzana carolina*	Sora	X	
Gruiformes	Rallidae	*Rallus elegans*	King rail	X	
Gruiformes	Rallidae	*Rallus limicola*	Virginia rail	X	

Table A-1 (continued). Birds known to occur at Canaveral National Seashore based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Gruiformes	Rallidae	*Rallus longirostris*	Clapper rail	X	X
Passeriformes	Bombycillidae	*Bombycilla cedrorum*	Cedar waxwing	X	X
Passeriformes	Cardinalidae	*Cardinalis cardinalis*	Northern cardinal	X	X
Passeriformes	Cardinalidae	*Guiraca caerulea*	Blue grosbeak	X	
Passeriformes	Cardinalidae	*Passerina ciris*	Painted bunting	X	
Passeriformes	Cardinalidae	*Passerina cyanea*	Indigo bunting	X	
Passeriformes	Cardinalidae	*Pheucticus ludovicianus*	Rose-breasted grosbeak	X	
Passeriformes	Cardinalidae	*Spiza americana*	Dickcissel	X	
Passeriformes	Corvidae	*Aphelocoma coerulescens*	Florida scrub-jay	X	X
Passeriformes	Corvidae	*Corvus brachyrhynchos*	American crow	X	X
Passeriformes	Corvidae	*Corvus ossifragus*	Fish crow	X	X
Passeriformes	Corvidae	*Cyanocitta cristata*	Blue jay	X	X
Passeriformes	Emberizidae	*Aimophila aestivalis*	Bachman's sparrow	X	
Passeriformes	Emberizidae	*Ammodramus caudacutus*	Saltmarsh sharp-tailed sparrow	X	
Passeriformes	Emberizidae	*Ammodramus henslowii*	Henslow's sparrow	X	
Passeriformes	Emberizidae	*Ammodramus maritimus*	Seaside sparrow	X	
Passeriformes	Emberizidae	*Ammodramus savannarum*	Grasshopper sparrow	X	
Passeriformes	Emberizidae	*Chondestes grammacus*	Lark sparrow	X	
Passeriformes	Emberizidae	*Melospiza georgiana*	Swamp sparrow	X	
Passeriformes	Emberizidae	*Melospiza lincolnii*	Lincoln's sparrow	X	
Passeriformes	Emberizidae	*Melospiza melodia*	Song sparrow	X	
Passeriformes	Emberizidae	*Passerculus sandwichensis*	Savannah sparrow	X	
Passeriformes	Emberizidae	*Passerella iliaca*	Fox sparrow	X	
Passeriformes	Emberizidae	*Pipilo erythrophthalmus*	Eastern towhee	X	X
Passeriformes	Emberizidae	*Pooecetes gramineus*	Vesper sparrow	X	
Passeriformes	Emberizidae	*Spizella passerina*	Chipping sparrow	X	
Passeriformes	Emberizidae	*Spizella pusilla*	Field sparrow	X	
Passeriformes	Emberizidae	*Zonotrichia albicollis*	White-throated sparrow	X	
Passeriformes	Fringillidae	*Carduelis pinus*	Pine siskin	X	
Passeriformes	Fringillidae	*Carduelis tristis*	American goldfinch	X	X
Passeriformes	Fringillidae	*Carpodacus mexicanus*	House finch		X
Passeriformes	Hirundinidae	*Hirundo rustica*	Barn swallow	X	X
Passeriformes	Hirundinidae	*Petrochelidon pyrrhonota*	Cliff swallow	X	
Passeriformes	Hirundinidae	*Progne subis*	Purple martin	X	X
Passeriformes	Hirundinidae	*Riparia riparia*	Bank swallow	X	
Passeriformes	Hirundinidae	*Stelgidopteryx serripennis*	Northern rough-winged swallow	X	
Passeriformes	Hirundinidae	*Tachycineta bicolor*	Tree swallow	X	
Passeriformes	Icteridae	*Agelaius phoeniceus*	Red-winged blackbird	X	X
Passeriformes	Icteridae	*Dolichonyx oryzivorus*	Bobolink	X	
Passeriformes	Icteridae	*Euphagus carolinus*	Rusty blackbird	X	
Passeriformes	Icteridae	*Icterus galbula*	Baltimore oriole	X	
Passeriformes	Icteridae	*Icterus spurius*	Orchard oriole	X	X
Passeriformes	Icteridae	*Molothrus ater*	Brown-headed cowbird	X	X

Table A-1 (continued). Birds known to occur at Canaveral National Seashore based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Passeriformes	Icteridae	*Quiscalus major*	Boat-tailed grackle	X	X
Passeriformes	Icteridae	*Quiscalus quiscula*	Common grackle	X	X
Passeriformes	Icteridae	*Sturnella magna*	Eastern meadowlark	X	X
Passeriformes	Laniidae	*Lanius ludovicianus*	Loggerhead shrike	X	X
Passeriformes	Mimidae	*Dumetella carolinensis*	Gray catbird	X	X
Passeriformes	Mimidae	*Mimus polyglottos*	Northern mockingbird	X	X
Passeriformes	Mimidae	*Toxostoma rufum*	Brown thrasher	X	X
Passeriformes	Motacillidae	*Anthus rubescens*	American pipit	X	
Passeriformes	Paridae	*Baeolophus bicolor*	Tufted titmouse	X	X
Passeriformes	Paridae	*Poecile carolinensis*	Carolina chickadee		X
Passeriformes	Parulidae	*Dendroica caerulescens*	Black-throated blue warbler	X	X
Passeriformes	Parulidae	*Dendroica castanea*	Bay-breasted warbler	X	
Passeriformes	Parulidae	*Dendroica coronata*	Yellow-rumped warbler	X	
Passeriformes	Parulidae	*Dendroica discolor*	Prairie warbler	X	X
Passeriformes	Parulidae	*Dendroica dominica*	Yellow-throated warbler	X	X
Passeriformes	Parulidae	*Dendroica fusca*	Blackburnian warbler	X	
Passeriformes	Parulidae	*Dendroica magnolia*	Magnolia warbler	X	
Passeriformes	Parulidae	*Dendroica palmarum*	Palm warbler	X	
Passeriformes	Parulidae	*Dendroica pensylvanica*	Chestnut-sided warbler	X	
Passeriformes	Parulidae	*Dendroica petechia*	Yellow warbler	X	
Passeriformes	Parulidae	*Dendroica pinus*	Pine warbler	X	X
Passeriformes	Parulidae	*Dendroica striata*	Blackpoll warbler	X	
Passeriformes	Parulidae	*Dendroica tigrina*	Cape May warbler	X	
Passeriformes	Parulidae	*Dendroica virens*	Black-throated green warbler	X	
Passeriformes	Parulidae	*Geothlypis trichas*	Common yellowthroat	X	X
Passeriformes	Parulidae	*Helmitheros vermivorus*	Worm-eating warbler	X	X
Passeriformes	Parulidae	*Icteria virens*	Yellow-breasted chat	X	
Passeriformes	Parulidae	*Limnothlypis swainsonii*	Swainson's warbler	X	
Passeriformes	Parulidae	*Mniotilta varia*	Black-and-white warbler	X	X
Passeriformes	Parulidae	*Oporornis agilis*	Connecticut warbler	X	
Passeriformes	Parulidae	*Oporornis formosus*	Kentucky warbler	X	
Passeriformes	Parulidae	*Parula americana*	Northern parula	X	X
Passeriformes	Parulidae	*Protonotaria citrea*	Prothonotary warbler	X	
Passeriformes	Parulidae	*Seiurus aurocapillus*	Ovenbird	X	
Passeriformes	Parulidae	*Seiurus motacilla*	Louisiana waterthrush	X	
Passeriformes	Parulidae	*Seiurus noveboracensis*	Northern waterthrush	X	
Passeriformes	Parulidae	*Setophaga ruticilla*	American redstart	X	X
Passeriformes	Parulidae	*Vermivora celata*	Orange-crowned warbler	X	
Passeriformes	Parulidae	*Vermivora chrysoptera*	Golden-winged warbler	X	
Passeriformes	Parulidae	*Vermivora peregrina*	Tennessee warbler	X	
Passeriformes	Parulidae	*Vermivora pinus*	Blue-winged warbler	X	
Passeriformes	Parulidae	*Vermivora ruficapilla*	Nashville warbler	X	
Passeriformes	Parulidae	*Wilsonia citrina*	Hooded warbler	X	

Table A-1 (continued). Birds known to occur at Canaveral National Seashore based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Passeriformes	Parulidae	*Wilsonia pusilla*	Wilson's warbler	X	
Passeriformes	Passeridae	*Passer domesticus*	House sparrow	X	
Passeriformes	Polioptilidae	*Polioptila caerulea*	Blue-gray gnatcatcher	X	X
Passeriformes	Regulidae	*Regulus calendula*	Ruby-crowned kinglet	X	
Passeriformes	Sittidae	*Sitta carolinensis*	White-breasted nuthatch		X
Passeriformes	Sturnidae	*Sturnus vulgaris*	European starling	X	X
Passeriformes	Thraupidae	*Piranga olivacea*	Scarlet tanager	X	
Passeriformes	Thraupidae	*Piranga rubra*	Summer tanager	X	X
Passeriformes	Troglodytidae	*Cistothorus palustris*	Marsh wren	X	
Passeriformes	Troglodytidae	*Cistothorus platensis*	Sedge wren	X	
Passeriformes	Troglodytidae	*Thryothorus ludovicianus*	Carolina wren	X	X
Passeriformes	Troglodytidae	*Troglodytes aedon*	House wren	X	
Passeriformes	Turdidae	*Catharus bicknelli*	Bicknell's thrush		X
Passeriformes	Turdidae	*Catharus fuscescens*	Veery	X	
Passeriformes	Turdidae	*Catharus guttatus*	Hermit thrush	X	
Passeriformes	Turdidae	*Catharus minimus*	Gray-cheeked thrush	X	
Passeriformes	Turdidae	*Catharus ustulatus*	Swainson's thrush	X	
Passeriformes	Turdidae	*Hylocichla mustelina*	Wood thrush	X	
Passeriformes	Turdidae	*Sialis sialis*	Eastern bluebird		X
Passeriformes	Turdidae	*Turdus migratorius*	American robin	X	
Passeriformes	Tyrannidae	*Empidonax alnorum*	Alder flycatcher	X	
Passeriformes	Tyrannidae	*Empidonax minimus*	Least flycatcher	X	
Passeriformes	Tyrannidae	*Empidonax virescens*	Acadian flycatcher	X	
Passeriformes	Tyrannidae	*Myiarchus crinitus*	Great crested flycatcher	X	X
Passeriformes	Tyrannidae	*Sayornis phoebe*	Eastern phoebe	X	X
Passeriformes	Tyrannidae	*Tyrannus dominicensis*	Gray kingbird	X	
Passeriformes	Tyrannidae	*Tyrannus tyrannus*	Eastern kingbird	X	X
Passeriformes	Tyrannidae	*Tyrannus verticalis*	Western kingbird	X	
Passeriformes	Vireonidae	*Vireo altiloquus*	Black-whiskered vireo	X	
Passeriformes	Vireonidae	*Vireo flavifrons*	Yellow-throated vireo	X	X
Passeriformes	Vireonidae	*Vireo griseus*	White-eyed vireo	X	X
Passeriformes	Vireonidae	*Vireo olivaceus*	Red-eyed vireo	X	X
Passeriformes	Vireonidae	*Vireo solitarius*	Blue-headed vireo	X	
Pelecaniformes	Ardeidae	*Ardea alba*	Great egret	X	
Pelecaniformes	Ardeidae	*Ardea herodias*	Great blue heron	X	X
Pelecaniformes	Ardeidae	*Botaurus lentiginosus*	American bittern	X	
Pelecaniformes	Ardeidae	*Bubulcus ibis*	Cattle egret	X	
Pelecaniformes	Ardeidae	*Butorides virescens*	Green heron	X	X
Pelecaniformes	Ardeidae	*Egretta caerulea*	Little blue heron	X	
Pelecaniformes	Ardeidae	*Egretta rufescens*	Reddish egret	X	
Pelecaniformes	Ardeidae	*Egretta thula*	Snowy egret	X	
Pelecaniformes	Ardeidae	*Egretta tricolor*	Tricolored heron	X	

Table A-1 (continued). Birds known to occur at Canaveral National Seashore based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Pelecaniformes	Ardeidae	*Ixobrychus exilis*	Least bittern	X	
Pelecaniformes	Ardeidae	*Nyctanassa violacea*	Yellow-crowned night-heron	X	
Pelecaniformes	Ardeidae	*Nycticorax nycticorax*	Black-crowned night-heron	X	
Pelecaniformes	Pelecanidae	*Pelecanus erythrorhynchos*	American white pelican	X	
Pelecaniformes	Pelecanidae	*Pelecanus occidentalis*	Brown pelican	X	
Pelecaniformes	Threskiornithidae	*Eudocimus albus*	White ibis	X	
Pelecaniformes	Threskiornithidae	*Platalea ajaja*	Roseate spoonbill	X	
Pelecaniformes	Threskiornithidae	*Plegadis falcinellus*	Glossy ibis	X	
Phoenicopteriformes	Phoenicopteridae	*Phoenicopterus ruber*	Greater flamingo	X	
Piciformes	Picidae	*Colaptes auratus*	Common flicker	X	X
Piciformes	Picidae	*Dryocopus pileatus*	Pileated woodpecker	X	X
Piciformes	Picidae	*Melanerpes carolinus*	Red-bellied woodpecker	X	X
Piciformes	Picidae	*Melanerpes erythrocephalus*	Red-headed woodpecker	X	X
Piciformes	Picidae	*Picoides pubescens*	Downy woodpecker	X	X
Piciformes	Picidae	*Picoides villosus*	Hairy woodpecker	X	X
Piciformes	Picidae	*Sphyrapicus varius*	Yellow-bellied sapsucker	X	
Podicipediformes	Podicipedidae	*Podiceps auritus*	Horned grebe	X	
Podicipediformes	Podicipedidae	*Podilymbus podiceps*	Pied-billed grebe	X	
Procellariiformes	Hydrobatidae	*Oceanites oceanicus*	Wilson's storm-petrel	X	
Procellariiformes	Procellariidae	*Puffinus gravis*	Greater shearwater	X	
Procellariiformes	Procellariidae	*Puffinus lherminieri*	Audubon's shearwater	X	
Strigiformes	Strigidae	*Asio flammeus*	Short-eared owl	X	
Strigiformes	Strigidae	*Bubo virginianus*	Great horned owl	X	X
Strigiformes	Strigidae	*Megascops asio*	Eastern screech-owl	X	X
Strigiformes	Strigidae	*Strix varia*	Barred owl	X	
Strigiformes	Tytonidae	*Tyto alba*	Barn owl	X	
Suliformes	Anhingidae	*Anhinga anhinga*	Anhinga	X	
Suliformes	Fregatidae	*Fregata magnificens*	Magnificent frigatebird	X	
Suliformes	Phalacrocoracidae	*Phalacrocorax auritus*	Double-crested cormorant	X	
Suliformes	Sulidae	*Morus bassanus*	Northern gannet	X	

Appendix B—Species Detection Matrix

Table B-1. Species detected at each sampling location at Canaveral National Seashore in 2014. Refer to Figure 2 for labeled sampling locations.

Species	02	05	06	09	10	12	13	14	16	18	19	20	21	22	23	24	27	28	30	31	32	33	34	35	36	38	39	41	43
American crow						X				X						X			X										
American goldfinch							X																						
American oystercatcher	X																												
American redstart													X																
Bald eagle																				X							X		X
Barn swallow					X	X	X									X	X	X				X			X	X	X		X
Belted kingfisher																		X		X							X		
Bicknell's thrush																		X				X							
Black-and-white warbler																		X											
Black-necked stilt												X					X	X											
Black-throated blue warbler													X												X				
Blue jay	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
Boat-tailed grackle		X			X							X			X		X				X	X	X				X	X	
Brown thrasher				X																									
Brown-headed cowbird														X									X	X			X		X
Canada goose									X																				
Carolina chickadee																								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
Cedar waxwing			X	X														X							X		X		
Chimney swift																									X				
Clapper rail	X																											X	
Common grackle	X							X														X	X	X				X	
Common ground-dove			X				X	X																					
Common nighthawk			X		X		X													X									
Common yellowthroat	X		X		X	X	X		X	X	X	X	X				X		X		X	X	X	X		X		X	X
Downy woodpecker	X			X		X	X				X			X						X	X			X	X				X
Dunlin																				X									
Eastern bluebird												X							X		X							X	

Table B-1 (continued). Species detected at each sampling location at Canaveral National Seashore in 2014. Refer to Figure 2 for labeled sampling locations.

Species	02	05	06	09	10	12	13	14	16	18	19	20	21	22	23	24	27	28	30	31	32	33	34	35	36	38	39	41	43
Eastern kingbird																					X								
Eastern meadowlark	X	X			X							X					X												
Eastern phoebe															X														
Eastern screech owl						X	X																						
Eastern towhee	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
European starling						X																							
Fish crow			X				X	X			X		X	X		X													
Florida scrub-jay			X				X								X					X		X		X					
Gray catbird		X	X	X						X							X				X		X		X				X
Great blue heron																									X		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
Great horned owl																				X									
Greater yellowlegs		X										X					X				X								
Green heron													X	X														X	
Hairy woodpecker						X																							
House finch	X	X	X	X	X		X					X				X				X	X			X		X		X	
Killdeer	X	X			X			X				X	X				X				X	X	X	X		X		X	
Loggerhead shrike																	X												
Mottled duck																											X	X	
Mourning dove	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
Northern bobwhite	X	X	X	X	X	X	X			X		X	X	X	X		X		X	X	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	X	X	X
Northern flicker						X	X	X							X	X	X					X						X	
Northern mockingbird										X										X	X	X	X			X	X	X	
Northern parula				X						X	X		X					X							X				
Orchard oriole																	X												
Osprey							X	X							X	X													
Pileated woodpecker	X	X	X		X	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
Prairie warbler																							X						
Purple martin	X						X													X		X							

Table B-1 (continued). Species detected at each sampling location at Canaveral National Seashore in 2014. Refer to Figure 2 for labeled sampling locations.

Species	02	05	06	09	10	12	13	14	16	18	19	20	21	22	23	24	27	28	30	31	32	33	34	35	36	38	39	41	43
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	X	X			X	X
Red-eyed vireo							X			X	X		X					X						X	X	X			X
Red-headed woodpecker					X		X										X											X	
Red-shouldered hawk				X			X			X			X	X					X	X	X		X	X		X			
Red-tailed hawk								X																					
Red-winged blackbird	X	X		X	X	X		X		X		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Royal tern																											X		
Ruby-throated hummingbird					X																								
Sandhill crane																													X
Summer tanager														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
White-breasted nuthatch													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
Willet		X										X					X						X				X		
Wood duck														X															
Worm-eating warbler														X															
Yellow-throated vireo													X																
Yellow-throated warbler																									X				

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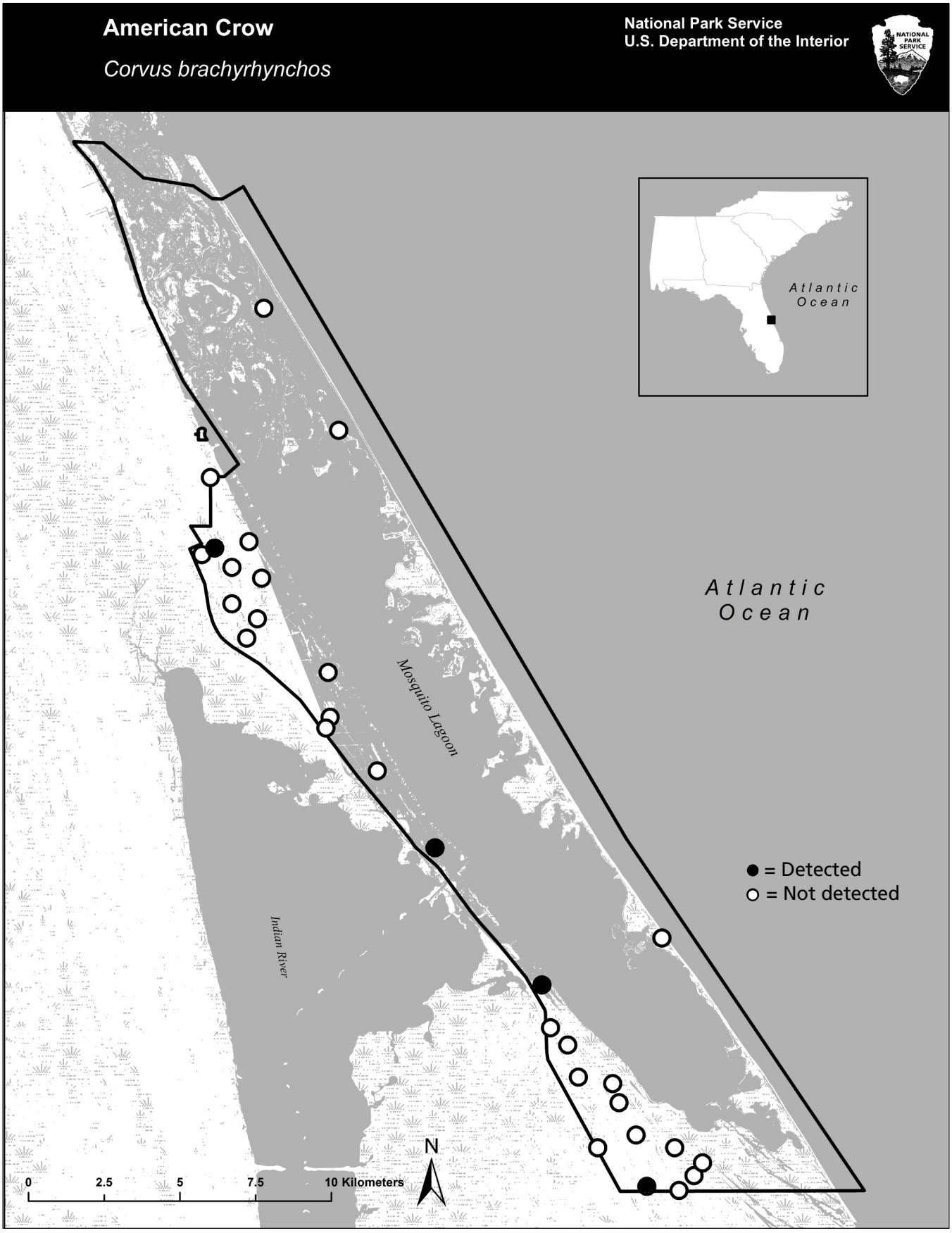


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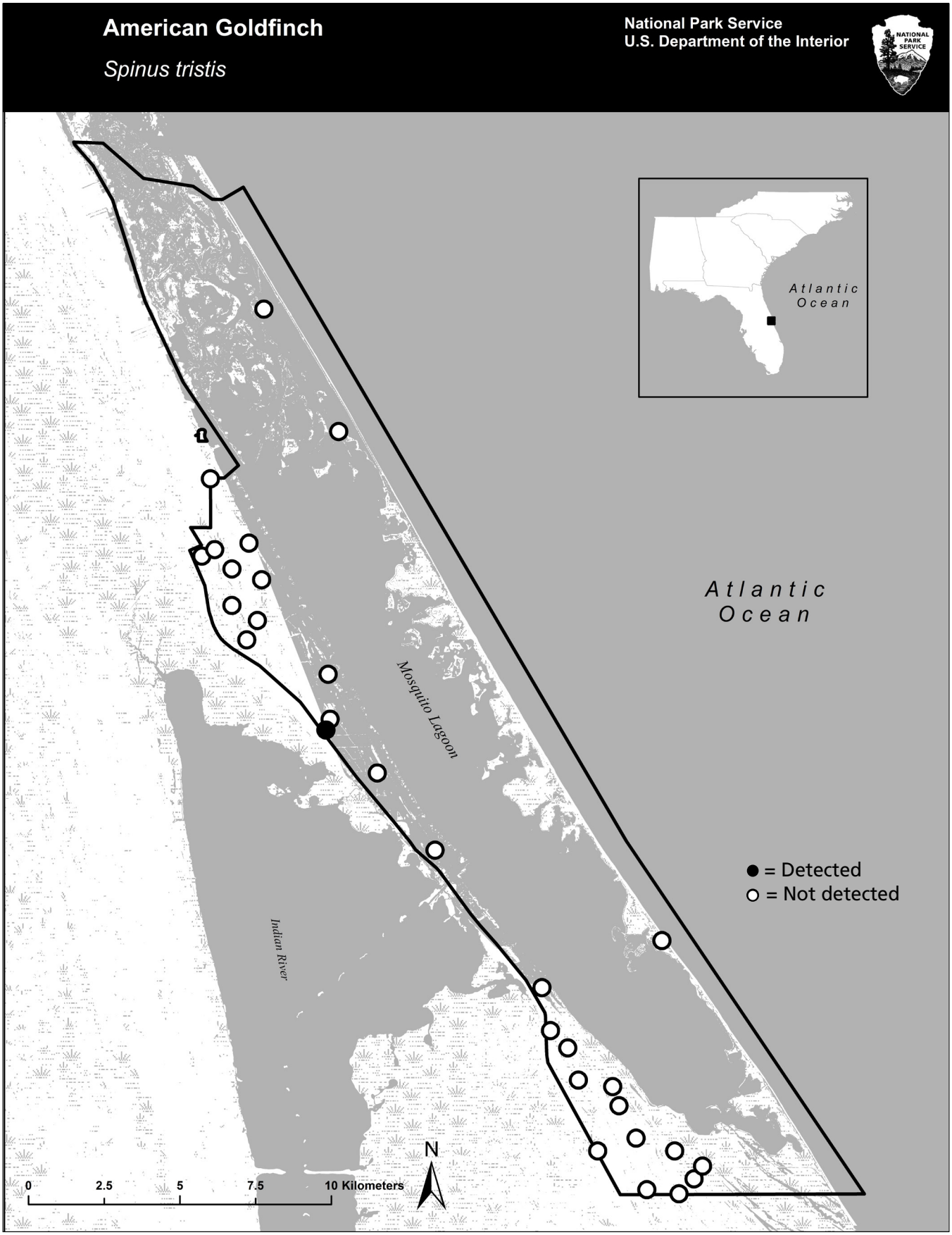


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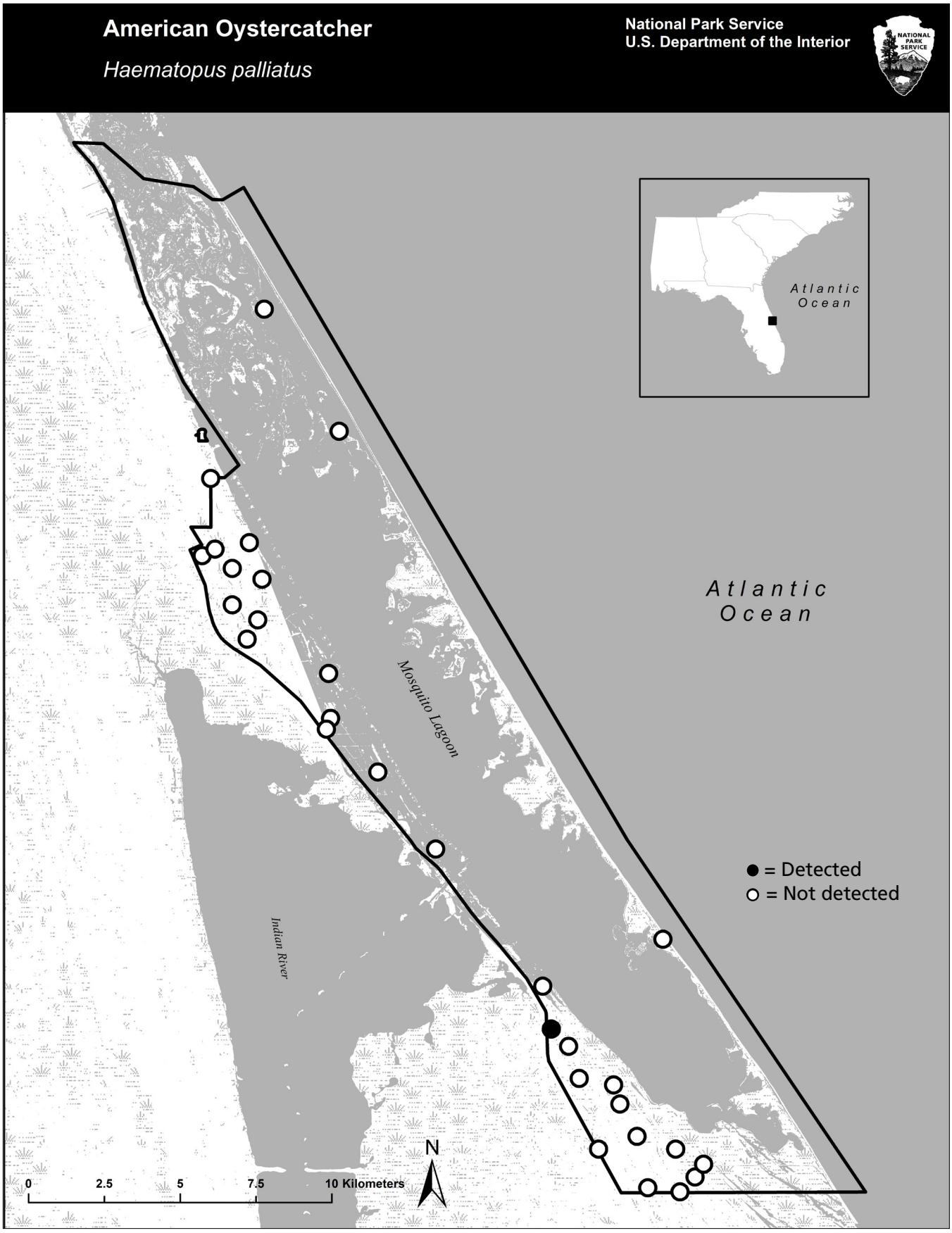


Figure C-3. Sampling locations where American oystercatcher (*Haematopus palliatus*) was detected at Canaveral National Seashore, 2014.

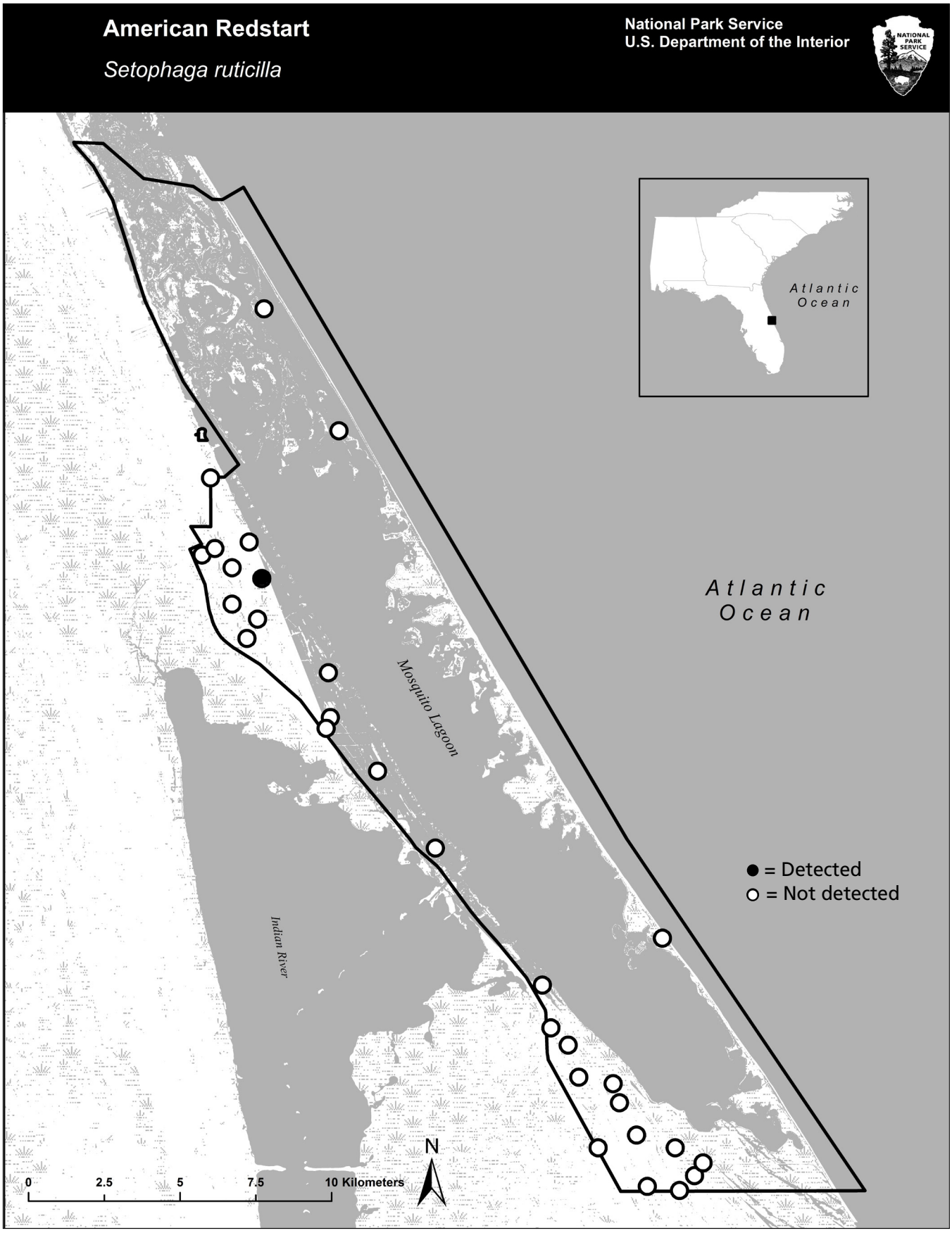


Figure C-4. Sampling locations where American redstart (*Setophaga ruticilla*) was detected at Canaveral National Seashore, 2014.

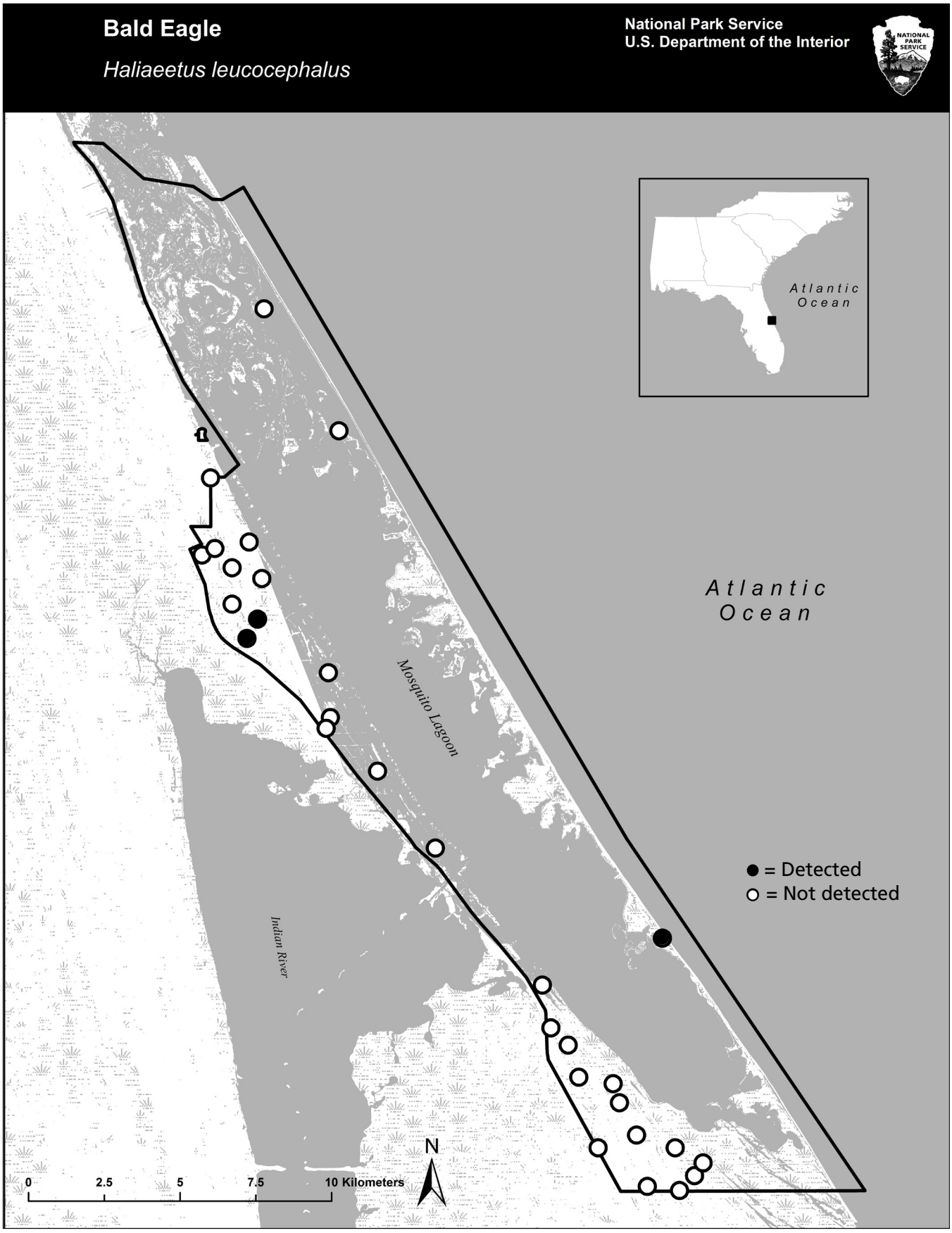


Figure C-5. Sampling locations where bald eagle (*Haliaeetus leucocephalus*) was detected at Canaveral National Seashore, 2014.

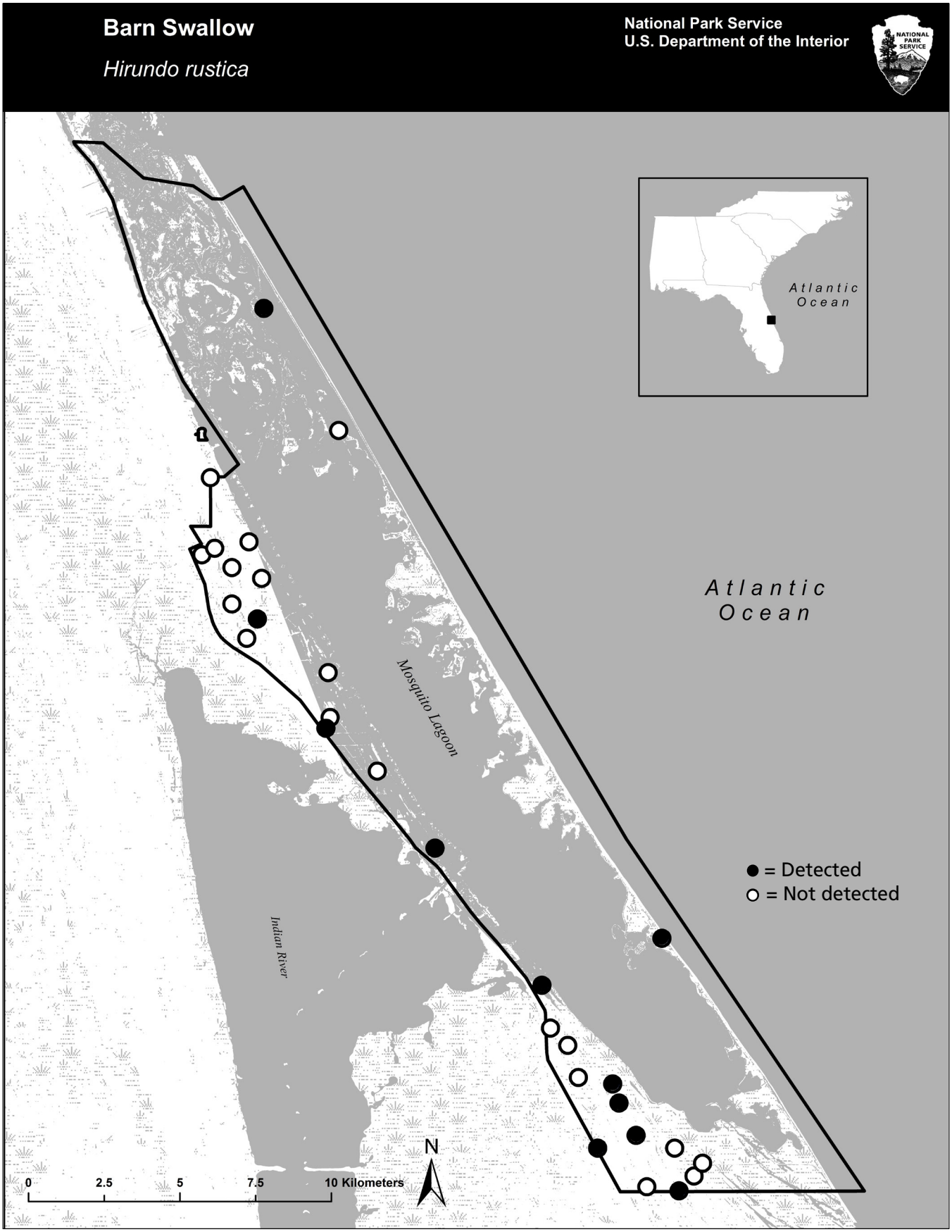


Figure C-6. Sampling locations where barn swallow (*Hirundo rustica*) was detected at Canaveral National Seashore, 2014.

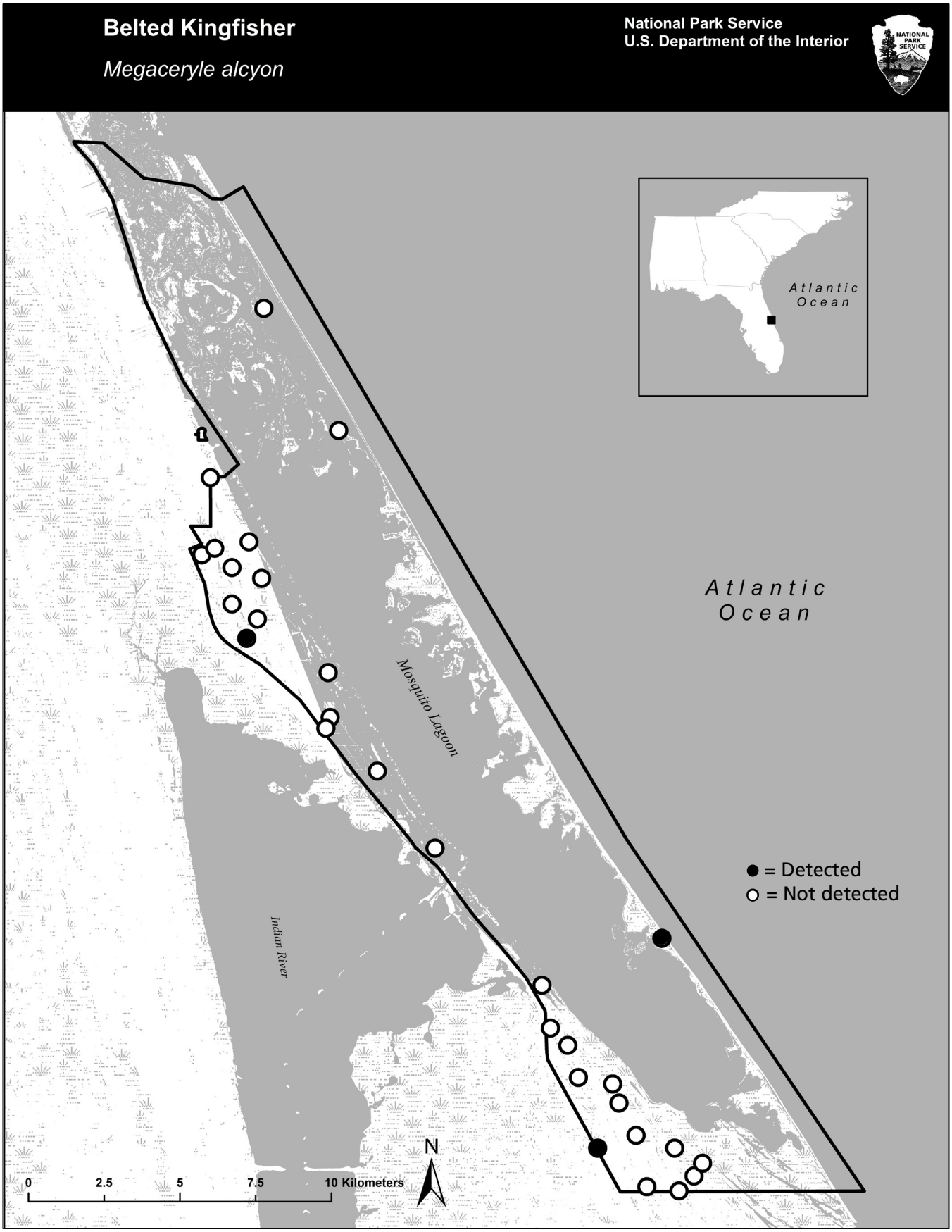


Figure C-7. Sampling locations where belted kingfisher (*Megaceryle alcyon*) was detected at Canaveral National Seashore, 2014.

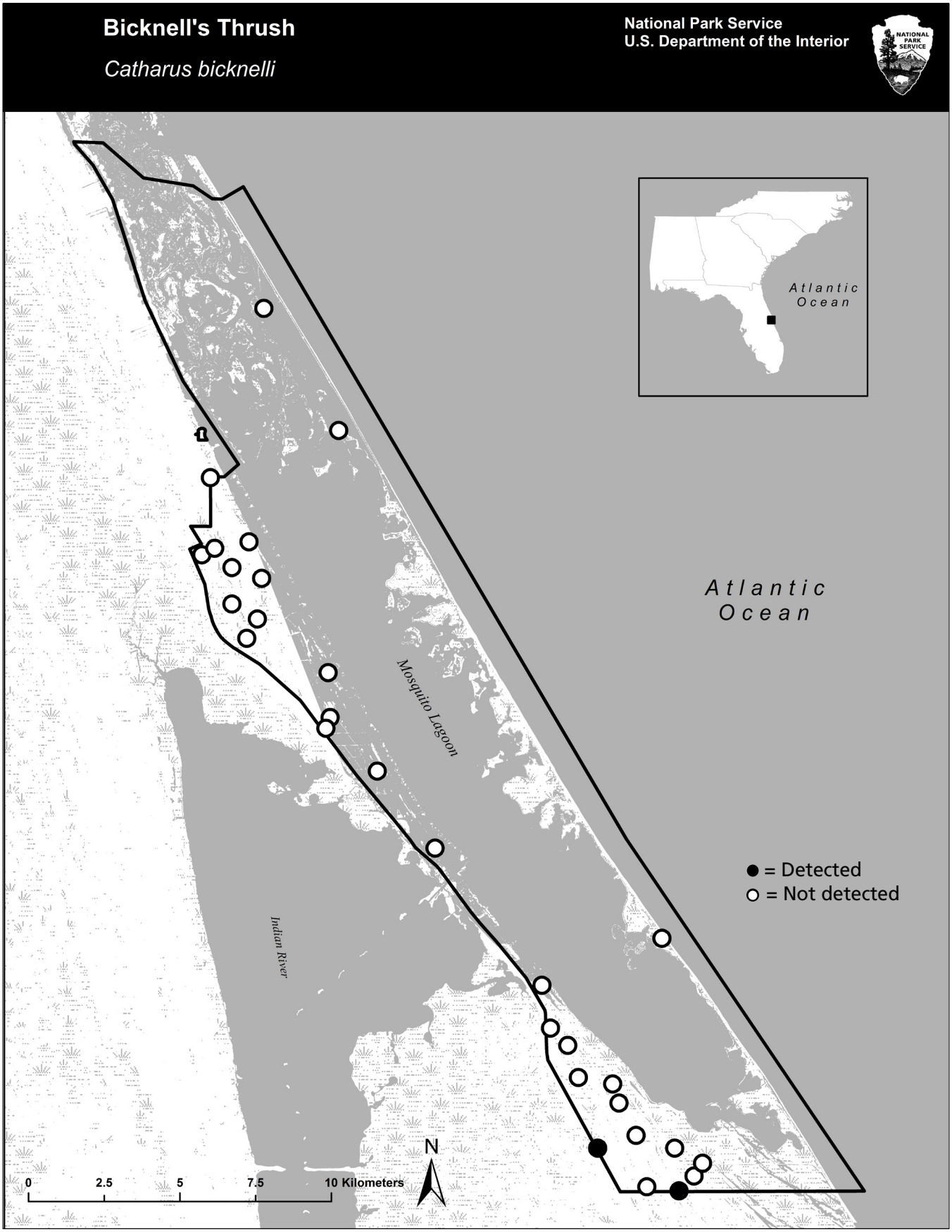


Figure C-8. Sampling locations where Bicknell's thrush (*Catharus bicknelli*) was detected at Canaveral National Seashore, 2014.

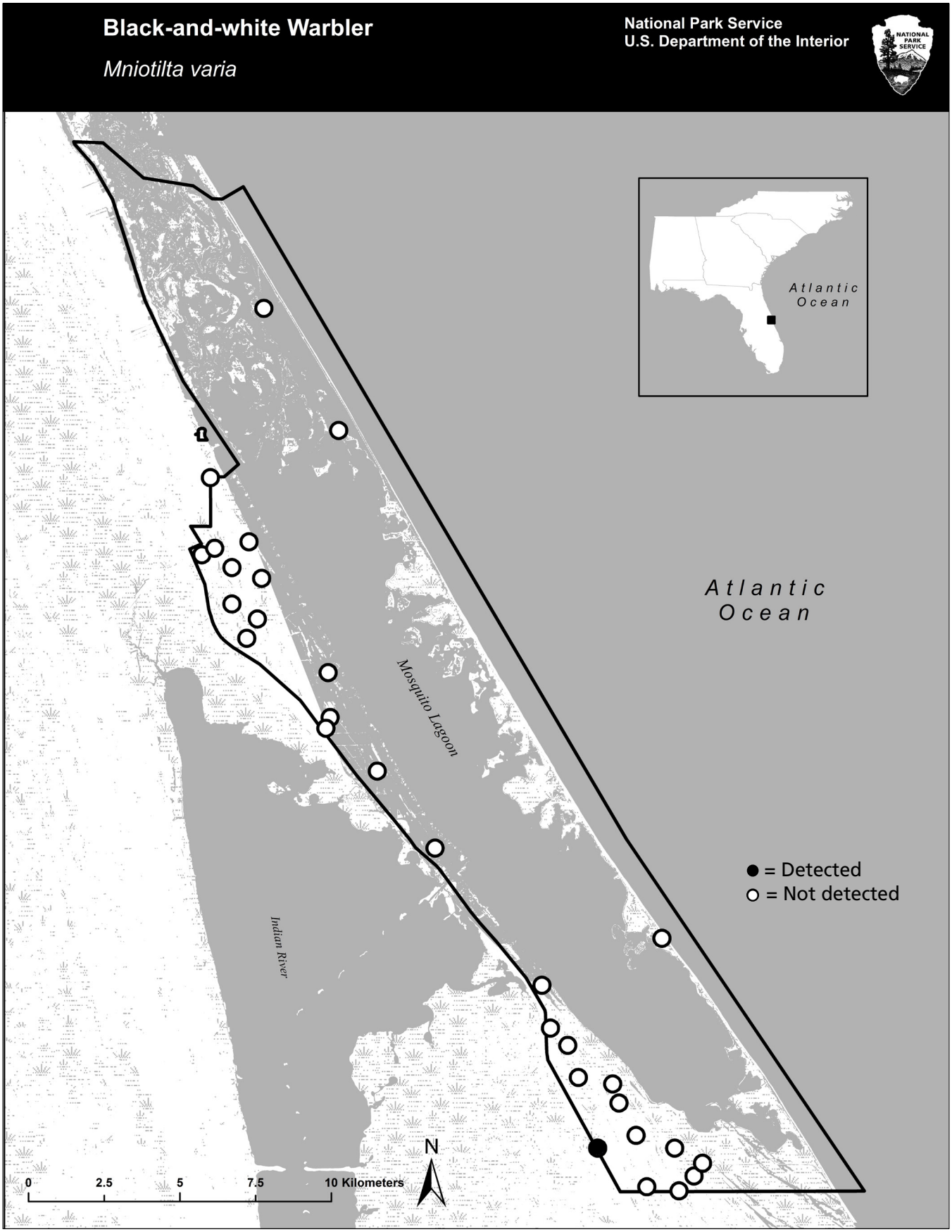


Figure C-9. Sampling locations where black-and-white warbler (*Mniotilta varia*) was detected at Canaveral National Seashore, 2014.

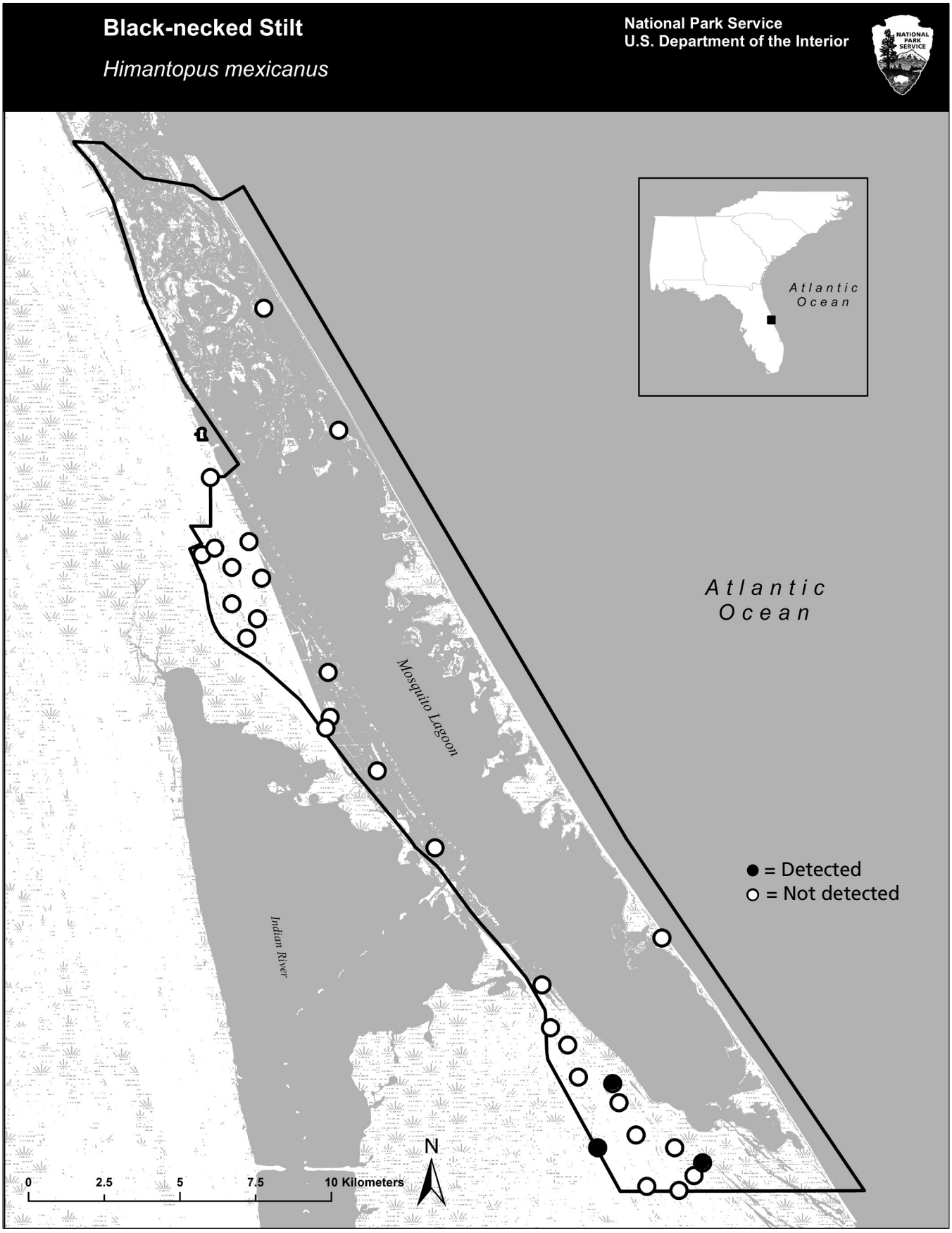


Figure C-10. Sampling locations where black-necked stilt (*Himantopus mexicanus*) was detected at Canaveral National Seashore, 2014.

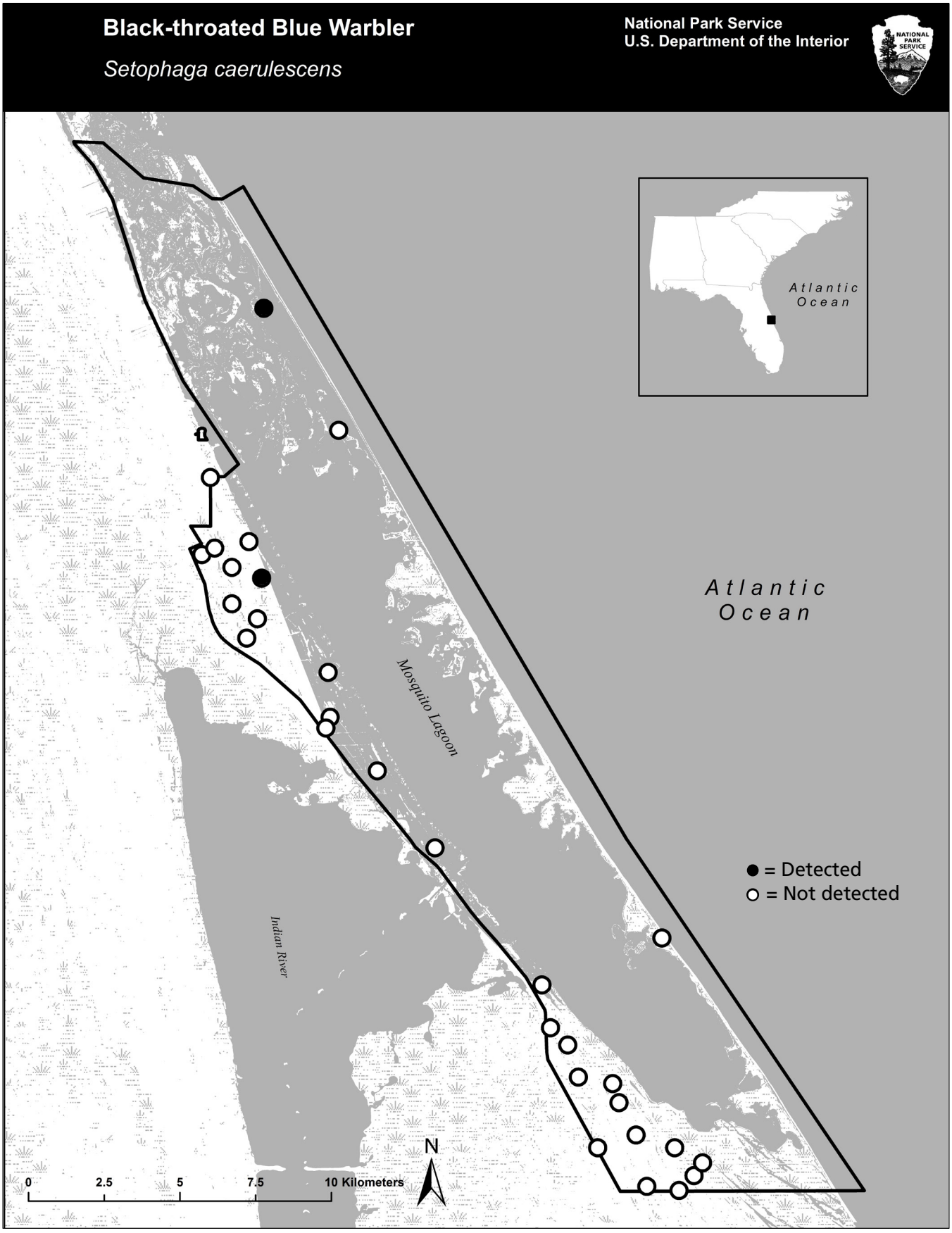


Figure C-11. Sampling locations where black-throated blue warbler (*Setophaga caerulescens*) was detected at Canaveral National Seashore, 2014.

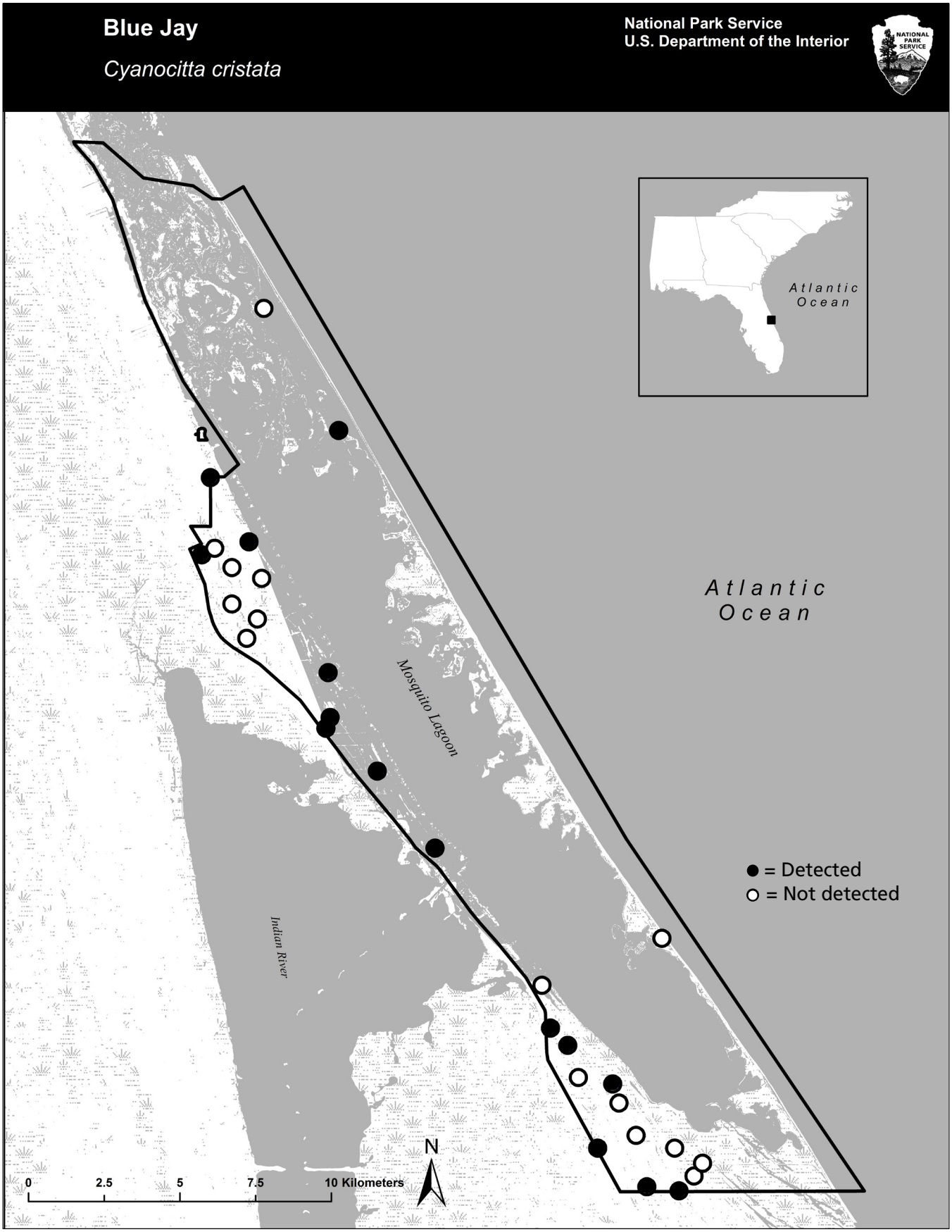


Figure C-12. Sampling locations where blue jay (*Cyanocitta cristata*) was detected at Canaveral National Seashore, 2014.

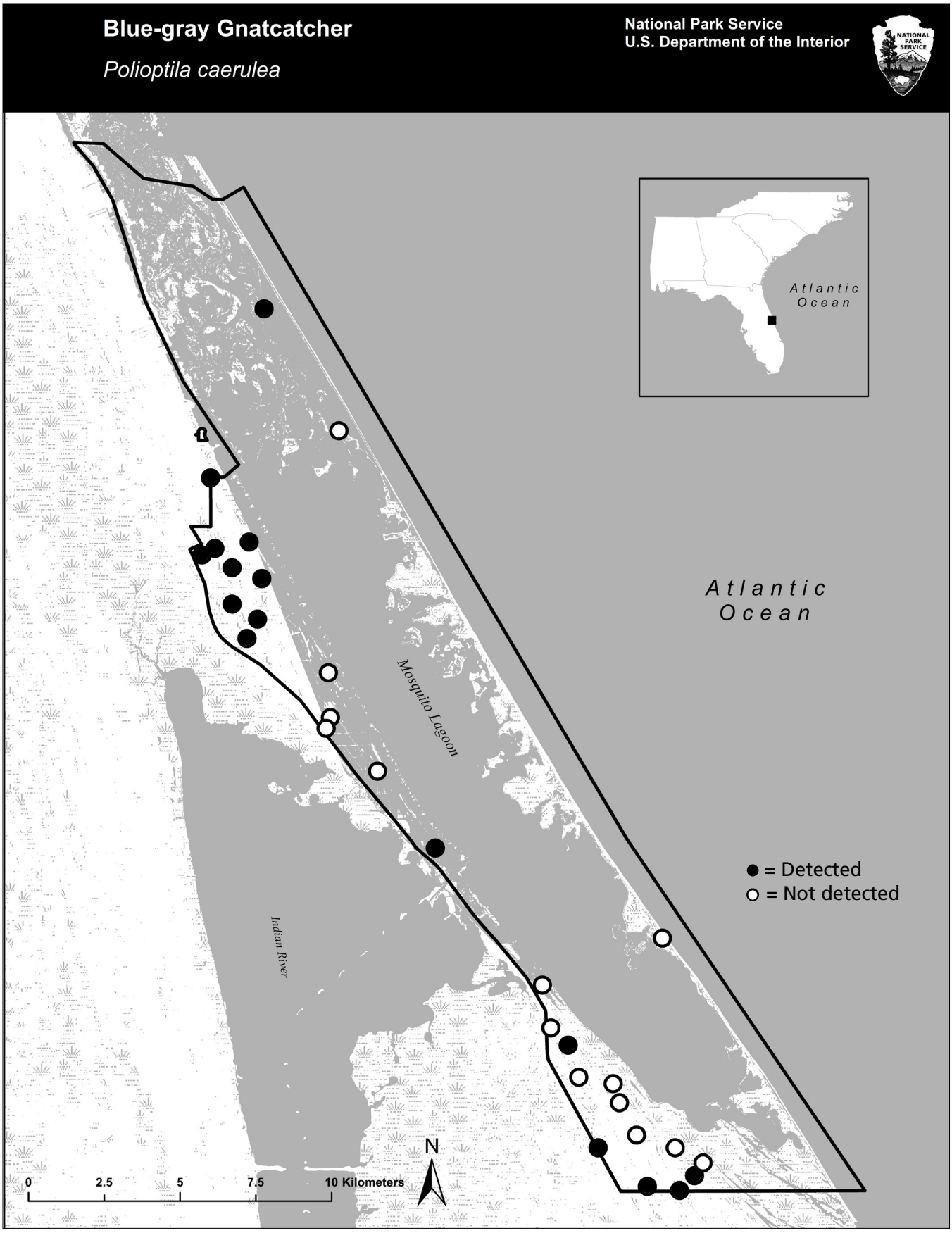


Figure C-13. Sampling locations where blue-gray gnatcatcher (*Polioptila caerulea*) was detected at Canaveral National Seashore, 2014.

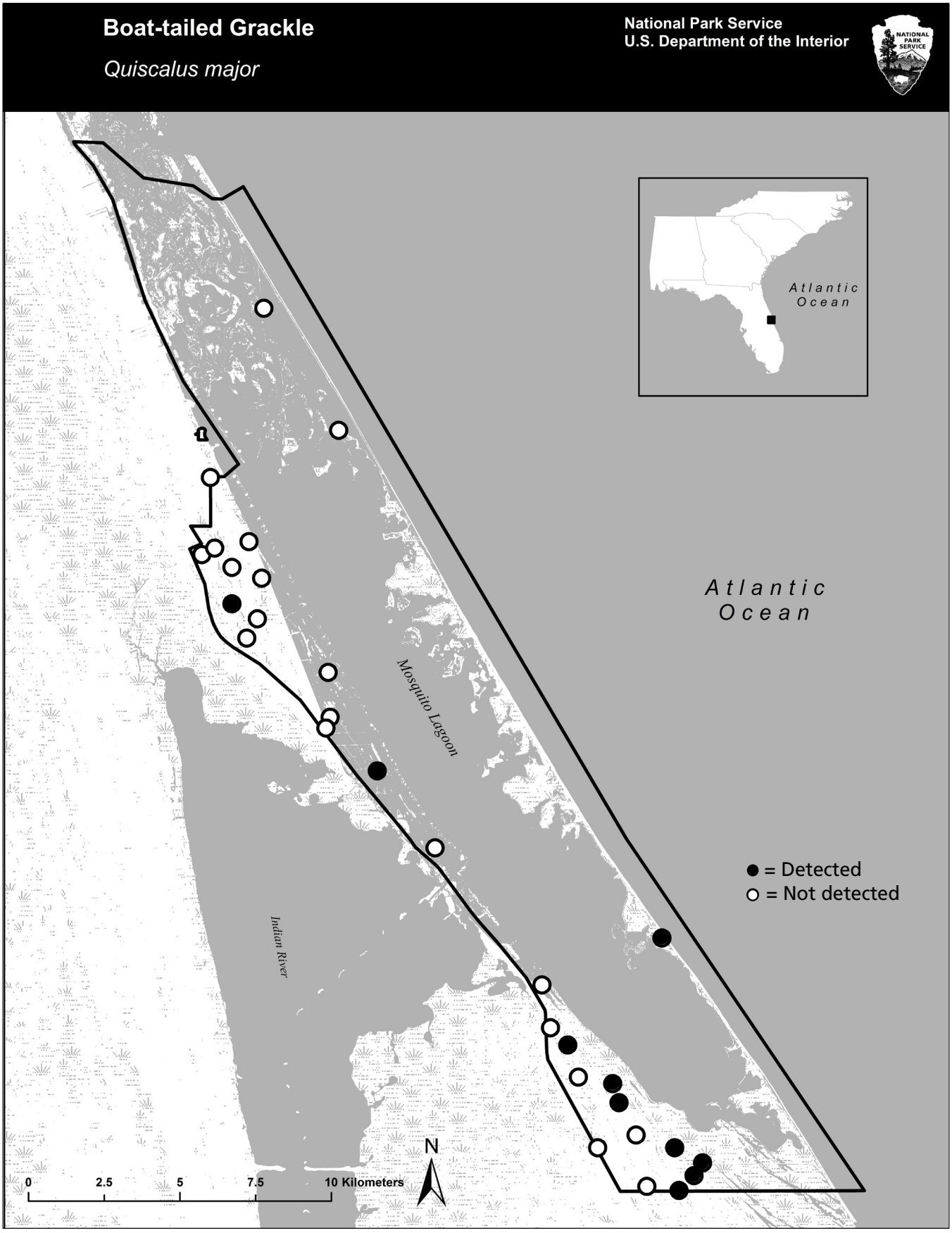


Figure C-14. Sampling locations where boat-tailed grackle (*Quiscalus major*) was detected at Canaveral National Seashore, 2014.

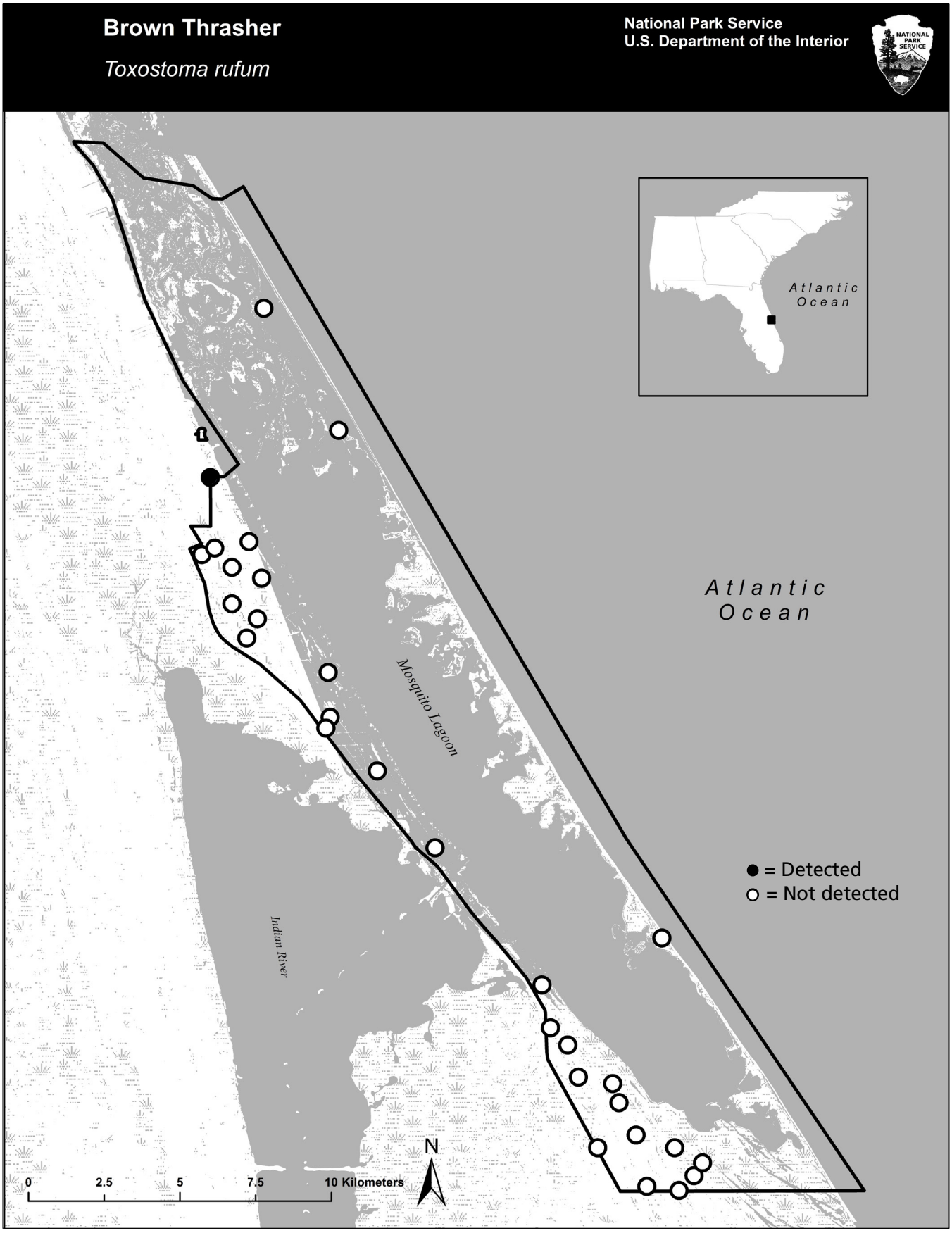


Figure C-15. Sampling locations where brown thrasher (*Toxostoma rufum*) was detected at Canaveral National Seashore, 2014.

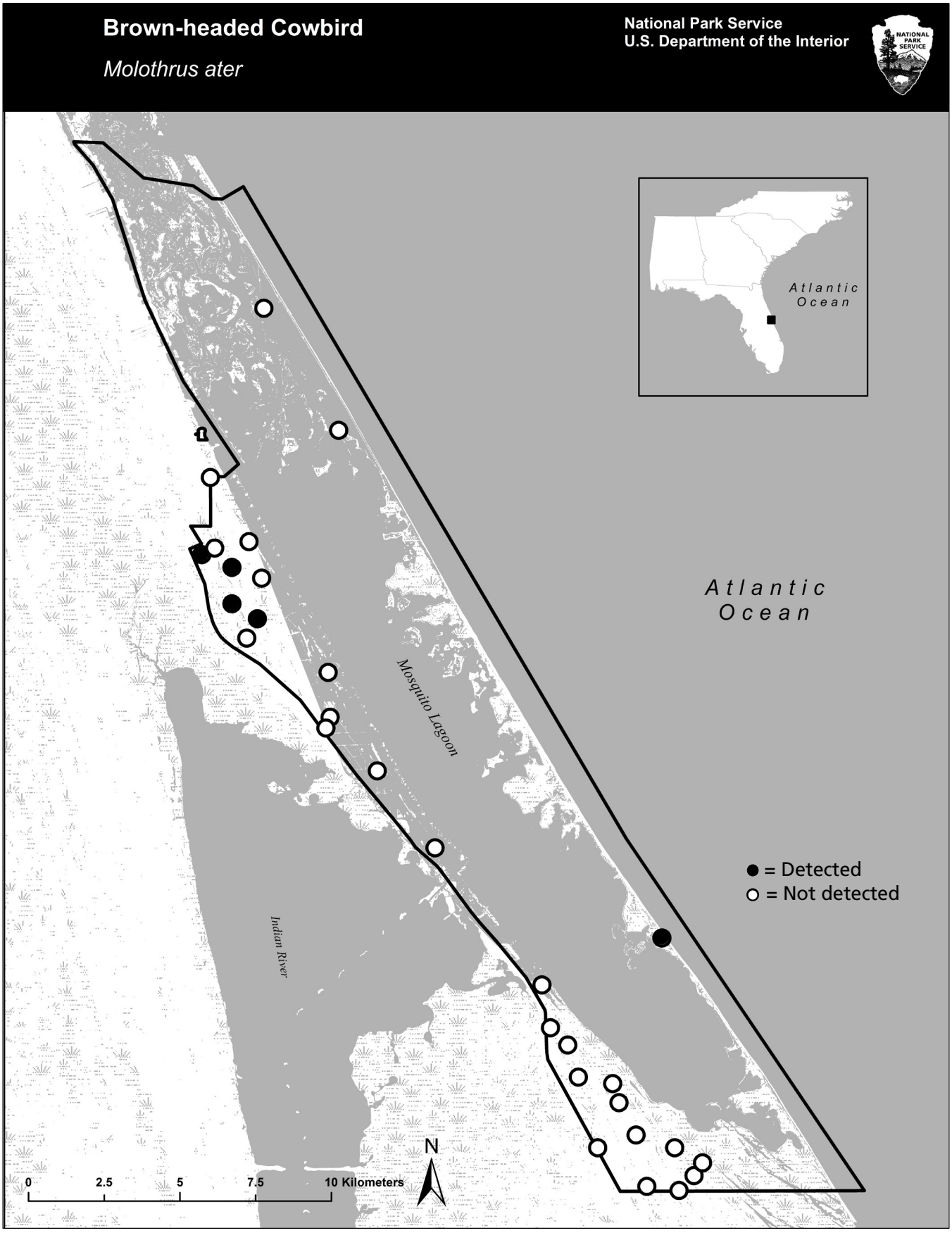


Figure C-16. Sampling locations where brown-headed cowbird (*Molothrus ater*) was detected at Canaveral National Seashore, 2014.

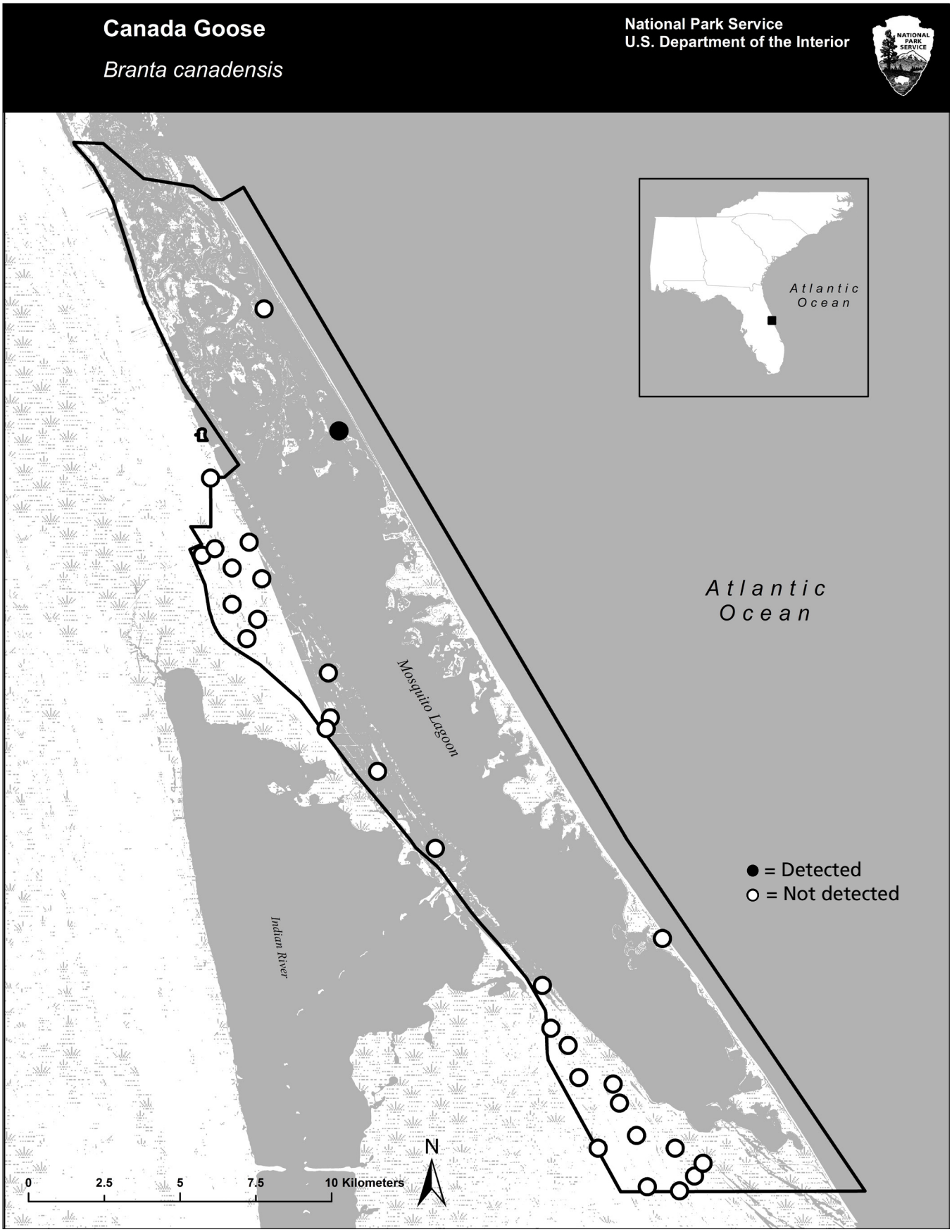


Figure C-17. Sampling locations where Canada goose (*Branta canadensis*) was detected at Canaveral National Seashore, 2014.

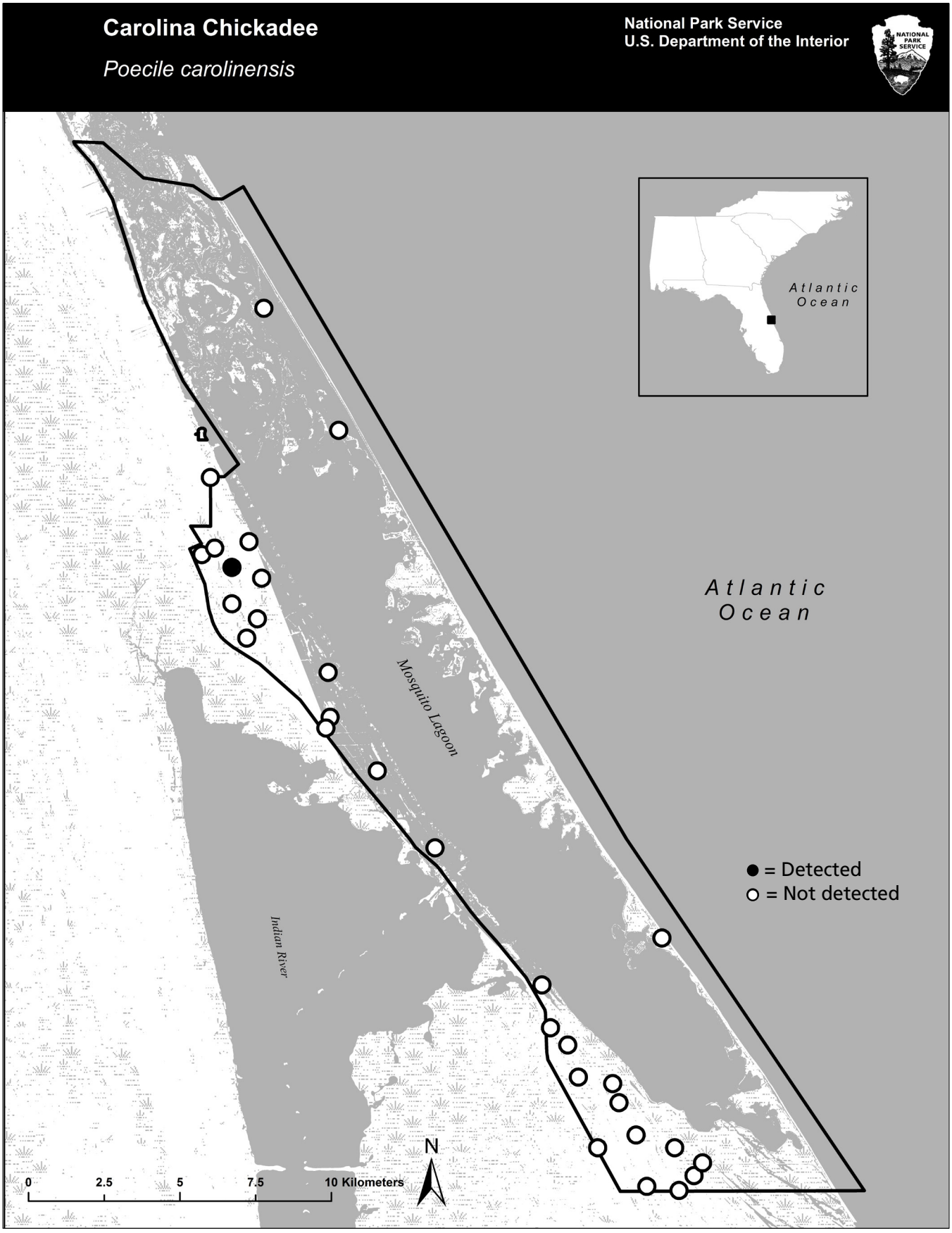


Figure C-18. Sampling locations where Carolina chickadee (*Poecile carolinensis*) was detected at Canaveral National Seashore, 2014.

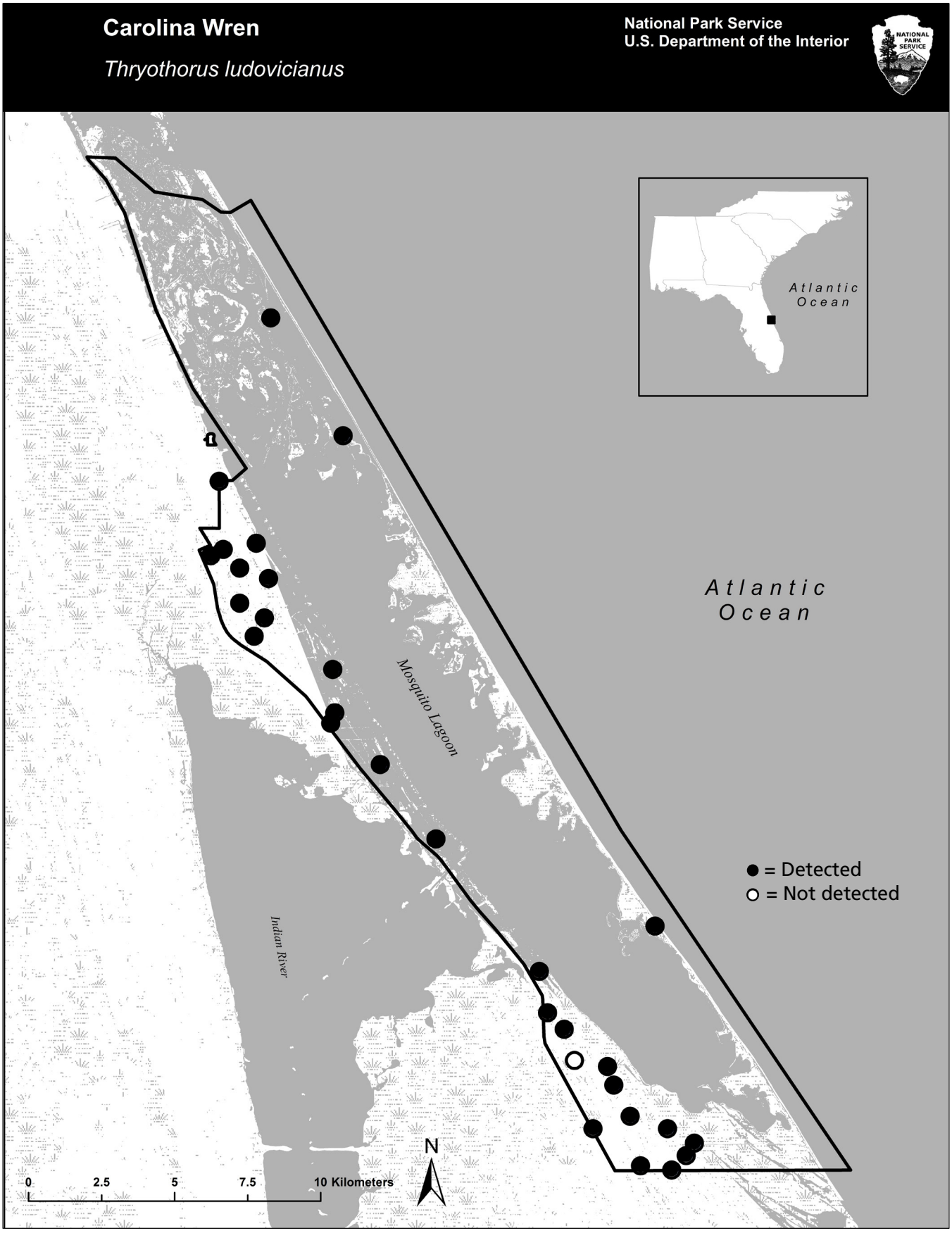


Figure C-19. Sampling locations where Carolina wren (*Thryothorus ludovicianus*) was detected at Canaveral National Seashore, 2014.

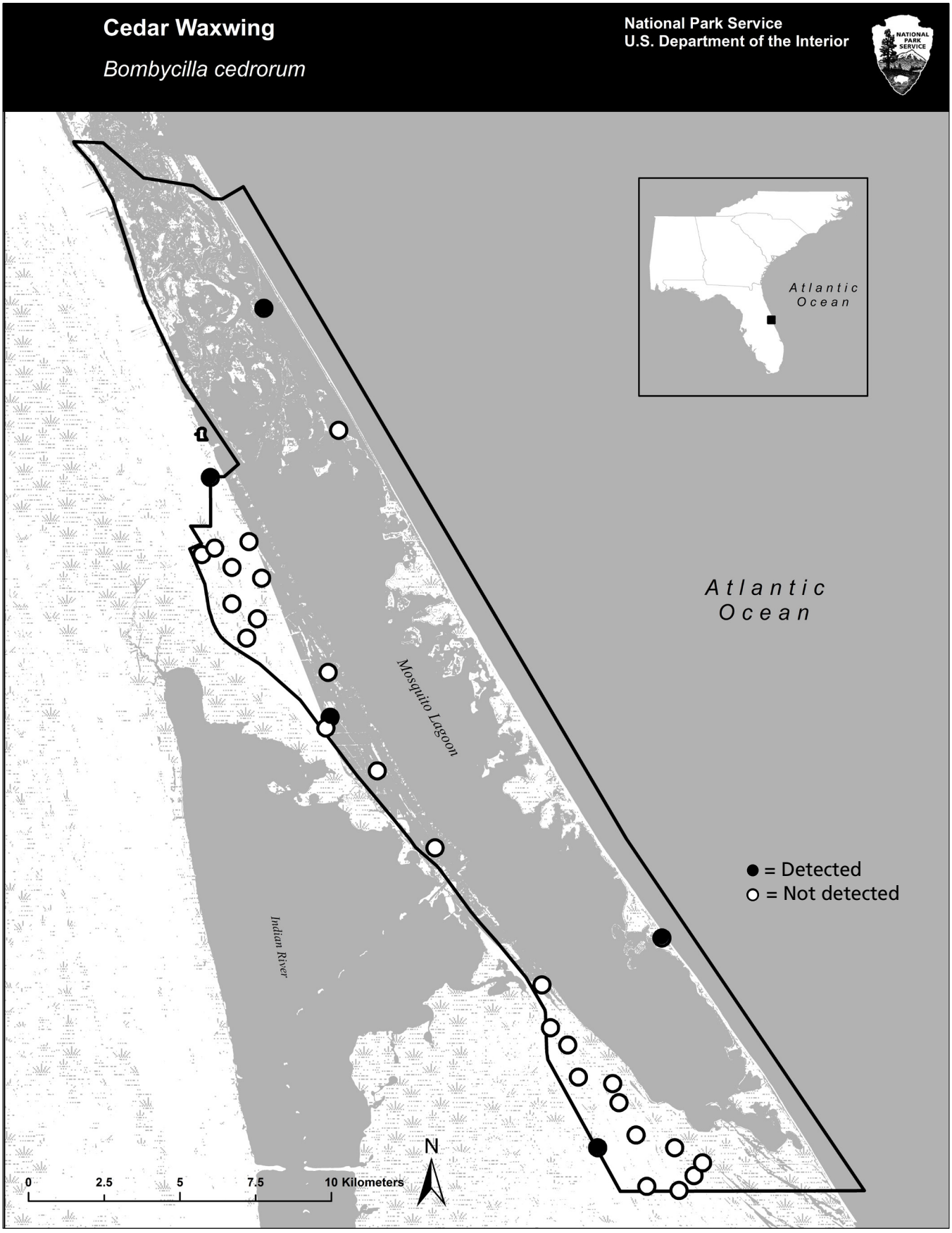


Figure C-20. Sampling locations where cedar waxwing (*Bombycilla cedrorum*) was detected at Canaveral National Seashore, 2014.

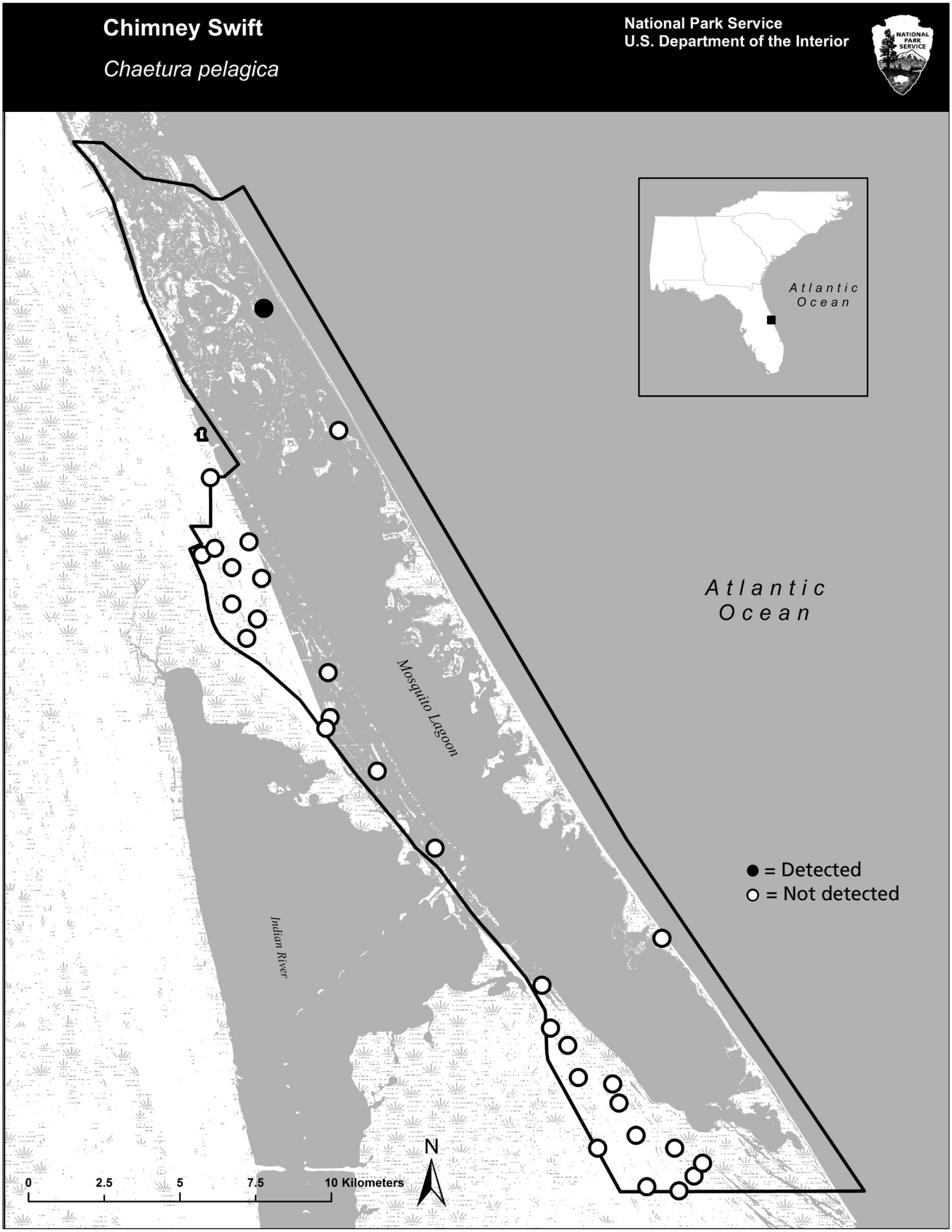


Figure C-21. Sampling locations where chimney swift (*Chaetura pelagica*) was detected at Canaveral National Seashore, 2014.

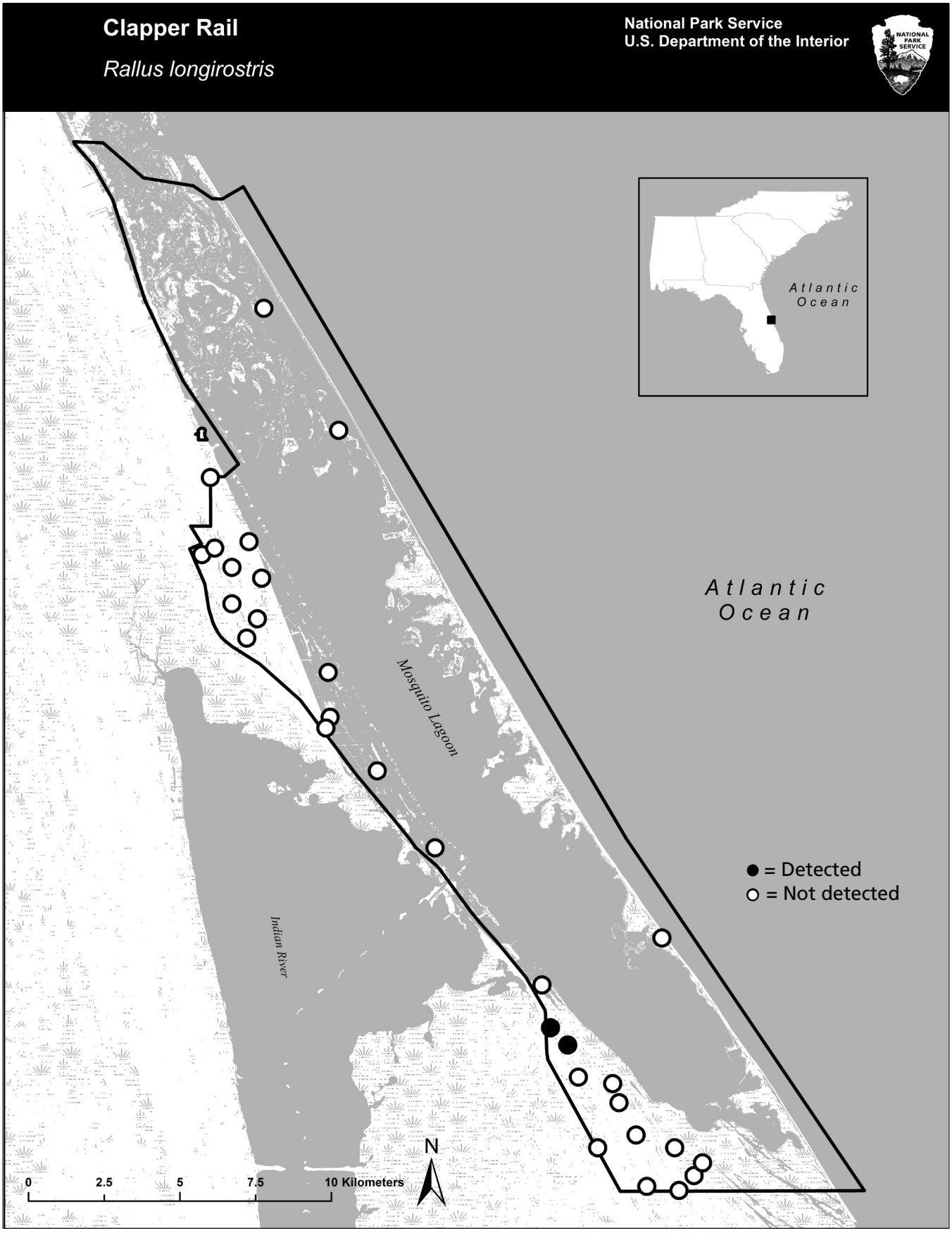


Figure C-22. Sampling locations where clapper rail (*Rallus longirostris*) was detected at Canaveral National Seashore, 2014.

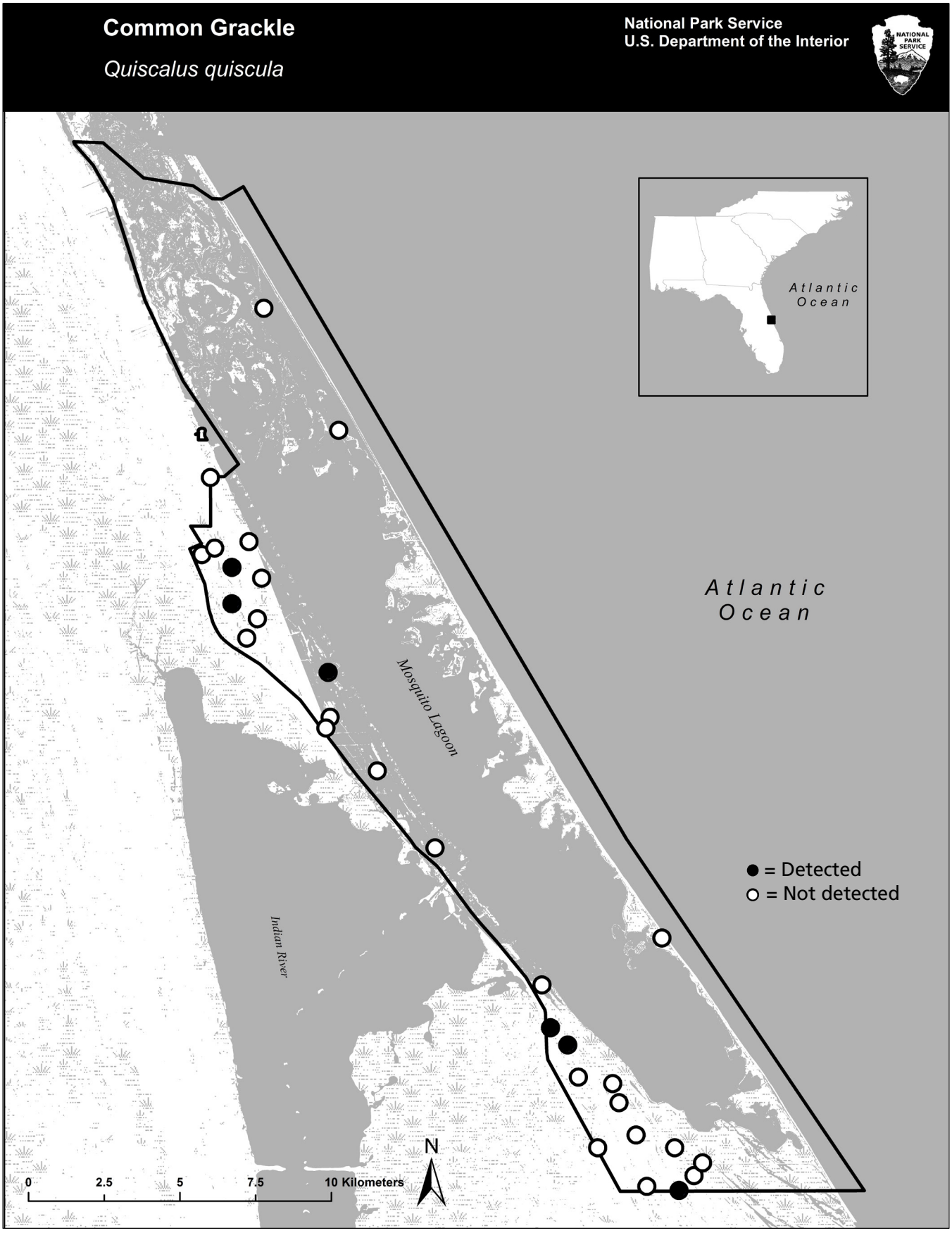


Figure C-23. Sampling locations where common grackle (*Quiscalus quiscula*) was detected at Canaveral National Seashore, 2014.

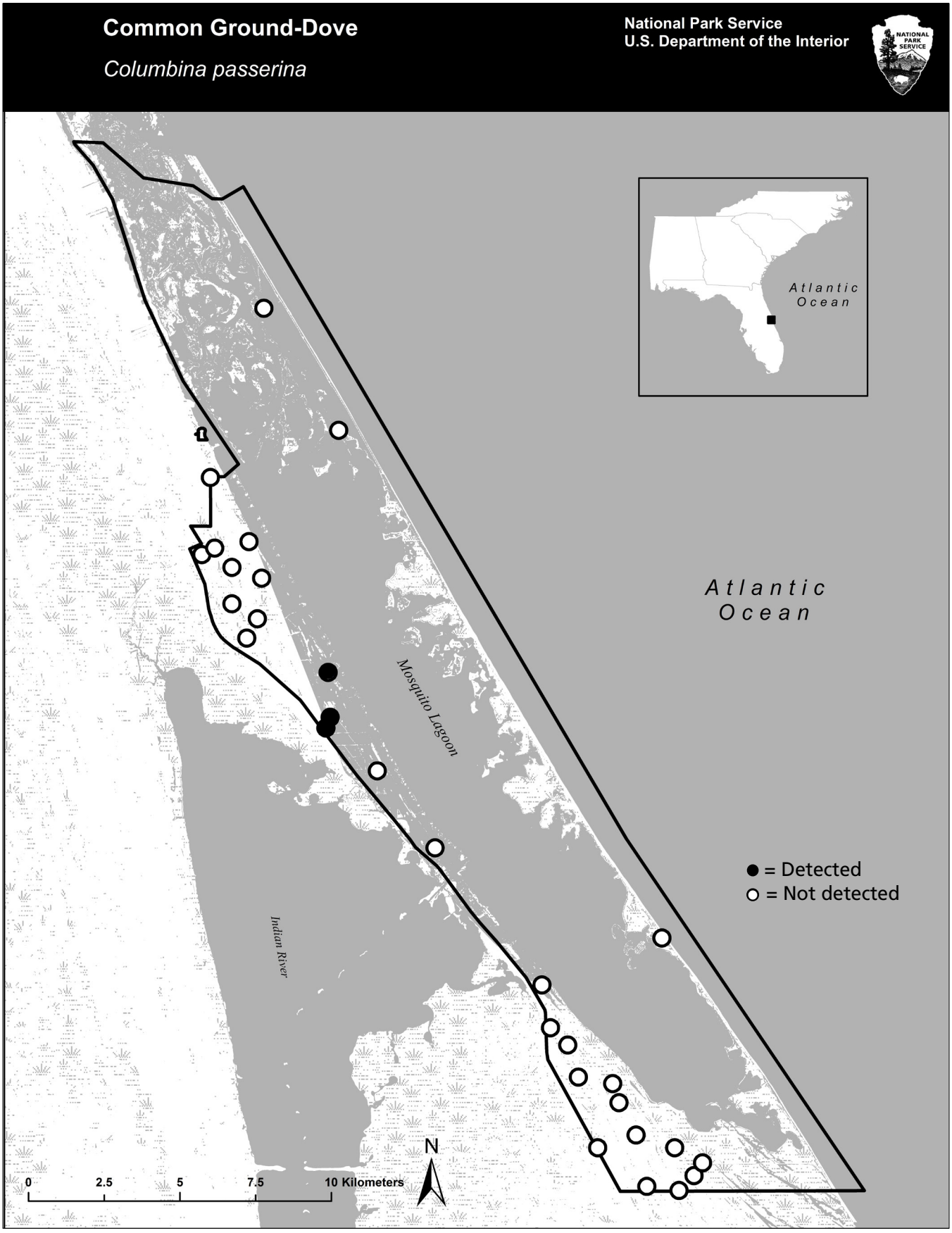


Figure C-24. Sampling locations where common ground-dove (*Columbina passerina*) was detected at Canaveral National Seashore, 2014.

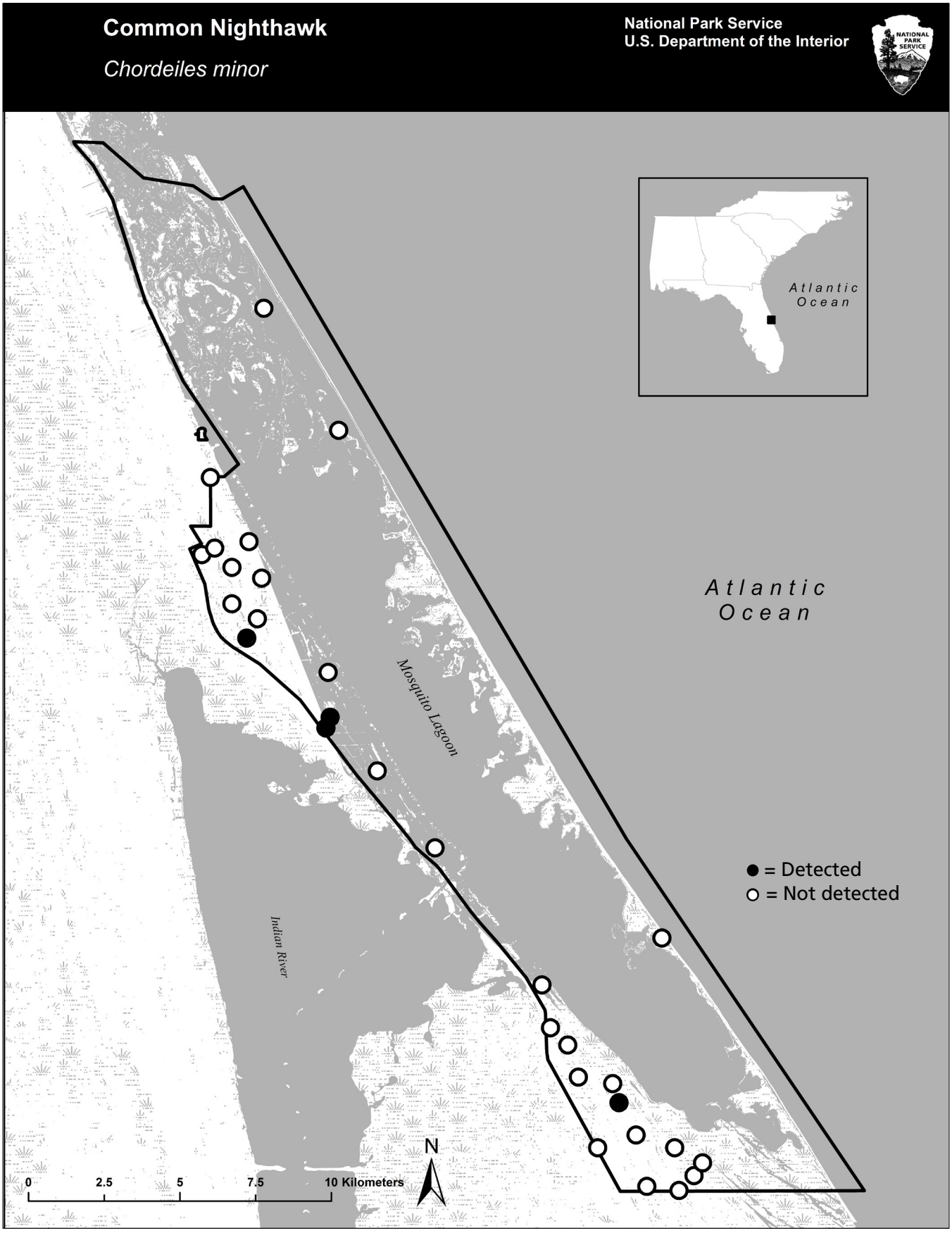


Figure C-25. Sampling locations where common nighthawk (*Chordeiles minor*) was detected at Canaveral National Seashore, 2014.

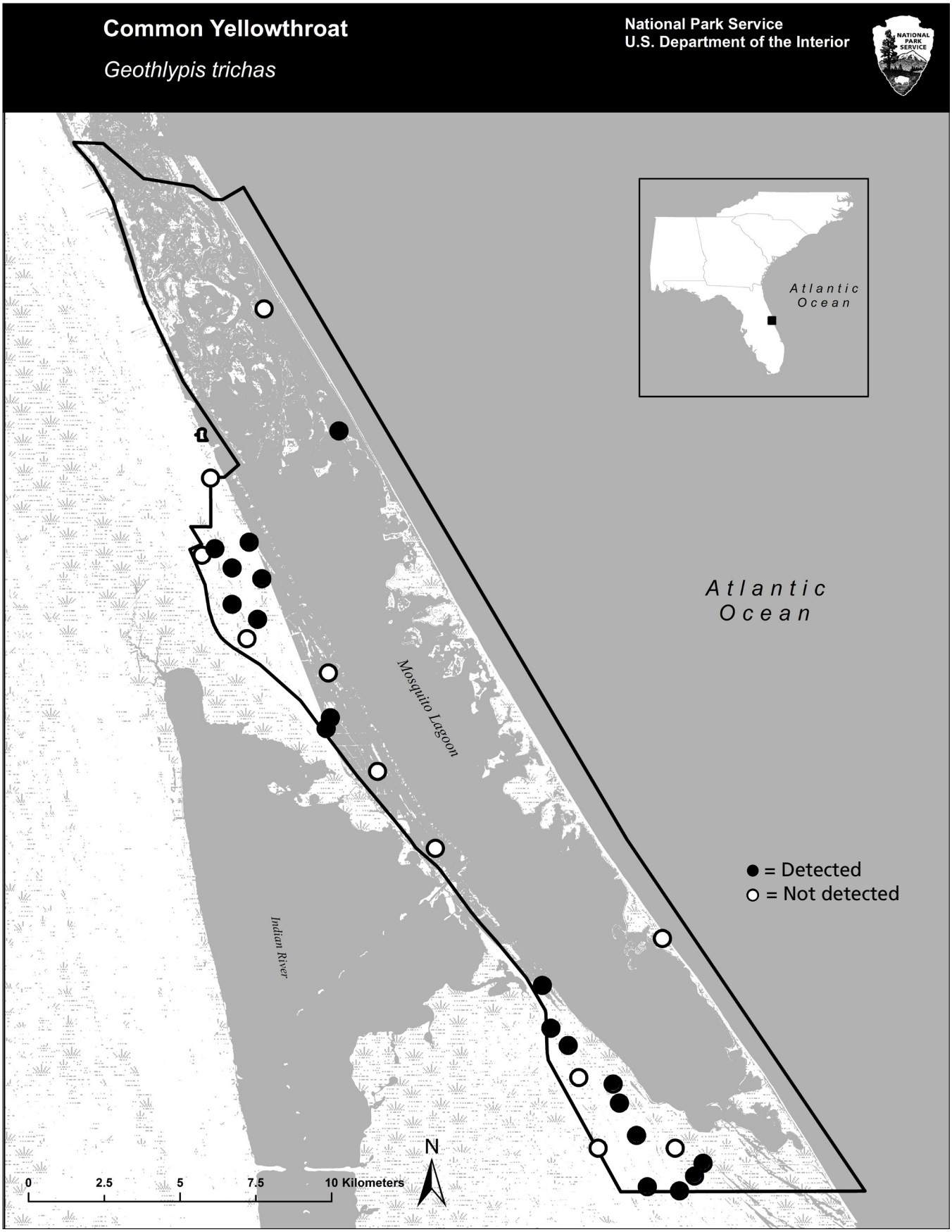


Figure C-26. Sampling locations where common yellowthroat (*Geothlypis trichas*) was detected at Canaveral National Seashore, 2014.

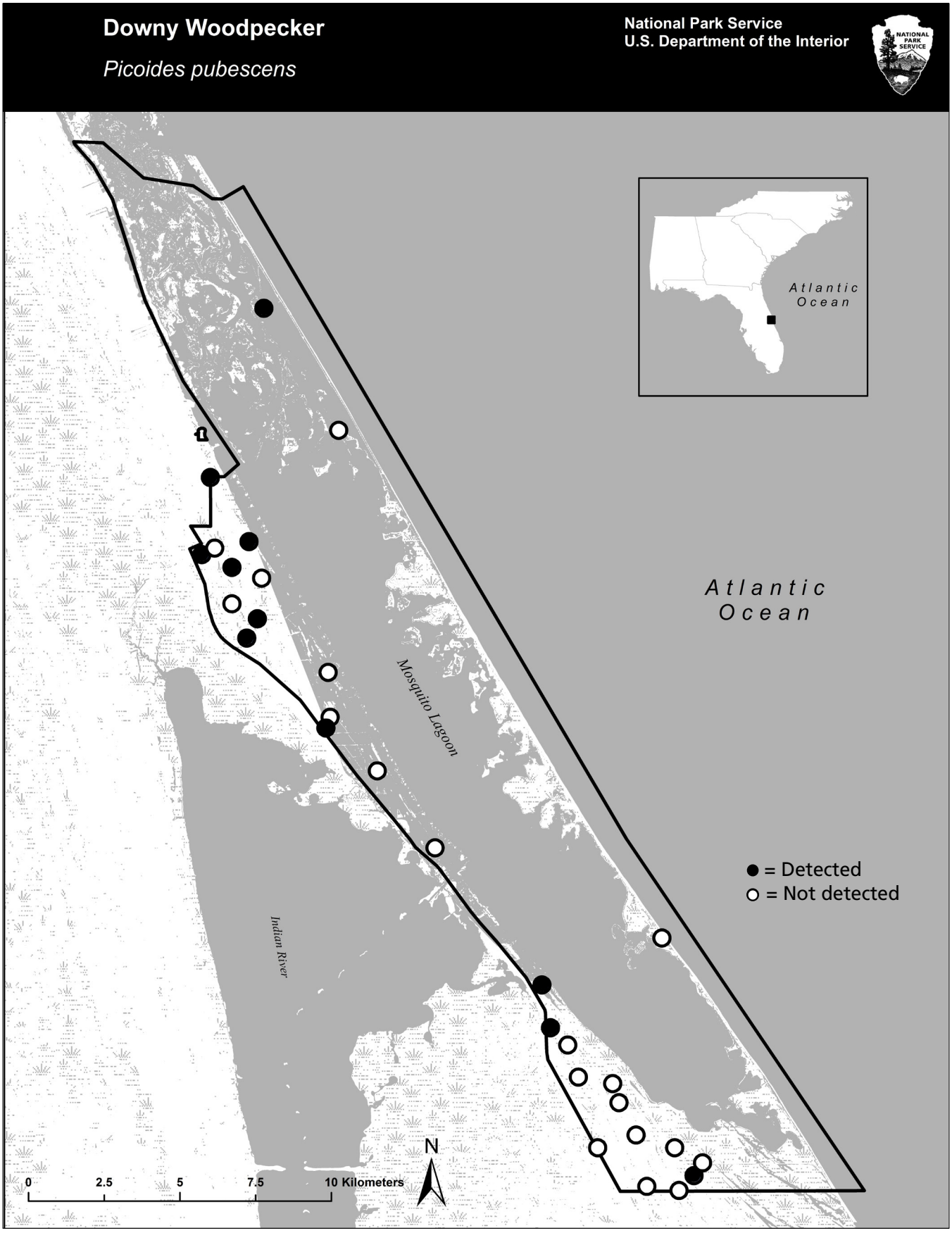


Figure C-27. Sampling locations where downy woodpecker (*Picoides pubescens*) was detected at Canaveral National Seashore, 2014.

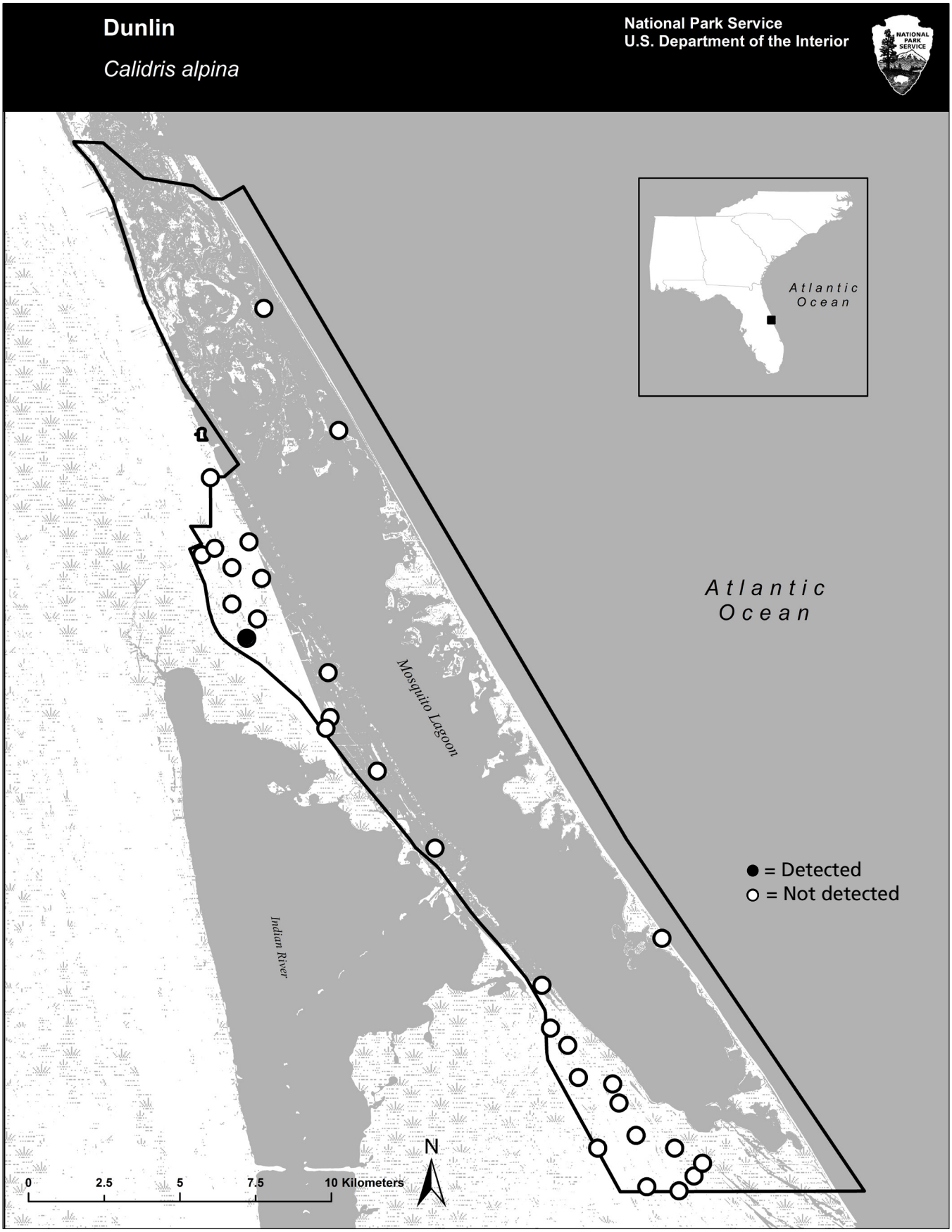


Figure C-28. Sampling locations where dunlin (*Calidris alpina*) was detected at Canaveral National Seashore, 2014.

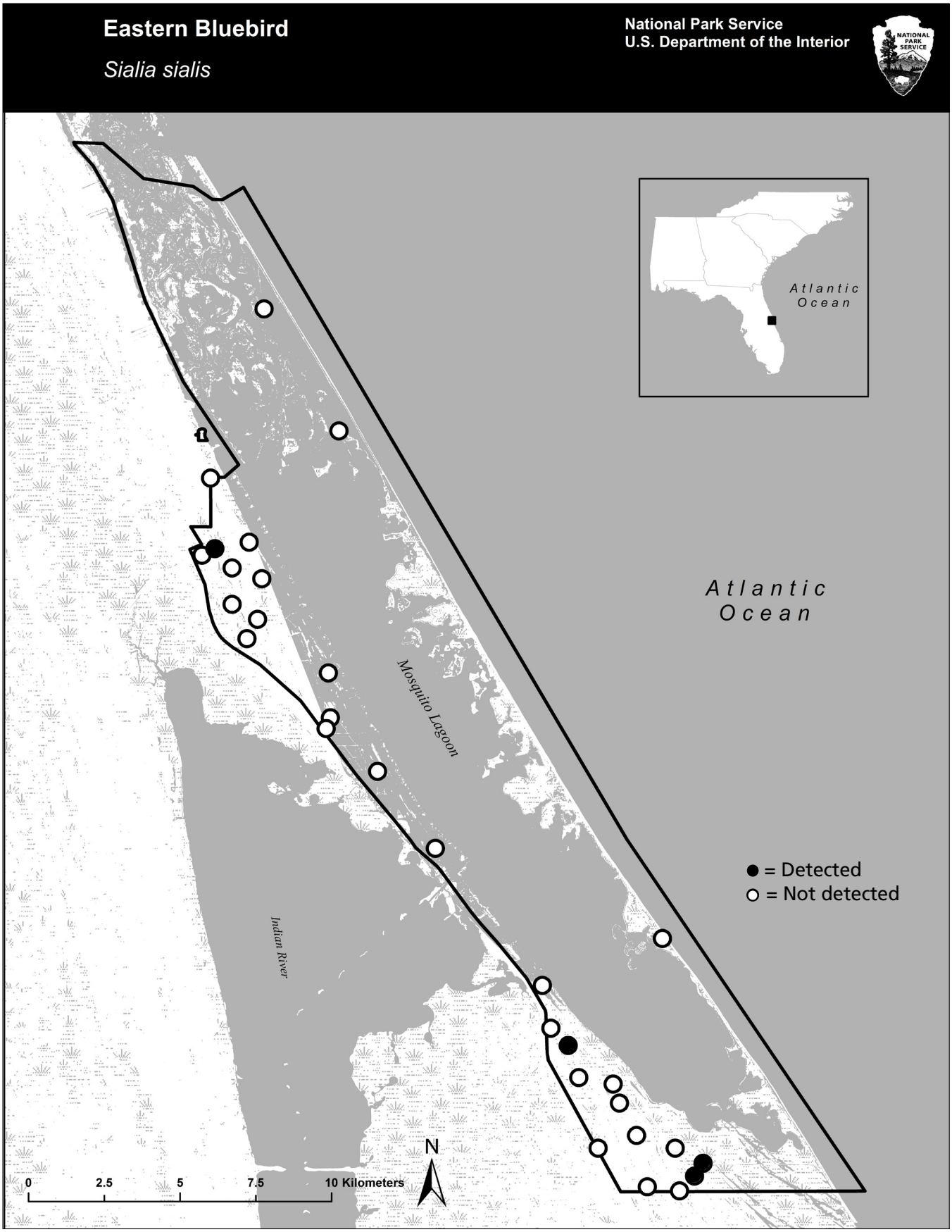


Figure C-29. Sampling locations where eastern bluebird (*Sialia sialis*) was detected at Canaveral National Seashore, 2014.

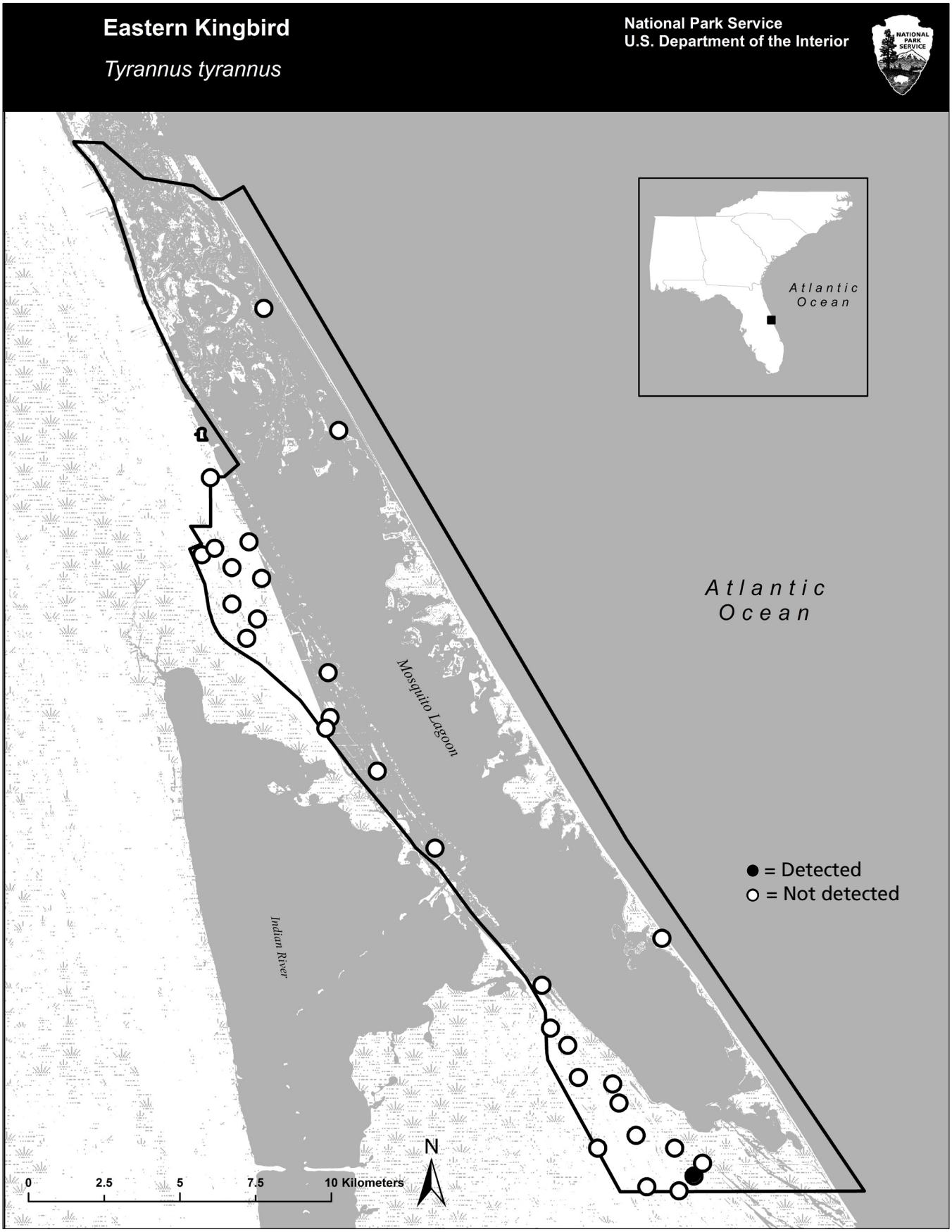


Figure C-30. Sampling locations where eastern kingbird (*Tyrannus tyrannus*) was detected at Canaveral National Seashore, 2014.

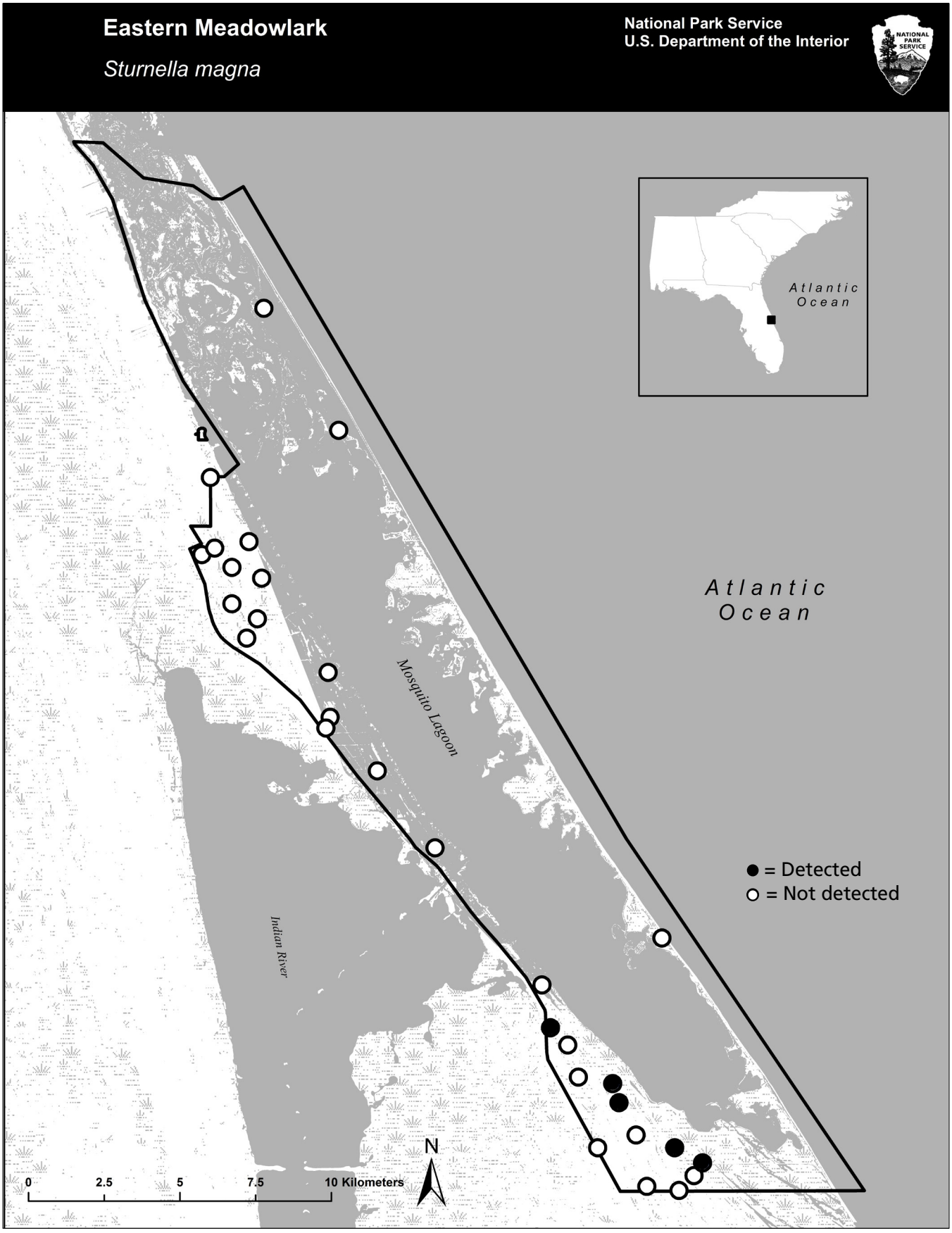


Figure C-31. Sampling locations where eastern meadowlark (*Sturnella magna*) was detected at Canaveral National Seashore, 2014.

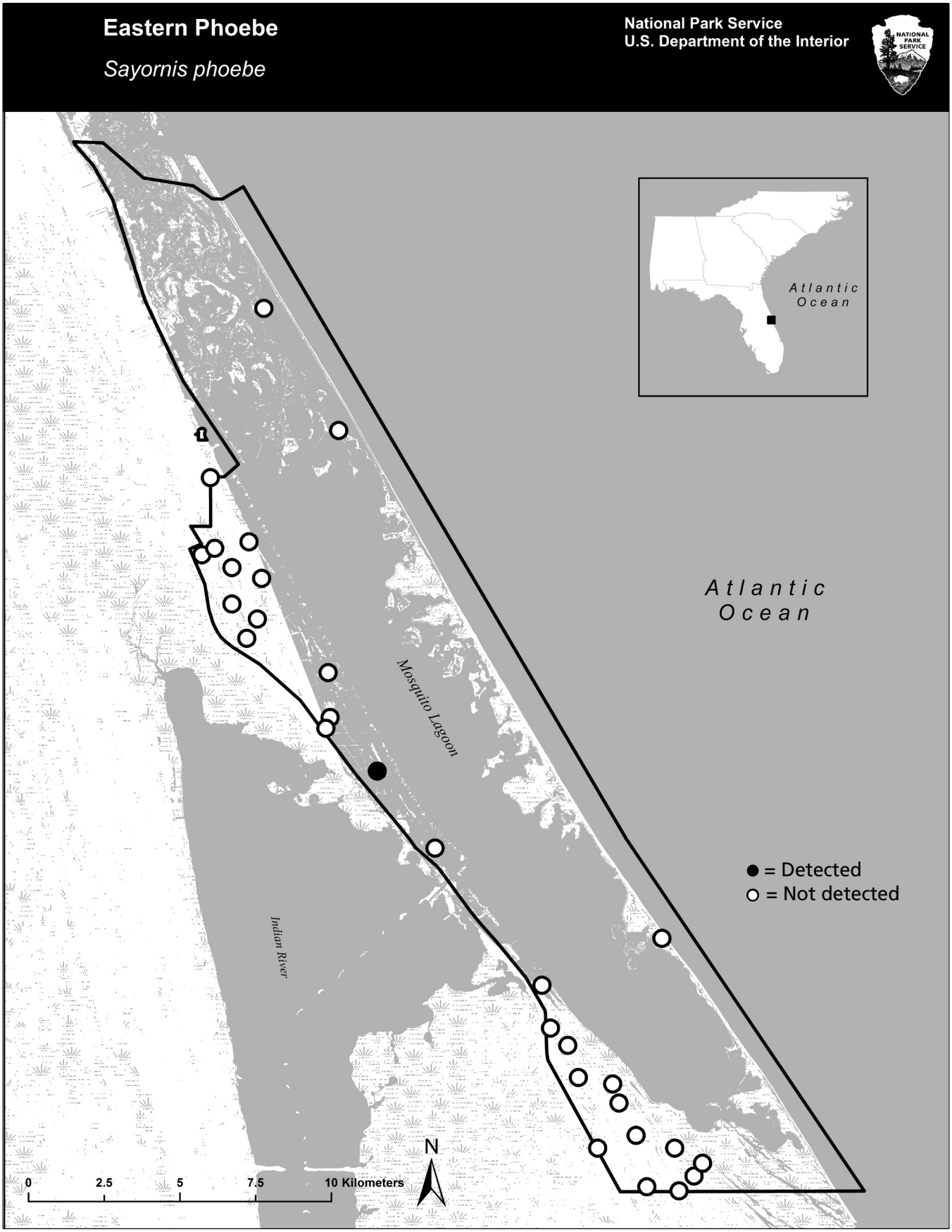


Figure C-32. Sampling locations where eastern phoebe (*Sayornis phoebe*) was detected at Canaveral National Seashore, 2014.

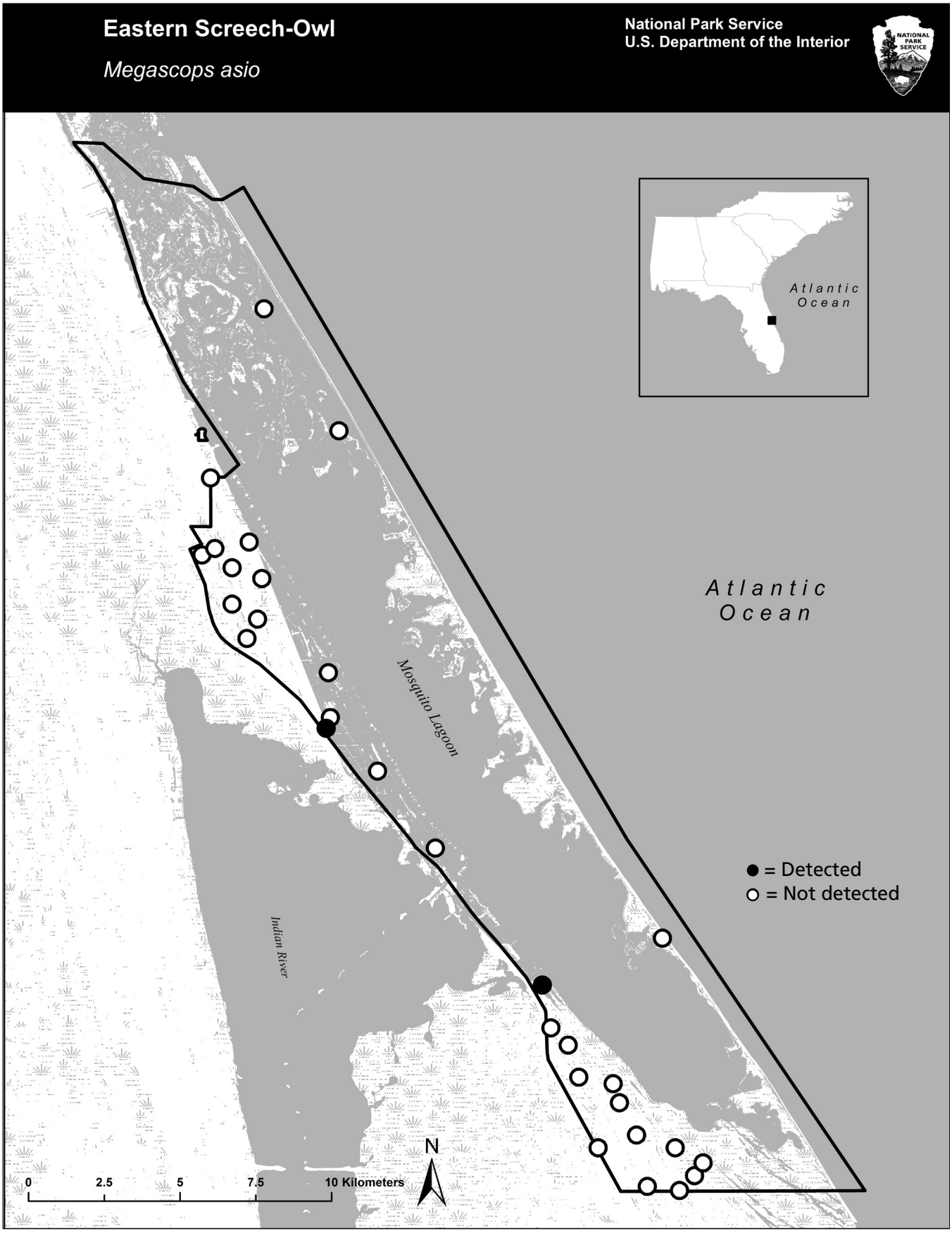


Figure C-33. Sampling locations where eastern screech owl (*Megascops asio*) was detected at Canaveral National Seashore, 2014.

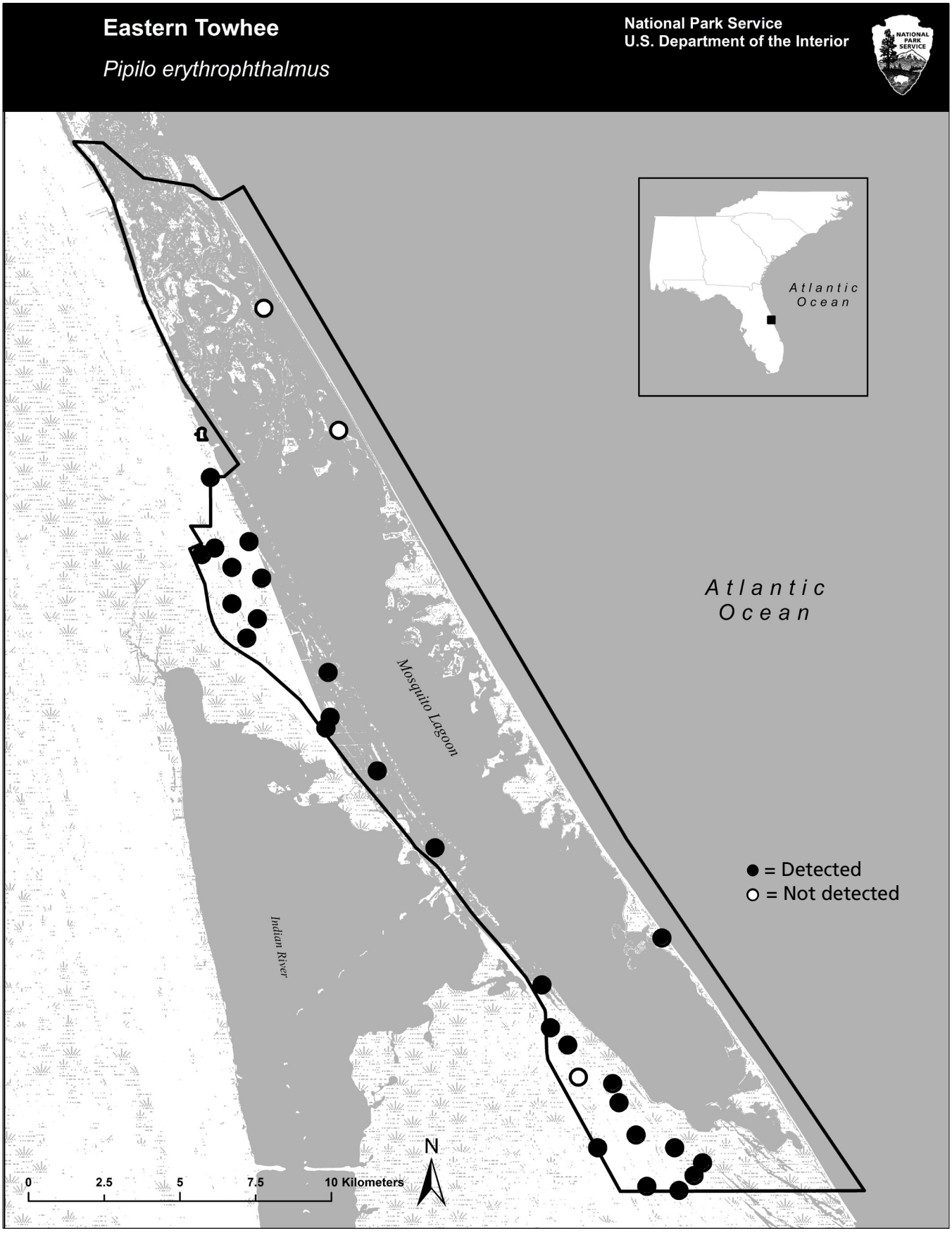


Figure C-34. Sampling locations where eastern towhee (*Pipilo erythrophthalmus*) was detected at Canaveral National Seashore, 2014.

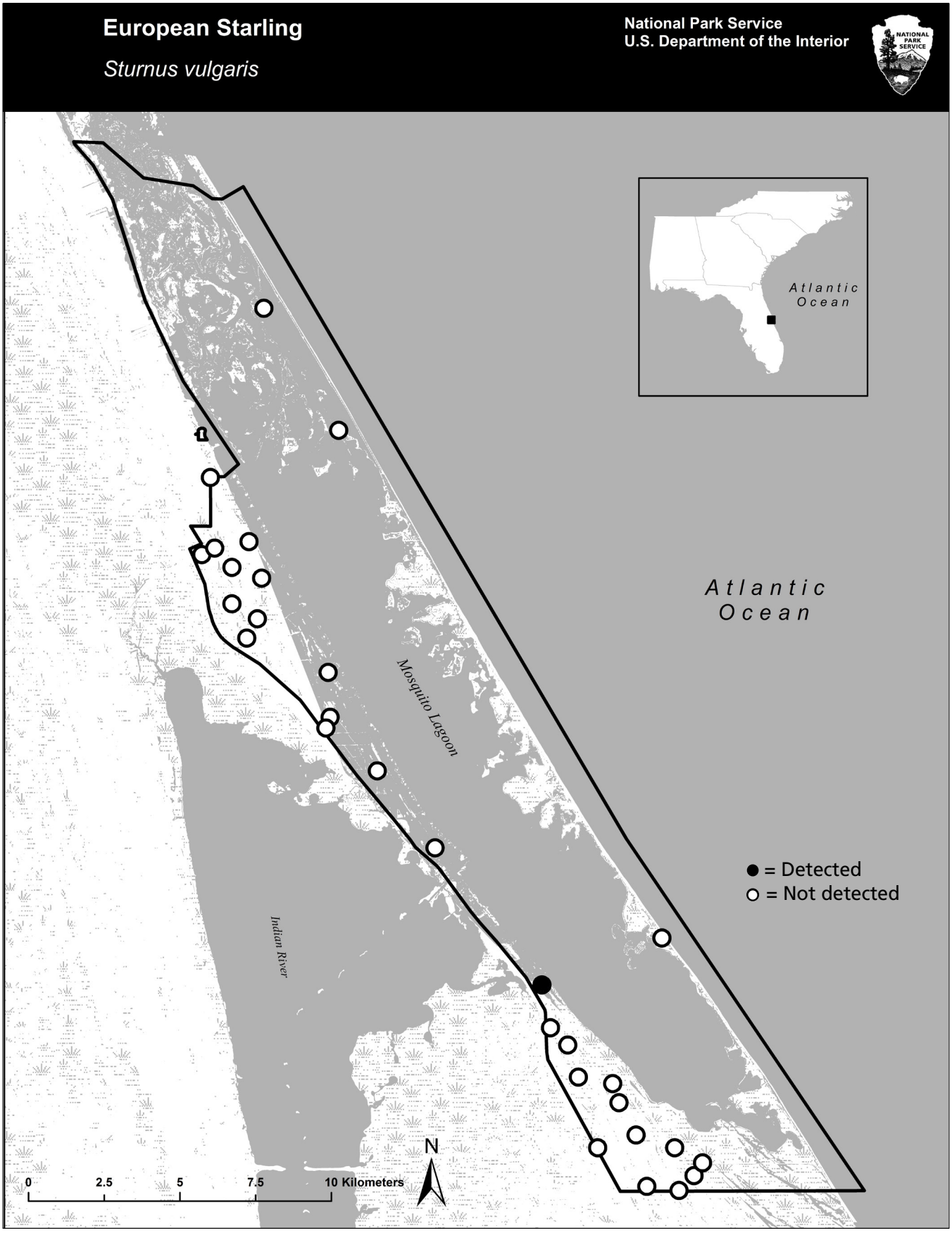


Figure C-35. Sampling locations where European starling (*Sturnus vulgaris*) was detected at Canaveral National Seashore, 2014.

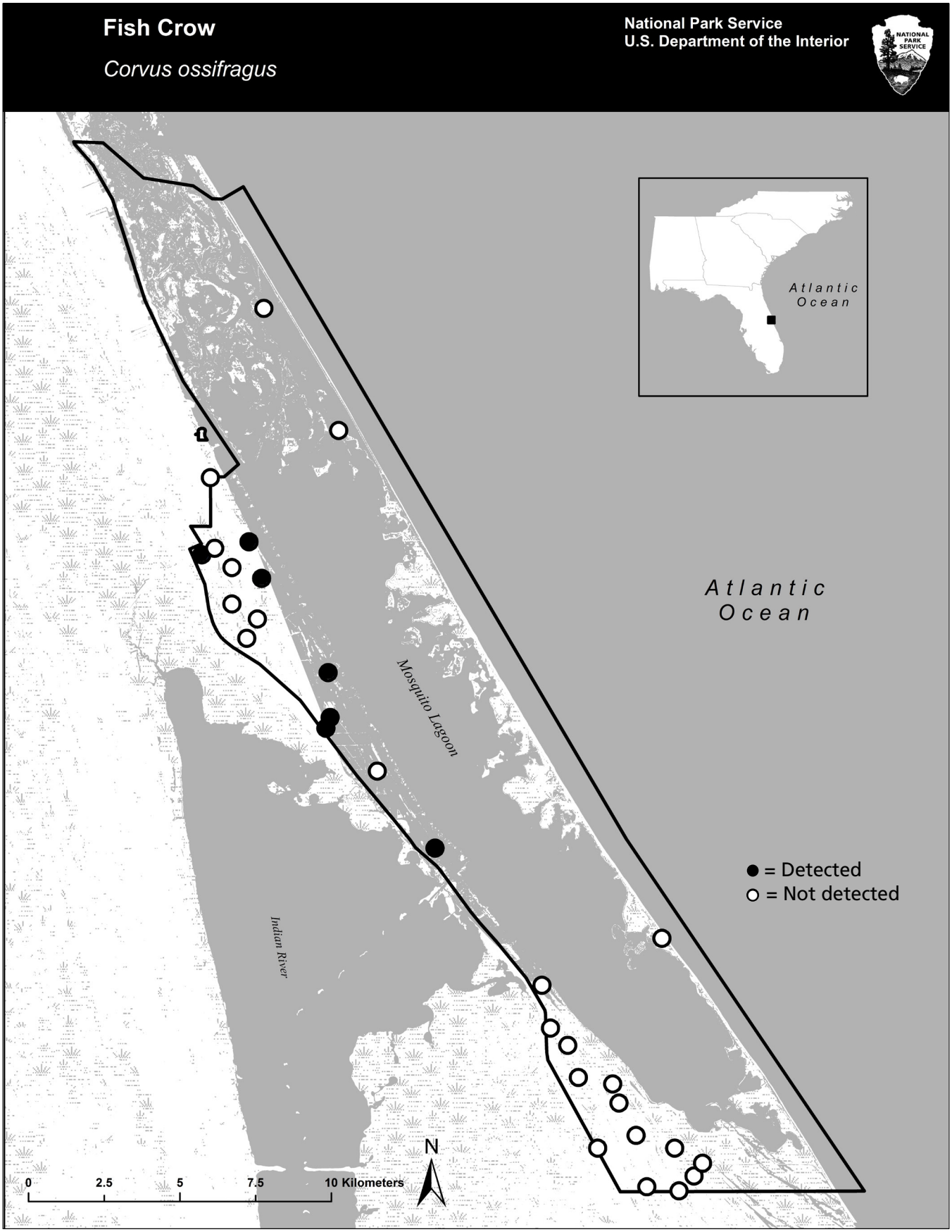


Figure C-36. Sampling locations where fish crow (*Corvus ossifragus*) was detected at Canaveral National Seashore, 2014.

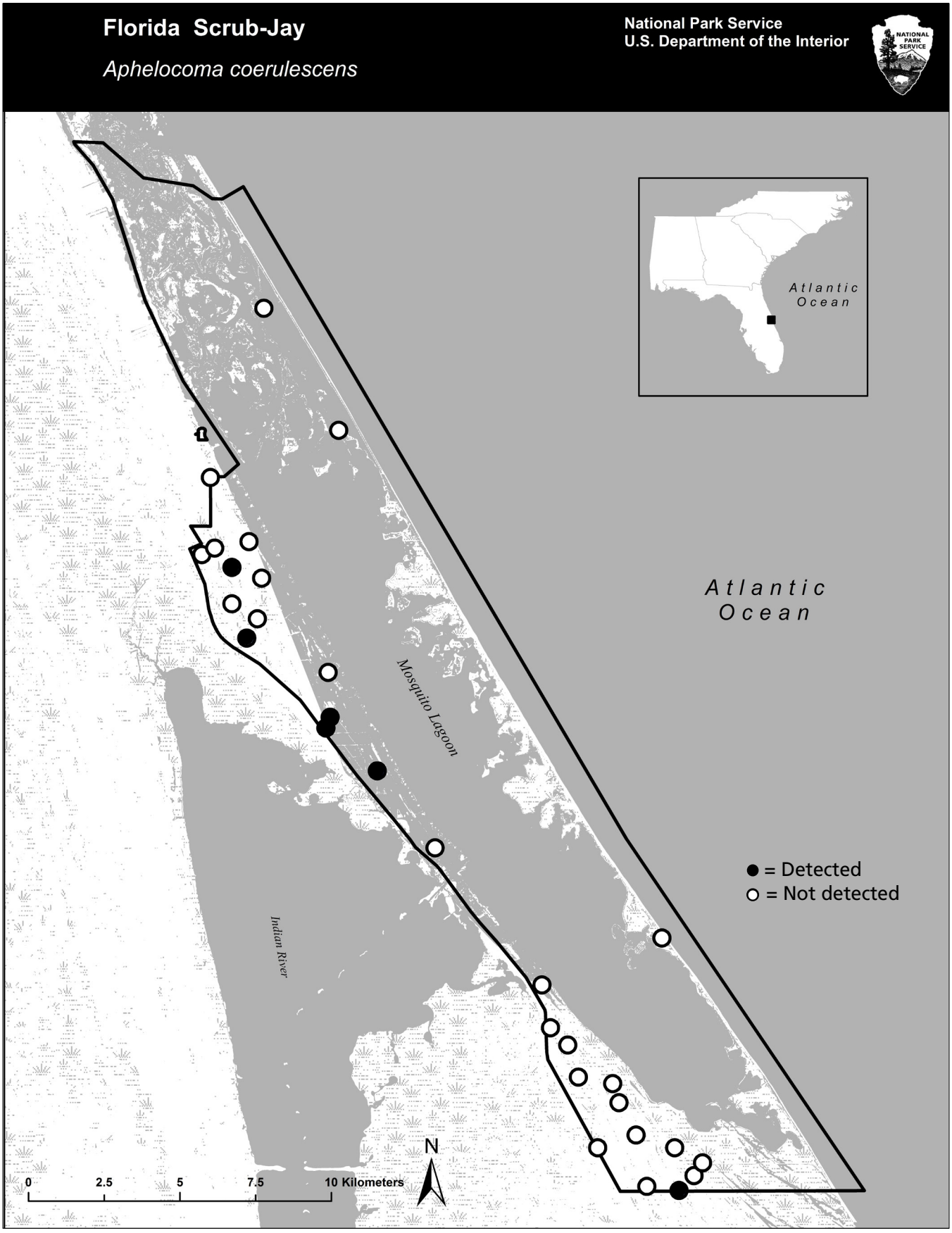


Figure C-37. Sampling locations where Florida scrub-jay (*Aphelocoma coerulescens*) was detected at Canaveral National Seashore, 2014.

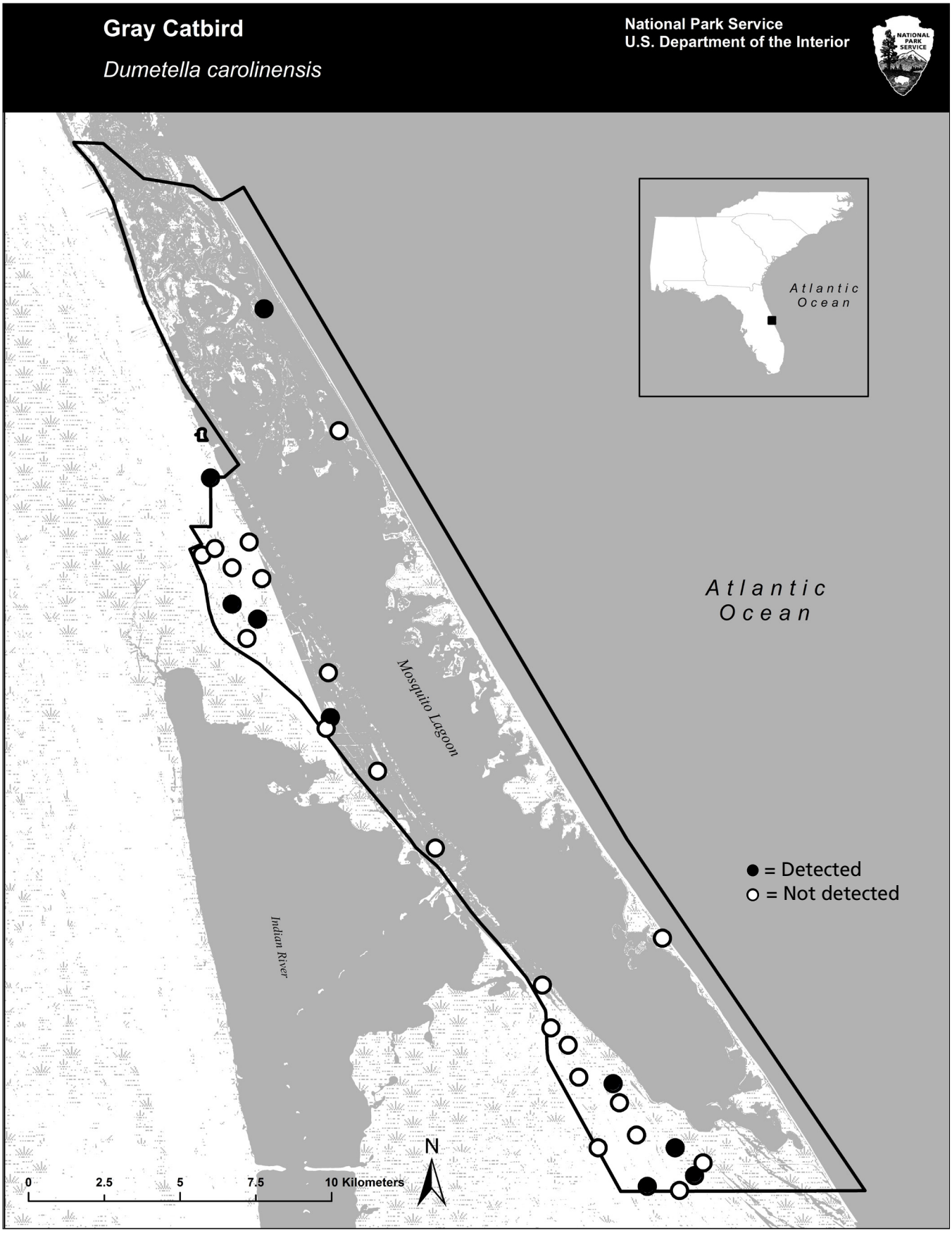


Figure C-38. Sampling locations where gray catbird (*Dumetella carolinensis*) was detected at Canaveral National Seashore, 2014.

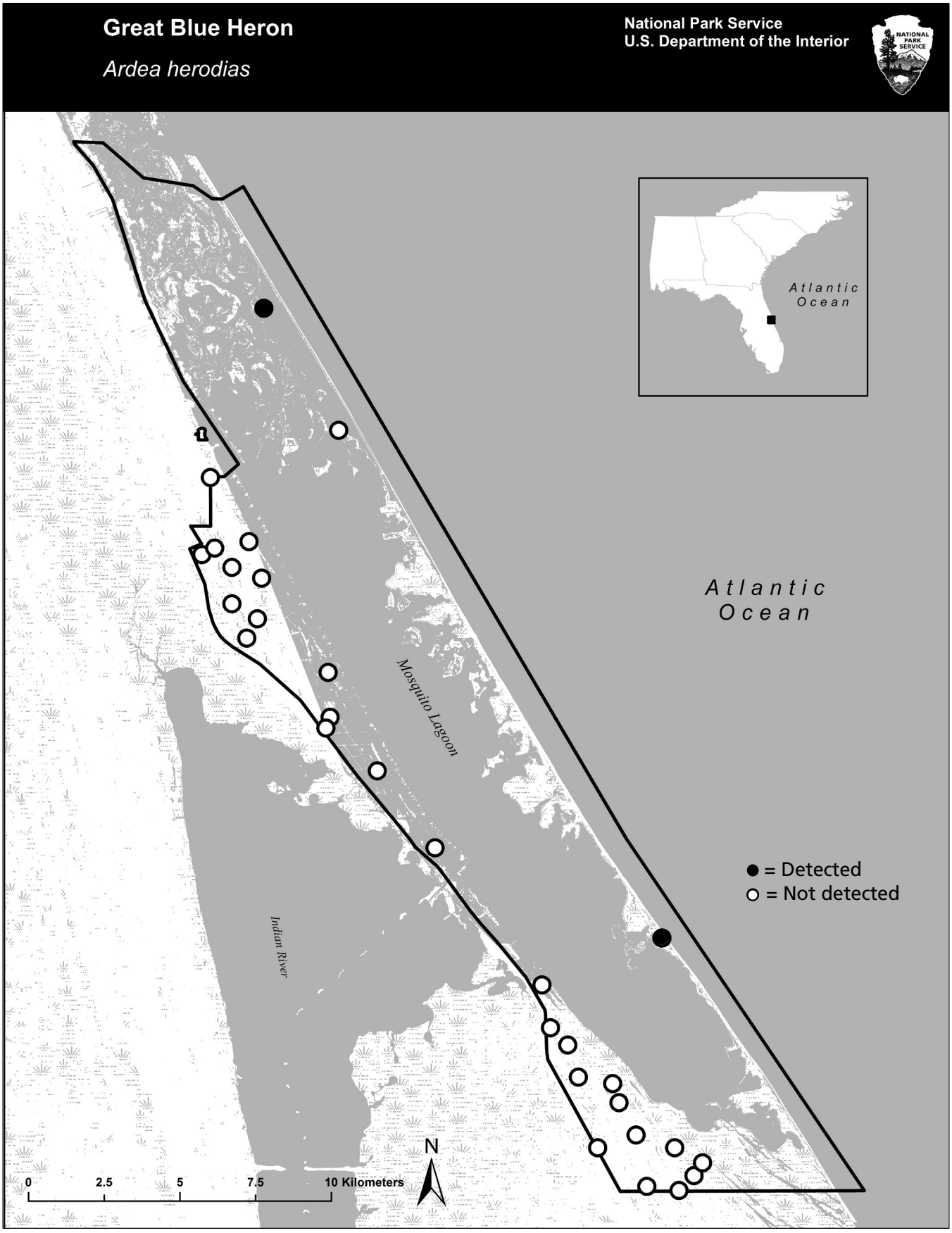


Figure C-39. Sampling locations where great blue heron (*Ardea herodias*) was detected at Canaveral National Seashore, 2014.

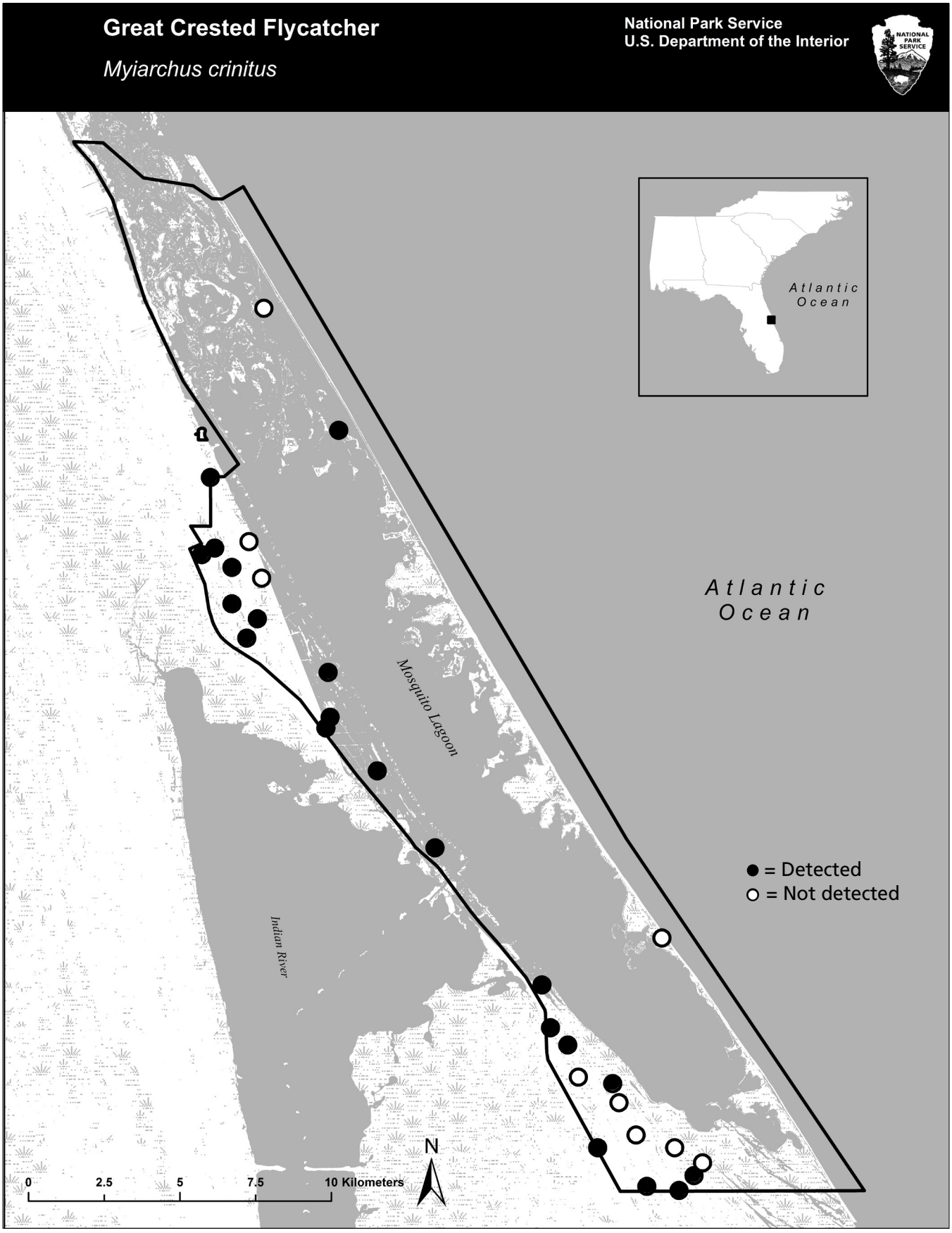


Figure C-40. Sampling locations where great crested flycatcher (*Myiarchus crinitus*) was detected at Canaveral National Seashore, 2014.

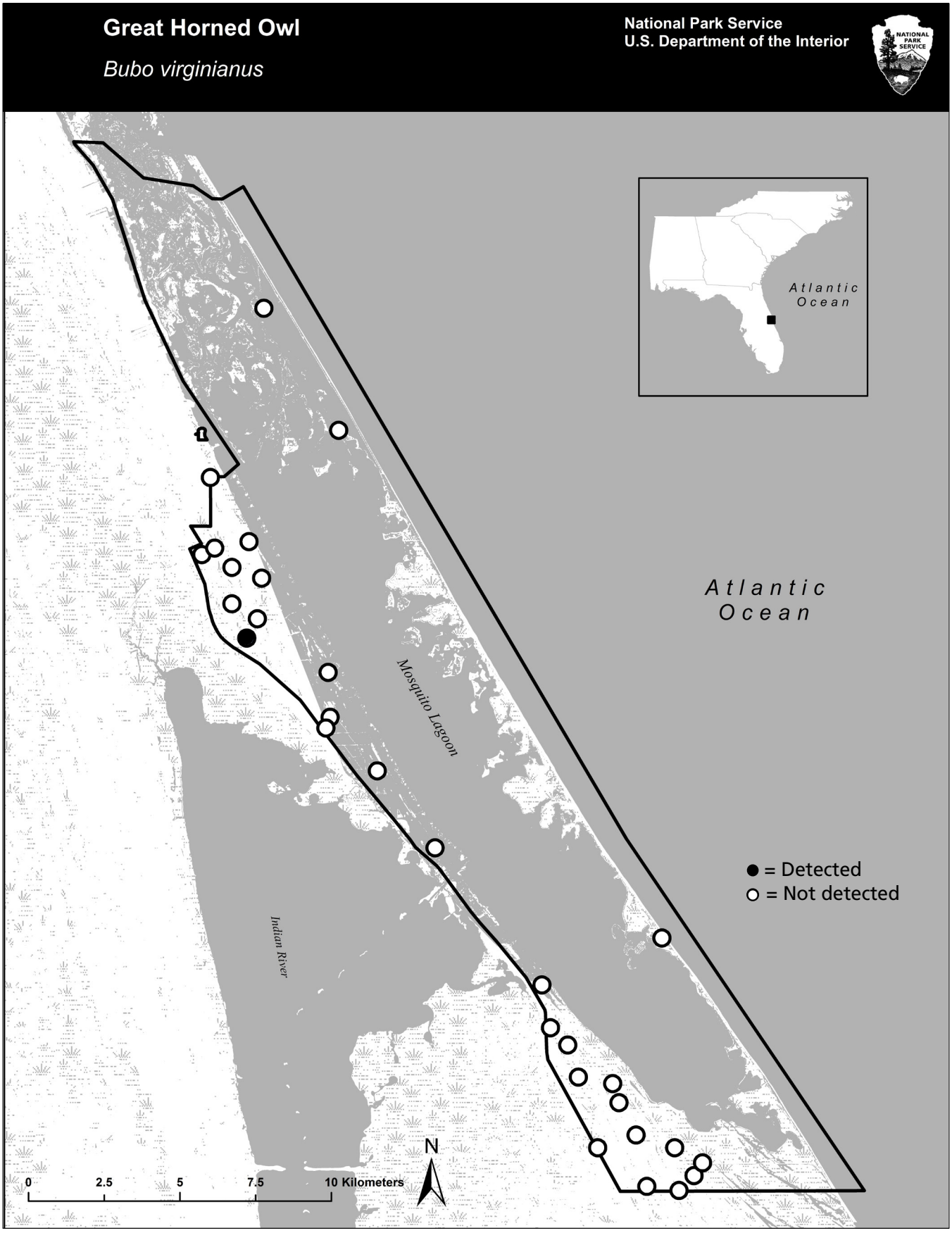


Figure C-41. Sampling locations where great horned owl (*Bubo virginianus*) was detected at Canaveral National Seashore, 2014.

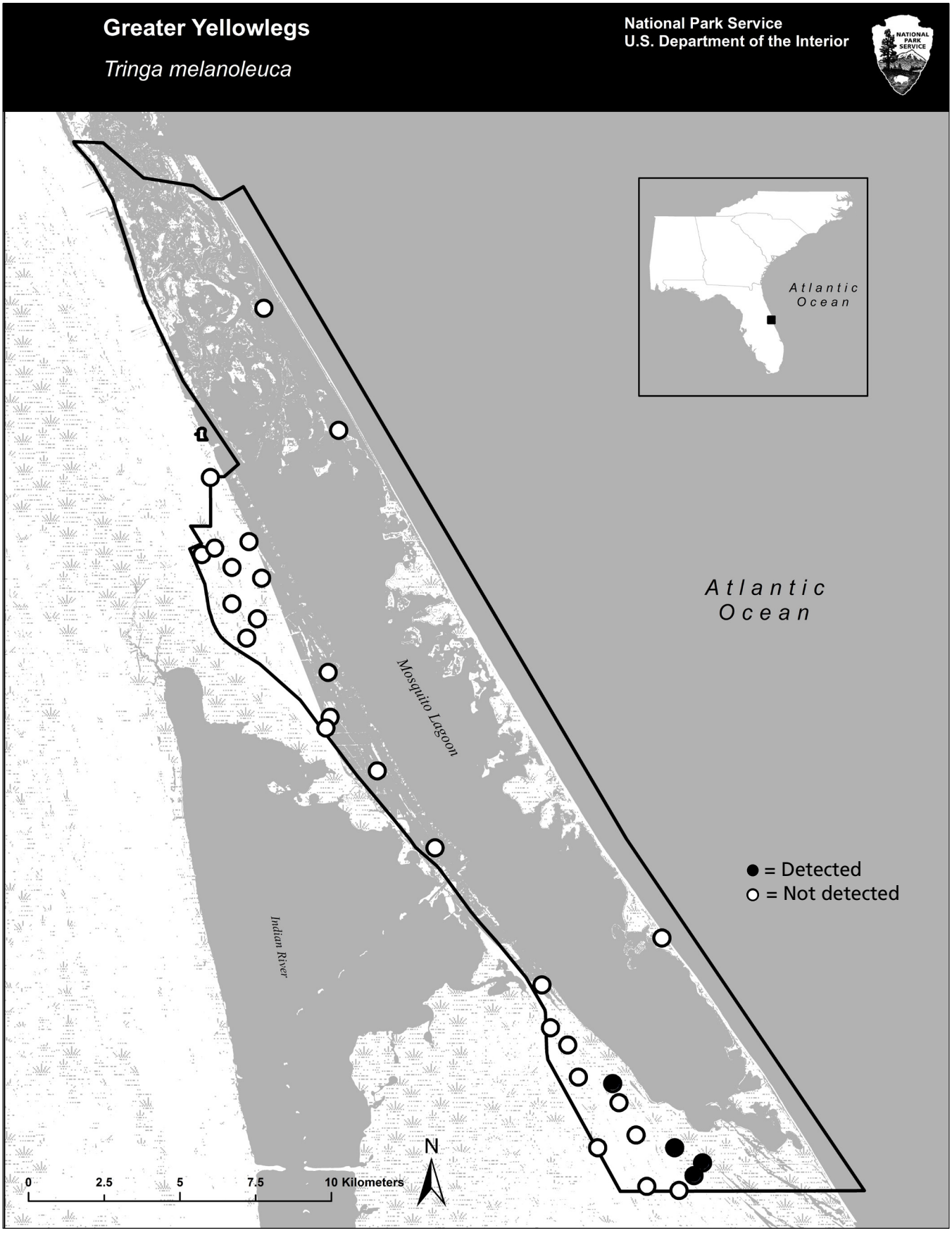


Figure C-42. Sampling locations where greater yellowlegs (*Tringa melanoleuca*) was detected at Canaveral National Seashore, 2014.

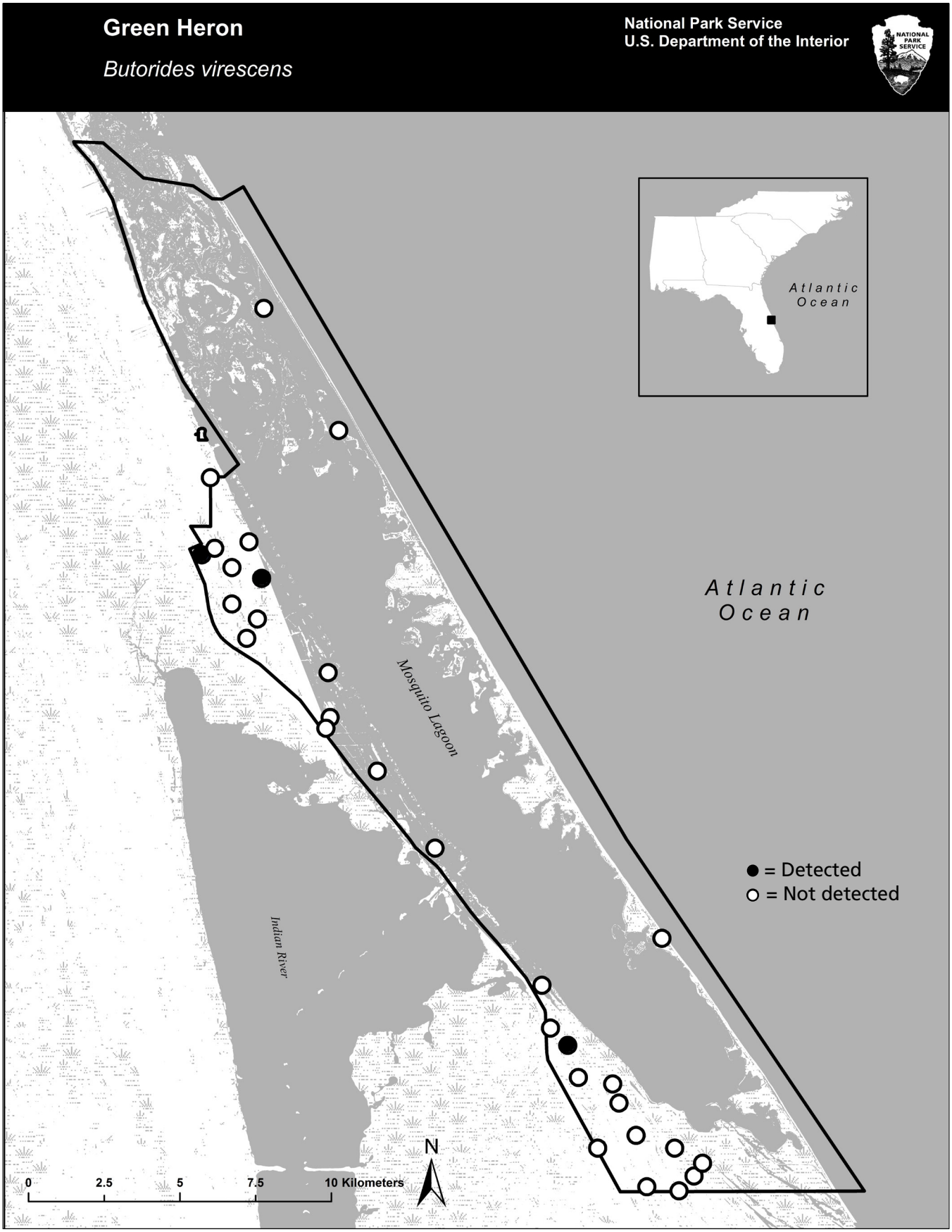


Figure C-43. Sampling locations where green heron (*Butorides virescens*) was detected at Canaveral National Seashore, 2014.

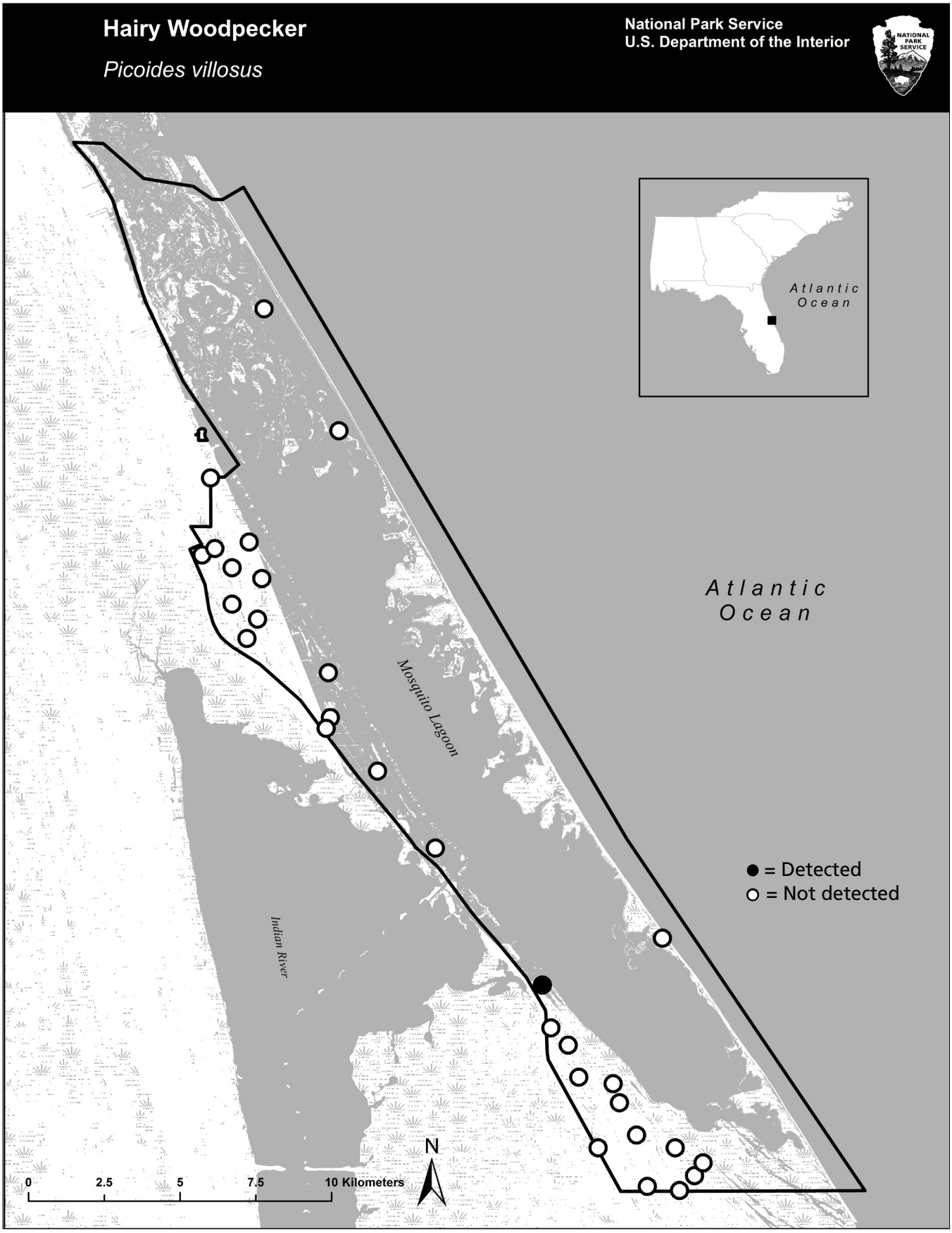


Figure C-44. Sampling locations where hairy woodpecker (*Picoides villosus*) was detected at Canaveral National Seashore, 2014.

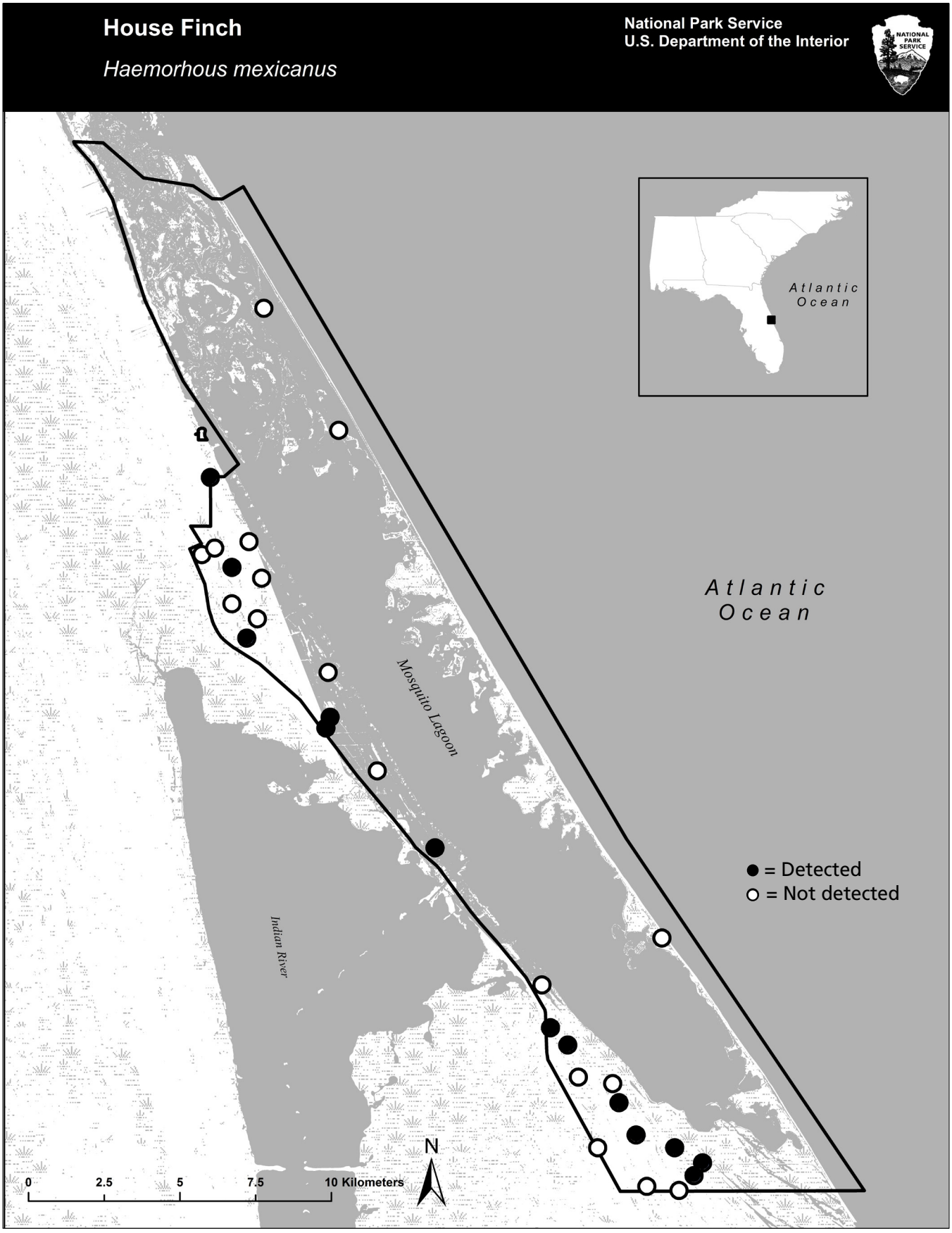


Figure C-45. Sampling locations where house finch (*Haemorhous mexicanus*) was detected at Canaveral National Seashore, 2014.

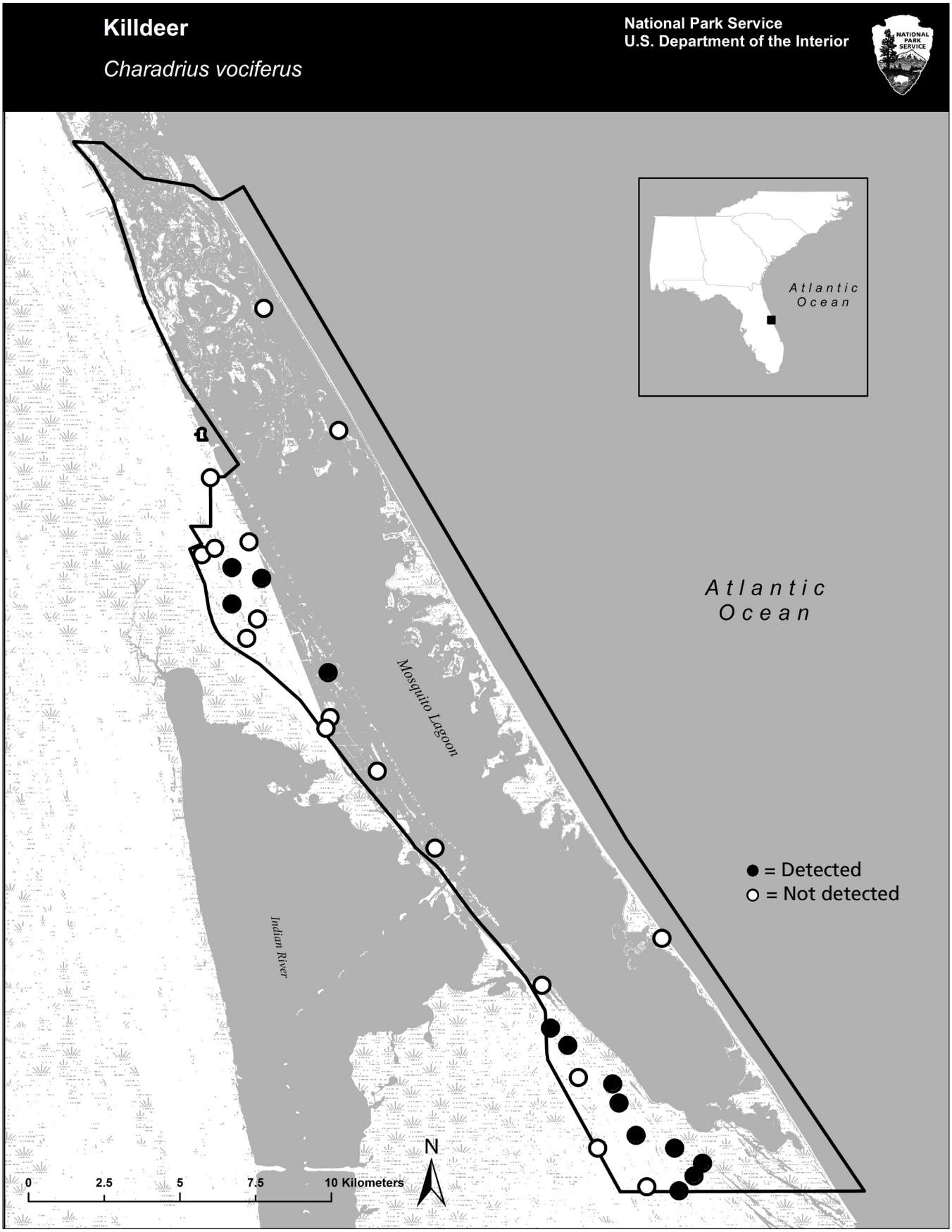


Figure C-46. Sampling locations where killdeer (*Charadrius vociferus*) was detected at Canaveral National Seashore, 2014.

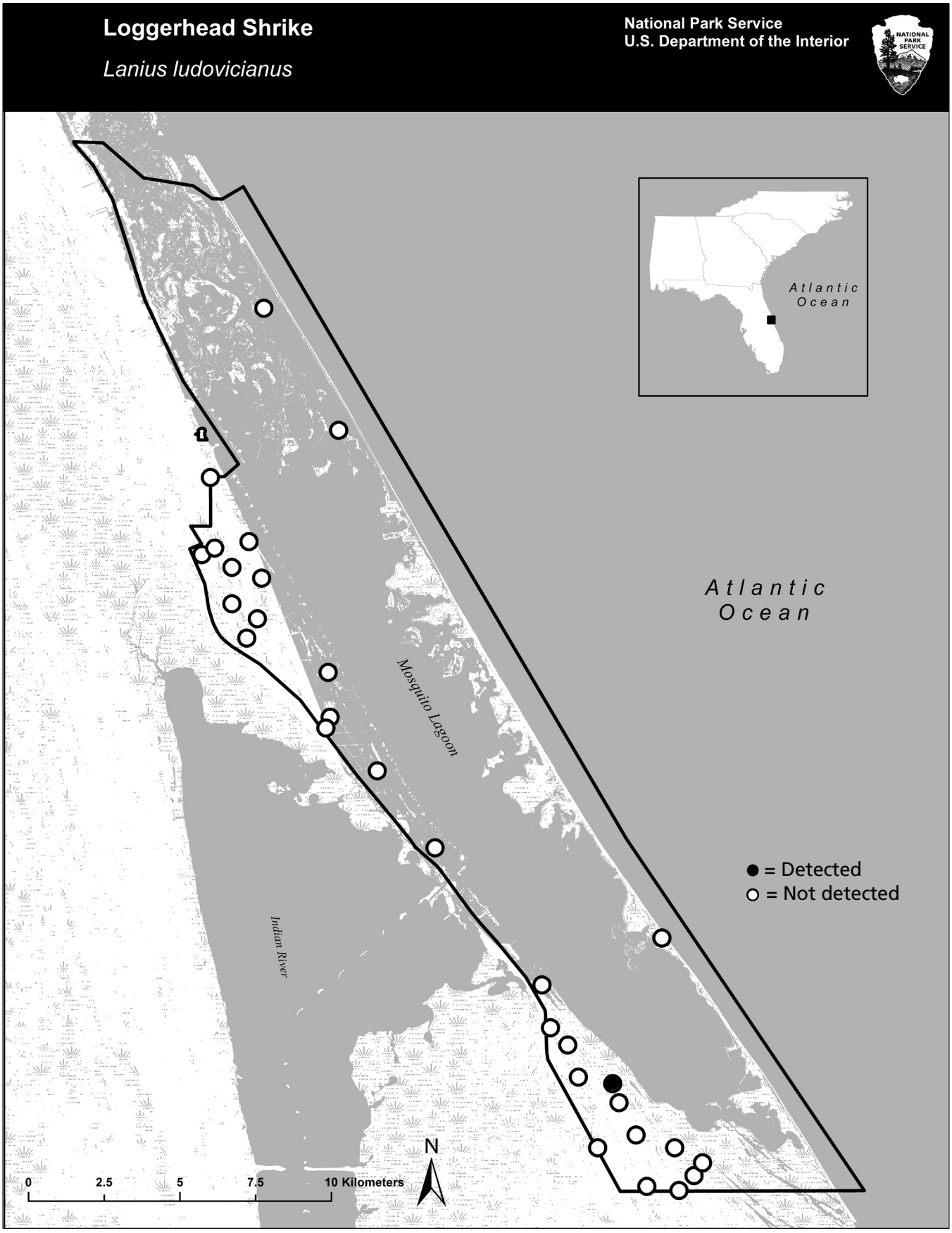


Figure C-47. Sampling locations where loggerhead shrike (*Larus atricilla*) was detected at Canaveral National Seashore, 2014.

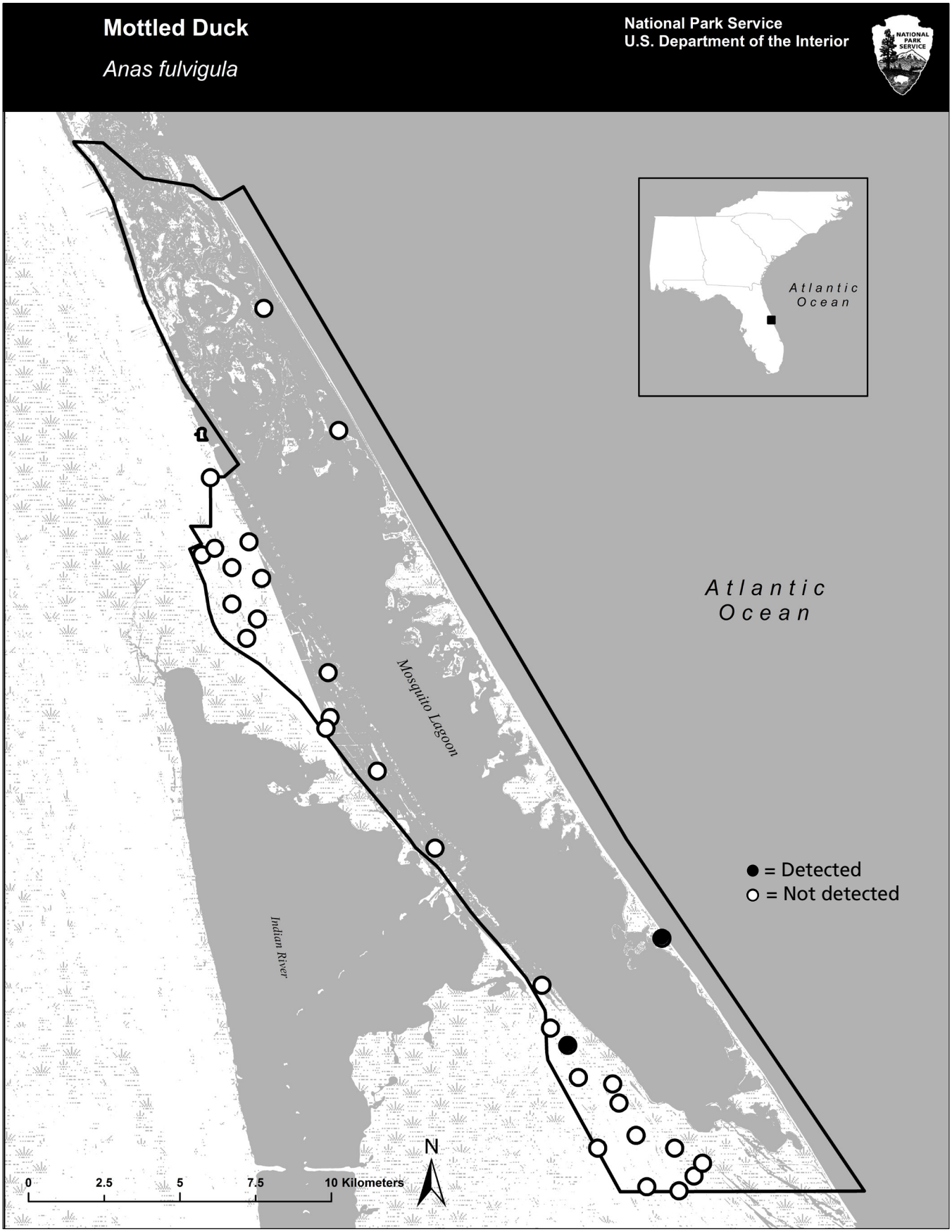


Figure C-48. Sampling locations where mottled duck (*Anas fulvigula*) was detected at Canaveral National Seashore, 2014.

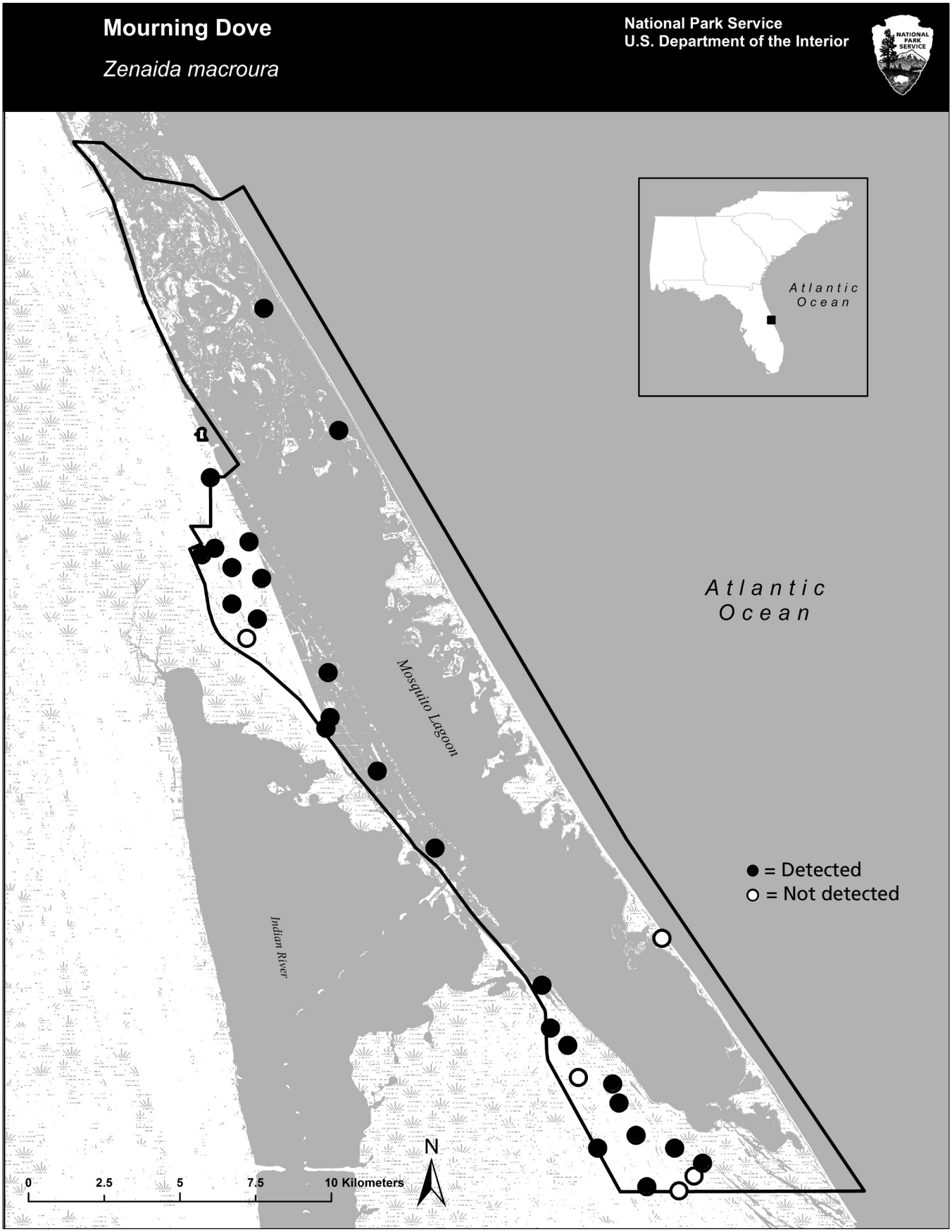


Figure C-49. Sampling locations where mourning dove (*Zenaida macroura*) was detected at Canaveral National Seashore, 2014.

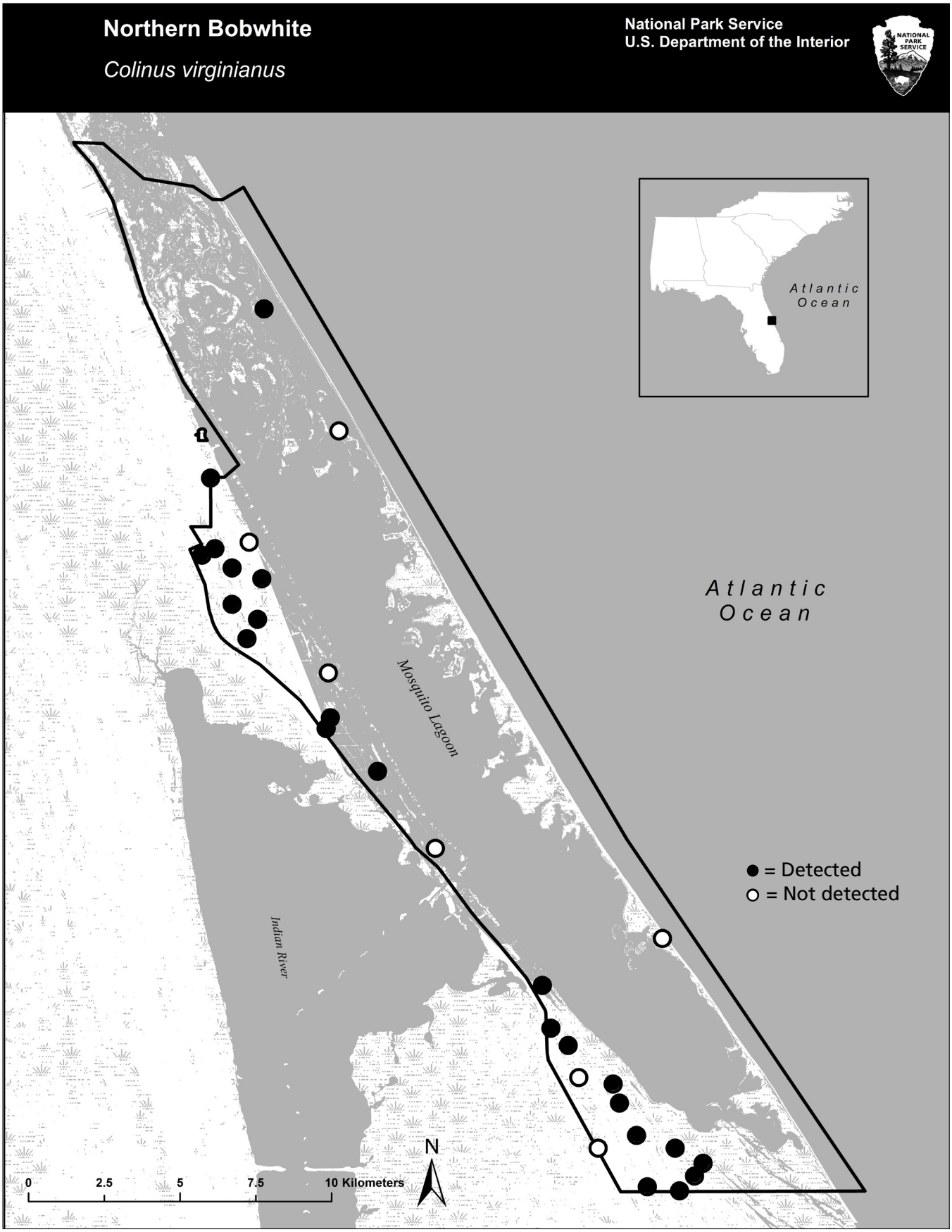


Figure C-50. Sampling locations where northern bobwhite (*Colinus virginianus*) was detected at Canaveral National Seashore, 2014.

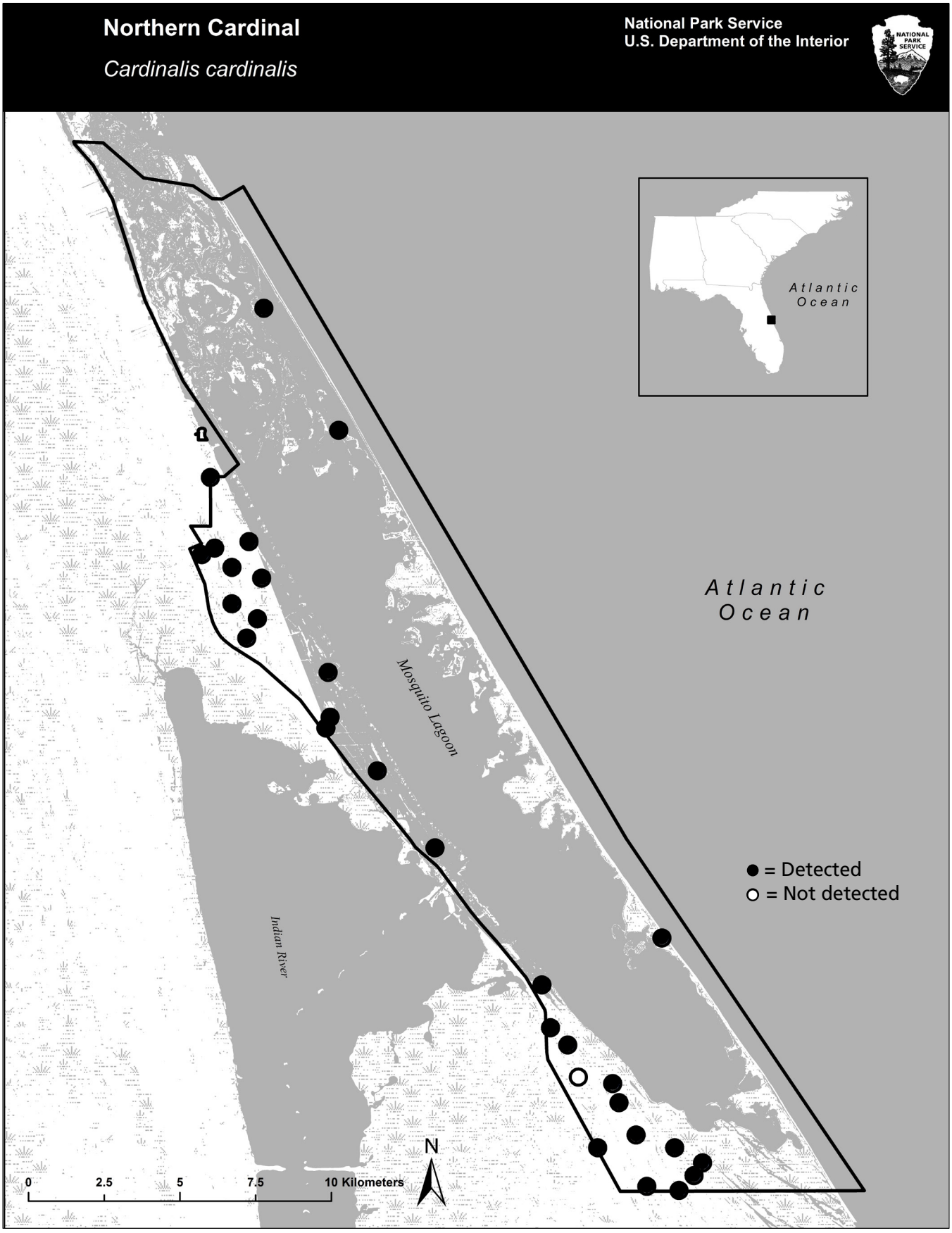


Figure C-51. Sampling locations where northern cardinal (*Cardinalis cardinalis*) was detected at Canaveral National Seashore, 2014.

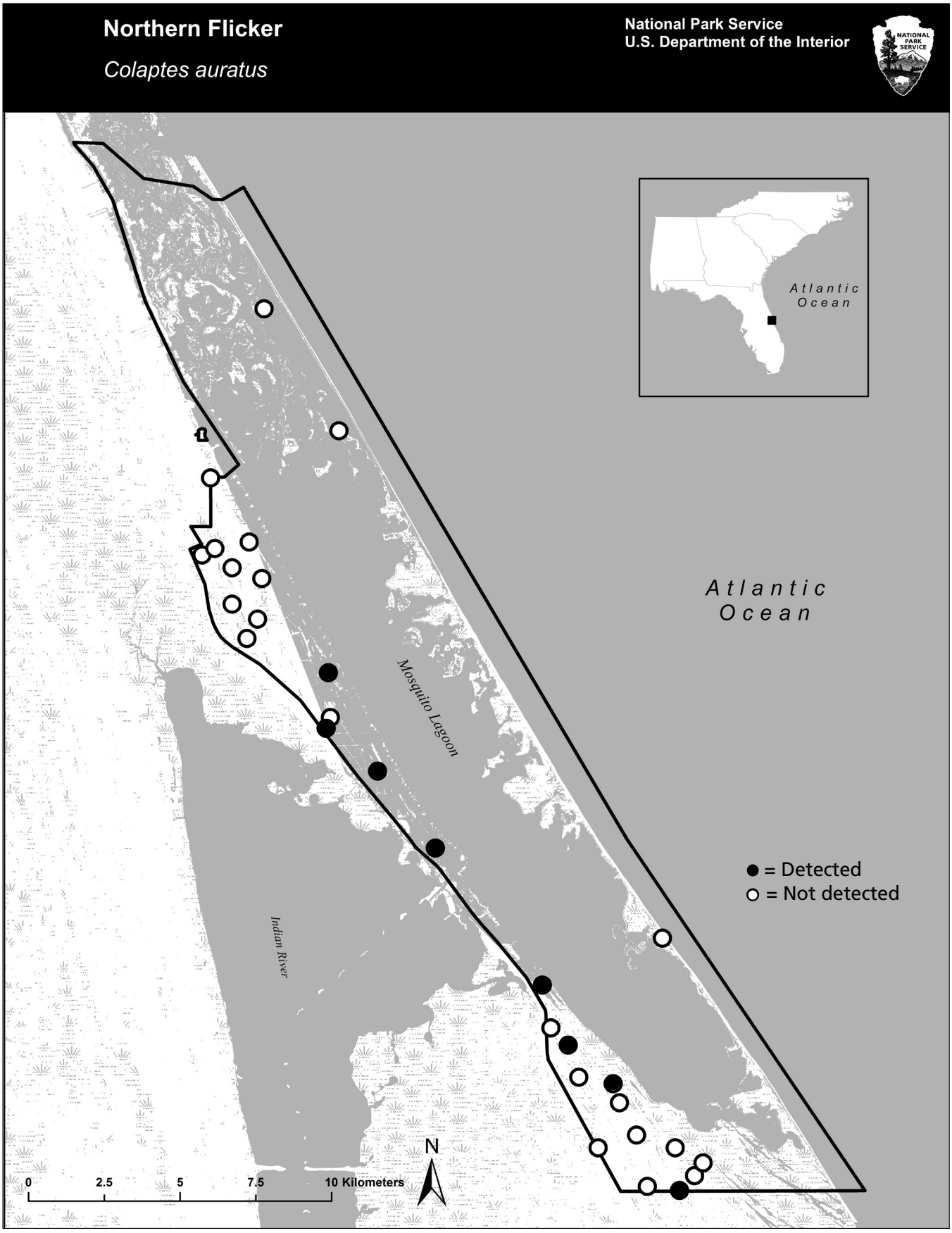


Figure C-52. Sampling locations where northern flicker (*Colaptes auratus*) was detected at Canaveral National Seashore, 2014.

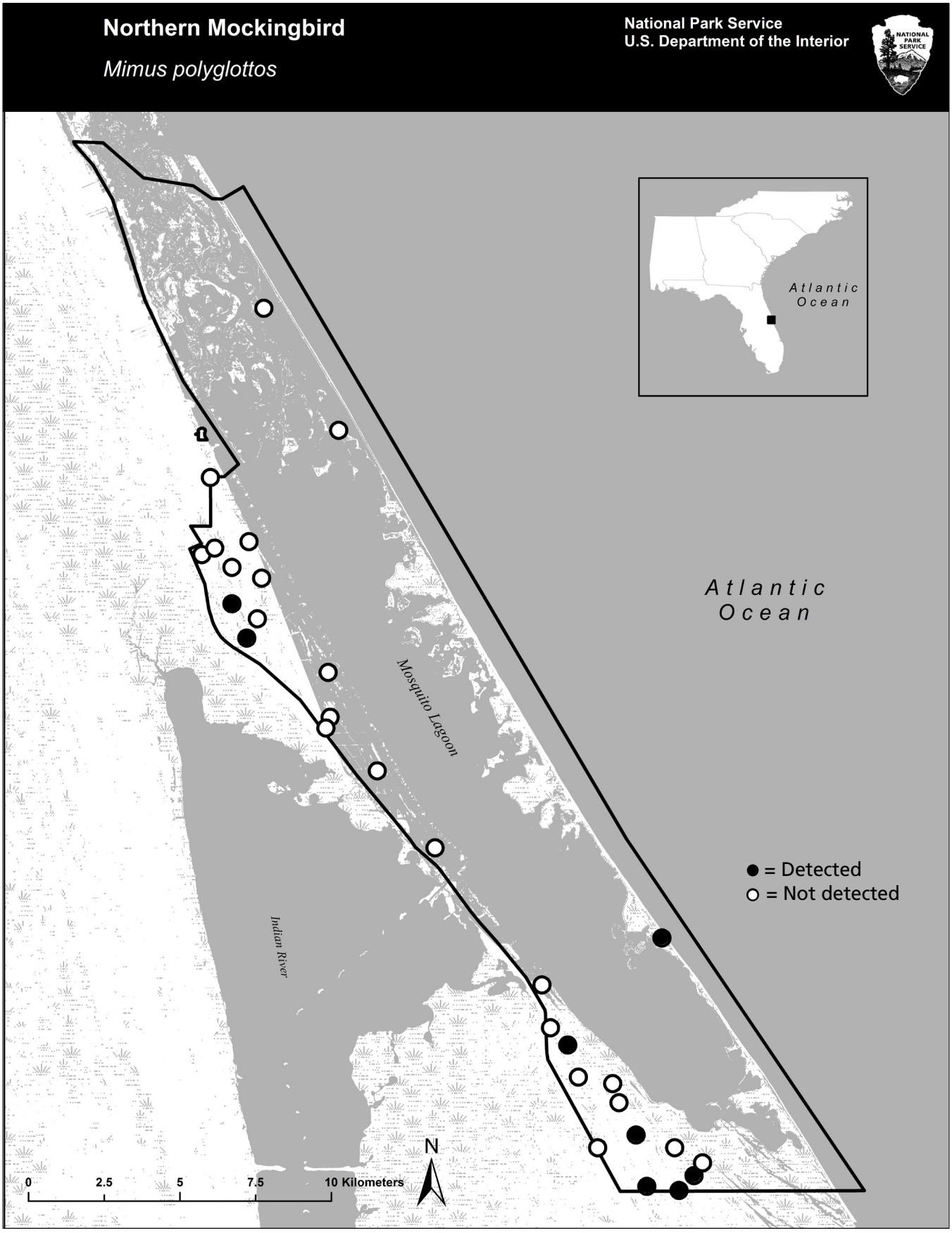


Figure C-53. Sampling locations where northern mockingbird (*Mimus polyglottos*) was detected at Canaveral National Seashore, 2014.

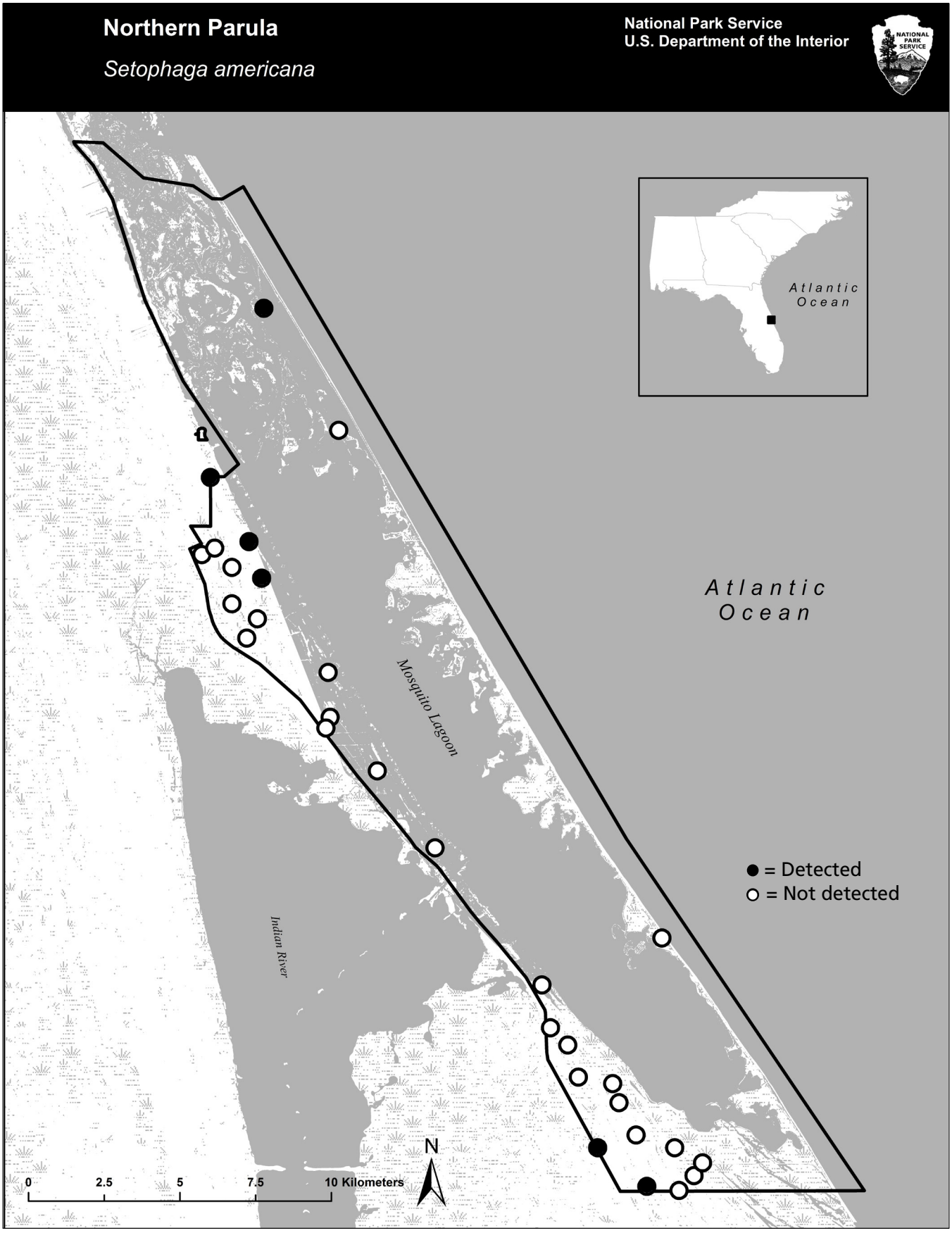


Figure C-54. Sampling locations where northern parula (*Setophaga americana*) was detected at Canaveral National Seashore, 2014.

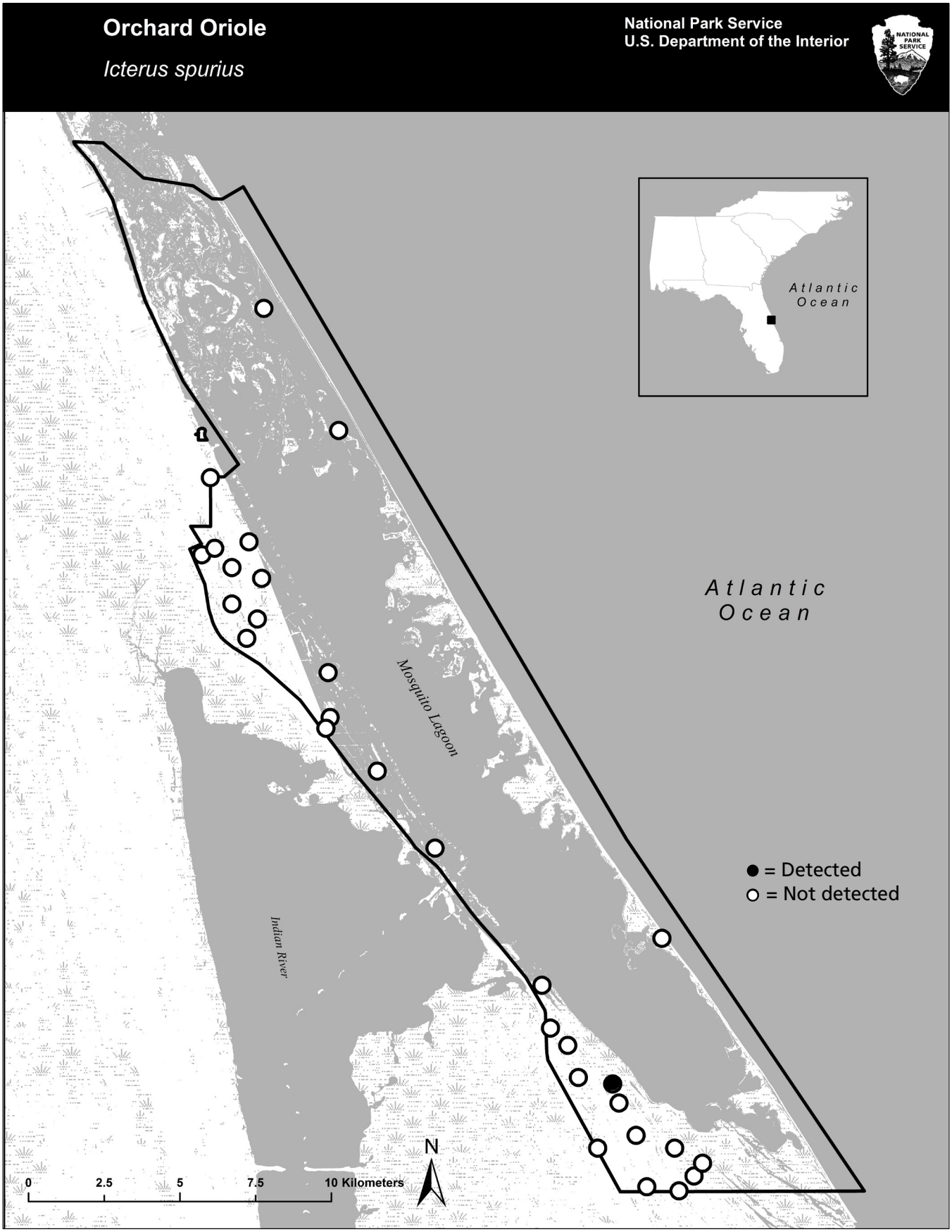


Figure C-55. Sampling locations where orchard oriole (*Icterus spurius*) was detected at Canaveral National Seashore, 2014.

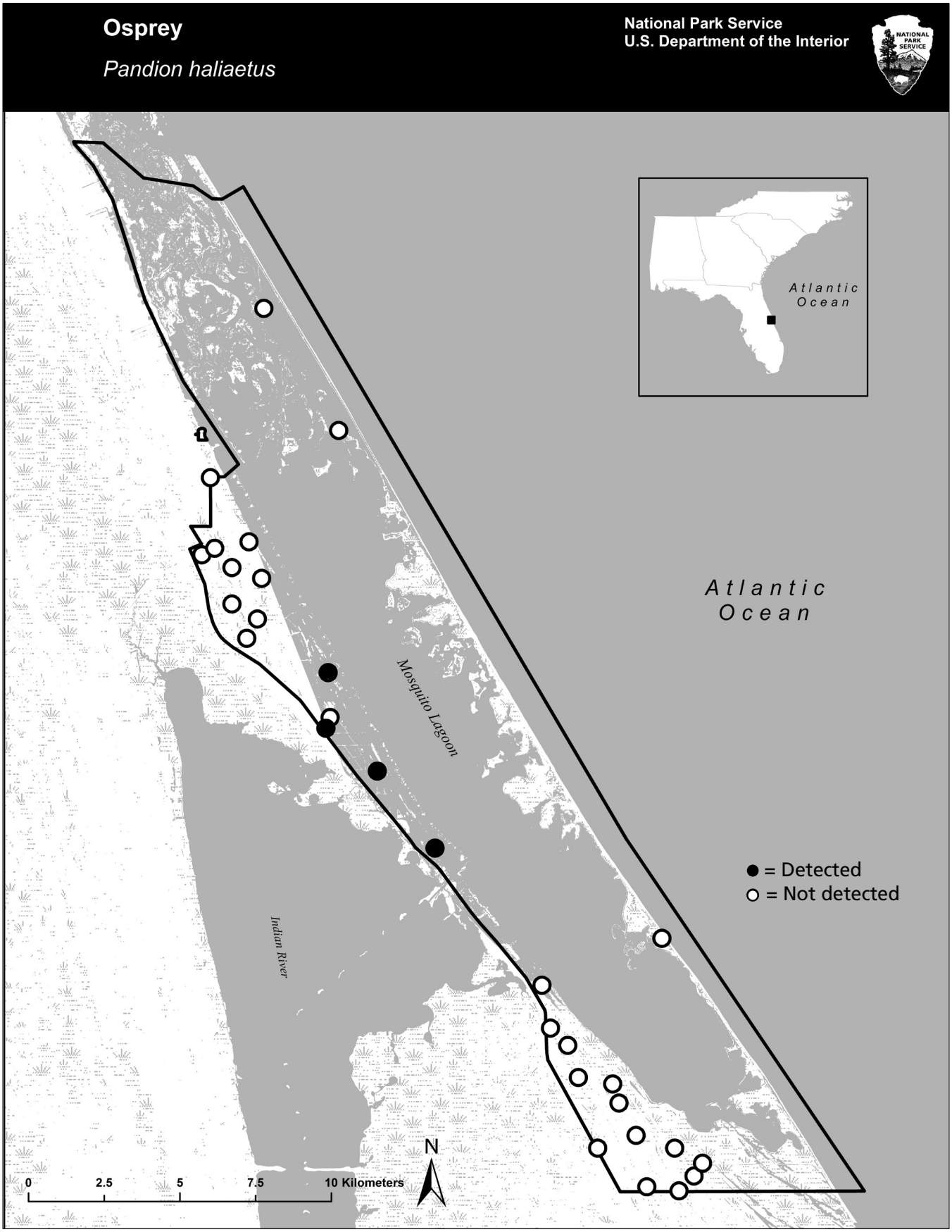


Figure C-56. Sampling locations where osprey (*Pandion haliaetus*) was detected at Canaveral National Seashore, 2014.

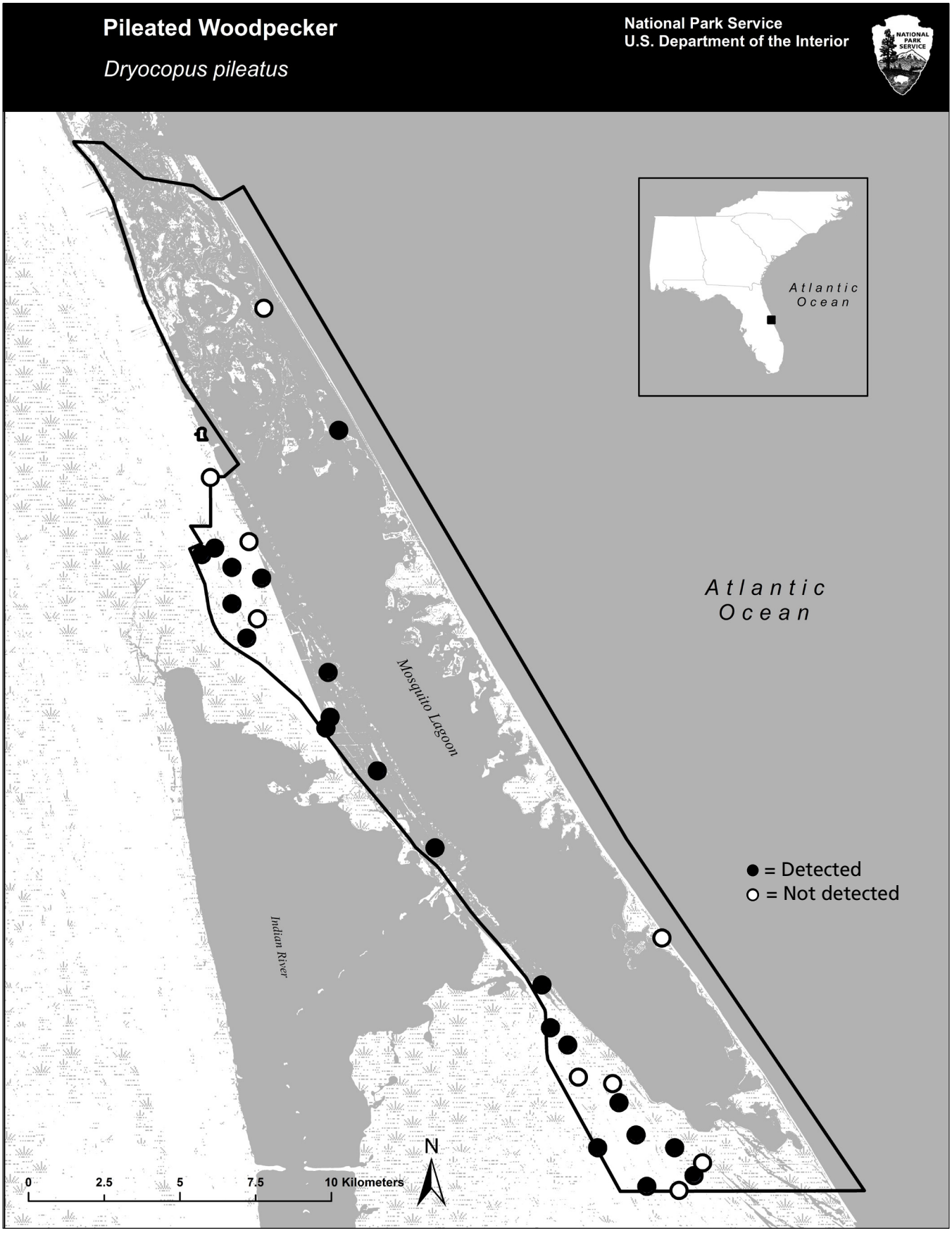


Figure C-57. Sampling locations where pileated woodpecker (*Dryocopus pileatus*) was detected at Canaveral National Seashore, 2014.

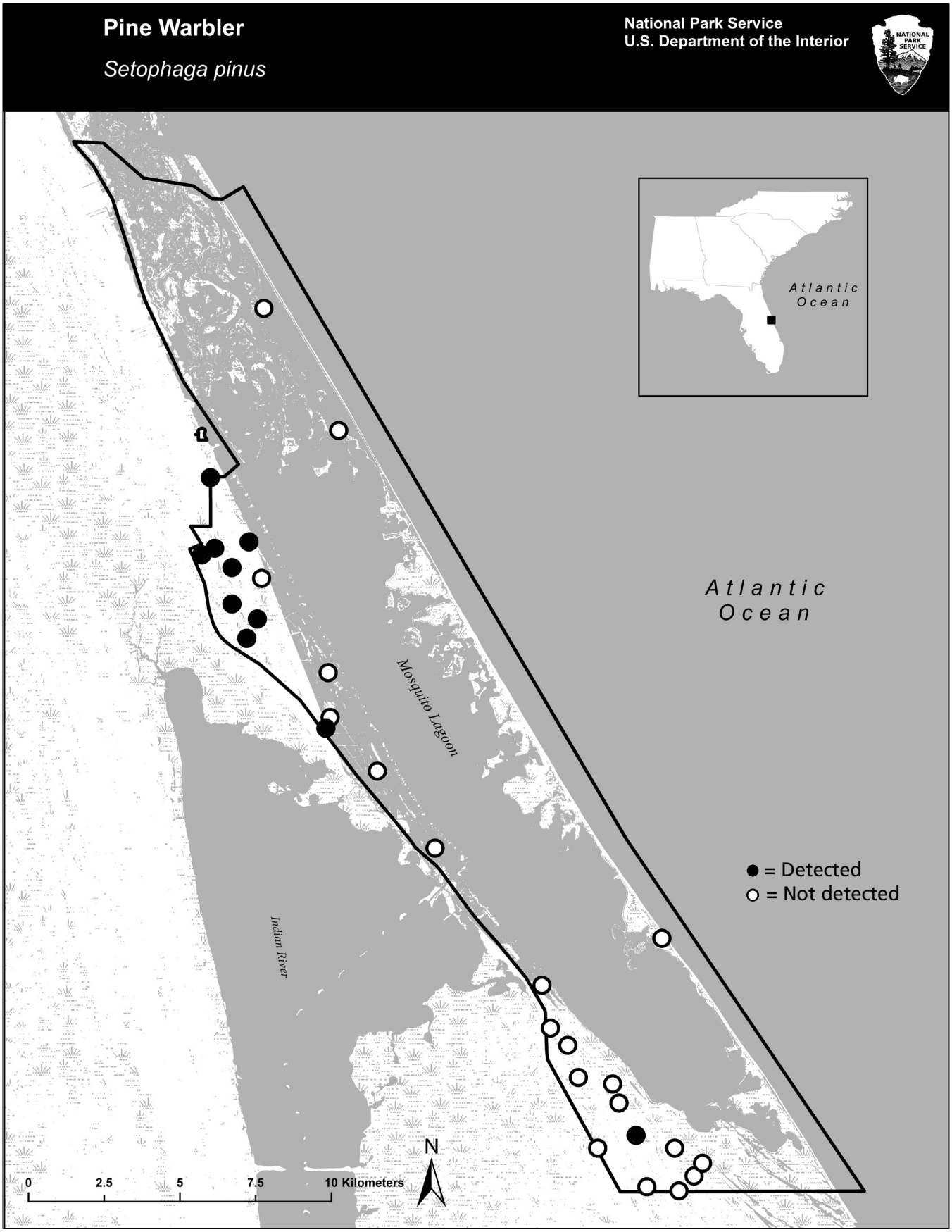


Figure C-58. Sampling locations where pine warbler (*Setophaga pinus*) was detected at Canaveral National Seashore, 2014.

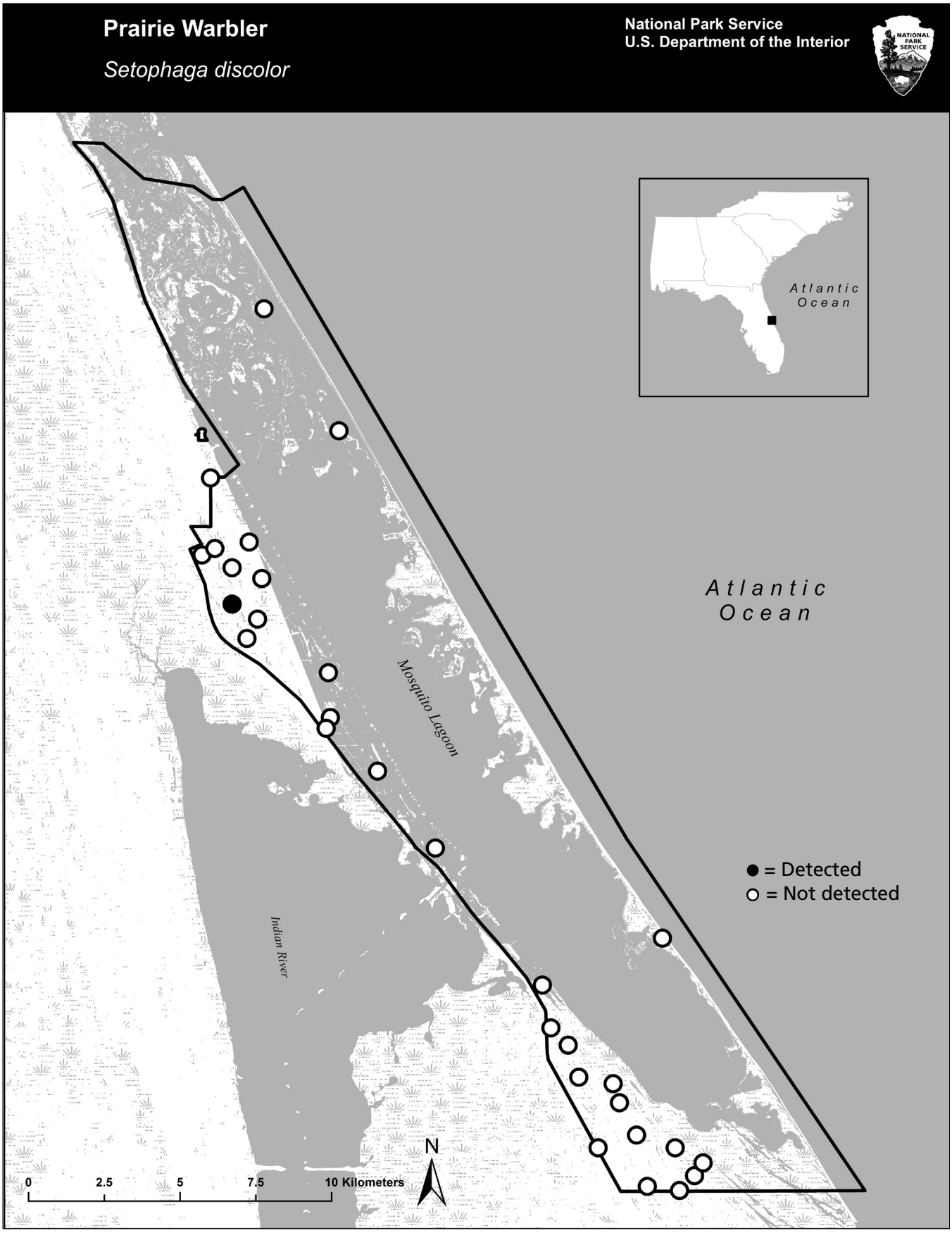


Figure C-59. Sampling locations where prairie warbler (*Setophaga discolor*) was detected at Canaveral National Seashore, 2014.

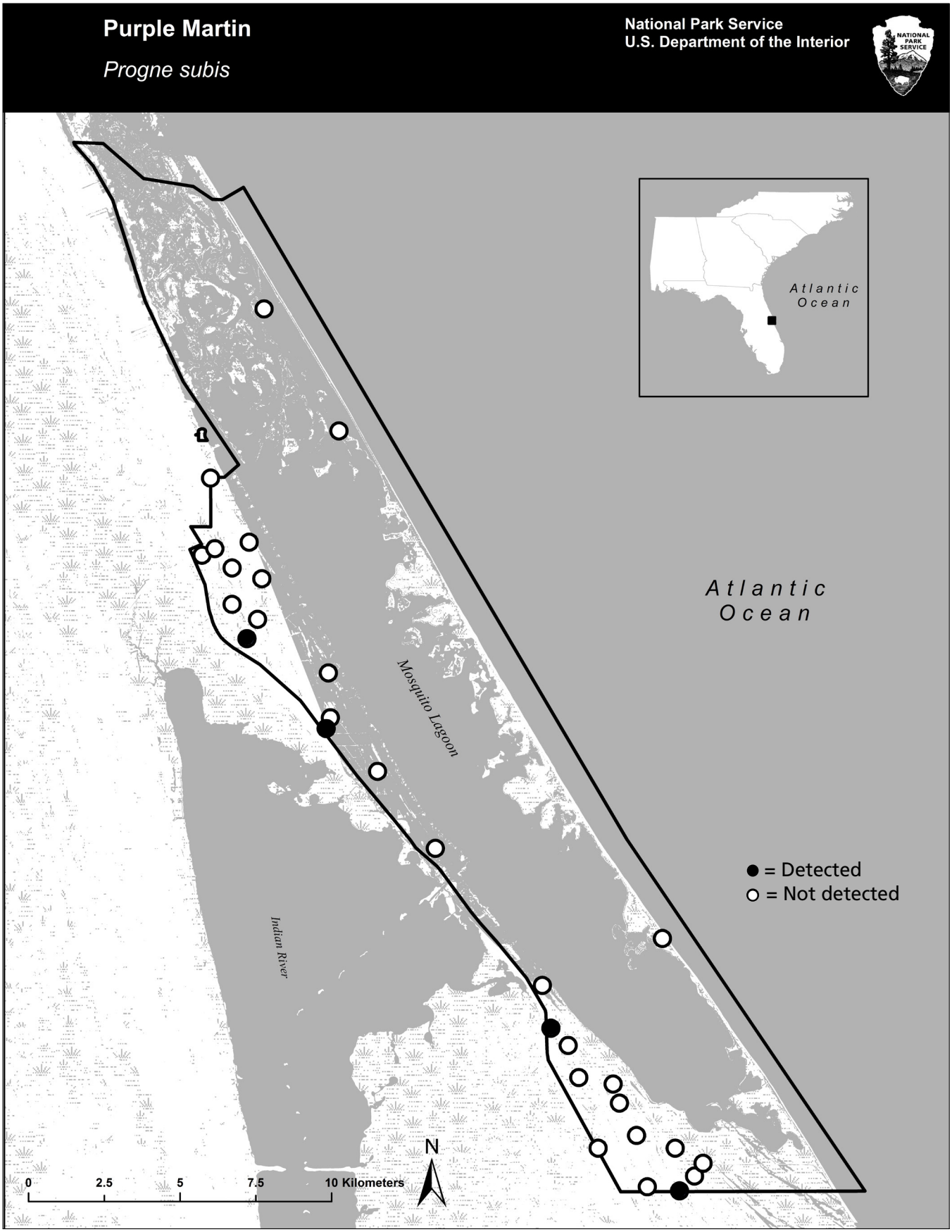


Figure C-60. Sampling locations where purple martin (*Progne subis*) was detected at Canaveral National Seashore, 2014.

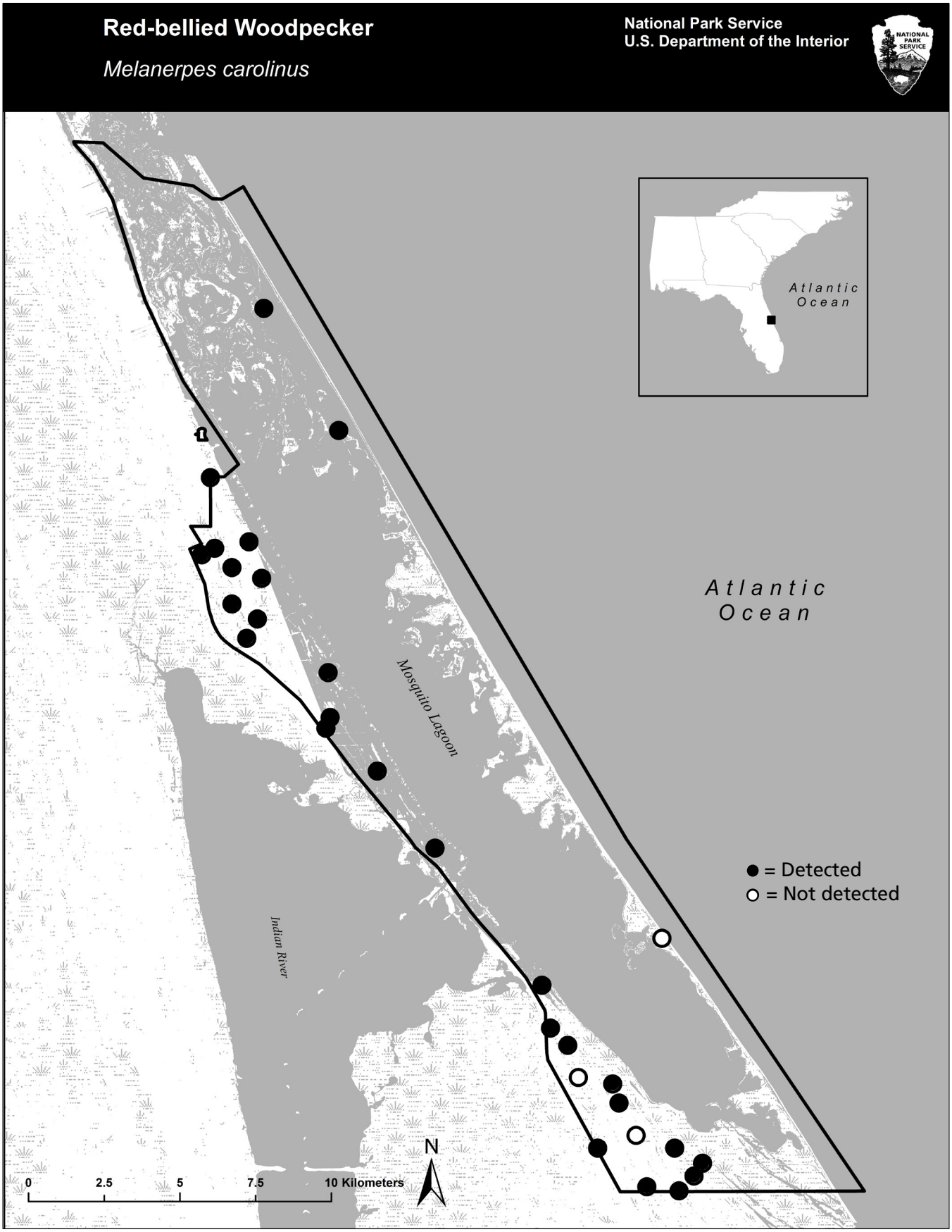


Figure C-61. Sampling locations where red-bellied woodpecker (*Melanerpes carolinus*) was detected at Canaveral National Seashore, 2014.

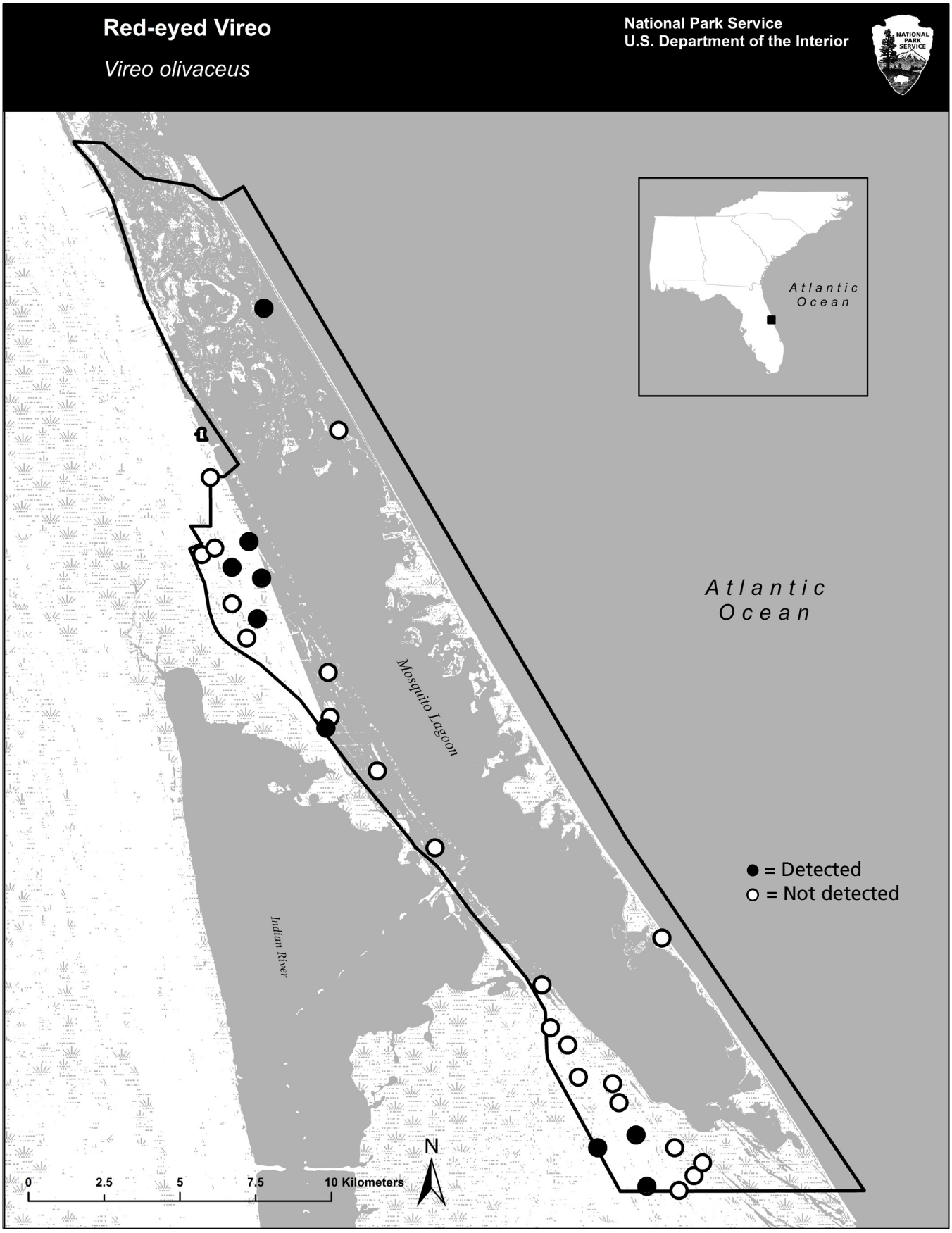


Figure C-62. Sampling locations where red-eyed vireo (*Vireo olivaceus*) was detected at Canaveral National Seashore, 2014.

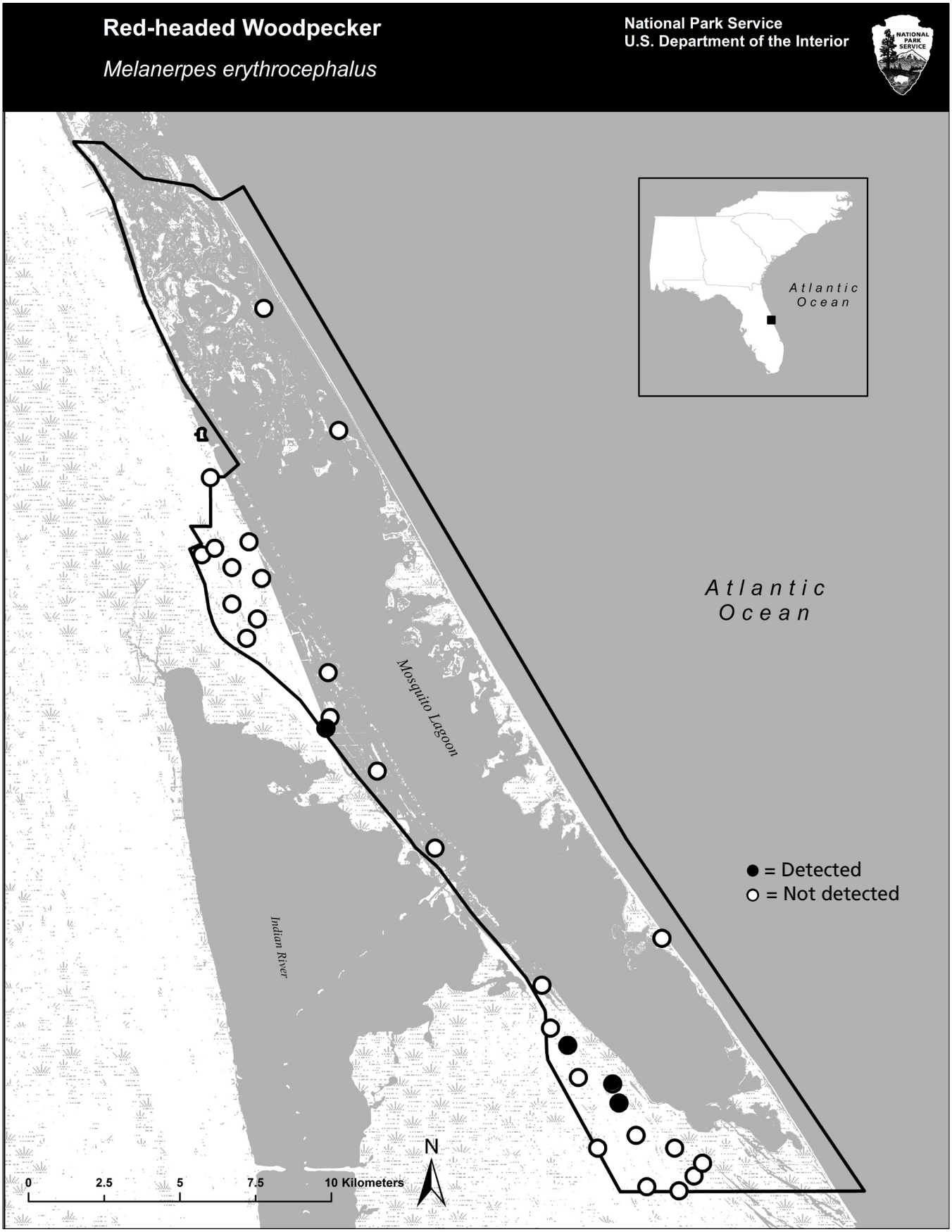


Figure C-63. Sampling locations where red-headed woodpecker (*Melanerpes erythrocephalus*) was detected at Canaveral National Seashore, 2014.

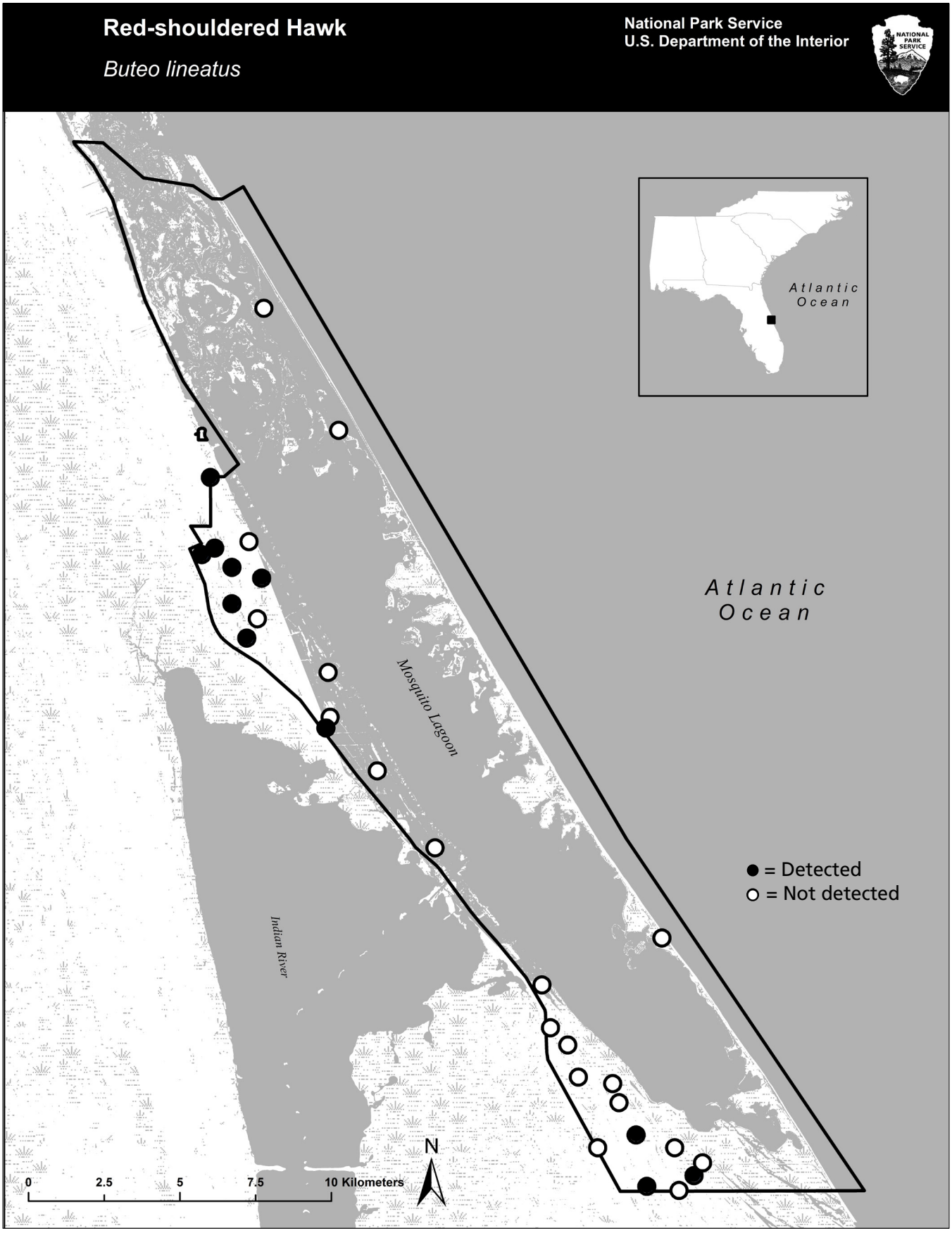


Figure C-64. Sampling locations where red-shouldered hawk (*Buteo lineatus*) was detected at Canaveral National Seashore, 2014.

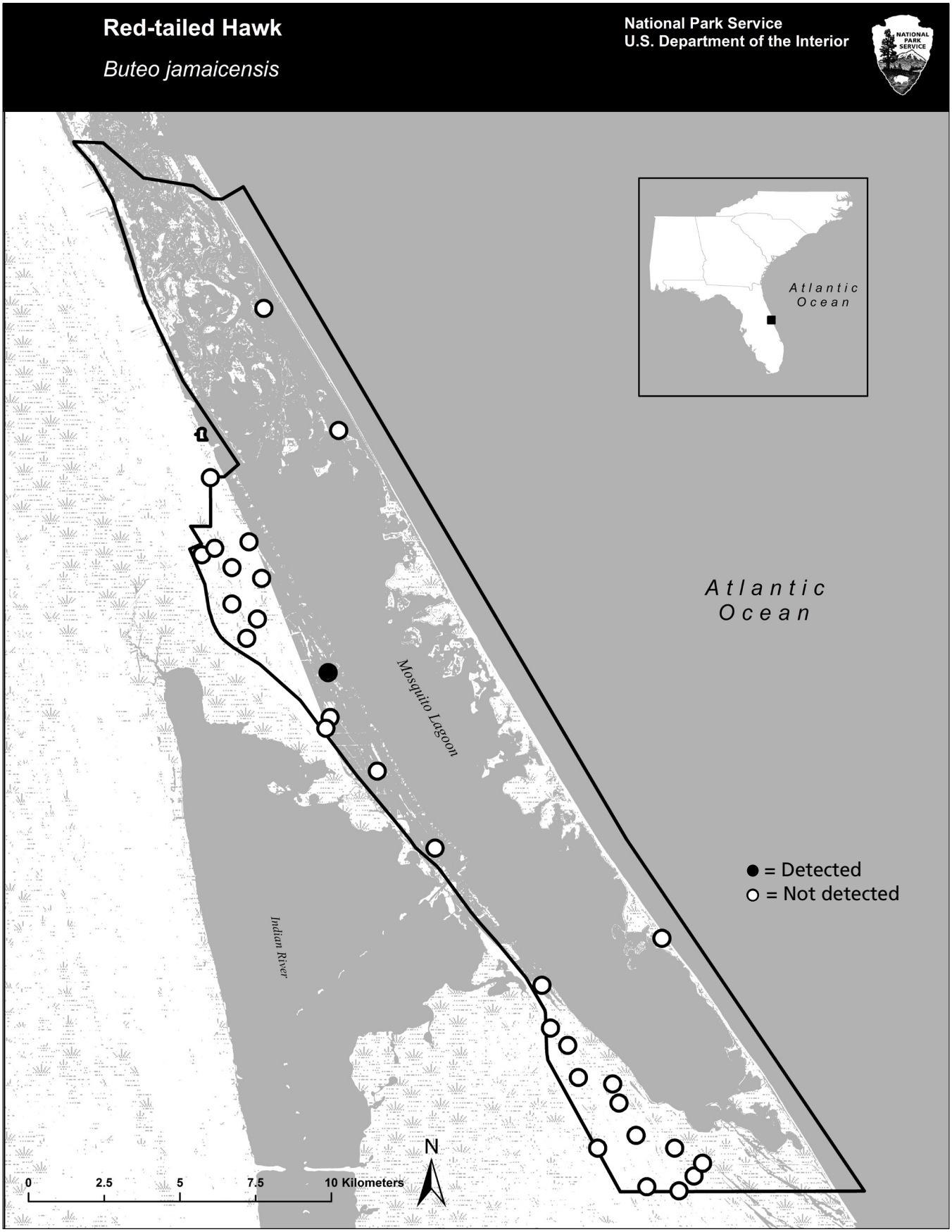


Figure C-65. Sampling locations where red-tailed hawk (*Buteo jamaicensis*) was detected at Canaveral National Seashore, 2014.

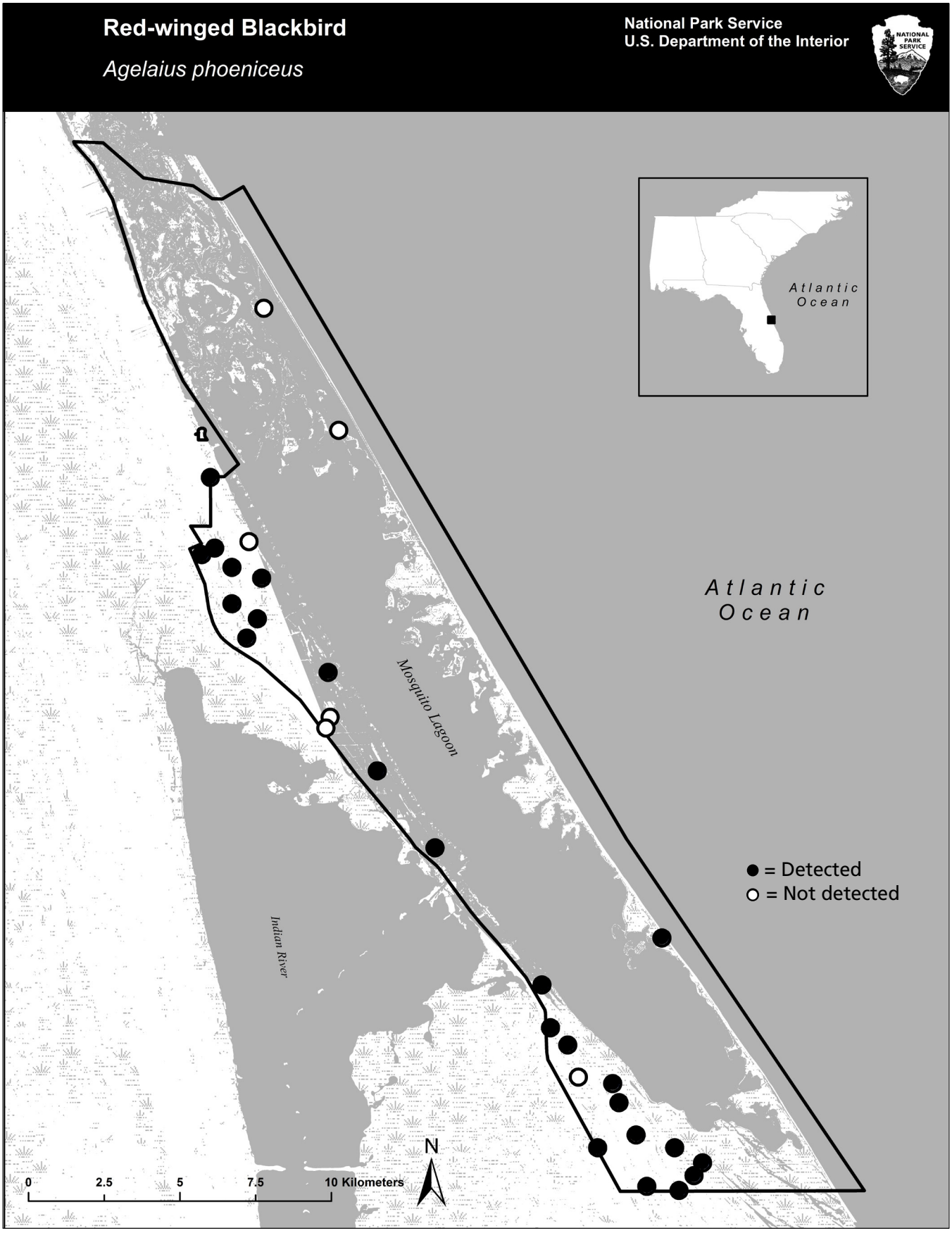


Figure C-66. Sampling locations where red-winged blackbird (*Agelaius phoeniceus*) was detected at Canaveral National Seashore, 2014.

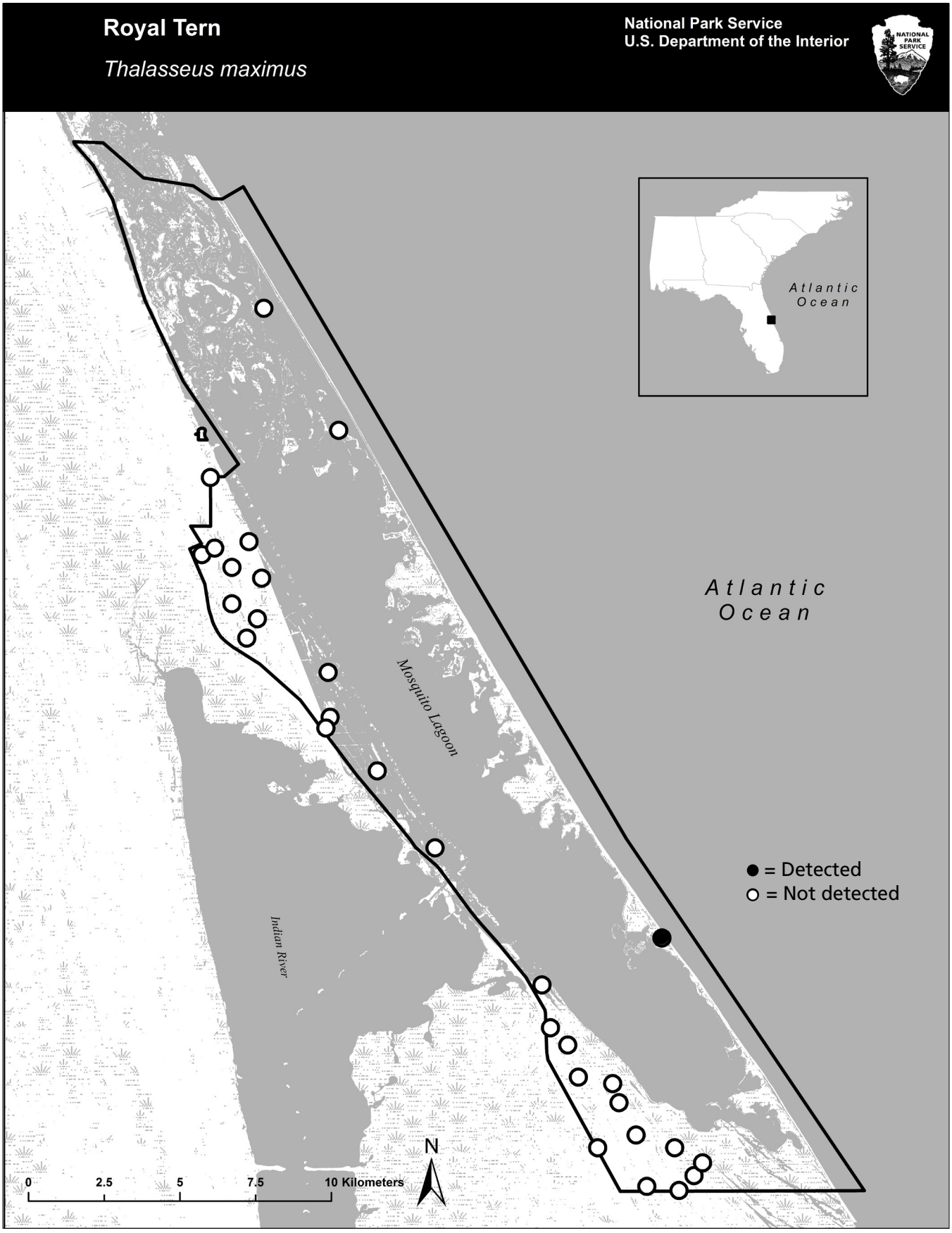


Figure C-67. Sampling locations where royal tern (*Sterna maxima*) was detected at Canaveral National Seashore, 2014.

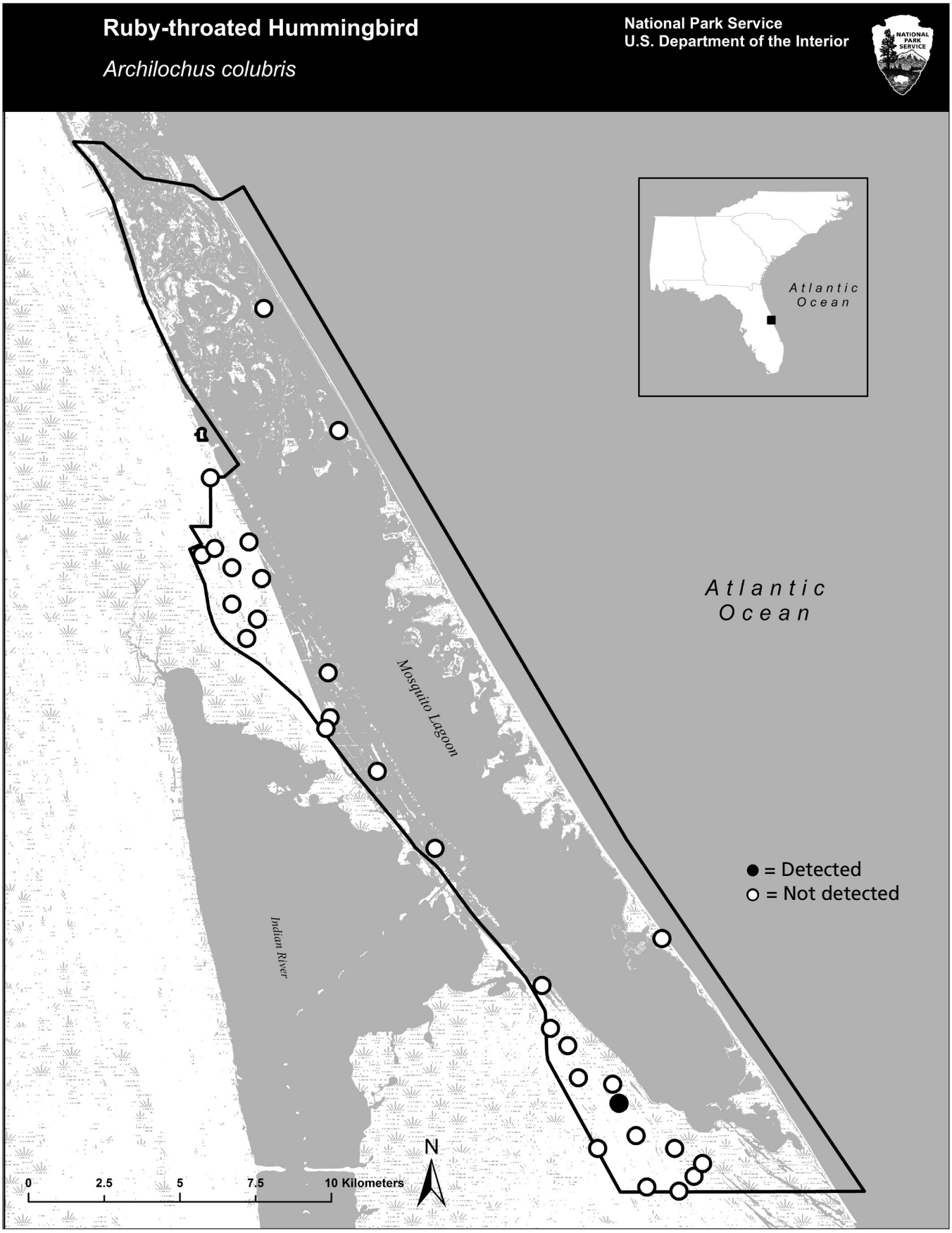


Figure C-68. Sampling locations where ruby-throated hummingbird (*Archilochus colubris*) was detected at Canaveral National Seashore, 2014.

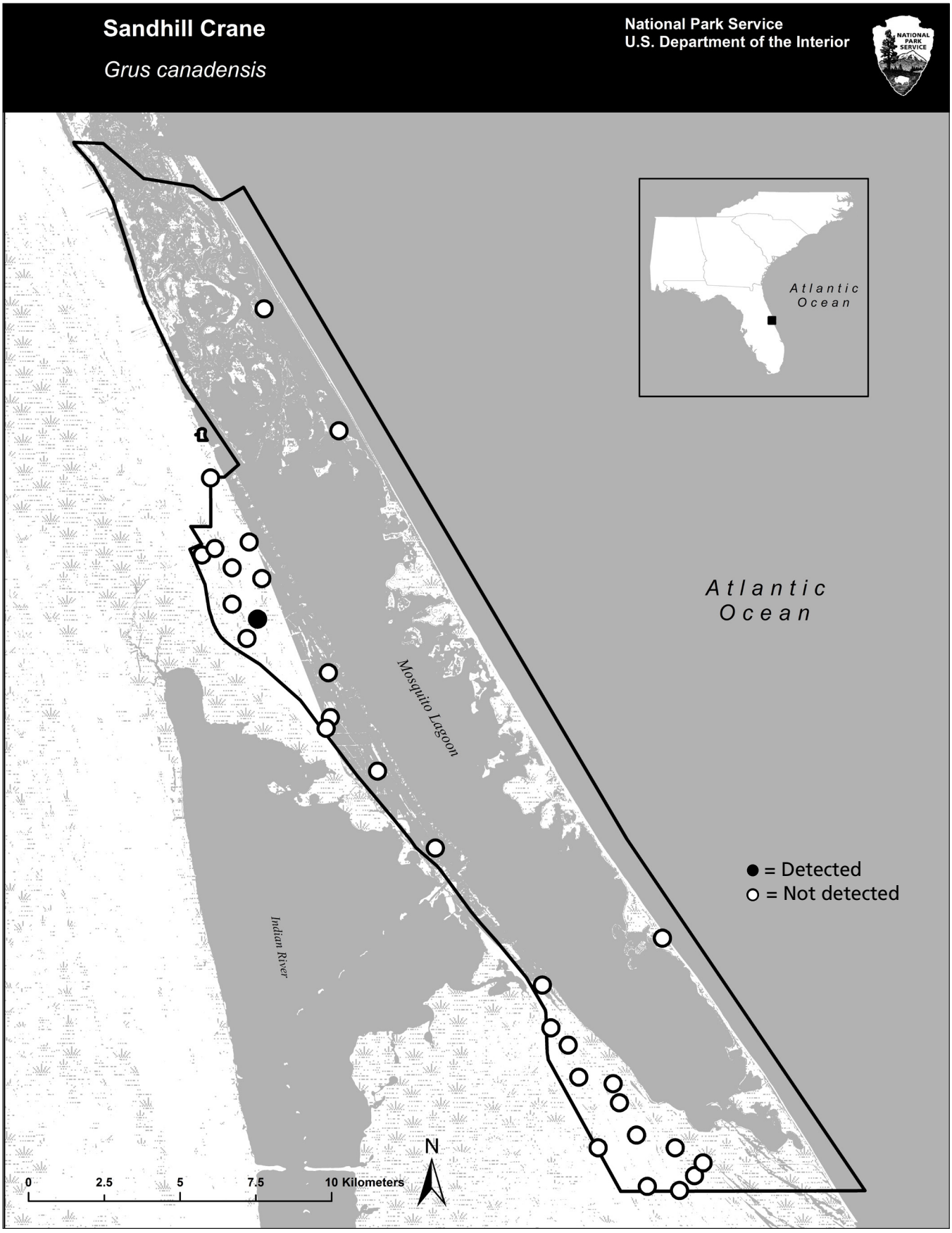


Figure C-69. Sampling locations where sandhill crane (*Grus canadensis*) was detected at Canaveral National Seashore, 2014.

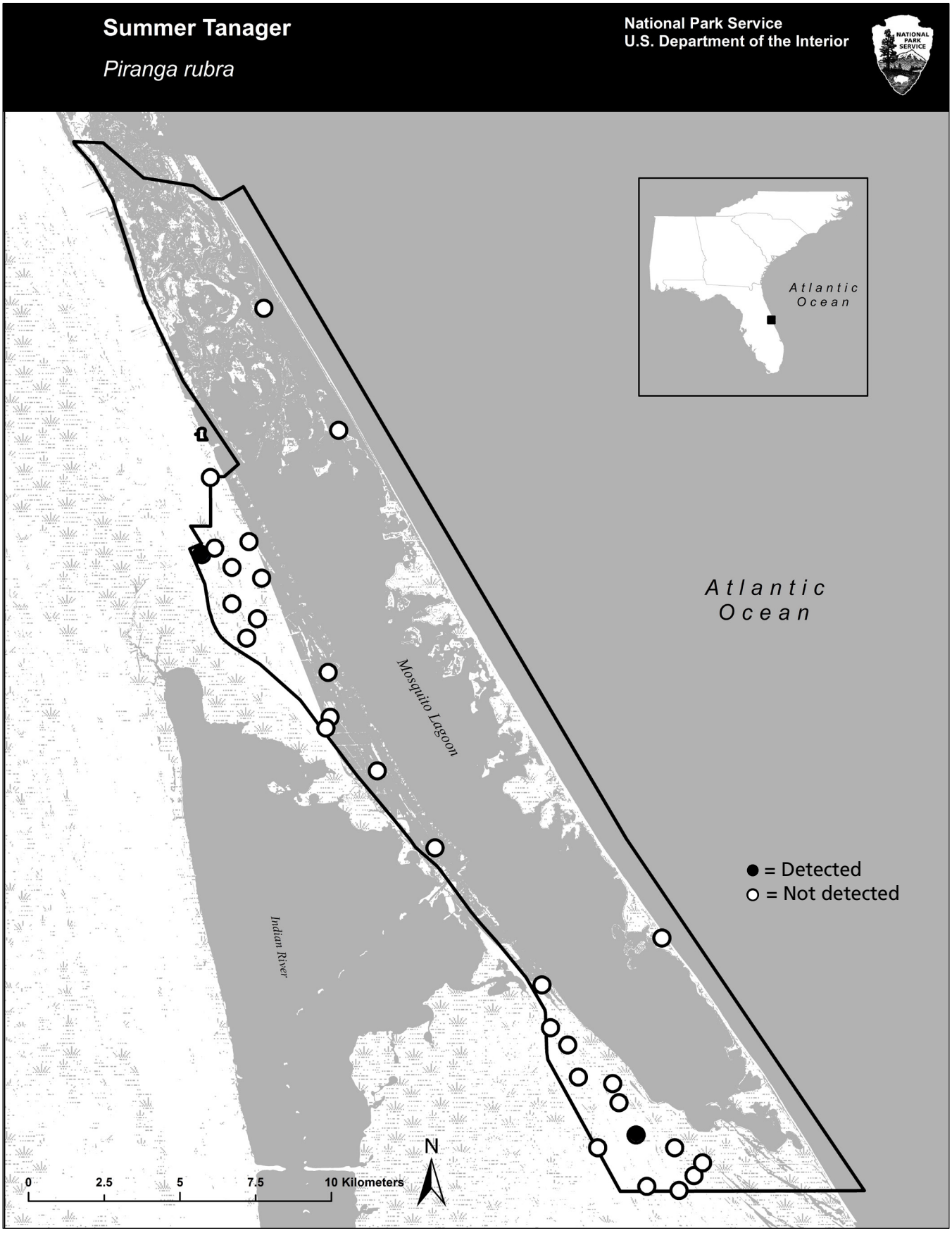


Figure C-70. Sampling locations where summer tanager (*Piranga rubra*) was detected at Canaveral National Seashore, 2014.

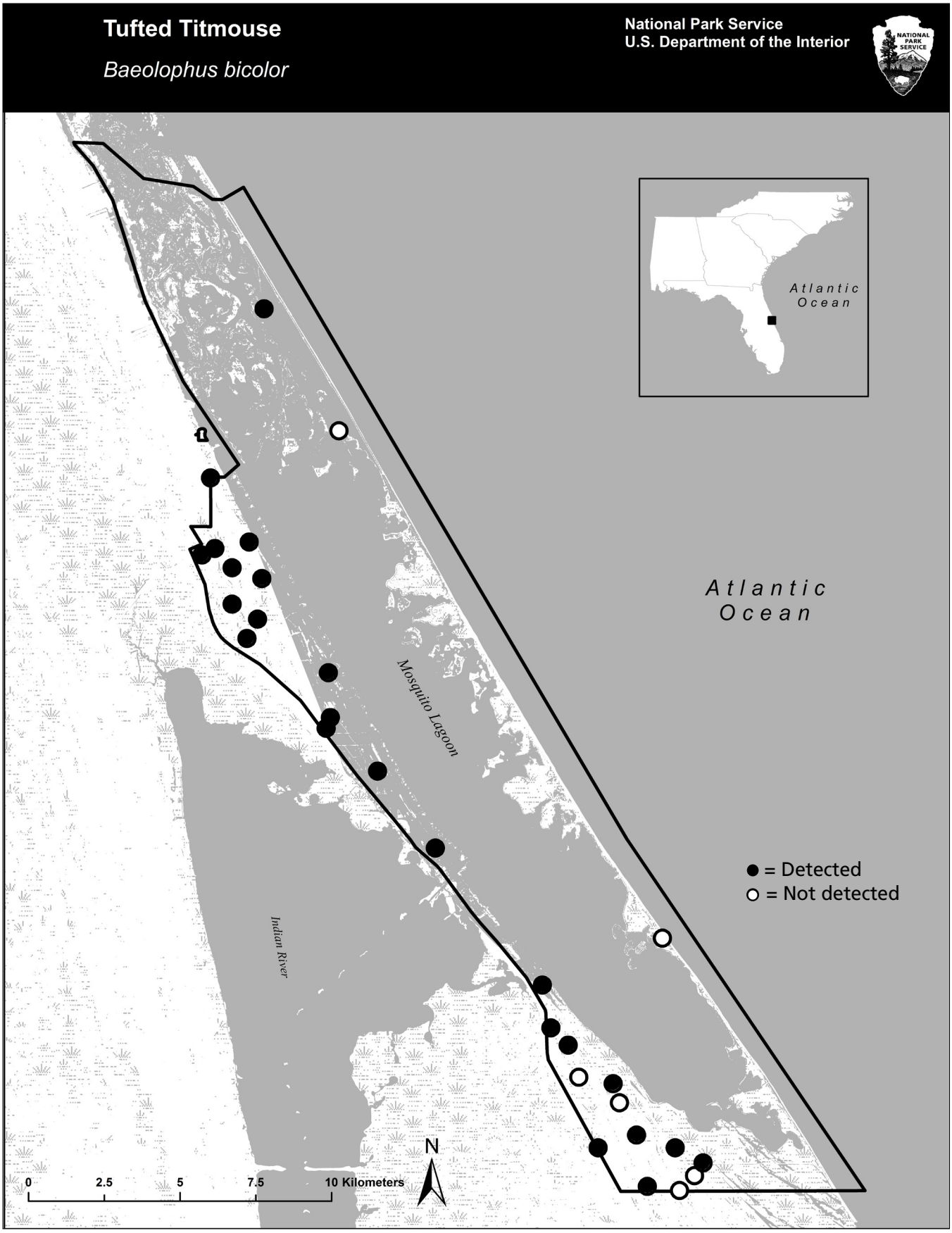


Figure C-71. Sampling locations where tufted titmouse (*Baeolophus bicolor*) was detected at Canaveral National Seashore, 2014.

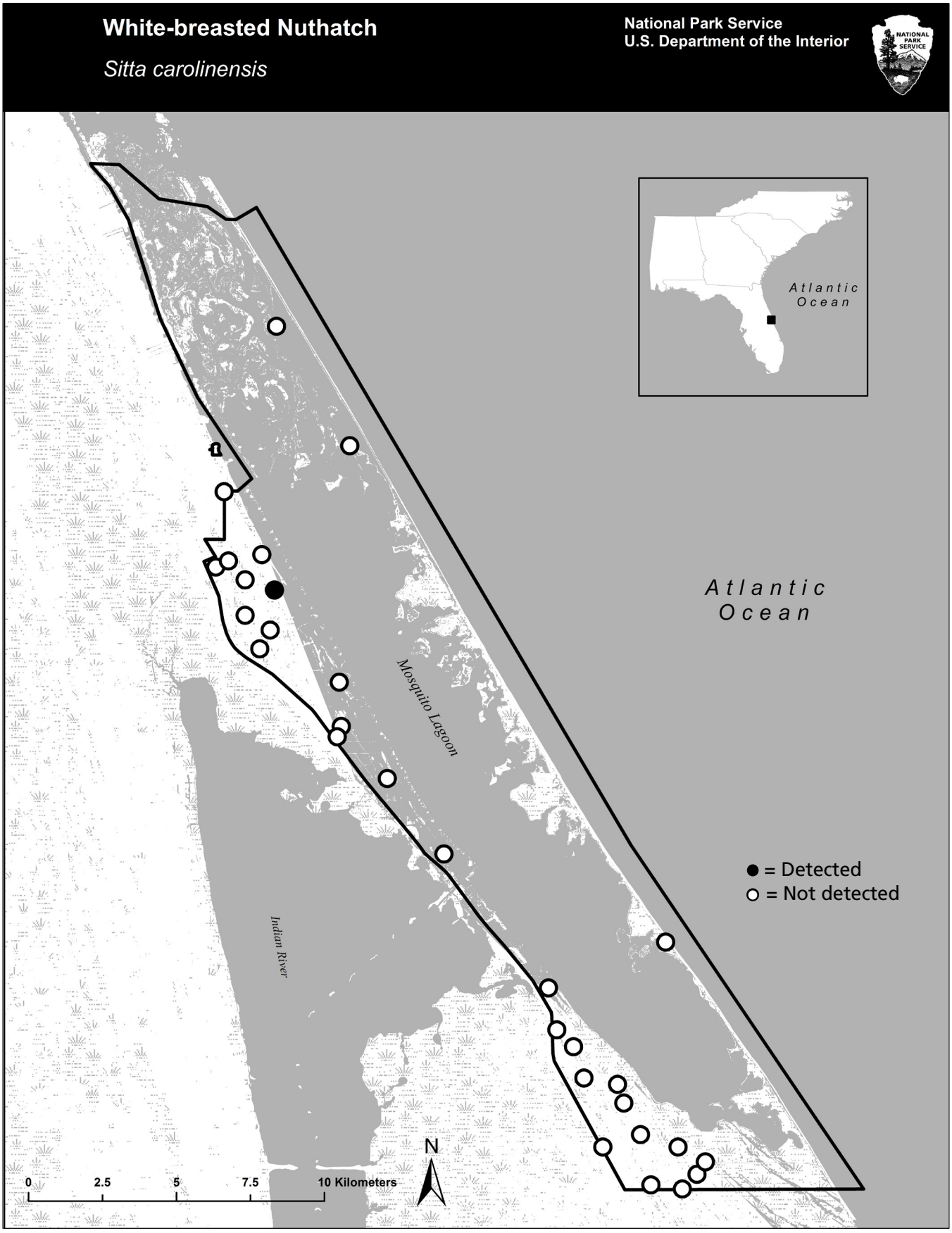


Figure C-72. Sampling locations where white-breasted nuthatch (*Sitta carolinensis*) was detected at Canaveral National Seashore, 2014.

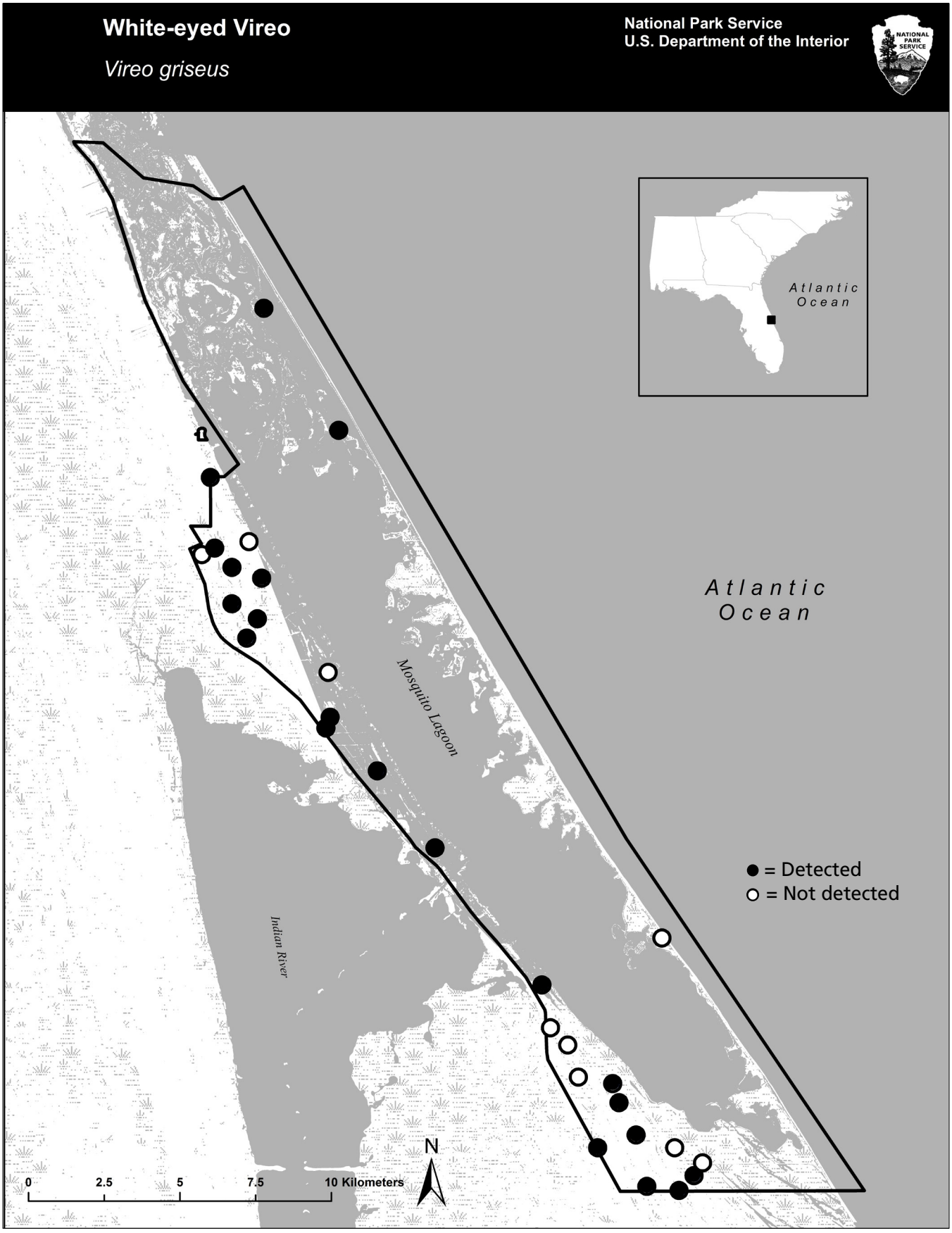


Figure C-73. Sampling locations where white-eyed vireo (*Vireo griseus*) was detected at Canaveral National Seashore, 2014.

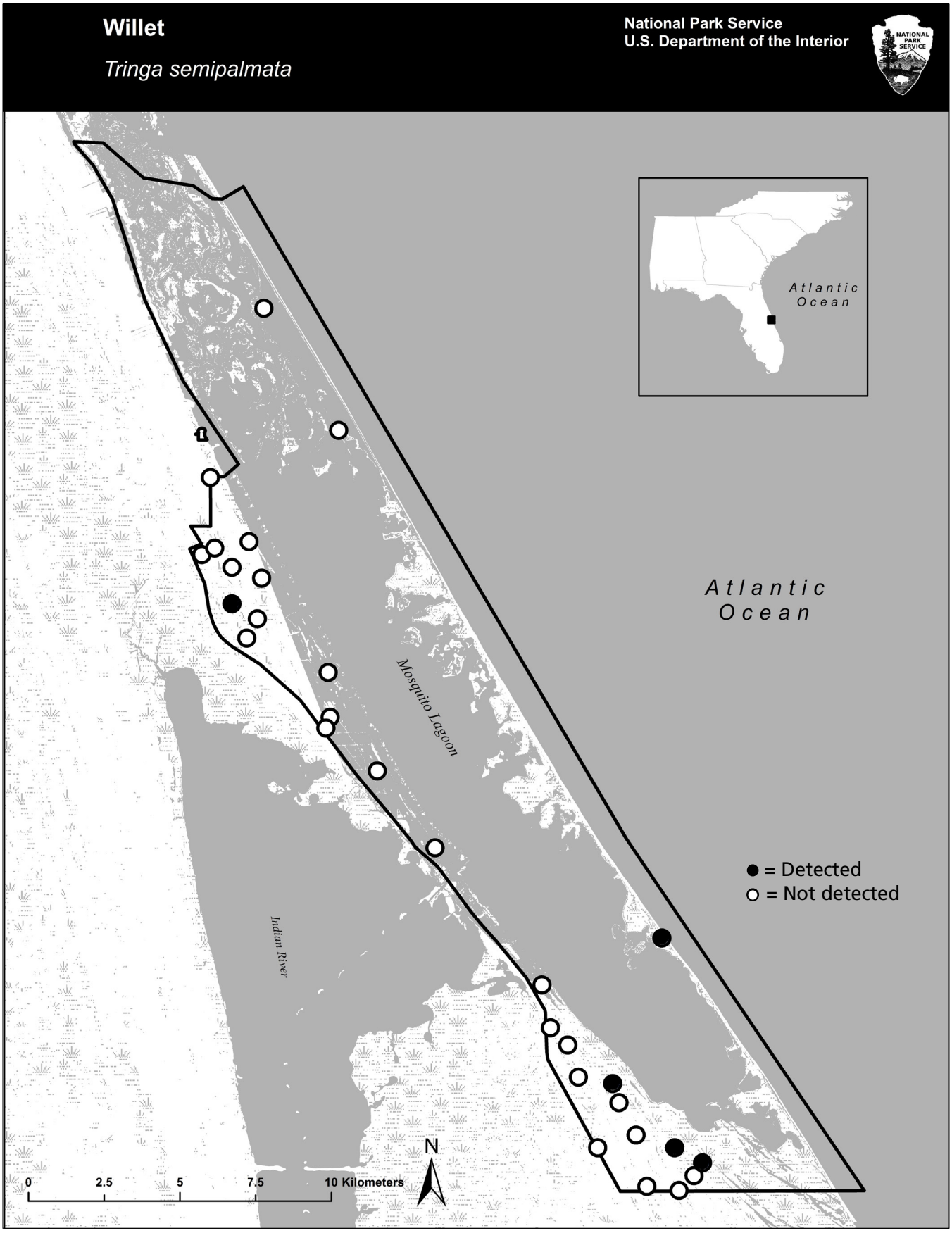


Figure C-74. Sampling locations where willet (*Catoptrophorus semipalmatus*) was detected at Canaveral National Seashore, 2014.

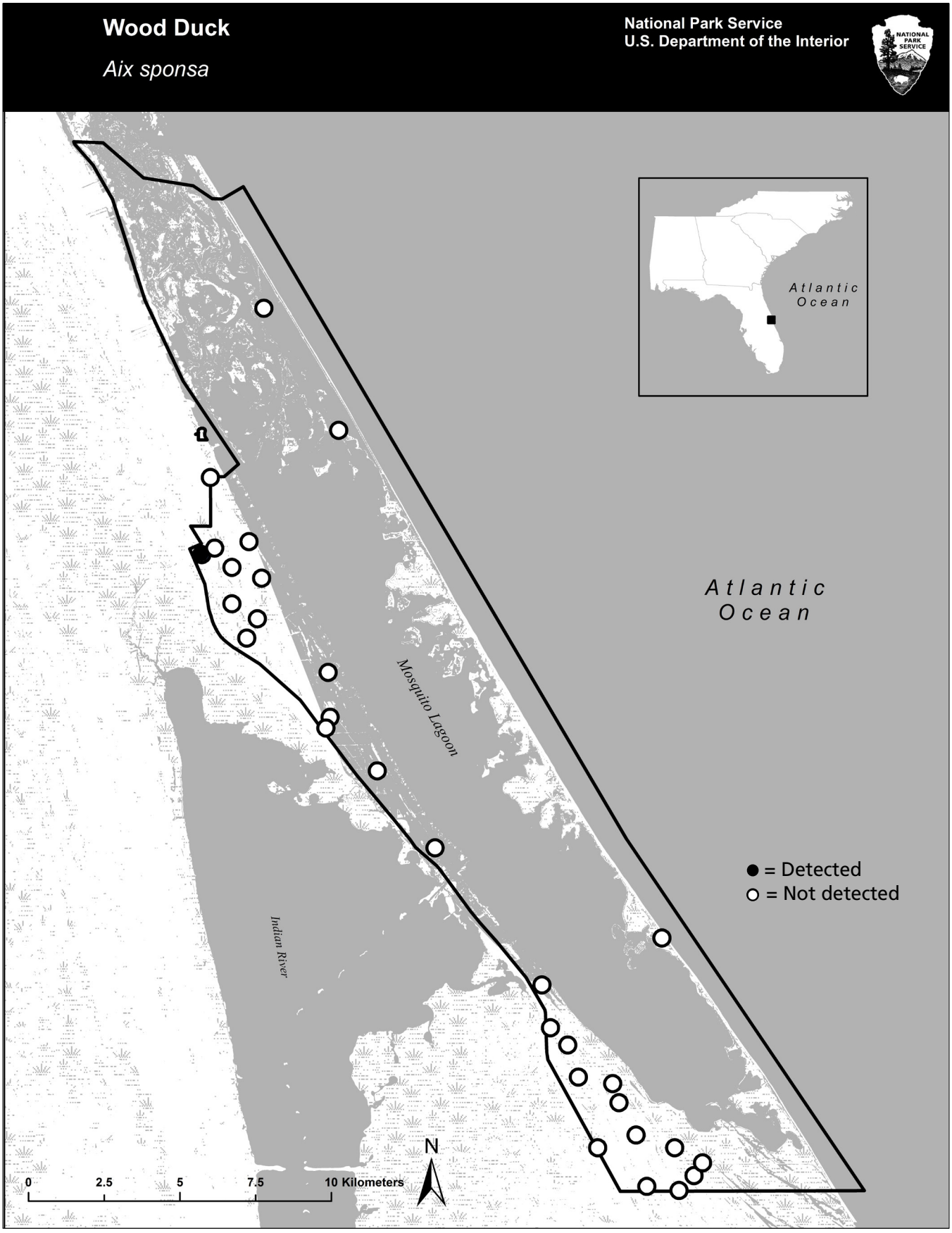


Figure C-75. Sampling locations where wood duck (*Aix sponsa*) was detected at Canaveral National Seashore, 2014.

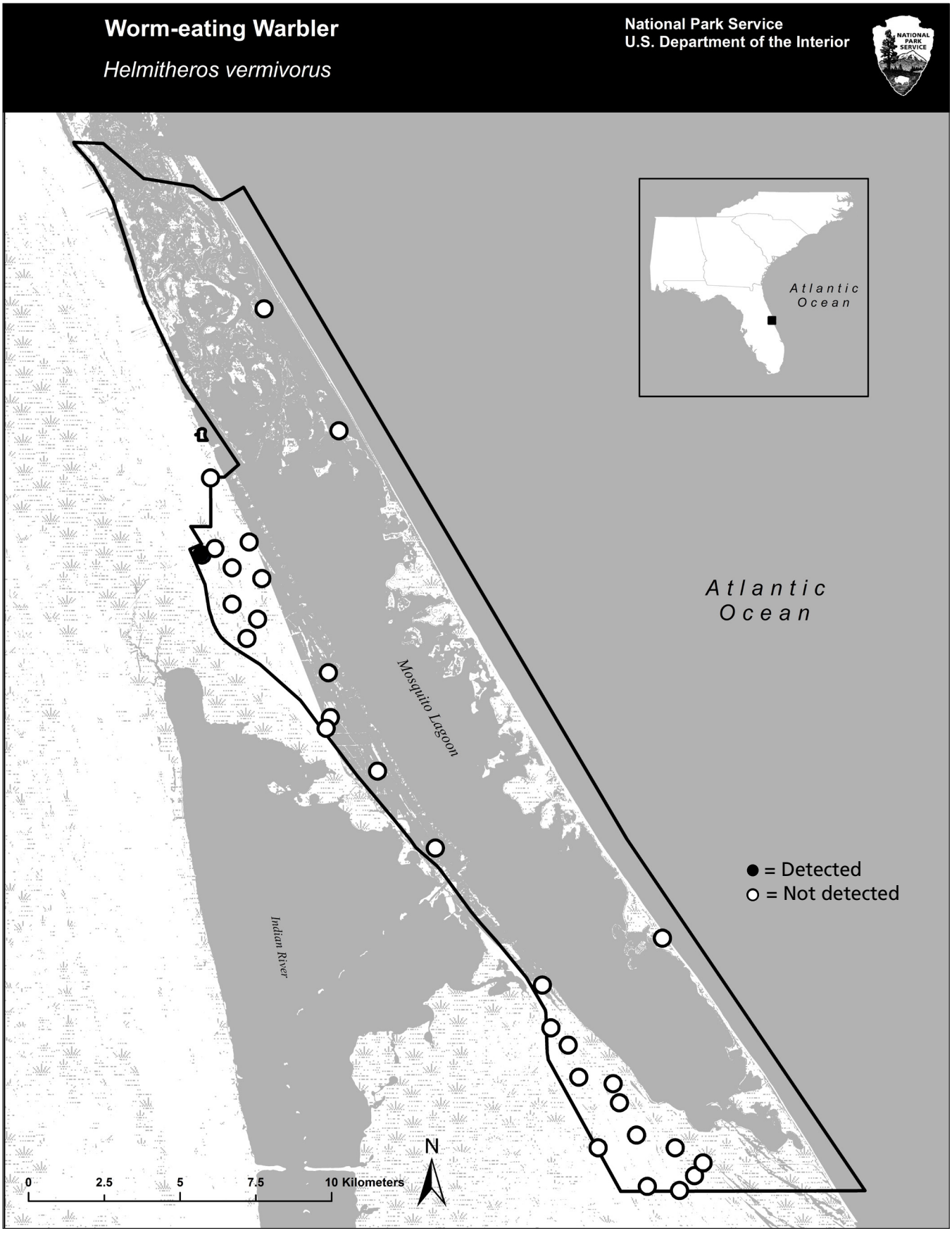


Figure C-76. Sampling locations where worm-eating warbler (*Helmitheros vermivorus*) was detected at Canaveral National Seashore, 2014.

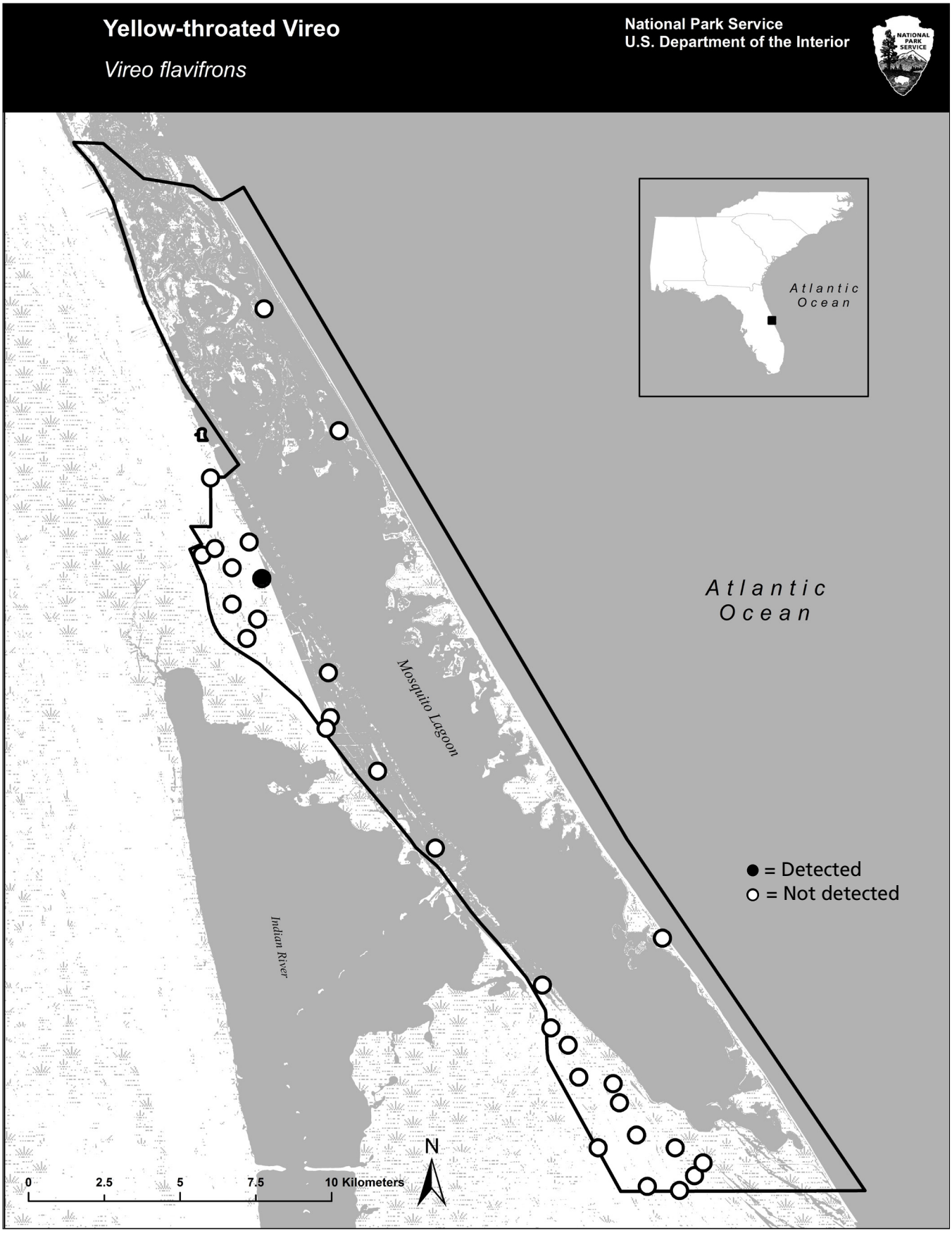


Figure C-77. Sampling locations where yellow-throated vireo (*Vireo flavifrons*) was detected at Canaveral National Seashore, 2014.

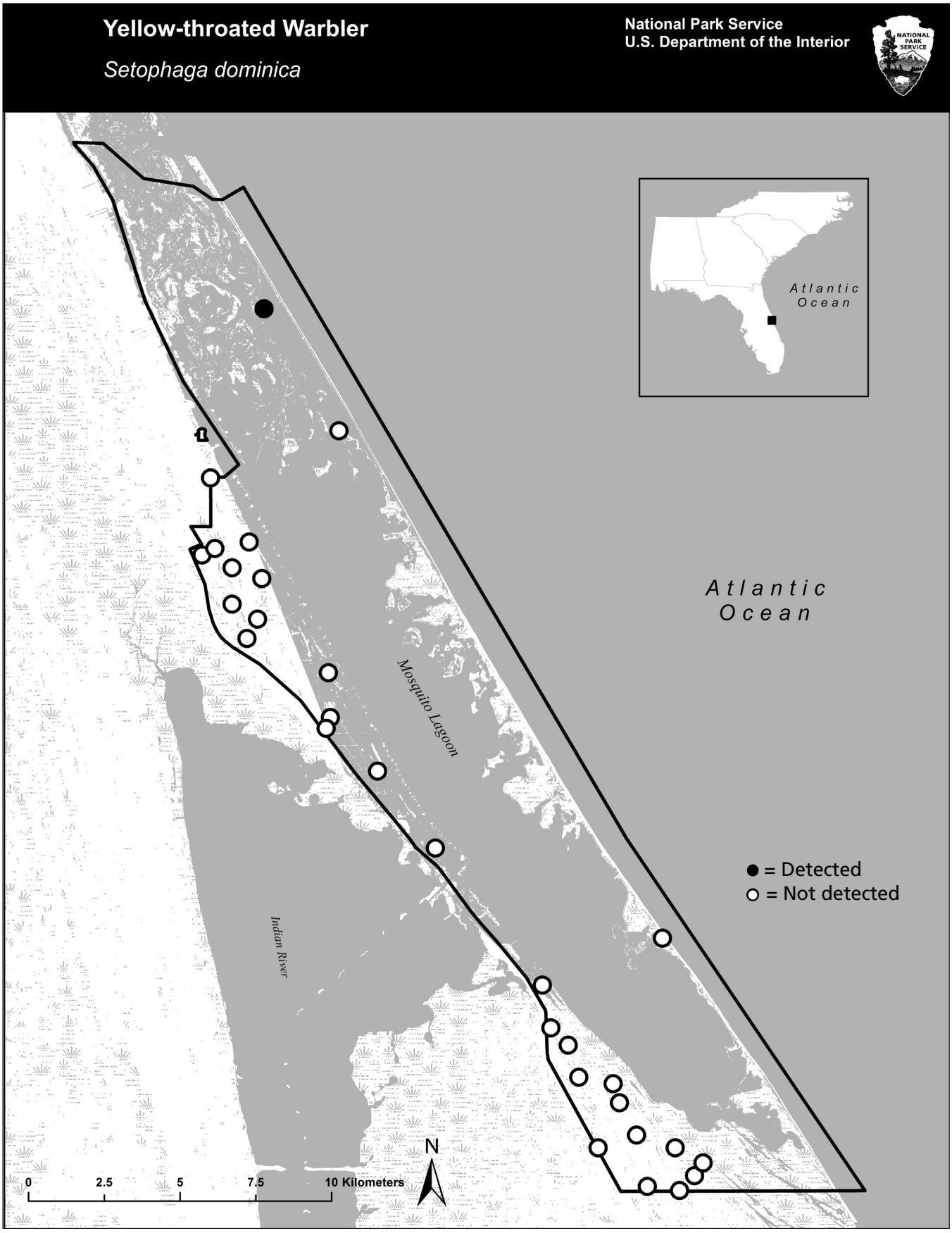


Figure C-78. Sampling locations where yellow-throated warbler (*Setophaga dominica*) was detected at Canaveral National Seashore, 2014.

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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