



Songbird Monitoring in the Great Lakes Network Parks

2014–2018

Natural Resource Report NPS/GLKN/NRR—2021/2217



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ON THE COVER

Alex Egan conducts a point count on the Lake Richie to Greenstone Trail at Isle Royale National Park.
NPS photo.

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Samuel G. Roberts¹, Zachary S. Ladin¹, Elizabeth L. Tymkiw¹, W. Gregory Shriver¹, and Ted Gostomski²

¹ 250 Townsend Hall
Department of Entomology and Wildlife Ecology
University of Delaware
Newark, Delaware 19716

² National Park Service
Great Lakes Inventory and Monitoring Network
2800 Lakeshore Drive East
Ashland, Wisconsin 54806

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Abstract

This report presents analyses and summaries of five years (2014–2018) of landbird monitoring data collected in eight Great Lakes Network (GLKN) parks as part of long-term monitoring conducted by the National Park Service’s Inventory and Monitoring Division. Four years of data (2015–2018) are presented for one park. The primary goal of this program is to track long-term trends in population indices for priority landbird species or suites of birds, and to place park trends and other parameters in a regional context.

Data are collected annually through point count surveys, with eight parks following standard operating procedures outlined in the Great Lakes Network’s landbird monitoring protocol, and one park following the North American Breeding Bird Survey (NABBS) protocol. The NABBS protocol differs greatly from the network protocol, which prevents a full analysis for that park, but summary statistics are provided.

With five years of data, we were able to estimate park-level bird community richness and diversity and population occupancies and densities. Species richness is provided as a simple count of species detected within each park across the five years. We used the *vegan* package in program R to calculate Simpson’s Index of Diversity. This report focuses on mean occupancy and density estimates across the five years of data collection. We analyzed the point count data using the *unmarked* package in R to estimate occupancy and density.

Over five years of data collection, 2,810 point count surveys were conducted and 171 unique species were detected in eight GLKN parks. The number of breeding bird species detected ranged from 47 to 101 species detected in a single year in a park. All eight parks had a Simpson’s Index of Diversity ≥ 0.95 (on a scale of 0–1), indicating high levels of diversity in all parks. The mean occupancy and density estimates provide important baseline values for each park for future comparison as the monitoring of these landbird populations continues.

A power analysis was also conducted, and those data are presented in a separate report.

Acknowledgments

Landbird data collection is accomplished by park staff, contractors, and volunteers, and we thank all of them for their dedication to this program. Thank you to R. Key for her masterful handling of all things data management. Data analysis and the creation of this report was accomplished in partnership with the University of Delaware under Agreement P19AC00043.

Acronyms Used in This Report

APIS	Apostle Islands National Lakeshore
GLKN	Great Lakes Inventory and Monitoring Network
GRPO	Grand Portage National Monument
INDU	Indiana Dunes National Park
ISRO	Isle Royale National Park
MISS	Mississippi National River and Recreation Area
PIRO	Pictured Rocks National Lakeshore
SACN	St. Croix National Scenic Riverway
SLBE	Sleeping Bear Dunes National Lakeshore
VOYA	Voyageurs National Park

Standardized four-letter bird codes are listed in Appendix F.

Introduction

The Great Lakes Inventory and Monitoring Network (GLKN or network) is composed of nine national park units in Michigan, Indiana, Wisconsin, and Minnesota (Figure 1). The parks span across two Bird Conservation Regions (Rich et al. 2004) and provide important breeding habitat for more than 100 species of landbirds, some of which are long-distance (Neotropical) migrants.

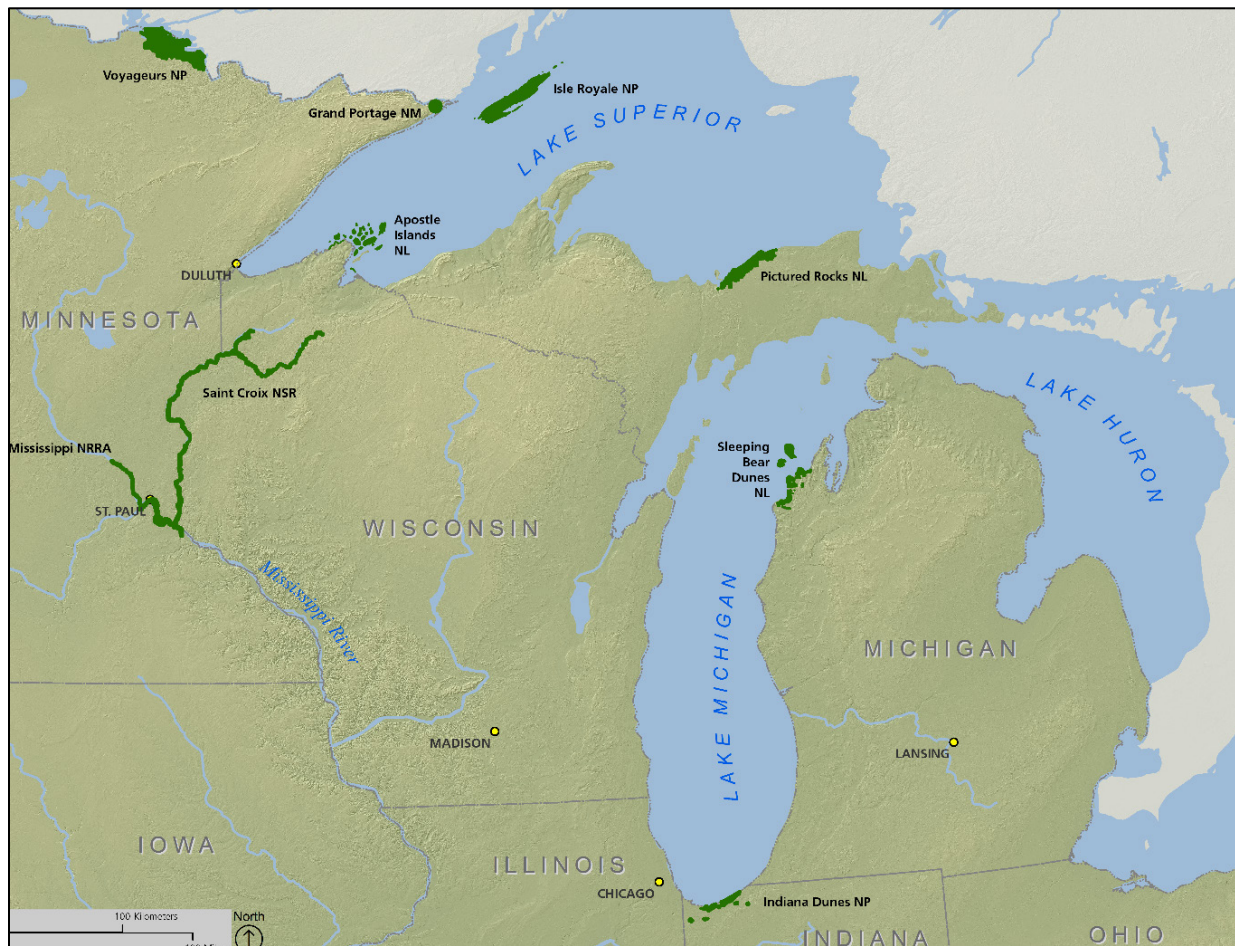


Figure 1. Locations of the nine national park units in the Great Lakes Inventory and Monitoring Network.

Seven of the nine GLKN parks were monitoring songbirds prior to the creation of the National Park Service (NPS) Inventory and Monitoring (I&M) program in 1999: Apostle Islands National Lakeshore (APIS), Grand Portage National Monument (GRPO), Indiana Dunes National Park (INDU), Isle Royale National Park (ISRO), St. Croix National Scenic Riverway (SACN), Sleeping Bear Dunes National Lakeshore (SLBE), and Voyageurs National Park (VOYA). The individual park programs followed standardized methods for point count studies (e.g., Ralph et al. 1995, Howe et al. 1997, USGS and CWS 1998). Once the GLKN protocol (Gostomski et al. 2010) was completed, six of the parks made minor adjustments to their methods to comply with the over-arching protocol. INDU continued to conduct surveys according to the North American Breeding Bird Survey protocol

(USGS and CWS 1998) to maintain consistency with their past efforts. The two remaining parks—Pictured Rocks National Lakeshore (PIRO) and Mississippi National River and Recreation Area (MISS)—initiated monitoring programs according to the network protocol beginning in 2011 and 2015, respectively.

The goal of this monitoring program is to track long-term trends in population indices for priority landbird species (Table 1) or suites of birds, and to place park trends and other parameters in a regional context.

Table 1. Regional and Continental status of Great Lakes Network priority landbird species.

Species	Regional Concern (by Bird Conservation Region) ^a	Continental Importance ^b
Black-and-white Warbler	BCR 12	–
Canada Warbler	BCR 12	Watch List – Yellow D
Common Grackle	–	CBSD
Eastern Kingbird	BCR 12, BCR 23	–
Eastern Meadowlark	BCR 12, BCR 23	CBSD
Golden-winged Warbler	BCR 12, BCR 23	Watch List – Red
Great Crested Flycatcher	BCR 12	–
Least Flycatcher	BCR 12, BCR 23	CBSD
Northern Flicker	BCR 23	–
Prothonotary Warbler	–	Watch List – Yellow D
Scarlet Tanager	BCR 12	–
Tree Swallow	BCR 12	–
Veery	BCR 12	–
Wood Thrush	BCR 12	Watch List – Yellow D

^a BCR 12 = Boreal Hardwood Transition (encompasses all GLKN parks except MISS and INDU and the southern half of SACN). BCR 23 = Prairie Hardwood Transition (MISS, INDU, and southern half of SACN).

^b CBSD = Common Bird in Steep Decline. Watch List – Red = Species with extremely high vulnerability due to small population and range, high threats, and range wide declines. Watch List – Yellow D = Species with population declines and moderate to high threats. Continental status from Partners in Flight (2019).

A previous analysis of network data (Egan et al. 2015) did not include MISS or PIRO because they had an insufficient amount of data for analysis. Here, we report results from data collected at all nine network parks from 2014 through 2018 (2015–2018 for MISS). This is the first such analysis to include all nine network parks, though only a limited summary is provided for Indiana Dunes (Appendix A).

Methods

Study Areas

Survey points at most GLKN parks are distributed along trails and generally account for both representative habitats in and geographic distribution across the parks so as to achieve spatial balance (Stevens and Olsen 2004). Survey points at INDU are located along a single roadside transect in accordance with North American Breeding Bird Survey (NABBS) methods (USGS and CWS 1998, Sauer et al. 2014). At PIRO, 52 survey points were randomly distributed across the park, following sample design suggestions provided by Knutson et al. (2010). At SACN, points are located along both the Namekagon and St. Croix rivers for the entire length of the park, and surveys are conducted from an anchored canoe. SLBE was the only park to proportionally stratify point distribution by habitat type.

Apostle Islands National Lakeshore (Wisconsin)

Ten survey routes were established in 1995 (Van Stappen and Dallman 1996) (Figure 2). Count duration is 10 minutes per point.

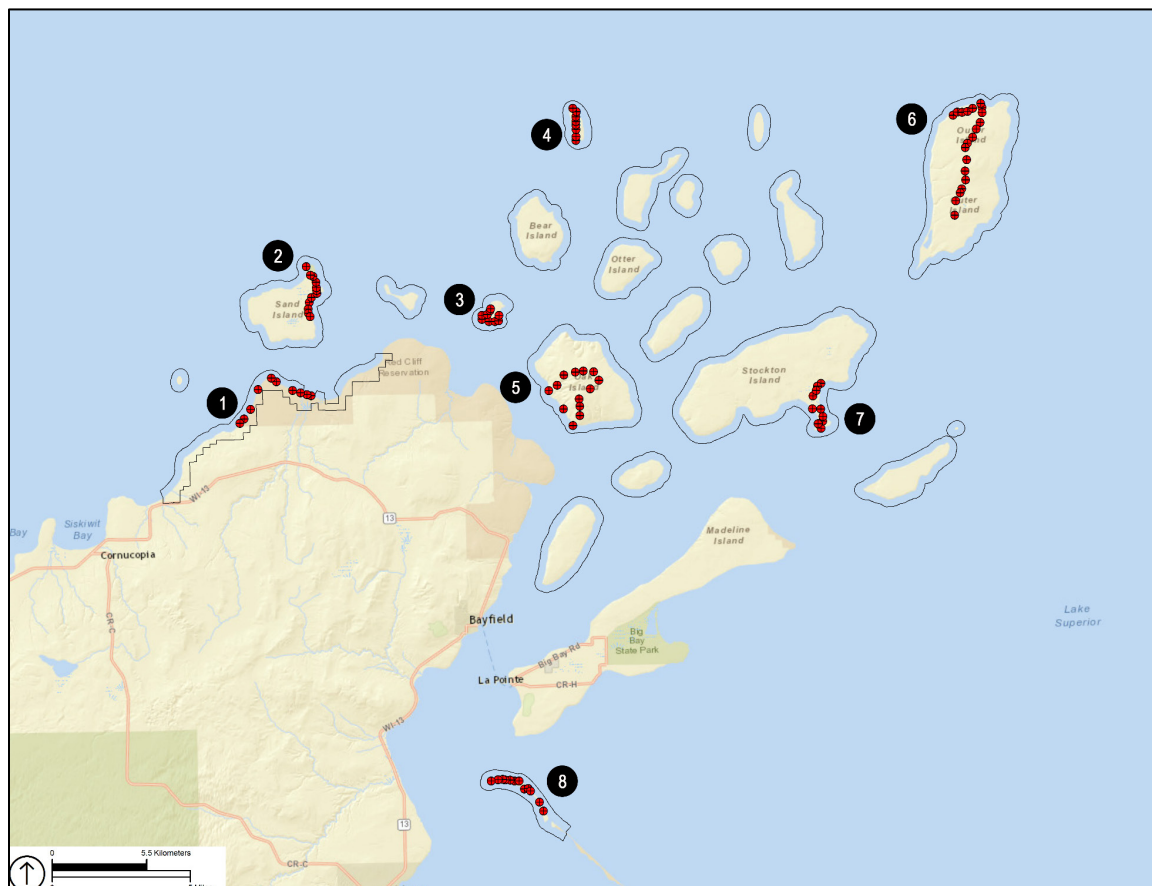


Figure 2. Locations of ten breeding bird survey routes at Apostle Islands National Lakeshore (Wisconsin). 1= Mainland Trail, 2 = Sand Island, 3 = Raspberry Island, 4 = Devils Island, 5 = Oak Island, 6 = Outer Island, 7= Stockton Island, 8 = Long Island.

Grand Portage National Monument (Minnesota)

The GRPO survey was established in 1999. Points are distributed along a single route on the historic canoe portage from Lake Superior to the Pigeon River (Figure 3). Count duration is 10 minutes per point.

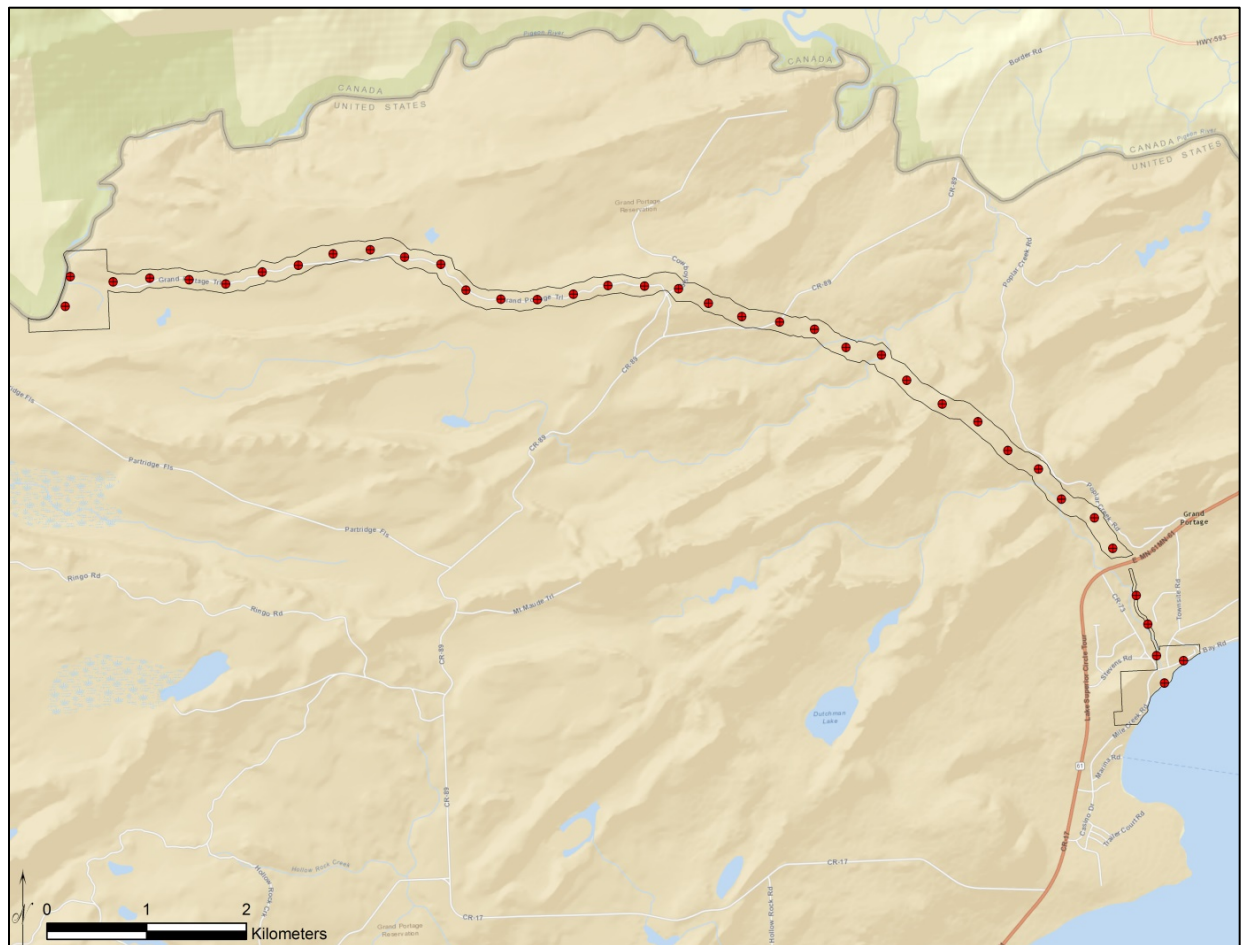


Figure 3. Breeding bird survey points at Grand Portage National Monument (Minnesota) are distributed at ≥ 250 m intervals along the 13.7 km portage trail.

Indiana Dunes National Park (Indiana)

Indiana Dunes has conducted three-minute counts at 50 roadside points in accordance with NABBS standards (USGS and CWS 1998, Sauer et al. 2014) since 1993 (Figure 4). This is the only roadside survey among the GLKN parks.

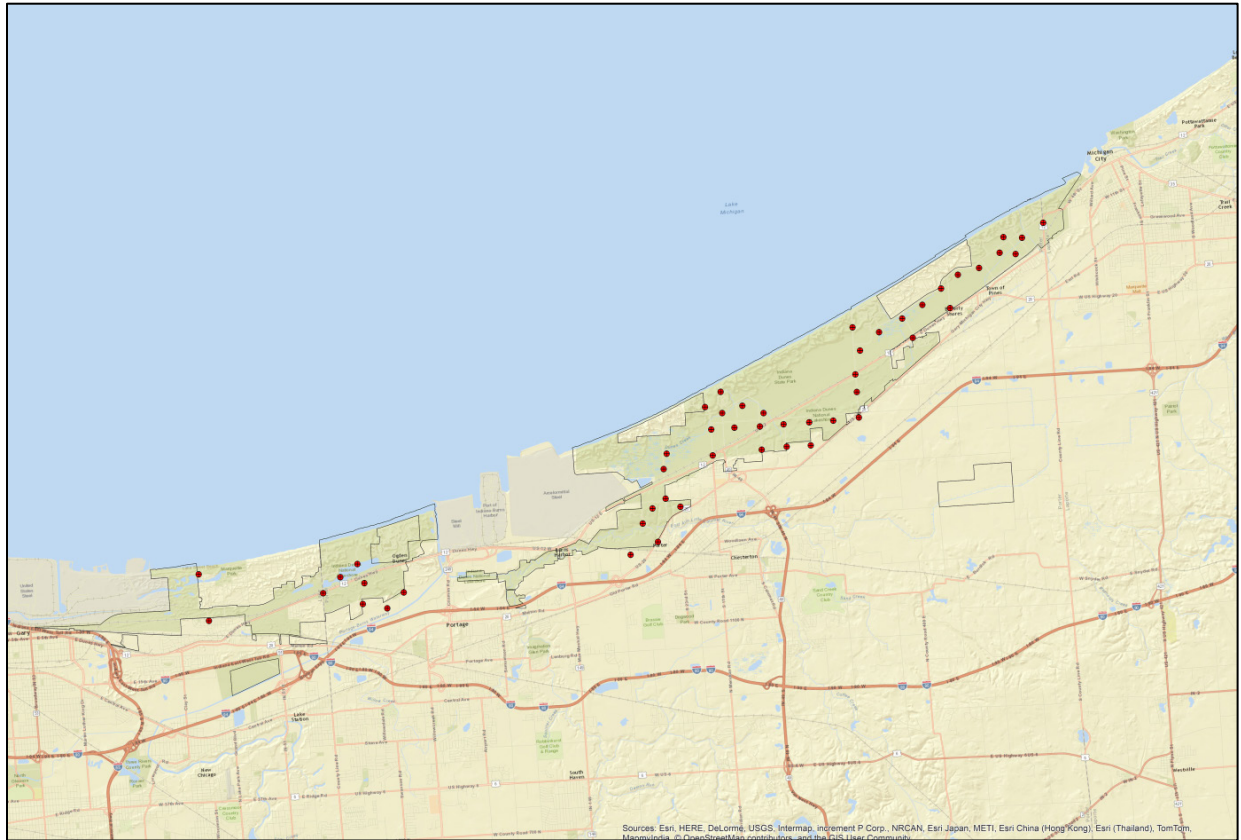


Figure 4. Location of breeding bird survey points at Indiana Dunes National Park (Indiana). This is North American Breeding Bird Survey route 35901.

Isle Royale National Park (Michigan)

The eight survey routes vary in length, with a total of 130 points across the park (Figure 5). Surveys began in 1994, but point locations and methods were not formalized until 1996. Count duration is five minutes per point.

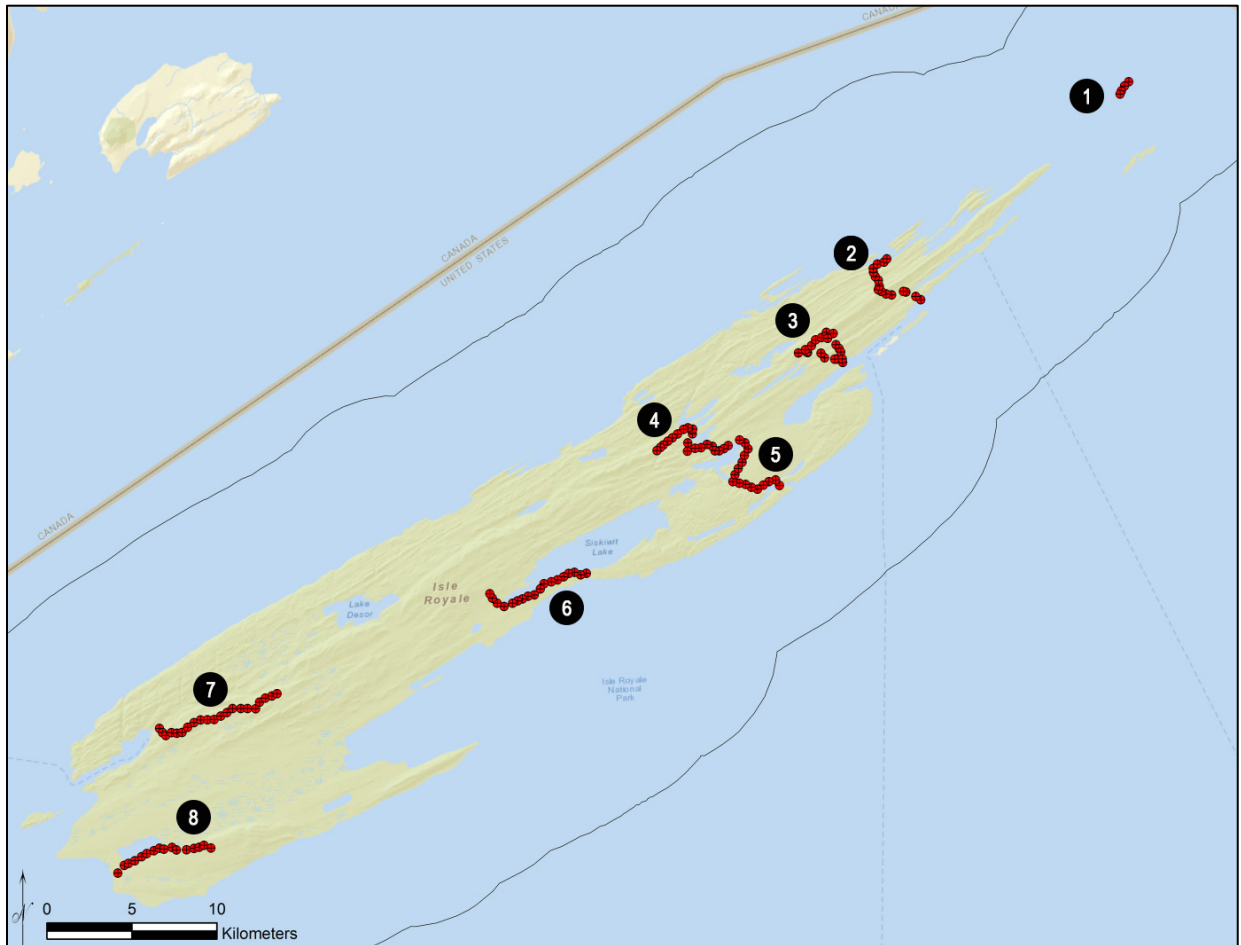


Figure 5. Locations of eight breeding bird survey routes at Isle Royale National Park (Michigan). 1 = Passage Island, 2 = Three Mile to Lane Cove, 3 = Mt. Ojibway Loop, 4 = Lake Richie to the Greenstone, 5 = Chippewa Harbor to Lake Richie, 6 = Ishpeming Trail, 7 = Windigo, 8 = Feldtmann Lake.

Mississippi National River and Recreation Area (Minnesota)

MISS initiated its landbird monitoring program in 2015, establishing 49 points across 10 locations (city, county, and regional parks along the river) that span the 72-mile length of the park boundary. Count duration is 10 minutes per point.

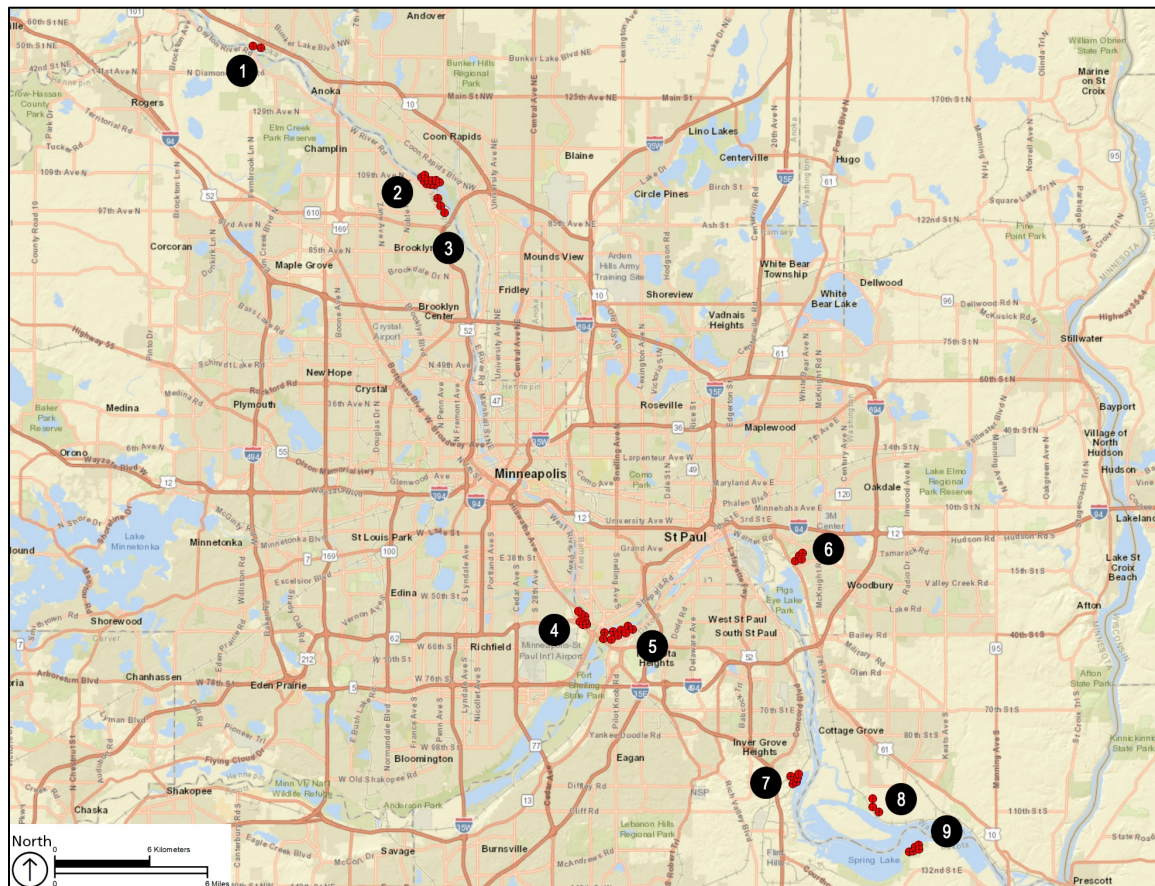


Figure 6. Distribution of breeding bird survey points at Mississippi National River and Recreation Area (Minnesota). 1 = Mississippi West Regional Park, 2 = Coon Rapids Dam West, 3 = Coon Rapids Dam East, 4 = Coldwater Spring, 5 = Pike Island (Fort Snelling SP), 6 = Battle Creek Regional Park, 7 = Grey Cloud Dunes SNA, 8 = Ordway Field Station, 9 = Schaar's Bluff (Spring Lake Park).

Pictured Rocks National Lakeshore (Michigan)

PIRO began their surveys in 2011 with 48 points randomly distributed throughout the park. Points were added in subsequent years to a maximum of 53, but total points settled at 52 by 2015. Count duration is 10 minutes per point.

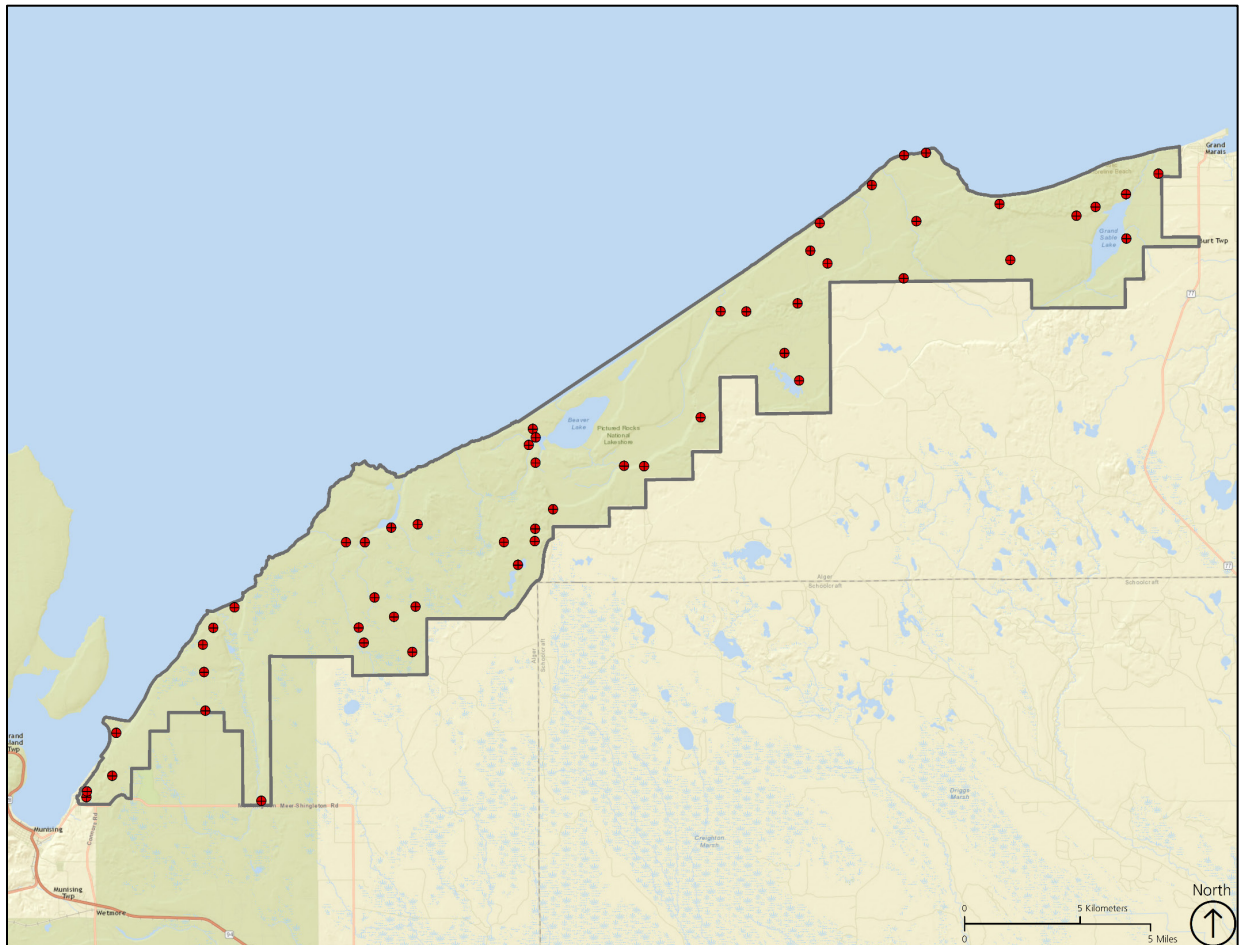


Figure 7. Distribution of breeding bird survey points at Pictured Rocks National Lakeshore (Michigan).

St. Croix National Scenic Riverway (Wisconsin/Minnesota)

Six river-based routes are surveyed from an anchored boat/canoe at fixed locations. Count duration is six minutes per point (Figure 8):

1. Upper Namekagon River (UNAM), from Namekagon Dam to Phipps Flowage;
2. Lower Namekagon River (LNAM), from County K Landing to Totogatic River;
3. Upper St. Croix River (USAC), from Gordon Dam to Riverside
4. St. Croix River North (SACN), from Highway 77/48 to Highway 70;
5. Middle St. Croix River (MSAC), from Raspberry Landing to Nevers Dam; and
6. Lower St. Croix River (LOSA), from St. Croix Falls to Stillwater.

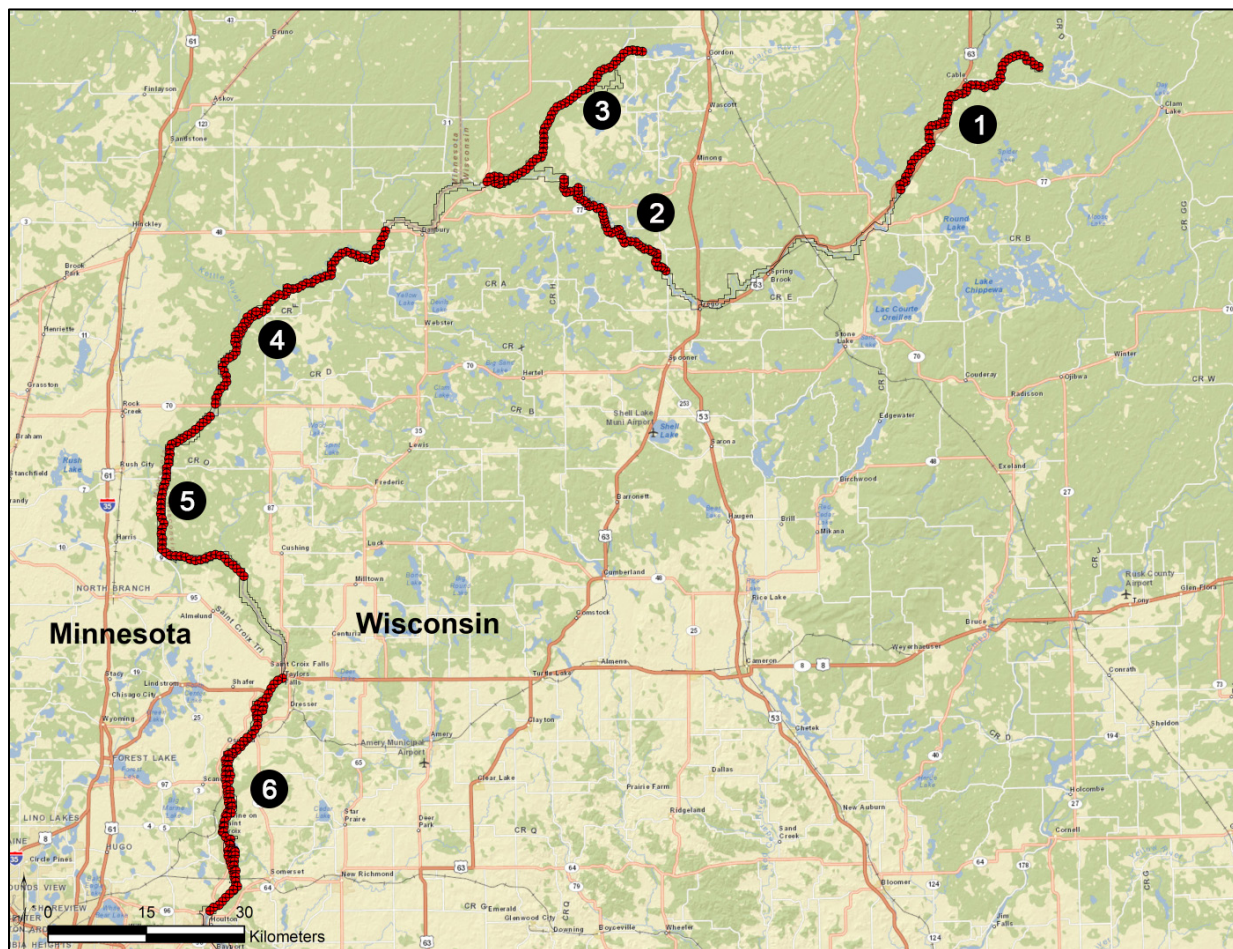


Figure 8. Six breeding bird survey river routes at St. Croix National Scenic Riverway (Wisconsin/Minnesota). Identifier numbers correspond to list in text above.

Surveys along two of the routes (LOSA, LNAM) began in 1982 and 1983, respectively, but were not revisited until 1998. In order to more adequately cover park habitats and species not represented by the original routes, two additional routes were added in 2000 (SACN, UNAM), another in 2003

(USAC), and one more in 2012 (MSAC). With a range from 47 to 53 points along a given stretch, each route takes three mornings to complete. The “SACN” acronym is used both for the park and a survey route within the park. Except for this section of the report, SACN will always refer to the park.

Sleeping Bear Dunes National Lakeshore (Michigan)

SLBE began conducting surveys in 2004 using 10-minute surveys to sample 41 points along five routes (Figure 9). Points were distributed in a stratified manner proportionate to the acreage of eight representative habitat types.

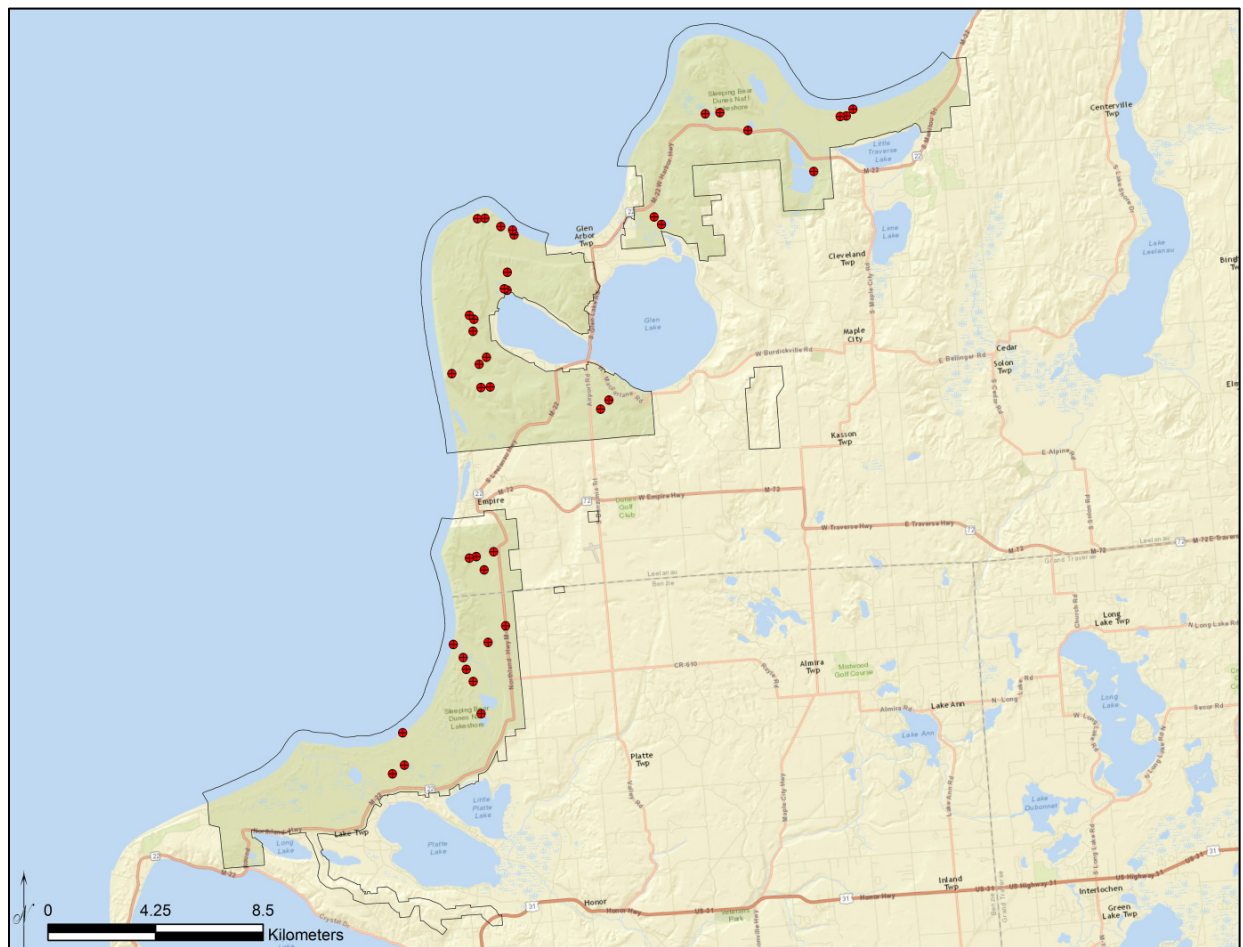


Figure 9. Locations of 41 breeding bird survey points at Sleeping Bear Dunes National Lakeshore (Michigan).

Voyageurs National Park (Minnesota)

Grim et al. (1995) provided a detailed survey protocol and rationale for point count surveys at VOYA. Consistent data collection began in 1997 on eight routes with 10 points each. Changes were made over the years as points were found to be too close together, leading to possible double-counting, or for logistical reasons (one survey route was outside the park). Surveys are now conducted annually on six routes (Figure 10). Count duration is 10 minutes per point.

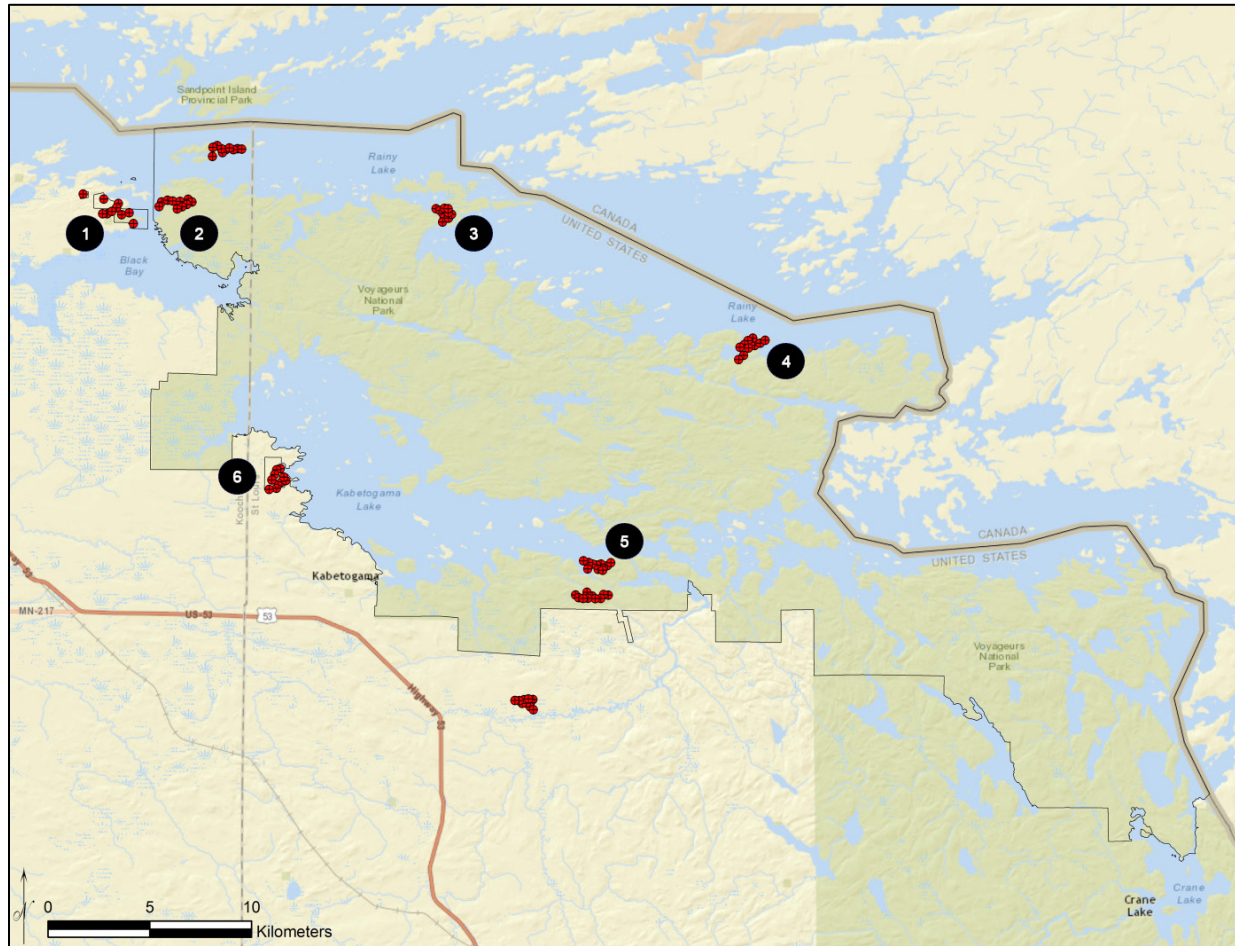


Figure 10. Six breeding bird survey routes consistently surveyed at Voyageurs National Park (Minnesota). 1 = Rainy Lake Visitor Center Trail, 2 = Black Bay Ski Trail, 3 = Lost Bay Portage Trail, 4 = Anderson Bay Loop Trail, 5 = Blind Ash Bay Trail, 6 = Echo Bay Trail. Three unnumbered routes are no longer used.

Field Methods

Variable circular plot (VCP) counts were conducted at all points once annually during the month of June. Weather delays caused some parks to conduct counts as late as 20 July. Observers began surveys 30 minutes before sunrise and ended no later than four hours after sunrise. Surveys were not conducted during high winds (>10 mph), heavy rain, or when fog was present. Count duration ranged from three to 10 minutes, depending on the park. Observers recorded temperature, sky condition, wind speed (using the Beaufort scale), and background noise levels upon reaching each point.

Observers record the following data for all birds seen and heard during the count period: name of the bird, using standardized four-letter codes (Pyle and DeSante 2019); the time (minute-interval) of detection; detection type (singing, calling, non-vocal sound [drumming grouse, tapping woodpeckers], observed, flyover); and the bird's distance from the point center in one of three categories (0–50 m, 51–100 m, and >100 m).

Data Analysis

Overview

We analyzed five years of point count data from seven parks (APIS, GRPO, ISRO, PIRO, SACN, SLBE, and VOYA) and four years of point count data from MISS, which began monitoring efforts in 2015. For these eight parks, we determined park-level bird population richness, diversity, occupancy, and density.

Detections of “unknown bird” were removed from all analyses. Also, because ISRO used a different protocol for 39 points in 2014 and two points in 2015, we removed those points from all analyses and summaries.

INDU follows the North American Breeding Bird Survey protocol (USGS and CWS 1998), which differs greatly from the other parks, so a full analysis could not be conducted, but summary statistics are provided in Appendix A.

Richness

Species richness is provided as a simple count of species detected across the five years of data from each park. We did not truncate survey data for these analyses, opting instead to include all individuals detected during surveys.

Diversity

We used the *vegan* package in program R (version 3.1.3; RCoreTeam 2014) to calculate Simpson's Index of Diversity. We did not truncate survey data for these analyses, opting instead to include all individuals detected during surveys.

Simpson's Index of Diversity is a mathematical measure of species diversity in a community based on species richness (the number of species present) and species abundance (the number of individuals present per species). It incorporates species dominance by weighting towards the abundance of the most common species. The Simpson's Index gives the probability of any two individuals drawn randomly from a community belonging to different species (Morris et al. 2014).

Occupancy

Occupancy is the probability that a species is present at a sampling location. To estimate annual occupancy, we analyzed point count data using the *unmarked* package (Fiske and Chandler 2011) in R (version 3.1.3; RCoreTeam 2014). Because point count locations were only visited once annually, we fit a single model using the *occuTTD* function (Garrard et al. 2008, 2013; Kery and Royle 2016), which estimates occupancy based on the time-to-detection (TTD) using the minute-interval in which a species was first detected at a survey location. This function assumes population closure during the duration of surveys. For seven out of eight parks our model included observer as a detection

covariate, which allows for the adjustment of the occupancy estimate based on variation in the detection probability depending on the observer. We used the null detection function model for GRPO because there was only one observer across all years. Because low detection probabilities can result in inaccurate occupancy estimates, we established a detection probability threshold of 0.05, removing occupancy estimates with detection probabilities below this threshold.

We then calculated the mean annual occupancy and standard errors across all years (2014–2018; 2015–2018 for MISS) for all species with at least ten detections in one year. Because not all species had at least ten detections each year, the mean park occupancy was calculated using one to five years, depending on the species. At SACN, where two sets of three transects are visited in alternating years, we could not estimate annual occupancy across all transects in the park, so we directly estimated occupancy across all years and transects. See Appendix B for tables of annual occupancy by park and by set of transects at SACN.

Density

In distance sampling, the distribution of observed distances of objects is dependent on the actual distribution of objects with respect to the observer and the detectability of an object. As such, detection functions must first be fit to distance-sampling data to describe the probability of detection of an object. The selected detection function is then used to estimate an average probability of detection, which allows for observed counts to be corrected and used for abundance and density estimation.

Our analysis focused on estimating annual densities within each park for all species with at least ten detections in one year. We excluded flyovers and birds detected beyond 100 meters from our analyses to avoid double counting of individuals from multiple points. We analyzed these data using the *gmultmix* function (Chandler et al. 2011) in the *unmarked* package (Fiske and Chandler 2011) in R (version 3.1.3; RCoreTeam 2014). We used a model selection approach that included fitting the following detection models: Null (Poisson), Null (Negative Binomial), Observer (Poisson), Observer (Negative Binomial), background noise (Poisson), and background noise (Negative Binomial) for data from each year. We ranked models using Akaike's Information Criterion (AICc), selecting the top model as the most parsimonious detection function for each species (Burnham and Anderson 2002). We used the top detection function for each species in each park in each year to estimate abundance per point count location, which was then converted to density (birds/km²) based on the area of a 100-meter radius point count circle. Because low detection probabilities can result in inaccurate density estimates, we established a detection probability threshold of 0.05, removing density estimates with detection probabilities below this threshold.

We then calculated the mean of the annual densities and standard errors across all years (2014–2018; 2015–2018 for MISS) for all species with at least ten detections in one year (Table 2). At SACN, where two sets of three transects are visited in alternating years, we could not estimate annual density across all transects in the park and instead directly estimated a mean density across all years and transects.

Table 2. Species with sufficient sample sizes for occupancy and density estimates within each park.

Species	Park							
	<i>APIS</i>	<i>GRPO</i>	<i>ISRO</i>	<i>MISS</i>	<i>PIRO</i>	<i>SACN</i>	<i>SLBE</i>	<i>VOYA</i>
Alder Flycatcher	X	–	X	–	–	X	–	–
American Crow	X	–	X	X	–	–	–	X
American Goldfinch	–	–	–	X	–	–	X	–
American Redstart	X	X	X	X	X	X	X	X
American Robin	X	X	X	X	X	X	X	X
Baltimore Oriole	–	–	–	X	–	X	X	–
Blackburnian Warbler	–	X	X	–	–	–	–	X
Black-capped Chickadee	X	–	X	X	X	X	X	X
Black-throated Blue Warbler	X	–	X	–	X	–	–	–
Black-throated Green Warbler	X	X	X	–	X	–	–	X
Blue Jay	X	X	X	X	–	X	–	X
Brown Creeper	–	–	X	–	–	–	–	–
Brown-headed Cowbird	–	–	–	X	–	X	–	–
Cedar Waxwing	–	–	–	–	X	X	X	–
Chestnut-sided Warbler	–	–	X	–	–	X	–	X
Chipping Sparrow	X	–	–	–	X	–	X	X
Common Yellowthroat	X	–	–	X	–	X	X	–
Downy Woodpecker	–	–	–	X	–	–	–	–
Eastern Wood-Pewee	X	–	–	X	X	X	X	X
Golden-crowned Kinglet	–	X	X	–	–	–	–	X
Gray Catbird	–	–	–	X	–	X	X	–
Hairy Woodpecker	–	–	–	X	–	–	–	–
Hermit Thrush	X	–	X	–	X	–	–	X
House Wren	–	–	–	X	–	X	–	–

Table 2 (continued). Species with sufficient sample sizes for occupancy and density estimates within each park.

Species	Park							
	APIS	GRPO	ISRO	MISS	PIRO	SACN	SLBE	VOYA
Indigo Bunting	–	–	–	X	–	–	X	–
Magnolia Warbler	X	X	X	–	–	–	–	X
Mourning Dove	–	–	–	–	–	–	X	–
Mourning Warbler	–	–	X	–	–	X	–	–
Nashville Warbler	X	X	X	–	X	X	X	X
Northern Cardinal	–	–	–	X	–	–	–	–
Northern Parula	X	X	–	–	–	–	–	X
Northern Waterthrush	–	–	–	–	–	X	–	–
Ovenbird	X	X	X	–	X	X	X	X
Pileated Woodpecker	–	–	–	–	–	X	–	–
Pine Warbler	–	–	–	–	–	X	X	X
Red-bellied Woodpecker	–	–	–	X	–	X	–	–
Red-breasted Nuthatch	X	X	X	–	X	X	–	X
Red-eyed Vireo	X	X	X	X	X	X	X	X
Red-winged Blackbird	–	–	–	–	–	X	X	–
Rose-breasted Grosbeak	–	–	–	–	X	X	X	–
Ruby-crowned Kinglet	–	–	–	–	–	–	–	X
Song Sparrow	X	–	–	X	–	X	X	–
Swainson's Thrush	X	X	X	–	X	–	–	–
Swamp Sparrow	–	–	–	–	–	X	–	–
Warbling Vireo	–	–	–	–	–	X	–	–
White-breasted Nuthatch	–	–	–	X	–	X	–	–
White-throated Sparrow	X	X	X	–	X	X	–	X
Winter Wren	X	X	X	–	–	–	–	X
Yellow Warbler	–	–	–	X	–	X	X	–
Yellow-bellied Flycatcher	–	–	X	–	–	–	–	–
Yellow-bellied Sapsucker	–	–	–	–	X	–	–	X
Yellow-rumped Warbler	X	–	X	–	X	X	–	X
Yellow-throated Vireo	–	–	–	–	–	X	–	–

See Appendix C for annual density estimates for each species within seven of the parks and annual estimates for each of the two sets of transects at SACN. See Appendix D for the number of annual detections for each species in each park.

Trends

To determine trend direction and significance, we fit a simple linear model to the annual densities of species with greater than three annual estimates available. This was done within each park except SACN because of the difference in sampling design used there.

Guilds

We assigned species to guilds based on:

- Diet (frugivore, granivore, insectivore, omnivore)
- Forage substrate (air, bark, ground, shrub/low canopy, high canopy)
- Habitat (grassland/open, wetland, successional/scrub, woodland, urban), and
- Migration status (permanent resident, short-distance migrant, long-distance/Neotropical migrant).

Placement of species into guilds was based on categories defined by DeGraff et al. (1985), Peterjohn and Sauer (1993), and Ehrlich et al. (1988) and confirmed or modified for the Great Lakes region using species profiles from the Birds of North America series (Cornell Lab of Ornithology 2015). Many species fit multiple categories within a guild, such as feeding both on the ground and in the low canopy.

As with the individual species occupancy and density estimates, density estimates for guilds were calculated using those species with at least ten detections in a year. Guild trends were calculated using species with more than three annual density estimates available.

Results

Overview

From 2014 through 2018, surveys were conducted at 2,810 points in eight GLKN parks (Table 3). There were 171 unique species documented, of which 164 were within 100 meters of the observer—a requirement for being included in our analyses (Appendix D).

Table 3. The number of points surveyed in each park, 2014–2018.

Park	2014	2015	2016	2017	2018
APIS	76	76	74	59	52
GRPO	37	37	37	37	37
ISRO	91	128	130	130	130
MISS	0 ^a	42	46	48	47
PIRO	46	52	52	52	52
SACN	150	150	149	138	134
SLBE	41	41	40	40	41
VOYA	59	58	60	60	60

^a Surveys at MISS began in 2015.

The occupancy and density figures are five-year means estimated by park for all species with at least ten detections in one year (see Table 2).

There were sufficient data to identify 92 park-specific species trends, with 8–20 species per park (Table 4). Among those 92 park-specific trends, 10 were significant and are shown below.

Table 4. Number of species with sufficient data to identify population trends in each park.

Park	Number of Species
APIS	11
GRPO	8
ISRO	20
MISS	15
PIRO	11
SLBE	11
VOYA	16

Richness

The number of breeding bird species detected within the GLKN varied by park and year, ranging from 47 to 101 species detected in a single year in a park (Table 5). SLBE had the highest annual mean number of species, with an average of 91 species detected per year, while GRPO had the lowest annual mean number of species, with an average of 52 species detected per year (Figure 11).

Table 5. Number of species (species richness) detected in each GLKN park during songbird surveys, 2014–2018.

Park	2014	2015	2016	2017	2018
APIS	57	68	73	62	54
GRPO	47	48	47	57	59
ISRO	49	58	60	55	58
MISS	n/a ^a	61	64	71	69
PIRO	71	74	71	75	82
SACN	95	101	90	79	74
SLBE	83	95	89	92	96
VOYA	51	58	59	55	54

^a Surveys at MISS began in 2015.

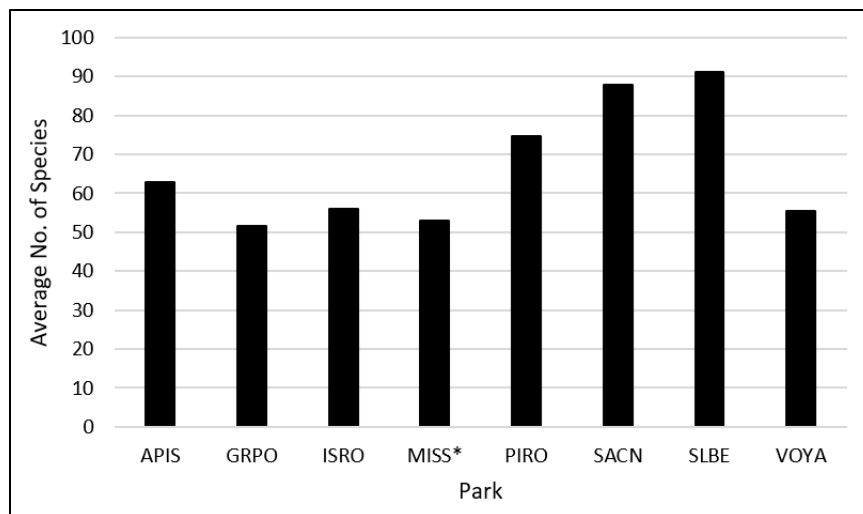


Figure 11. Average species richness for each park, 2014–2018. *MISS data from 2015–2018.

Diversity

The Simpson's Index of Diversity represents the probability that two individuals randomly selected from a sample will be different species. Values range from 0 (low diversity) to 1 (high diversity). Because this index gives more weight to the more abundant species, the presence of uncommon species causes only small changes in the value of the index.

All parks within the GLKN have a Simpson's Index between 0.95 and 0.97, indicating a high level of diversity in all parks.

Occupancy and Density

Park-specific occupancy and density estimates are presented for all species with at least ten detections in a year, along with park-specific species trends. Trends were calculated for species having more than three annual density estimates available. Annual estimates for occupancy and density are in Appendices B and C, respectively. Common and scientific names associated with the species codes presented below are found in Appendix F.

Occupancy and density data are presented in separate graphs, but the information they provide is interconnected. Occupancy is the probability that a species is present at any given sampling location, while density is an estimate of the number of individuals of that species per square kilometer in a park.

Apostle Islands National Lakeshore

Five species occurred at occupancies of >50% at APIS: Black-throated Green Warbler (73%), Ovenbird (66%), Red-eyed Vireo (63%), Common Yellowthroat (59%), and Nashville Warbler (57%). Swainson's Thrush was the least likely to be present (14% occupancy) (Figure 12a).

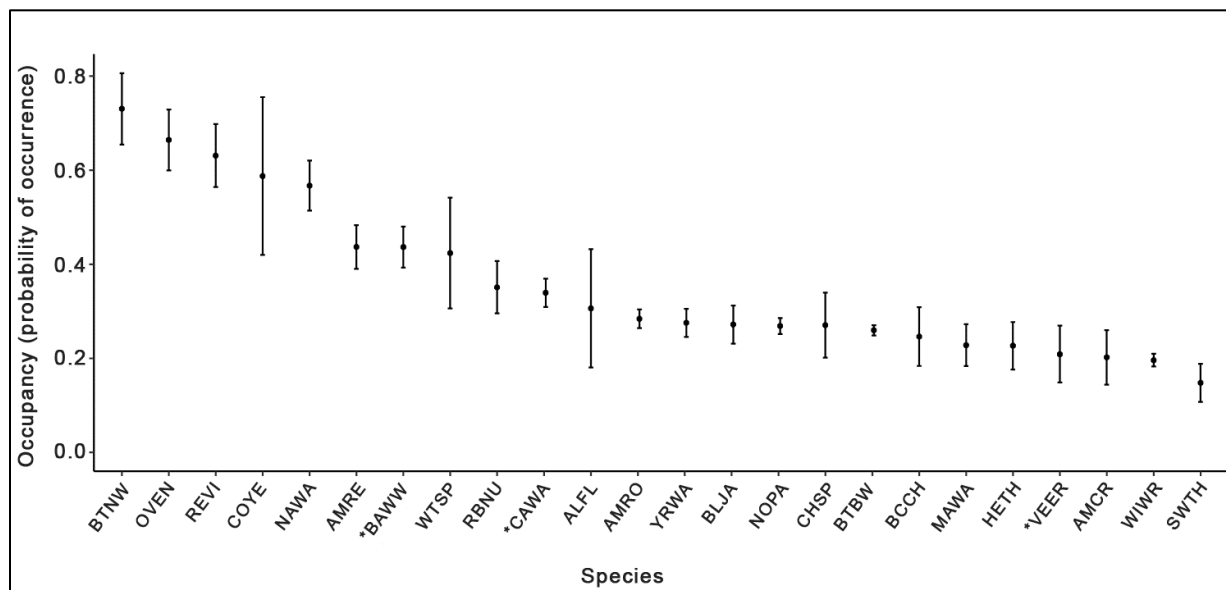


Figure 12a. Mean occupancy ($\pm$ SE) for all species with ten or more detections per year at Apostle Islands National Lakeshore, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

Song Sparrow and Ovenbird each had average population densities of 38 birds/km², the highest at APIS (Figure 12b).

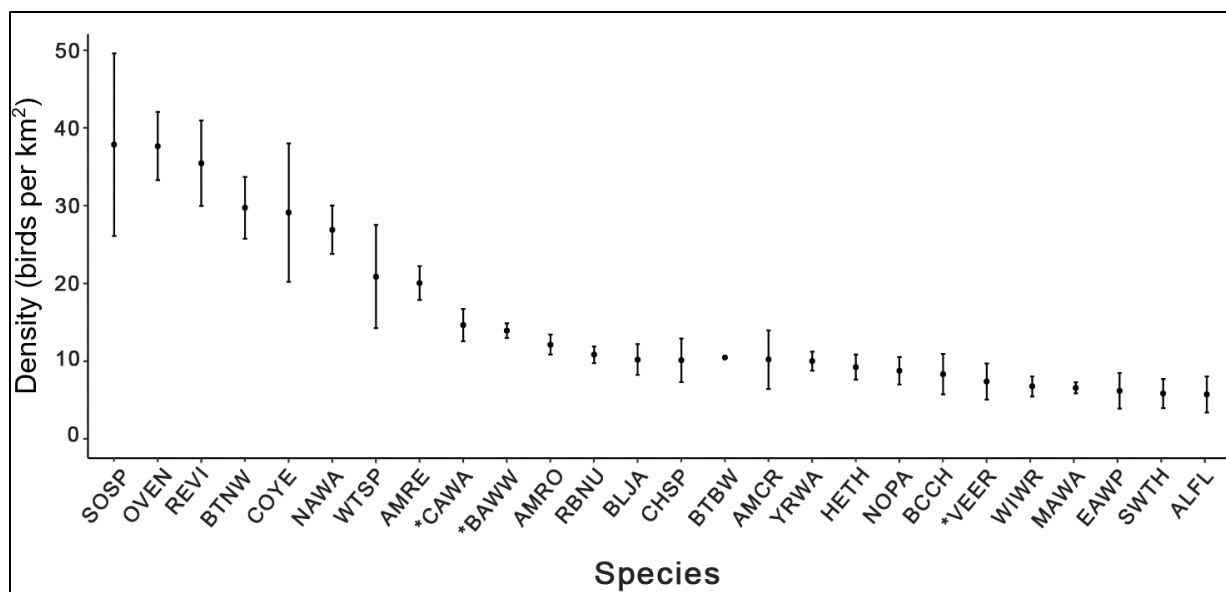


Figure 12b. Mean density ($\pm$ SE) for all species with ten or more detections per year at Apostle Islands National Lakeshore, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

Ten species exhibited increasing trends during the sample period (Table 6), only three of which were statistically significant ($p < 0.05$). One species—American Robin—exhibited a declining, but non-significant, trend.

Table 6. Population density trends for individual species at Apostle Islands National Lakeshore, 2014–2018. Slope, R^2 values, and sample size of estimated annual densities are all shown. Sample sizes are the number of years used for these trends.

Species	Slope	R^2	Sample Size (no. of yrs)
Red-eyed Vireo	7.13 ^a	0.84	5
Black-throated Green Warbler	5.25 ^a	0.88	5
Black-and-white Warbler ^b	1.42 ^a	0.97	4
Song Sparrow	13.45	0.55	4
White-throated Sparrow	7.33	0.51	4
Ovenbird	4.64	0.56	5
American Redstart	2.56	0.69	5
Nashville Warbler	1.51	0.12	5
Blue Jay	1.18	0.26	4
Yellow-rumped Warbler	0.40	0.04	4
American Robin	-0.12	0.00	5

^a Indicates a significant trend ($p < 0.05$).

^b Species of concern in Bird Conservation Region 12 (Boreal Hardwood Transition).

Red-eyed Vireos showed the greatest increase in density over time, at a rate of 7.13 individuals per km^2 per year (Figure 13). Black-throated Green and Black-and-white Warblers also exhibited significant increases at 5.25 individuals/ km^2 /year and 1.42 individuals/ km^2 /year, respectively.

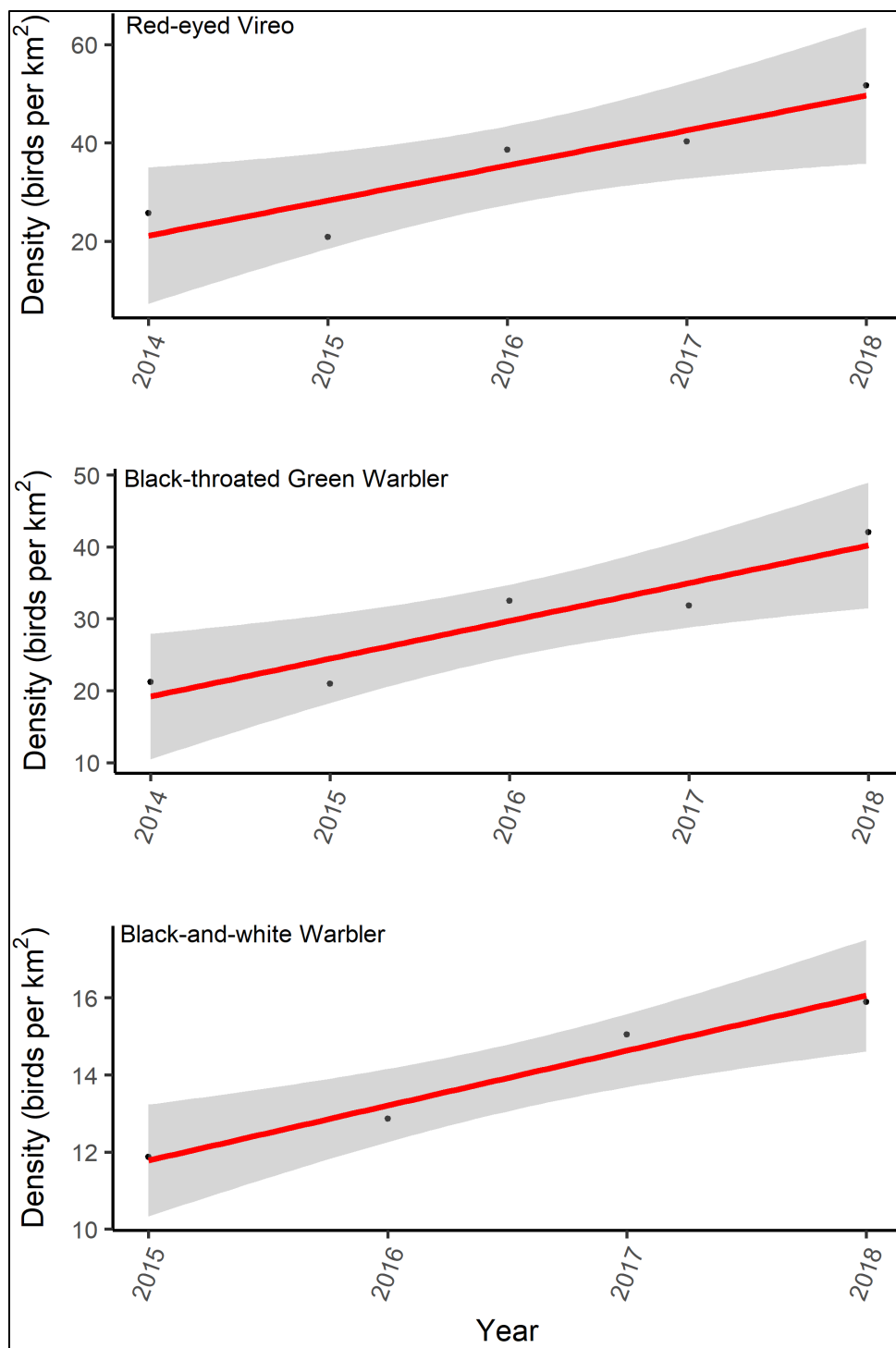


Figure 13. Significant ($p < 0.05$) density trends for Red-eyed Vireo, Black-throated Green Warbler, and Black-and-white Warbler at Apostle Islands National Lakeshore, 2014–2018. There were too few detections of Black-and-white Warblers in 2014 to calculate a density estimate.

Grand Portage National Monument

Six species occurred at occupancies >50% at GRPO: Nashville Warbler (62%), Ovenbird (60%), Black-throated Green Warbler (58%), Red-eyed Vireo (52%), Northern Parula (52%), and American Redstart (52%) (Figure 14a).

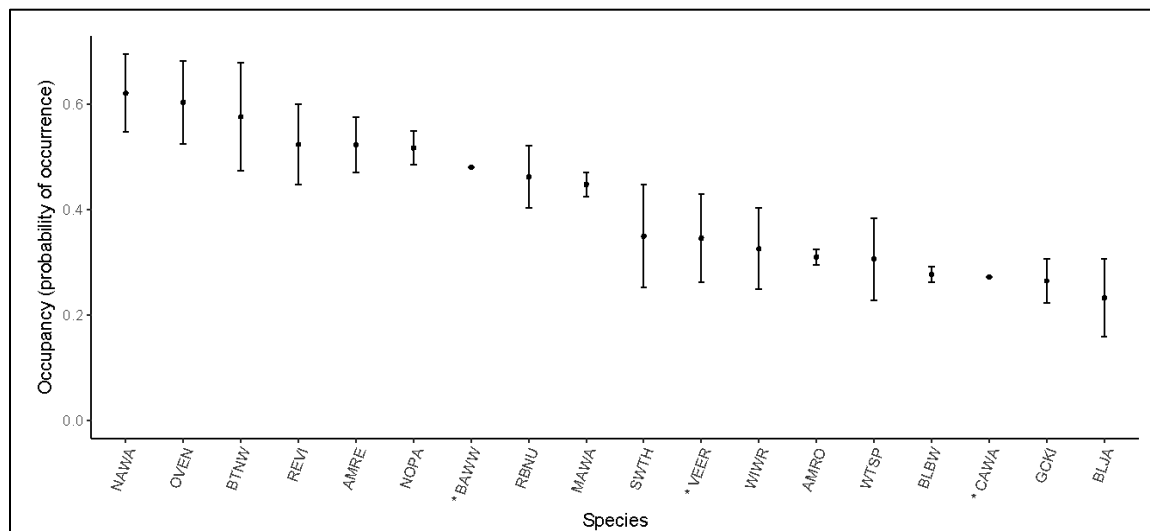


Figure 14a. Mean occupancy ($\pm$ SE) for all species with ten or more detections per year at Grand Portage National Monument, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

Ovenbird and Nashville Warbler had the densest populations at GRPO, with each averaging 27 birds/km² (Figure 14b). Blackburnian Warbler was the least dense species, averaging 9 birds/km².

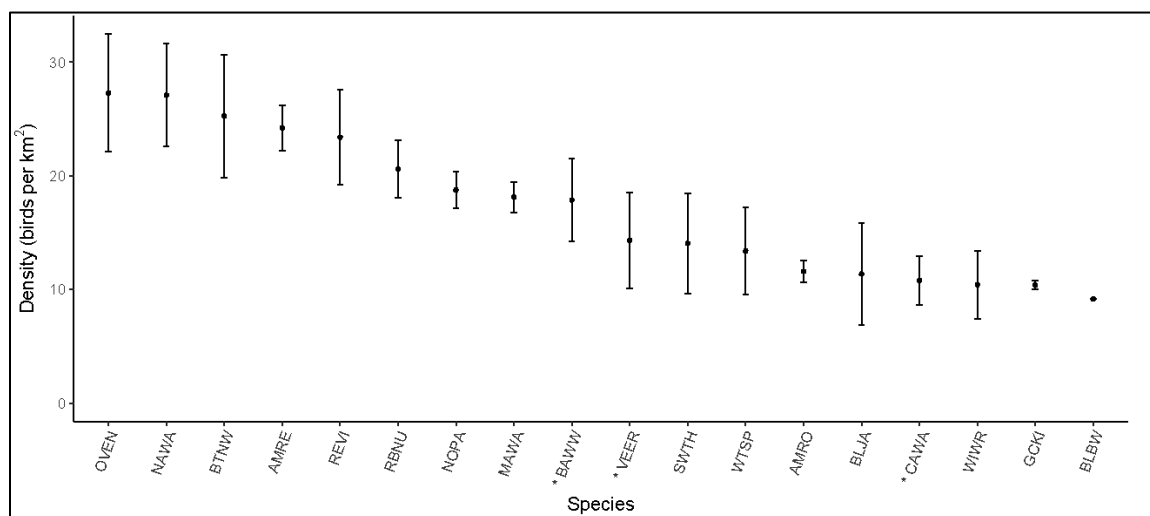


Figure 14b. Mean density ($\pm$ SE) for all species with ten or more detections per year at Grand Portage National Monument, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

Among seven species with increasing trends over the five-year period, Nashville Warbler and American Redstart were the only two with significant trends, rising by 6 birds/km²/year and 3 birds/km²/year, respectively (Figure 15, Table 7). Red-breasted Nuthatch was the only species to show a declining, but non-significant, trend (Table 7).

Table 7. Population density trends for individual species at Grand Portage National Monument, 2014–2018. Slope, R² values, and sample size of estimated annual densities are all shown. Sample sizes are the number of years used for these trends.

Species	Slope	R ²	Sample Size (no. of yrs)
Nashville Warbler	5.91 ^a	0.85	5
American Redstart	2.58 ^a	0.85	5
Black-throated Green Warbler	7.52	0.81	4
Ovenbird	5.44	0.55	5
Red-eyed Vireo	4.42	0.56	5
Northern Parula	1.75	0.61	5
Magnolia Warbler	0.98	0.27	5
Red-breasted Nuthatch	-1.30	0.11	4

^a Significant trend (p<0.05).

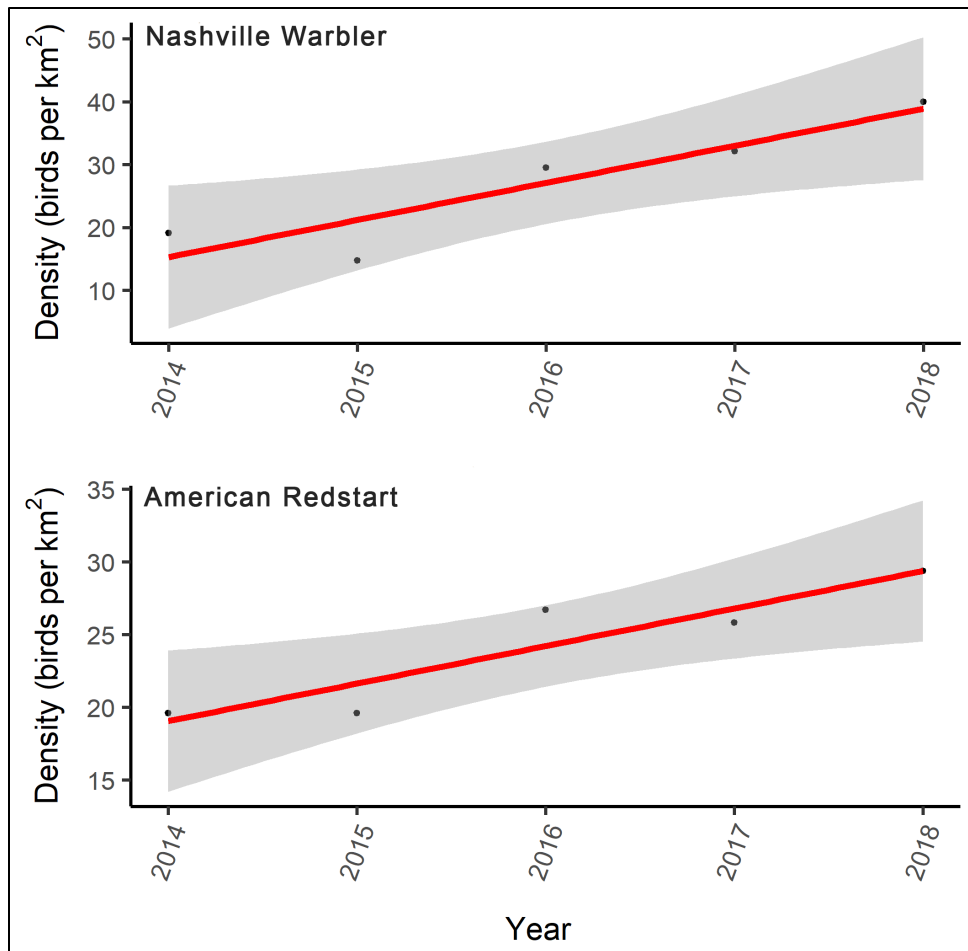


Figure 15. Significant ($p < 0.05$) density trends for American Redstart and Nashville Warbler at Grand Portage National Monument, 2014–2018.

Isle Royale National Park

Four species occurred at occupancies $> 50\%$ at ISRO: Nashville Warbler (78%), White-throated Sparrow (60%), Winter Wren (55%), and Ovenbird (52%) (Figure 16a). The same four species also exhibited the densest populations on the island, with only Ovenbird and Winter Wren trading ranks (Figure 16b).

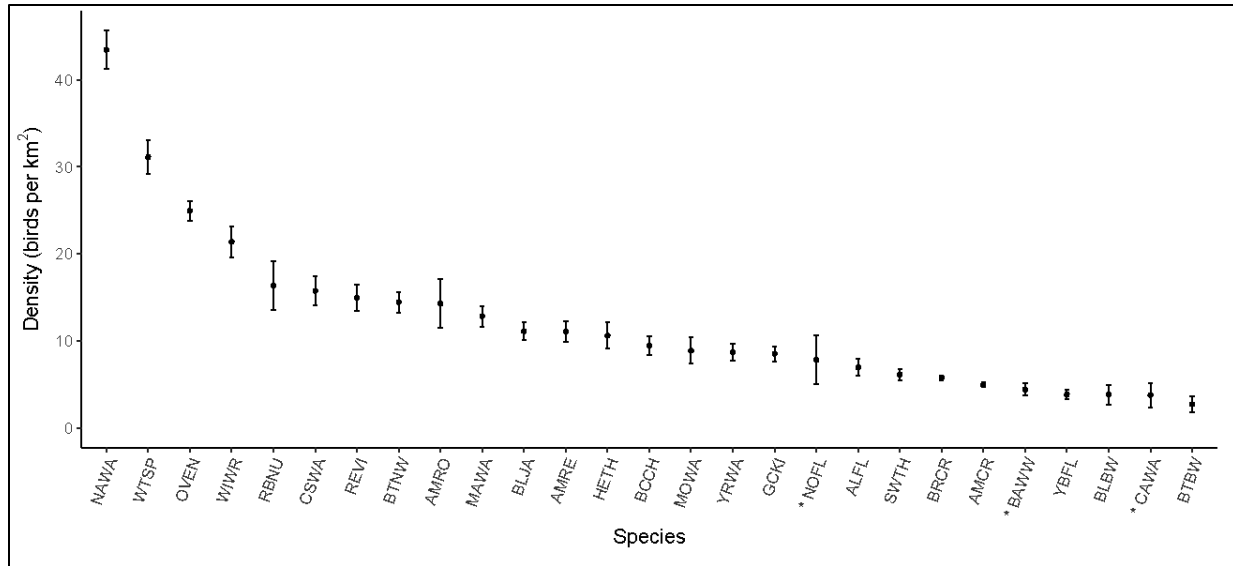


Figure 16a. Mean occupancy ($\pm$ SE) for all species with ten or more detections per year at Isle Royale National Park, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

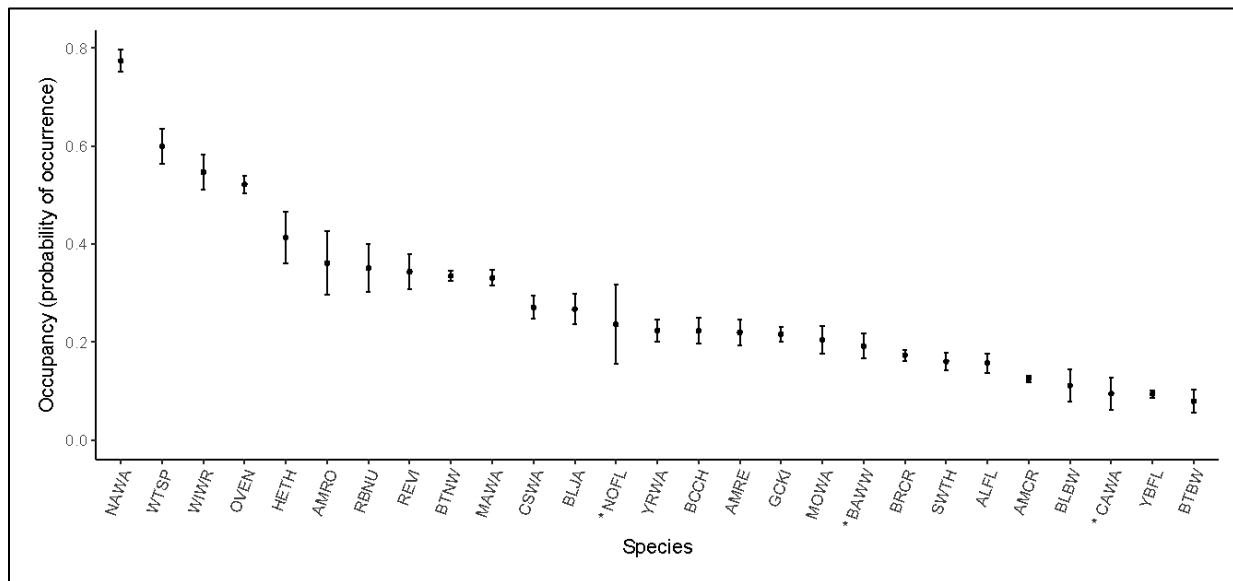


Figure 16b. Mean density ($\pm$ SE) for all species with ten or more detections per year at Isle Royale National Park, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

However, among those four species, all but White-throated Sparrow exhibited declining trends over the five-year period, Nashville Warbler showing the greatest decline at 2.35 birds/km²/year (Table 8). The only significant trend was that of Yellow-bellied Flycatcher, declining at a rate of almost 1 bird/km²/year (Figure 17).

Table 8. Population density trends for individual species at Isle Royale National Park, 2014–2018. Slope, R^2 values, and sample size of estimated annual densities are all shown. Sample sizes are the number of years used for these trends.

Species	Slope	R^2	Sample Size (no. of yrs)
Red-breasted Nuthatch	3.26	0.68	5
Black-throated Green Warbler	1.37	0.70	5
American Redstart	1.29	0.63	5
Red-eyed Vireo	1.22	0.33	5
Swainson's Thrush	0.44	0.22	5
White-throated Sparrow	0.07	0.00	5
Hermit Thrush	-0.13	0.00	5
Blue Jay	-0.16	0.01	5
Yellow-rumped Warbler	-0.49	0.13	5
Alder Flycatcher	-0.66	0.25	5
Golden-crowned Kinglet	-0.66	0.24	4
Yellow-bellied Flycatcher	-0.76 ^a	0.91	4
Black-capped Chickadee	-0.96	0.33	4
Chestnut-sided Warbler	-1.08	0.21	5
Ovenbird	-1.33	0.72	5
Magnolia Warbler	-1.36	0.67	5
Winter Wren	-1.99	0.65	5
American Robin	-1.99	0.25	5
Mourning Warbler	-2.10	0.81	4
Nashville Warbler	-2.35	0.57	5

^a Significant trend ($p < 0.05$).

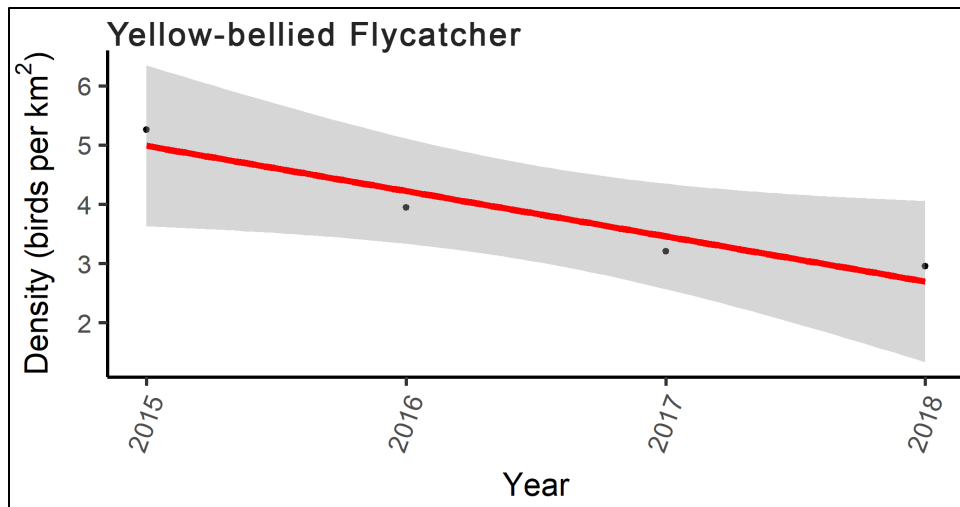


Figure 17. The Yellow-bellied Flycatcher exhibited the only significant ($p < 0.05$) density trend at Isle Royale National Park, 2015–2018.

Mississippi National River and Recreation Area

Formal surveys began in 2015 at MISS, so only four years of data were available for these analyses. Nine species occurred at occupancies of $>50\%$: Hairy Woodpecker (76%), Black-capped Chickadee (71%), American Robin (66%), American Goldfinch (64%), Brown-headed Cowbird (54%), American Crow (53%), Northern Cardinal (53%), House Wren (52%), and Great Crested Flycatcher (50%) (Figure 18a).

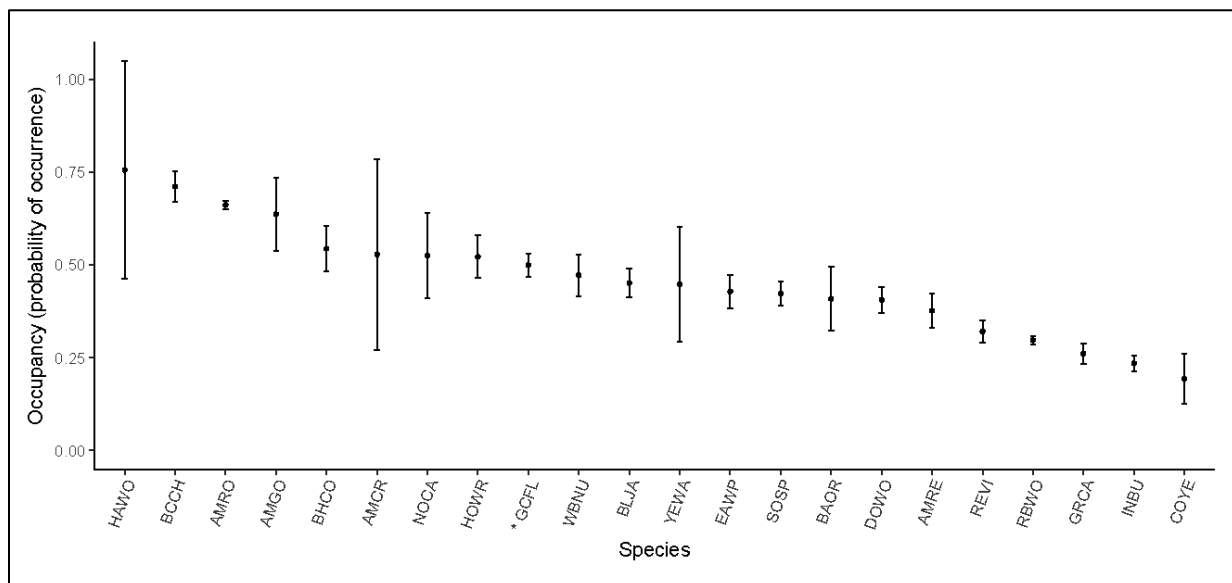


Figure 18a. Mean occupancy ($\pm$ SE) for all species with ten or more detections per year at Mississippi National River and Recreation Area, 2015–2018. Asterisk (*) indicates species of regional concern or continental importance.

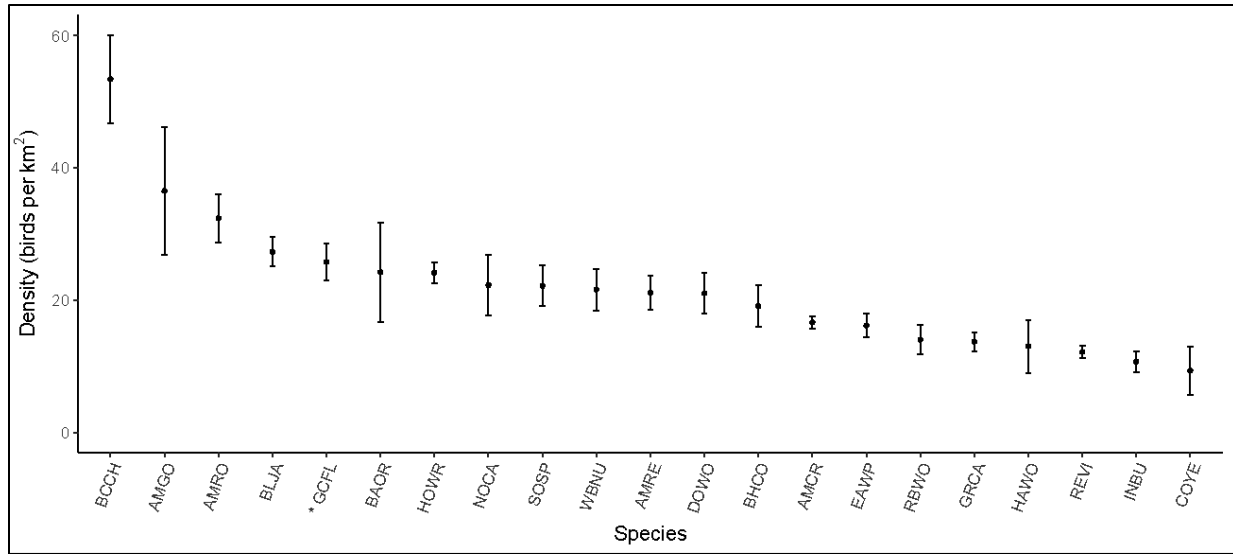


Figure 18b. Mean density ($\pm$ SE) for all species with ten or more detections per year at Mississippi National River and Recreation Area, 2015–2018. Asterisk (*) indicates species of regional concern or continental importance.

Black-capped Chickadee was the most densely populated species at 53 birds/km², followed by American Goldfinch (37 birds/km²) and American Robin (32 birds/km²) (Figure 18b). Eastern Wood-Pewee was the only species with a significant trend, increasing at 3 birds/km²/year (Table 9, Figure 19).

Table 9. Population density trends for individual species at Mississippi National River and Recreation Area, 2015–2018. Slope, R^2 values, and sample size of estimated annual densities are all shown. Sample sizes are the number of years used for these trends.

Species	Slope	R^2	Sample Size (no. of yrs)
Eastern Wood-Pewee	2.62 ^a	0.92	4
American Goldfinch	8.21	0.30	4
American Robin	3.74	0.44	4
Downy Woodpecker	2.68	0.33	4
Indigo Bunting	1.75	0.54	4
Brown-headed Cowbird	1.62	0.11	4
House Wren	0.62	0.06	4
Red-eyed Vireo	0.01	0.00	4
Great Crested Flycatcher ^b	-0.26	0.00	4
American Redstart	-1.29	0.10	4
Northern Cardinal	-2.01	0.08	4
Blue Jay	-2.20	0.41	4
Black-capped Chickadee	-2.34	0.05	4
White-breasted Nuthatch	-2.56	0.28	4
Song Sparrow	-3.15	0.44	4

^a Significant trend ($p < 0.05$).

^b Species of concern in Bird Conservation Region 12 (Boreal Hardwood Transition).

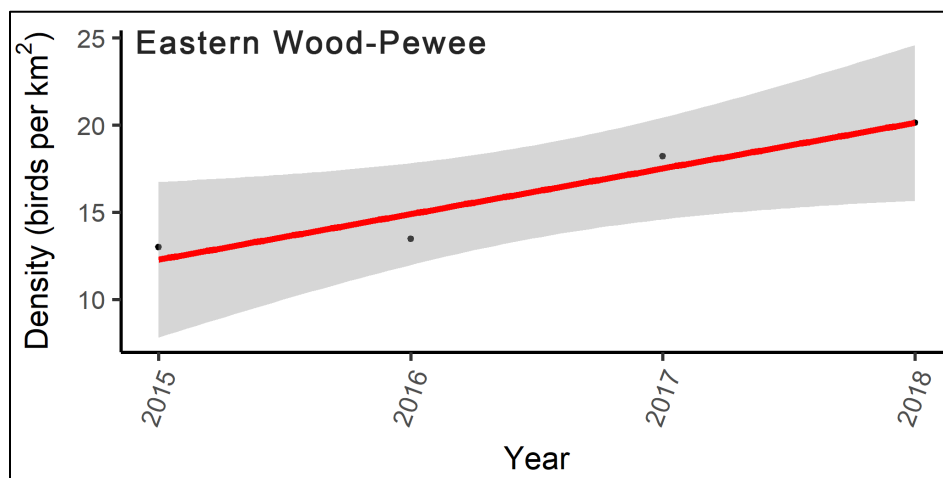


Figure 19. The Eastern Wood-Pewee exhibited the only significant ($p < 0.05$) density trend at Mississippi National River and Recreation Area, 2015–2018.

Pictured Rocks National Lakeshore

Three species occurred at occupancies >50%: Red-eyed Vireo (58%), American Redstart (54%), and Ovenbird (53%) (Figure 20a). The same three also exhibited the densest populations: Red-eyed Vireo (30 birds/km²), American Redstart (27 birds/km²), and Ovenbird (25 birds/km²) (Figure 20b).

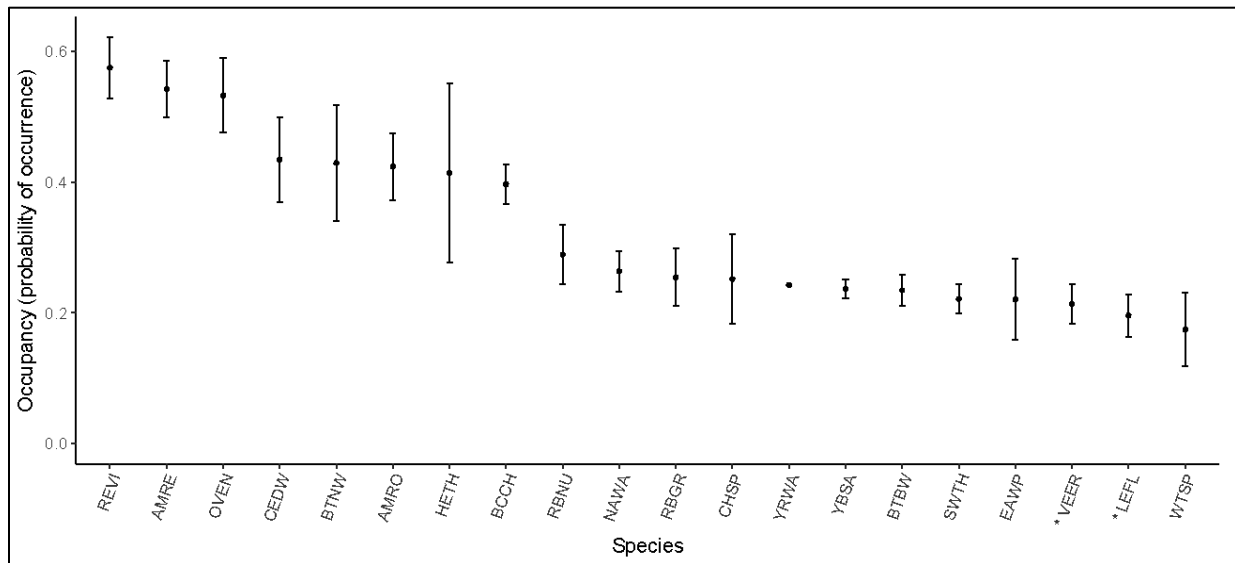


Figure 20a. Mean occupancy ($\pm$ SE) for all species with ten or more detections per year at Pictured Rocks National Lakeshore, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

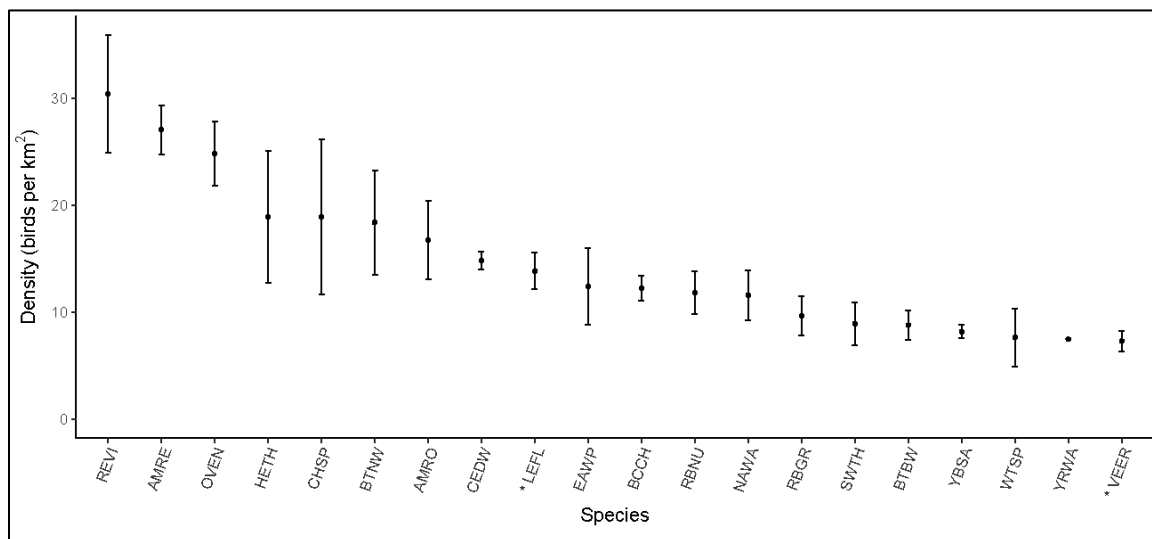


Figure 20b. Mean density ($\pm$ SE) for all species with ten or more detections per year at Pictured Rocks National Lakeshore, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

Among the species with at least four years of density estimates available, none showed a significant trend (Table 10).

Table 10. Population density trends for individual species at Pictured Rocks National Lakeshore, 2014–2018. Slope, R^2 values, and sample size of estimated annual densities are all shown. Sample sizes are the number of years used for these trends. There were no statistically significant trends ($p < 0.05$).

Species	Slope	R^2	Sample Size (no. of yrs)
Red-breasted Nuthatch	-0.26	0.01	4
American Redstart	-0.40	0.02	5
Black-capped Chickadee	-0.70	0.18	5
Black-throated Blue Warbler	-0.87	0.20	5
Least Flycatcher ^b	-1.47	0.38	5
Swainson's Thrush	-1.62	0.54	4
Nashville Warbler	-2.46	0.80	4
American Robin	-3.36	0.42	5
Ovenbird	-3.44	0.66	5
Black-throated Green Warbler	-4.41	0.41	5
Red-eyed Vireo	-5.63	0.52	5

^b Common Bird in Serious Decline and species of concern in Bird Conservation Regions 12 (Boreal Hardwood Transition) and 23 (Prairie Hardwood Transition).

St. Croix National Scenic Riverway

Occupancy and density were calculated by pooling data from all transects. Two species occurred at occupancies $> 50\%$ at SACN: Red-eyed Vireo (80%) and Song Sparrow (75%). All other species occurred at $< 50\%$ occupancy (Figure 21a). Red-eyed Vireo and Song Sparrow were also the densest populations, though they switched places, with Song Sparrow exhibiting the greatest density (36 birds/km²), followed by the Red-eyed Vireo (33 birds/km²) (Figure 21b).

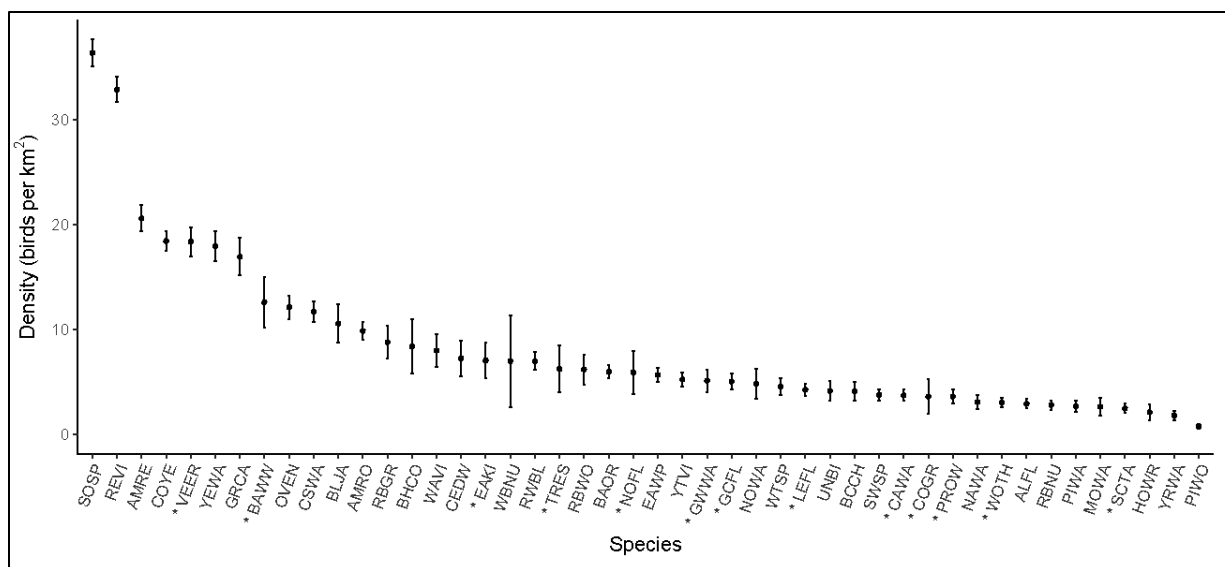


Figure 21a. Mean occupancy ($\pm$ SE) for all species with ten or more detections per year at St. Croix National Scenic Riverway, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

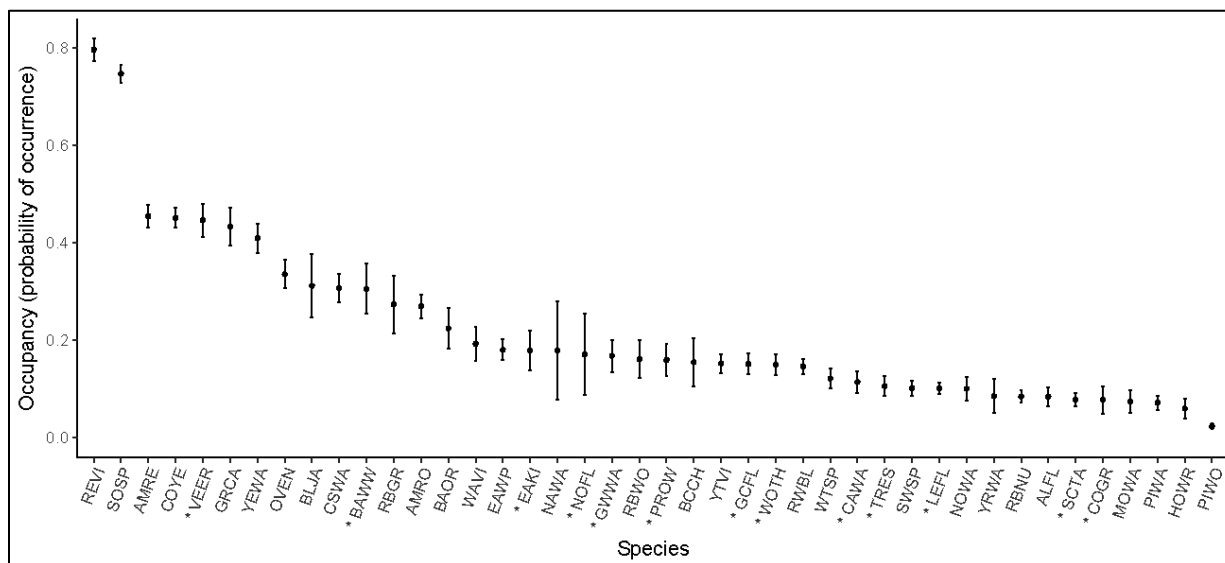


Figure 21b. Mean density ($\pm$ SE) for all species with ten or more detections per year at St. Croix National Scenic Riverway, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

The survey method employed at SACN of visiting three river stretches one year and another three the following year leaves insufficient data for assessing species trends during the current analysis period.

Sleeping Bear Dunes National Lakeshore

Three species occurred at occupancies $\geq 50\%$: Red-eyed Vireo (66%), American Robin (56%), and American Redstart (50%) (Figure 22a).

Common Grackle was the most densely populated species, with 78 birds/km² (Figure 22b). Red-eyed Vireo (47 birds/km²) and Red-winged Blackbird (40 birds/km²) were the next highest, while the rest of the species averaged <30 birds/km² (Figure 22b).

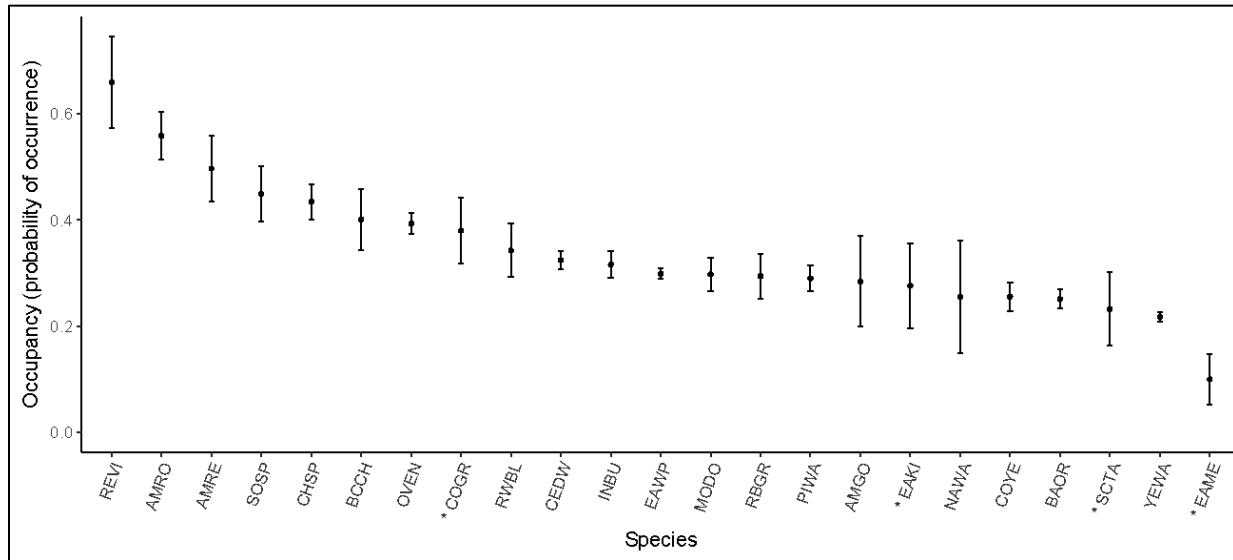


Figure 22a. Mean occupancy (±SE) for all species with ten or more detections per year at Sleeping Bear Dunes National Lakeshore, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

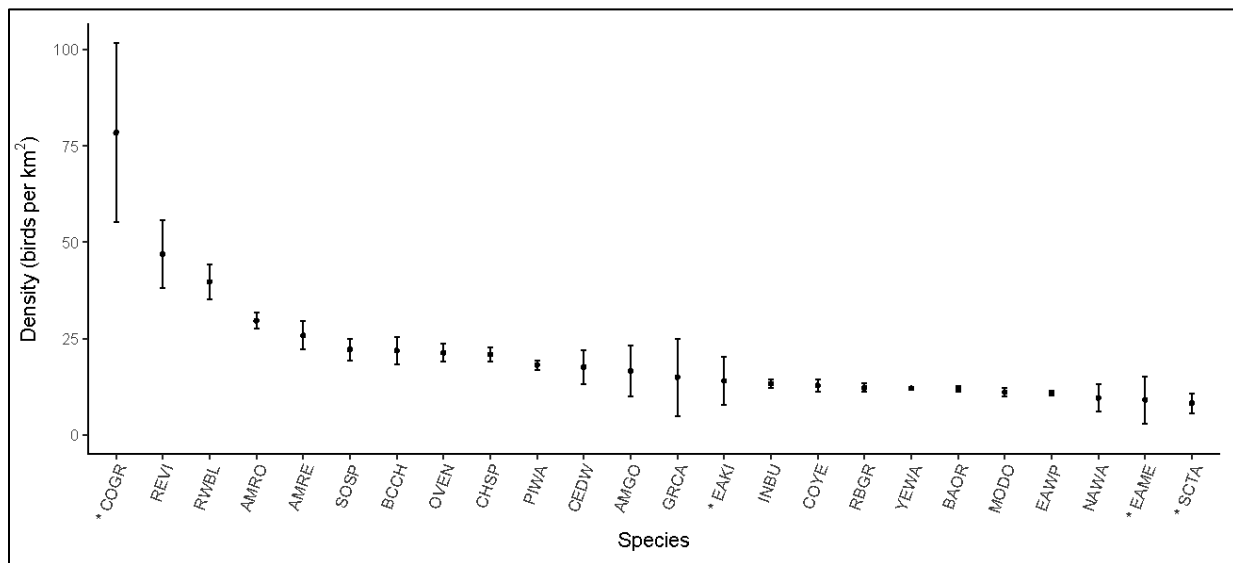


Figure 22b. Mean density (±SE) for all species with ten or more detections per year at Sleeping Bear Dunes National Lakeshore, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

There were two significant density trends at SLBE, one negative and one positive (Table 11). Chipping Sparrow increased at a rate of 2 birds/km²/year over the five-year survey period, while Eastern Wood-Pewee exhibited a decrease over four years of <1 bird/km²/year (Figure 23, Table 11).

Table 11. Population density trends for individual species at Sleeping Bear Dunes National Lakeshore, 2014–2018. Slope, R² values, and sample size of estimated annual densities are all shown. Sample sizes are the number of years used for these trends.

Species	Slope	R ²	Sample Size (no. of yrs)
Chipping Sparrow	2.41 ^a	0.78	5
Red-eyed Vireo	8.77	0.50	5
American Redstart	4.57	0.76	5
Song Sparrow	3.46	0.75	5
Red-winged Blackbird	2.01	0.09	4
American Robin	1.59	0.28	5
Common Yellowthroat	0.39	0.02	4
Mourning Dove	-0.24	0.03	4
Eastern Wood-Pewee	-0.89 ^a	0.92	4
Black-capped Chickadee	-1.14	0.04	4
Ovenbird	-3.24	0.76	4

^a Significant trend (p<0.05).

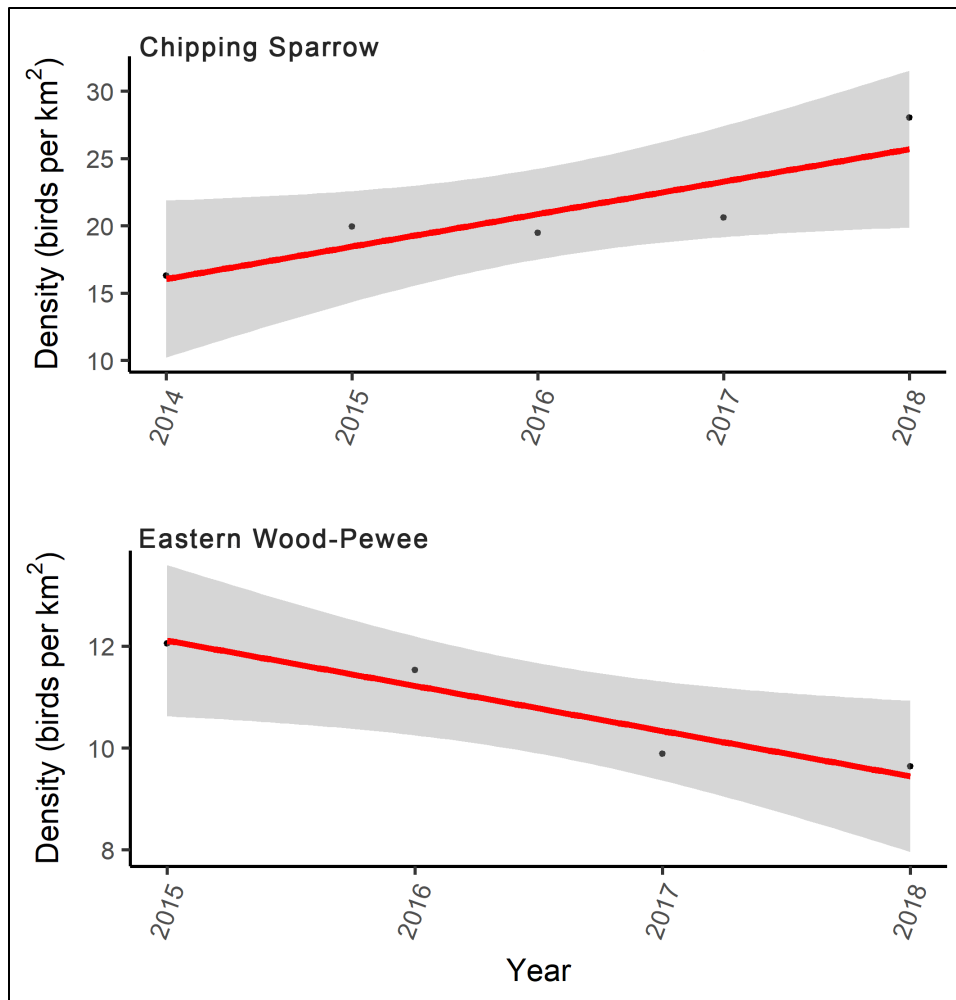


Figure 23. Significant ($P < 0.05$) density trends for Chipping Sparrow (5-year trend) and Eastern Wood-Pewee (4-year trend) at Sleeping Bear Dunes National Lakeshore, 2014–2018. There was an insufficient number of detections of Eastern Wood-Pewees in 2014 to calculate a density estimate.

Voyageurs National Park

Six species occurred at occupancies $> 50\%$ at VOYA: Nashville Warbler (80%), Ovenbird (76%), Red-eyed Vireo (68%), Red-breasted Nuthatch (59%), White-throated Sparrow (58%), and Blue Jay (55%) (Figure 24a). Those same six species also had the densest populations, with > 30 birds/km², while eighteen other species had < 20 birds/km² (Figure 24b).

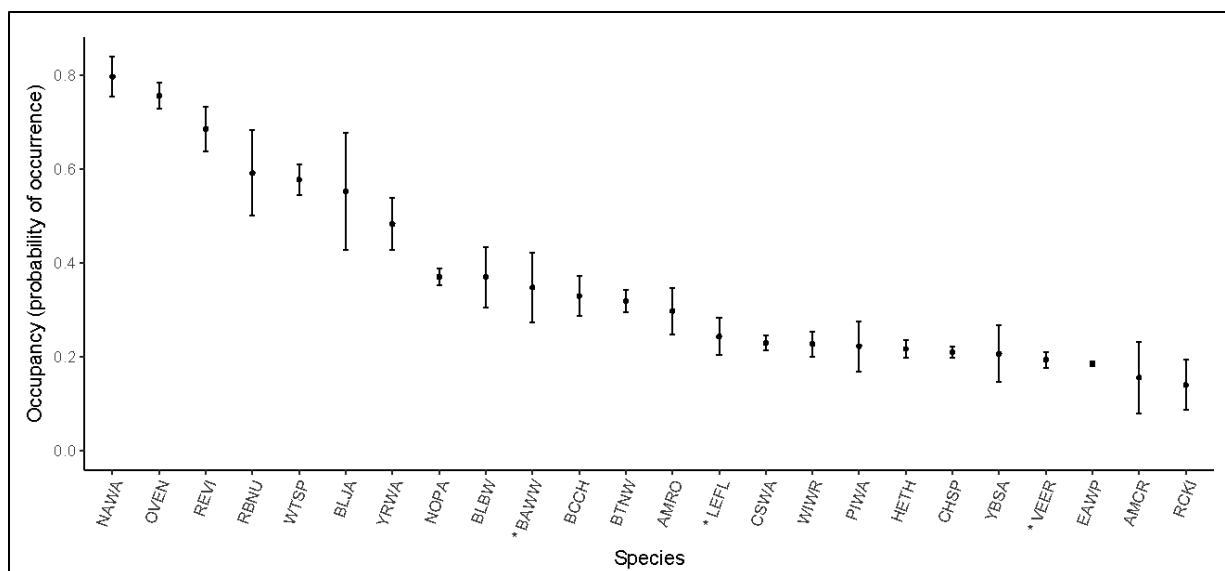


Figure 24a. Mean occupancy ($\pm$ SE) for all species with ten or more detections per year at Voyageurs National Park, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

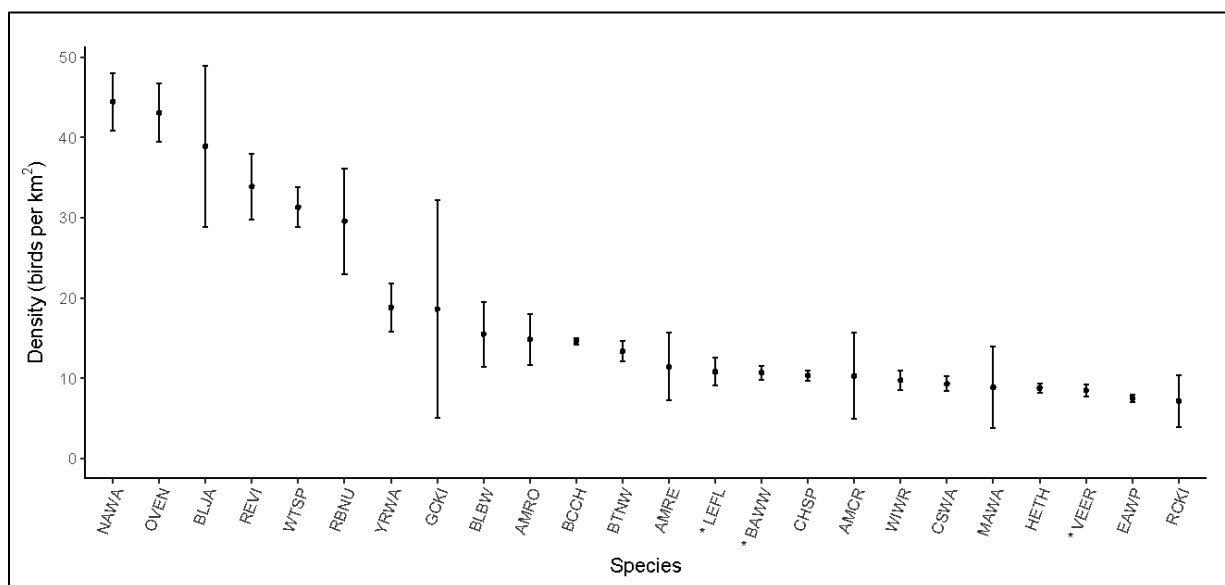


Figure 24b. Mean density ($\pm$ SE) for all species with ten or more detections per year at Voyageurs National Park, 2014–2018. Asterisk (*) indicates species of regional concern or continental importance.

Among 16 species for which trends could be calculated, only the Black-and-white Warbler trend was significant, declining at a rate of 1 bird/km²/year over the five-year period (Table 12, Figure 25).

Table 12. Population density trends for individual species at Voyageurs National Park, 2014–2018. Slope, R^2 values, and sample size of estimated annual densities are all shown. Sample sizes are the number of years used for these trends.

Species	Slope	R^2	Sample Size (no. of yrs)
Yellow-rumped Warbler	3.76	0.65	4
Blue Jay	3.35	0.05	4
Ovenbird	1.63	0.10	5
Red-eyed Vireo	1.41	0.06	5
Chestnut-sided Warbler	0.92	0.41	4
Black-throated Green Warbler	0.71	0.16	5
Hermit Thrush	0.61	0.49	5
Eastern Wood-Pewee	0.41	0.65	4
Veery ^b	0.37	0.11	4
Winter Wren	0.29	0.03	5
Least Flycatcher ^c	0.23	0.01	5
White-throated Sparrow	0.02	0.00	5
American Robin	-0.70	0.02	5
Nashville Warbler	-0.87	0.03	5
Black-and-white Warbler ^b	-1.10 ^a	0.78	5
Red-breasted Nuthatch	-2.01	0.05	5

^a Significant trend ($p < 0.05$), also shown in bold.

^b Species of concern in Bird Conservation Region 12 (Boreal Hardwood Transition).

^c Common Bird in Serious Decline and species of concern in Bird Conservation Regions 12 (Boreal Hardwood Transition) and 23 (Prairie Hardwood Transition).

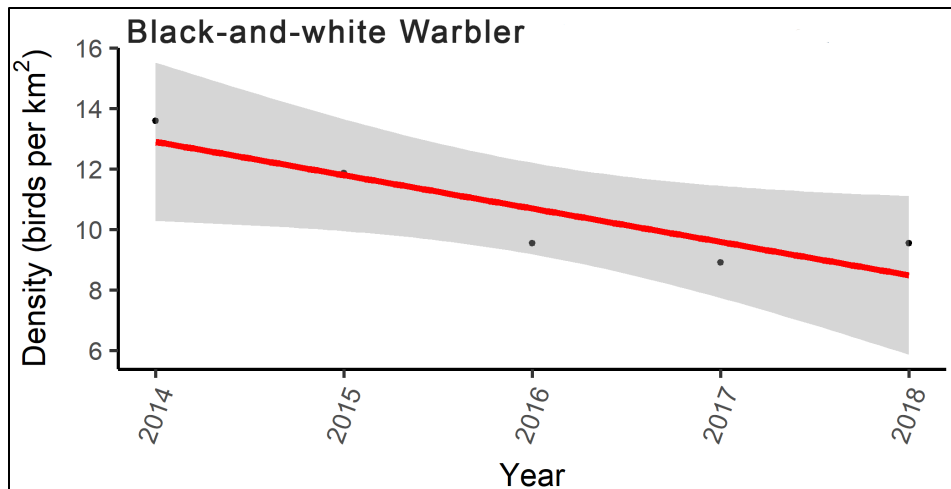


Figure 25. Density trend for Black-and-white Warbler at Voyageurs National Park, 2014–2018.

Guild Analysis

Fifty-two species were included in the guild analyses, ranging from 17 species at PIRO to 31 at SACN (Table 13). Species-guild associations for each park are shown in Appendix G.

Table 13. Number of species per park used in guild analyses. Species had to have at least ten detections in a year and at least three annual density estimates to be included.

Park	No. of Species Included in Guild Analyses
APIS	23
GRPO	15
ISRO	24
MISS	20
PIRO	17
SACN	31
SLBE	19
VOYA	21

Apostle Islands National Lakeshore

All guilds at APIS exhibited increasing density trends, ranging from +0.44 birds/km²/year (permanent resident species) to +8.65 birds/km²/year (successional/agricultural/scrub habitat species) (Table 14).

Table 14. Population density trends for landbird guilds at Apostle Islands National Lakeshore, 2014–2018. Representative species had density estimates available for at least one year. Sample sizes are the maximum number of annual density estimates available for at least one species in the guild. Guilds with <4 years of density estimates available for all species in that guild were excluded.

Guild Category	Guild (No. of Species)	Slope	R ²	Sample Size
Diet	Insectivore (20)	2.23	0.53	5
	Omnivore (3)	0.49	0.27	5
Forage substrate	Air (3)	2.72	0.39	5
	Ground (11)	2.21	0.25	5
	Shrub/low canopy (11)	1.20	0.11	5
	Upper canopy (5)	3.27 ^b	0.95	5
Habitat	Successional/Agricultural/Scrub (4)	8.65	0.67	4
	Urban (5)	0.47 ^a	0.78	5
	Woodland (21)	1.80	0.56	5
Migrant status	Continental (6)	0.99	0.04	5
	Neotropical (12)	2.30	0.53	5
	Permanent (5)	0.44	0.50	5

^a p-value <0.05.

^b p-value <0.01.

Significant increasing trends were observed among the upper canopy foragers and urban species, rising at 3.27 and 0.47 birds/km²/year, respectively (Table 14, Figure 26).

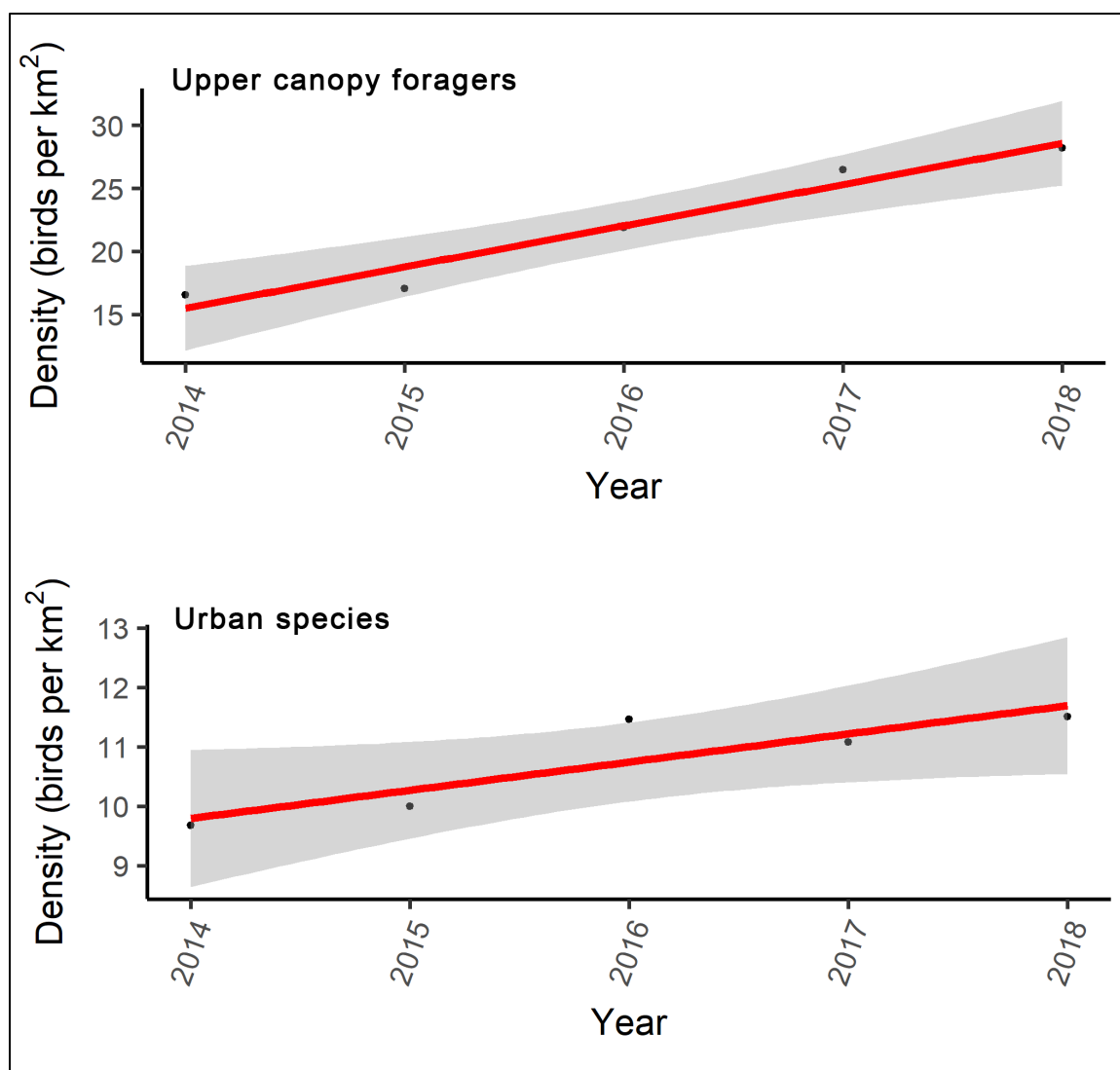


Figure 26. Significant increasing density trends for two landbird guilds—upper canopy foraging species (*top*; $p < 0.01$) and urban species (*bottom*; $p < 0.05$)—at Apostle Islands National Lakeshore, 2014–2018.

Grand Portage National Monument

Bark gleaners and permanent residents exhibited declining, but non-significant, density trends at GRPO over the study period, while the other guilds showed increasing density trends (Table 15). Three of the increasing trends were significant: insectivores (+2.46 birds/km²/year), aerial foragers (+2.58 birds/km²/year), and woodland species (+1.99 birds/km²/year) (Table 15, Figure 27).

Table 15. Population density trends for landbird guilds at Grand Portage National Monument, 2014–2018. Representative species had density estimates available for at least one year. Sample sizes are the maximum number of annual density estimates available for at least one species in the guild. Guilds with <4 years of density estimates available for all species in that guild were excluded.

Guild Category	Guild (No. of Species)	Slope	R²	Sample Size
Diet	Insectivore (13)	2.46 ^a	0.91	5
Forage substrate	Air (1)	2.58 ^a	0.85	5
	Bark (1)	-1.30	0.11	4
	Ground (6)	0.49	0.03	5
	Shrub/low canopy (7)	1.28	0.51	5
	Upper canopy (6)	2.78	0.55	5
Habitat	Woodland (15)	1.99 ^a	0.85	5
Migrant status	Neotropical (9)	3.07	0.74	5
	Permanent (3)	-2.44	0.23	4

^a p-value <0.05.

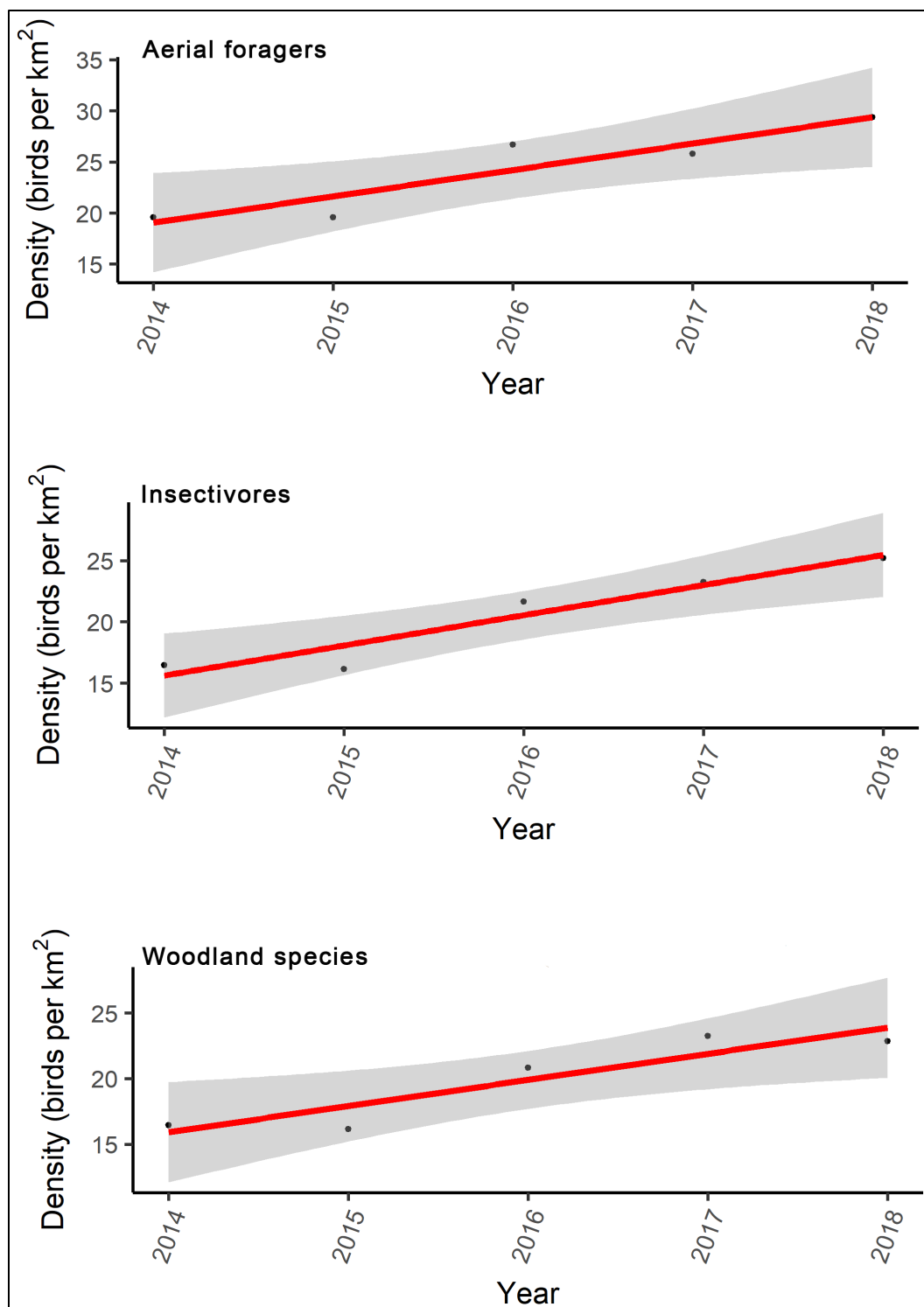


Figure 27. Significant increasing density trends ($p < 0.05$) for three landbird guilds—insectivores (*top*, +2.46 birds/km²/year), aerial foragers (*middle*, +2.58 birds/km²/year), and woodland species (*bottom*, +1.99 birds/km²/year)—at Grand Portage National Monument, 2014–2018.

Isle Royale National Park

Increasing densities of bark gleaners (+1.53 birds/km²/year), upper canopy gleaners (+0.74 birds/km²/year), and permanent residents (+0.23 birds/km²/year) at ISRO were non-significant (Table 16). The remaining guilds exhibited declining density trends, four of which were significant: insectivores (−0.68 birds/km²/year, $p < 0.01$), shrub/low canopy foragers (−0.96 birds/km²/year, $p < 0.05$), successional/scrub species (−1.85 birds/km²/year), and woodland species (−0.60 birds/km²/year; $p < 0.05$) (Table 16, Figure 28).

Table 16. Population density trends for landbird guilds at Isle Royale National Park, 2014–2018. Representative species had density estimates available for at least one year. Sample sizes are the maximum number of annual density estimates available for at least one species in the guild. Guilds with <4 years of density estimates available for all species in that guild were excluded.

Guild Category	Guild (No. of Species)	Slope	R ²	Sample Size
Diet	Insectivore (21)	−0.68 ^b	0.95	5
	Omnivore (3)	−0.79	0.17	5
Forage substrate	Air (3)	−0.09	0.02	5
	Bark (3)	1.53	0.35	5
	Ground (8)	−0.57	0.22	5
	Shrub/low canopy (12)	−0.96 ^a	0.90	5
	Upper canopy (5)	0.74	0.34	5
Habitat	Successional/Agricultural/Scrub (4)	−1.85 ^a	0.79	5
	Urban (4)	−0.69	0.18	5
	Wetland (1)	−0.66	0.25	5
	Woodland (22)	−0.60 ^a	0.86	5
Migrant status	Continental (5)	−0.94	0.51	5
	Neotropical (13)	−0.81	0.68	5
	Permanent (6)	0.23	0.02	5

^a p -value < 0.05 .

^b p -value < 0.01 .

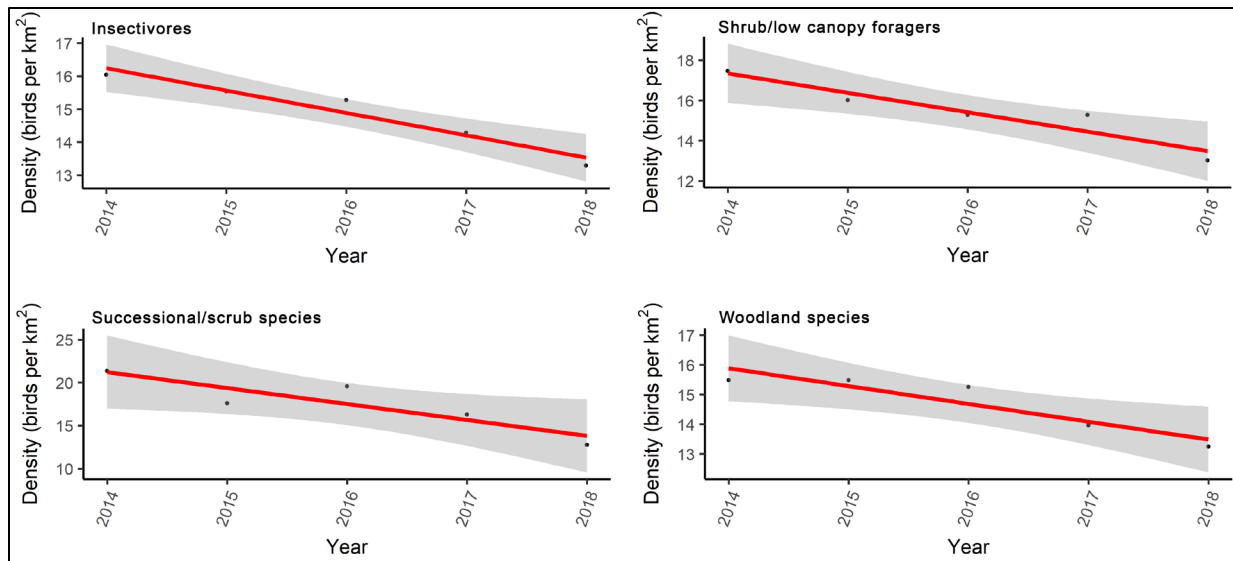


Figure 28. Significant density trends for four landbird guilds—*clockwise from top left*: insectivores ($p < 0.01$), shrub/low canopy foragers ($p < 0.05$), successional/scrub species ($p < 0.05$), and woodland species ($p < 0.05$)—at Isle Royale National Park, 2014–2018.

Mississippi National River and Recreation Area

There were no significant density trends among the guilds at MISS. Six guilds exhibited declining trends during the four-year period (2015–2018): insectivores (-0.42 birds/ km^2 /year), bark (-0.42 birds/ km^2 /year) and upper canopy (-1.16 birds/ km^2 /year) foragers, successional/agricultural/scrub (-0.47 birds/ km^2 /year) and urban (-0.26 birds/ km^2 /year) species, and continental migrants (0.69 birds/ km^2 /year) (Table 17).

Table 17. Population density trends for landbird guilds at Mississippi National River and Recreation Area, 2015–2018. Representative species had density estimates available for at least one year. Sample sizes are the maximum number of annual density estimates available for at least one species in the guild. Guilds with <4 years of density estimates available for all species in that guild were excluded.

Guild Category	Guild (No. of Species)	Slope	R ²	Sample Size
Diet	Frugivore (4)	1.73	0.52	4
	Granivore (2)	4.91	0.54	4
	Insectivore (13)	−0.42	0.03	4
	Omnivore (6)	0.17	0.01	4
Forage substrate	Air (2)	0.66	0.08	4
	Bark (5)	−0.42	0.00	4
	Ground (11)	0.19	0.03	4
	Shrub/low canopy (12)	0.01	0.00	4
	Upper canopy (3)	−1.16	0.18	4
Habitat	Open grassland (2)	8.00	0.25	4
	Successional/Agricultural/Scrub (8)	−0.47	0.20	4
	Urban (8)	−0.26	0.01	4
	Woodland (15)	0.09	0.00	4
Migrant status	Continental (4)	−0.69	0.11	4
	Neotropical (6)	0.54	0.09	4
	Permanent (10)	0.98	0.19	4

Pictured Rocks National Lakeshore

There were no significant density trends among the guilds at PIRO. All but one guild (aerial foragers, +1.72 birds/km²/year) exhibited declines during the study period, ranging from −0.18 birds/km²/year (successional/agricultural/scrub species) to −2.85 birds/km²/year (upper canopy foragers) (Table 18).

Table 18. Population density trends for landbird guilds at Pictured Rocks National Lakeshore, 2014–2018. Representative species had density estimates available for at least one year. Sample sizes are the maximum number of annual density estimates available for at least one species in the guild. Guilds with <4 years of density estimates available for all species in that guild were excluded.

Guild Category	Guild (No. of Species)	Slope	R ²	Sample Size
Diet	Insectivore (14)	−1.47	0.51	5
	Omnivore (3)	−2.20	0.42	5
Forage substrate	Air (2)	1.72	0.53	5
	Bark (3)	−0.28	0.05	5
	Ground (6)	−1.56	0.62	5
	Shrub/low canopy (8)	−0.78	0.28	5
	Upper canopy (4)	−2.85	0.45	5
Habitat	Successional/Agricultural/Scrub (2)	−0.18	0.01	5
	Urban (3)	−1.82	0.54	5
	Woodland (17)	−1.59	0.48	5
Migrant status	Continental (5)	−1.70	0.37	4
	Neotropical (9)	−2.20	0.59	5
	Permanent (3)	−1.43	0.55	5

St. Croix National Scenic Riverway

No density trends were calculated for guilds at SACN.

Sleeping Bear Dunes National Lakeshore

Most guild density trends at SLBE were positive, but non-significant. Three guilds exhibited non-significant declining trends: bark foragers (−0.02 birds/km²/year), open grassland birds (−2.30 birds/km²/year), and permanent resident species (−0.47 birds/km²/year) (Table 19).

Three guilds showed significant increasing density trends ($p < 0.05$): shrub/low canopy foragers (+1.75 birds/km²/year), woodland species (+2.55 birds/km²/year), and Neotropical migrants (+2.59 birds/km²/year) (Table 19, Figure 29).

Table 19. Population density trends for landbird guilds at Sleeping Bear Dunes National Lakeshore, 2014–2018. Representative species had density estimates available for at least one year. Sample sizes are the maximum number of annual density estimates available for at least one species in the guild. Guilds with <4 years of density estimates available for all species in that guild were excluded.

Guild Category	Guild	Slope	R ²	Sample Size
Diet	Granivore (4)	1.72	0.51	5
	Insectivore (14)	2.67	0.73	5
	Omnivore (3)	0.11	0.01	5
Forage substrate	Air (2)	1.94	0.66	5
	Bark (2)	−0.02	0.00	4
	Ground (10)	0.90	0.41	5
	Shrub/low canopy (11)	1.75 ^a	0.89	5
	Upper canopy (4)	4.76	0.65	5
Habitat	Open grassland (2)	−2.30	0.12	4
	Successional/Agricultural/Scrub (8)	0.74	0.71	5
	Urban (5)	0.77	0.62	5
	Wetland (1)	2.01	0.09	4
	Woodland (12)	2.55 ^a	0.82	5
Migrant status	Continental (6)	1.92	0.63	5
	Neotropical (10)	2.59 ^a	0.82	5
	Permanent (4)	−0.47	0.11	5

^a p-value <0.05.

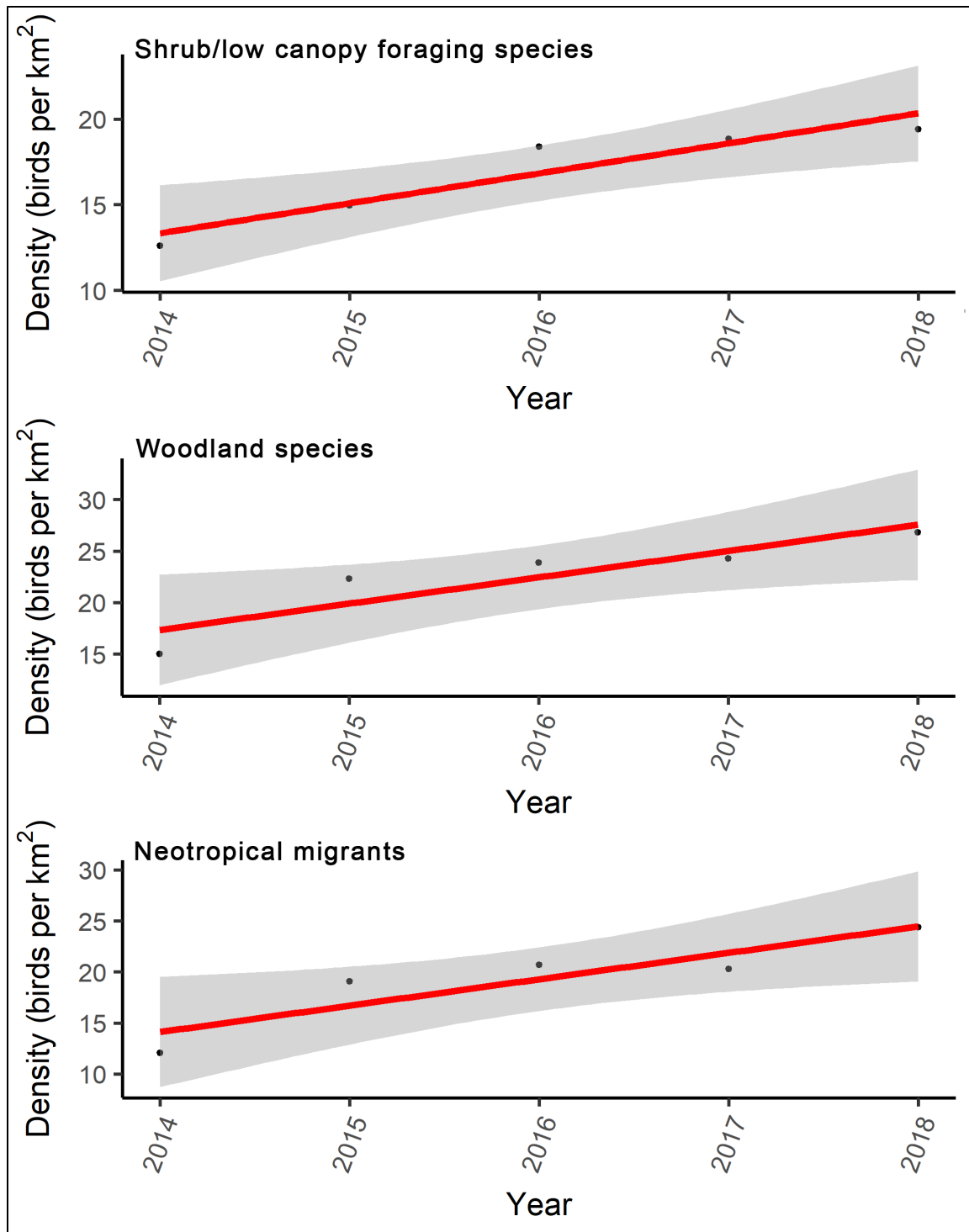


Figure 29. Significant density trends for three landbird guilds—shrub/low canopy foragers, woodland species, Neotropical migrants—at Sleeping Bear Dunes National Lakeshore, 2014–2018.

Voyageurs National Park

There were no significant density trends among guilds at VOYA. Increasing trends ranged from +0.30 birds/km²/year (shrub/low canopy foragers) to +3.37 birds/km²/year (urban species) (Table

20). Declines occurred among the aerial foragers (-0.03 birds/km²/year) and bark gleaners (-2.69 birds/km²/year) (Table 20).

Table 20. Population density trends for landbird guilds at Voyageurs National Park, 2014–2018. Representative species had density estimates available for at least one year. Sample sizes are the maximum number of annual density estimates available for at least one species in the guild. Guilds with <4 years of density estimates available for all species in that guild were excluded.

Guild Category	Guild	Slope	R ²	Sample Size
Diet	Insectivore (18)	0.55	0.20	5
	Omnivore (3)	3.29	0.34	5
Forage substrate	Air (2)	-0.03	0.00	5
	Bark (2)	-2.69	0.11	5
	Ground (8)	1.68	0.38	5
	Shrub/low canopy (10)	0.30	0.01	5
	Upper canopy (5)	2.79	0.31	5
Habitat	Successional/Agricultural/Scrub (3)	0.81	0.14	5
	Urban (5)	3.37	0.39	5
	Woodland (20)	0.69	0.14	5
Migrant status	Continental (7)	1.16	0.44	5
	Neotropical (9)	0.60	0.07	5
	Permanent (5)	1.04	0.06	5

Discussion

Trends

We found significant density trends for eight species in seven parks (density trends were not calculated for INDU or SACN): American Redstart at GRPO, Black-and-white Warbler at APIS and VOYA, Black-throated Green Warbler at APIS, Chipping Sparrow at SLBE, Eastern Wood-Pewee at MISS and SLBE, Nashville Warbler at GRPO, Red-eyed Vireo at APIS, and Yellow-bellied Flycatcher at ISRO (Table 21). Species with significant trends at more than one park had contrary trends between the two parks: Black-and-white Warbler (+1.42 birds/km²/year at APIS versus -1.10 birds/km²/year at VOYA) and Eastern Wood-Pewee (+2.62 birds/km²/year at MISS versus -0.89 birds/km²/year at SLBE).

Among all available trends, significant or not, twenty species exhibited a density trend in more than one park, but only one (Red-eyed Vireo) was shared by all seven parks for which trends were calculated (Table 21). Two species had a consistent trend direction across parks: Black-capped Chickadee declined at ISRO, MISS, PIRO, and SLBE, while the White-throated Sparrow increased at APIS, ISRO, and VOYA.

Table 21. Species exhibiting trends in more than one park, 2014–2018 (2015–2018 at MISS).

Species	Park	Trend (birds/km ² /yr)
American Redstart	APIS	+2.56
	GRPO	+2.58 ^a
	ISRO	+1.29
	MISS	-1.29
	PIRO	-0.40
	SLBE	+4.57
American Robin	APIS	-0.12
	ISRO	-1.99
	MISS	+3.74
	PIRO	-3.36
	SLBE	+1.59
	VOYA	-0.70

^a Significant trend ($p < 0.05$).

^b Species of concern in Bird Conservation Region 12 (Boreal Hardwood Transition).

^c Species of concern in BCRs 12 and 23 (Prairie Hardwood Transition), and a Common Bird in Steep Decline (Partners in Flight 2019).

Table 21 (continued). Species exhibiting trends in more than one park, 2014–2018 (2015–2018 at MISS).

Species	Park	Trend (birds/km ² /yr)
Black-and-white Warbler ^b	APIS	+1.42 ^a
	VOYA	–1.10 ^a
Black-capped Chickadee	ISRO	–0.96
	MISS	–2.34
	PIRO	–0.70
	SLBE	–1.14
Black-throated Green Warbler	APIS	+5.25 ^a
	GRPO	+7.52
	ISRO	+1.37
	PIRO	–4.41
	VOYA	+0.71
Blue Jay	APIS	+1.18
	ISRO	–0.16
	MISS	–2.20
	VOYA	+3.35
Chestnut-sided Warbler	ISRO	–1.08
	VOYA	+0.92
Eastern Wood-Pewee	MISS	+2.62 ^a
	SLBE	–0.89 ^a
	VOYA	+0.41
Hermit Thrush	ISRO	–0.13
	VOYA	+0.61
Least Flycatcher ^c	PIRO	–1.47
	VOYA	+0.23
Magnolia Warbler	GRPO	+0.98
	ISRO	–1.36

^a Significant trend ($p < 0.05$).

^b Species of concern in Bird Conservation Region 12 (Boreal Hardwood Transition).

^c Species of concern in BCRs 12 and 23 (Prairie Hardwood Transition), and a Common Bird in Steep Decline (Partners in Flight 2019).

Table 21 (continued). Species exhibiting trends in more than one park, 2014–2018 (2015–2018 at MISS).

Species	Park	Trend (birds/km ² /yr)
Nashville Warbler	APIS	+1.51
	GRPO	+5.91 ^a
	ISRO	–2.35
	PIRO	–2.46
	VOYA	–0.87
Ovenbird	APIS	+4.64
	GRPO	+5.44
	ISRO	–1.33
	PIRO	–3.44
	SLBE	–3.24
	VOYA	+1.63
Red-breasted Nuthatch	GRPO	–1.30
	ISRO	+3.26
	PIRO	–0.26
	VOYA	–2.01
Red-eyed Vireo	APIS	+7.13 ^a
	GRPO	+4.42
	ISRO	+1.22
	MISS	+0.01
	PIRO	–5.63
	SLBE	+8.77
	VOYA	+1.41
Song Sparrow	APIS	+13.45
	MISS	–3.15
	SLBE	+3.46

^a Significant trend ($p < 0.05$).

^b Species of concern in Bird Conservation Region 12 (Boreal Hardwood Transition).

^c Species of concern in BCRs 12 and 23 (Prairie Hardwood Transition), and a Common Bird in Steep Decline (Partners in Flight 2019).

Table 21 (continued). Species exhibiting trends in more than one park, 2014–2018 (2015–2018 at MISS).

Species	Park	Trend (birds/km ² /yr)
Swainson's Thrush	ISRO	+0.44
	PIRO	–1.62
White-throated Sparrow	APIS	+7.33
	ISRO	+0.07
	VOYA	+0.02
Winter Wren	ISRO	–1.99
	VOYA	+0.29
Yellow-rumped Warbler	APIS	+0.40
	ISRO	–0.49
	VOYA	+3.76

^a Significant trend ($p < 0.05$).

^b Species of concern in Bird Conservation Region 12 (Boreal Hardwood Transition).

^c Species of concern in BCRs 12 and 23 (Prairie Hardwood Transition), and a Common Bird in Steep Decline (Partners in Flight 2019).

Comparison With 2015 Analysis

It is difficult to make meaningful comparisons with the one previous analysis that was done (Egan et al. 2015) because of (a) inter-park differences in the amount of data used in the previous analysis (range 8–15 years, mean=14.6 years) for the five parks in common with this analysis, (b) lack of time-delineated data (minute of detection) in some parks during the previous analysis, and (c) different methods of analysis between the previous report and this one. We identified trends based on density estimates for each species, while the previous analysis log-transformed annual counts for each species, using data from the most consistently surveyed routes in each park (Egan et al. 2015). However, while the values cannot be compared, a superficial look at which species exhibited trends in both analyses may have some value.

Eleven species exhibited trends during both analyses, four of those at more than one park (Table 22): American Robin (at APIS, ISRO, and SLBE), Nashville Warbler (at GRPO, ISRO, and VOYA), Ovenbird (at APIS, GRPO, and VOYA), and Red-breasted Nuthatch (at ISRO and VOYA). Only the Nashville Warbler at GRPO exhibited a significant trend in both analyses (+5.91 birds/km²/year in 2015, +0.01 birds/km²/year currently).

Table 22. Comparison of species exhibiting trends in both the 2015 analysis and this one.

Species	Park	Trend	
		<i>This analysis</i>	2015
Alder Flycatcher	ISRO	-0.66	0.03 ^a
American Robin	APIS	-0.12	0.01 ^a
	ISRO	-1.99	0.02 ^a
	SLBE	1.59	0.03 ^a
Black-and-white Warbler ^b	VOYA	-1.10 ^a	0.01
Chestnut-sided Warbler	VOYA	0.92	-0.02 ^a
Golden-crowned Kinglet	ISRO	-0.66	0.02
Nashville Warbler	GRPO	5.91 ^a	0.01 ^a
	ISRO	-2.35	0.01
	VOYA	-0.87	-0.01 ^a
Ovenbird	APIS	4.64	0.01 ^a
	GRPO	5.44	-0.01 ^a
	VOYA	1.63	-0.01 ^a
Red-breasted Nuthatch	ISRO	3.26	0.02 ^a
	VOYA	-2.01	0.01
Red-eyed Vireo	SLBE	8.77	0.02 ^a
Swainson's Thrush	ISRO	0.44	0.01 ^a
Yellow-rumped Warbler	VOYA	3.76	0.02

^a Significant trend ($p < 0.05$).

^b Species of concern in Bird Conservation Region 12 (Boreal Hardwood Transition).

Because species of conservation concern often occur in low densities, estimates of occupancy, density, and abundance can be difficult to obtain using the methods of this monitoring program. For this reason, the species of concern presented here are some of the more commonly found species across the network parks. In all eight parks, one or more of the 14 species of conservation concern were among those for which we could estimate occupancy and density. In future monitoring and analysis, selecting species of conservation concern at the park level will be necessary to adequately assess the status of all species in decline or otherwise threatened. Because species of conservation concern are often rare, limited in range, or cryptic in behavior, modified sampling designs may be necessary to collect sufficient data for the status assessments of these species

With continued monitoring of these parks, analyzing long-term trends in these community and population metrics will be an essential step towards the management of these lands and landbird populations. With the unknown effects of threats to these populations, such as climate change, it will be important to monitor both common and uncommon species.

A post hoc review of the species guilds revealed discrepancies such as missing species and misclassified species. These omissions cast doubt on the validity of our analyses of habitat and forage substrate guilds because of the elasticity some species exhibit relative to these classifications. However, there is less elasticity in migratory status and diet guilds.

Future guild analyses should include a guild for nesting location, which, more than habitat type, is critical for species conservation and survival.

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Appendix A. Summary statistics for Indiana Dunes National Park.

From 2014 through 2018, 50 point-count stations were visited once annually in Indiana Dunes National Park, following the North American Breeding Bird Survey Protocol (USGS and CWS 1998, Sauer et al. 2017). All but three points were completed across the five years, resulting in a total of 247 completed counts.

A total of 85 unique species were detected during these counts (Table A1), with an average of 58 species over the five-year period (Figure A1). Eleven species accounted for 50% of all the birds detected during the five-year period (Table A2).

Data collected during these surveys are not limited to songbirds, so non-target species such as herons, gulls, geese, and ducks are included in the data below.

Table A1. Number of detections, by species, during breeding bird surveys at Indiana Dunes National Park, 2014–2018.

Species	2014	2015	2016	2017	2018	TOTAL	Five-Year Average
Acadian Flycatcher	1	0	0	0	1	2	0.4
Alder Flycatcher	1	0	0	0	0	1	0.2
American Coot	1	0	1	0	0	2	0.4
American Crow	4	3	7	2	4	20	4
American Goldfinch	2	3	3	4	4	16	3.2
American Redstart	7	7	5	2	4	25	5
American Robin	20	16	19	15	20	90	18
American Woodcock	1	0	1	0	0	2	0.4
Baltimore Oriole	2	2	0	6	1	11	2.2
Barn Swallow	2	3	2	5	1	13	2.6
Belted Kingfisher	1	0	0	0	0	1	0.2
Black-and-white Warbler	1	0	0	0	0	1	0.2
Black-capped Chickadee	5	0	1	2	3	11	2.2
Blue Jay	3	2	2	2	2	11	2.2
Blue-gray Gnatcatcher	6	4	3	5	1	19	3.8
Brown Thrasher	0	0	0	0	2	2	0.4
Brown-headed Cowbird	5	3	15	10	11	44	8.8
Canada Goose	2	3	1	1	2	9	1.8

Species	2014	2015	2016	2017	2018	TOTAL	Five-Year Average
Cedar Waxwing	5	1	2	1	0	9	1.8
Cerulean Warbler	2	0	0	1	1	4	0.8
Chestnut-sided Warbler	1	1	1	0	0	3	0.6
Chimney Swift	2	1	3	1	2	9	1.8
Chipping Sparrow	3	5	3	3	4	18	3.6
Common Grackle	1	2	4	3	3	13	2.6
Common Yellowthroat	11	11	8	10	10	50	10
Dickcissel	1	0	0	0	0	1	0.2
Downy Woodpecker	6	3	0	1	0	10	2
Eastern Bluebird	0	2	1	0	0	3	0.6
Eastern Kingbird	0	2	1	0	1	4	0.8
Eastern Phoebe	1	0	2	0	0	3	0.6
Eastern Towhee	9	10	5	2	9	35	7
Eastern Whip-poor-will	0	1	0	0	1	2	0.4
Eastern Wood-Pewee	2	6	6	3	7	24	4.8
European Starling	1	3	2	0	1	7	1.4
Field Sparrow	1	0	3	5	2	11	2.2
Gray Catbird	9	9	9	7	10	44	8.8
Great Blue Heron	2	2	1	0	0	5	1
Great Crested Flycatcher	4	4	5	3	3	19	3.8
Great Egret	1	2	1	0	3	7	1.4
Green Heron	2	0	0	0	0	2	0.4
Herring Gull	1	0	0	0	0	1	0.2
Hooded Warbler	1	0	0	0	0	1	0.2
House Finch	0	1	2	1	2	6	1.2
House Sparrow	2	2	1	1	1	7	1.4
House Wren	6	3	5	8	11	33	6.6
Indigo Bunting	5	3	6	5	4	23	4.6
Killdeer	2	0	0	0	0	2	0.4
Mallard	0	2	0	0	1	3	0.6
Marsh Wren	6	1	3	4	3	17	3.4

Species	2014	2015	2016	2017	2018	TOTAL	Five-Year Average
Mourning Dove	6	3	5	1	6	21	4.2
Mute Swan	0	1	0	0	1	2	0.4
Northern Cardinal	18	18	11	6	8	61	12.2
Northern Flicker	0	0	0	1	0	1	0.2
Northern Shoveler	0	1	0	0	0	1	0.2
Ovenbird	0	4	0	0	1	5	1
Pileated Woodpecker	0	0	1	0	1	2	0.4
Prothonotary Warbler	1	0	0	0	0	1	0.2
Red-bellied Woodpecker	5	6	4	6	6	27	5.4
Red-eyed Vireo	8	7	4	10	7	36	7.2
Red-headed Woodpecker	0	0	1	0	1	2	0.4
Red-shouldered Hawk	1	0	0	0	0	1	0.2
Red-tailed Hawk	0	2	0	0	0	2	0.4
Red-winged Blackbird	12	14	14	15	14	69	13.8
Ring-billed Gull	2	3	2	5	4	16	3.2
Rock Pigeon	1	0	0	0	1	2	0.4
Rose-breasted Grosbeak	1	0	1	0	0	2	0.4
Ruby-throated Hummingbird	2	0	0	0	1	3	0.6
Sandhill Crane	1	1	2	0	1	5	1
Scarlet Tanager	0	0	1	0	1	2	0.4
Song Sparrow	11	8	9	13	12	53	10.6
Swamp Sparrow	1	2	4	4	4	15	3
Tree Swallow	2	3	5	5	5	20	4
Tufted Titmouse	6	6	3	3	3	21	4.2
Turkey Vulture	0	3	0	2	1	6	1.2
Veery	1	1	1	0	1	4	0.8
Virginia Rail	0	1	0	0	0	1	0.2
Warbling Vireo	1	2	1	4	2	10	2
White-breasted Nuthatch	2	0	1	2	2	7	1.4
White-eyed Vireo	0	0	0	0	1	1	0.2
Wild Turkey	0	1	0	0	0	1	0.2

Species	2014	2015	2016	2017	2018	TOTAL	Five-Year Average
Willow Flycatcher	0	2	4	3	3	12	2.4
Wood Duck	1	1	0	2	2	6	1.2
Wood Thrush	3	3	4	5	5	20	4
Yellow Warbler	16	15	20	11	19	81	16.2
Yellow-throated Vireo	2	2	3	0	2	9	1.8

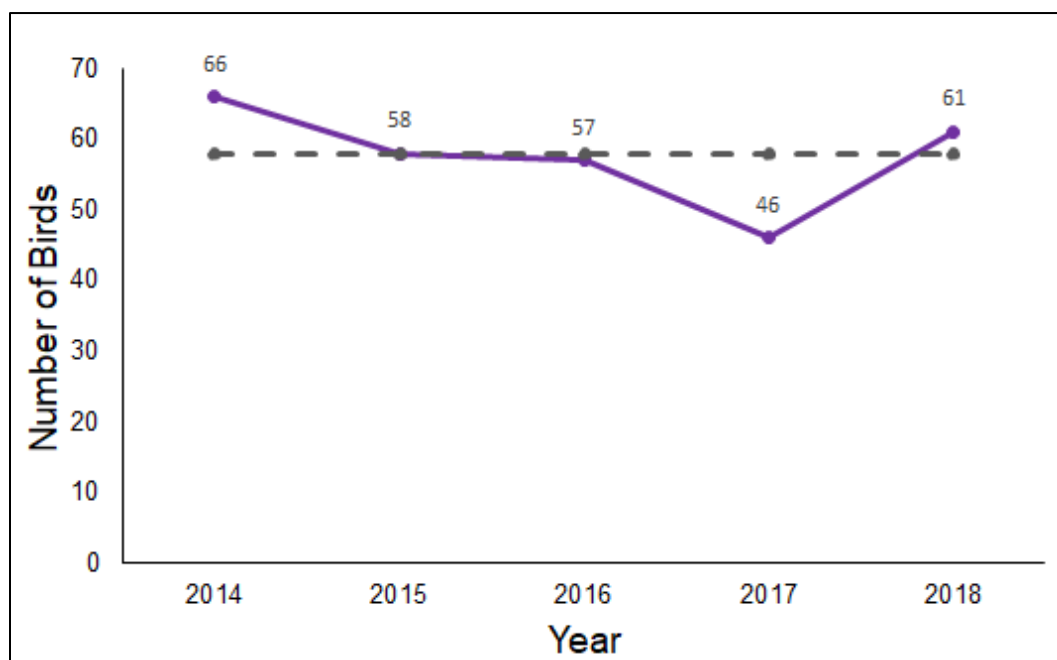


Figure A1. Number of species detected during annual breeding bird surveys at Indiana Dunes National Park, 2014–2018. Dashed line indicates the five-year average number of species (58).

Table A2. Eleven most common species, in order of total number, detected during breeding bird surveys at Indiana Dunes National Park, 2014–2018. These eleven species compose the top 50% of all 1,184 birds detected over the five-year period.

Species	2014	2015	2016	2017	2018	TOTAL	Five-Year Average
American Robin	20	16	19	15	20	90	18
Yellow Warbler	16	15	20	11	19	81	16.2
Red-winged Blackbird	12	14	14	15	14	69	13.8
Northern Cardinal	18	18	11	6	8	61	12.2
Song Sparrow	11	8	9	13	12	53	10.6
Common Yellowthroat	11	11	8	10	10	50	10
Brown-headed Cowbird	5	3	15	10	11	44	8.8
Gray Catbird	9	9	9	7	10	44	8.8
Red-eyed Vireo	8	7	4	10	7	36	7.2
Eastern Towhee	9	10	5	2	9	35	7
House Wren	6	3	5	8	11	33	6.6

Appendix B. Annual mean occupancy and standard error for all landbird species with ≥10 detections, by park.

Table B1. Annual mean occupancy and standard error for all landbird species with ≥10 detections at Apostle Islands National Lakeshore, 2014–2018. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2014	2015	2016	2017	2018
Alder Flycatcher	0.31 ± 0.13	NA	NA	NA	NA
American Crow	0.20 ± 0.06	NA	NA	NA	NA
American Redstart	0.34 ± 0.06	0.43 ± 0.06	0.43 ± 0.06	0.38 ± 0.06	0.61 ± 0.08
American Robin	0.35 ± 0.11	0.27 ± 0.06	0.29 ± 0.07	0.23 ± 0.07	0.32 ± 0.10
Black-and-white Warbler ^a	NA	0.38 ± 0.11	0.36 ± 0.10	0.46 ± 0.13	0.55 ± 0.14
Black-capped Chickadee	NA	NA	0.24 ± 0.06	NA	NA
Black-throated Blue Warbler	NA	NA	0.27 ± 0.06	0.25 ± 0.07	0.28 ± 0.07
Black-throated Green Warbler	0.59 ± 0.10	0.52 ± 0.07	0.8 ± 0.06	0.82 ± 0.07	0.92 ± 0.06
Blue Jay	0.19 ± 0.07	NA	0.35 ± 0.10	0.23 ± 0.08	0.34 ± 0.12
Canada Warbler ^a	NA	0.32 ± 0.09	0.38 ± 0.11	NA	NA
Chipping Sparrow	NA	0.27 ± 0.07	NA	NA	NA
Common Yellowthroat	NA	0.26 ± 0.07	0.7 ± 0.11	0.81 ± 0.10	NA
Hermit Thrush	NA	NA	0.22 ± 0.05	0.14 ± 0.05	0.31 ± 0.08
Magnolia Warbler	NA	NA	NA	0.18 ± 0.06	0.27 ± 0.09
Nashville Warbler	0.42 ± 0.06	0.49 ± 0.06	0.56 ± 0.07	0.64 ± 0.07	0.72 ± 0.09
Northern Parula	NA	0.31 ± 0.13	0.25 ± 0.07	NA	0.26 ± 0.07
Ovenbird	0.64 ± 0.09	0.45 ± 0.06	0.8 ± 0.06	0.64 ± 0.08	0.79 ± 0.06
Red-breasted Nuthatch	NA	0.29 ± 0.09	0.46 ± 0.13	NA	0.3 ± 0.10
Red-eyed Vireo	0.52 ± 0.06	0.46 ± 0.06	0.77 ± 0.05	0.61 ± 0.06	0.79 ± 0.06
Swainson's Thrush	NA	0.14 ± 0.04	NA	NA	NA
Veery ^a	NA	NA	0.21 ± 0.06	NA	NA
White-throated Sparrow	0.33 ± 0.09	0.14 ± 0.05	0.66 ± 0.11	0.57 ± 0.12	NA
Winter Wren	0.17 ± 0.05	NA	0.2 ± 0.05	NA	0.21 ± 0.06
Yellow-rumped Warbler	0.25 ± 0.08	0.33 ± 0.11	0.34 ± 0.07	0.22 ± 0.06	NA

^a species of regional concern or continental importance (see Table 1).

Table B2. Annual mean occupancy and standard error for all landbird species with ≥ 10 detections at Grand Portage National Monument, 2014–2018. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2014	2015	2016	2017	2018
American Redstart	0.39 ± 0.08	0.45 ± 0.08	0.62 ± 0.08	0.48 ± 0.09	0.67 ± 0.08
American Robin	NA	NA	0.32 ± 0.08	NA	0.3 ± 0.08
Black-and-white Warbler ^a	0.48 ± 0.24	NA	0.48 ± 0.24	NA	NA
Blackburnian Warbler	0.29 ± 0.08	NA	NA	NA	0.26 ± 0.08
Black-throated Green Warbler	NA	0.27 ± 0.07	0.69 ± 0.08	0.63 ± 0.08	0.71 ± 0.08
Blue Jay	NA	NA	NA	NA	0.23 ± 0.07
Canada Warbler ^a	0.27 ± 0.07	NA	0.27 ± 0.07	NA	NA
Golden-crowned Kinglet	NA	NA	0.31 ± 0.08	0.22 ± 0.07	NA
Magnolia Warbler	0.48 ± 0.09	0.39 ± 0.08	0.39 ± 0.08	0.48 ± 0.09	0.5 ± 0.09
Nashville Warbler	0.54 ± 0.08	0.38 ± 0.08	0.68 ± 0.08	0.68 ± 0.08	0.82 ± 0.06
Northern Parula	0.44 ± 0.08	0.53 ± 0.08	0.44 ± 0.08	0.56 ± 0.08	0.61 ± 0.08
Ovenbird	0.54 ± 0.08	0.33 ± 0.08	0.65 ± 0.08	0.76 ± 0.07	0.73 ± 0.07
Red-breasted Nuthatch	NA	0.54 ± 0.11	0.32 ± 0.09	0.57 ± 0.11	0.41 ± 0.10
Red-eyed Vireo	0.27 ± 0.07	0.44 ± 0.08	0.68 ± 0.08	0.65 ± 0.08	0.57 ± 0.08
Swainson's Thrush	NA	NA	NA	0.25 ± 0.07	0.45 ± 0.08
Veery ^a	NA	NA	NA	0.35 ± 0.08	NA
White-throated Sparrow	NA	NA	0.31 ± 0.08	NA	NA
Winter Wren	NA	NA	NA	0.33 ± 0.08	NA

^a Species of regional concern or continental importance (see Table 1)

Table B3. Annual mean occupancy and standard error for all landbird species with ≥ 10 detections at Isle Royale National Park, 2014–2018. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2014	2015	2016	2017	2018
Alder Flycatcher	0.13 ± 0.04	0.23 ± 0.05	0.16 ± 0.04	0.15 ± 0.04	0.11 ± 0.03
American Crow	0.12 ± 0.04	NA	0.12 ± 0.04	0.14 ± 0.04	NA
American Redstart	0.15 ± 0.04	0.17 ± 0.04	0.26 ± 0.05	0.28 ± 0.05	0.24 ± 0.04
American Robin	0.34 ± 0.06	0.43 ± 0.06	0.57 ± 0.07	0.25 ± 0.05	0.21 ± 0.05
Black-and-white Warbler ^a	NA	0.22 ± 0.05	NA	0.14 ± 0.04	0.21 ± 0.05
Blackburnian Warbler	NA	NA	NA	0.11 ± 0.03	NA
Black-capped Chickadee	NA	0.25 ± 0.05	0.27 ± 0.05	0.23 ± 0.05	0.15 ± 0.04
Black-throated Blue Warbler	NA	NA	0.08 ± 0.02	NA	NA
Black-throated Green Warbler	0.30 ± 0.05	0.34 ± 0.05	0.33 ± 0.04	0.33 ± 0.04	0.37 ± 0.05
Blue Jay	0.25 ± 0.05	0.30 ± 0.06	0.36 ± 0.06	0.26 ± 0.05	0.17 ± 0.04
Brown Creeper	NA	0.18 ± 0.07	NA	NA	0.16 ± 0.06
Canada Warbler ^a	0.09 ± 0.03	NA	NA	NA	NA
Chestnut-sided Warbler	0.26 ± 0.05	0.34 ± 0.05	0.30 ± 0.05	0.25 ± 0.05	0.20 ± 0.04
Golden-crowned Kinglet	NA	0.21 ± 0.04	0.24 ± 0.04	0.24 ± 0.04	0.18 ± 0.04
Hermit Thrush	0.33 ± 0.07	0.45 ± 0.08	0.61 ± 0.08	0.36 ± 0.07	0.33 ± 0.07
Magnolia Warbler	0.36 ± 0.05	0.37 ± 0.05	0.28 ± 0.05	0.33 ± 0.05	0.31 ± 0.04
Mourning Warbler	NA	0.25 ± 0.06	0.23 ± 0.06	0.21 ± 0.06	0.13 ± 0.05
Nashville Warbler	0.77 ± 0.05	0.79 ± 0.05	0.85 ± 0.04	0.74 ± 0.05	0.73 ± 0.04
Northern Flicker ^a	NA	NA	0.24 ± 0.08	NA	NA
Ovenbird	0.58 ± 0.05	0.54 ± 0.04	0.48 ± 0.04	0.51 ± 0.04	0.51 ± 0.04
Red-breasted Nuthatch	0.16 ± 0.04	0.39 ± 0.06	0.42 ± 0.07	0.42 ± 0.06	0.35 ± 0.06
Red-eyed Vireo	0.24 ± 0.05	0.39 ± 0.04	0.38 ± 0.04	0.28 ± 0.04	0.43 ± 0.04
Swainson's Thrush	0.11 ± 0.03	0.21 ± 0.04	0.15 ± 0.04	0.15 ± 0.04	0.19 ± 0.04
White-throated Sparrow	0.56 ± 0.05	0.61 ± 0.05	0.73 ± 0.05	0.59 ± 0.05	0.52 ± 0.05
Winter Wren	0.57 ± 0.05	0.63 ± 0.05	0.53 ± 0.05	0.59 ± 0.05	0.41 ± 0.05
Yellow-bellied Flycatcher	NA	0.11 ± 0.03	0.10 ± 0.03	0.08 ± 0.02	0.09 ± 0.02
Yellow-rumped Warbler	0.25 ± 0.05	0.26 ± 0.06	0.17 ± 0.04	0.27 ± 0.06	0.17 ± 0.04

^a Species of regional concern or continental importance (see Table 1).

Table B4. Annual mean occupancy and standard error for all landbird species with ≥ 10 detections at Mississippi National River and Recreation Area, 2015–2018. Landbird surveys began in 2015 at MISS. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2015	2016	2017	2018
American Crow	NA	0.79 ± 0.49	0.27 ± 0.18	NA
American Goldfinch	0.65 ± 0.15	0.49 ± 0.12	0.49 ± 0.11	0.91 ± 0.27
American Redstart	0.48 ± 0.18	0.34 ± 0.08	0.41 ± 0.08	0.27 ± 0.11
American Robin	0.64 ± 0.10	0.69 ± 0.08	0.65 ± 0.07	0.67 ± 0.09
Baltimore Oriole	NA	NA	0.41 ± 0.09	NA
Black-capped Chickadee	0.65 ± 0.09	0.81 ± 0.11	0.74 ± 0.11	0.64 ± 0.07
Blue Jay	0.53 ± 0.09	0.48 ± 0.09	0.46 ± 0.10	0.34 ± 0.07
Brown-headed Cowbird	0.40 ± 0.13	0.48 ± 0.13	0.67 ± 0.12	0.62 ± 0.24
Common Yellowthroat	NA	NA	NA	0.19 ± 0.07
Downy Woodpecker	0.31 ± 0.08	0.45 ± 0.09	0.46 ± 0.09	0.41 ± 0.08
Eastern Wood-Pewee	0.39 ± 0.15	0.35 ± 0.09	0.42 ± 0.08	0.56 ± 0.28
Gray Catbird	NA	0.31 ± 0.09	0.22 ± 0.07	0.25 ± 0.08
Great Crested Flycatcher ^a	0.57 ± 0.14	0.48 ± 0.10	0.42 ± 0.10	0.53 ± 0.19
Hairy Woodpecker	0.76 ± 0.29	NA	NA	NA
House Wren	0.65 ± 0.09	0.48 ± 0.07	0.57 ± 0.07	0.39 ± 0.07
Indigo Bunting	0.22 ± 0.06	0.29 ± 0.07	0.19 ± 0.06	0.24 ± 0.06
Northern Cardinal	0.50 ± 0.09	0.56 ± 0.11	0.8 ± 0.17	0.24 ± 0.07
Red-bellied Woodpecker	0.31 ± 0.09	NA	0.31 ± 0.07	0.28 ± 0.07
Red-eyed Vireo	0.31 ± 0.08	0.38 ± 0.07	0.34 ± 0.07	0.25 ± 0.07
Song Sparrow	0.46 ± 0.08	0.44 ± 0.07	0.47 ± 0.07	0.32 ± 0.07
White-breasted Nuthatch	0.53 ± 0.14	0.59 ± 0.10	0.45 ± 0.12	0.33 ± 0.07
Yellow Warbler	NA	NA	0.29 ± 0.15	0.60 ± 0.29

^a Species of regional concern or continental importance (see Table 1).

Table B5. Annual mean occupancy and standard error for all landbird species with ≥ 10 detections at Pictured Rocks National Lakeshore, 2014–2018. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2014	2015	2016	2017	2018
American Redstart	0.68 ± 0.08	0.41 ± 0.07	0.52 ± 0.07	0.56 ± 0.07	0.54 ± 0.07
American Robin	0.63 ± 0.08	0.39 ± 0.07	0.35 ± 0.07	0.37 ± 0.07	0.37 ± 0.07
Black-capped Chickadee	NA	0.35 ± 0.15	0.48 ± 0.19	0.41 ± 0.17	0.35 ± 0.15
Black-throated Blue Warbler	0.31 ± 0.07	0.17 ± 0.05	0.23 ± 0.06	0.19 ± 0.05	0.27 ± 0.06
Black-throated Green Warbler	0.76 ± 0.08	0.35 ± 0.07	0.23 ± 0.06	0.40 ± 0.07	0.4 ± 0.07
Cedar Waxwing	0.32 ± 0.20	0.55 ± 0.36	NA	0.43 ± 0.29	NA
Chipping Sparrow	0.25 ± 0.07	NA	NA	NA	NA
Eastern Wood-Pewee	0.22 ± 0.06	NA	NA	NA	NA
Hermit Thrush	0.41 ± 0.14	NA	NA	NA	NA
Least Flycatcher ^a	0.31 ± 0.07	0.15 ± 0.05	0.19 ± 0.05	0.12 ± 0.04	0.21 ± 0.06
Nashville Warbler	0.32 ± 0.07	NA	0.29 ± 0.06	0.17 ± 0.05	0.27 ± 0.06
Ovenbird	0.74 ± 0.07	0.56 ± 0.07	0.50 ± 0.07	0.44 ± 0.07	0.42 ± 0.07
Red-breasted Nuthatch	0.22 ± 0.15	NA	0.42 ± 0.09	0.25 ± 0.07	0.27 ± 0.07
Red-eyed Vireo	0.74 ± 0.06	0.62 ± 0.07	0.50 ± 0.07	0.52 ± 0.07	0.50 ± 0.07
Rose-breasted Grosbeak	0.34 ± 0.07	NA	0.23 ± 0.06	NA	0.19 ± 0.05
Swainson's Thrush	0.27 ± 0.07	0.19 ± 0.05	NA	0.25 ± 0.06	0.17 ± 0.05
Veery ^a	NA	0.18 ± 0.06	NA	NA	0.24 ± 0.06
White-throated Sparrow	0.17 ± 0.06	NA	NA	NA	NA
Yellow-bellied Sapsucker	NA	0.22 ± 0.07	0.22 ± 0.07	0.27 ± 0.07	NA
Yellow-rumped Warbler	NA	0.24 ± 0.07	0.24 ± 0.07	NA	NA

^a Species of regional concern or continental importance (see Table 1).

Table B6. Mean occupancy and standard error for all landbird species with ≥ 10 detections on six transects at St. Croix National Scenic Riverway (Middle St. Croix, St. Croix North, and Upper Namekagon transects sampled in 2014, 2016, and 2018; Lower Namekagon, Lower St. Croix, and Upper St. Croix transects sampled in 2015 and 2017). "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	Mean Occupancy $\pm$ SE
Alder Flycatcher	0.08 $\pm$ 0.02
American Redstart	0.45 $\pm$ 0.02
American Robin	0.27 $\pm$ 0.02
Baltimore Oriole	0.22 $\pm$ 0.04
Black-and-white Warbler ^a	0.31 $\pm$ 0.05
Black-capped Chickadee	0.15 $\pm$ 0.05
Blue Jay	0.31 $\pm$ 0.06
Brown-headed Cowbird	NA
Canada Warbler ^a	0.11 $\pm$ 0.02
Cedar Waxwing	NA
Chestnut-sided Warbler	0.31 $\pm$ 0.03
Common Grackle ^a	0.08 $\pm$ 0.03
Common Yellowthroat	0.45 $\pm$ 0.02
Eastern Kingbird ^a	0.18 $\pm$ 0.04
Eastern Wood-Pewee	0.18 $\pm$ 0.02
Golden-winged Warbler ^a	0.17 $\pm$ 0.03
Gray Catbird	0.43 $\pm$ 0.04
Great Crested Flycatcher ^a	0.15 $\pm$ 0.02
House Wren	0.06 $\pm$ 0.02
Least Flycatcher ^a	0.10 $\pm$ 0.01
Mourning Warbler	0.07 $\pm$ 0.02
Nashville Warbler	0.18 $\pm$ 0.10
Northern Flicker ^a	0.17 $\pm$ 0.08
Northern Waterthrush	0.10 $\pm$ 0.02
Ovenbird	0.34 $\pm$ 0.03
Pileated Woodpecker	0.02 $\pm$ 0.01
Pine Warbler	0.07 $\pm$ 0.01

^a Species of regional concern or continental importance (see Table 1).

Table B6 (continued). Mean occupancy and standard error for all landbird species with ≥ 10 detections on six transects at St. Croix National Scenic Riverway (Middle St. Croix, St. Croix North, and Upper Namekagon transects sampled in 2014, 2016, and 2018; Lower Namekagon, Lower St. Croix, and Upper St. Croix transects sampled in 2015 and 2017). "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	Mean Occupancy $\pm$ SE
Prothonotary Warbler ^a	0.16 $\pm$ 0.03
Red-bellied Woodpecker	0.16 $\pm$ 0.04
Red-breasted Nuthatch	0.08 $\pm$ 0.01
Red-eyed Vireo	0.80 $\pm$ 0.02
Red-winged Blackbird	0.15 $\pm$ 0.02
Rose-breasted Grosbeak	0.27 $\pm$ 0.06
Scarlet Tanager ^a	0.08 $\pm$ 0.01
Song Sparrow	0.75 $\pm$ 0.02
Swamp Sparrow	0.10 $\pm$ 0.02
Tree Swallow ^a	0.11 $\pm$ 0.02
Veery ^a	0.45 $\pm$ 0.03
Warbling Vireo	0.19 $\pm$ 0.03
White-breasted Nuthatch	NA
White-throated Sparrow	0.12 $\pm$ 0.02
Wood Thrush ^a	0.15 $\pm$ 0.02
Yellow Warbler	0.41 $\pm$ 0.03
Yellow-rumped Warbler	0.08 $\pm$ 0.03
Yellow-throated Vireo	0.15 $\pm$ 0.02

^a Species of regional concern or continental importance (see Table 1).

Table B7. Annual mean occupancy and standard error for all landbird species with ≥ 10 detections on the Middle St. Croix, St. Croix North, and Upper Namekagon transects at St. Croix National Scenic Riverway, 2014, 2016, 2018. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2014	2016	2018
Alder Flycatcher	0.08 ± 0.02	0.06 ± 0.02	NA
American Redstart	0.40 ± 0.05	0.38 ± 0.05	0.40 ± 0.05
American Robin	0.21 ± 0.04	0.30 ± 0.04	0.20 ± 0.05
Baltimore Oriole	0.14 ± 0.04	0.20 ± 0.05	NA
Black-and-white Warbler ^a	NA	0.11 ± 0.04	0.13 ± 0.06
Black-capped Chickadee	NA	0.09 ± 0.04	0.15 ± 0.06
Blue Jay	0.24 ± 0.08	0.43 ± 0.12	NA
Canada Warbler ^a	0.09 ± 0.03	0.09 ± 0.03	NA
Cedar Waxwing	NA	0.21 ± 0.20	0.15 ± 0.09
Chestnut-sided Warbler	0.31 ± 0.05	0.39 ± 0.05	0.23 ± 0.04
Common Yellowthroat	0.42 ± 0.04	0.54 ± 0.04	0.36 ± 0.04
Eastern Kingbird ^a	NA	NA	NA
Eastern Wood-Pewee	0.15 ± 0.03	0.22 ± 0.04	NA
Golden-winged Warbler ^a	NA	NA	NA
Gray Catbird	0.46 ± 0.10	0.47 ± 0.10	0.19 ± 0.05
Great Crested Flycatcher ^a	0.20 ± 0.04	0.11 ± 0.03	NA
Least Flycatcher ^a	0.11 ± 0.03	0.13 ± 0.03	0.11 ± 0.03
Mourning Warbler	NA	NA	NA
Nashville Warbler	NA	NA	0.08 ± 0.03
Northern Flicker ^a	NA	NA	NA
Northern Waterthrush	NA	NA	NA
Ovenbird	0.32 ± 0.05	0.45 ± 0.05	0.21 ± 0.04
Pine Warbler	NA	NA	NA
Prothonotary Warbler ^a	NA	NA	NA
Red-bellied Woodpecker	0.11 ± 0.05	NA	NA
Red-breasted Nuthatch	NA	0.09 ± 0.03	0.13 ± 0.03

^a Species of regional concern or continental importance (see Table 1).

Table B7 (continued). Annual mean occupancy and standard error for all landbird species with ≥ 10 detections on the Middle St. Croix, St. Croix North, and Upper Namekagon transects at St. Croix National Scenic Riverway, 2014, 2016, 2018. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2014	2016	2018
Red-eyed Vireo	0.81 ± 0.03	0.85 ± 0.03	0.34 ± 0.04
Red-winged Blackbird	0.25 ± 0.07	0.20 ± 0.06	0.08 ± 0.02
Rose-breasted Grosbeak	0.25 ± 0.11	0.44 ± 0.18	NA
Scarlet Tanager ^a	0.08 ± 0.02	0.06 ± 0.02	NA
Song Sparrow	0.72 ± 0.04	0.77 ± 0.04	0.60 ± 0.05
Swamp Sparrow	0.08 ± 0.03	0.07 ± 0.02	0.11 ± 0.03
Tree Swallow ^a	NA	NA	NA
Veery ^a	0.42 ± 0.05	0.55 ± 0.05	0.24 ± 0.04
Warbling Vireo	NA	NA	NA
White-breasted Nuthatch	0.11 ± 0.04	0.16 ± 0.06	NA
White-throated Sparrow	0.12 ± 0.03	0.13 ± 0.03	0.14 ± 0.10
Wood Thrush ^a	0.14 ± 0.03	0.16 ± 0.03	NA
Yellow Warbler	0.44 ± 0.05	0.44 ± 0.05	0.07 ± 0.03
Yellow-rumped Warbler	NA	NA	0.15 ± 0.08
Yellow-throated Vireo	0.17 ± 0.03	0.15 ± 0.03	NA

^a Species of regional concern or continental importance (see Table 1).

Table B8. Annual mean occupancy and standard error for all landbird species with ≥ 10 detections on the Lower Namekagon, Lower St. Croix, and Upper St. Croix transects at St. Croix National Scenic Riverway, 2015 and 2017. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2015	2017
Alder Flycatcher	0.13 ± 0.03	NA
American Redstart	0.54 ± 0.04	0.49 ± 0.05
American Robin	0.35 ± 0.08	0.27 ± 0.05
Baltimore Oriole	0.28 ± 0.05	0.20 ± 0.04
Black-and-white Warbler ^a	0.32 ± 0.05	0.20 ± 0.09
Black-capped Chickadee	0.20 ± 0.09	NA
Blue Jay	0.27 ± 0.08	0.22 ± 0.23
Canada Warbler ^a	0.15 ± 0.04	0.10 ± 0.03
Cedar Waxwing	NA	0.14 ± 0.08
Chestnut-sided Warbler	0.30 ± 0.07	0.22 ± 0.04
Common Yellowthroat	0.61 ± 0.07	0.37 ± 0.04
Eastern Kingbird ^a	0.19 ± 0.04	0.13 ± 0.05
Eastern Wood-Pewee	0.18 ± 0.03	NA
Golden-winged Warbler ^a	0.17 ± 0.03	0.10 ± 0.05
Gray Catbird	0.44 ± 0.05	0.25 ± 0.05
Great Crested Flycatcher ^a	0.17 ± 0.03	0.14 ± 0.04
Least Flycatcher ^a	0.11 ± 0.03	NA
Mourning Warbler	0.07 ± 0.02	NA
Nashville Warbler	NA	NA
Northern Flicker ^a	0.18 ± 0.10	NA
Northern Waterthrush	0.10 ± 0.03	0.11 ± 0.07
Ovenbird	0.29 ± 0.04	0.12 ± 0.03
Pine Warbler	0.08 ± 0.02	NA
Prothonotary Warbler ^a	0.17 ± 0.03	0.10 ± 0.03
Red-bellied Woodpecker	0.17 ± 0.04	NA
Red-breasted Nuthatch	NA	NA

^a Species of regional concern or continental importance (see Table 1).

Table B8 (continued). Annual mean occupancy and standard error for all landbird species with ≥ 10 detections on the Lower Namekagon, Lower St. Croix, and Upper St. Croix transects at St. Croix National Scenic Riverway, 2015 and 2017. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2015	2017
Red-eyed Vireo	0.76 ± 0.04	0.51 ± 0.04
Red-winged Blackbird	0.13 ± 0.03	0.15 ± 0.03
Rose-breasted Grosbeak	0.22 ± 0.06	0.10 ± 0.03
Scarlet Tanager ^a	0.09 ± 0.02	NA
Song Sparrow	0.81 ± 0.04	0.82 ± 0.04
Swamp Sparrow	0.10 ± 0.02	0.13 ± 0.03
Tree Swallow ^a	NA	0.13 ± 0.03
Veery ^a	0.40 ± 0.06	0.23 ± 0.04
Warbling Vireo	0.20 ± 0.03	0.08 ± 0.03
White-breasted Nuthatch	NA	NA
White-throated Sparrow	NA	NA
Wood Thrush ^a	NA	NA
Yellow Warbler	0.35 ± 0.04	NA
Yellow-rumped Warbler	NA	NA
Yellow-throated Vireo	0.14 ± 0.03	NA

^a Species of regional concern or continental importance (see Table 1).

Table B9. Annual mean occupancy and standard error for all landbird species with ≥ 10 detections at Sleeping Bear Dunes National Lakeshore, 2014–2018. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2014	2015	2016	2017	2018
American Goldfinch	NA	NA	NA	NA	0.28 ± 0.09
American Redstart	0.27 ± 0.07	0.5 ± 0.08	0.56 ± 0.08	0.51 ± 0.08	0.65 ± 0.08
American Robin	0.45 ± 0.08	0.47 ± 0.08	0.64 ± 0.08	0.67 ± 0.08	0.57 ± 0.08
Baltimore Oriole	NA	0.23 ± 0.08	0.27 ± 0.09	NA	NA
Black-capped Chickadee	NA	0.34 ± 0.10	0.44 ± 0.11	0.54 ± 0.12	0.28 ± 0.09
Cedar Waxwing	NA	NA	0.29 ± 0.10	0.33 ± 0.11	0.35 ± 0.11
Chipping Sparrow	0.55 ± 0.16	0.46 ± 0.08	0.39 ± 0.08	0.36 ± 0.08	0.41 ± 0.08
Common Grackle ^a	NA	0.39 ± 0.23	0.27 ± 0.17	NA	0.48 ± 0.28
Common Yellowthroat	NA	0.22 ± 0.07	0.28 ± 0.07	0.20 ± 0.06	0.32 ± 0.07
Eastern Kingbird ^a	NA	0.28 ± 0.08	NA	NA	NA
Eastern Meadowlark ^a	NA	NA	0.1 ± 0.05	NA	NA
Eastern Wood-Pewee	NA	0.28 ± 0.07	0.32 ± 0.08	0.32 ± 0.08	0.28 ± 0.07
Indigo Bunting	NA	0.30 ± 0.07	0.36 ± 0.08	NA	0.28 ± 0.07
Mourning Dove	NA	0.38 ± 0.08	0.24 ± 0.07	0.29 ± 0.07	0.28 ± 0.07
Nashville Warbler	NA	0.26 ± 0.11	NA	NA	NA
Ovenbird	NA	0.44 ± 0.08	0.35 ± 0.08	0.40 ± 0.08	0.37 ± 0.08
Pine Warbler	NA	NA	0.27 ± 0.07	0.27 ± 0.07	0.34 ± 0.08
Red-eyed Vireo	0.33 ± 0.08	0.68 ± 0.07	0.73 ± 0.07	0.73 ± 0.07	0.83 ± 0.06
Red-winged Blackbird	NA	0.28 ± 0.07	0.45 ± 0.08	0.24 ± 0.07	0.41 ± 0.08
Rose-breasted Grosbeak	NA	0.21 ± 0.07	0.32 ± 0.08	0.35 ± 0.08	NA
Scarlet Tanager ^a	NA	0.23 ± 0.07	NA	NA	NA
Song Sparrow	0.27 ± 0.07	0.49 ± 0.08	0.40 ± 0.08	0.53 ± 0.09	0.55 ± 0.09
Yellow Warbler	NA	0.22 ± 0.08	0.23 ± 0.08	0.20 ± 0.07	NA

^a Species of regional concern or continental importance (see Table 1).

Table B10. Annual mean occupancy and standard error for all landbird species with ≥ 10 detections at Voyageurs National Park, 2014–2018. "NA" is shown for years in which there were too few detections to estimate occupancy.

Species	2014	2015	2016	2017	2018
American Crow	NA	NA	0.16 ± 0.08	NA	NA
American Robin	0.19 ± 0.06	0.37 ± 0.08	0.44 ± 0.08	0.19 ± 0.06	0.29 ± 0.07
Black-and-white Warbler ^a	0.64 ± 0.41	0.32 ± 0.08	0.26 ± 0.07	0.26 ± 0.07	0.26 ± 0.07
Blackburnian Warbler	0.33 ± 0.07	NA	0.50 ± 0.16	0.29 ± 0.11	NA
Black-capped Chickadee	NA	NA	0.29 ± 0.09	NA	0.37 ± 0.11
Black-throated Green Warbler	0.25 ± 0.09	0.39 ± 0.16	0.32 ± 0.11	0.29 ± 0.11	0.34 ± 0.12
Blue Jay	NA	0.21 ± 0.07	0.72 ± 0.26	0.76 ± 0.27	0.51 ± 0.2
Chestnut-sided Warbler	0.27 ± 0.10	0.20 ± 0.06	0.21 ± 0.07	0.23 ± 0.07	NA
Chipping Sparrow	0.19 ± 0.06	0.22 ± 0.06	0.22 ± 0.06	NA	NA
Eastern Wood-Pewee	0.20 ± 0.07	NA	0.17 ± 0.05	0.17 ± 0.05	0.19 ± 0.05
Hermit Thrush	0.19 ± 0.05	0.16 ± 0.05	0.26 ± 0.06	0.23 ± 0.06	0.24 ± 0.06
Least Flycatcher ^a	0.16 ± 0.05	0.21 ± 0.05	0.29 ± 0.08	0.37 ± 0.09	0.18 ± 0.06
Nashville Warbler	0.69 ± 0.06	0.81 ± 0.05	0.89 ± 0.06	0.88 ± 0.06	0.71 ± 0.08
Northern Parula	0.35 ± 0.34	0.39 ± 0.14	NA	NA	NA
Ovenbird	0.78 ± 0.05	0.66 ± 0.06	0.80 ± 0.05	0.81 ± 0.05	0.73 ± 0.06
Pine Warbler	NA	NA	NA	0.17 ± 0.06	0.28 ± 0.08
Red-breasted Nuthatch	0.42 ± 0.11	0.84 ± 0.17	0.78 ± 0.11	0.41 ± 0.09	0.51 ± 0.10
Red-eyed Vireo	0.57 ± 0.09	0.73 ± 0.06	0.76 ± 0.06	0.79 ± 0.06	0.57 ± 0.07
Ruby-crowned Kinglet	NA	NA	0.14 ± 0.05	NA	NA
Veery ^a	NA	0.22 ± 0.06	0.23 ± 0.06	0.16 ± 0.05	0.17 ± 0.05
White-throated Sparrow	0.61 ± 0.06	0.49 ± 0.07	0.68 ± 0.08	0.53 ± 0.07	0.57 ± 0.07
Winter Wren	0.27 ± 0.06	0.20 ± 0.05	0.14 ± 0.05	0.28 ± 0.06	0.26 ± 0.06
Yellow-bellied Sapsucker	NA	0.21 ± 0.06	NA	NA	NA
Yellow-rumped Warbler	NA	0.34 ± 0.09	0.53 ± 0.09	0.45 ± 0.09	0.61 ± 0.10

^a Species of regional concern or continental importance (see Table 1).

Appendix C. Annual mean density (birds/km²) and standard error for all landbird species with ≥10 detections, by park.

Table C1. Annual mean density (birds/km²) and standard error for all landbird species with ≥10 detections at Apostle Islands National Lakeshore, 2014–2018. "NA" is shown for years in which there were too few detections to estimate density.

Species	2014	2015	2016	2017	2018
Alder Flycatcher	5.31 ± 2.32	NA	NA	NA	NA
American Crow	9.54 ± 3.77	NA	NA	NA	NA
American Redstart	13.90 ± 2.76	21.04 ± 3.53	18.04 ± 3.09	19.83 ± 3.66	27.30 ± 5.62
American Robin	14.12 ± 4.94	9.88 ± 2.73	13.95 ± 3.35	8.15 ± 2.59	14.41 ± 4.79
Black-and-white Warbler ^a	NA	11.87 ± 4.21	12.87 ± 3.2	15.05 ± 4.13	15.89 ± 4.34
Black-capped Chickadee	NA	NA	7.66 ± 2.59	NA	NA
Black-throated Blue Warbler	NA	NA	9.86 ± 2.48	9.52 ± 2.89	9.99 ± 2.82
Black-throated Green Warbler	21.23 ± 3.86	20.95 ± 3.08	32.51 ± 4.27	31.81 ± 4.90	42.06 ± 5.24
Blue Jay	5.37 ± 2.09	NA	12.76 ± 3.95	14.01 ± 4.43	8.61 ± 3.47
Canada Warbler ^a	NA	12.55 ± 4.01	16.73 ± 5.20	NA	NA
Chipping Sparrow	NA	10.11 ± 2.80	NA	NA	NA
Common Yellowthroat	NA	11.57 ± 2.99	40.5 ± 8.70	35.22 ± 8.11	NA
Eastern Wood-Pewee	NA	NA	NA	5.96 ± 2.29	NA
Hermit Thrush	NA	NA	7.41 ± 1.8	6.56 ± 1.90	11.74 ± 3.26
Magnolia Warbler	NA	NA	NA	5.64 ± 2.13	7.04 ± 2.63
Nashville Warbler	24.15 ± 3.59	19.56 ± 3.20	30.70 ± 4.22	37.01 ± 5.32	22.98 ± 4.26
Northern Parula	NA	5.37 ± 1.80	7.52 ± 2.24	NA	11.41 ± 3.44
Ovenbird	33.66 ± 4.84	23.90 ± 3.20	42.92 ± 4.90	37.72 ± 5.34	49.96 ± 5.73
Red-breasted Nuthatch	NA	9.26 ± 2.57	12.87 ± 3.2	NA	10.35 ± 3.2
Red-eyed Vireo	25.71 ± 3.46	20.87 ± 3.11	38.58 ± 4.39	40.25 ± 5.04	51.68 ± 6.24
Song Sparrow	23.80 ± 5.43	12.73 ± 3.22	62.93 ± 10.62	51.92 ± 9.62	NA
Swainson's Thrush	NA	5.47 ± 1.87	NA	NA	NA
Veery ^a	NA	NA	6.71 ± 2.31	NA	NA
White-throated Sparrow	11.96 ± 3.82	7.99 ± 2.33	36.61 ± 8.15	26.86 ± 6.98	NA
Winter Wren	4.26 ± 1.35	NA	6.12 ± 1.64	NA	8.71 ± 2.33
Yellow-rumped Warbler	7.45 ± 2.01	9.43 ± 2.29	12.75 ± 2.74	7.67 ± 2.30	NA

^a Species of regional concern or continental importance (see Table 1).

Table C2. Annual mean density (birds/km²) and standard error for all landbird species with ≥10 detections at Grand Portage National Monument, 2014–2018. "NA" is shown for years in which there were too few detections to estimate density.

Species	2014	2015	2016	2017	2018
American Redstart	19.58 ± 4.18	19.58 ± 4.18	26.7 ± 4.89	25.81 ± 4.81	29.37 ± 5.13
American Robin	NA	NA	12.55 ± 3.62	NA	10.62 ± 3.31
Black-and-white Warbler ^a	14.22 ± 6.38	NA	21.53 ± 9.46	NA	NA
Blackburnian Warbler	9.17 ± 2.92	NA	NA	NA	9.17 ± 2.92
Black-throated Green Warbler	NA	9.53 ± 2.87	26.97 ± 4.85	31.39 ± 5.24	33.13 ± 5.38
Blue Jay	NA	NA	NA	NA	11.37 ± 4.47
Canada Warbler ^a	12.96 ± 3.35	NA	8.64 ± 2.73	NA	NA
Golden-crowned Kinglet	NA	NA	10.79 ± 3.16	10 ± 3.07	NA
Magnolia Warbler	18.66 ± 4.08	15.99 ± 3.78	15.99 ± 3.78	16.88 ± 3.88	23.1 ± 4.54
Nashville Warbler	19.10 ± 4.07	14.76 ± 3.58	29.52 ± 5.06	32.13 ± 5.28	39.95 ± 5.89
Northern Parula	15.77 ± 3.72	18.40 ± 4.02	14.89 ± 3.61	21.90 ± 4.38	22.78 ± 4.47
Ovenbird	20.73 ± 4.23	10.36 ± 2.99	32.82 ± 5.32	38.87 ± 5.79	33.68 ± 5.39
Red-breasted Nuthatch	NA	24.94 ± 5.88	15.18 ± 4.39	24.93 ± 5.88	17.34 ± 4.74
Red-eyed Vireo	12.13 ± 3.24	15.59 ± 3.68	30.32 ± 5.13	33.78 ± 5.41	25.12 ± 4.66
Swainson's Thrush	NA	NA	NA	9.66 ± 2.92	18.45 ± 4.03
Veery ^a	NA	NA	NA	14.33 ± 4.24	NA
White-throated Sparrow	NA	NA	13.39 ± 3.8	NA	NA
Winter Wren	NA	NA	NA	10.42 ± 3.01	NA

^a Species of regional concern or continental importance (see Table 1).

Table C3. Annual mean density (birds/km²) and standard error for all landbird species with ≥10 detections at Isle Royale National Park, 2014–2018. "NA" is shown for years in which there were too few detections to estimate density.

Species	2014	2015	2016	2017	2018
Alder Flycatcher	5.98 ± 1.83	10.00 ± 2.50	7.87 ± 2.09	6.61 ± 1.86	4.35 ± 1.42
American Crow	4.42 ± 1.52	NA	5.40 ± 1.72	5.03 ± 1.63	NA
American Redstart	6.86 ± 1.99	11.27 ± 2.66	11.37 ± 2.65	13.85 ± 3.04	12.04 ± 3.00
American Robin	13.56 ± 2.45	17.36 ± 2.75	23.19 ± 3.24	10.15 ± 2.02	7.19 ± 1.67
Black-and-white Warbler ^a	NA	5.30 ± 1.29	NA	3.02 ± 0.94	4.94 ± 1.23
Blackburnian Warbler	NA	NA	NA	3.84 ± 1.13	NA
Black-capped Chickadee	NA	9.36 ± 2.28	11.54 ± 2.58	10.47 ± 2.48	6.52 ± 1.76
Black-throated Blue Warbler	NA	NA	2.71 ± 0.92	NA	NA
Black-throated Green Warbler	11.13 ± 2.23	14.81 ± 2.23	13.82 ± 2.12	14.08 ± 2.15	18.35 ± 2.54
Blue Jay	9.89 ± 2.30	10.70 ± 2.34	14.36 ± 2.88	12.25 ± 2.54	8.32 ± 2.01
Brown Creeper	NA	5.50 ± 2.03	NA	NA	6.04 ± 2.17
Canada Warbler ^a	3.76 ± 1.41	NA	NA	NA	NA
Chestnut-sided Warbler	14.36 ± 3.27	19.12 ± 3.95	20.25 ± 4.05	12.92 ± 2.88	12.08 ± 2.89
Golden-crowned Kinglet	NA	8.88 ± 1.77	8.74 ± 1.74	10.31 ± 1.92	6.14 ± 1.41
Hermit Thrush	7.92 ± 1.88	11.21 ± 2.27	15.98 ± 2.83	10.17 ± 2.10	7.77 ± 1.77
Magnolia Warbler	16.43 ± 2.60	14.72 ± 2.06	10.25 ± 1.67	11.50 ± 1.78	11.25 ± 1.76
Mourning Warbler	NA	12.57 ± 3.50	8.33 ± 2.66	9.29 ± 2.84	5.25 ± 1.90
Nashville Warbler	50.95 ± 4.50	41.25 ± 3.38	45.82 ± 3.55	38.88 ± 3.24	40.37 ± 3.31
Northern Flicker ^a	NA	NA	7.81 ± 2.78	NA	NA
Ovenbird	27.95 ± 3.31	27.33 ± 2.75	22.96 ± 2.48	22.96 ± 2.48	23.46 ± 2.51
Red-breasted Nuthatch	5.56 ± 1.73	16.31 ± 3.25	20.16 ± 3.73	19.19 ± 3.63	20.44 ± 3.75
Red-eyed Vireo	10.59 ± 2.06	16.06 ± 2.21	17.29 ± 2.29	12.35 ± 1.88	18.52 ± 2.39
Swainson's Thrush	4.04 ± 1.38	7.83 ± 1.79	5.65 ± 1.43	5.91 ± 1.47	7.20 ± 1.67
White-throated Sparrow	28.37 ± 3.39	29.35 ± 3.34	38.22 ± 3.85	32.51 ± 3.51	27.14 ± 3.16
Winter Wren	25.65 ± 3.00	23.23 ± 2.41	19.19 ± 2.17	23.12 ± 2.39	15.74 ± 1.97
Yellow-bellied Flycatcher	NA	5.26 ± 1.50	3.95 ± 1.22	3.21 ± 1.06	2.96 ± 1.01
Yellow-rumped Warbler	8.87 ± 2.15	11.19 ± 2.37	6.18 ± 1.62	10.22 ± 2.21	6.88 ± 1.73

^a Species of regional concern or continental importance (see Table 1).

Table C4. Annual mean density (birds/km²) and standard error for all landbird species with ≥10 detections at Mississippi National River and Recreation Area, 2015–2018. Landbird surveys began in 2015 at MISS. "NA" is shown for years in which there were too few detections to estimate density.

Species	2015	2016	2017	2018
American Crow	NA	17.54 ± 6.62	15.75 ± 6.19	NA
American Goldfinch	37.06 ± 9.30	21.57 ± 6.23	23.89 ± 5.95	63.64 ± 20.21
American Redstart	24.42 ± 9.35	16.71 ± 5.03	26.77 ± 7.08	16.77 ± 5.75
American Robin	21.66 ± 4.31	36.65 ± 5.60	37.42 ± 5.44	33.87 ± 5.23
Baltimore Oriole	NA	NA	24.24 ± 7.46	NA
Black-capped Chickadee	44.81 ± 8.07	72.27 ± 11.79	53.41 ± 8.75	43.28 ± 7.40
Blue Jay	30.69 ± 7.65	25.98 ± 6.66	31.07 ± 7.97	21.65 ± 5.25
Brown-headed Cowbird	14.47 ± 4.08	17.34 ± 4.38	28.48 ± 5.94	16.16 ± 4.15
Common Yellowthroat	NA	NA	NA	9.36 ± 3.67
Downy Woodpecker	15.45 ± 4.18	18.52 ± 4.47	29.58 ± 5.86	20.72 ± 4.74
Eastern Wood-Pewee	13.00 ± 3.45	13.46 ± 3.37	18.21 ± 3.88	20.14 ± 4.14
Gray Catbird	NA	14.36 ± 5.40	11.00 ± 4.36	15.92 ± 5.81
Great Crested Flycatcher ^a	31.10 ± 8.53	20.90 ± 5.14	21.04 ± 4.83	30.18 ± 12.62
Hairy Woodpecker	13.07 ± 4.01	NA	NA	NA
House Wren	24.47 ± 4.33	20.25 ± 3.76	28.11 ± 4.34	23.92 ± 4.04
Indigo Bunting	9.36 ± 3.19	9.26 ± 3.03	8.88 ± 2.88	15.34 ± 4.19
Northern Cardinal	21.48 ± 4.91	22.88 ± 4.89	33.67 ± 6.12	11.20 ± 3.19
Red-bellied Woodpecker	11.35 ± 3.67	NA	18.34 ± 4.73	12.48 ± 3.70
Red-eyed Vireo	10.99 ± 2.95	12.91 ± 3.05	14.43 ± 3.16	10.53 ± 2.73
Song Sparrow	23.91 ± 5.28	25.35 ± 5.25	26.32 ± 5.27	13.10 ± 3.40
White-breasted Nuthatch	20.42 ± 4.15	29.54 ± 6.02	22.24 ± 5.37	14.32 ± 3.37

^a Species of regional concern or continental importance (see Table 1).

Table C5. Annual mean density (birds/km²) and standard error for all landbird species with ≥10 detections at Pictured Rocks National Lakeshore, 2014–2018. "NA" is shown for years in which there were too few detections to estimate density.

Species	2014	2015	2016	2017	2018
American Redstart	33.62 ± 5.09	19.23 ± 3.45	27.29 ± 4.12	27.91 ± 4.16	27.29 ± 4.12
American Robin	31.42 ± 5.33	12.45 ± 2.79	12.45 ± 2.79	13.07 ± 2.86	14.32 ± 2.99
Black-capped Chickadee	12.77 ± 4.09	11.29 ± 3.59	16.13 ± 4.56	12.10 ± 3.76	8.87 ± 3.08
Black-throated Blue Warbler	13.85 ± 3.10	6.13 ± 1.94	7.96 ± 2.21	6.74 ± 2.03	9.19 ± 2.37
Black-throated Green Warbler	37.35 ± 5.39	15.32 ± 3.06	9.19 ± 2.37	14.09 ± 2.94	15.93 ± 3.12
Cedar Waxwing	13.17 ± 5.10	16.02 ± 5.63	NA	15.29 ± 5.42	NA
Chipping Sparrow	18.90 ± 7.26	NA	NA	NA	NA
Eastern Wood-Pewee	12.40 ± 3.60	NA	NA	NA	NA
Hermit Thrush	18.90 ± 6.14	NA	NA	NA	NA
Least Flycatcher ^a	20.21 ± 7.78	11.63 ± 4.55	13.47 ± 5.15	10.41 ± 4.15	13.47 ± 5.15
Nashville Warbler	17.55 ± 4.55	NA	12.86 ± 3.36	6.74 ± 2.25	9.19 ± 2.71
Ovenbird	36.49 ± 5.17	24.49 ± 3.87	20.81 ± 3.57	21.43 ± 3.62	20.81 ± 3.57
Red-breasted Nuthatch	9.92 ± 3.26	NA	17.87 ± 3.97	9.51 ± 2.70	9.94 ± 2.83
Red-eyed Vireo	52.32 ± 6.05	23.87 ± 3.82	26.94 ± 4.06	25.71 ± 3.97	23.26 ± 3.77
Rose-breasted Grosbeak	13.04 ± 3.14	NA	9.19 ± 2.37	NA	6.74 ± 2.03
Swainson's Thrush	14.83 ± 3.46	6.74 ± 2.03	NA	7.96 ± 2.21	6.13 ± 1.94
Veery ^a	NA	6.33 ± 2.01	NA	NA	8.23 ± 2.29
White-throated Sparrow	7.62 ± 2.73	NA	NA	NA	NA
Yellow-bellied Sapsucker	NA	7.20 ± 2.39	7.92 ± 2.52	9.36 ± 2.77	NA
Yellow-rumped Warbler	NA	7.44 ± 2.30	7.45 ± 2.30	NA	NA

^a Species of regional concern or continental importance (see Table 1).

Table C6. Mean density (birds/km²) and standard error for all species with ≥10 detections on six transects at St. Croix National Scenic Riverway (Middle St. Croix, St. Croix North, and Upper Namekagon transects sampled in 2014, 2016, and 2018; Lower Namekagon, Lower St. Croix, and Upper St. Croix transects sampled in 2015 and 2017). "NA" is shown for years in which there were too few detections to estimate density.

Species	Mean Density (± SE)
Alder Flycatcher	2.93 ± 0.43
American Redstart	20.61 ± 1.26
American Robin	9.87 ± 0.86
Baltimore Oriole	5.97 ± 0.61
Black-and-white Warbler ^a	12.60 ± 2.41
Black-capped Chickadee	4.10 ± 0.91
Blue Jay	10.58 ± 1.83
Brown-headed Cowbird	8.38 ± 2.60
Canada Warbler ^a	3.73 ± 0.54
Cedar Waxwing	7.24 ± 1.67
Chestnut-sided Warbler	11.70 ± 0.97
Common Grackle ^a	3.61 ± 1.64
Common Yellowthroat	18.45 ± 0.94
Eastern Kingbird ^a	7.05 ± 1.70
Eastern Wood-Pewee	5.67 ± 0.69
Golden-winged Warbler ^a	5.11 ± 1.09
Gray Catbird	16.94 ± 1.79
Great Crested Flycatcher ^a	5.03 ± 0.74
House Wren	2.11 ± 0.75
Least Flycatcher ^a	4.24 ± 0.54
Mourning Warbler	2.64 ± 0.84
Nashville Warbler	3.08 ± 0.67
Northern Flicker ^a	5.91 ± 2.03
Northern Waterthrush	4.83 ± 1.41
Ovenbird	12.13 ± 1.11

^a Species of regional concern or continental importance (see Table 1).

Table C6 (continued). Mean density (birds/km²) and standard error for all species with ≥10 detections on six transects at St. Croix National Scenic Riverway (Middle St. Croix, St. Croix North, and Upper Namekagon transects sampled in 2014, 2016, and 2018; Lower Namekagon, Lower St. Croix, and Upper St. Croix transects sampled in 2015 and 2017). "NA" is shown for years in which there were too few detections to estimate density.

Species	Mean Density (± SE)
Pileated Woodpecker	0.77 ± 0.23
Pine Warbler	2.68 ± 0.57
Prothonotary Warbler ^a	3.60 ± 0.65
Red-bellied Woodpecker	6.18 ± 1.43
Red-breasted Nuthatch	2.79 ± 0.43
Red-eyed Vireo	32.91 ± 1.22
Red-winged Blackbird	6.98 ± 0.85
Rose-breasted Grosbeak	8.78 ± 1.58
Scarlet Tanager ^a	2.47 ± 0.43
Song Sparrow	36.40 ± 1.29
Swamp Sparrow	3.77 ± 0.53
Tree Swallow ^a	6.23 ± 2.22
Veery ^a	18.38 ± 1.40
Warbling Vireo	7.99 ± 1.53
White-breasted Nuthatch	6.99 ± 4.36
White-throated Sparrow	4.55 ± 0.80
Wood Thrush ^a	3.03 ± 0.47
Yellow Warbler	17.94 ± 1.41
Yellow-rumped Warbler	1.80 ± 0.45
Yellow-throated Vireo	5.24 ± 0.67

^a Species of regional concern or continental importance (see Table 1).

Table C7. Annual mean density (birds/km²) and standard error for all species with ≥10 detections on the Middle St. Croix, St. Croix North, and Upper Namekagon transects at St. Croix National Scenic Riverway, 2014, 2016, 2018. "NA" is shown for years in which there were too few detections to estimate density.

Species	2014	2016	2018
Alder Flycatcher	3.25 ± 0.97	2.62 ± 0.85	NA
American Redstart	16.57 ± 2.15	15.26 ± 2.06	15.26 ± 2.02
American Robin	7.68 ± 1.42	12.44 ± 1.84	6.82 ± 1.44
Baltimore Oriole	4.07 ± 1.00	6.02 ± 1.23	NA
Black-and-white Warbler ^a	NA	3.89 ± 1.13	3.40 ± 1.09
Black-capped Chickadee	NA	3.85 ± 1.35	5.60 ± 1.82
Blue Jay	8.27 ± 1.88	14.57 ± 2.77	NA
Blue-gray Gnatcatcher	NA	NA	NA
Brown-headed Cowbird	NA	8.04 ± 3.84	NA
Canada Warbler ^a	3.68 ± 1.06	3.46 ± 1.02	NA
Cedar Waxwing	NA	11.95 ± 4.32	7.85 ± 3.17
Chestnut-sided Warbler	12.90 ± 1.97	17.96 ± 2.41	7.77 ± 1.55
Common Yellowthroat	16.33 ± 1.93	22.52 ± 2.29	12.93 ± 1.76
Eastern Kingbird ^a	NA	NA	NA
Eastern Wood-Pewee	4.21 ± 0.97	6.70 ± 1.23	NA
Golden-winged Warbler ^a	NA	NA	NA
Gray Catbird	16.16 ± 3.33	16.57 ± 3.40	6.99 ± 1.77
Great Crested Flycatcher ^a	6.93 ± 1.48	3.24 ± 0.96	NA
Hairy Woodpecker	12.82 ± 12.28	10.97 ± 10.56	NA
Least Flycatcher ^a	4.17 ± 1.10	5.18 ± 1.32	4.11 ± 1.20
Mourning Warbler	NA	NA	NA
Nashville Warbler	NA	NA	2.53 ± 0.85
Northern Flicker ^a	NA	NA	NA
Northern Waterthrush	NA	NA	NA
Ovenbird	10.54 ± 1.57	15.46 ± 1.92	6.93 ± 1.34
Pine Warbler	NA	NA	NA

^a Species of regional concern or continental importance (see Table 1).

Table C7 (continued). Annual mean density (birds/km²) and standard error for all species with ≥10 detections on the Middle St. Croix, St. Croix North, and Upper Namekagon transects at St. Croix National Scenic Riverway, 2014, 2016, 2018. "NA" is shown for years in which there were too few detections to estimate density.

Species	2014	2016	2018
Red-bellied Woodpecker	3.76 ± 1.26	NA	NA
Red-breasted Nuthatch	NA	3.89 ± 1.11	4.07 ± 1.21
Red-eyed Vireo	40.62 ± 2.97	45.03 ± 3.13	12.34 ± 1.73
Red-winged Blackbird	11.97 ± 4.09	10.72 ± 3.71	3.37 ± 1.07
Rose-breasted Grosbeak	6.72 ± 1.54	12.76 ± 2.28	NA
Scarlet Tanager ^a	2.44 ± 0.74	2.24 ± 0.71	NA
Song Sparrow	38.35 ± 2.90	42.77 ± 3.07	21.71 ± 2.30
Swamp Sparrow	2.24 ± 0.81	3.15 ± 1.00	4.00 ± 1.24
Tree Swallow ^a	NA	NA	NA
Veery ^a	17.49 ± 2.04	23.86 ± 2.40	8.50 ± 1.49
Warbling Vireo	NA	NA	NA
White-breasted Nuthatch	5.47 ± 2.02	7.76 ± 2.66	NA
White-throated Sparrow	6.53 ± 1.83	6.92 ± 1.85	4.06 ± 1.40
Wood Thrush ^a	4.79 ± 1.12	6.13 ± 1.30	NA
Yellow Warbler	20.30 ± 2.57	18.05 ± 2.50	3.10 ± 0.96
Yellow-rumped Warbler	NA	NA	3.93 ± 1.30
Yellow-throated Vireo	7.08 ± 1.59	6.20 ± 1.48	NA

^a Species of regional concern or continental importance (see Table 1).

Table C8. Annual mean density (birds/km²) and standard error for all landbird species with ≥10 detections on the Lower Namekagon, Lower St. Croix, and Upper St. Croix transects at St. Croix National Scenic Riverway, 2015 and 2017. "NA" is shown for years in which there were too few detections to estimate density.

Species	2015	2017
Alder Flycatcher	5.20 ± 1.31	NA
American Redstart	34.00 ± 3.03	17.69 ± 2.15
American Robin	12.44 ± 1.85	9.29 ± 1.66
Baltimore Oriole	10.28 ± 1.64	6.76 ± 1.36
Black-and-white Warbler ^a	13.52 ± 2.47	5.10 ± 1.37
Black-capped Chickadee	6.77 ± 2.02	NA
Blue Jay	8.56 ± 1.92	4.81 ± 1.38
Blue-gray Gnatcatcher	9.34 ± 4.93	NA
Brown-headed Cowbird	15.88 ± 7.81	NA
Canada Warbler ^a	5.40 ± 1.34	3.47 ± 1.06
Cedar Waxwing	7.00 ± 2.55	7.85 ± 3.03
Chestnut-sided Warbler	11.40 ± 1.83	7.81 ± 1.54
Common Yellowthroat	28.54 ± 3.59	14.42 ± 1.83
Eastern Kingbird ^a	7.87 ± 1.83	4.28 ± 1.26
Eastern Wood-Pewee	5.99 ± 1.16	NA
Golden-winged Warbler ^a	5.49 ± 1.15	2.49 ± 0.80
Gray Catbird	17.83 ± 2.15	8.56 ± 2.01
Great Crested Flycatcher ^a	6.03 ± 1.14	4.91 ± 1.22
Hairy Woodpecker	8.97 ± 8.70	NA
Least Flycatcher ^a	5.69 ± 1.36	NA
Mourning Warbler	3.13 ± 1.05	NA
Nashville Warbler	196.94 ± 770.36	NA
Northern Flicker ^a	7.11 ± 2.25	NA
Northern Waterthrush	5.05 ± 1.44	4.27 ± 2.57
Ovenbird	11.92 ± 1.67	4.48 ± 1.06

^a Species of regional concern or continental importance (see Table 1).

Table C8 (continued). Annual mean density (birds/km²) and standard error for all landbird species with ≥ 10 detections on the Lower Namekagon, Lower St. Croix, and Upper St. Croix transects at St. Croix National Scenic Riverway, 2015 and 2017. "NA" is shown for years in which there were too few detections to estimate density.

Species	2015	2017
Pine Warbler	3.83 $\pm$ 1.13	NA
Red-bellied Woodpecker	10.00 $\pm$ 2.51	NA
Red-breasted Nuthatch	NA	NA
Red-eyed Vireo	43.43 $\pm$ 3.07	19.96 $\pm$ 2.17
Red-winged Blackbird	6.37 $\pm$ 1.59	6.78 $\pm$ 1.71
Rose-breasted Grosbeak	8.75 $\pm$ 1.77	3.81 $\pm$ 1.14
Scarlet Tanager ^a	2.89 $\pm$ 0.81	NA
Song Sparrow	41.83 $\pm$ 3.02	35.76 $\pm$ 2.91
Swamp Sparrow	4.92 $\pm$ 1.35	4.62 $\pm$ 1.35
Tree Swallow ^a	4.97 $\pm$ 1.98	12.52 $\pm$ 4.81
Veery ^a	14.96 $\pm$ 1.88	8.00 $\pm$ 1.42
Warbling Vireo	8.18 $\pm$ 1.52	2.40 $\pm$ 0.79
White-breasted Nuthatch	8.66 $\pm$ 3.20	NA
White-throated Sparrow	NA	NA
Wood Thrush ^a	NA	NA
Yellow Warbler	18.81 $\pm$ 2.48	NA
Yellow-rumped Warbler	NA	NA
Yellow-throated Vireo	6.61 $\pm$ 1.61	NA

^a Species of regional concern or continental importance (see Table 1).

Table C9. Annual mean density (birds/km²) and standard error for all landbird species with ≥10 detections at Sleeping Bear Dunes National Lakeshore, 2014–2018. "NA" is shown for years in which there were too few detections to estimate density.

Species	2014	2015	2016	2017	2018
American Goldfinch	NA	NA	NA	NA	16.58 ± 6.55
American Redstart	11.96 ± 3.24	24.83 ± 4.90	30.57 ± 5.80	28.80 ± 5.42	32.81 ± 5.91
American Robin	21.48 ± 4.46	32.32 ± 5.53	32.37 ± 6.00	32.72 ± 5.71	29.23 ± 5.57
Baltimore Oriole	NA	11.15 ± 4.56	12.58 ± 5.00	NA	NA
Black-capped Chickadee	NA	16.98 ± 6.11	30.17 ± 9.62	25.53 ± 8.42	14.72 ± 5.50
Cedar Waxwing	NA	NA	26.03 ± 10.19	11.57 ± 5.17	15.05 ± 6.32
Chipping Sparrow	16.31 ± 4.19	19.92 ± 4.76	19.49 ± 5.00	20.59 ± 4.94	28.02 ± 6.30
Common Grackle ^a	NA	50.91 ± 29.98	59.91 ± 35.40	NA	124.56 ± 69.34
Common Yellowthroat	NA	12.87 ± 4.03	14.02 ± 4.32	8.25 ± 3.04	16.09 ± 4.70
Eastern Kingbird ^a	NA	14.00 ± 6.13	NA	NA	NA
Eastern Meadowlark ^a	NA	NA	9.09 ± 6.12	NA	NA
Eastern Wood-Pewee	NA	12.05 ± 3.12	11.53 ± 3.09	9.88 ± 2.86	9.64 ± 2.79
Gray Catbird	NA	NA	NA	NA	14.93 ± 10.06
Indigo Bunting	NA	14.29 ± 3.52	14.64 ± 3.61	NA	10.92 ± 3.07
Mourning Dove	NA	13.21 ± 3.34	8.46 ± 2.69	11.00 ± 3.08	11.56 ± 3.12
Nashville Warbler	NA	9.56 ± 3.50	NA	NA	NA
Ovenbird	NA	28.37 ± 6.43	20.20 ± 5.12	18.58 ± 4.84	18.13 ± 4.70
Pine Warbler	NA	NA	16.53 ± 5.35	17.29 ± 5.31	20.43 ± 5.87
Red-eyed Vireo	12.11 ± 3.13	56.41 ± 6.77	56.33 ± 7.01	51.15 ± 6.52	58.58 ± 6.88
Red-winged Blackbird	NA	32.75 ± 12.57	49.21 ± 18.29	31.59 ± 11.54	45.33 ± 16.87
Rose-breasted Grosbeak	NA	10.03 ± 2.93	13.71 ± 3.48	12.85 ± 3.36	NA
Scarlet Tanager ^a	NA	8.18 ± 2.61	NA	NA	NA
Song Sparrow	13.25 ± 3.21	23.66 ± 4.69	18.86 ± 4.21	25.15 ± 4.90	29.79 ± 5.30
Yellow Warbler	NA	11.18 ± 4.63	12.5 ± 5.08	12.5 ± 5.08	NA

^a Species of regional concern or continental importance (see Table 1).

Table C10. Annual mean density (birds/km²) and standard error for all landbird species with ≥10 detections at Voyageurs National Park, 2014–2018. "NA" is shown for years in which there were too few detections to estimate density.

Species	2014	2015	2016	2017	2018
American Crow	NA	NA	10.30 ± 5.39	NA	NA
American Redstart	NA	11.45 ± 4.19	NA	NA	NA
American Robin	10.86 ± 3.21	17.95 ± 4.54	25.36 ± 5.73	7.34 ± 2.50	12.68 ± 3.53
Black-and-white Warbler ^a	13.60 ± 3.17	11.86 ± 2.96	9.55 ± 2.59	8.91 ± 2.49	9.55 ± 2.59
Blackburnian Warbler	10.72 ± 2.51	NA	23.50 ± 8.76	12.26 ± 5.18	NA
Black-capped Chickadee	NA	NA	14.21 ± 6.05	NA	15.05 ± 6.32
Black-throated Green Warbler	9.00 ± 2.97	16.74 ± 7.77	12.81 ± 4.98	14.52 ± 5.50	13.67 ± 5.24
Blue Jay	NA	17.00 ± 8.09	54.01 ± 22.65	57.54 ± 24.04	27.01 ± 12.00
Chestnut-sided Warbler	9.25 ± 2.62	6.89 ± 2.60	9.72 ± 4.17	11.36 ± 4.73	NA
Chipping Sparrow	9.17 ± 3.33	10.76 ± 3.76	11.09 ± 3.79	NA	NA
Eastern Wood-Pewee	6.94 ± 2.63	NA	6.67 ± 2.25	7.83 ± 2.47	8.58 ± 2.67
Golden-crowned Kinglet	NA	NA	NA	NA	18.63 ± 13.59
Hermit Thrush	7.84 ± 2.33	6.83 ± 2.17	9.91 ± 2.67	9.91 ± 2.67	9.36 ± 2.58
Least Flycatcher ^a	8.29 ± 2.78	10.24 ± 3.25	12.81 ± 3.75	16.30 ± 4.50	6.40 ± 2.32
Magnolia Warbler	NA	NA	NA	NA	8.87 ± 5.06
Nashville Warbler	40.90 ± 4.86	44.81 ± 5.06	51.57 ± 6.44	52.22 ± 6.49	32.87 ± 4.95
Ovenbird	40.34 ± 4.75	32.55 ± 4.28	53.62 ± 5.62	48.48 ± 5.33	40.50 ± 4.86
Red-breasted Nuthatch	17.14 ± 5.43	47.35 ± 12.17	43.62 ± 8.52	17.91 ± 4.52	21.81 ± 5.16
Red-eyed Vireo	22.43 ± 3.68	36.43 ± 4.61	41.30 ± 4.88	42.99 ± 5.12	26.22 ± 3.89
Ruby-crowned Kinglet	NA	NA	7.16 ± 3.21	NA	NA
Veery ^a	NA	8.12 ± 2.61	8.98 ± 2.74	6.73 ± 2.27	10.10 ± 2.97
White-throated Sparrow	35.25 ± 4.50	24.66 ± 3.95	35.98 ± 5.20	25.88 ± 4.31	34.72 ± 5.09
Winter Wren	12.19 ± 3.67	6.95 ± 2.14	6.73 ± 2.25	11.82 ± 3.32	11.18 ± 2.76
Yellow-rumped Warbler	NA	10.69 ± 2.78	21.93 ± 4.09	18.06 ± 3.66	24.53 ± 4.37

^a Species of regional concern or continental importance (see Table 1).

Appendix D. Total number of detections for all species across all years (2014–2018) within each park.

Table D1. Total number of detections for all species across all years (2014–2018) within each park (excluding Indiana Dunes National Park). Species that did not have at least one year with ≥ 10 detections appear in this table, but not in the analyses.

Species	APIS	GRPO	ISRO	MISS	PIRO	SACN	SLBE	VOYA
Acadian Flycatcher	–	–	–	3	–	2	–	–
Alder Flycatcher	36	29	110	1	24	79	13	6
American Crow	78	44	115	101	38	300	207	167
American Goldfinch	9	1	4	143	34	105	65	9
American Redstart	194	129	145	92	241	459	147	11
American Robin	113	85	222	195	163	300	189	122
Baltimore Oriole	1	1	–	63	–	181	40	–
Bank Swallow	–	–	–	2	1	12	11	–
Barn Swallow	–	–	–	7	–	2	11	–
Belted Kingfisher	6	1	2	1	4	37	12	–
Black-and-white Warbler	81	43	61	–	34	108	9	85
Black-backed Woodpecker	–	–	–	–	–	–	–	1
Black-billed Cuckoo	–	1	–	–	11	12	5	–
Blackburnian Warbler	23	42	39	1	36	6	5	73
Black-capped Chickadee	37	44	117	193	68	84	81	52
Blackpoll Warbler	1	–	–	–	–	–	–	–
Black-throated Blue Warbler	56	2	34	–	96	–	7	–
Black-throated Green Warbler	301	166	291	–	233	6	37	85
Blue Jay	111	61	177	166	48	266	99	181
Blue-gray Gnatcatcher	–	–	–	27	–	30	–	–
Blue-headed Vireo	1	2	5	–	20	14	4	7
Blue-winged Teal	–	–	–	–	–	–	1	–
Blue-winged Warbler	–	–	–	–	–	5	–	–
Bobolink	–	–	–	1	5	–	19	–
Brewer's Blackbird	–	–	–	3	–	4	–	–
Brown Creeper	27	22	45	2	35	7	5	10

Species	APIS	GRPO	ISRO	MISS	PIRO	SACN	SLBE	VOYA
Brown Thrasher	–	–	–	8	1	5	41	–
Brown-headed Cowbird	–	–	–	99	1	88	18	–
Canada Warbler	45	57	30	–	9	83	6	33
Cape May Warbler	4	–	24	–	1	5	–	4
Cedar Waxwing	19	14	38	26	79	97	83	12
Chestnut-sided Warbler	26	23	197	–	43	275	7	53
Chimney Swift	18	11	7	13	6	6	4	4
Chipping Sparrow	49	14	14	9	71	28	122	68
Clay-colored Sparrow	3	–	–	20	11	2	2	–
Cliff Swallow	–	–	–	7	–	9	–	–
Common Grackle	7	1	16	22	5	65	76	7
Common Nighthawk	–	–	–	–	1	1	1	–
Common Raven	8	27	27	1	26	46	23	16
Common Yellowthroat	87	20	18	46	33	565	85	28
Dark-eyed Junco	–	–	–	–	9	–	–	3
Dickcissel	–	–	–	12	–	–	–	–
Downy Woodpecker	12	4	25	105	7	39	8	4
Eastern Bluebird	2	–	–	15	7	2	10	–
Eastern Kingbird	1	–	–	7	1	60	52	–
Eastern Meadowlark	–	–	–	9	1	–	66	–
Eastern Phoebe	13	3	–	11	–	47	9	4
Eastern Towhee	1	–	–	19	1	5	31	–
Eastern Whip-poor-will	–	–	–	–	–	1	–	–
Eastern Wood-Pewee	31	2	4	128	56	191	73	75
European Starling	–	–	–	7	–	5	24	–
Evening Grosbeak	1	1	2	–	2	–	–	–
Field Sparrow	–	–	–	22	–	–	23	–
Golden-crowned Kinglet	2	36	123	–	11	–	–	19
Golden-winged Warbler	1	–	–	–	–	53	–	–
Grasshopper Sparrow	–	–	–	16	–	–	21	–
Gray Catbird	–	2	–	58	1	277	37	–

Species	APIS	GRPO	ISRO	MISS	PIRO	SACN	SLBE	VOYA
Gray Jay	–	3	12	–	–	–	–	9
Great Crested Flycatcher	6	–	–	92	6	207	52	6
Hairy Woodpecker	12	11	27	33	23	75	34	10
Henslow's Sparrow	–	–	–	5	–	–	2	–
Hermit Thrush	80	15	184	–	87	11	30	136
House Finch	–	–	–	11	–	–	4	–
House Sparrow	–	–	–	1	–	–	–	–
House Wren	–	–	–	142	–	28	21	–
Indigo Bunting	3	–	1	79	30	17	77	–
Le Conte's Sparrow	1	1	–	2	–	–	–	–
Least Flycatcher	27	4	13	14	98	105	18	95
Lincoln's Sparrow	8	1	–	1	–	–	–	–
Louisiana Waterthrush	–	–	–	–	–	12	–	–
Magnolia Warbler	41	112	240	–	22	1	1	32
Marsh Wren	–	–	–	–	–	–	1	–
Mourning Dove	1	–	–	13	6	77	62	–
Mourning Warbler	10	47	72	–	24	29	1	15
Nashville Warbler	299	174	732	4	144	71	24	368
Northern Cardinal	–	–	–	156	–	16	13	–
Northern Flicker	17	18	42	13	17	71	27	28
Northern Parula	62	120	19	–	44	18	1	49
Northern Rough-winged Swallow	–	–	–	1	–	53	1	–
Northern Waterthrush	1	2	9	–	7	72	4	–
Olive-sided Flycatcher	1	–	4	–	–	–	–	–
Orange-crowned Warbler	1	–	–	–	–	–	–	–
Orchard Oriole	–	–	–	1	–	1	–	–
Ovenbird	401	269	495	10	314	344	146	443
Palm Warbler	5	–	–	–	–	2	–	5
Philadelphia Vireo	–	–	2	–	–	–	–	–
Pileated Woodpecker	25	23	33	27	26	78	26	36
Pine Siskin	9	–	10	–	27	–	1	–

Species	APIS	GRPO	ISRO	MISS	PIRO	SACN	SLBE	VOYA
Pine Warbler	22	–	–	–	37	51	74	47
Prairie Warbler	–	–	–	–	–	–	2	–
Prothonotary Warbler	–	–	–	–	–	81	–	–
Purple Finch	1	4	8	–	17	8	9	5
Red Crossbill	5	–	5	–	14	–	–	–
Red-bellied Woodpecker	–	–	–	76	–	160	18	1
Red-breasted Nuthatch	80	104	196	3	69	64	18	192
Red-eyed Vireo	426	261	372	79	370	952	304	311
Red-headed Woodpecker	–	–	–	2	–	1	–	–
Red-winged Blackbird	17	3	5	40	11	225	135	26
Ring-necked Pheasant	–	–	–	7	–	20	–	–
Rock Pigeon	–	–	–	3	–	2	2	–
Rose-breasted Grosbeak	30	12	3	29	90	232	68	12
Ruby-crowned Kinglet	–	4	13	–	–	–	–	34
Ruby-throated Hummingbird	5	13	1	12	8	21	5	5
Ruffed Grouse	1	9	–	–	25	1	6	14
Savannah Sparrow	8	–	–	5	14	–	3	–
Scarlet Tanager	16	–	1	18	29	94	54	11
Sedge Wren	1	6	2	2	–	–	–	1
Song Sparrow	107	25	28	134	30	1,007	152	8
Swainson's Thrush	38	108	141	–	86	–	2	7
Swamp Sparrow	13	16	26	2	15	108	20	13
Tennessee Warbler	1	1	9	–	–	–	–	–
Tree Swallow	2	–	–	48	1	170	22	–
Tufted Titmouse	–	–	–	–	–	–	3	–
Upland Sandpiper	–	–	–	–	–	–	5	–
Veery	50	81	41	–	56	467	17	94
Vesper Sparrow	–	–	–	10	6	–	21	–
Warbling Vireo	–	–	1	19	–	88	26	–
White-breasted Nuthatch	7	–	1	101	4	79	4	4
White-crowned Sparrow	–	–	–	–	–	–	–	1

Species	APIS	GRPO	ISRO	MISS	PIRO	SACN	SLBE	VOYA
White-throated Sparrow	77	137	542	–	64	110	10	310
White-winged Crossbill	2	–	1	–	4	–	–	–
Wild Turkey	–	–	–	4	–	13	11	–
Willow Flycatcher	–	–	1	8	–	–	–	–
Wilson's Snipe	1	1	44	–	–	–	–	–
Wilson's Warbler	3	1	–	–	–	–	–	3
Winter Wren	62	100	498	–	31	25	16	93
Wood Thrush	–	–	–	2	9	114	35	–
Yellow Warbler	14	7	–	62	2	307	46	10
Yellow-bellied Flycatcher	10	17	66	–	4	3	–	–
Yellow-bellied Sapsucker	41	50	13	–	116	48	18	36
Yellow-billed Cuckoo	–	–	–	1	–	12	8	–
Yellow-headed Blackbird	–	–	–	–	–	1	–	–
Yellow-rumped Warbler	93	26	121	–	75	43	23	131
Yellow-throated Vireo	–	–	–	10	–	129	14	–

Appendix E. List of common names, four-letter codes, and scientific names of species detected at Great Lakes Network parks (including Indiana Dunes National Park), 2014–2018.

Table E1. List of common names, four-letter codes, and scientific names of species detected at Great Lakes Network parks (including Indiana Dunes National Park), 2014–2018. Four-letter species codes (“AOU Code”) are standardized by the American Ornithologist’s Union (Pyle and DeSante 2019). “Non-target species” are those that are often detected during point count surveys, but they are not songbirds and so are not appropriately monitored using the point count method; other methods exist for monitoring for those species.

Common Name	AOU Code	Scientific Name	Non-Target Species
Acadian Flycatcher	ACFL	<i>Empidonax virescens</i>	–
Alder Flycatcher	ALFL	<i>Empidonax alnorum</i>	–
American Bittern	AMBI	<i>Botaurus lentiginosus</i>	x
American Coot	AMCO	<i>Fulica americana</i>	x
American Crow	AMCR	<i>Corvus brachyrhynchos</i>	–
American Goldfinch	AMGO	<i>Spinus tristis</i>	–
American Redstart	AMRE	<i>Setophaga ruticilla</i>	–
American Robin	AMRO	<i>Turdus migratorius</i>	–
Bald Eagle	BAEA	<i>Haliaeetus leucocephalus</i>	x
Baltimore Oriole	BAOR	<i>Icterus galbula</i>	–
Bank Swallow	BANS	<i>Riparia riparia</i>	–
Barn Swallow	BARS	<i>Hirundo rustica</i>	–
Barred Owl	BADO	<i>Strix varia</i>	x
Belted Kingfisher	BEKI	<i>Megaceryle alcyon</i>	x
Black-and-white Warbler	BAWW	<i>Mniotilta varia</i>	–
Black-backed Woodpecker	BBWO	<i>Picoides arcticus</i>	–
Black-billed Cuckoo	BBCU	<i>Coccyzus erythrophthalmus</i>	–
Blackburnian Warbler	BLBW	<i>Setophaga fusca</i>	–
Black-capped Chickadee	BCCH	<i>Poecile atricapillus</i>	–
Blackpoll Warbler	BLPW	<i>Setophaga striata</i>	–
Black-throated Blue Warbler	BTBW	<i>Setophaga caerulescens</i>	–
Black-throated Green Warbler	BTNW	<i>Setophaga virens</i>	–

Common Name	AOU Code	Scientific Name	Non-Target Species
Blue Jay	BLJA	<i>Cyanocitta cristata</i>	—
Blue-gray Gnatcatcher	BGGN	<i>Polioptila caerulea</i>	—
Blue-headed Vireo	BHVI	<i>Vireo solitarius</i>	—
Blue-winged Teal	BWTE	<i>Anas discors</i>	x
Blue-winged Warbler	BWWA	<i>Vermivora cyanoptera</i>	—
Bobolink	BOBO	<i>Dolichonyx oryzivorus</i>	—
Brewer's Blackbird	BRBL	<i>Euphagus cyanocephalus</i>	—
Broad-winged Hawk	BWHA	<i>Buteo platypterus</i>	x
Brown Creeper	BRCR	<i>Certhia americana</i>	—
Brown Thrasher	BRTH	<i>Toxostoma rufum</i>	—
Brown-headed Cowbird	BHCO	<i>Molothrus ater</i>	—
Canada Goose	CANG	<i>Branta canadensis</i>	x
Canada Warbler	CAWA	<i>Cardellina canadensis</i>	—
Cape May Warbler	CMWA	<i>Setophaga tigrina</i>	—
Caspian Tern	CATE	<i>Hydroprogne caspia</i>	x
Cedar Waxwing	CEDW	<i>Bombycilla cedrorum</i>	—
Chestnut-sided Warbler	CSWA	<i>Setophaga pensylvanica</i>	—
Chimney Swift	CHSW	<i>Chaetura pelagica</i>	—
Chipping Sparrow	CHSP	<i>Spizella passerina</i>	—
Clay-colored Sparrow	CCSP	<i>Spizella pallida</i>	—
Cliff Swallow	CLSW	<i>Petrochelidon pyrrhonota</i>	—
Common Goldeneye	COGO	<i>Bucephala clangula</i>	x
Common Grackle	COGR	<i>Quiscalus quiscula</i>	—
Common Loon	COLO	<i>Gavia immer</i>	x
Common Merganser	COME	<i>Mergus merganser</i>	x
Common Nighthawk	CONI	<i>Chordeiles minor</i>	—
Common Raven	CORA	<i>Corvus corax</i>	—
Common Yellowthroat	COYE	<i>Geothlypis trichas</i>	—
Cooper's Hawk	COHA	<i>Accipiter cooperii</i>	x
Dark-eyed Junco	DEJU	<i>Junco hyemalis</i>	—
Dickcissel	DICK	<i>Spiza americana</i>	—

Common Name	AOU Code	Scientific Name	Non-Target Species
Double-crested Cormorant	DCCO	<i>Phalacrocorax auritus</i>	x
Downy Woodpecker	DOWO	<i>Picoides pubescens</i>	—
Eastern Bluebird	EABL	<i>Sialia sialis</i>	—
Eastern Kingbird	EAKI	<i>Tyrannus tyrannus</i>	—
Eastern Meadowlark	EAME	<i>Sturnella magna</i>	—
Eastern Phoebe	EAPH	<i>Sayornis phoebe</i>	—
Eastern Towhee	EATO	<i>Pipilo erythrophthalmus</i>	—
Eastern Whip-poor-will	EWPW	<i>Antrostomus vociferus</i>	—
Eastern Wood-Pewee	EAWP	<i>Contopus virens</i>	—
European Starling	EUST	<i>Sturnus vulgaris</i>	—
Evening Grosbeak	EVGR	<i>Coccothraustes vespertinus</i>	—
Field Sparrow	FISP	<i>Spizella pusilla</i>	—
Golden-crowned Kinglet	GCKI	<i>Regulus satrapa</i>	—
Golden-winged Warbler	GWWA	<i>Vermivora chrysoptera</i>	—
Grasshopper Sparrow	GRSP	<i>Ammodramus savannarum</i>	—
Gray Catbird	GRCA	<i>Dumetella carolinensis</i>	—
Gray Jay	GRAJ	<i>Perisoreus canadensis</i>	—
Great Blue Heron	GBHE	<i>Ardea herodias</i>	x
Great Crested Flycatcher	GCFL	<i>Myiarchus crinitus</i>	—
Great Egret	GREG	<i>Ardea alba</i>	x
Green Heron	GRHE	<i>Butorides virescens</i>	x
Hairy Woodpecker	HAWO	<i>Picoides villosus</i>	—
Henslow's Sparrow	HESP	<i>Ammodramus henslowii</i>	—
Hermit Thrush	HETH	<i>Catharus guttatus</i>	—
Herring Gull	HERG	<i>Larus argentatus</i>	x
Hooded Merganser	HOME	<i>Lophodytes cucullatus</i>	x
House Finch	HOFI	<i>Haemorhous mexicanus</i>	—
House Sparrow	HOSP	<i>Passer domesticus</i>	—
House Wren	HOWR	<i>Troglodytes aedon</i>	—
Indigo Bunting	INBU	<i>Passerina cyanea</i>	—
Killdeer	KILL	<i>Charadrius vociferus</i>	x

Common Name	AOU Code	Scientific Name	Non-Target Species
Le Conte's Sparrow	LCSP	<i>Ammodramus leconteii</i>	—
Least Flycatcher	LEFL	<i>Empidonax minimus</i>	—
Lincoln's Sparrow	LISP	<i>Melospiza lincolnii</i>	—
Louisiana Waterthrush	LOWA	<i>Parkesia motacilla</i>	—
Magnolia Warbler	MAWA	<i>Setophaga magnolia</i>	—
Mallard	MALL	<i>Anas platyrhynchos</i>	x
Marsh Wren	MAWR	<i>Cistothorus palustris</i>	—
Merlin	MERL	<i>Falco columbarius</i>	x
Mourning Dove	MODO	<i>Zenaida macroura</i>	—
Mourning Warbler	MOWA	<i>Geothlypis philadelphia</i>	—
Nashville Warbler	NAWA	<i>Oreothlypis ruficapilla</i>	—
Northern Cardinal	NOCA	<i>Cardinalis cardinalis</i>	—
Northern Flicker	NOFL	<i>Colaptes auratus</i>	—
Northern Goshawk	NOGO	<i>Accipiter gentilis</i>	x
Northern Harrier	NOHA	<i>Circus cyaneus</i>	x
Northern Parula	NOPA	<i>Setophaga americana</i>	—
Northern Rough-winged Swallow	NRWS	<i>Stelgidopteryx serripennis</i>	—
Northern Waterthrush	NOWA	<i>Parkesia noveboracensis</i>	—
Olive-sided Flycatcher	OSFL	<i>Contopus cooperi</i>	—
Orange-crowned Warbler	OCWA	<i>Oreothlypis celata</i>	—
Orchard Oriole	OROR	<i>Icterus spurius</i>	—
Osprey	OSPR	<i>Pandion haliaetus</i>	x
Ovenbird	OVEN	<i>Seiurus aurocapilla</i>	—
Palm Warbler	PAWA	<i>Setophaga palmarum</i>	—
Peregrine Falcon	PEFA	<i>Falco peregrinus</i>	x
Philadelphia Vireo	PHVI	<i>Vireo philadelphicus</i>	—
Pied-billed Grebe	PBGR	<i>Podilymbus podiceps</i>	x
Pileated Woodpecker	PIWO	<i>Dryocopus pileatus</i>	—
Pine Siskin	PISI	<i>Spinus pinus</i>	—
Pine Warbler	PIWA	<i>Setophaga pinus</i>	—
Piping Plover	PIPL	<i>Charadrius melodus</i>	x

Common Name	AOU Code	Scientific Name	Non-Target Species
Prairie Warbler	PRAW	<i>Setophaga discolor</i>	—
Prothonotary Warbler	PROW	<i>Protonotaria citrea</i>	—
Purple Finch	PUFI	<i>Haemorhous purpureus</i>	—
Red Crossbill	RECR	<i>Loxia curvirostra</i>	—
Red-bellied Woodpecker	RBWO	<i>Melanerpes carolinus</i>	—
Red-breasted Nuthatch	RBNU	<i>Sitta canadensis</i>	—
Red-eyed Vireo	REVI	<i>Vireo olivaceus</i>	—
Red-headed Woodpecker	RHOW	<i>Melanerpes erythrocephalus</i>	—
Red-shouldered Hawk	RSHA	<i>Buteo lineatus</i>	x
Red-tailed Hawk	RTHA	<i>Buteo jamaicensis</i>	x
Red-winged Blackbird	RWBL	<i>Agelaius phoeniceus</i>	—
Ring-billed Gull	RBGU	<i>Larus delawarensis</i>	x
Ring-necked Pheasant	RNEP	<i>Phasianus colchicus</i>	—
Rock Pigeon	ROPI	<i>Columba livia</i>	—
Rose-breasted Grosbeak	RBGR	<i>Pheucticus ludovicianus</i>	—
Ruby-crowned Kinglet	RCKI	<i>Regulus calendula</i>	—
Ruby-throated Hummingbird	RTHU	<i>Archilochus colubris</i>	—
Ruffed Grouse	RUGR	<i>Bonasa umbellus</i>	—
Sandhill Crane	SACR	<i>Grus canadensis</i>	x
Savannah Sparrow	SAVS	<i>Passerculus sandwichensis</i>	—
Scarlet Tanager	SCTA	<i>Piranga olivacea</i>	—
Sedge Wren	SEWR	<i>Cistothorus platensis</i>	—
Sharp-shinned Hawk	SSHA	<i>Accipiter striatus</i>	x
Song Sparrow	SOSP	<i>Melospiza melodia</i>	—
Sora	SORA	<i>Porzana carolina</i>	x
Spotted Sandpiper	SPSA	<i>Actitis macularius</i>	x
Swainson's Thrush	SWTH	<i>Catharus ustulatus</i>	—
Swamp Sparrow	SWSP	<i>Melospiza georgiana</i>	—
Tennessee Warbler	TEWA	<i>Oreothlypis peregrina</i>	—
Tree Swallow	TRES	<i>Tachycineta bicolor</i>	—
Trumpeter Swan	TRUS	<i>Cygnus buccinator</i>	x

Common Name	AOU Code	Scientific Name	Non-Target Species
Tufted Titmouse	TUTI	<i>Baeolophus bicolor</i>	–
Turkey Vulture	TUVU	<i>Cathartes aura</i>	x
Upland Sandpiper	UPSA	<i>Bartramia longicauda</i>	–
Veery	VEER	<i>Catharus fuscescens</i>	–
Vesper Sparrow	VESP	<i>Poocetes gramineus</i>	–
Virginia Rail	VIRA	<i>Rallus limicola</i>	x
Warbling Vireo	WAVI	<i>Vireo gilvus</i>	–
White-breasted Nuthatch	WBNU	<i>Sitta carolinensis</i>	–
White-crowned Sparrow	WCSP	<i>Zonotrichia leucophrys</i>	–
White-throated Sparrow	WTSP	<i>Zonotrichia albicollis</i>	–
White-winged Crossbill	WWCR	<i>Loxia leucoptera</i>	–
Wild Turkey	WITU	<i>Meleagris gallopavo</i>	–
Willow Flycatcher	WIFL	<i>Empidonax traillii</i>	–
Wilson's Snipe	WISN	<i>Gallinago delicata</i>	–
Wilson's Warbler	WIWA	<i>Cardellina pusilla</i>	–
Winter Wren	WIWR	<i>Troglodytes hiemalis</i>	–
Wood Duck	WODU	<i>Aix sponsa</i>	x
Wood Thrush	WOTH	<i>Hylocichla mustelina</i>	–
Yellow Warbler	YEWA	<i>Setophaga petechia</i>	–
Yellow-bellied Flycatcher	YBFL	<i>Empidonax flaviventris</i>	–
Yellow-bellied Sapsucker	YBSA	<i>Sphyrapicus varius</i>	–
Yellow-billed Cuckoo	YBCU	<i>Coccyzus americanus</i>	–
Yellow-headed Blackbird	YHBL	<i>Xanthocephalus xanthocephalus</i>	–
Yellow-rumped Warbler	YRWA	<i>Setophaga coronata</i>	–
Yellow-throated Vireo	YTVI	<i>Vireo flavifrons</i>	–

Appendix F. Species-guild associations used for landbird guild analysis, by park.

Table F1. Apostle Islands National Lakeshore.

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
Alder Flycatcher	5.31 $\pm$ 2.32	Neotropical	Wetland	Air	Insectivore
American Crow	9.54 $\pm$ 3.77	Permanent	Grassland/Open Urban Woodland	Ground	Omnivore
American Redstart	20.02 $\pm$ 2.18	Neotropical	Woodland	Air Shrub/Low canopy Upper canopy	Insectivore
American Robin	12.10 $\pm$ 1.29	Permanent	Urban Woodland	Ground	Omnivore
Black-capped Chickadee	7.66 $\pm$ 2.59	Permanent	Successional/Agricultural/Scrub Urban Woodland	Bark Shrub/Low canopy	Insectivore
Black-throated Blue Warbler	9.79 $\pm$ 0.14	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Black-throated Green Warbler	29.71 $\pm$ 3.96	Neotropical	Woodland	Upper canopy	Insectivore
Blue Jay	10.19 $\pm$ 1.98	Permanent	Urban Woodland	Ground Shrub/Low canopy Upper canopy	Omnivore
Chipping Sparrow	10.11 $\pm$ 2.80	Continental	Urban Woodland	Ground	Granivore Insectivore
Common Yellowthroat	29.09 $\pm$ 8.90	Neotropical	Successional/Agricultural/Scrub	Ground Shrub/Low canopy	Insectivore
Eastern Wood-Pewee	5.96 $\pm$ 2.29	Neotropical	Woodland	Air	Insectivore

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
Hermit Thrush	8.57 $\pm$ 1.60	Continental	Woodland	Ground	Insectivore
Magnolia Warbler	6.34 $\pm$ 0.70	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Nashville Warbler	26.88 $\pm$ 3.11	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Northern Parula	8.10 $\pm$ 1.77	Neotropical	Woodland	Upper canopy	Insectivore
Ovenbird	37.63 $\pm$ 4.38	Neotropical	Woodland	Ground	Insectivore
Red-breasted Nuthatch	10.83 $\pm$ 1.07	Permanent	Woodland	Bark	Insectivore
Red-eyed Vireo	35.42 $\pm$ 5.49	Neotropical	Woodland	Upper canopy	Insectivore
Song Sparrow	37.84 $\pm$ 11.74	Continental	Successional/Agricultural/Scrub Woodland	Ground Shrub/Low canopy	Insectivore
Swainson's Thrush	5.47 $\pm$ 1.87	Neotropical	Woodland	Ground Shrub/Low canopy	Insectivore
White-throated Sparrow	20.85 $\pm$ 6.64	Continental	Successional/Agricultural/Scrub Woodland	Ground Shrub/Low canopy	Insectivore
Winter Wren	6.37 $\pm$ 1.29	Continental	Woodland	Ground	Insectivore
Yellow-rumped Warbler	9.33 $\pm$ 1.22	Continental	Woodland	Shrub/Low canopy	Insectivore

Table F2. Grand Portage National Monument.

Species	Species Density ($\pm$SE)	Migratory Status	Habitat	Forage Substrate	Diet
American Redstart	24.21 $\pm$ 1.98	Neotropical	Woodland	Upper canopy Shrub/Low canopy Air	Insectivore
American Robin	11.58 $\pm$ 0.97	Permanent	Woodland Urban	Ground	Omnivore
Blackburnian Warbler	9.17 $\pm$ 0.00	Neotropical	Woodland	Upper canopy	Insectivore
Black-throated Green Warbler	25.26 $\pm$ 5.40	Neotropical	Woodland	Upper canopy	Insectivore
Blue Jay	11.37 $\pm$ 4.47	Permanent	Woodland Urban	Upper canopy Shrub/Low canopy Ground	Omnivore
Golden-crowned Kinglet	10.39 $\pm$ 0.40	Continental	Woodland	Shrub/Low canopy	Insectivore
Magnolia Warbler	18.12 $\pm$ 1.34	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Nashville Warbler	27.09 $\pm$ 4.54	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Northern Parula	18.75 $\pm$ 1.58	Neotropical	Woodland	Upper canopy	Insectivore
Ovenbird	27.29 $\pm$ 5.17	Neotropical	Woodland	Ground	Insectivore
Red-breasted Nuthatch	20.60 $\pm$ 2.54	Permanent	Woodland	Bark	Insectivore
Red-eyed Vireo	23.39 $\pm$ 4.16	Neotropical	Woodland	Upper canopy	Insectivore
Swainson's Thrush	14.06 $\pm$ 4.39	Neotropical	Woodland	Shrub/Low canopy Ground	Insectivore
White-throated Sparrow	13.39 $\pm$ 3.80	Continental	Woodland Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
Winter Wren	10.42 $\pm$ 3.01	Continental	Woodland	Ground	Insectivore

Table F3. Isle Royale National Park.

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
Alder Flycatcher	6.96 $\pm$ 0.95	Neotropical	Wetland	Air	Insectivore
American Crow	4.95 $\pm$ 0.29	Permanent	Woodland Urban Grassland/Open	Ground	Omnivore
American Redstart	11.08 $\pm$ 1.15	Neotropical	Woodland	Upper canopy Shrub/Low canopy Air	Insectivore
American Robin	14.29 $\pm$ 2.80	Permanent	Woodland Urban	Ground	Omnivore
Blackburnian Warbler	3.84 $\pm$ 1.13	Neotropical	Woodland	Upper canopy	Insectivore
Black-capped Chickadee	9.47 $\pm$ 1.08	Permanent	Woodland Urban Successional/Agricultural/Scrub	Shrub/Low canopy Bark	Insectivore
Black-throated Blue Warbler	2.71 $\pm$ 0.92	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Black-throated Green Warbler	14.44 $\pm$ 1.16	Neotropical	Woodland	Upper canopy	Insectivore
Blue Jay	11.10 $\pm$ 1.03	Permanent	Woodland Urban	Upper canopy Shrub/Low canopy Ground	Omnivore
Brown Creeper	5.77 $\pm$ 0.27	Permanent	Woodland	Bark	Insectivore
Chestnut-sided Warbler	15.75 $\pm$ 1.66	Neotropical	Successional/Agricultural/Scrub	Shrub/Low canopy	Insectivore
Golden-crowned Kinglet	8.52 $\pm$ 0.87	Continental	Woodland	Shrub/Low canopy	Insectivore
Hermit Thrush	10.61 $\pm$ 1.50	Continental	Woodland	Ground	Insectivore
Magnolia Warbler	12.83 $\pm$ 1.17	Neotropical	Woodland	Shrub/Low canopy	Insectivore

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
Mourning Warbler	8.86 $\pm$ 1.51	Neotropical	Woodland Successional/Agricultural/Scrub	Shrub/Low canopy	Insectivore
Nashville Warbler	43.45 $\pm$ 2.20	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Ovenbird	24.93 $\pm$ 1.11	Neotropical	Woodland	Ground	Insectivore
Red-breasted Nuthatch	16.33 $\pm$ 2.79	Permanent	Woodland	Bark	Insectivore
Red-eyed Vireo	14.96 $\pm$ 1.50	Neotropical	Woodland	Upper canopy	Insectivore
Swainson's Thrush	6.13 $\pm$ 0.66	Neotropical	Woodland	Shrub/Low canopy Ground	Insectivore
White-throated Sparrow	31.12 $\pm$ 1.99	Continental	Woodland Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
Winter Wren	21.39 $\pm$ 1.75	Continental	Woodland	Ground	Insectivore
Yellow-bellied Flycatcher	3.84 $\pm$ 0.52	Neotropical	Woodland	Air	Insectivore
Yellow-rumped Warbler	8.67 $\pm$ 0.95	Continental	Woodland	Shrub/Low canopy	Insectivore

Table F4. Mississippi National River and Recreation Area.

Species	Species Density ($\pm$SE)	Migratory Status	Habitat	Forage Substrate	Diet
American Crow	16.65 $\pm$ 0.90	Permanent	Woodland Urban Grassland/Open	Ground	Omnivore
American Goldfinch	36.54 $\pm$ 9.66	Permanent	Successional/Agricultural/Scrub Grassland/Open	Shrub/Low canopy Ground	Granivore
American Redstart	21.17 $\pm$ 2.60	Neotropical	Woodland	Upper canopy Shrub/Low canopy Air	Insectivore
American Robin	32.40 $\pm$ 3.66	Permanent	Woodland Urban	Ground	Omnivore
Baltimore Oriole	24.24 $\pm$ 7.46	Neotropical	Woodland Urban	Shrub/Low canopy	Insectivore Frugivore
Black-capped Chickadee	53.44 $\pm$ 6.66	Permanent	Woodland Urban Successional/Agricultural/Scrub	Shrub/Low canopy	Insectivore
Blue Jay	27.35 $\pm$ 2.23	Permanent	Woodland Urban	Upper canopy Shrub/Low canopy Ground	Omnivore
Brown-headed Cowbird	19.11 $\pm$ 3.18	Continental	Woodland Urban Successional/Agricultural/Scrub	Ground	Insectivore Granivore
Common Yellowthroat	9.36 $\pm$ 3.67	Neotropical	Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
Downy Woodpecker	21.07 $\pm$ 3.04	Permanent	Woodland	Shrub/Low canopy Bark	Insectivore

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
Eastern Wood-Pewee	16.20 $\pm$ 1.76	Neotropical	Woodland	Air	Insectivore
Gray Catbird	13.76 $\pm$ 1.45	Continental	Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
Hairy Woodpecker	13.07 $\pm$ 4.01	Permanent	Woodland	Shrub/Low canopy Bark	Insectivore Frugivore
House Wren	24.19 $\pm$ 1.61	Continental	Woodland Urban	Shrub/Low canopy Ground	Insectivore
Indigo Bunting	10.71 $\pm$ 1.55	Neotropical	Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Omnivore
Northern Cardinal	22.31 $\pm$ 4.60	Permanent	Urban Successional/Agricultural/Scrub	Ground	Omnivore
Red-bellied Woodpecker	14.06 $\pm$ 2.16	Permanent	Woodland	Bark	Omnivore
Red-eyed Vireo	12.21 $\pm$ 0.90	Neotropical	Woodland	Upper canopy	Insectivore
Song Sparrow	22.17 $\pm$ 3.06	Continental	Woodland Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
White-breasted Nuthatch	21.63 $\pm$ 3.13	Permanent	Woodland	Bark	Insectivore

Table F5. Pictured Rocks National Lakeshore.

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
American Redstart	27.07 $\pm$ 2.29	Neotropical	Woodland	Upper canopy Shrub/Low canopy Air	Insectivore
American Robin	16.74 $\pm$ 3.69	Permanent	Woodland Urban	Ground	Omnivore
Black-capped Chickadee	12.23 $\pm$ 1.18	Permanent	Woodland Urban Successional/Agricultural/Scrub	Shrub/Low canopy	Insectivore
Black-throated Blue Warbler	8.77 $\pm$ 1.37	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Black-throated Green Warbler	18.38 $\pm$ 4.89	Neotropical	Woodland	Upper canopy	Insectivore
Chipping Sparrow	18.90 $\pm$ 7.26	Continental	Woodland Urban	Ground	Insectivore
Eastern Wood-Pewee	12.40 $\pm$ 3.60	Neotropical	Woodland	Air	Insectivore
Hermit Thrush	18.90 $\pm$ 6.14	Continental	Woodland	Ground	Insectivore
Nashville Warbler	11.58 $\pm$ 2.35	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Ovenbird	24.81 $\pm$ 3.00	Neotropical	Woodland	Ground	Insectivore
Red-breasted Nuthatch	11.81 $\pm$ 2.02	Permanent	Woodland	Bark	Insectivore
Red-eyed Vireo	30.42 $\pm$ 5.51	Neotropical	Woodland	Upper canopy	Insectivore
Rose-breasted Grosbeak	9.65 $\pm$ 1.83	Neotropical	Woodland	Upper canopy Shrub/Low canopy	Omnivore
Swainson's Thrush	8.91 $\pm$ 2.01	Neotropical	Woodland	Shrub/Low canopy Ground	Insectivore

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
White-throated Sparrow	7.62 $\pm$ 2.73	Continental	Woodland Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
Yellow-bellied Sapsucker	8.16 $\pm$ 0.64	Continental	Woodland	Bark	Omnivore
Yellow-rumped Warbler	7.45 $\pm$ 0.00	Continental	Woodland	Shrub/Low canopy	Insectivore

Table F6. St. Croix National Scenic Riverway.

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
Alder Flycatcher	2.93 $\pm$ 0.43	Neotropical	Wetland	Air	Insectivore
American Redstart	20.61 $\pm$ 1.26	Neotropical	Woodland	Upper canopy Shrub/Low canopy Air	Insectivore
American Robin	9.87 $\pm$ 0.86	Permanent	Woodland Urban	Ground	Omnivore
Baltimore Oriole	5.97 $\pm$ 0.61	Neotropical	Woodland Urban	Shrub/Low canopy	Insectivore Frugivore
Black-capped Chickadee	4.10 $\pm$ 0.91	Permanent	Woodland Urban Successional/Agricultural/Scrub	Shrub/Low canopy	Insectivore
Blue Jay	10.58 $\pm$ 1.83	Permanent	Woodland Urban	Upper canopy Shrub/Low canopy Ground	Omnivore
Brown-headed Cowbird	8.38 $\pm$ 2.60	Continental	Woodland Urban Successional/Agricultural/Scrub	Ground	Insectivore Granivore
Chestnut-sided Warbler	11.70 $\pm$ 0.97	Neotropical	–	Shrub/Low canopy Successional/Agricultural/Scrub	Insectivore
Common Yellowthroat	18.45 $\pm$ 0.94	Neotropical	Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
Eastern Wood-Pewee	5.67 $\pm$ 0.69	Neotropical	Woodland	Air	Insectivore
Gray Catbird	16.94 $\pm$ 1.79	Continental	Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore Frugivore

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
House Wren	2.11 $\pm$ 0.75	Continental	Woodland Urban	Shrub/Low canopy Ground	Insectivore
Mourning Warbler	2.64 $\pm$ 0.84	Neotropical	Woodland Successional/Agricultural/Scrub	Shrub/Low canopy	Insectivore
Nashville Warbler	3.08 $\pm$ 0.67	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Northern Waterthrush	4.83 $\pm$ 1.41	Neotropical	Woodland	Ground	Insectivore
Ovenbird	12.13 $\pm$ 1.11	Neotropical	Woodland	Ground	Insectivore
Pileated Woodpecker	0.77 $\pm$ 0.23	Permanent	Woodland	Bark	Insectivore
Pine Warbler	2.68 $\pm$ 0.57	Continental	Woodland	Upper canopy Bark	Insectivore
Red-bellied Woodpecker	6.18 $\pm$ 1.43	Permanent	Woodland	Bark	Omnivore
Red-breasted Nuthatch	2.79 $\pm$ 0.43	Permanent	Woodland	Bark	Insectivore
Red-eyed Vireo	32.91 $\pm$ 1.22	Neotropical	Woodland	Upper canopy	Insectivore
Red-winged Blackbird	6.98 $\pm$ 0.85	Continental	Wetland Grassland/Open	Ground	Insectivore Granivore
Rose-breasted Grosbeak	8.78 $\pm$ 1.58	Neotropical	Woodland	Upper canopy Shrub/Low canopy	Omnivore
Song Sparrow	36.40 $\pm$ 1.29	Continental	Woodland Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
Swamp Sparrow	3.77 $\pm$ 0.53	Continental	Wetland	Shrub/Low canopy Ground	Insectivore
Warbling Vireo	7.99 $\pm$ 1.53	Neotropical	Woodland Urban	Upper canopy	Insectivore
White-breasted Nuthatch	6.99 $\pm$ 4.36	Permanent	Woodland	Bark	Insectivore

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
White-throated Sparrow	4.55 $\pm$ 0.80	Continental	Woodland Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
Yellow Warbler	17.94 $\pm$ 1.41	Neotropical	Successional/Agricultural/Scrub	Shrub/Low canopy	Insectivore
Yellow-rumped Warbler	1.80 $\pm$ 0.45	Continental	Woodland	Shrub/Low canopy	Insectivore
Yellow-throated Vireo	5.24 $\pm$ 0.67	Neotropical	Woodland	Upper canopy	Insectivore

Table F7. Sleeping Bear Dunes National Lakeshore.

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
American Goldfinch	16.58 $\pm$ 6.55	Permanent	Successional/Agricultural/Scrub Grassland/Open	Shrub/Low canopy Ground	Granivore
American Redstart	25.79 $\pm$ 3.70	Neotropical	Woodland	Upper canopy Shrub/Low canopy Air	Insectivore
American Robin	29.62 $\pm$ 2.13	Permanent	Woodland Urban	Ground	Omnivore
Baltimore Oriole	11.86 $\pm$ 0.71	Neotropical	Woodland Urban	Shrub/Low canopy	Insectivore Frugivore
Black-capped Chickadee	21.85 $\pm$ 3.62	Permanent	Woodland Urban Successional/Agricultural/Scrub	Shrub/Low canopy Bark	Insectivore
Chipping Sparrow	20.87 $\pm$ 1.93	Continental	Woodland Urban	Ground	Insectivore Granivore
Common Yellowthroat	12.81 $\pm$ 1.66	Neotropical	Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
Eastern Wood-Pewee	10.78 $\pm$ 0.60	Neotropical	Woodland	Air	Insectivore
Gray Catbird	14.93 $\pm$ 10.06	Continental	Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore Frugivore
Indigo Bunting	13.28 $\pm$ 1.18	Neotropical	Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Omnivore
Mourning Dove	11.06 $\pm$ 0.98	Permanent Continental	Urban Successional/Agricultural/Scrub	Ground	Granivore
Nashville Warbler	9.56 $\pm$ 3.50	Neotropical	Woodland	Shrub/Low canopy	Insectivore

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
Ovenbird	21.32 $\pm$ 2.39	Neotropical	Woodland	Ground	Insectivore
Pine Warbler	18.08 $\pm$ 1.19	Continental	Woodland	Upper canopy Bark	Insectivore
Red-eyed Vireo	46.92 $\pm$ 8.79	Neotropical	Woodland	Upper canopy	Insectivore
Red-winged Blackbird	39.72 $\pm$ 4.44	Continental	Wetland Grassland/Open	Ground	Insectivore Granivore
Rose-breasted Grosbeak	12.19 $\pm$ 1.11	Neotropical	Woodland	Upper canopy Shrub/Low canopy	Omnivore
Song Sparrow	22.14 $\pm$ 2.83	Continental	Woodland Successional/Agricultural/Scrub	Shrub/Low canopy	Insectivore
Yellow Warbler	12.06 $\pm$ 0.44	Neotropical	Successional/Agricultural/Scrub	Shrub/Low canopy	Insectivore

Table F8. Voyageurs National Park.

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
American Crow	10.30 $\pm$ 5.39	Permanent	Woodland Urban Grassland/Open	Ground	Omnivore
American Redstart	11.45 $\pm$ 4.19	Neotropical	Woodland	Upper canopy Shrub/Low canopy Air	Insectivore
American Robin	14.84 $\pm$ 3.14	Permanent	Woodland Urban	Ground	Omnivore
Blackburnian Warbler	15.49 $\pm$ 4.03	Neotropical	Woodland	Upper canopy	Insectivore
Black-capped Chickadee	14.63 $\pm$ 0.42	Permanent	Woodland Urban Successional/Agricultural/Scrub	Shrub/Low canopy Bark	Insectivore
Black-throated Green Warbler	13.35 $\pm$ 1.27	Neotropical	Woodland	Upper canopy	Insectivore
Blue Jay	38.89 $\pm$ 9.99	Permanent	Woodland Urban	Upper canopy Shrub/Low canopy Ground	Omnivore
Chestnut-sided Warbler	9.30 $\pm$ 0.92	Neotropical	Successional/Agricultural/Scrub	Shrub/Low canopy	Insectivore
Chipping Sparrow	10.34 $\pm$ 0.59	Continental	Woodland Urban	Ground	Insectivore Granivore
Eastern Wood-Pewee	7.51 $\pm$ 0.44	Neotropical	Woodland	Air	Insectivore
Golden-crowned Kinglet	18.63 $\pm$ 13.59	Continental	Woodland	Shrub/Low canopy	Insectivore
Hermit Thrush	8.77 $\pm$ 0.61	Continental	Woodland	Ground	Insectivore
Magnolia Warbler	8.87 $\pm$ 5.06	Neotropical	Woodland	Shrub/Low canopy	Insectivore
Nashville Warbler	44.48 $\pm$ 3.59	Neotropical	Woodland	Shrub/Low canopy	Insectivore

Species	Species Density ($\pm$ SE)	Migratory Status	Habitat	Forage Substrate	Diet
Ovenbird	43.10 $\pm$ 3.64	Neotropical	Woodland	Ground	Insectivore
Red-breasted Nuthatch	29.57 $\pm$ 6.57	Permanent	Woodland	Bark	Insectivore
Red-eyed Vireo	33.88 $\pm$ 4.09	Neotropical	Woodland	Upper canopy	Insectivore
Ruby-crowned Kinglet	7.16 $\pm$ 3.21	Continental	Woodland	Shrub/Low canopy	Insectivore
White-throated Sparrow	31.30 $\pm$ 2.48	Continental	Woodland Successional/Agricultural/Scrub	Shrub/Low canopy Ground	Insectivore
Winter Wren	9.78 $\pm$ 1.21	Continental	Woodland	Ground	Insectivore
Yellow-rumped Warbler	18.80 $\pm$ 3.01	Continental	Woodland	Shrub/Low canopy	Insectivore

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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1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525