2004

Surveys of Breeding Birds Within Portions of Meadowood SRMA, Fairfax County, Virginia

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December 2004

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This paper is funded by grants from the Department of the Interior, Bureau of Land Management-Eastern States. The views expressed herein are those of the authors and do not necessarily reflect the views of the Bureau of Land Management.

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Recommended Citation:

LeClerc, J. E. and B. J. Paxton. 2004. Surveys of Breeding Birds Within Portions of Meadowood SRMA, Fairfax County, Virginia. Technical Report Series, CCBTR-04-13. Center for Conservation Biology, College of William and Mary, Williamsburg, VA. 27 pp.

Project Funded By:

Department of the Interior,
BLM-Eastern States

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EXECUTIVE SUMMARY

Birds are essential components of natural ecosystems, effective indicators of environmental health, and the focus of an emerging ecotourism industry that represents a growing portion of the world's economy. An increased concern for the status of many North American bird populations has resulted in an escalation of monitoring and management efforts. Much of this concern has been focused upon the many species of forest-dwelling neotropical migrants (species that migrate between forested breeding grounds in the temperate latitudes of North America and wintering grounds in Central and South America and the Caribbean) and open habitat-dependent birds that have exhibited substantial population declines in recent decades. The Mid-Atlantic Coastal Plain plays a significant role in the life cycle of many of the most vulnerable bird species in North America. The diversity of habitats available to birds during the breeding and winter periods, along with the strategic geographic position of the region for migrants, combine to make this one of the most diverse regions in eastern North America.

Northern Virginia has experienced dramatic urbanization in the past 30 years, and remaining conservation lands will play an increasingly vital role in stabilizing regional bird populations. On October 18, 2001, the Department of the Interior, Bureau of Land Management-Eastern States acquired the 324 hectare Meadowood Farm on Mason Neck in Fairfax County, Virginia. The property, now called the Meadowood Special Recreation Management Area (SRMA), may provide important resources for birds in this rapidly changing environment.

A total of 15 survey points were used to measure bird species richness and frequency of occurrence within a focal area in the western parcel of the Meadowood SRMA. This focal area is a forest block surrounding a cleared field that has been selected as a site for flying model airplanes. A total of 624 detections of 47 bird species were made during the study, consisting of 22 neotropical migrant species, 9 temperate migrant species, and 16 non-migratory (resident) species. The species observed in this study are consistent with those normally found within field, forest, and edge habitats in the Mid-Atlantic Coastal Plain.

BACKGROUND

Context

Birds are essential components of natural ecosystems, effective indicators of environmental health, and the focus of an emerging ecotourism industry that represents a growing portion of the world's economy. During the course of the twentieth century, the living space and infrastructure required by an expanding human population has had a pervasive impact on the natural landscape, resulting in a direct change in the availability and distribution of the habitats required by many bird species. Restoring and maintaining healthy bird populations within these altered landscapes represents one of the most complex conservation challenges for the twenty-first century.

An increased concern for the status of many North American bird populations has resulted in an escalation of monitoring and management efforts. Much of this concern has been focused upon the many species of forest-dwelling neotropical migrants (species that migrate between forested breeding grounds in the temperate latitudes of North America and wintering grounds in Central and South America and the Caribbean) and open habitat-dependent birds that have exhibited substantial population declines in recent decades. There is increasing evidence that habitat loss and fragmentation are two of the leading causes for the observed population declines (Faaborg et al. 1995, Robinson et al. 1995, Hunter et al. 2001).

The Mid-Atlantic Coastal Plain plays a significant role in the life cycle of many of the most vulnerable bird species in North America. The diversity of habitats available to birds during the breeding and winter periods, along with the strategic geographic position of the region for migrants, make this one of the most diverse regions in eastern North America. The region was also the site of the first successful European settlement in North America and has been altered by European culture for nearly four centuries. Currently, the urban crescent extending from Baltimore, south to Richmond, and east to Norfolk is one of the fastest growing regions in North America. Growth is projected to continue for the foreseeable future, placing increasing demands on the region's natural resources.

Northern Virginia has experienced dramatic urbanization in the past 30 years, and remaining conservation lands will play an increasingly vital role in stabilizing regional bird populations. On October 18, 2001, the Department of the Interior, Bureau of Land Management-Eastern States acquired the 324-hectare Meadowood Farm on Mason Neck in Fairfax County, Virginia. The property, now called the Meadowood Special Recreation Management Area (SRMA), will be managed to provide open space for recreation, environmental education, and wild horse and burro interpretation. In addition, its variety of forested, edge, and open field habitats may provide important resources for birds in this rapidly changing environment.

Objectives

The overall objective of this project was to evaluate the breeding bird community within a small area of the western parcel of the Meadowood SRMA. The focal area was a forest block surrounding a cleared field that has been selected as a site for flying model airplanes. Information provided through this project will allow natural resources staff to evaluate the potential impact of proposed activities on the surrounding bird community.

METHODS

Study Area

This study was conducted within the western parcel of the Meadowood SRMA on the Mason Neck peninsula in Fairfax County, Virginia (Figure 1). Located on the Coastal Plain of Virginia, the 324-ha Meadowood SRMA contains approximately 243 ha of mixed forest (oak-beech-hickory-pine) with a diverse shrub-forb understory. The SRMA also contains 65 ha of open fields, historically used for hay production and as horse pasture. The open field within the focal area of the present study has been used in recent years for flying model airplanes.

Bird Surveys

A combination of fixed-radius and unlimited-radius point count techniques were used to measure bird density and frequency of occurrence. A network of 15 survey plots (point counts), each consisting of a 50-meter radius circle with a wire flag located at its center, was established throughout the study area (see Appendix I for point coordinates) (Figure 1). Survey plots contained varying proportions of field, forest, and edge habitat.

Point counts were conducted by a single observer standing at the plot center and recording all birds seen or heard within a 5-minute period. Birds detected were stratified according to location in field, forest, or edge habitat. Birds detected within the 50-m radius were used for density estimation, and those detected beyond 50 m were used to determine presence/absence patterns.

Surveys were conducted in 11-day time blocks where all points were surveyed within each block. Three survey rounds were completed between 13 June and 7 July 2004. The order of surveys was alternated between time blocks to reduce the impact of time-of-day effects. Surveys were conducted between 0.5 and 4.5 hours after sunrise on days with no precipitation and wind speeds of less than 15 mph.

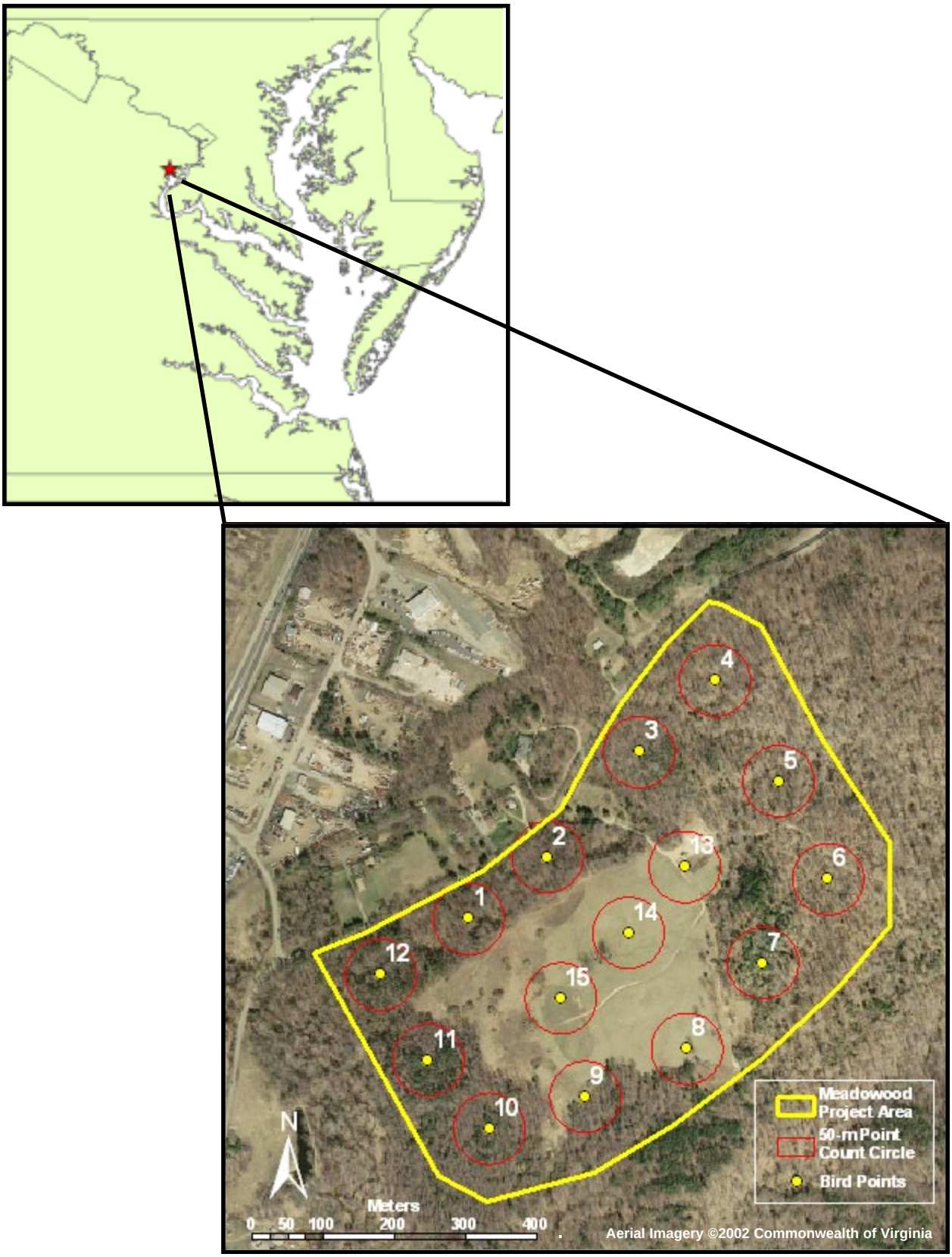

Figure 1. Map of study area within Meadowood SRMA.

Data Summary and Analysis

Bird survey data were summarized to determine overall bird abundance and species richness for individual habitat types as well as the entire study area. Bird densities were calculated from the number of birds detected within the 50-m radius point counts. For each species, the survey visit with the greatest number of individuals detected was used for analysis. Species richness values were calculated using the accumulated number of species detected within or beyond the 50-m radius point counts over three survey visits.

RESULTS

A total of 624 detections of 47 bird species were made during the 2004 surveys. These consisted of 22 neotropical migrant species, 9 temperate migrant species, and 16 non-migratory (resident) species (see Appendix II for summary of detections by point and survey round and Appendix III for list of birds with migration status). Wood Thrush, Northern Cardinal, Indigo Bunting, Common Grackle, Carolina Wren, and Eastern Towhee were the most common species, accounting for over 42% of all detections.

Edge habitat supported the highest number of species, followed by forest and field habitat, with species richness values of 38, 31, and 22, respectively (Figure 2). The most common species detected in edge habitat were Northern Cardinal, Indigo Bunting, and Carolina Wren, accounting for 30% of the 227 detections in that habitat. Wood Thrush, Northern Cardinal, and Red-bellied Woodpecker were the most common species in forest habitat, accounting for over 38% of the 312 forest habitat detections. The most common species in field habitat were Indigo Bunting, Common Yellowthroat, and Yellow-breasted Chat, accounting for over 43% of the 85 field habitat detections.

Only 5 species were detected in sufficient numbers to estimate densities. Each of the following species was detected at a maximum density of 2.55 birds/ha at the survey points listed: Blue-gray Gnatcatcher at survey point 10; Wood Thrush at survey points 1, 8, and 11; Eastern Towhee at survey point 6; Northern Cardinal at survey points 1, 2, 4, and 10; and Indigo Bunting at survey point 9 (Figure 1).

DISCUSSION

This study provides an account of the species composition and relative abundance of birds occupying the various habitat types within a focal area in the western parcel of the Meadowood SRMA. The species observed in this study are consistent with those normally found within field, forest, and edge habitats in the Mid-Atlantic Coastal Plain.

The observed increase in species richness from field, to forest, to edge habitat

(Figure 2) can be explained by the corresponding increase in structural complexity within the habitats. More species can be supported by habitats with greater structural diversity. It should be noted, however, that preservation of field and forest habitats is crucial to regional bird conservations efforts. In this study, three forest-dwelling neotropical migrants, Wood Thrush, Ovenbird, and Louisiana Waterthrush, were found only in forested habitat.

The large disparity between habitats in number of birds detected could be due in part to habitat structural complexity, but it is more likely driven by sampling bias. Due to area constraints, there was no effort made to sample habitats evenly, and the majority of survey plots were placed within forested habitat (Figure 1), thus explaining the high number of birds detected there.

Only 5 of the 47 species detected were observed in high enough numbers to estimate densities. These results are typical of a survey of such a small area. Furthermore, three of these species (Blue-gray Gnatcatcher, Wood Thrush, and Indigo Bunting) are neotropical migrants, indicating that the study area is providing habitat for species of conservation concern.

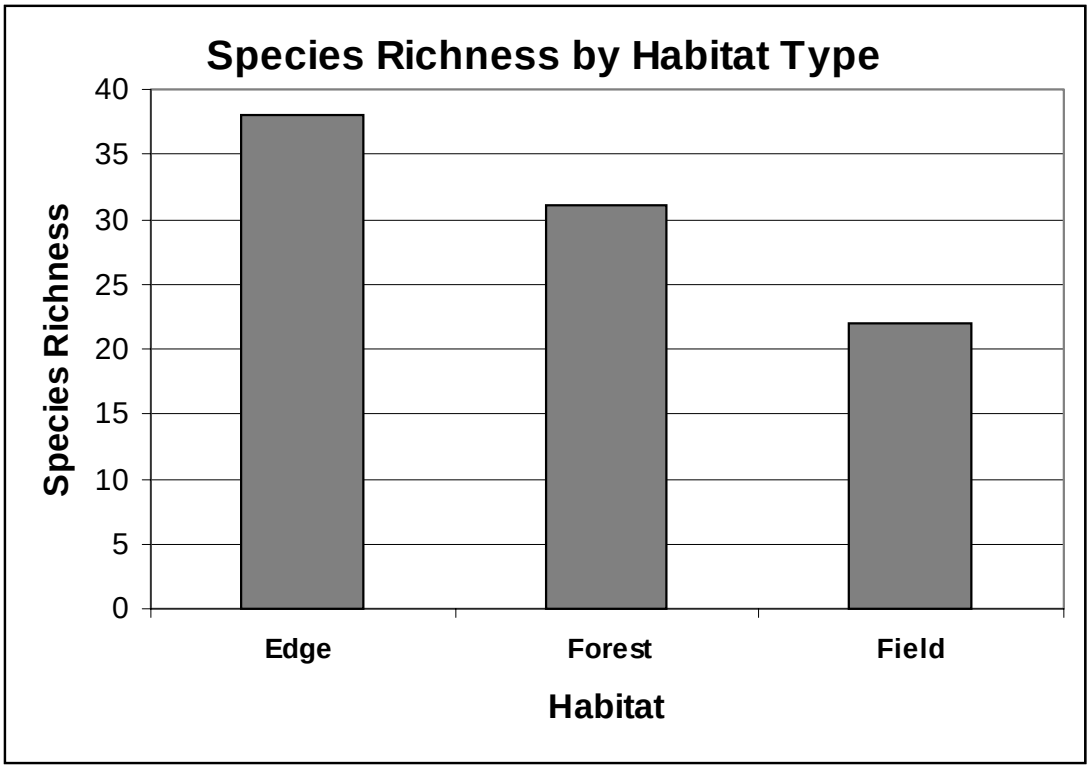

Figure 2. Species richness values for habitat types within surveyed area of Meadowood SMRA's western parcel. Values are based on the accumulated number of species detected within each habitat type over three survey visits.

ACKNOWLEDGMENTS

This project would not have been possible without the efforts of many people. Geoffrey Walsh at the Bureau of Land Management-Eastern States provided the opportunity to conduct the study and administrative support. Kurt Gaskill conducted the bird surveys, and Fletcher Smith assisted in establishing the survey sites. Lydia Whitaker, Carlton Adams, Renee Peace, Anne Womack, Gloria Sciole, Mark Roberts, and Cheryl Pope provided important administrative support from the College of William and Mary. This study was funded by the Bureau of Land Management-Eastern States.

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Appendix I. List of bird point counts with coordinates.

Point Number	Latitude	Longitude
1	38.67914	-77.22135
2	38.67990	-77.22007
3	38.68121	-77.21857
4	38.68210	-77.21733
5	38.68082	-77.21632
6	38.67958	-77.21555
7	38.67853	-77.21662
8	38.67746	-77.21786
9	38.67687	-77.21951
10	38.67648	-77.22107
11	38.67736	-77.22203
12	38.67845	-77.22278
13	38.67976	-77.21786
14	38.67893	-77.21878
15	38.67812	-77.21988

Appendix II A . Bird species and numbers of detections by point and round.

Species	Point	Round 1	Round 2	Round 3	Total
RSHA	7	0	1	0	1
RSHA	13	0	1	0	1
Total		0	2	0	2
RTHA	9	0	1	0	1
RTHA	13	0	0	1	1
Total		0	1	1	2
MODO	2	0	1	0	1
MODO	6	0	1	0	1
MODO	13	1	0	0	1
Total		1	2	0	3
YBCU	1	1	0	0	1
YBCU	4	0	0	1	1
YBCU	5	0	1	0	1
YBCU	6	0	0	1	1
YBCU	12	1	0	0	1
YBCU	13	0	1	0	1
YBCU	15	1	1	0	2
Total		3	3	2	8
RBWO	1	1	0	0	1
RBWO	4	1	1	2	4
RBWO	5	1	2	0	3
RBWO	6	1	2	0	3
RBWO	7	0	1	1	2
RBWO	8	2	0	0	2
RBWO	9	1	2	0	3
RBWO	10	0	1	0	1
RBWO	11	0	1	0	1
RBWO	13	2	0	0	2
RBWO	14	0	0	1	1
RBWO	15	0	0	1	1
Total		9	10	5	24
DOWO	1	0	0	1	1
DOWO	3	0	0	1	1
DOWO	6	0	0	1	1
DOWO	9	0	1	0	1
DOWO	10	0	0	1	1
DOWO	11	1	2	0	3
DOWO	12	1	1	0	2
DOWO	13	0	1	1	2
DOWO	14	0	1	0	1
DOWO	15	0	0	1	1
Total		2	6	6	14
HAWO	6	0	2	0	2
HAWO	7	0	0	1	1
HAWO	8	0	1	0	1
HAWO	14	1	0	0	1
Total		1	3	1	5
NOFL	4	0	1	0	1

Appendix II A (continued). Bird species and numbers of detections by point and round.

Species	Point	Round 1	Round 2	Round 3	Total
NOFL	5	1	0	0	1
NOFL	6	0	0	2	2
NOFL	7	0	1	0	1
NOFL	10	1	0	0	1
NOFL	13	0	1	0	1
Total		2	3	2	7
PIWO	5	1	0	0	1
PIWO	6	0	1	0	1
PIWO	13	0	1	0	1
Total		1	2	0	3
EAWP	3	0	1	1	2
EAWP	4	1	1	1	3
EAWP	6	0	0	1	1
EAWP	7	1	0	0	1
EAWP	8	1	4	0	5
EAWP	12	0	1	0	1
EAWP	13	0	1	1	2
EAWP	14	1	0	2	3
EAWP	15	0	1	2	3
Total		4	9	8	21
ACFL	3	1	0	0	1
ACFL	11	1	1	1	3
ACFL	12	1	1	1	3
Total		3	2	2	7
EAPH	9	0	1	0	1
Total		0	1	0	1
GCFL	2	0	1	0	1
GCFL	4	1	0	0	1
GCFL	6	1	0	0	1
GCFL	7	1	0	0	1
GCFL	9	0	0	1	1
GCFL	14	1	0	0	1
GCFL	15	1	1	0	2
Total		5	2	1	8
EAKI	8	0	1	0	1
EAKI	15	0	1	0	1
Total		0	2	0	2
WEVI	6	0	0	1	1
WEVI	8	0	1	1	2
WEVI	9	1	1	1	3
WEVI	10	0	1	0	1
WEVI	11	0	1	1	2
WEVI	12	1	1	0	2
WEVI	13	0	0	1	1
WEVI	14	0	1	0	1
WEVI	15	0	1	1	2
Total		2	7	6	15
REVI	1	1	0	1	2
REVI	2	1	0	0	1

Appendix II A (continued). Bird species and numbers of detections by point and round.

Species	Point	Round 1	Round 2	Round 3	Total
REVI	3	2	2	0	4
REVI	6	1	1	0	2
REVI	7	1	0	0	1
REVI	8	1	0	0	1
REVI	9	1	1	0	2
REVI	10	0	2	1	3
REVI	13	0	1	1	2
REVI	14	0	1	2	3
Total		8	8	5	21
BLJA	2	0	2	1	3
BLJA	3	2	0	0	2
BLJA	4	1	0	0	1
BLJA	5	1	3	0	4
BLJA	6	1	1	0	2
BLJA	7	1	1	0	2
BLJA	13	1	2	0	3
BLJA	14	2	2	0	4
BLJA	15	2	0	0	2
Total		11	11	1	23
AMCR	5	2	0	0	2
AMCR	6	1	0	0	1
Total		3	0	0	3
TRES	9	1	0	0	1
Total		1	0	0	1
BARS	9	0	4	0	4
Total		0	4	0	4
CACH	1	0	1	0	1
CACH	2	0	1	0	1
CACH	3	1	0	0	1
CACH	8	0	1	0	1
CACH	9	0	1	0	1
CACH	12	0	2	0	2
CACH	13	0	0	1	1
CACH	15	0	0	1	1
Total		1	6	2	9
ETTI	1	1	2	0	3
ETTI	4	2	1	0	3
ETTI	5	0	2	0	2
ETTI	6	0	1	2	3
ETTI	7	0	0	1	1
ETTI	8	0	0	1	1
ETTI	9	0	1	0	1
ETTI	10	0	1	0	1
ETTI	11	0	0	1	1
ETTI	12	2	0	0	2
ETTI	13	1	0	1	2
ETTI	14	1	0	0	1
ETTI	15	0	1	0	1
Total		7	9	6	22

Appendix II A (continued). Bird species and numbers of detections by point and round.

Species	Point	Round 1	Round 2	Round 3	Total
WBNU	5	0	0	1	1
WBNU	6	0	0	1	1
WBNU	7	0	0	1	1
WBNU	8	1	1	0	2
WBNU	9	0	2	0	2
WBNU	12	0	0	1	1
WBNU	14	0	0	1	1
WBNU	15	0	1	1	2
Total		1	4	6	11
CARW	1	1	2	3	6
CARW	2	0	1	1	2
CARW	3	1	0	0	1
CARW	4	2	0	0	2
CARW	6	0	0	2	2
CARW	7	0	1	2	3
CARW	8	1	1	1	3
CARW	9	1	0	0	1
CARW	10	0	0	1	1
CARW	11	2	1	1	4
CARW	12	2	1	2	5
CARW	13	1	0	0	1
CARW	14	0	0	2	2
CARW	15	0	1	1	2
Total		11	8	16	35
BGGN	2	0	0	1	1
BGGN	4	0	1	0	1
BGGN	7	1	0	1	2
BGGN	8	1	0	0	1
BGGN	9	1	0	1	2
BGGN	10	1	0	2	3
BGGN	11	1	0	0	1
BGGN	12	0	0	1	1
BGGN	14	1	0	0	1
BGGN	15	1	0	0	1
Total		7	1	6	14
WOTH	1	2	1	2	5
WOTH	2	2	1	0	3
WOTH	3	1	3	2	6
WOTH	4	1	3	2	6
WOTH	5	1	1	0	2
WOTH	6	1	2	1	4
WOTH	7	2	1	0	3
WOTH	8	2	1	1	4
WOTH	9	2	2	2	6
WOTH	10	3	1	2	6
WOTH	11	1	2	3	6
WOTH	12	0	1	2	3
WOTH	13	2	2	0	4
WOTH	14	2	2	0	4

Appendix II A (continued). Bird species and numbers of detections by point and round.

Species	Point	Round 1	Round 2	Round 3	Total
WOTH	15	0	2	2	4
Total		22	25	19	66
AMRO	1	0	1	1	2
AMRO	2	1	1	1	3
AMRO	3	0	2	2	4
AMRO	7	0	0	1	1
AMRO	11	0	1	0	1
AMRO	12	0	1	0	1
AMRO	15	0	0	3	3
Total		1	6	8	15
NOMO	9	0	0	1	1
Total		0	0	1	1
EUST	9	0	0	1	1
Total		0	0	1	1
NOPA	1	1	0	0	1
NOPA	10	0	0	1	1
NOPA	11	1	1	1	3
NOPA	12	1	1	1	3
NOPA	15	1	0	0	1
Total		4	2	3	9
PRAW	1	1	1	0	2
PRAW	8	1	0	0	1
PRAW	13	0	1	0	1
PRAW	14	1	1	0	2
PRAW	15	2	1	0	3
Total		5	4	0	9
OVEN	5	0	1	0	1
OVEN	6	1	2	0	3
OVEN	7	0	3	1	4
OVEN	10	0	1	0	1
OVEN	12	0	1	0	1
Total		1	8	1	10
LOWA	5	0	1	0	1
Total		0	1	0	1
COYE	1	0	0	1	1
COYE	2	0	0	1	1
COYE	8	0	0	1	1
COYE	9	0	2	1	3
COYE	10	0	0	1	1
COYE	11	0	0	1	1
COYE	12	0	0	1	1
COYE	13	0	1	1	2
COYE	14	1	2	1	4
COYE	15	1	1	2	4
Total		2	6	11	19
YBCH	1	1	0	1	2
YBCH	8	0	0	1	1
YBCH	9	0	1	1	2
YBCH	10	0	0	1	1

Appendix II A (continued). Bird species and numbers of detections by point and round.

Species	Point	Round 1	Round 2	Round 3	Total
YBCH	11	2	0	0	2
YBCH	13	0	1	0	1
YBCH	14	0	1	0	1
YBCH	15	2	1	1	4
Total		5	4	5	14
SUTA	10	0	1	0	1
SUTA	13	0	1	0	1
SUTA	14	0	0	2	2
SUTA	15	0	0	1	1
Total		0	2	3	5
SCTA	4	1	0	0	1
SCTA	5	1	2	1	4
SCTA	6	0	1	1	2
SCTA	7	1	0	1	2
SCTA	13	1	0	0	1
SCTA	14	1	1	0	2
Total		5	4	3	12
EATO	1	1	1	1	3
EATO	2	0	0	1	1
EATO	3	0	0	2	2
EATO	4	0	1	0	1
EATO	6	2	0	0	2
EATO	7	2	1	2	5
EATO	8	0	0	1	1
EATO	9	0	1	0	1
EATO	11	0	0	1	1
EATO	12	0	0	2	2
EATO	13	0	0	1	1
EATO	14	2	0	1	3
EATO	15	0	0	2	2
Total		7	4	14	25
CHSP	2	1	1	1	3
Total		1	1	1	3
FISP	1	0	1	0	1
FISP	2	0	1	0	1
FISP	8	0	1	0	1
FISP	9	0	1	0	1
FISP	10	0	0	1	1
FISP	11	0	1	0	1
FISP	12	0	1	0	1
FISP	14	0	1	0	1
FISP	15	1	1	0	2
Total		1	8	1	10
NOCA	1	2	1	2	5
NOCA	2	0	2	2	4
NOCA	3	2	0	2	4
NOCA	4	1	2	1	4
NOCA	5	1	3	0	4
NOCA	6	3	2	0	5

Appendix II A (continued). Bird species and numbers of detections by point and round.

Species	Point	Round 1	Round 2	Round 3	Total
NOCA	7	0	2	2	4
NOCA	8	1	3	0	4
NOCA	9	2	2	1	5
NOCA	10	2	1	2	5
NOCA	11	2	2	1	5
NOCA	12	1	3	2	6
NOCA	13	0	1	1	2
NOCA	14	2	0	1	3
Total		19	24	17	60
BLGR	1	0	1	0	1
BLGR	2	0	1	0	1
BLGR	7	1	1	0	2
BLGR	8	1	0	0	1
BLGR	9	1	1	1	3
BLGR	11	0	1	0	1
BLGR	13	0	1	1	2
BLGR	14	1	1	2	4
BLGR	15	1	1	1	3
Total		5	8	5	18
INBU	1	0	0	1	1
INBU	2	0	1	1	2
INBU	3	0	1	0	1
INBU	6	0	1	1	2
INBU	7	0	1	2	3
INBU	8	1	1	1	3
INBU	9	2	2	3	7
INBU	10	1	1	0	2
INBU	11	1	0	0	1
INBU	12	1	0	1	2
INBU	13	1	1	2	4
INBU	14	2	4	2	8
INBU	15	2	2	2	6
Total		11	15	16	42
COGR	1	7	0	0	7
COGR	3	4	0	0	4
COGR	4	1	0	0	1
COGR	5	5	0	0	5
COGR	6	1	0	0	1
COGR	8	2	1	0	3
COGR	9	6	0	0	6
COGR	10	1	0	0	1
COGR	11	1	0	0	1
COGR	12	2	0	0	2
COGR	13	3	2	0	5
Total		33	3	0	36
BHCO	3	0	1	0	1
Total		0	1	0	1
ORORO	1	0	1	0	1
Total		0	1	0	1

Appendix II A (continued). Bird species and numbers of detections by point and round.

Species	Point	Round 1	Round 2	Round 3	Total
AMGO	1	0	1	0	1
Total		0	1	0	1
Column Total		205	234	185	624

Appendix II B. Bird species and numbers of detections by point and round within edge habitat.

Species	Point	Round 1	Round 2	Round 3	Total
MODO	13	1	0	0	1
Total		1	0	0	1
YBCU	15	1	0	0	1
Total		1	0	0	1
RBWO	8	1	0	0	1
RBWO	9	1	1	0	2
RBWO	13	1	0	0	1
RBWO	15	0	0	1	1
Total		3	1	1	5
DOWO	3	0	0	1	1
DOWO	9	0	1	0	1
DOWO	13	0	0	1	1
DOWO	15	0	0	1	1
Total		0	1	3	4
HAWO	14	1	0	0	1
Total		1	0	0	1
NOFL	5	1	0	0	1
NOFL	7	0	1	0	1
Total		1	1	0	2
EAWP	8	1	4	0	5
EAWP	13	0	1	1	2
EAWP	14	1	0	2	3
EAWP	15	0	0	2	2
Total		2	5	5	12
ACFL	12	0	1	0	1
Total		0	1	0	1
EAPH	9	0	1	0	1
Total		0	1	0	1
GCFL	2	0	1	0	1
GCFL	7	1	0	0	1
GCFL	9	0	0	1	1
GCFL	14	1	0	0	1
Total		2	1	1	4
EAKI	8	0	1	0	1
Total		0	1	0	1
WEVI	8	0	1	0	1
WEVI	9	1	0	0	1
WEVI	10	0	1	0	1
WEVI	11	0	1	0	1
WEVI	12	1	1	0	2
WEVI	13	0	0	1	1
WEVI	15	0	1	0	1
Total		2	5	1	8
REVI	13	0	1	0	1
REVI	14	0	0	1	1
Total		0	1	1	2
BLJA	2	0	2	0	2
BLJA	3	2	0	0	2

Appendix II B (continued). Bird species and numbers of detections by point and round within edge habitat.

Species	Point	Round 1	Round 2	Round 3	Total
BLJA	5	1	2	0	3
BLJA	7	1	0	0	1
BLJA	13	1	2	0	3
BLJA	14	1	2	0	3
BLJA	15	2	0	0	2
Total		8	8	0	16
CACH	2	0	1	0	1
CACH	8	0	1	0	1
CACH	9	0	1	0	1
CACH	13	0	0	1	1
CACH	15	0	0	1	1
Total		0	3	2	5
ETTI	8	0	0	1	1
ETTI	9	0	1	0	1
ETTI	10	0	1	0	1
ETTI	13	1	0	1	2
ETTI	14	1	0	0	1
Total		2	2	2	6
WBNU	8	1	0	0	1
WBNU	9	0	2	0	2
WBNU	14	0	0	1	1
WBNU	15	0	0	1	1
Total		1	2	2	5
CARW	1	1	2	1	4
CARW	2	0	1	1	2
CARW	3	1	0	0	1
CARW	4	1	0	0	1
CARW	8	1	1	1	3
CARW	11	0	1	1	2
CARW	12	2	1	1	4
CARW	13	1	0	0	1
CARW	14	0	0	1	1
CARW	15	0	0	1	1
Total		7	6	7	20
BGGN	8	1	0	0	1
BGGN	9	0	0	1	1
BGGN	10	1	0	0	1
BGGN	15	1	0	0	1
Total		3	0	1	4
AMRO	1	0	0	1	1
AMRO	2	0	1	1	2
AMRO	3	0	0	1	1
AMRO	7	0	0	1	1
Total		0	1	4	5
NOMO	9	0	0	1	1
Total		0	0	1	1
EUST	9	0	0	1	1
Total		0	0	1	1
NOPA	1	1	0	0	1

Appendix II B (continued). Bird species and numbers of detections by point and round within edge habitat.

Species	Point	Round 1	Round 2	Round 3	Total
NOPA	15	1	0	0	1
Total		2	0	0	2
PRAW	1	1	1	0	2
PRAW	8	1	0	0	1
PRAW	13	0	1	0	1
Total		2	2	0	4
COYE	9	0	2	0	2
COYE	10	0	0	1	1
COYE	11	0	0	1	1
COYE	13	0	1	1	2
Total		0	3	3	6
YBCH	1	1	0	0	1
YBCH	9	0	1	0	1
YBCH	10	0	0	1	1
YBCH	11	2	0	0	2
YBCH	13	0	1	0	1
Total		3	2	1	6
SUTA	10	0	1	0	1
SUTA	13	0	1	0	1
SUTA	14	0	0	1	1
SUTA	15	0	0	1	1
Total		0	2	2	4
SCTA	13	1	0	0	1
Total		1	0	0	1
EATO	1	1	0	0	1
EATO	2	0	0	1	1
EATO	3	0	0	1	1
EATO	7	0	0	2	2
EATO	8	0	0	1	1
EATO	9	0	1	0	1
EATO	12	0	0	2	2
EATO	14	2	0	1	3
EATO	15	0	0	2	2
Total		3	1	10	14
CHSP	2	0	1	1	2
Total		0	1	1	2
FISP	1	0	1	0	1
FISP	2	0	1	0	1
FISP	8	0	1	0	1
FISP	10	0	0	1	1
FISP	11	0	1	0	1
FISP	12	0	1	0	1
Total		0	5	1	6
NOCA	1	0	0	2	2
NOCA	2	0	2	2	4
NOCA	3	0	0	2	2
NOCA	8	1	3	0	4
NOCA	9	2	2	0	4
NOCA	10	1	1	0	2

Appendix II B (continued). Bird species and numbers of detections by point and round within edge habitat.

Species	Point	Round 1	Round 2	Round 3	Total
NOCA	11	1	0	0	1
NOCA	12	1	1	0	2
NOCA	13	0	0	1	1
NOCA	14	2	0	0	2
Total		8	9	7	24
BLGR	1	0	1	0	1
BLGR	2	0	1	0	1
BLGR	7	1	1	0	2
BLGR	9	0	1	0	1
BLGR	11	0	1	0	1
BLGR	13	0	1	0	1
BLGR	14	1	1	0	2
BLGR	15	0	1	1	2
Total		2	8	1	11
INBU	1	0	0	1	1
INBU	2	0	1	0	1
INBU	3	0	1	0	1
INBU	7	0	1	2	3
INBU	8	1	1	0	2
INBU	9	0	0	1	1
INBU	10	1	1	0	2
INBU	11	1	0	0	1
INBU	12	1	0	1	2
INBU	13	0	1	1	2
INBU	14	2	2	2	6
INBU	15	0	0	2	2
Total		6	8	10	24
COGR	3	4	0	0	4
COGR	5	5	0	0	5
COGR	12	2	0	0	2
COGR	13	3	0	0	3
Total		14	0	0	14
BHCO	3	0	1	0	1
Total		0	1	0	1
ORIOR	1	0	1	0	1
Total		0	1	0	1
AMGO	1	0	1	0	1
Total		0	1	0	1
Column Total		75	84	68	227

Appendix II C. Bird species and numbers of detections by point and round within forest habitat.

Species	Point	Round 1	Round 2	Round 3	Total
RSHA	7	0	1	0	1
RSHA	13	0	1	0	1
Total		0	2	0	2
RTHA	13	0	0	1	1
Total		0	0	1	1
MODO	2	0	1	0	1
MODO	6	0	1	0	1
Total		0	2	0	2
YBCU	1	1	0	0	1
YBCU	4	0	0	1	1
YBCU	5	0	1	0	1
YBCU	6	0	0	1	1
YBCU	12	1	0	0	1
YBCU	13	0	1	0	1
YBCU	15	0	1	0	1
Total		2	3	2	7
RBWO	1	1	0	0	1
RBWO	4	1	1	2	4
RBWO	5	1	2	0	3
RBWO	6	1	2	0	3
RBWO	7	0	1	1	2
RBWO	8	1	0	0	1
RBWO	9	0	1	0	1
RBWO	10	0	1	0	1
RBWO	11	0	1	0	1
RBWO	13	1	0	0	1
RBWO	14	0	0	1	1
Total		6	9	4	19
DOWO	1	0	0	1	1
DOWO	6	0	0	1	1
DOWO	10	0	0	1	1
DOWO	11	1	2	0	3
DOWO	12	1	1	0	2
DOWO	13	0	1	0	1
DOWO	14	0	1	0	1
Total		2	5	3	10
HAWO	6	0	2	0	2
HAWO	7	0	0	1	1
HAWO	8	0	1	0	1
Total		0	3	1	4
NOFL	4	0	1	0	1
NOFL	6	0	0	2	2
NOFL	10	1	0	0	1
NOFL	13	0	1	0	1
Total		1	2	2	5
PIWO	5	1	0	0	1
PIWO	6	0	1	0	1
PIWO	13	0	1	0	1

Appendix II C (continued). Bird species and numbers of detections by point and round within forest habitat.

Species	Point	Round 1	Round 2	Round 3	Total
Total		1	2	0	3
EAWP	3	0	1	1	2
EAWP	4	1	1	1	3
EAWP	6	0	0	1	1
EAWP	7	1	0	0	1
EAWP	12	0	1	0	1
EAWP	15	0	1	0	1
Total		2	4	3	9
ACFL	3	1	0	0	1
ACFL	11	1	1	1	3
ACFL	12	1	0	1	2
Total		3	1	2	6
GCFL	4	1	0	0	1
GCFL	6	1	0	0	1
GCFL	15	1	0	0	1
Total		3	0	0	3
WEVI	6	0	0	1	1
Total		0	0	1	1
REVI	1	1	0	1	2
REVI	3	2	2	0	4
REVI	6	1	1	0	2
REVI	7	1	0	0	1
REVI	8	1	0	0	1
REVI	9	1	1	0	2
REVI	10	0	2	1	3
REVI	13	0	0	1	1
REVI	14	0	1	1	2
Total		7	7	4	18
BLJA	2	0	0	1	1
BLJA	4	1	0	0	1
BLJA	5	0	1	0	1
BLJA	6	1	1	0	2
BLJA	7	0	1	0	1
BLJA	14	1	0	0	1
Total		3	3	1	7
AMCR	5	2	0	0	2
AMCR	6	1	0	0	1
Total		3	0	0	3
CACH	1	0	1	0	1
CACH	3	1	0	0	1
CACH	12	0	2	0	2
Total		1	3	0	4
ETTI	1	1	2	0	3
ETTI	4	2	1	0	3
ETTI	5	0	2	0	2
ETTI	6	0	1	2	3
ETTI	7	0	0	1	1
ETTI	11	0	0	1	1
ETTI	12	2	0	0	2

Appendix II C (continued). Bird species and numbers of detections by point and round within forest habitat.

Species	Point	Round 1	Round 2	Round 3	Total
ETTI	15	0	1	0	1
Total		5	7	4	16
WBNU	5	0	0	1	1
WBNU	6	0	0	1	1
WBNU	7	0	0	1	1
WBNU	8	0	1	0	1
WBNU	12	0	0	1	1
WBNU	15	0	1	0	1
Total		0	2	4	6
CARW	1	0	0	2	2
CARW	4	1	0	0	1
CARW	6	0	0	2	2
CARW	7	0	1	2	3
CARW	9	1	0	0	1
CARW	11	2	0	0	2
CARW	12	0	0	1	1
CARW	14	0	0	1	1
Total		4	1	8	13
BGGN	2	0	0	1	1
BGGN	4	0	1	0	1
BGGN	7	1	0	1	2
BGGN	10	0	0	2	2
BGGN	11	1	0	0	1
BGGN	12	0	0	1	1
Total		2	1	5	8
WOTH	1	2	1	2	5
WOTH	2	1	1	0	2
WOTH	3	1	3	2	6
WOTH	4	1	3	2	6
WOTH	5	1	1	0	2
WOTH	6	1	2	1	4
WOTH	7	2	1	0	3
WOTH	8	2	1	1	4
WOTH	9	2	2	2	6
WOTH	10	3	1	2	6
WOTH	11	1	2	3	6
WOTH	12	0	1	2	3
WOTH	13	2	2	0	4
WOTH	14	2	2	0	4
WOTH	15	0	2	2	4
Total		21	25	19	65
AMRO	1	0	1	0	1
AMRO	3	0	2	1	3
AMRO	11	0	1	0	1
AMRO	12	0	1	0	1
AMRO	15	0	0	3	3
Total		0	5	4	9
NOPA	10	0	0	1	1
NOPA	11	1	1	1	3

Appendix II C (continued). Bird species and numbers of detections by point and round within forest habitat.

Species	Point	Round 1	Round 2	Round 3	Total
NOPA	12	1	1	1	3
Total		2	2	3	7
OVEN	5	0	1	0	1
OVEN	6	1	2	0	3
OVEN	7	0	3	1	4
OVEN	10	0	1	0	1
OVEN	12	0	1	0	1
Total		1	8	1	10
LOWA	5	0	1	0	1
Total		0	1	0	1
SCTA	4	1	0	0	1
SCTA	5	1	2	1	4
SCTA	6	0	1	1	2
SCTA	7	1	0	1	2
SCTA	14	1	1	0	2
Total		4	4	3	11
EATO	1	0	1	1	2
EATO	3	0	0	1	1
EATO	4	0	1	0	1
EATO	6	2	0	0	2
EATO	7	2	1	0	3
EATO	11	0	0	1	1
Total		4	3	3	10
NOCA	1	2	1	0	3
NOCA	3	2	0	0	2
NOCA	4	1	2	1	4
NOCA	5	1	3	0	4
NOCA	6	3	2	0	5
NOCA	7	0	2	2	4
NOCA	10	1	0	2	3
NOCA	11	1	2	1	4
NOCA	12	0	2	2	4
NOCA	13	0	1	0	1
NOCA	14	0	0	1	1
Total		11	15	9	35
INBU	6	0	1	1	2
Total		0	1	1	2
COGR	1	7	0	0	7
COGR	4	1	0	0	1
COGR	6	1	0	0	1
COGR	8	2	0	0	2
COGR	10	1	0	0	1
COGR	11	1	0	0	1
COGR	13	0	2	0	2
Total		13	2	0	15
Column Total		101	123	88	312

Appendix II D. Bird species and numbers of detections by point and round within field habitat.

Species	Point	Round 1	Round 2	Round 3	Total
RTHA	9	0	1	0	1
Total		0	1	0	1
GCFL	15	0	1	0	1
Total		0	1	0	1
EAKI	15	0	1	0	1
Total		0	1	0	1
WEVI	8	0	0	1	1
WEVI	9	0	1	1	2
WEVI	11	0	0	1	1
WEVI	14	0	1	0	1
WEVI	15	0	0	1	1
Total		0	2	4	6
REVI	2	1	0	0	1
Total		1	0	0	1
TRES	9	1	0	0	1
Total		1	0	0	1
BARS	9	0	4	0	4
Total		0	4	0	4
CARW	10	0	0	1	1
CARW	15	0	1	0	1
Total		0	1	1	2
BGGN	9	1	0	0	1
BGGN	14	1	0	0	1
Total		2	0	0	2
WOTH	2	1	0	0	1
Total		1	0	0	1
AMRO	2	1	0	0	1
Total		1	0	0	1
PRAW	14	1	1	0	2
PRAW	15	2	1	0	3
Total		3	2	0	5
COYE	1	0	0	1	1
COYE	2	0	0	1	1
COYE	8	0	0	1	1
COYE	9	0	0	1	1
COYE	12	0	0	1	1
COYE	14	1	2	1	4
COYE	15	1	1	2	4
Total		2	3	8	13
YBCH	1	0	0	1	1
YBCH	8	0	0	1	1
YBCH	9	0	0	1	1
YBCH	14	0	1	0	1
YBCH	15	2	1	1	4
Total		2	2	4	8
SUTA	14	0	0	1	1
Total		0	0	1	1
EATO	13	0	0	1	1

Appendix II D (continued). Bird species and numbers of detections by point and round within field habitat.

Species	Point	Round 1	Round 2	Round 3	Total
Total		0	0	1	1
CHSP	2	1	0	0	1
Total		1	0	0	1
FISP	9	0	1	0	1
FISP	14	0	1	0	1
FISP	15	1	1	0	2
Total		1	3	0	4
NOCA	9	0	0	1	1
Total		0	0	1	1
BLGR	8	1	0	0	1
BLGR	9	1	0	1	2
BLGR	13	0	0	1	1
BLGR	14	0	0	2	2
BLGR	15	1	0	0	1
Total		3	0	4	7
INBU	2	0	0	1	1
INBU	8	0	0	1	1
INBU	9	2	2	2	6
INBU	13	1	0	1	2
INBU	14	0	2	0	2
INBU	15	2	2	0	4
Total		5	6	5	16
COGR	8	0	1	0	1
COGR	9	6	0	0	6
Total		6	1	0	7
Column Total		29	27	29	85

Appendix III. List of species detected with scientific name, alpha code, and migration status.

Common Name	Genus	Species	AOU Alpha code	Migration Status
Red-shouldered Hawk	*Buteo*	*lineatus*	RSHA	Resident
Red-tailed Hawk	*Buteo*	*jamaicensis*	RTHA	Temperate Migrant
Mourning Dove	*Zenaida*	*macroura*	MODO	Resident
Yellow-billed Cuckoo	*Coccyzus*	*americanus*	YBCU	Neotropical Migrant
Red-bellied Woodpecker	*Melanerpes*	*carolinus*	RBWO	Resident
Downy Woodpecker	*Picoides*	*pubescens*	DOWO	Resident
Hairy Woodpecker	*Picoides*	*villosus*	HAWO	Resident
Northern Flicker	*Colaptes*	*auratus*	NOFL	Temperate Migrant
Pileated Woodpecker	*Dryocopus*	*pileatus*	PIWO	Resident
Eastern Wood-Pewee	*Contopus*	*virens*	EAWP	Neotropical Migrant
Acadian Flycatcher	*Empidonax*	*virescens*	ACFL	Neotropical Migrant
Eastern Phoebe	*Sayornis*	*phoebe*	EAPH	Temperate Migrant
Great Crested Flycatcher	*Myiarchus*	*crinitus*	GCFL	Neotropical Migrant
Eastern Kingbird	*Tyrannus*	*tyrannus*	EAKI	Neotropical Migrant
White-eyed Vireo	*Vireo*	*griseus*	WEVI	Neotropical Migrant
Red-eyed Vireo	*Vireo*	*olivaceus*	REVI	Neotropical Migrant
Blue Jay	*Cyanocitta*	*cristata*	BLJA	Temperate Migrant
American Crow	*Corvus*	*brachyrhynchos*	AMCR	Resident
Tree Swallow	*Tachycineta*	*bicolor*	TRES	Neotropical Migrant
Barn Swallow	*Hirundo*	*rustica*	BARS	Neotropical Migrant
Carolina Chickadee	*Poecile*	*carolinensis*	CACH	Resident
Eastern Tufted Titmouse	*Baeolophus*	*bicolor*	ETTI	Resident
White-breasted Nuthatch	*Sitta*	*carolinensis*	WBNU	Resident
Carolina Wren	*Thryothorus*	*ludovicianus*	CARW	Resident
Blue-gray Gnatcatcher	*Polioptila*	*caerulea*	BGGN	Neotropical Migrant
Wood Thrush	*Hylocichla*	*mustelina*	WOTH	Neotropical Migrant
American Robin	*Turdus*	*migratorius*	AMRO	Temperate Migrant
Northern Mockingbird	*Mimus*	*polyglottos*	NOMO	Resident
European Starling	*Sturnus*	*vulgaris*	EUST	Resident
Northern Parula	*Parula*	*americana*	NOPA	Neotropical Migrant
Prairie Warbler	*Dendroica*	*discolor*	PRAW	Neotropical Migrant
Ovenbird	*Seiurus*	*aurocapilla*	OVEN	Neotropical Migrant
Louisiana Waterthrush	*Seiurus*	*motacilla*	LOWA	Neotropical Migrant
Common Yellowthroat	*Geothlypis*	*trichas*	COYE	Neotropical Migrant
Yellow-breasted Chat	*Icteria*	*virens*	YBCH	Neotropical Migrant
Summer Tanager	*Piranga*	*rubra*	SUTA	Neotropical Migrant
Scarlet Tanager	*Piranga*	*olivacea*	SCTA	Neotropical Migrant
Eastern Towhee	*Pipilo*	*erythrophthalmus*	EATO	Temperate Migrant
Chipping Sparrow	*Spizella*	*passerina*	CHSP	Temperate Migrant
Field Sparrow	*Spizella*	*pusilla*	FISP	Temperate Migrant
Northern Cardinal	*Cardinalis*	*cardinalis*	NOCA	Resident
Blue Grosbeak	*Passerina*	*caerulea*	BLGR	Neotropical Migrant
Indigo Bunting	*Passerina*	*cyanea*	INBU	Neotropical Migrant
Common Grackle	*Quiscalus*	*quiscula*	COGR	Resident
Brown-headed Cowbird	*Molothrus*	*ater*	BHCO	Resident
Orchard Oriole	*Icterus*	*spurius*	OROR	Neotropical Migrant
American Goldfinch	*Carduelis*	*tristis*	AMGO	Temperate Migrant