South Dakota Breeding Bird Atlas II
2012 Field Season Report

Rocky Mountain Bird Observatory
Tech. Report # M-SDBBA2-06

ROCKY MOUNTAIN BIRD OBSERVATORY

***Mission**: To conserve birds and their habitats*

***Vision**: Native bird populations are sustained in healthy ecosystems*

***Core Values**:*

1. ***Science** provides the foundation for effective bird conservation.*
2. ***Education** is critical to the success of bird conservation.*
3. ***Stewardship** of birds and their habitats is a shared responsibility.*

RMBO accomplishes its mission by:

- ***Monitoring** long-term trends in bird populations to provide a scientific foundation for conservation action.*
- ***Researching** bird ecology and population response to anthropogenic and natural processes to evaluate and adjust management and conservation strategies using the best available science.*
- ***Educating** people of all ages through active, experiential programs that create an awareness and appreciation for birds.*
- ***Fostering** good stewardship on private and public lands through voluntary, cooperative partnerships that create win-win situations for wildlife and people.*
- ***Partnering** with state and federal natural resource agencies, private citizens, schools, and other non-governmental organizations to build synergy and consensus for bird conservation..*
- ***Sharing** the latest information in land management and bird conservation practices to create informed publics.*
- ***Delivering** bird conservation at biologically relevant scales by working across political and jurisdictional boundaries in western North America.*

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EXECUTIVE SUMMARY

The Breeding Bird Atlas is a relatively simple, repeatable, probabilistic grid-based survey that aims to monitor and document changes in the distribution of breeding birds on a large scale. Results of the first South Dakota Breeding Bird Atlas, conducted from 1988-1992, were extremely valuable in describing the status and distribution of South Dakota's breeding birds and established a baseline against which future changes in breeding bird populations will be measured. Since the first Breeding Bird Atlas, South Dakota's landscape has changed, and most likely, these changes are impacting South Dakota's breeding birds. The second South Dakota Breeding Bird Atlas was conducted 2008 – 2012. The goal of SDBBA2 is to document the current distribution of every bird species that nests in South Dakota and to compare these distributions to those of the first South Dakota Breeding Bird Atlas. These data will support the efforts of land-use planners, decision-makers, researchers, educators, students, and bird enthusiasts to maintain healthy bird populations and conserve avian diversity within the state.

During the SDBBA2, volunteers and paid field technicians visited 433 blocks, with a total of 2,420 visits. Observers spent 7,269 hours on blocks and submitted almost 25,600 bird records. Observers found an average of 57 species (range 15-104 species) per block. Blocks in the prairie pothole and coteau regions of the state had the highest number of species while western grassland or wheat field blocks had the lowest.

SDBBA2 atlasers found 35 more species (254 species, 242 confirmed breeding) than recorded 20 years ago during the first atlas (219 species, 212 confirmed). Five additional species either were non-breeding summer residents or are awaiting verification from the state Rare Bird Committee. Mallard was the most frequently reported species (537 records), Brown-headed Cowbird was reported within all 433 blocks, and 25 species were reported in all 66 counties. Twenty-two species were recorded during SDBBA2 that were not reported during the first South Dakota Atlas and atlasers confirmed breeding by 15 of these: Common Loon, Sandhill Crane, Neotropic Cormorant, Glossy Ibis, Herring Gull, Snowy Plover, Black-necked Stilt, Black Rail, Eurasian Collared-dove, Prothonotary Warbler, Chestnut-sided Warbler, Virginia's Warbler, Great-tailed Grackle, Cassin's Sparrow, and Lesser Goldfinch.

The next steps are to obtain more data from outside sources, such as university research projects or bird surveys by other agencies and organizations, finish proofing data, finalize the database and begin creating maps.

ACKNOWLEDGEMENTS

The second South Dakota Breeding Bird Atlas (SDBBA2) is a team effort, both organizationally and financially.

Coordination and organization:

- Eileen Dowd-Stukel, SDGFP, Wildlife Diversity Program
- Nancy Drilling, Rocky Mountain Bird Observatory (RMBO)

Technical Committee:

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- Richard Peterson, coordinator of SDBBA 1, Wewela
- Dave Swanson, University of South Dakota

GIS, database, and web site development:

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- Chandman Sambuu, RMBO
- Alex Ushakov, RMBO

SDBBA2 Logo design: Michael Retter

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INTRODUCTION

The Breeding Bird Atlas is a relatively simple, repeatable, grid-based survey that aims to monitor and document changes in the distribution of breeding birds on a large scale (Smith 1990). The first South Dakota Breeding Bird Atlas (SDBBA) began 20 years ago (Peterson 1995). During that ambitious project, 71 volunteers collected data over six years of fieldwork and submitted more than 24,000 breeding records, representing 219 bird species. The resulting resource has been extremely valuable in describing the status and distribution of South Dakota's breeding game and nongame species. The first atlas database also represents a baseline against which future changes in breeding bird populations can be measured.

Since the first Breeding Bird Atlas commenced in 1988, South Dakota's landscape has changed (e.g., Bakker and Higgins, 1998, Higgins *et al*. 2002, Grant *et al*. 2004). In addition, land-use changes in the upcoming few years could be staggering. Increasing CRP conversion, bio-fuels production, wind farm development, and urbanization are a few landscape alterations of concern to conservation biologists (Stephens et al. 2006, Stubbs 2007). South Dakota's Wildlife Action Plan (SD GFP 2006) explicitly notes the link between habitat quality/quantity and the health of animal populations. Most likely, these landscape-level changes are impacting South Dakota's breeding birds. Regular monitoring of all breeding species on a large scale allows us to detect impacts of such large-scale landscape changes. Repeating the Breeding Bird Atlas approximately every 20 years not only documents bird response to habitat deterioration and loss, but also can improve our understanding of bird response to management actions designed to improve wildlife habitat quality and quantity. In addition, each Breeding Bird Atlas serves as a baseline to which future changes can be compared.

The goal of the second South Dakota Breeding Bird Atlas is to document the current distribution of every bird species that nests in South Dakota and to compare these distributions to those of the first South Dakota Breeding Bird Atlas (1988-1992). These data will support the efforts of land-use planners, conservation decision-makers, researchers, educators, students, and bird enthusiasts to maintain healthy bird populations and conserve avian diversity within the state. Specific objectives include:

1. Document current distribution of all breeding bird species.
2. Assess changes in distributions of breeding birds since the first SDBBA (1988-1992).
3. Identify habitat associations and requirements for all breeding species.
4. Produce a report with species distribution maps and analyses results.

Scientific questions to be addressed are:

1. What is the current statewide distribution of occurrences and nesting of every breeding bird species?
2. Which species have declined or increased in distribution since 1988-1992?
3. Are non-native bird populations increasing within or throughout the state?
4. What are the habitat associations or requirements of each breeding species?

Expected Benefits include:

1. More complete and up-to-date knowledge of breeding bird species status and distribution.
2. Improved understanding of changes in breeding bird populations over last 20 years.
3. More complete knowledge of bird-habitat associations.
4. Identification of species that have declined in distribution over the past 20 years and may require active management to keep from becoming a Species of Greatest Conservation Need.
5. An established baseline of species distribution for future surveys and atlases.
6. Contribution to a better understanding of regional breeding bird status and distribution, in conjunction with simultaneous atlases being conducted in Minnesota, Iowa, and Nebraska.
7. Provision of a resource for researchers, land managers, land-use planners, students, agency personnel, educators, and others.
8. An increased interest in birds by the general public and an opportunity for knowledgeable birders to engage in citizen science.

One important issue is that not all species are detected, no matter how much effort one puts into the survey (MacKenzie *et al*. 2006). Detectability, the probability that a species is detected when present, is affected by time of day, season, weather, observer abilities, species-specific characteristics, and habitat, among other factors. Failing to record a species that is actually there (false absence) biases the resulting maps and analyses, and makes interpretation of survey results more difficult. When detectability is quantified, we can make statements about the 'completeness' of a distribution map or account for this nuisance error during analyses, especially when comparing first and second atlas results. In addition, estimating detectability allows us to estimate occupancy rates (proportion of an area occupied by a species). In conjunction with a covariate, such as habitat type, estimated occupancy rates allow us to predict where species may occur in areas that are not surveyed. Thus, we collected data to estimate species detection probabilities on atlas blocks. The objectives were to estimate detection probabilities for as many species as possible, and to evaluate whether collecting these sort of data 1) interferes with or detracts from collecting primary atlas data (species presence and breeding confirmation) and 2) contributes to our understanding of species distributions within the state.

METHODS

GENERAL METHODS

Data collection for the Breeding Bird Atlas involved visiting pre-selected 3-mile x 3-mile areas ('blocks') and surveying all habitats within each block for bird presence and evidence of breeding for all bird species. Surveys during SDBBA2 followed the standardized protocols as recommended by the North American Ornithological Atlas Committee (Smith 1990) with some minor modifications. Atlasers were encouraged to visit their block during the breeding season at least three times during the day and once in the evening. Visits usually were at least 10 days apart and often spread out over multiple breeding seasons. Atlasers tabulated the number of person-hours spent surveying their blocks and attempted a minimum effort of at least 15 hours on a block. The entire block did not need to be surveyed; rather, efforts were focused on surveying each habitat type within a block.

The primary focus of surveys was to document all breeding birds within a block. Bird observations were categorized as *Possible* breeding, *Probable* breeding, or *Confirmed* breeding, based upon a series of standardized breeding behavior criteria, within that species' breeding season. To document breeding phenology, emphasis was placed on recording ALL observations, not just the 'highest' breeding category observed for each species. In addition, observers recorded the habitat each bird was observed in. Outside of designated blocks, the atlas encouraged all interested persons to submit extra observations of *Confirmed* breeding by any species or any observations of rare species anywhere within the state.

The SDBBA2 Handbook, available from the Project Coordinator or at the SDBBA2 web site (http://www.rmbo.org/sdbba2), gives detailed protocol information and breeding status and habitat code descriptions.

ATLAS BLOCK SELECTION

Number of Blocks The second breeding bird atlas surveyed 425 random blocks and eight special blocks. At the beginning of field work, 124 of these blocks were the same random blocks covered in the first South Dakota Breeding Bird Atlas while the remaining 301 random blocks were newly selected for the second atlas (Figure 1). However, atlasers were denied access to eleven blocks and these blocks were replaced with new selections (see Results, Blocks).

Eight special blocks were added because they contained rare habitats that were not represented in the randomly-chosen blocks. These blocks included forested buttes in Harding County (3 blocks), mountain mahogany shrubland in Custer County (1 block), bluffs of the Missouri River (1 block), southwest sage grassland-

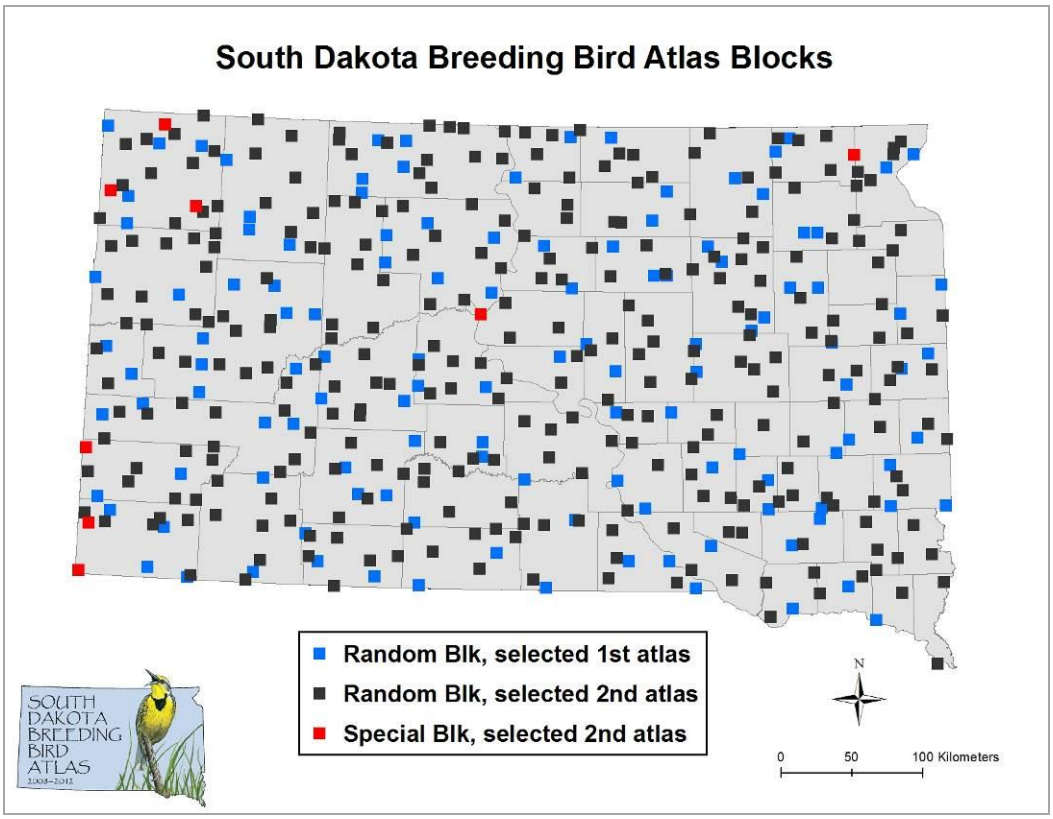

Figure 1. Location of blocks originally selected to be surveyed during the second South Dakota Breeding Bird Atlas. Note that block size is enlarged and not to scale.

sage shrubland in Fall River (2 blocks) and coteau forested ravines in Roberts County (1 block).

Block size and grid system. All blocks were 3 miles x 3 miles in size. Blocks selected in the two different atlases were based on different grid systems. The original blocks comprised nine Public Land Survey System (PLSS) sections. The SDBBA2 blocks were based on a uniform 3x3 mile grid placed over the entire state rather than on the PLSS sections.

Selection of original random blocks. The original 124 blocks were selected in 1988 for the first Breeding Bird Atlas. The state was divided into 62 equal-sized 'superblocks' and two 3-section x 3-section blocks were randomly selected within each superblock.

Selection of new blocks. The 301 new blocks were selected using a spatially-balanced sampling design (Stevens *et al*. 2004, Theobald *et al*. 2007). This

probabilistic sampling design accounts for the fact that sites close together probably are more similar and produces a more spread out sample distribution. In ArcGIS v.9.0, a uniform grid of 8,819 3-mile x 3-mile blocks was placed over the entire state. More than 400 blocks were randomly selected using the RRQRR algorithm developed by David Theobald at Colorado State University (Theobald *et al*. 2007). The first 301 samples 'drawn' in this procedure represented the new blocks to be surveyed during the second atlas. The center points of seven selected blocks fell outside the state border and were replaced by the next seven samples in the 408 sample list. One important requirement of spatially-balanced sampling is that blocks are surveyed in the order in which they are drawn. If they are not, the resulting design is not spatially balanced nor is it random. Thus, results from block # 276 only could be used if blocks 1-275 were also surveyed.

SPECIES DETECTION PROBABILITIES

Paid staff collected data on 136 randomly chosen blocks to estimate species detection probabilities using occupancy modeling (MacKenzie *et al*. 2006). Field technicians conducted these special surveys on 43 of the 136 blocks in 2009, 42

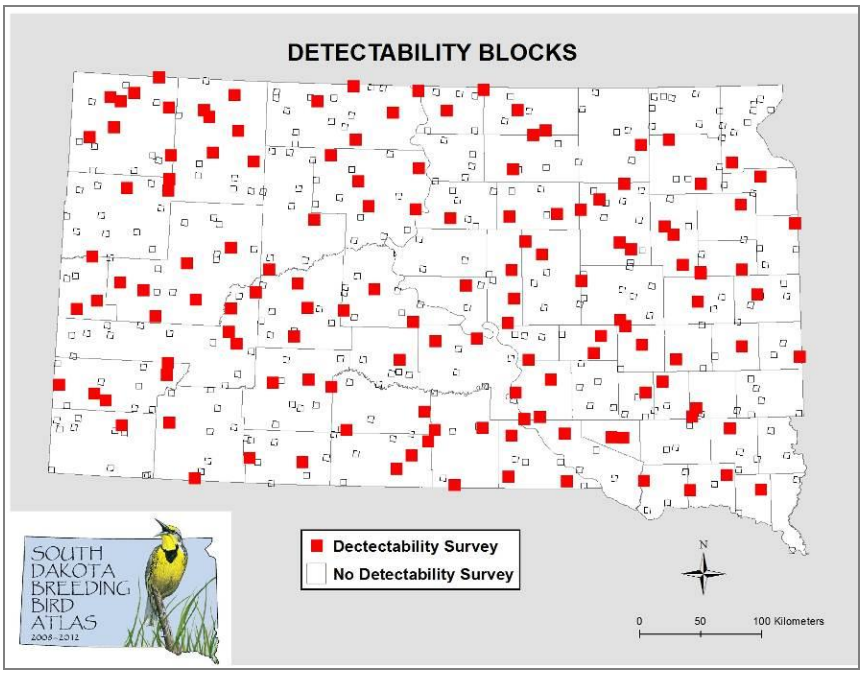

Figure 2. Location of breeding bird atlas blocks randomly selected for collecting species detectability data (red squares, not to scale). Open squares are blocks that were not selected.

blocks in 2010, 37 in 2011, and 16 in 2012 (Figure 2). Each block targeted for the special surveys was visited three times within a four-week period. These blocks could be surveyed on three consecutive days, three consecutive weeks, or at irregular intervals. Each survey lasted four hours and was finished by 10:00 AM CDT. The survey was conducted along the exact same route in each of the three visits. Observers were not required to survey the entire block or visit every habitat during the four-hour survey. If some portions of the block or certain habitats were missed during the four hours, they were to be surveyed at another time; these data were used as general atlas data but not used in estimating detection probabilities. During the survey, observers recorded the same data as in a regular Atlas survey (species, breeding status, habitat code, and location). Observers also estimated the percentage of the block surveyed during the four hours. These data were recorded on separate forms and entered in a separate database for analyses but were also are included in the general atlas database of species occurrence and breeding status. These data will be used both as block data and for calculating species-specific detection probabilities.

PROJECT ORGANIZATION

The second South Dakota Breeding Bird Atlas is administered by two committees - a Steering Committee and a Technical Committee. The Steering Committee is responsible for overall guidance of project planning and implementation, as well as publicity and fund-raising. Members of the Steering Committee include a Project Director, Project Coordinator, representatives of federal, state, and tribal agencies, representatives of scientific and ornithological organizations and universities, and at-large and youth representatives. The Project Coordinator is in charge of actual planning, implementation, and coordination of all aspects of the Atlas. The Technical Committee is responsible for providing guidance on all scientific issues, such as appropriate methods of block selection and data collection, and data analyses and presentation. Members of the Technical Committee include the Project Coordinator, SD GFP Wildlife Diversity scientists, and three University scientists.

RESULTS

PERSONNEL

During SDBBA2, 40 volunteers submitted records for 97 blocks. In the summer of 2012, 16 of these volunteers spent 224 hours conducting surveys on 30 blocks during 65 visits. Four paid staff spent 659 hours on 178 blocks during 296 visits.

In 2012, atlasers submitted 10,706 records from blocks and an additional 1,860 Extra Observations.

BLOCKS

During 2012, atlasers visited 208 random and special blocks at least once (Table 1). During the five year period, surveyors were denied access to eleven blocks; two of the original 124 blocks from SDBBAI and nine of the 301 newly-selected blocks (Figure 3, left map; Table 2). These were replaced using the spatially-balanced sampling design (Figure 3, right map). Figure 4 shows the final result – all blocks that were actually surveyed during the second breeding bird atlas.

Table 1 . Summary of annual and total block results of the South Dakota Breeding Bird Atlas II.

	2008	2009	2010	2011	2012	Total
Num. blocks visited at least once	101	162	257	271	208	**433**
Total num. visits to blocks	252	478	708	619	361	**2418**
Total num. hours on blocks	1014	1512	2067	1793	883	**7269**

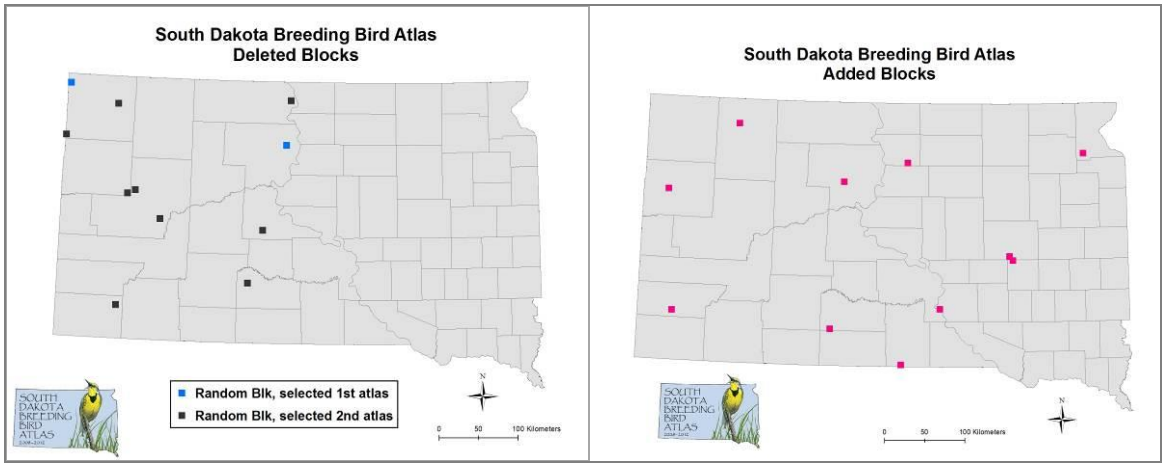

Figure 3. Location of blocks that were deleted (left map) and added (right map) during the second Breeding Bird Atlas. Block size is not to scale.

Table 2. Deleted blocks and reasons for their deletion.

Block Name	County	Year Deleted	Reason for Deletion
West Elm Crk	Butte	2009	landowner says no way to get there
Coffee Butte	Dewey	2011	tribal buffalo ranch, access denied
Northeast of Wakpala	Corson	2011	access denied when cattle there, but are there all summer, every summer
Prospect Twp.	Mellette	2011	access denied when cattle there, but are there all summer, every summer
Hay Canyon	Fall River	2011	no one could figure out how to get there
Brush Creek	Stanley	2011	access denied on all routes in (same person)
Dipping Vat Creek	Harding	2012	far from road, fire danger driving out there
Bradley Draw	Meade	2012	access denied to private road - only way in
East end E6 Rd	Harding	2012	never answered phone
N. Fk Beaver Dam Crk	Harding	2012	far from road, fire danger driving out there
Coyote Creek	Meade	2012	denied permission because of aggressive guard dog with puppies

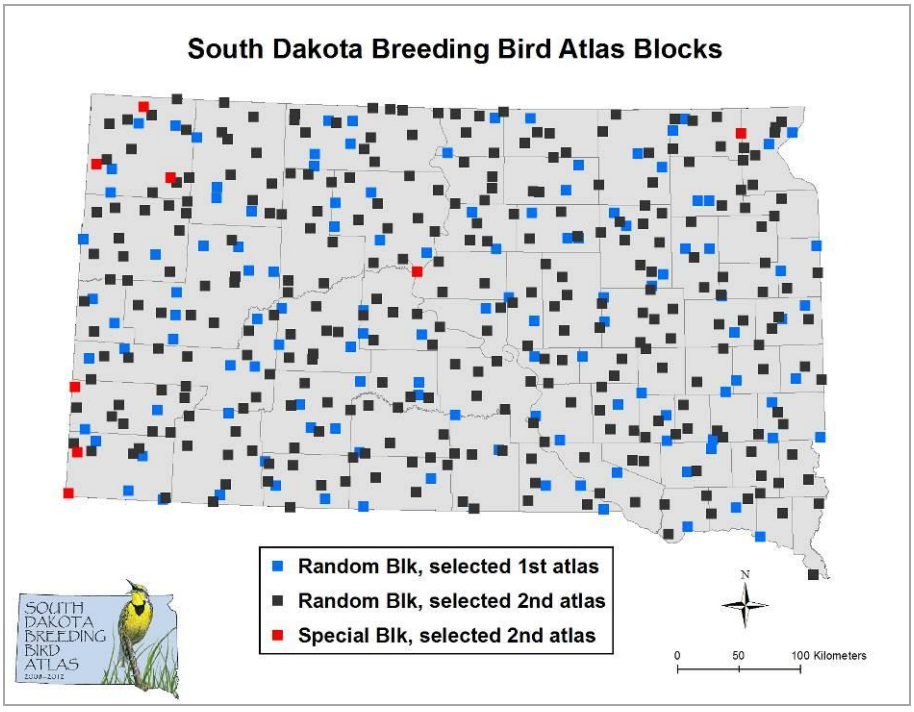

Figure 4. Location of 433 blocks actually surveyed during SDBBA2.

Although 433 blocks were surveyed during SDBBA2, eight of these blocks were considered ‘unfinished’; i.e., block species list clearly missing many species, given the habitat. Reasons are because atlasers were denied access to two of these after a first visit, reduced their effort on five blocks grassland blocks suffering from drought, and missed repeated visits on one block due to a clerical error.

Only four (0.01%) blocks were visited just once during 2008-2011, while 6% were visited twice, 19% visited three times, and 77% visited four or more times (maximum 41 visits). Of all blocks, 17 (4% of total) received less than 5 hours of total survey effort while 42% received more than the recommended 15 hours of survey effort (Figure 5).

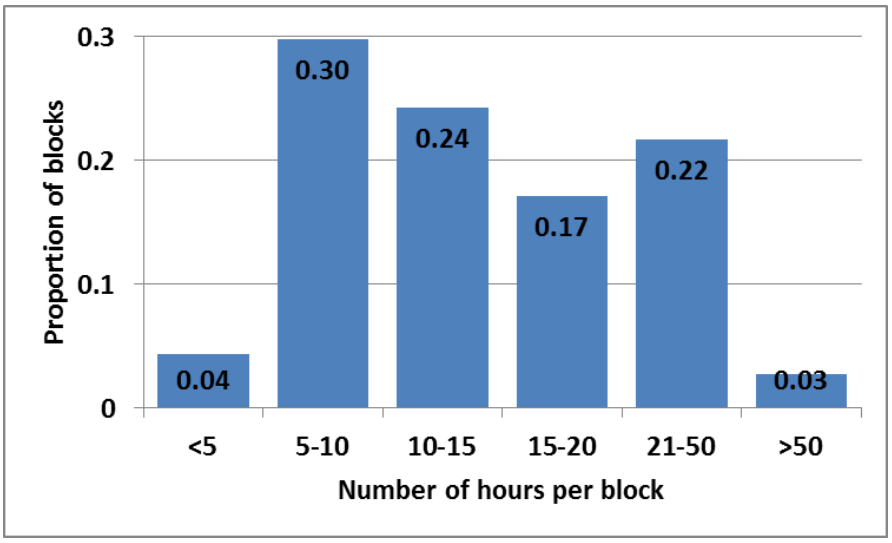

Figure 5. Frequency distribution of total number of survey hours per atlas block.

Atlasers recorded 80 or more species (excluding non-breeding species) on 21 (4.8%) atlas blocks (Appendix A). Another 42 blocks (9.7%) have 73-79 recorded species. Species totals per block ranged from 15 - 104 species (Figure 6, Table 3). Blocks with higher species richness were located in the prairie pothole and prairie coteau regions of the east, along the Missouri River, and along wooded rivers and creeks in the west (Figure 7, Appendix A). Blocks with lower species richness occurred in grassland and wheat field blocks throughout the western part of the state and higher elevations or burn areas of the Black Hills (Figure 7, Appendix B).

Pennington, Fall River, Meade and Custer counties had the highest species counts in the state, while Moody, Miner, Union, and Hanson counties had the lowest number of species (Appendix C).

Table 3. Summary statistics for blocks

Average num. visits per block (range)	5 (1-41)
Average num. hours per block (range)	16.8 (2-201)
Average num. species recorded per block (range)	57 (15-104)
Average % species confirmed per block (range)	24 (3-62%)

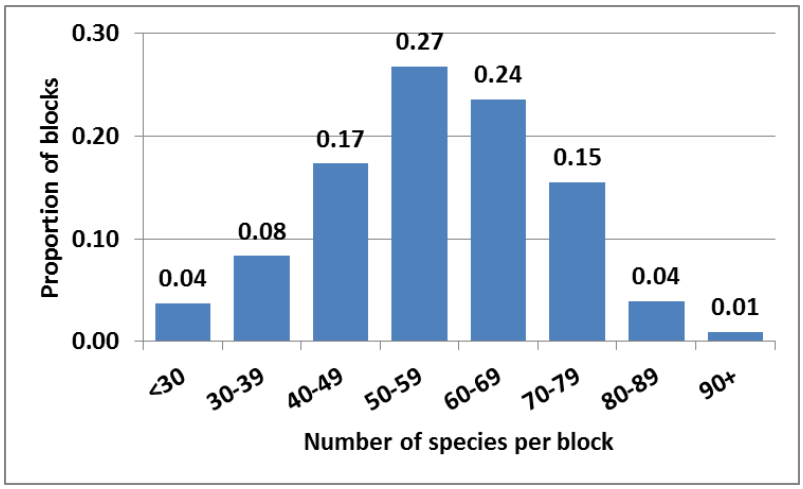

Figure 6. Frequency distribution of the number of species per block.

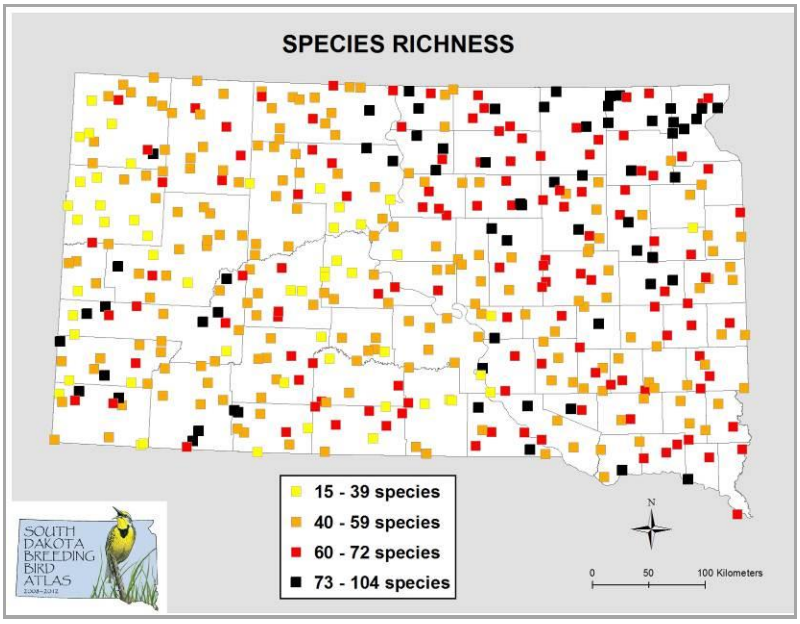

Figure 7. Total number of species recorded per block during SDBBA2. Block size is not to scale.

SPECIES

Based on 31,492 records submitted during 2008-2012, 254 species were recorded at least once in the state (Appendix D). Of these, 242 (95%) were confirmed as breeding, eight (3%) were 'probable' breeders, and two (0.1%) were 'possible' breeders. This tally does not include one species (Bewick's Wren) that is awaiting verification from the state Rare Bird Committee, one hybrid (Indigo-Lazuli Bunting), or three non-breeding summer residents (Snow Goose, Peregrine Falcon and Orange-billed Nightingale-Thrush).

During the second atlas, 237 species were recorded at least once on blocks while 17 species were only reported as extra observations (Table 4).

Table 4. Species only recorded as extra observations during SDBBA2.

Species	# Extra Observat.	# Extra Obs Confirmed	# County Detected	# County Confirmed
American Dipper	46	42	1	1
Common Moorhen	6	3	1	1
Lesser Goldfinch	5	1	1	1
Pacific/Winter Wren	3	0	2	0
Snowy Plover	2	1	1	1
Alder Flycatcher	2	0	1	0
McCown's Longspur	2	0	2	0
Greater Sandhill Crane	1	1	1	1
Neotropic Cormorant	1	1	1	1
Yellow-crowned Night-heron	1	1	1	1
Black Rail	1	1	1	1
Chestnut-sided Warbler	1	1	1	1
Prothonotory Warbler	1	1	1	1
Tricolored Heron	1	0	1	1
Chuck-will's Widow	1	0	1	0
Hermit Thrush	1	0	1	0
Golden-winged Warbler	1	0	1	0

Combining 2008-2012 data, Mallard was the most frequently reported species, Brown-headed Cowbird, Western Meadowlark and Mourning Dove were reported from the highest percentage of blocks, and 25 species were reported from all 66 counties (Table 5).

Table 5. Most common species reported during SDBBA2, defined as those with at least 400 records, in at least 80% of all blocks, or in all 66 counties.

Species	Total # Records	% Blocks Detected	# County Detected
Mallard	537	0.87	66
Western Meadowlark	484	0.98	66
Red-winged Blackbird	468	0.96	66
Brown-headed Cowbird	465	1.00	66
Killdeer	464	0.95	66
Mourning Dove	457	0.98	66
Barn Swallow	452	0.95	65
Red-tailed Hawk	451	0.90	66
Blue-winged Teal	442	0.73	64
Eastern Kingbird	441	0.96	66
American Robin	436	0.89	66
Cliff Swallow	424	0.66	63
Common Grackle	422	0.88	66
Orchard Oriole	416	0.89	65
Grasshopper Sparrow	414	0.91	66
Western Kingbird	411	0.87	66
Upland Sandpiper	407	0.87	65
Horned Lark	392	0.89	66
European Starling	392	0.84	66
Brown Thrasher	390	0.84	66
Yellow Warbler	381	0.81	66
American Goldfinch	369	0.83	66
Dickcissel	363	0.81	66
House Wren	363	0.81	66
House Sparrow	329	0.70	66
Common Yellowthroat	320	0.72	66
Tree Swallow	294	0.63	66
Warbling Vireo	282	0.62	66
Rock Pigeon	255	0.57	66

Twenty-two species were detected during SDBBA2 that were not reported during the first South Dakota Breeding Bird Atlas (Table 6). In addition, 14 species (American Black Duck, Cinnamon Teal, Barred Owl, Common Gallinule, Horned Grebe, Little Blue Heron, Yellow-crowned Night-heron, Caspian Tern, Broad-tailed

Hummingbird, Canyon Wren, Clark's Nutcracker, Sprague's Pipit, Baird's Sparrow, and Le Conte's Sparrow) were reported but never confirmed nesting during the first atlas but were confirmed breeding during the current atlas.

Whip-poor-will is the only species that was confirmed breeding during the first atlas that was not confirmed breeding during SDBBA2. In addition there were four species (King Rail, Chukar, Carolina Wren, Cerulean Warbler) that were classified as 'Possible' breeders during the first atlas but not detected during SDBBA2.

Table 6. Species reported during SDBBA2 that were not detected during the first breeding bird atlas.

Confirmed during 2nd atlas	Reported but not confirmed
Sandhill Crane	Tri-colored Heron
Common Loon	Chuck-will's-widow
Neotropic Cormorant	Alder Flycatcher
Glossy Ibis	Hermit Thrush
Herring Gull	Golden-winged Warbler
Snowy Plover	Blue-winged Warbler
Black-necked Stilt	Henslow's Sparrow
Black Rail**	
Eurasian Collared-Dove	
Chestnut-sided Warbler	
Prothonotary Warbler	
Virginia's Warbler	
Great-tailed Grackle	
Cassin's Sparrow	
Lesser Goldfinch	

**Record awaiting approval by Rare Bird Committee

DISCUSSION

During summer 2012, the last field season of SDBBA2, most of the state was in the second year of severe to exceptional drought. This impacted the atlas in two ways – by limiting access to some blocks because of risk of fire and by reducing number of species found because of lack of water. Two of five blocks replaced with new blocks during 2012 were replaced because they were far from roads and required driving through pastures for several miles to access them. The fear was

that hot vehicles would start a fire in the tinder-dry grasslands. Because of this possibility, atlasers in 2012 also were denied access to two other blocks, in Lyman and Bennett counties, that had been visited earlier in the SDBBA2. These two blocks had to remain unfinished. Five grassland blocks which we could walk into, in Harding, Butte, and Meade counties, were first visited in 2012. Because of the extreme drought, wetlands were entirely dry and total species counts were very low. These five also had to remain unfinished for the atlas. If there were adequate moisture in 2013, we would consider attempting at least one visit to each of these but long-term forecast does not predict such a scenario.

During the first atlas, an average of 49 species were recorded per random block (Peterson 1996) while in this atlas, an average of 57 species were recorded. In addition, SDBBA2 had 61 random blocks with more than 72 species, the maximum number of species recorded on first atlas random blocks. Because we do not know how much effort, in terms of hours, was spent per block during the first atlas, we can only speculate whether difference in effort explains higher species totals during the current atlas. One difference between the two atlases is that the second atlas utilized paid staff while all first-atlas surveyors were volunteers. Paid atlasers are expert at bird-identification, while some volunteers are not. In addition, paid staff spent eight hours or more a day, six weeks a summer on atlas blocks. Volunteers, who usually had other jobs and responsibilities, were not able to spend so much time on blocks, no matter how excellent they were at atlasing. Thus, it is probable that the use of paid atlasers was a factor in higher overall species totals.

Besides mapping individual species distributions, we can also map patterns of bird species diversity across the state and possible reasons for those patterns (Figure 7). Habitat in many of the low diversity blocks was grassland-pasture or grassland-pasture-wheat field habitats with little to no water or trees. Water was scarce on many of these blocks, especially during the drought of the last two years of the atlas. Low-diversity blocks in the Black Hills consisted of monoculture, even-aged ponderosa pine stands where atlasers struggled to find any other habitats (riparian, shrubby, deciduous, or spruce) which would host additional bird species. The fact that an adjacent block could have double the number of species highlights the importance of land management on bird species diversity. High bird diversity blocks were characterized by having several types of good-quality semi-natural habitat, such as ponds of various depths and sizes, large dense shelterbelts, pastures and grasslands with different grazing regimes, and very little row crop or residential habitats.

SDBBA2 (254 species, 242 confirmed breeding) found 35 more species than recorded 20 years ago during the first atlas (219 species, 212 confirmed). The current list includes two ‘new’ species which have been split from Rufous-sided Towhee (now Spotted and Eastern Towhee) and Northern Oriole (now Bullock’s and Baltimore Oriole) since the first atlas. The South Dakota breeding bird species total is similar to totals recorded in states of similar size but with thousands of

atlasers, such as Pennsylvania (6 years, 3282 atlasers, 217 species, 189 confirmed) and New York (5 years, 1187 atlasers, 242 species, 240 confirmed). The next steps are to obtain more data from outside sources (i.e., other research projects, RMBO monitoring database, state and federal survey results, etc.) and then calculate detection probabilities for each species.

For common species, first and second atlas results are similar. The following were most frequently reported species on first atlas random blocks (in decreasing order of frequency): Mourning Dove, Western Meadowlark, Brown-headed Cowbird, Killdeer, Red-winged Blackbird, Eastern Kingbird, Barn Swallow, Common Grackle, American Robin, and Mallard (Peterson 1995). This list is almost identical to the SDBBA2 data (Table 5).

Breeding bird highlights of 2012 were scattered throughout the state as atlasers surveyed in areas where little bird survey work has been done. These areas included the West River tribal lands, extreme northeast South Dakota, and the northwestern counties of Perkins, Harding, Meade, and Butte. From these surveys, we learned that many of these areas host high or the highest species richness in the state (Figure 7). The atlas was also aided by simultaneous colonial waterbird surveys which documented breeding by several rare species and provided breeding data on more than 180 active colonies. Some volunteers made an effort to document and confirm breeding by rarer species, and ended up confirming breeding by 20 more species. These included confirmation of breeding by Cinnamon Teal, Veery, Brown Creeper, Nelson's Sparrow, and Cassin's Finch, among others. If accepted by the state Rare Bird Committee, observations of breeding Glossy Ibis and Neotropic Cormorant will be first state records.

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APPENDIX A. BLOCKS WITH HIGHEST SPECIES RICHNESS

Breeding Bird Atlas blocks with at least 80 recorded species, excluding observed (non-breeding) species.

Block ID	Block Name	County	Num. Species	1st Atlas Results
2R0203	Dayton Township	Marshall	104	N/A
2R0236	SW Drywood Lake	Roberts	101	N/A
2S0001	Sica Hollow	Roberts	98	N/A
2R0168	Whitestone Lake	Roberts	92	N/A
1R1107	Boyer GPA	Brule	89	49 spp
2R0304	Blue Blanket Lake	Walworth	87	N/A
2R0301	Jct. Hwy 10/45-112 St.	McPherson	87	N/A
2R0212	VenJohn WPA	Hand	87	NA
2R0269	Newport Township	Marshall	86	N/A
2R0057	Spring Lake	Walworth	86	N/A
2R0270	Sheep Crk-Slim Buttes	Harding	85	N/A
2R0105	Bryant	Hamlin	84	N/A
2R0147	Blackfoot	Dewey	83	N/A
1R0203	Silver City	Pennington	83	58 spp
2R0308	Roy Lake GPA	Marshall	82	N/A
2R0300	White Horse Creek	Shannon	82	N/A
2R0314	Song Dog Drive	Custer	82	N/A
1R0505	No Flesh Creek	Bennett	82	53 spp
2R0036	Goodwill Township	Roberts	81	N/A
1R0206	Craven-Red Canyon	Fall River	81	62 spp
2R0173	Redstone Crk-James Riv.	Sanborn	80	N/A

APPENDIX B. BLOCKS WITH LOWEST SPECIES RICHNESS

Breeding Bird Atlas blocks with less than 35 recorded species, excluding observed (non-breeding) species.

Block ID	Block Name	County	Num Species	1st Atlas Results
2R0194	Eightmile Creek	Butte	15	N/A
1R0106	Jug Creek	Butte	19	22 spp
1R0401	Four-mile Creek	Meade	20	40 spp
2R0312	Nicholas Creek	Lyman	21	N/A
2R0169	BLM Fourmile	Butte	21	N/A
2R0068	100th Meridian	Tripp	21	N/A
2R0014	Southwest of Buffalo	Harding	21	N/A
2R0056	SE Fall River County**	Fall River	22	N/A
1R0105	South of Owl Crk at WY border	Butte	23	43 spp
2R0282	SW Red Fish Twp	Mellette	24	N/A
2R0024	Mattison Twp	Haakon	25	N/A
2R0042	BIA 802	Dewey	26	N/A
2R0223	Jct. Hwys 73-44	Jackson	26	N/A
2R0224	Wolf Creek	Buffalo	26	N/A
1R0507	Madera Creek**	Fall River	27	31 spp
2R0133	Granger Creek	Harding	29	N/A
2R0174	Lame Johnny Creek	Custer	30	N/A
2R0309	Kinghorn Road	Butte	30	N/A
2R0302	Mitchell Creek	Haakon	30	N/A
2R0020	Crow Creek NW of Belle Fourche	Butte	31	N/A
2R0075	Heckel Creek	Bennett	32	N/A
2R0219	Conata Basin Road	Pennington	32	N/A
1R0701	Wagonbound Creek	Stanley	33	37 spp
1R0708	Pleasant Valley Twp	Tripp	33	40 spp
2R0210	FR283	Pennington	33	N/A
2R0152	Gallup Creek	Harding	34	N/A
2R0119	Green Grass Creek	Dewey	34	N/A
1R0204	South Fork Castle Creek	Pennington	34	31 spp

**Madera Creek and SE Fall River County blocks overlap each other

APPENDIX C. COUNTY SUMMARY STATISTICS

Summary statistics by county, counties ordered from highest to lowest species totals. Columns include total number of species recorded in the county (Num Species), total number (Num CO) and percent (% CO) of species confirmed breeding, number of atlas blocks in the county (Num Blocks), total number of visits (Num Visits) and total number of hours (Total Hours) spent on all blocks in the county.

Rank	County	Num Species	Num CO	% CO	Num Blocks	Num Visits	Total Hours
1	Pennington	163	98	0.60	16	147	522
2	Fall River	152	94	0.62	11	81	265
3	Meade	147	83	0.56	16	81	265
4	Custer	146	90	0.62	12	102	333
5	Roberts	144	82	0.57	10	42	120
6	Bennett	141	82	0.58	9	51	154
7	Brown	140	76	0.54	6	44	78
8	Harding	138	99	0.72	17	113	454
9	Dewey	135	64	0.47	15	60	144
10	Marshall	134	69	0.51	7	25	74
11	Shannon	132	64	0.48	9	41	167
12	Perkins	128	97	0.76	14	79	217
13	Stanley	126	82	0.65	10	79	233
14	Walworth	123	66	0.54	5	14	34
15	Butte	122	68	0.56	13	45	128
16	Spink	122	56	0.46	13	56	181
17	McPherson	121	78	0.64	5	26	66
18	Campbell	121	66	0.55	8	34	105
19	Todd	121	53	0.44	8	35	123
20	Day	120	78	0.65	5	23	65
21	Jackson	118	58	0.49	10	54	175
22	Corson	117	64	0.55	16	64	135
23	Ziebach	117	48	0.41	9	42	89
24	Potter	116	68	0.59	6	26	82
25	Haakon	115	65	0.57	10	49	152
26	Edmunds	115	51	0.44	6	24	63
27	Brule	114	61	0.54	4	28	103
28	Tripp	113	59	0.52	8	41	107
29	Lawrence	112	77	0.69	5	47	171
30	Lyman	112	53	0.47	7	25	81

Appendix C: County Summary Statistics (cont.)

Rank	County	Num Species	Num CO	% CO	Num Blocks	Num Visits	Total Hours
31	Hand	111	45	0.41	6	32	95
32	Grant	111	35	0.32	2	10	22
33	Minnehaha	110	84	0.76	6	73	194
34	Buffalo	109	40	0.37	4	18	49
35	Charles Mix	108	69	0.64	4	22	62
36	Hughes	107	66	0.62	3	15	47
37	Beadle	107	61	0.57	9	40	145
38	Gregory	107	50	0.47	7	43	144
39	Clark	104	53	0.51	5	28	95
40	Brookings	104	50	0.48	6	34	86
41	Bon Homme	101	46	0.46	4	23	85
42	Deuel	101	45	0.45	4	16	46
43	Sully	100	58	0.58	4	19	50
44	Faulk	98	51	0.52	6	38	80
45	Yankton	98	47	0.48	3	16	58
46	Hamlin	97	38	0.39	4	24	78
47	Kingsbury	95	56	0.59	3	18	73
48	Aurora	94	49	0.52	5	16	46
49	Douglas	94	42	0.45	2	17	59
50	Hyde	93	59	0.63	5	22	67
51	Codington	93	40	0.43	3	13	41
52	Jerauld	91	29	0.32	3	13	41
53	Clay	90	59	0.66	2	17	57
54	Lincoln	90	47	0.52	2	12	39
55	Sanborn	90	31	0.34	3	14	48
56	Mellette	89	43	0.48	5	22	75
57	Davison	88	32	0.36	4	13	46
58	Jones	86	53	0.62	6	30	67
59	Lake	86	34	0.40	2	11	41
60	Hutchinson	86	27	0.31	3	12	28
61	McCook	84	31	0.37	3	10	38
62	Turner	83	38	0.46	4	15	54
63	Hanson	83	30	0.36	3	11	41
64	Union	82	43	0.52	2	13	39
65	Miner	82	32	0.39	3	13	46
66	Moody	78	35	0.45	3	15	79

APPENDIX D. SPECIES SUMMARIES

Summary of block and extra observations and confirmed breeding by species. Information includes total number of records (Total Recs) and confirmed breeding (Totl Num CO); number of blocks species was reported in (Num Blks), proportion of all blocks (Prop Blks), and number of blocks in which species was confirmed breeding (Num Blks CO); number of extra observations (Num Extra Obs) and extra confirmed breeding observations (Num Extra Obs CO); number of counties in which species was observed (Num Cnty) and confirmed breeding (Num Cnty CO); and the highest reported breeding status.

Scientific Name	Common Name	Total Recs	Totl Num CO	Num Blks	Prop Blks	Num Blks CO	Num Extra Obs	Num Extra Obs CO	Num Cnty	Num Cnty CO	Highest Status
Branta canadensis	Canada Goose	309	205	219	0.51	116	90	89	64	54	confirmed
Cygnus buccinator	Trumpeter Swan	16	7	3	0.01	0	13	7	8	4	confirmed
Aix sponsa	Wood Duck	185	78	144	0.33	39	41	39	60	39	confirmed
Anas strepera	Gadwall	376	180	280	0.65	86	96	94	61	44	confirmed
Anas americana	American Wigeon	126	24	109	0.25	13	17	11	38	14	confirmed
Anas rubripes	American Black Duck	3	1	1	0.00	0	2	1	3	1	confirmed
Anas platyrhynchos	Mallard	537	326	375	0.87	167	162	159	66	62	confirmed
Anas discors	Blue-winged Teal	442	277	316	0.73	154	126	123	64	56	confirmed
Anas cyanoptera	Cinnamon Teal	11	2	3	0.01	0	8	2	8	2	confirmed
Anas clypeata	Northern Shoveler	304	157	220	0.51	73	84	84	58	42	confirmed
Anas acuta	Northern Pintail	284	124	221	0.51	63	63	61	56	41	confirmed
Anas crecca	Green-winged Teal	135	23	119	0.27	10	16	13	49	14	confirmed
Aythya valisineria	Canvasback	56	18	41	0.09	7	15	11	27	12	confirmed
Aythya americana	Redhead	143	42	122	0.28	22	21	20	49	24	confirmed
Aythya collaris	Ring-necked Duck	40	6	33	0.08	0	7	6	20	5	confirmed
Aythya affinis	Lesser Scaup	66	16	44	0.10	3	22	13	34	8	confirmed
Bucephala albeola	Bufflehead	7	1	5	0.01	1	2	0	2	1	confirmed
Lophodytes cucullatus	Hooded Merganser	27	9	13	0.03	3	14	6	8	7	confirmed
Mergus merganser	Common Merganser	3	1	1	0.00	0	2	1	1	1	confirmed

Scientific Name	Common Name	Total Recs	Totl Num CO	Num Blks	Prop Blks	Num Blks CO	Num Extra Obs	Num Extra Obs CO	Num Cnty	Num Cnty CO	Highest Status
Oxyura jamaicensis	Ruddy Duck	124	19	111	0.26	10	13	9	45	17	confirmed
Perdix perdix	Gray Partridge	83	15	59	0.14	8	24	7	36	14	confirmed
Phasianus colchicus	Ring-necked Pheasant	378	172	343	0.79	139	35	33	62	48	confirmed
Bonasa umbellus	Ruffed Grouse	13	4	2	0.00	1	11	3	3	2	confirmed
Centrocercus urophasianus	Greater Sage-Grouse	10	3	3	0.01	0	7	3	3	1	confirmed
Tympanuchus phasianellus	Sharp-tailed Grouse	200	67	160	0.37	39	40	28	39	27	confirmed
Tympanuchus cupido	Greater Prairie-chicken	39	5	27	0.06	1	12	4	19	5	confirmed
Meleagris gallopavo	Wild Turkey	151	52	124	0.29	27	27	25	49	32	confirmed
Colinus virginianus	Northern Bobwhite	4	1	1	0.00	0	3	1	6	1	confirmed
Gavia immer	Common Loon	3	1	1	0.00	1	2	0	4	1	confirmed
Podilymbus podiceps	Pied-billed Grebe	265	166	174	0.40	80	91	86	61	50	confirmed
Podiceps auritus	Horned Grebe	18	5	4	0.01	0	14	5	3	2	confirmed
Podiceps grisegena	Red-necked Grebe	35	16	11	0.03	6	24	10	6	5	confirmed
Podiceps nigricollis	Eared Grebe	117	70	45	0.10	9	72	61	33	23	confirmed
Aechmophorus occidentalis	Western Grebe	125	88	50	0.12	21	75	67	40	32	confirmed
Aechmophorus clarkii	Clark's Grebe	24	10	9	0.02	2	15	8	15	9	confirmed
Grus canadensis	Greater Sandhill Crane	1	1	0	0.00	0	1	1	1	1	confirmed
Pelecanus erythrorhynchos	American White Pelican	111	6	105	0.24	0	6	6	44	5	confirmed
Phalacrocorax brasilianus	Neotropic Cormorant	1	1	0	0.00	0	1	1	1	1	confirmed
Phalacrocorax auritus	Double-crested Cormorant	225	108	123	0.28	7	102	101	52	30	confirmed
Botaurus lentiginosus	American Bittern	86	2	83	0.19	1	3	1	40	2	confirmed
Ixobrychus exilis	Least Bittern	36	2	23	0.05	1	13	1	20	2	confirmed
Ardea herodias	Great Blue Heron	366	143	232	0.54	11	134	132	55	42	confirmed
Ardea alba	Great Egret	79	28	49	0.11	0	30	28	16	14	confirmed
Egretta thula	Snowy Egret	29	13	16	0.04	1	13	12	10	6	confirmed
Egretta caerulea	Little Blue Heron	7	1	2	0.00	0	5	1	3	1	confirmed

Scientific Name	Common Name	Total Recs	Totl Num CO	Num Blks	Prop Blks	Num Blks CO	Num Extra Obs	Num Extra Obs CO	Num Cnty	Num Cnty CO	Highest Status
Egretta tricolor	Tricolored Heron	1	0	0	0.00	0	1	0	1	0	probable
Bubulcus ibis	Cattle Egret	58	14	42	0.10	1	16	13	10	8	confirmed
Butorides virescens	Green Heron	35	6	20	0.05	2	15	4	20	5	confirmed
Nycticorax nycticorax	Black-crowned Night-heron	85	21	62	0.14	4	23	17	23	12	confirmed
Nyctanassa violacea	Yellow-crowned Night-heron	1	1	0	0.00	0	1	1	1	1	confirmed
Plegadis falcinellus	Glossy Ibis	8	3	4	0.01	0	4	3	4	2	confirmed
Plegadis chihi	White-faced Ibis	46	13	34	0.08	1	12	12	16	7	confirmed
Cathartes aura	Turkey Vulture	218	3	212	0.49	0	6	3	50	3	confirmed
Pandion haliaetus	Osprey	23	17	5	0.01	1	18	16	4	4	confirmed
Haliaeetus leucocephalus	Bald Eagle	70	30	38	0.09	6	32	24	29	22	confirmed
Circus cyaneus	Northern Harrier	269	26	254	0.59	14	15	12	57	19	confirmed
Accipiter striatus	Sharp-shinned Hawk	10	1	7	0.02	1	3	0	7	1	confirmed
Accipiter cooperii	Cooper's Hawk	102	15	61	0.14	5	41	10	46	12	confirmed
Accipiter gentilis	Northern Goshawk	8	2	3	0.01	1	5	1	3	1	confirmed
Buteo platypterus	Broad-winged Hawk	12	1	8	0.02	1	4	0	3	1	confirmed
Buteo swainsoni	Swainson's Hawk	281	72	234	0.54	30	47	42	57	24	confirmed
Buteo jamaicensis	Red-tailed Hawk	451	103	391	0.90	44	60	59	66	38	confirmed
Buteo regalis	Ferruginous Hawk	98	16	61	0.14	0	37	16	27	9	confirmed
Aquila chrysaetos	Golden Eagle	87	22	67	0.15	6	20	16	18	8	confirmed
Falco sparverius	American Kestrel	233	36	217	0.50	28	16	8	57	25	confirmed
Falco columbarius	Merlin	13	2	9	0.02	1	4	1	4	1	confirmed
Falco mexicanus	Prairie Falcon	40	10	27	0.06	3	13	7	12	3	confirmed
Laterallus jamaicensis	Black Rail	1	1	0	0.00	0	1	1	1	1	confirmed
Rallus limicola	Virginia Rail	103	21	82	0.19	7	21	14	48	15	confirmed
Porzana carolina	Sora	169	10	154	0.36	4	15	6	54	9	confirmed
Gallinula chloropus	Common Gallinule	6	3	0	0.00	0	6	3	1	1	confirmed
Fulica americana	American Coot	268	186	190	0.44	112	78	74	58	51	confirmed

Scientific Name	Common Name	Total Recs	Totl Num CO	Num Blks	Prop Blks	Num Blks CO	Num Extra Obs	Num Extra Obs CO	Num Cnty	Num Cnty CO	Highest Status
Charadrius nivosus	Snowy Plover	2	1	0	0.00	0	2	1	1	1	confirmed
Charadrius melodus	Piping Plover	15	5	4	0.01	0	11	5	8	3	confirmed
Charadrius vociferus	Killdeer	464	231	412	0.95	181	52	50	66	64	confirmed
Himantopus mexicanus	Black-necked Stilt	7	2	1	0.00	0	6	2	4	2	confirmed
Recurvirostra americana	American Avocet	133	78	65	0.15	19	68	59	37	28	confirmed
Tringa semipalmata	Willet	71	20	51	0.12	5	20	15	28	11	confirmed
Actitis macularius	Spotted Sandpiper	150	17	122	0.28	2	28	15	56	11	confirmed
Bartramia longicauda	Upland Sandpiper	407	82	377	0.87	54	30	28	65	35	confirmed
Numenius americanus	Long-billed Curlew	110	15	58	0.13	8	52	7	22	11	confirmed
Limosa fedoa	Marbled Godwit	171	22	145	0.33	7	26	15	42	15	confirmed
Gallinago delicata	Wilson's Snipe	109	8	100	0.23	5	9	3	40	6	confirmed
Scolopax minor	American Woodcock	13	1	3	0.01	0	10	1	6	1	confirmed
Phalaropus tricolor	Wilson's Phalarope	199	37	169	0.39	16	30	21	47	22	confirmed
Leucophaeus pipixcan	Franklin's Gull	76	7	65	0.15	1	11	6	4	4	confirmed
Larus delawarensis	Ring-billed Gull	90	11	79	0.18	0	11	11	7	7	confirmed
Larus californicus	California Gull	34	6	23	0.05	0	11	6	6	5	confirmed
Larus argentatus	Herring Gull	4	3	1	0.00	0	3	3	3	3	confirmed
Hydroprogne caspia	Caspian Tern	7	3	2	0.00	0	5	3	3	3	confirmed
Sterna hirundo	Common Tern	22	10	10	0.02	0	12	10	5	5	confirmed
Sterna forsteri	Forster's Tern	56	20	32	0.07	6	24	14	19	8	confirmed
Sternula antillarum	Least Tern	12	2	6	0.01	0	6	2	6	2	confirmed
Chlidonias niger	Black Tern	137	31	94	0.22	17	43	14	33	12	confirmed
Columba livia	Rock Pigeon	255	12	246	0.57	7	9	5	66	11	confirmed
Streptopelia decaocto	Eurasian Collared-dove	223	18	78	0.18	6	145	12	63	15	confirmed
Zenaida macroura	Mourning Dove	457	190	423	0.98	162	34	28	66	62	confirmed
Coccyzus erythropthalmus	Black-billed Cuckoo	78	5	64	0.15	3	14	2	38	4	confirmed
Coccyzus americanus	Yellow-billed Cuckoo	77	8	59	0.14	2	18	6	38	8	confirmed
Tyto alba	Barn Owl	34	25	4	0.01	1	30	24	17	13	confirmed

Scientific Name	Common Name	Total Recs	Totl Num CO	Num Blks	Prop Blks	Num Blks CO	Num Extra Obs	Num Extra Obs CO	Num Cnty	Num Cnty CO	Highest Status
Megascops asio	Eastern Screech-owl	52	8	24	0.06	1	28	7	27	5	confirmed
Bubo virginianus	Great Horned Owl	286	95	200	0.46	28	86	67	65	36	confirmed
Athene cunicularia	Burrowing Owl	329	228	88	0.20	36	241	192	38	28	confirmed
Strix varia	Barred Owl	5	2	3	0.01	0	2	2	3	2	confirmed
Asio otus	Long-eared Owl	56	26	14	0.03	0	42	26	13	7	confirmed
Asio flammeus	Short-eared Owl	54	6	32	0.07	2	22	4	21	4	confirmed
Aegolius acadicus	Northern Saw-whet Owl	72	40	18	0.04	4	54	36	7	1	confirmed
Chordeiles minor	Common Nighthawk	241	9	225	0.52	1	16	8	52	8	confirmed
Phalaenoptilus nuttallii	Common Poorwill	31	3	16	0.04	1	15	2	13	2	confirmed
Antrostomus carolinensis	Chuck-will's Widow	1	0	0	0.00	0	1	0	1	0	probable
Antrostomus vociferus	Whip-poor-will	9	0	2	0.00	0	7	0	7	0	probable
Chaetura pelagica	Chimney Swift	118	5	48	0.11	0	70	5	55	4	confirmed
Aeronautes saxatalis	White-throated Swift	25	2	18	0.04	1	7	1	7	2	confirmed
Archilochus colubris	Ruby-throated Hummingbird	17	4	6	0.01	1	11	3	11	4	confirmed
Selasphorus platycercus	Broad-tailed Hummingbird	9	3	4	0.01	1	5	2	3	2	confirmed
Megaceryle alcyon	Belted Kingfisher	103	19	94	0.22	14	9	5	47	14	confirmed
Melanerpes lewis	Lewis's Woodpecker	16	9	7	0.02	3	9	6	6	2	confirmed
Melanerpes erythrocephalus	Red-headed Woodpecker	243	80	196	0.45	47	47	33	64	42	confirmed
Melanerpes carolinus	Red-bellied Woodpecker	33	8	24	0.06	0	9	8	17	8	confirmed
Sphyrapicus varius	Yellow-bellied Sapsucker	16	7	6	0.01	0	10	7	6	3	confirmed
Sphyrapicus nuchalis	Red-naped Sapsucker	22	14	12	0.03	7	10	7	4	3	confirmed
Picoides pubescens	Downy Woodpecker	172	30	157	0.36	18	15	12	59	19	confirmed
Picoides villosus	Hairy Woodpecker	173	27	157	0.36	15	16	12	60	19	confirmed
Picoides dorsalis	Amer. Three-toed Woodpecker	12	1	2	0.00	0	10	1	3	1	confirmed
Picoides arcticus	Black-backed Woodpecker	13	4	3	0.01	1	10	3	3	2	confirmed
Colaptes auratus	Northern Flicker	349	50	337	0.78	43	12	7	64	35	confirmed
Dryocopus pileatus	Pileated Woodpecker	5	0	3	0.01	0	2	0	2	0	probable
Contopus sordidulus	Western Wood-pewee	68	15	60	0.14	9	8	6	13	8	confirmed

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Contopus virens	Eastern Wood-pewee	55	8	46	0.11	3	9	5	30	6	confirmed
Empidonax traillii	Willow Flycatcher	199	23	190	0.44	16	9	7	57	16	confirmed
Empidonax alnorum	Alder Flycatcher	2	0	0	0.00	0	2	0	1	0	probable
Empidonax minimus	Least Flycatcher	149	12	140	0.32	5	9	7	43	7	confirmed
Empidonax oberholseri	Dusky Flycatcher	15	3	13	0.03	1	2	2	4	2	confirmed
Empidonax occidentalis	Cordilleran Flycatcher	27	9	13	0.03	2	14	7	5	3	confirmed
Sayornis phoebe	Eastern Phoebe	84	25	70	0.16	13	14	12	42	17	confirmed
Sayornis saya	Say's Phoebe	139	49	112	0.26	32	27	17	31	20	confirmed
Myiarchus crinitus	Great Crested Flycatcher	82	14	69	0.16	9	13	5	33	9	confirmed
Tyrannus vociferans	Cassin's Kingbird	10	1	2	0.00	0	8	1	4	1	confirmed
Tyrannus verticalis	Western Kingbird	411	185	378	0.87	153	33	32	66	52	confirmed
Tyrannus tyrannus	Eastern Kingbird	441	201	416	0.96	178	25	23	66	64	confirmed
Lanius ludovicianus	Loggerhead Shrike	170	57	137	0.32	33	33	24	39	24	confirmed
Vireo bellii	Bell's Vireo	104	22	82	0.19	10	22	12	34	16	confirmed
Vireo flavifrons	Yellow-throated Vireo	17	5	4	0.01	1	13	4	10	4	confirmed
Vireo plumbeus	Plumbeous Vireo	22	7	16	0.04	3	6	4	6	4	confirmed
Vireo gilvus	Warbling Vireo	282	28	270	0.62	19	12	9	66	20	confirmed
Vireo olivaceus	Red-eyed Vireo	97	10	82	0.19	4	15	6	39	8	confirmed
Perisoreus canadensis	Gray Jay	31	3	9	0.02	1	22	2	3	3	confirmed
Cyanocitta cristata	Blue Jay	190	32	173	0.40	19	17	13	61	24	confirmed
Gymnorhinus cyanocephalus	Pinyon Jay	12	1	3	0.01	0	9	1	5	1	confirmed
Nucifraga columbiana	Clark's Nutcracker	11	1	3	0.01	0	8	1	3	1	confirmed
Pica hudsonia	Black-billed Magpie	78	10	51	0.12	4	27	6	22	10	confirmed
Corvus brachyrhynchos	American Crow	219	17	209	0.48	8	10	9	54	10	confirmed
Eremophila alpestris	Horned Lark	392	71	385	0.89	65	7	6	66	27	confirmed
Progne subis	Purple Martin	88	72	23	0.05	11	65	61	41	37	confirmed
Tachycineta bicolor	Tree Swallow	294	110	274	0.63	90	20	20	66	45	confirmed
Tachycineta thalassina	Violet-green Swallow	39	15	30	0.07	6	9	9	7	7	confirmed

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Stelgidopteryx serripennis	N. Rough-winged Swallow	181	46	162	0.37	29	19	17	53	26	confirmed
Riparia riparia	Bank Swallow	147	51	119	0.27	23	28	28	48	32	confirmed
Petrochelidon pyrrhonota	Cliff Swallow	424	267	287	0.66	130	137	137	63	60	confirmed
Hirundo rustica	Barn Swallow	452	211	410	0.95	172	42	39	66	61	confirmed
Poecile atricapillus	Black-capped Chickadee	165	39	143	0.33	19	22	20	55	18	confirmed
Sitta canadensis	Red-breasted Nuthatch	39	12	34	0.08	7	5	5	9	4	confirmed
Sitta carolinensis	White-breasted Nuthatch	125	30	106	0.24	14	19	16	47	14	confirmed
Sitta pygmaea	Pygmy Nuthatch	14	3	6	0.01	2	8	1	7	2	confirmed
Certhia americana	Brown Creeper	24	2	10	0.02	1	14	1	3	2	confirmed
Salpinctes obsoletus	Rock Wren	60	17	37	0.09	12	23	5	19	9	confirmed
Catherpes mexicanus	Canyon Wren	11	5	3	0.01	2	8	3	4	2	confirmed
Troglodytes aedon	House Wren	363	88	337	0.78	66	26	22	66	43	confirmed
Troglodytes sp.	Pacific/Winter Wren	3	0	0	0.00	0	3	0	2	0	probable
Cistothorus platensis	Sedge Wren	165	5	156	0.36	2	9	3	47	4	confirmed
Cistothorus palustris	Marsh Wren	158	16	145	0.33	11	13	5	48	11	confirmed
Cinclus mexicanus	American Dipper	46	42	0	0.00	0	46	42	2	1	confirmed
Regulus satrapa	Golden-crowned Kinglet	7	3	5	0.01	1	2	2	2	1	confirmed
Regulus calendula	Ruby-crowned Kinglet	19	3	9	0.02	1	10	2	4	3	confirmed
Polioptila caerulea	Blue-gray Gnatcatcher	22	10	7	0.02	1	15	9	10	7	confirmed
Sialia sialis	Eastern Bluebird	159	53	127	0.29	28	32	25	58	38	confirmed
Sialia currucoides	Mountain Bluebird	56	28	45	0.10	19	11	9	14	8	confirmed
Myadestes townsendi	Townsend's Solitaire	29	12	16	0.04	2	13	10	6	5	confirmed
Catharus fuscescens	Veery	9	1	3	0.01	0	6	1	3	1	confirmed
Catharus ustulatus	Swainson's Thrush	15	3	9	0.02	0	6	3	4	1	confirmed
Catharus guttatus	Hermit Thrush	1	0	0	0.00	0	1	0	1	0	possible
Hylocichla mustelina	Wood Thrush	7	3	2	0.00	0	5	3	5	2	confirmed
Turdus migratorius	American Robin	436	277	387	0.89	229	49	48	66	65	confirmed
Dumetella carolinensis	Gray Catbird	181	43	157	0.36	23	24	20	61	28	confirmed

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Mimus polyglottos	Northern Mockingbird	37	1	20	0.05	1	17	0	24	1	confirmed
Oreoscoptes montanus	Sage Thrasher	11	2	3	0.01	0	8	2	5	2	confirmed
Toxostoma rufum	Brown Thrasher	390	129	362	0.84	102	28	27	66	54	confirmed
Sturnus vulgaris	European Starling	392	216	362	0.84	189	30	27	66	65	confirmed
Anthus spragueii	Sprague's Pipit	50	3	14	0.03	1	36	2	12	2	confirmed
Bombycilla cedrorum	Cedar Waxwing	181	42	156	0.36	19	25	23	60	28	confirmed
Vermivora cyanoptera	Blue-winged Warbler	3	0	1	0.00	0	2	0	1	0	probable
Vermivora chrysoptera	Golden-winged Warbler	1	0	0	0.00	0	1	0	1	0	possible
Oerothlypis virginiae	Virginia's Warbler	6	2	2	0.00	1	4	1	1	1	confirmed
Setophaga petechia	Yellow Warbler	381	80	352	0.81	55	29	25	66	36	confirmed
Setophaga pensylvanica	Chestnut-sided Warbler	1	1	0	0.00	0	1	1	1	1	confirmed
Setophaga coronata	Yellow-rumped Warbler	36	20	28	0.06	13	8	7	9	6	confirmed
Mniotilta varia	Black-and-White Warbler	15	1	8	0.02	1	7	0	7	1	confirmed
Setophaga ruticilla	American Redstart	53	8	44	0.10	4	9	4	21	6	confirmed
Protonotaria citrea	Prothonotory Warbler	1	1	0	0.00	0	1	1	1	1	confirmed
Seiurus aurocapilla	Ovenbird	47	9	33	0.08	4	14	5	15	5	confirmed
Geothlypis tolmiei	MacGillivray's Warbler	14	5	9	0.02	1	5	4	4	2	confirmed
Geothlypis trichas	Common Yellowthroat	320	23	313	0.72	19	7	4	66	21	confirmed
Icteria virens	Yellow-breasted Chat	92	12	78	0.18	6	14	6	26	8	confirmed
Piranga olivacea	Scarlet Tanager	12	5	5	0.01	2	7	3	6	3	confirmed
Piranga ludoviciana	Western Tanager	32	13	24	0.06	8	8	5	8	7	confirmed
Pipilo maculatus	Spotted Towhee	138	35	123	0.28	26	15	9	33	16	confirmed
Pipilo erythrophthalmus	Eastern Towhee	14	2	9	0.02	0	5	2	7	2	confirmed
Peucaea cassinii	Cassin's Sparrow	6	1	2	0.00	0	4	1	3	1	confirmed
Spizella passerina	Chipping Sparrow	317	90	294	0.68	70	23	20	65	43	confirmed
Spizella pallida	Clay-colored Sparrow	149	23	132	0.30	8	17	15	32	9	confirmed
Spizella breweri	Brewer's Sparrow	26	11	18	0.04	8	8	3	4	3	confirmed
Spizella pusilla	Field Sparrow	145	36	127	0.29	24	18	12	51	24	confirmed

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Pooecetes gramineus	Vesper Sparrow	289	31	282	0.65	28	7	3	63	17	confirmed
Chondestes grammacus	Lark Sparrow	280	120	247	0.57	90	33	30	58	39	confirmed
Calamospiza melanocorys	Lark Bunting	246	89	218	0.50	65	28	24	39	18	confirmed
Passerculus sandwichensis	Savannah Sparrow	196	13	191	0.44	8	5	5	51	10	confirmed
Ammodramus savannarum	Grasshopper Sparrow	414	124	393	0.91	106	21	18	66	41	confirmed
Ammodramus bairdii	Baird's Sparrow	77	2	26	0.06	1	51	1	11	2	confirmed
Ammodramus henslowii	Henslow's Sparrow	11	0	6	0.01	0	5	0	6	0	probable
Ammodramus leconteii	Le Conte's Sparrow	84	3	29	0.07	0	55	3	14	2	confirmed
Ammodramus nelsoni	Nelson's Sparrow	66	1	22	0.05	1	44	0	16	1	confirmed
Melospiza melodia	Song Sparrow	253	46	245	0.57	38	8	8	62	30	confirmed
Melospiza georgiana	Swamp Sparrow	53	5	48	0.11	2	5	3	19	5	confirmed
Junco hyemalis	Dark-eyed Junco	20	12	16	0.04	11	4	1	6	5	confirmed
Rhynchophanes mccownii	McCown's Longspur	2	0	0	0.00	0	2	0	1	0	possible
Calcarius ornatus	Chestnut-collared Longspur	198	60	169	0.39	38	29	22	41	24	confirmed
Cardinalis cardinalis	Northern Cardinal	71	17	39	0.09	3	32	14	30	12	confirmed
Pheucticus ludovicianus	Rose-breasted Grosbeak	90	14	76	0.18	6	14	8	38	10	confirmed
Pheucticus melanocephalus	Black-headed Grosbeak	101	20	87	0.20	10	14	10	25	12	confirmed
Passerina caerulea	Blue Grosbeak	176	20	154	0.36	10	22	10	53	17	confirmed
Passerina amoena	Lazuli Bunting	50	4	46	0.11	2	4	2	17	4	confirmed
Passerina cyanea	Indigo Bunting	96	8	82	0.19	5	14	3	46	6	confirmed
Spiza americana	Dickcissel	363	55	350	0.81	45	13	10	66	39	confirmed
Dolichonyx oryzivorus	Bobolink	326	49	310	0.72	37	16	12	62	31	confirmed
Agelaius phoeniceus	Red-winged Blackbird	468	279	416	0.96	229	52	50	66	65	confirmed
Sturnella magna	Eastern Meadowlark	12	3	6	0.01	0	6	3	4	2	confirmed
Sturnella neglecta	Western Meadowlark	484	332	426	0.98	275	58	57	66	63	confirmed
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	280	123	242	0.56	92	38	31	64	57	confirmed
Euphagus cyanocephalus	Brewer's Blackbird	116	33	103	0.24	23	13	10	27	14	confirmed

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Quiscalus quiscula	Common Grackle	422	304	381	0.88	263	41	41	66	66	confirmed
Quiscalus mexicanus	Great-tailed Grackle	29	5	18	0.04	0	11	5	18	5	confirmed
Molothrus ater	Brown-headed Cowbird	465	88	432	1.00	58	33	30	66	43	confirmed
Icterus spurius	Orchard Oriole	416	162	387	0.89	139	29	23	65	57	confirmed
Icterus bullockii	Bullock's Oriole	49	14	41	0.09	8	8	6	12	7	confirmed
Icterus galbula	Baltimore Oriole	225	78	202	0.47	60	23	18	55	38	confirmed
Haemorhous cassinii	Cassin's Finch	10	1	4	0.01	0	6	1	4	1	confirmed
Haemorhous mexicanus	House Finch	132	17	48	0.11	5	84	12	57	13	confirmed
Loxia curvirostra	Red Crossbill	55	7	34	0.08	5	21	2	9	3	confirmed
Loxia leucoptera	White-winged Crossbill	2	0	1	0.00	0	1	0	1	0	probable
Spinus pinus	Pine Siskin	31	6	17	0.04	3	14	3	14	6	confirmed
Spinus psaltria	Lesser Goldfinch	5	1	0	0.00	0	5	1	2	1	confirmed
Spinus tristis	American Goldfinch	369	42	359	0.83	35	10	7	66	29	confirmed
Coccothraustes vespertinus	Evening Grosbeak	3	1	1	0.00	0	2	1	1	1	confirmed
Passer domesticus	House Sparrow	329	150	304	0.70	126	25	24	66	56	confirmed