Monitoring the Birds of Southern Rockies/ Colorado Plateau Bird Conservation Region (BCR 16)
2009 Annual Report

June 2010

ROCKY MOUNTAIN BIRD OBSERVATORY

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***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 bird population trends 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, universities, and other non-governmental organizations to build synergy and consensus for bird conservation.*
- ***Sharing** the latest information on bird populations, land management and 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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Cliff Swallow, by Tom Munson. Used with Permission.

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EXECUTIVE SUMMARY

Rocky Mountain Bird Observatory, in conjunction with federal and state partners, conducted landbird monitoring in the Southern Rockies/Colorado Plateau Bird Conservation Region (BCR 16) in Colorado and Wyoming in 2009. In 2008, RMBO implemented a new spatially-balanced sampling design in BCRs 16 and 18 in Colorado and Wyoming; this design is titled "Integrated Monitoring in Bird Conservation Regions (IMBCR)".

Under this sampling design there has not yet been stratification or sampling in the New Mexico, Arizona, Utah, Nevada or Idaho portions of the BCR. RMBO and its partners are continuing to work with partners in other portions of BCR16 to achieve the goal of full participation across the BCR. Thus the current scope of inference is restricted to the Colorado and Wyoming portions of the BCR.

We observed 14,869 birds of 151 species across all strata in Bird Conservation Region 16 in 2009. We obtained sufficient numbers of observations to estimate density of 76 species, including 41 priority species. We obtained precise density estimates (CV ≤ 50%) for 66 species in at least one stratum. We were able to estimate occupancy rates of 12 additional species, including 7 priority species for which sample sizes were too small to estimate density.

ACKNOWLEDGEMENTS

Stratification and allocation of survey effort in Bird Conservation Region 16 were determined in collaboration with partner agencies and organizations, each of which provided funding in 2008 and/or 2009: Colorado Division of Wildlife, USDA Forest Service, USDI Bureau of Land Management and Wyoming Game and Fish Department. Many individuals helped make the 2009 field season a success. We thank Andrea Orabona of Wyoming Game and Fish Department and Robert Skorkowsky of the USDA Forest Service. We thank crew leaders Matt Gracey and Jora Rehm-Lorber of RMBO and Hannah Griscom of Wyoming Natural Diversity Database and the field crews of both organizations. Chandman Sambuu managed and updated the RMBO database and produced a new online mapping tool allowing for easier planning of field crew schedules and navigation to survey sites. Rob Sparks of RMBO produced a sample allocation map for this report. RMBO office staff Paul Franco and Sarah Kormos contacted county assessors and private landowners, obtaining access and establishing the relationships that enabled monitoring on private lands. This report benefited greatly from review by RMBO staff.

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INTRODUCTION

Population monitoring forms the backbone of avian conservation; without current monitoring data, conservation efforts may be misguided and inefficient. Population monitoring helps to achieve the intent of legislation such as the Migratory Bird Treaty Act (1918), National Environmental Policy Act (1969), Endangered Species Act (1973), the National Forest Management Act (1976) and various state laws (Manley et al. 1993, Sauer 1993).

The North American Bird Conservation Initiative's "Opportunities for Improving Avian Monitoring" (NABCI 2007) provided goals and recommendations for avian monitoring programs:

> Goal 1: Fully integrate monitoring into bird management and conservation practices and ensure that monitoring is aligned with management and conservation priorities.
>
> Goal 2: Coordinate monitoring programs among organizations and integrate them across spatial scales to solve conservation or management problems effectively.
>
> Goal 3: Increase the value of monitoring information by improving statistical design.
>
> Goal 4: Maintain bird population monitoring data in modern data management systems. Recognizing legal, institutional, proprietary, and other constraints provide greater availability of raw data, associated metadata, and summary data for bird monitoring programs.

With the NABCI (2007) guidelines in mind, RMBO and its partners designed a broad-scale monitoring program titled "Integrated Monitoring in Bird Conservation Regions (IMBCR)" and implemented IMBCR in Colorado in 2008 (Blakesley and Hanni 2009). Important properties of the IMBCR design are:

- All vegetation types are available for sampling.
- Strata are based on fixed attributes; this will allow us to relate changes in bird populations to changes on the landscape through time.
- Each states' portion of a BCR can be stratified differently, depending upon local needs and areas to which one wants to make inferences.
- Aggregation of strata-wide estimates to BCR- or state-wide estimates is built into the design.
- Local population trends can be directly compared to regional trends.
- Coordination among partners can reduce the costs of monitoring per partner.

Using the IMBCR design, RMBO'S landbird monitoring objectives are to:

1. Provide a design framework to spatially integrate existing bird monitoring efforts in the region to provide better information on distribution and abundance of breeding landbirds, especially for high priority species;
2. Provide basic habitat association data for most bird species to address habitat management issues;
3. Provide long-term status and trend data for all regularly occurring breeding species throughout BCR 18, with a target of detecting a minimum rate of population change of 3.0% per year within 30 years, with power = 0.8 and alpha = 0.1;

4. Maintain a high-quality database that is accessible to all of our collaborators as well as to the public over the internet, in the form of raw and summarized data and;
5. Generate decision support tools that help guide conservation efforts and provide a better measure of conservation success.

METHODS

Study Area
The Southern Rockies/Colorado Plateau Bird Conservation Region (BCR 16) is a geologically and topographically varied area containing arid grassland and shrubland, juniper woodland, montane shrubland, vast tracts of coniferous forest, and alpine tundra (NABCI 2000). The diversity of vegetations types is reflected in a rich diversity of avian species. In 2008 and 2009 we sampled the Colorado and Wyoming portions of BCR 16 (Figures 1 and 2).

Sampling Design
RMBO and its partners defined BCR 16 as the sampling frame; the broad-scale area selected to make inferences about bird populations. Within the BCR, RMBO and its partners established strata and substrata based on smaller-scale areas to which we also wanted to make inferences; e.g., states or individual National Forests (Table 1). The strata within BCRs are based on fixed attributes, without regard to existing vegetation conditions.

Within each stratum, the IMBCR design uses generalized random-tessellation stratification (GRTS), a spatially balanced sampling algorithm, to select sample units (Stevens and Olsen 2004). The GRTS design has several appealing properties with respect to long-term monitoring of birds at large spatial scales:

- Spatially-balanced sampling is generally more efficient than simple random sampling of natural resources (Stevens and Olsen 2004). Incorporating information about spatial autocorrelation in the data can increase precision in density estimates;

- Sample units can be weighted according to any factor expected to influence species' distributions, to adjust the probability that sample units will be selected (Stevens and Olsen 2004). The sample weight can be accounted for in data analyses;

- All sample units in the sampling frame are ordered, such that any set of consecutively numbered units is a spatially well-balanced sample (Stevens and Olsen 2004). In the case of fluctuating budgets, we can adjust the sampling effort among years within each stratum while still preserving a random, spatially-balanced sampling design.

The IMBCR design defines sampling units as 1-km^2 cells that are used to create a uniform grid over the entire BCR, with a random starting point. All spatial data were compiled using ARCGIS 9.2 (ESRI). The heirarchical nature of our data analysis required that a minimum of two transects were sampled within each stratum. The remaining allocation of sampling effort among strata was based on the priorities of our funding partners (Table 1).

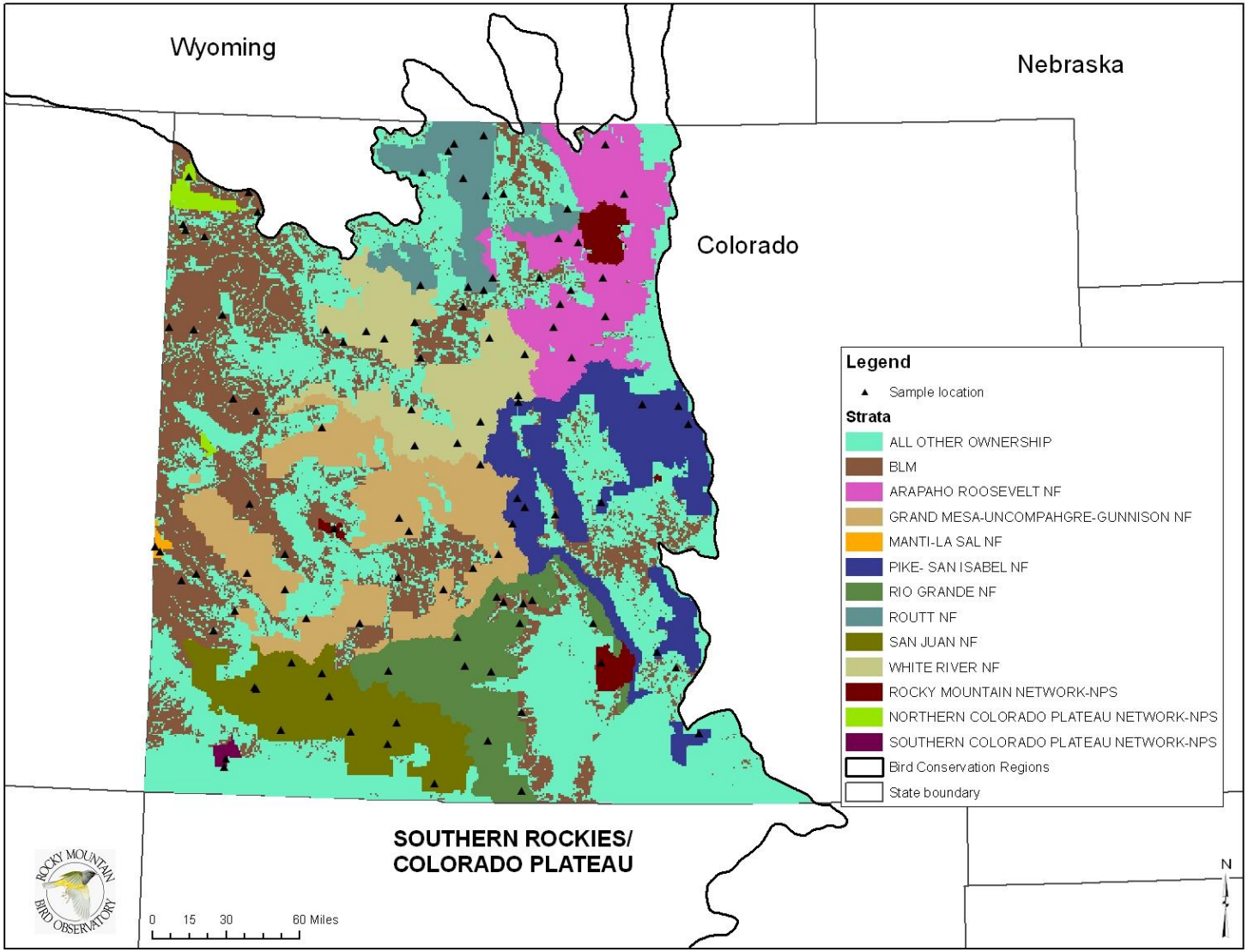

Figure 1. Stratification and sample locations in the Southern Rockies/Colorado Plateau Bird Conservation Region (BCR 16) in Colorado, 2009.

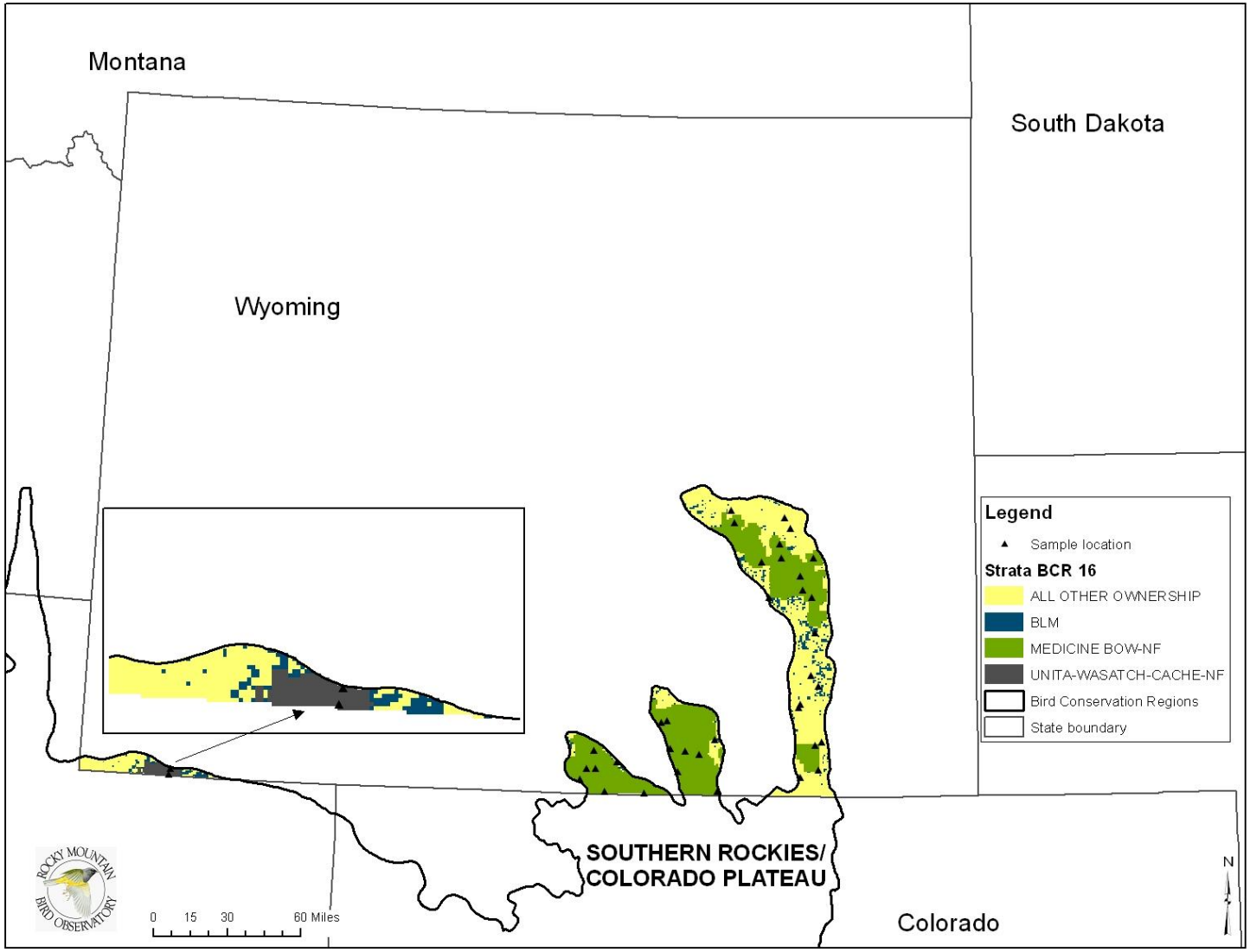

Figure 2. Stratification and sample locations in the Southern Rockies/Colorado Plateau Bird Conservation Region (BCR 16) in Wyoming, 2009.

Table 1. Sample allocation among strata in the Southern Rockies/Colorado Plateau Bird Conservation Region (BCR 16), 2008-2009.

State	Land Ownership	Stratum	Area (km^2)	Samples 2008	Samples 2009
Colorado					
	Bureau of Land Management				
		Colorado BLM	27,845	36	27
	National Forests				
		Arapaho-Roosevelt	9,645	8	10
		Grand Mesa-Gunnison-Uncompahgre	13,630	9	10
		Manti-La Sal	131	1	2
		Pike-San Isabel	10,950	10	10
		Rio Grande	8,348	9	10
		Routt	5,123	20	10
		San Juan	8,794	8	10
		White River	8,814	7	10
	National Park Inventory and Monitoring Networks				
		Northern Colorado Plateau	692	2	2
		Rocky Mountain	1,260	2	2
		Southern Colorado Plateau	214	2	2
	All Other Lands				
		Colorado All Other	51,517	31	2
Wyoming					
	Bureau of Land Management				
		Wyoming BLM	647	0	2
	National Forests				
		Medicine Bow	5,329	34	24
		Uinta-Wasatch-Cache	180	0	2
	All Other Lands				
		Wyoming All Other	5,438	0	10
	Total		158,557	179	145

In 2008 RMBO and its partners used cell weighting to ensure that large rivers and high-elevation areas would receive sufficient samples for estimating avian densities because these areas constitute a smaller proportion of the landscape than areas containing low order streams and low- to mid-elevations. Within each stratum we weighted cells by Stralher stream order so that cells containing larger streams had a higher probability of being sampled (with stream orders 4-8 carrying equal weight). We arbitrarily chose to assign a 4 times higher inclusion probability to cells between 3000-3999 m, and 5 times higher for cells ≥ 4000 m elevation.

Upon reviewing sample sizes obtained in 2008, RMBO and its partners concluded that riparian birds were well sampled without weighting for higher order streams and that mid-elevation birds were not sampled in sufficient numbers. Therefore, in 2009 we drew new samples without using any weighting factors (every cell had an equal probability of being selected for sampling).

Sampling Methods

Within each sample cell we established a 4 x 4 grid of 16 points spaced 250 meters apart. We surveyed birds from points using methods that allow for estimating detection probability through the principles of Distance sampling, Removal modeling, and Occupancy modeling. Distance sampling theory was developed to account for the decreasing probability of detecting an object of interest (e.g., a bird) with increasing distance from the observer to the object (Buckland et al. 2001). The detection probability is used to adjust the count of birds to account for birds that were present but undetected. Application of distance theory requires that three critical assumptions be met: 1) all birds at and near the sampling location (distance = 0) are detected; 2) distances of birds are measured accurately; and 3) birds do not move in response to the observer's presence.

Removal modeling is based on mark-recapture theory; detection probability is estimated based on the number of birds detected during consecutive sampling intervals (Farnsworth et al. 2002). In this design, sampling intervals consist of 1-2 minutes segments of a complete sampling period. Removal modeling can also incorporate distance data.

Occupancy estimation is most commonly used to quantify the proportion of sample units occupied by an organism (MacKenzie et al. 2002). Occupancy estimation uses a detection probability to adjust the proportion of sites occupied to account for species that were present but undetected (MacKenzie et al. 2002). We used our data to estimate the site occupancy of species of special concern for which we had too few detections to estimate population density. Occupancy estimation requires multiple surveys to the sample unit in time or space (MacKenzie and Royle 2005). The assumptions of occupancy estimation are 1) the probabilities of detection and occupancy are constant across the sample units; 2) each point is closed to changes in occupancy over the sampling season; 3) the detection of species at each point are independent; and 4) the target species are never falsely identified (MacKenzie et al. 2006).

Field technicians conducted point counts (Buckland et al. 2001) following protocol established by RMBO (Hanni et al. 2009). Observers surveyed in the morning, from ½-hour before sunrise to 11 AM. At each point, observers conducted a five-minute point count. For every bird detected during the five minute period, we recorded species, sex, horizontal distance from the observer, minute we detected the bird, and type of detection (e.g., call, song, visual). Observers measured distances using laser rangefinders. When it was not possible to measure the distance to a bird, observers estimated distance by measuring to some nearby object. Observers recorded birds flying over but not using the immediate surrounding landscape. Observers also recorded the presence of all low-density species heard and seen when traveling the 250 meters between points. Low density species are those rare or difficult to detect species (i.e., woodpeckers, owls, raptors) for which we are not able to estimate density; we collect these data for distribution mapping purposes.

We considered all non-independent detections of birds, i.e., flocks or pairs of conspecific birds together in close proximity, as part of a 'cluster' rather than as separate independent observations. Observers recorded the number of birds detected within the cluster along with a letter code to keep track of each distinct cluster.

At the start and end of each transect, observers recorded time and atmospheric data (i.e., temperature, cloud cover, precipitation, and wind speed). We navigated to each point using hand-held Garmin® Global Positioning System (GPS) units. Before beginning each five-minute count, we recorded vegetation data (within a 50 meter radius) and distance from a road (if within 100 meters). For vegetation data, we recorded the dominant habitat type and structural stage, and the relative abundance, percent cover, and mean height of trees, shrubs, and groundcover. If there was a distinct subcanopy present, we recorded the species of sub-canopy trees. We recorded vegetation data quietly to allow birds, potentially disturbed by our approach, time to return to their normal habits prior to the beginning of the survey.

RMBO staff, biological technicians with excellent aural and visual bird-identification skills, conducted field work in 2009. Technicians completed an intensive five-day training program at the beginning of the field season to ensure full understanding of field protocols, practice bird identification, and practice distance estimation in a variety of habitats.

Data Analysis

Distance Analysis

Analysis of distance data is accomplished by fitting a detection function to the distribution of recorded distances. The distribution of distances can be a function of characteristics of the object (e.g., for birds, its size and color, movement, volume of song or call, and frequency of call), the surrounding environment (e.g., density of vegetation), and observer ability. Because detectability varies among species, we analyzed the data separately for each species.

We used the analysis software Distance 6.0 (Thomas et al. 2010) to estimate detection probabilities using our point count data. We estimated densities of species for which we obtained at least 60 independent detections (n) across years (2008-2009). We excluded birds flying over but not using the immediate surrounding landscape and birds detected between-point from analyses. We fit the following functions to the distribution of distances for each species: Half normal key function with cosine series expansion, Uniform function with cosine series expansion, Hazard rate key function with cosine series expansion, and Hazard rate key function with simple polynomial series expansion (Buckland et al. 2001). We combined data across years and strata to estimate global detection functions, and compared these models with models that estimated detection functions separately for each year (when sample sizes allowed). We used Akaike's Information Criterion (AIC) corrected for small sample size (AIC_c) and model selection theory to select the most parsimonious detection function for each species (Burnham and Anderson 2002).

We used the SPSURVEY package (Kincaid 2008) in Program R (R Development Core Team 2008) to estimate density and its variance for each bird species. This was greatly facilitated by R code written for us by Paul Lukacs of the Colorado Division of Wildlife.

Occupancy Analysis

Under the sampling framework, RMBO used a removal model to estimate a detection probability from the sequential 1-2 minute sampling intervals. The 16 grid points served as spatial replicates for estimating the proportion of points occupied within the sampling cells. We used a multi-scale occupancy model (Nichols et al. 2008) to estimate 1) the proportion of 1-km^2 sampling units occupied by a species (Psi); 2) the proportion of points occupied by a species given presence within the1-km^2 sampling units (Theta); and 3) the probability of detecting a species given presence (p). We constrained Theta and p by holding these parameters

constant. Our application of the multi-scale model is analogous to a within-season robust design (Pollock 1982) where the points are the primary samples for estimating Theta and the sampling intervals at each point are the secondary samples for estimating p (Nichols et al. 2008). We considered both Theta and p to be nuisance variables that were important for generating unbiased estimates of Psi. Theta can be considered an availability parameter or the probability that a species was present and available for sampling at the points (Nichols et al. 2008). We estimated the detection probabilities (p) using a removal model with 3 intervals. Using the five 1-minute intervals recorded during sampling, we binned minutes 1 and 2, and minutes 3 and 4 to meet the assumption of a monotonic decline in the detection rates. After the target species was detected at a point, we set all subsequent sample intervals at that point to missing data. We truncated the data, using only detections within 125 m of the sample points; this allows us to use bird detections over a consistent plot size and ensures that the points were independent (points are spread 250 m apart). Truncating allows us to estimate Theta (the proportion of points occupied within each sample unit).

We used program SAS (PROC NLMIXED, SAS Institute 2008) to estimate the model parameters and account for unequal interval length. Gary White from Colorado State University wrote the initial SAS code for running the multi-scale occupancy models. We combined stratum-level estimates of Psi using a weighted mean indexed by stratum area. We estimated the sampling variance and standard error for the weighted mean of Psi using the delta method (Powell 2007) in program SAS (PROC IML, SAS Institute 2008). We estimated occupancy for all priority species that had a minimum of 10 detections after truncating the data to observations within 125 m of each point.

RESULTS

We surveyed 1729 points among 147 transects from 11 May to 23 July 2009. We observed 14,869 birds of 151 species across all strata in Bird Conservation Region 16 in 2009. We obtained sufficient numbers of observations to estimate density of 76 species, including 41 species of conservation concern. We obtained precise density estimates (CV ≤ 50%) for 66 species in at least one stratum.

Estimated density and population size are presented by year for each species in each stratum in BCR 16 (Tables 2-3). Table 2 contains estimates for individual National Forests. Table 3 contains estimates for BLM lands in Colorado (BCR16) and “All Other” lands in Colorado and Wyoming (BCR 16). Results are presented only for strata with > 2 samples, because results from strata with only 2 samples are not informative. Table 4 contains estimates of density and population size for the state-wide portions of BCR 16.

We were able to estimate occupancy rates of 12 species for which sample sizes were too small to estimate density, including 7 species of conservation concern. Occupancy rates for the Colorado portion of BCR 16 are presented in Table 5.

We followed the American Ornithological Union guidelines, 7th edition (http://www.aou.org/checklist/north/full.php) for common names of all bird species. Detailed species accounts including distribution maps, density estimate graphs and tables are available for viewing and download at http://rmbo.org/public/monitoring/speciesAccounts.aspx.

Table 2. Estimated densities (D), estimated population sizes (N), percent coefficient of variation of estimates (%CV), and sample sizes (n) of breeding bird species on National Forests of the Rocky Mountain Region (R2), 2008-2009.

		Arapaho-Roosevelt				Grand Mesa-Uncomp-Gunnison				Medicine Bow			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Mourning Dove	2008				0				0	2.3	12,279	37.3	10
	2009				0	1.8	23,912	38	11	1.8	9,546	46	22
White-throated Swift[3]	2008				0				0				0
	2009				0				0				0
Broad-tailed Hummingbird[3]	2008	22.0	212,517	28	13	5.0	68,012	56	5	4.2	22,256	58.9	7
	2009	5.6	54,327	49	3	26.4	359,543	46	17	12.7	67,547	35	16
Red-naped Sapsucker[3]	2008				0				0	0.4	2,035	44.9	5
	2009				0	2.0	27,500	49	4	3.1	16,468	35	12
Hairy Woodpecker[3]	2008	0.6	5,757	98	2				0	10.0	53,446	25.6	50
	2009	4.1	39,841	52	4	6.8	93,062	35	8	25.3	134,678	25	58
American Three-toed Woodpecker[3]	2008				0	1.3	17,876	94	3	5.4	28,971	43.7	48
	2009	1.9	18,108	93	2				0	5.1	27,440	43	13
Northern Flicker	2008	0.5	4,355	48	3	0.8	10,937	49	4	3.9	20,825	25.1	52
	2009	1.4	13,751	62	3	7.1	96,361	33	18	7.6	40,607	27	38
Olive-sided Flycatcher[3]	2008	0.2	2,380	98	3				0	0.2	1,080	53.0	10
	2009				0	0.5	6,411	84	2	2.5	13,438	48	21
Western Wood-Pewee	2008	0.3	2,421	97	3				0	1.5	7,895	39.9	31
	2009				0	4.8	65,221	53	20	6.6	35,151	28	54
Hammond's Flycatcher[3]	2008	0.4	3,429	93	1				0	0.4	2,094	74.7	3
	2009				0	8.4	114,824	79	12				0
Gray Flycatcher[3]	2008				0				0				0
	2009				0				0				0
Dusky Flycatcher[3]	2008	1.6	15,552	74	2				0	8.4	44,916	13.6	31
	2009	5.3	51,061	83	5	33.3	453,223	45	38	2.7	14,285	51	6
Cordilleran Flycatcher[3]	2008	0.3	2,896	92	1	2.6	35,342	62	6	2.4	12,869	43.0	15
	2009				0	9.5	129,283	41	16				0
Ash-throated Flycatcher[3]	2008				0				0				0
	2009				0				0				0
Gray Vireo[3]	2008				0				0				0
	2009				0				0				0
Plumbeous Vireo[3]	2008				0				0	0.1	701	81.9	3
	2009				0	0.4	5,476	86	1	1.6	8,745	60	8

		Arapaho-Roosevelt				Grand Mesa-Uncomp-Gunnison				Medicine Bow			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Warbling Vireo[3]	2008	0.9	8,217	97	5	3.3	45,092	80	5	13.7	73,130	30.0	106
	2009				0	50.7	690,580	36	86	11.1	59,307	42	37
Gray Jay	2008	12.7	122,541	33	10	13.8	188,275	81	8	3.6	19,050	35.7	20
	2009	8.8	84,413	34	6	3.6	49,293	89	3				0
Steller's Jay	2008				0				0	1.6	8,430	71.9	3
	2009	0.4	4,303	83	1	6.3	85,433	52	17	0.4	2,006	66	2
Western Scrub-Jay[3]	2008				0				0				0
	2009				0	0.2	3,398	83	1				0
Pinyon Jay[3]	2008				0				0				0
	2009				0				0	0.1	371	91	1
Clark's Nutcracker[3]	2008	0.9	8,222	46	5	0.6	8,379	57	4	0.9	4,736	39.5	23
	2009	0.5	4,419	84	2	1.7	23,225	41	9	1.1	5,666	32	11
Black-billed Magpie[3]	2008				0				0	1.3	7,019	74.9	7
	2009				0	0.2	2,570	89	2	0.1	513	85	2
American Crow	2008				0				0	0.7	3,498	37.8	22
	2009				0				0	0.1	455	52	3
Common Raven	2008	0.9	8,528	72	4				0	0.5	2,459	44.8	13
	2009	0.1	1,423	44	3	0.2	2,215	53	4	0.4	1,990	29	18
Horned Lark	2008	1.7	16,597	67	5				0	0.2	1,310	86.4	2
	2009				0				0	1.2	6,138	79	8
Tree Swallow	2008				0				0	3.5	18,393	56.2	8
	2009				0	3.8	52,299	56	3				0
Violet-green Swallow[3]	2008				0	1.8	24,292	87	1	2.4	12,972	74.8	2
	2009	1.4	13,364	85	1	5.7	78,039	43	5	1.8	9,346	63	3
Cliff Swallow	2008				0				0				0
	2009				0				0				0
Mountain Chickadee	2008	44.4	427,925	39	56	32.6	444,620	30	47	26.4	140,509	35.2	152
	2009	46.5	448,793	25	28	125.0	1,703,484	25	91	68.7	366,193	19	98
Juniper Titmouse[3]	2008				0				0				0
	2009				0	0.7	9,564	84	1				0
Red-breasted Nuthatch	2008	3.0	29,296	80	5	1.2	15,697	92	4	4.0	21,440	33.3	52
	2009	4.3	41,741	49	7	8.7	118,392	44	17	5.0	26,413	26	19
White-breasted Nuthatch	2008				0				0	0.2	932	65.0	3
	2009	3.2	30,831	53	4	5.5	74,935	41	10	2.0	10,781	46	6

		Arapaho-Roosevelt				Grand Mesa-Uncomp-Gunnison				Medicine Bow			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Rock Wren[3]	2008				0				0	1.1	6,037	28.6	13
	2009	0.3	3,259	82	2				0	4.1	22,031	30	58
Bewick's Wren[3]	2008				0				0				0
	2009				0				0				0
House Wren	2008	0.9	8,911	88	1	2.2	29,333	49	2	15.1	80,308	31.1	49
	2009				0	29.7	405,194	49	43	21.5	114,739	27	61
Golden-crowned Kinglet[3]	2008	0.8	8,033	100	1				0	1.5	8,118	62.5	5
	2009	4.0	38,388	61	2	32.9	448,331	44	20	7.6	40,272	46	9
Ruby-crowned Kinglet	2008	15.2	146,654	23	42	20.7	282,050	32	51	13.0	69,387	28.3	213
	2009	24.3	234,765	30	52	15.9	216,183	37	41	17.2	91,568	26	87
Blue-gray Gnatcatcher	2008				0				0	6.1	32,292	78.0	2
	2009				0	7.6	103,472	83	5				0
Mountain Bluebird[3]	2008	1.3	12,836	67	2				0	2.9	15,689	35.9	12
	2009				0	0.4	5,506	88	1	5.2	27,476	43	25
Townsend's Solitaire[3]	2008	1.5	14,647	61	10	0.5	6,682	59	2	3.3	17,515	53.6	33
	2009	3.4	32,458	52	6	6.0	82,134	47	13	1.4	7,567	61	6
Hermit Thrush[3]	2008	6.1	59,024	38	50	4.4	59,393	28	45	5.6	29,905	40.2	188
	2009	7.1	68,224	22	54	6.2	84,106	14	57	7.0	37,112	21	126
American Robin	2008	22.4	216,155	26	45	17.3	236,280	31	30	24.6	130,882	13.2	155
	2009	10.1	97,891	26	18	49.4	673,265	21	106	28.8	153,410	17	121
American Pipit[3]	2008	7.5	72,531	49	21	24.1	328,743	84	48				0
	2009				0				0				0
Orange-crowned Warbler	2008				0				0	0.0	266	91.2	1
	2009				0	2.2	30,336	65	3				0
Virginia's Warbler[3]	2008				0				0	1.6	8,556	76.1	1
	2009				0	2.4	32,898	50	3				0
Yellow Warbler	2008				0				0	10.6	56,267	39.4	23
	2009				0	3.2	43,284	87	7	3.2	17,280	30	14
Yellow-rumped Warbler	2008	14.6	140,566	20	32	30.5	416,031	28	60	41.2	219,500	38.7	296
	2009	38.6	372,526	23	47	43.5	592,443	25	64	47.5	253,148	22	137
Black-throated Gray Warbler[3]	2008				0				0				0
	2009				0				0				0
MacGillivray's Warbler[3]	2008				0				0	1.3	7,030	72.4	2
	2009				0	13.2	180,213	58	23	6.8	35,973	32	23

		Arapaho-Roosevelt				Grand Mesa-Uncomp-Gunnison				Medicine Bow			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Wilson's Warbler[3]	2008	1.9	18,711	55	2	2.2	29,423	58	2	1.6	8,375	45.6	10
	2009	4.3	41,390	83	5				0	4.7	25,088	45	13
Western Tanager	2008	1.3	12,624	68	5	0.6	8,104	73	3	14.5	77,222	39.1	87
	2009	0.4	4,105	82	1	7.4	100,668	40	21	8.8	46,887	27	49
Green-tailed Towhee[3]	2008				0	3.4	46,204	84	4	29.6	157,841	33.0	96
	2009				0	21.8	296,860	42	40	23.6	125,921	29	85
Spotted Towhee	2008				0				0	9.2	48,856	45.1	8
	2009				0	16.0	217,509	70	36	3.4	18,091	57	15
Chipping Sparrow	2008	0.3	3,293	97	2	3.9	52,665	69	7	7.3	38,990	15.9	46
	2009	2.2	21,431	64	2	5.5	75,088	62	6	10.8	57,456	40	23
Brewer's Sparrow[3]	2008				0				0	1.2	6,593	44.3	11
	2009				0				0	0.4	2,149	65	2
Vesper Sparrow[3]	2008				0				0	10.3	55,000	60.2	38
	2009				0				0	0.7	3,709	72	5
Lark Sparrow[3]	2008				0				0	1.4	7,490	58.8	7
	2009				0				0	2.5	13,111	67	13
Sage Sparrow[3]	2008				0				0				0
	2009				0				0				0
Lark Bunting[3]	2008				0				0				0
	2009				0				0				0
Savannah Sparrow	2008	19.8	190,572	67	18				0	0.6	3,189	86.1	3
	2009				0				0				0
Song Sparrow	2008				0				0	0.6	3,161	72.4	4
	2009				0				0	3.1	16,720	80	10
Lincoln's Sparrow[3]	2008	21.8	210,581	39	21	8.6	117,265	43	7	5.7	30,416	38.5	26
	2009	6.3	60,840	70	6	12.2	165,796	44	14	4.4	23,639	31	10
White-crowned Sparrow	2008	24.1	232,382	55	40	25.1	342,524	51	31				0
	2009	5.9	56,835	50	9	7.0	95,879	80	13	2.5	13,250	90	9
Dark-eyed Junco	2008	56.2	541,725	30	59	18.7	254,807	24	24	33.7	179,764	28.7	190
	2009	109.7	1,058,080	29	63	172.7	2,353,790	18	120	88.2	469,845	18	120
Black-headed Grosbeak	2008				0				0	1.6	8,711	67.7	6
	2009				0	2.2	29,348	61	6	0.4	1,953	88	2
Lazuli Bunting[3]	2008				0				0	3.0	15,859	80.3	4
	2009				0	0.7	10,163	89	2				0

		Arapaho-Roosevelt				Grand Mesa-Uncomp-Gunnison				Medicine Bow			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Red-winged Blackbird	2008				0				0	0.9	5,006	77.3	7
	2009				0				0	2.8	15,086	54	10
Western Meadowlark	2008				0				0	6.0	32,013	55.4	60
	2009				0				0	0.9	4,538	74	20
Brewer's Blackbird	2008				0				0	1.6	8,289	66.7	10
	2009				0				0	4.1	21,752	44	13
Brown-headed Cowbird	2008				0				0	4.1	21,839	54.6	7
	2009				0	1.2	16,070	86	2	2.1	11,227	56	7
Pine Grosbeak	2008	7.1	68,136	30	11	4.9	67,065	69	8	1.1	5,962	52.4	18
	2009	2.5	24,248	49	4	3.6	49,559	72	7	1.9	9,893	50	7
Cassin's Finch[3]	2008	0.2	1,934	92	1	1.4	19,087	80	3	2.0	10,818	32.5	35
	2009				0	2.8	37,772	48	7				0
House Finch	2008				0				0				0
	2009				0	0.3	3,851	87	1				0
Red Crossbill[3]	2008	6.0	57,852	36	16	4.6	62,466	58	19	10.1	53,913	38.6	50
	2009	6.2	59,854	80	9	1.1	15,534	67	2	3.5	18,605	63	12
Pine Siskin[3]	2008	28.3	272,957	23	68	10.9	148,047	34	26	9.7	51,848	25.3	100
	2009	20.6	198,892	33	19	40.4	550,154	33	45	27.9	148,864	26	61

[1] Density = (birds/km^2); [2] n = number of independent detections used to estimate density;
[3] Priority species in Bird Conservation Region 16 (see Appendix A).

Table 3, continued. Estimated densities (D), estimated population sizes (N), percent coefficient of variation of estimates (%CV), and sample sizes (n) of breeding bird species on National Forests of the Rocky Mountain Region (R2), 2008-2009.

		Pike-San Isabel				Rio Grande				Routt			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Mourning Dove	2008	0.2	2,240	95	3	0.3	2,221	101	4				0
	2009	2.2	24,364	44	16	2.9	23,317	54	21				0
White-throated Swift[3]	2008				0				0				0
	2009				0				0				0
Broad-tailed Hummingbird[3]	2008	41.5	455,042	49	20	18.6	151,701	57	8	8.7	44,343	37	17
	2009	31.1	340,747	36	23	21.2	172,840	26	16	31.9	163,336	30	18
Red-naped Sapsucker[3]	2008	0.7	7,924	91	1	0.7	5,891	80	1	1.3	6,484	50	9
	2009	0.4	4,816	84	1				0	2.9	14,748	66	5
Hairy Woodpecker[3]	2008				0				0	18.7	95,877	30	34
	2009	5.2	57,040	42	7	2.2	17,825	49	3	7.8	39,928	56	8
American Three-toed Woodpecker[3]	2008				0				0	3.6	18,292	40	6
	2009				0				0	2.7	13,611	69	3
Northern Flicker	2008	1.8	19,548	42	9	0.8	6,531	80	2	0.8	3,890	56	10
	2009	6.2	67,500	31	18	5.7	46,484	26	17	4.0	20,672	23	9
Olive-sided Flycatcher[3]	2008				0				0	0.5	2,351	54	4
	2009	0.8	8,982	72	4	1.8	14,736	75	9	0.3	1,375	83	1
Western Wood-Pewee	2008	0.6	6,306	54	3	0.8	6,328	47	2	5.1	26,155	43	57
	2009	0.2	2,284	83	1	3.7	29,981	39	18	0.8	4,197	59	3
Hammond's Flycatcher[3]	2008	2.8	31,002	54	4	3.0	24,596	81	3	1.1	5,857	77	4
	2009	4.9	53,622	58	8	6.6	53,761	54	11				0
Gray Flycatcher[3]	2008				0				0				0
	2009				0	4.3	35,254	83	7				0
Dusky Flycatcher[3]	2008	4.3	47,055	78	2	5.5	44,557	76	3	6.2	31,948	49	22
	2009	18.3	200,513	42	24	8.9	73,103	41	12	6.0	30,703	52	6
Cordilleran Flycatcher[3]	2008	14.3	156,752	68	11	9.2	74,905	37	10	1.0	5,209	47	6
	2009	4.6	50,941	83	9	4.5	37,144	46	9	3.4	17,334	74	5
Ash-throated Flycatcher[3]	2008				0				0				0
	2009	0.5	5,443	83	2				0				0
Gray Vireo[3]	2008				0				0				0
	2009				0				0				0
Plumbeous Vireo[3]	2008	0.7	8,102	98	3				0				0
	2009	2.8	30,689	53	8	5.8	47,551	84	17				0

		Pike-San Isabel				Rio Grande				Routt			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Warbling Vireo[3]	2008	9.3	102,112	40	12	10.8	88,203	40	13	11.8	60,508	31	81
	2009	7.7	84,374	57	15	27.1	221,479	34	54	13.5	68,905	45	20
Gray Jay	2008	13.3	145,336	45	6				0	7.6	38,800	28	12
	2009	17.8	195,667	47	17	3.1	25,177	67	3	17.9	91,647	34	13
Steller's Jay	2008	8.5	93,047	31	19	0.4	3,493	88	1	0.2	800	95	1
	2009	7.1	77,446	40	22	4.1	33,369	55	13	3.4	17,249	57	8
Western Scrub-Jay[3]	2008				0				0				0
	2009				0				0				0
Pinyon Jay[3]	2008				0	0.1	797	101	2				0
	2009				0	0.2	1,900	93	2				0
Clark's Nutcracker[3]	2008	1.9	20,663	38	11	1.0	8,093	55	4	2.5	12,903	37	20
	2009	2.3	25,307	51	14	4.1	33,436	38	25	1.1	5,536	65	5
Black-billed Magpie[3]	2008				0				0				0
	2009				0				0				0
American Crow	2008				0				0				0
	2009	0.1	1,065	84	2				0				0
Common Raven	2008	0.4	4,636	82	1	0.5	4,253	83	1	0.8	3,988	51	6
	2009	0.4	4,268	42	11	0.1	1,191	51	6	0.5	2,376	41	10
Horned Lark	2008	0.6	6,449	89	1	8.5	69,674	80	10				0
	2009	0.5	5,385	89	2	1.0	7,853	88	4				0
Tree Swallow	2008	1.8	19,195	80	1	5.3	43,417	82	2	5.1	26,002	64	7
	2009	3.3	36,635	96	3	12.0	97,945	50	11	16.1	82,275	56	11
Violet-green Swallow[3]	2008				0	7.1	58,307	78	3	4.4	22,384	53	8
	2009	8.0	87,465	56	8	11.7	95,663	48	12	2.6	13,393	85	2
Cliff Swallow	2008				0	30.5	248,962	81	10				0
	2009				0				0				0
Mountain Chickadee	2008	41.1	450,545	21	44	43.4	354,353	37	49	30.7	157,250	16	77
	2009	102.8	1,127,710	16	86	79.6	650,173	17	68	83.1	425,677	26	53
Juniper Titmouse[3]	2008				0				0				0
	2009				0	0.6	4,885	93	1				0
Red-breasted Nuthatch	2008	1.4	15,337	87	2	3.0	24,656	67	5	4.3	21,993	26	19
	2009	4.9	53,662	38	11	7.0	56,914	41	16	8.7	44,820	24	15
White-breasted Nuthatch	2008	0.7	7,782	95	3	1.4	11,210	76	1				0
	2009	4.6	50,446	57	8	10.7	87,360	23	19				0

		Pike-San Isabel				Rio Grande				Routt			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Rock Wren[3]	2008				0	0.0	408	101	1	0.3	1,396	49	4
	2009	0.1	1,333	94	1	1.0	7,775	51	8				0
Bewick's Wren[3]	2008				0				0				0
	2009				0				0				0
House Wren	2008	1.7	18,955	45	3	2.2	18,284	47	2	5.9	30,112	54	23
	2009	7.8	85,810	35	13	6.5	52,943	47	11	20.5	105,118	45	26
Golden-crowned Kinglet[3]	2008	4.7	51,673	91	2				0	2.4	12,133	61	3
	2009	2.9	31,405	83	2	18.2	148,845	32	13	1.9	9,618	93	1
Ruby-crowned Kinglet	2008	16.2	177,828	14	28	11.8	96,305	33	26	16.3	83,364	20	79
	2009	19.5	214,224	19	58	26.4	215,452	21	80	30.5	156,097	16	69
Blue-gray Gnatcatcher	2008				0				0				0
	2009				0	1.3	10,570	90	1				0
Mountain Bluebird[3]	2008	1.2	12,692	89	2	6.0	49,300	42	11	1.9	9,797	49	7
	2009	2.8	30,854	94	8	5.9	47,807	43	17	1.8	9,449	49	4
Townsend's Solitaire[3]	2008	6.2	68,238	26	20	1.6	13,198	38	5	2.5	12,919	39	23
	2009	13.3	146,048	38	33	12.2	100,038	44	31	1.1	5,421	62	2
Hermit Thrush[3]	2008	5.4	59,488	30	37	5.5	45,070	25	40	7.4	37,817	16	122
	2009	7.4	80,622	20	78	8.0	65,569	25	87	6.9	35,453	18	56
American Robin	2008	19.7	216,454	28	34	16.8	137,126	35	26	30.2	154,571	14	132
	2009	23.9	262,503	20	59	17.9	145,988	34	45	27.7	141,707	17	52
American Pipit[3]	2008	2.9	31,853	89	6				0	1.5	7,443	88	12
	2009	4.4	48,397	80	15				0				0
Orange-crowned Warbler	2008				0				0	0.8	4,056	71	4
	2009	5.8	63,750	77	9	0.6	5,165	91	1				0
Virginia's Warbler[3]	2008				0				0				0
	2009	3.5	38,408	83	5	0.7	5,601	82	1				0
Yellow Warbler	2008	1.1	12,198	78	1				0	0.2	984	87	1
	2009				0	7.0	56,849	60	18	0.5	2,653	90	1
Yellow-rumped Warbler	2008	58.1	636,773	16	73	28.9	235,833	28	37	35.6	182,373	11	134
	2009	47.3	518,751	20	80	27.2	222,222	17	47	52.7	270,075	14	68
Black-throated Gray Warbler[3]	2008	0.5	5,647	97	1				0				0
	2009				0				0				0
MacGillivray's Warbler[3]	2008	0.8	9,031	91	1	1.2	9,757	77	1	1.2	6,014	60	7
	2009	4.0	43,909	58	8				0	1.3	6,723	63	2

		Pike-San Isabel				Rio Grande				Routt			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Wilson's Warbler[3]	2008	12.1	132,745	53	8				0	2.5	12,913	42	10
	2009	6.8	74,495	50	11	1.8	14,814	64	3	9.7	49,776	51	12
Western Tanager	2008	0.6	6,507	78	1	1.0	8,215	84	2	4.7	24,124	27	36
	2009	11.9	130,960	33	39	12.9	105,284	29	43	0.4	2,057	88	1
Green-tailed Towhee[3]	2008	3.1	33,792	42	5	1.9	15,897	64	4	0.1	659	92	1
	2009	2.4	25,993	40	5	7.0	56,860	51	15	2.5	12,737	73	4
Spotted Towhee	2008				0				0				0
	2009	3.1	33,858	67	8	1.1	9,258	74	3				0
Chipping Sparrow	2008	2.4	25,906	35	6	1.9	15,298	57	4	4.6	23,511	34	30
	2009	10.4	113,964	64	13	36.0	294,037	30	46	6.3	32,217	59	6
Brewer's Sparrow[3]	2008				0	0.1	1,153	100	1	0.2	1,179	90	2
	2009				0				0				0
Vesper Sparrow[3]	2008				0	0.2	1,592	100	2	0.5	2,651	49	7
	2009	2.4	26,032	83	10	1.2	9,491	59	5				0
Lark Sparrow[3]	2008				0				0				0
	2009				0				0				0
Sage Sparrow[3]	2008				0				0				0
	2009				0				0				0
Lark Bunting[3]	2008				0				0				0
	2009				0				0				0
Savannah Sparrow	2008	1.9	20,937	89	2	20.8	169,660	79	15	1.0	4,973	90	5
	2009				0				0				0
Song Sparrow	2008				0	1.3	10,430	87	1	0.5	2,666	93	2
	2009				0	2.6	21,391	65	5	0.7	3,594	100	1
Lincoln's Sparrow[3]	2008	20.5	225,065	29	14	15.7	128,488	43	11	6.8	34,826	40	24
	2009	8.3	91,252	57	11	14.1	114,928	48	19	24.8	127,027	37	25
White-crowned Sparrow	2008	7.8	85,006	89	10	15.9	129,725	68	24	6.2	31,702	37	34
	2009	16.5	180,822	47	35	5.5	45,205	42	12	16.1	82,274	39	26
Dark-eyed Junco	2008	42.8	468,994	18	36	47.1	385,022	28	42	68.0	348,336	21	149
	2009	111.5	1,222,865	13	89	109.1	891,661	22	89	139.6	715,341	16	85
Black-headed Grosbeak	2008				0				0	0.2	778	83	1
	2009	2.5	27,410	46	8				0				0
Lazuli Bunting[3]	2008				0				0	0.1	451	93	1
	2009				0				0	0.9	4,361	54	2

		Pike-San Isabel				Rio Grande				Routt			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Red-winged Blackbird	2008				0	10.4	84,703	82	9				0
	2009				0	0.5	3,860	85	1				0
Western Meadowlark	2008				0	3.4	27,384	74	15				0
	2009				0				0				0
Brewer's Blackbird	2008				0	2.2	17,621	68	5	0.4	1,836	91	2
	2009				0	1.0	8,563	61	2				0
Brown-headed Cowbird	2008				0	1.2	10,005	82	1				0
	2009	0.5	5,628	86	1	1.0	8,208	56	2				0
Pine Grosbeak	2008	5.5	60,573	51	6				0	2.5	12,740	33	7
	2009	0.9	9,919	57	2				0	0.6	3,038	90	1
Cassin's Finch[3]	2008				0				0	1.0	4,911	50	8
	2009	2.4	26,459	56	7	1.7	13,780	47	5	2.3	11,576	40	5
House Finch	2008				0				0				0
	2009				0				0				0
Red Crossbill[3]	2008	6.7	73,131	62	13	2.9	23,432	57	8	1.6	8,229	44	10
	2009	11.3	124,380	61	21	7.3	59,508	64	15	4.7	24,322	66	6
Pine Siskin[3]	2008	19.3	211,903	22	25	26.7	218,225	41	44	20.9	107,020	19	83
	2009	30.5	333,994	19	39	27.5	224,801	26	36	34.8	178,344	32	34

[1] Density = (birds/km^2); [2] n = number of independent detections used to estimate density;
[3] Priority species in Bird Conservation Region 16 (see Appendix A).

Table 4, continued. Estimated densities (D), estimated population sizes (N), percent coefficient of variation of estimates (%CV), and sample sizes (n) of breeding bird species on National Forests of the Rocky Mountain Region (R2), 2008-2009.

		San Juan				White River				All R2 National Forests			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Mourning Dove	2008	0.8	6,829	60	5	0.8	7,330	39	2	0.4	30,898	24	24
	2009	1.1	9,342	59	6				0	1.3	90,480	22	76
White-throated Swift[3]	2008	2.3	20,637	81	3				0	0.3	20,637	81	3
	2009				0				0	0.0			0
Broad-tailed Hummingbird[3]	2008	13.5	118,438	72	8	22.5	198,603	70	10	18.0	1,270,913	24	88
	2009	17.2	151,479	38	10	28.1	247,579	35	19	22.1	1,557,400	16	122
Red-naped Sapsucker[3]	2008	0.7	6,379	85	3	7.1	62,507	31	9	1.3	91,219	24	28
	2009	3.4	29,544	50	6	0.5	4,236	86	1	1.4	97,312	24	29
Hairy Woodpecker[3]	2008	0.3	2,876	101	2	20.9	183,802	47	12	4.8	341,757	27	100
	2009				0	3.3	28,668	68	4	5.8	411,044	16	92
American Three-toed Woodpecker[3]	2008	0.6	5,559	79	2	2.2	19,609	60	2	1.3	90,307	28	61
	2009				0				0	0.8	59,159	38	18
Northern Flicker	2008	1.1	9,663	54	10	2.0	17,595	38	6	1.3	93,343	16	96
	2009	12.2	107,358	36	28	6.0	52,772	38	16	6.3	445,505	14	147
Olive-sided Flycatcher[3]	2008				0	1.0	8,995	73	3	0.2	14,806	48	20
	2009				0	1.1	9,875	50	5	0.8	54,818	29	42
Western Wood-Pewee	2008	1.0	8,771	78	15	3.3	29,102	24	10	1.2	86,978	18	121
	2009	1.3	11,678	38	5	2.1	18,082	63	9	2.4	166,596	24	110
Hammond's Flycatcher[3]	2008	0.4	3,848	101	1				0	1.0	70,826	38	16
	2009				0	0.7	5,895	86	1	3.2	228,102	44	32
Gray Flycatcher[3]	2008				0				0	0.0			0
	2009				0	2.1	18,225	84	3	0.8	53,479	62	10
Dusky Flycatcher[3]	2008	1.2	10,321	83	7	15.8	139,473	31	9	4.7	333,822	21	76
	2009				0	5.8	51,438	61	7	12.4	874,325	26	98
Cordilleran Flycatcher[3]	2008	2.5	22,071	78	2	1.2	10,494	99	4	4.5	320,538	36	55
	2009	4.6	40,511	51	7	1.7	14,935	47	3	4.1	290,148	26	49
Ash-throated Flycatcher[3]	2008				0				0	0.0			0
	2009	0.9	8,347	86	3				0	0.2	13,790	62	5
Gray Vireo[3]	2008				0				0	0.0			0
	2009	1.5	13,280	52	5				0	0.2	13,280	52	5
Plumbeous Vireo[3]	2008	0.8	6,770	102	10				0	0.2	15,573	68	16
	2009	2.2	19,611	86	5				0	1.6	112,073	42	39

		San Juan				White River				All R2 National Forests			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Warbling Vireo[3]	2008	3.6	31,425	51	15	18.8	165,365	34	32	8.1	574,053	16	269
	2009	2.0	17,254	61	3	13.5	118,737	50	24	17.9	1,260,636	22	239
Gray Jay	2008	5.2	45,298	49	4	9.5	83,972	43	6	9.1	643,271	28	66
	2009	16.9	148,580	35	14	25.3	222,715	33	22	11.6	817,493	18	78
Steller's Jay	2008	2.9	25,515	41	10	5.3	47,063	34	8	2.5	178,348	20	42
	2009	7.8	68,388	31	19	4.6	40,251	56	13	4.7	328,446	20	95
Western Scrub-Jay[3]	2008				0				0	0.0			0
	2009				0				0	0.0	3,398	83	1
Pinyon Jay[3]	2008				0				0	0.0	797	101	2
	2009				0				0	0.0	2,272	79	3
Clark's Nutcracker[3]	2008	1.9	16,331	77	8	3.2	28,062	29	10	1.5	106,440	18	85
	2009	1.1	9,241	61	5	1.6	14,309	45	9	1.7	121,139	19	80
Black-billed Magpie[3]	2008				0				0	0.1	7,019	75	7
	2009	0.2	1,841	68	2	0.1	792	86	1	0.1	5,716	48	7
American Crow	2008				0	0.4	3,314	47	3	0.1	6,812	30	25
	2009	0.1	545	92	1	0.1	469	86	1	0.0	2,534	45	7
Common Raven	2008	0.3	2,218	74	3	1.2	10,447	77	2	0.5	36,528	32	30
	2009	0.0	397	84	1	0.2	1,706	54	5	0.2	15,565	18	58
Horned Lark	2008	5.8	51,103	81	7	2.7	23,677	91	9	2.4	168,809	44	34
	2009				0				0	0.3	19,377	50	14
Tree Swallow	2008	1.0	8,620	97	1				0	1.6	115,627	38	19
	2009	7.1	62,429	41	5	6.1	53,703	52	5	5.5	385,286	23	38
Violet-green Swallow[3]	2008	6.7	59,044	73	6	1.7	15,202	100	3	2.6	180,860	36	23
	2009	2.5	22,357	64	2	2.2	19,232	86	2	4.8	338,860	24	35
Cliff Swallow	2008				0				0	3.5	248,962	81	10
	2009				0				0	0.0			0
Mountain Chickadee	2008	43.6	383,524	27	51	18.1	159,893	19	22	35.7	2,518,619	12	498
	2009	167.7	1,474,819	19	110	104.7	922,668	39	80	101.0	7,119,517	10	614
Juniper Titmouse[3]	2008				0				0	0.0			0
	2009				0				0	0.2	14,449	64	2
Red-breasted Nuthatch	2008	4.8	42,527	57	8	7.0	62,018	36	8	3.3	232,965	21	103
	2009	4.0	34,916	88	7	4.1	36,492	39	9	5.9	413,349	18	101
White-breasted Nuthatch	2008	3.7	32,326	61	16	1.6	13,768	74	1	0.9	66,016	38	24
	2009	5.1	45,132	49	7	1.3	11,092	59	2	4.4	310,579	18	56

		San Juan				White River				All R2 National Forests			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Rock Wren[3]	2008				0				0	0.1	7,840	24	18
	2009				0				0	0.5	34,398	24	69
Bewick's Wren[3]	2008				0				0	0.0			0
	2009				0				0	0.0			0
House Wren	2008	0.7	6,119	70	3	5.3	46,297	30	4	3.4	238,319	16	87
	2009				0	15.8	139,337	47	24	12.8	903,142	24	178
Golden-crowned Kinglet[3]	2008				0	2.0	17,818	68	2	1.4	97,776	51	13
	2009	18.3	160,553	85	10	6.3	55,244	48	4	13.2	932,656	27	61
Ruby-crowned Kinglet	2008	15.3	134,251	34	40	19.9	175,716	14	40	16.5	1,165,554	10	519
	2009	22.8	200,153	43	53	27.3	240,397	21	74	22.3	1,568,839	10	514
Blue-gray Gnatcatcher	2008				0				0	0.5	32,292	78	2
	2009	1.7	14,822	82	1				0	1.8	128,864	68	7
Mountain Bluebird[3]	2008				0				0	1.4	100,314	26	34
	2009	9.0	78,868	37	20	0.8	6,784	84	2	2.9	206,744	23	77
Townsend's Solitaire[3]	2008	0.9	8,285	62	7	5.7	50,003	52	14	2.7	191,487	18	114
	2009	0.5	4,525	85	1	5.3	46,711	47	12	6.0	424,904	20	104
Hermit Thrush[3]	2008	5.5	48,539	29	43	5.3	46,691	27	35	5.5	385,927	11	560
	2009	4.0	34,875	26	33	3.6	31,819	29	35	6.2	437,780	8	526
American Robin	2008	13.1	114,965	24	26	24.7	217,378	14	32	20.2	1,423,812	9	480
	2009	82.3	723,314	15	159	26.6	234,796	20	60	34.5	2,432,874	8	620
American Pipit[3]	2008	15.7	138,228	81	23	6.1	54,143	91	25	9.0	632,941	48	135
	2009				0				0	0.7	48,397	80	15
Orange-crowned Warbler	2008				0	4.6	40,528	65	5	0.6	44,851	59	10
	2009				0	3.5	31,151	86	5	1.9	130,402	46	18
Virginia's Warbler[3]	2008				0				0	0.1	8,556	76	1
	2009	1.8	15,708	86	2				0	1.3	92,616	42	11
Yellow Warbler	2008				0	0.7	6,023	98	3	1.1	75,472	33	28
	2009	5.5	48,716	56	11				0	2.4	168,782	34	51
Yellow-rumped Warbler	2008	25.5	224,536	39	56	25.7	226,526	17	42	32.4	2,282,138	9	730
	2009	46.0	404,433	32	61	45.3	399,230	17	70	43.0	3,032,828	9	574
Black-throated Gray Warbler[3]	2008				0				0	0.1	5,647	97	1
	2009				0				0	0.0			0
MacGillivray's Warbler[3]	2008	0.5	4,119	78	2	3.1	27,589	59	5	0.9	63,541	33	18
	2009				0	1.1	9,655	85	2	3.9	276,472	39	58

		San Juan				White River				All R2 National Forests			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Wilson's Warbler[3]	2008				0	0.5	4,546	91	1	2.9	206,712	36	33
	2009	0.8	6,924	87	1	2.7	23,826	91	4	3.4	236,314	27	49
Western Tanager	2008	5.0	44,394	51	23	17.1	150,703	20	31	4.7	331,892	15	188
	2009	7.0	61,801	22	18	4.0	35,441	45	12	6.9	487,201	15	184
Green-tailed Towhee[3]	2008	0.8	7,340	90	8	6.6	57,822	52	9	4.5	319,555	23	127
	2009	0.6	5,315	85	1	18.2	160,036	61	35	9.7	683,722	24	185
Spotted Towhee	2008				0				0	0.7	48,856	45	8
	2009	3.4	30,292	47	7	0.4	3,722	84	1	4.4	312,730	49	70
Chipping Sparrow	2008	4.9	43,270	53	19	13.0	114,326	36	13	4.5	317,259	19	127
	2009	8.2	71,707	30	8	20.1	177,340	44	23	12.0	843,240	18	127
Brewer's Sparrow[3]	2008				0				0	0.1	8,925	37	14
	2009				0				0	0.0	2,149	65	2
Vesper Sparrow[3]	2008				0				0	0.8	59,244	56	47
	2009				0				0	0.6	39,231	58	20
Lark Sparrow[3]	2008				0				0	0.1	7,490	59	7
	2009	2.5	21,712	83	6				0	0.5	34,822	57	19
Sage Sparrow[3]	2008				0				0	0.0			0
	2009				0				0	0.0			0
Lark Bunting[3]	2008				0				0	0.0			0
	2009				0				0	0.0			0
Savannah Sparrow	2008				0				0	5.5	389,331	48	43
	2009	8.1	71,559	88	11				0	1.0	71,559	88	11
Song Sparrow	2008				0				0	0.2	16,257	60	7
	2009				0	1.8	15,482	94	3	0.8	57,186	43	19
Lincoln's Sparrow[3]	2008	10.4	91,877	84	17	14.0	123,702	68	11	13.7	962,221	18	131
	2009	15.4	135,712	89	16	12.4	109,445	52	15	11.8	828,639	22	116
White-crowned Sparrow	2008	16.6	145,698	55	15	23.5	207,196	52	45	16.7	1,174,233	24	199
	2009	16.8	147,907	55	28	35.1	308,994	25	68	13.2	931,167	18	200
Dark-eyed Junco	2008	64.9	570,462	19	66	61.5	542,385	15	50	46.7	3,291,496	8	616
	2009	134.2	1,180,090	14	84	149.5	1,317,261	21	109	130.7	9,208,933	7	759
Black-headed Grosbeak	2008				0				0	0.1	9,490	63	7
	2009				0	1.0	9,041	64	3	1.0	67,751	33	19
Lazuli Bunting[3]	2008				0				0	0.2	16,311	78	5
	2009				0				0	0.2	14,524	64	4

		San Juan				White River				All R2 National Forests			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Red-winged Blackbird	2008				0				0	1.3	89,709	78	16
	2009	0.6	5,413	93	1				0	0.3	24,360	41	12
Western Meadowlark	2008				0				0	0.8	59,397	45	75
	2009	1.6	13,840	45	17				0	0.3	18,378	38	37
Brewer's Blackbird	2008				0				0	0.4	27,746	48	17
	2009				0				0	0.4	30,315	36	15
Brown-headed Cowbird	2008	0.3	2,980	103	3				0	0.5	34,824	42	11
	2009	4.6	40,283	87	7				0	1.2	81,415	48	19
Pine Grosbeak	2008	0.4	3,501	95	1	1.8	15,442	56	3	3.3	233,419	26	54
	2009	3.5	30,425	71	6	2.0	17,448	38	4	2.1	144,529	31	31
Cassin's Finch[3]	2008	0.1	667	102	1	1.0	9,039	63	4	0.7	46,456	36	52
	2009				0	1.9	16,623	71	5	1.5	106,210	26	29
House Finch	2008				0	0.6	5,001	83	1	0.1	5,001	83	1
	2009				0				0	0.1	3,851	87	1
Red Crossbill[3]	2008	6.6	57,920	42	21	4.8	42,296	54	11	5.6	392,290	19	148
	2009	0.6	5,563	92	1	1.9	17,166	76	3	4.6	324,933	31	69
Pine Siskin[3]	2008	48.8	429,070	32	64	28.4	250,210	40	42	24.0	1,689,279	13	452
	2009	64.7	569,160	19	65	37.6	331,423	21	44	36.0	2,535,631	10	343

[1] Density = (birds/km^2); [2] n = number of independent detections used to estimate density;
[3] Priority species in Bird Conservation Region 16 (see Appendix A).

Table 3. Estimated densities (D), estimated population sizes (N), percent coefficient of variation of estimates (%CV), and sample sizes (n) of breeding bird species on BLM land in Colorado and "All Other" lands in BCR 16 of Colorado and Wyoming, 2008-2009.

		Colorado BLM				Colorado "All Other"				Wyoming "All Other"			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Mourning Dove	2008	5.5	153,194	23	127	5.7	290,342	33	71				
	2009	2.2	60,877	35	39					1.7	9,282	59	7
White-throated Swift[3]	2008	4.5	124,570	44	22	0.5	26,880	80	3				
	2009	0.8	21,700	57	6								0
Broad-tailed Hummingbird[3]	2008	12.7	352,618	35	39	35.0	1,792,023	31	50				
	2009	10.4	288,551	24	19					3.3	18,071	81	2
Red-naped Sapsucker[3]	2008	0.1	3,490	89	1				0				
	2009	0.2	4,937	83	1					0.5	2,937	82	1
Hairy Woodpecker[3]	2008	0.8	21,728	46	5	2.2	113,504	82	3				
	2009	0.6	16,706	68	2								0
American Three-toed Woodpecker[3]	2008				0				0				
	2009				0								0
Northern Flicker	2008	1.2	32,870	36	26	2.5	129,606	29	29				
	2009	2.6	73,038	26	19					2.5	13,722	81	6
Olive-sided Flycatcher[3]	2008				0	0.1	6,688	85	1				
	2009				0								0
Western Wood-Pewee	2008	0.7	18,839	39	13	3.0	153,620	32	29				
	2009	0.5	14,050	41	6								0
Hammond's Flycatcher[3]	2008	0.1	1,759	94	1	3.5	179,660	65	9				
	2009	0.2	6,871	90	1								0
Gray Flycatcher[3]	2008	9.0	249,784	27	91	0.2	10,343	89	4				
	2009	17.3	481,460	25	68								0
Dusky Flycatcher[3]	2008	5.7	157,520	29	37	2.8	141,332	50	11				
	2009	10.2	282,624	37	33					12.2	66,240	81	13
Cordilleran Flycatcher[3]	2008	0.2	4,455	61	3	2.9	146,227	42	10				
	2009				0								0
Ash-throated Flycatcher[3]	2008	6.0	167,729	21	70	0.8	39,592	56	14				
	2009	2.8	78,110	35	28								0
Gray Vireo[3]	2008	0.8	23,237	41	25				0				
	2009	1.8	50,594	40	19								0
Plumbeous Vireo[3]	2008	5.6	156,257	35	49	2.3	116,176	62	16				
	2009	5.1	141,565	30	36					0.4	2,340	83	1

		Colorado BLM				Colorado "All Other"				Wyoming "All Other"			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Warbling Vireo[3]	2008	1.4	40,154	43	17	12.0	616,732	41	55				
	2009	1.7	46,129	63	8					13.2	72,042	83	21
Gray Jay	2008				0				0				
	2009				0								0
Steller's Jay	2008	0.5	14,978	59	7	0.6	31,453	49	3				
	2009	1.8	50,521	54	14					0.4	2,147	82	1
Western Scrub-Jay[3]	2008	3.2	88,419	29	55	0.3	14,044	65	4				
	2009	0.7	19,518	40	8								0
Pinyon Jay[3]	2008	1.3	37,562	40	39	0.4	18,807	58	8				
	2009	2.6	73,466	27	55					0.3	1,589	93	2
Clark's Nutcracker[3]	2008	0.5	13,620	61	10	0.3	16,151	86	3				
	2009	0.6	16,677	46	9								0
Black-billed Magpie[3]	2008	0.4	9,750	49	16	1.5	78,449	38	46				
	2009	1.3	37,384	39	38					0.8	4,279	53	8
American Crow	2008	0.2	4,521	53	11	0.6	30,944	40	24				
	2009				0								0
Common Raven	2008	0.6	16,733	42	14	0.7	37,989	54	13				
	2009	0.4	11,533	25	29					0.6	3,313	26	14
Horned Lark	2008	7.7	214,952	36	113	7.4	380,502	41	73				
	2009	1.3	35,882	57	13					15.1	82,109	33	50
Tree Swallow	2008	1.0	26,549	85	3	5.0	254,580	56	7				
	2009	4.9	137,698	41	11								0
Violet-green Swallow[3]	2008	13.4	371,972	43	29	22.9	1,171,178	37	44				
	2009	4.8	134,489	47	12					3.7	20,004	51	3
Cliff Swallow	2008	41.8	1,162,050	67	55	16.7	852,927	38	29				
	2009				0								0
Mountain Chickadee	2008	1.3	36,913	48	10	6.4	329,305	28	16				
	2009	3.9	107,536	33	8					17.6	95,968	81	12
Juniper Titmouse[3]	2008	4.8	132,921	34	27	0.1	4,221	92	1				
	2009	6.2	171,690	44	25								0
Red-breasted Nuthatch	2008	0.1	3,377	83	1	0.3	14,529	80	1				
	2009	0.9	25,004	61	5					2.2	11,901	81	4
White-breasted Nuthatch	2008	1.3	35,180	56	10	1.9	97,873	55	6				
	2009	2.3	64,640	30	10					2.1	11,537	81	3

		Colorado BLM				Colorado "All Other"				Wyoming "All Other"			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Rock Wren[3]	2008	3.6	101,511	24	106	0.8	41,765	47	15				
	2009	5.8	162,601	19	119					1.0	5,691	38	7
Bewick's Wren[3]	2008	3.6	99,081	37	47	0.5	25,430	61	5				
	2009	2.1	59,802	50	18								0
House Wren	2008	0.2	6,927	77	4	14.3	734,150	36	46				
	2009	5.6	155,628	64	23					23.7	128,824	77	32
Golden-crowned Kinglet[3]	2008				0				0				
	2009				0								0
Ruby-crowned Kinglet	2008	0.7	19,128	64	4	3.3	170,644	65	9				
	2009	0.1	3,786	82	1								0
Blue-gray Gnatcatcher	2008	45.9	1,278,250	19	122	16.4	837,619	36	27				
	2009	55.5	1,545,437	14	104								0
Mountain Bluebird[3]	2008	5.0	138,134	31	56	1.5	79,293	51	16				
	2009	4.8	134,421	22	34					15.6	84,679	39	36
Townsend's Solitaire[3]	2008	0.1	3,897	78	3	1.2	62,396	71	5				
	2009	1.3	36,294	52	8					1.0	5,398	82	2
Hermit Thrush[3]	2008	0.4	11,588	46	12	2.0	100,231	64	19				
	2009	0.5	14,834	31	14					0.2	1,261	81	2
American Robin	2008	6.9	192,726	26	65	17.1	874,467	22	90				
	2009	16.6	460,647	26	101					8.0	43,416	62	16
American Pipit[3]	2008	5.2	144,424	53	15	2.6	134,747	81	6				
	2009				0								0
Orange-crowned Warbler	2008	1.2	32,439	53	10	3.9	199,235	58	12				
	2009	1.0	29,045	57	4								0
Virginia's Warbler[3]	2008	12.5	347,656	26	85	7.2	370,903	57	22				
	2009	7.6	212,608	39	27								0
Yellow Warbler	2008	1.6	43,885	39	9	13.7	699,736	37	66				
	2009	1.1	31,081	54	7								0
Yellow-rumped Warbler	2008	0.8	23,331	70	3	7.4	378,485	40	19				
	2009	2.2	59,824	51	9					14.5	79,095	81	20
Black-throated Gray Warbler[3]	2008	45.4	1,263,177	24	216	1.3	64,311	56	9				
	2009	24.4	679,648	26	153								0
MacGillivray's Warbler[3]	2008	0.2	6,858	58	3	0.8	43,066	74	5				
	2009	0.4	11,253	83	2								0

		Colorado BLM				Colorado "All Other"				Wyoming "All Other"			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Wilson's Warbler[3]	2008	0.1	3,554	90	2	0.4	20,169	89	1				
	2009	0.2	6,942	83	1								0
Western Tanager	2008	2.3	64,543	35	35	3.1	157,693	32	19				
	2009	2.7	75,729	44	22					0.8	4,096	81	2
Green-tailed Towhee[3]	2008	11.2	312,812	32	109	12.7	650,102	31	65				
	2009	31.4	873,980	27	164					12.2	66,583	50	21
Spotted Towhee	2008	15.9	442,084	34	141	13.3	682,055	30	62				
	2009	14.4	401,601	28	93					0.9	5,162	66	2
Chipping Sparrow	2008	13.3	369,672	21	132	2.6	131,325	35	17				
	2009	24.9	691,956	25	77					29.5	160,396	82	30
Brewer's Sparrow[3]	2008	9.9	276,068	39	127	6.3	324,618	43	48				
	2009	23.6	657,145	21	170					22.0	119,591	40	52
Vesper Sparrow[3]	2008	4.1	113,115	36	81	5.7	291,278	35	77				
	2009	6.7	186,795	30	70					2.6	14,289	75	9
Lark Sparrow[3]	2008	3.4	93,242	29	37	7.7	395,874	62	38				
	2009	4.6	126,978	42	35					4.8	25,902	42	12
Sage Sparrow[3]	2008	4.5	124,203	72	47	0.7	35,851	88	4				
	2009	2.5	69,162	70	18					1.7	9,221	69	5
Lark Bunting[3]	2008	0.1	3,220	69	1				0				
	2009				0					17.5	94,998	80	60
Savannah Sparrow	2008				0	15.0	768,011	52	52				
	2009				0								0
Song Sparrow	2008	0.5	14,555	72	2	6.7	341,475	64	25				
	2009	3.5	96,234	66	16					0.7	3,578	92	1
Lincoln's Sparrow[3]	2008				0	1.1	55,163	84	1				
	2009	0.3	8,504	83	1								0
White-crowned Sparrow	2008	0.8	21,384	47	5	3.5	178,195	75	5				
	2009	0.2	5,296	91	1								0
Dark-eyed Junco	2008	1.2	32,853	75	3	15.3	785,640	52	19				
	2009	3.0	84,509	37	6					1.5	8,380	81	1
Black-headed Grosbeak	2008	5.9	162,793	39	82	4.7	242,525	33	34				
	2009	1.8	49,172	45	14								0
Lazuli Bunting[3]	2008	2.2	60,766	47	18	1.3	66,079	59	13				
	2009	1.7	47,437	41	13								0

		Colorado BLM				Colorado "All Other"				Wyoming "All Other"			
Species	Year	D[1]	N	%CV	n[2]	D	N	%CV	n	D	N	%CV	n
Red-winged Blackbird	2008	1.5	40,506	63	7	20.4	1,043,626	43	73				
	2009				0								0
Western Meadowlark	2008	2.3	64,302	29	89	9.3	476,545	27	214				
	2009	1.9	53,053	53	65					14.4	78,183	24	161
Brewer's Blackbird	2008	4.4	123,669	47	27	15.3	785,605	37	44				
	2009	2.6	72,231	76	12					4.6	25,068	65	7
Brown-headed Cowbird	2008	4.1	114,501	38	24	8.8	451,040	34	35				
	2009	5.4	150,007	37	26					6.9	37,759	74	11
Pine Grosbeak	2008				0				0				
	2009	0.2	5,084	83	1								0
Cassin's Finch[3]	2008	0.6	16,129	86	5	0.2	7,746	87	1				
	2009				0								0
House Finch	2008	2.4	67,540	33	41	4.0	206,392	60	32				
	2009	4.7	129,956	42	47								0
Red Crossbill[3]	2008				0	0.9	46,458	62	7				
	2009				0					4.3	23,228	90	7
Pine Siskin[3]	2008	3.3	91,565	39	24	11.7	601,106	42	39				
	2009	1.6	43,894	53	5								0

[1] Density = (birds/km^2); [2] n = number of independent detections used to estimate density;
[3] Priority species in Bird Conservation Region 16 (see Appendix A).

Table 4. Estimated densities (D), estimated population sizes (N), percent coefficient of variation of estimates (%CV), and sample sizes (n) of breeding bird species in the BCR 16 portions of Colorado and Wyoming, 2008-2009.

		Colorado BCR 16				Wyoming BCR 16			
Species	Year	D	N	CV(N)	n	D	N	CV(N)	n
Mourning Dove	2008	3.2	469,738	22	226				
	2009	1.0	151,847	19	124	2.0	22,990	35	36
White-throated Swift	2008	1.3	184,723	33	36				
	2009	0.5	71,801	72	24	0.1	1,378	101	1
Broad-tailed Hummingbird	2008	23.4	3,445,749	19	178				
	2009	20.1	2,954,914	37	138	8.1	93,515	31	21
Red-naped Sapsucker	2008	0.7	97,402	24	26				
	2009	0.6	85,780	27	18	1.7	19,405	32	13
Hairy Woodpecker	2008	2.9	427,484	30	61				
	2009	2.1	306,680	19	39	11.8	137,002	24	62
American Three-toed Woodpecker	2008	0.4	61,336	36	13				
	2009	0.2	31,719	61	5	2.4	27,440	43	13
Northern Flicker	2008	1.6	238,132	18	103				
	2009	4.2	614,328	24	132	4.7	54,329	29	44
Olive-sided Flycatcher	2008	0.1	20,414	44	11				
	2009	0.3	41,381	36	21	1.2	13,438	48	21
Western Wood-Pewee	2008	1.8	263,877	21	143				
	2009	1.0	145,495	27	62	3.0	35,151	28	54
Hammond's Flycatcher	2008	1.7	250,150	48	23				
	2009	3.3	481,950	55	35				0
Gray Flycatcher	2008	2.1	307,878	23	115				
	2009	4.1	596,258	22	103				0
Dusky Flycatcher	2008	4.0	590,257	18	99				
	2009	7.8	1,145,848	22	129	7.8	90,311	61	22
Cordilleran Flycatcher	2008	3.3	480,578	27	58				
	2009	2.0	290,148	26	49				0
Ash-throated Flycatcher	2008	1.5	213,883	20	95				
	2009	0.7	100,125	29	50				0
Gray Vireo	2008	0.2	25,635	37	27				
	2009	0.5	67,030	32	30				0
Plumbeous Vireo	2008	2.0	299,807	30	84				
	2009	1.8	264,641	24	84	1.2	14,080	45	11

		Colorado BCR 16				Wyoming BCR 16			
Species	Year	D	N	CV(N)	n	D	N	CV(N)	n
Warbling Vireo	2008	7.9	1,157,810	23	235				
	2009	8.5	1,249,014	22	213	11.5	133,354	49	63
Gray Jay	2008	4.2	624,221	28	46				
	2009	5.6	817,493	18	78	0.1	1,641	100	2
Steller's Jay	2008	1.5	224,988	18	54				
	2009	2.6	376,961	19	107	0.4	4,153	53	3
Western Scrub-Jay	2008	0.7	104,276	26	60				
	2009	0.2	26,671	34	11				0
Pinyon Jay	2008	0.4	61,137	31	53				
	2009	0.5	78,483	25	63	0.2	1,961	77	3
Clark's Nutcracker	2008	0.9	135,557	19	76				
	2009	0.9	132,650	18	81	0.5	5,666	32	11
Black-billed Magpie	2008	0.6	88,456	34	64				
	2009	0.5	76,842	47	49	0.4	4,792	48	10
American Crow	2008	0.3	40,344	32	46				
	2009	0.8	117,332	17	10	0.0	455	52	3
Common Raven	2008	0.6	92,458	27	51				
	2009	0.2	26,529	15	79	0.5	5,413	19	36
Horned Lark	2008	5.2	762,954	25	218				
	2009	0.7	104,351	57	45	10.4	121,011	36	85
Tree Swallow	2008	2.6	378,364	40	21				
	2009	6.6	970,215	48	56				0
Violet-green Swallow	2008	12.1	1,773,456	26	101				
	2009	3.6	533,004	23	52	3.6	42,157	42	9
Cliff Swallow	2008	15.4	2,270,539	38	96				
	2009	3.4	504,983	102	1				0
Mountain Chickadee	2008	18.9	2,774,669	11	375				
	2009	46.8	6,881,550	10	526	40.7	471,509	22	120
Juniper Titmouse	2008	1.0	142,246	32	29				
	2009	1.3	192,429	40	36				0
Red-breasted Nuthatch	2008	1.6	229,431	22	53				
	2009	2.9	419,638	18	89	3.5	40,400	29	29
White-breasted Nuthatch	2008	1.4	204,328	31	39				
	2009	2.5	373,055	16	67	1.9	22,319	47	9

		Colorado BCR 16				Wyoming BCR 16			
Species	Year	D	N	CV(N)	n	D	N	CV(N)	n
Rock Wren	2008	1.0	150,530	21	136				
	2009	1.2	182,317	17	149	2.4	28,242	25	66
Bewick's Wren	2008	0.9	135,074	29	58				
	2009	0.4	59,802	50	18				0
House Wren	2008	6.2	914,177	29	94				
	2009	8.1	1,188,727	28	148	21.0	243,563	43	93
Golden-crowned Kinglet	2008	0.6	89,658	55	8				
	2009	6.1	892,385	28	52	3.5	40,272	46	9
Ruby-crowned Kinglet	2008	8.8	1,287,751	13	320				
	2009	10.1	1,481,057	11	428	8.0	92,885	25	92
Blue-gray Gnatcatcher	2008	14.8	2,172,136	18	167				
	2009	12.8	1,887,831	14	151	2.9	33,961	100	6
Mountain Bluebird	2008	2.1	307,731	21	97				
	2009	2.2	322,846	17	95	10.1	117,222	30	66
Townsend's Solitaire	2008	1.7	245,684	23	91				
	2009	3.1	461,022	19	109	1.1	12,965	49	8
Hermit Thrush	2008	3.2	468,731	16	406				
	2009	2.8	415,978	8	419	3.4	39,330	20	141
American Robin	2008	16.2	2,383,641	10	490				
	2009	20.1	2,957,083	10	634	17.1	197,777	19	140
American Pipit	2008	6.2	912,112	37	156				
	2009	0.3	48,397	80	15				0
Orange-crowned Warbler	2008	1.9	277,928	43	32				
	2009	1.2	177,518	36	27				0
Virginia's Warbler	2008	4.9	723,711	32	113				
	2009	3.0	440,764	37	63				0
Yellow Warbler	2008	5.2	763,523	34	81				
	2009	1.2	182,583	33	44	2.1	24,045	35	18
Yellow-rumpted Warbler	2008	17.4	2,552,950	10	467				
	2009	19.4	2,848,475	9	461	29.1	337,327	25	168
Black-throated Gray Warbler	2008	9.9	1,451,298	21	251				
	2009	5.1	748,803	24	200				0
MacGillivray's Warbler	2008	0.7	106,433	36	24				
	2009	1.7	251,752	43	37	3.1	35,973	32	23

		Colorado BCR 16				Wyoming BCR 16			
Species	Year	D	N	CV(N)	n	D	N	CV(N)	n
Wilson's Warbler	2008	1.5	222,061	34	26				
	2009	1.5	218,168	28	37	2.2	25,088	45	13
Western Tanager	2008	3.3	481,703	14	160				
	2009	3.6	527,690	15	164	4.4	50,983	26	51
Green-tailed Towhee	2008	7.7	1,134,835	20	209				
	2009	18.8	2,768,575	49	277	17.7	204,683	25	112
Spotted Towhee	2008	7.7	1,133,605	23	219				
	2009	5.3	778,671	26	200	3.3	38,126	48	26
Chipping Sparrow	2008	5.4	788,550	14	241				
	2009	14.7	2,163,164	31	210	18.8	217,852	61	53
Brewer's Sparrow	2008	4.1	603,018	29	178				
	2009	7.5	1,103,832	39	189	10.9	126,158	38	57
Vesper Sparrow	2008	2.8	416,723	26	174				
	2009	2.2	321,328	35	89	1.6	17,998	61	14
Lark Sparrow	2008	3.3	489,686	51	76				
	2009	1.1	155,744	36	46	3.4	39,012	36	25
Sage Sparrow	2008	1.1	160,054	59	51				
	2009	0.5	69,162	70	18	0.8	9,221	69	5
Lark Bunting	2008	0.0	3,220	69	1				
	2009				0	8.2	94,998	80	60
Savannah Sparrow	2008	7.9	1,154,153	38	92				
	2009	70.7	10,395,443	99	56				0
Song Sparrow	2008	2.6	379,034	58	35				
	2009	6.9	1,010,740	92	35	1.8	20,298	68	11
Lincoln's Sparrow	2008	6.7	991,040	18	107				
	2009	5.5	813,504	22	107	2.0	23,639	31	10
White-crowned Sparrow	2008	9.5	1,394,100	22	211				
	2009	6.3	923,213	18	192	1.1	13,250	90	9
Dark-eyed Junco	2008	26.9	3,950,698	12	453				
	2009	60.0	8,824,865	8	646	42.2	488,999	18	132
Black-headed Grosbeak	2008	2.8	406,608	25	120				
	2009	0.9	129,915	26	40	0.2	1,953	88	2
Lazuli Bunting	2008	0.9	133,167	36	39				
	2009	0.5	80,673	30	34				0

		Colorado BCR 16				Wyoming BCR 16			
Species	Year	D	N	CV(N)	n	D	N	CV(N)	n
Red-winged Blackbird	2008	8.0	1,171,434	39	90				
	2009	31.8	4,678,368	103	23	1.8	21,288	48	13
Western Meadowlark	2008	3.9	569,712	23	325				
	2009	1.5	218,527	68	111	7.9	91,115	22	208
Brewer's Blackbird	2008	6.3	928,731	32	78				
	2009	16.4	2,409,806	98	25	4.0	46,820	40	20
Brown-headed Cowbird	2008	3.9	578,526	28	63				
	2009	4.5	656,711	64	51	4.2	48,985	59	18
Pine Grosbeak	2008	1.5	227,456	26	36				
	2009	1.0	139,720	32	25	0.9	9,893	50	7
Cassin's Finch	2008	0.5	67,129	34	26				
	2009	0.7	106,210	26	29				0
House Finch	2008	1.9	279,803	45	76				
	2009	1.0	144,328	38	60				0
Red Crossbill	2008	2.6	380,565	21	111				
	2009	2.1	306,328	33	57	4.1	47,263	51	33
Pine Siskin	2008	16.0	2,357,552	14	426				
	2009	16.6	2,433,821	11	291	12.9	149,474	26	62

Table 5. Estimated site occupancy (Psi; proportion of sample units occupied), standard error of Psi (SE), percent coefficient of variation of Psi (%CV) and number of transects with detections (n Tran) of bird species throughout the Colorado portion of BCR 16, 2009.

Species	Psi	SE	%CV	n Tran
Turkey Vulture	0.05	0.02	48	5
American Kestrel	0.11	0.05	46	6
Williamson's Sapsucker[1]	0.13	0.06	43	10
Black-capped Chickadee	0.10	0.03	26	13
Pygmy Nuthatch[1]	0.10	0.03	28	12
Brown Creeper[1]	0.18	0.05	29	15
Western Bluebird[1]	0.09	0.03	33	11
Swainson's Thrush	0.05	0.02	45	6
Wilson's Warbler[1]	0.09	0.02	25	13
Black-throated Sparrow[1]	0.05	0.02	34	7
Bullock's Oriole[1]	0.02	0.01	54	3
American Goldfinch	0.01	0.01	87	2

[1]Priority species in Bird Conservation Region 16 (see Appendix A).

DISCUSSION

In 2009 RMBO led an avian landbird monitoring program throughout the Colorado and Wyoming portions of the Southern Rockies/Colorado Plateau Bird Conservation Region. This program compliments landbird monitoring programs conducted concurrently by RMBO and its partners in The Shortgrass Prairie, Badlands and Prairies, and Northern Rockies Bird Conservation Regions, including state-wide programs in Colorado and Wyoming. Due to a spending freeze in the Colorado state government, the Colorado Division of Wildlife could not contribute funding to landbird monitoring in 2009, resulting in a decreased sampling effort on non-federal lands ("All Other" stratum) from 2008 to 2009 (Table 1). Nevertheless, by combining data across states and years, we were able to estimate densities of 76 landbird species in BCR 16 in 2008-2009.

RMBO and its partners eliminated cell weighting (for high stream orders and higher elevations) between 2008 and 2009 in BCR 16. We anticipated that we would observer fewer individuals of high elevation species such as American Pipit and more individuals of mid-elevation species such as Pygmy Nuthatch. We did observer fewer Pipits in 2009 (Table 4) but observed similar numbers of Pygmy Nuthatches (28 in 2008 and 32 in 2009). Interestingly, we observed fewer Pygmy Nuthatches on the San Juan and White River National Forests and in National Parks of the Rocky Mountain Inventory and Monitoring Network (15, 2 and 8 in 2008 and 2, 0 and 0 in 2009, respectively). At the same time, we observed no Pygmy Nuthatches in 2008 in the following strata: Arapaho-Roosevelt, Grand Mesa-Uncompaghre-Gunnison, Manti-La Sal, Pike-San Isabel and Rio Grande National Forests, and BLM. In 2009 we obtained 1, 4, 4, 6, 9 and 2 independent detections of Pygmy Nuthatches in these strata, respectively. Samples sizes of Pygmy Nuthatches across both years were too small to estimated densities. However, we were able to estimate site occupancy rates for this and other species of conservation concern.

Elimination of cell weighting greatly simplified estimation of occupancy rates and their standard errors; current occupancy estimation software does not incorporate cell weighting. Analysis of occupancy estimates from weighted samples would require a large investment in statistical programming.

When comparing results in this report with that from the 2009 report on Monitoring Colorado's Birds (Blakesley and Hanni 2009) please note that density estimates in last year's report were valid but estimates of population size were not, due to an error in the R code, which was fixed prior to analyses presented in this report.

The IMBCR sampling design, which contributes to regional, BCR-wide monitoring, serves as a model for other long-term monitoring efforts because of its ability to address the conservation and management needs of a wide range of stakeholders, landowners and governmental entities at both local and regional scales. The IMBCR design represents one method for achieving effective collaboration and coordinated bird monitoring efforts in North America (NABCI 2007) and could be applied to other BCRs and regions across the continent.

The IMBCR sampling design is not limited to estimating population density and occupancy rates of birds. This design could be used to estimate nesting success or other demographic parameters. Furthermore, our sampling design could be used to monitor the distribution and population dynamics of additional taxonomic groups, including reptiles, small mammals and plants. A spatially balanced design using similar stratification and cell weighting for ponds and wetlands could be used to monitor shorebirds and amphibians, whereas a design with larger sample cells would be appropriate for monitoring large mammals. Identifying and monitoring the distributions of plants and animals at multiple spatial scales over time will help scientists and land managers face challenges associated with climate change and other natural and anthropogenic changes to the environment.

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APPENDIX A

Priority species detected within the Southern Rockies/Colorado Plateau Bird Conservation Region (BCR 16) in 2009. Codes for Agencies/Organizations: USDI Fish and Wildlife Service (USFWS), USDA Forest Service (USFS), USDI Bureau of Land Management (BLM), Partners in Flight (PIF), Colorado Division of Wildlife (CDOW) and Wyoming Game and Fish Department (WGFD).

	USFWS		USFS		BLM	Partners In Flight		CDOW		WGFD
Species	BCR 16	Region 6	Region 2	Individual Forests		BCR 16	WY	WAP[1]	CO TES[2]	WAP[1]
Northern Pintail								SGCN		SGCN
Redhead										SGCN
Lesser Scaup								SGCN		SGCN
Dusky Grouse						CC	WY-III	SGCN		
Wild Turkey				MIS						
Clark's Grebe							WY-III			SGCN
American White Pelican					SS		WY-II	SGCN		SGCN
Great Blue Heron										SGCN
Black-crowned Night-Heron										SGCN
White-faced Ibis					SS			SGCN		SGCN
Osprey								SGCN		
Bald Eagle	BCC	BCC					WY-I	SGCN	ST	SGCN
Northern Harrier			R2SS				WY-III	SGCN		
Northern Goshawk			R2SS	MIS	SS		WY-I	SGCN		SGCN
Swainson's Hawk						CC,RC	WY-I	SGCN		SGCN
Ferruginous Hawk	BCC	BCC	R2SS		SS	RC	WY-I	SGCN	SC	SGCN
Golden Eagle	BCC	BCC		MIS		RC	WY-III	SGCN		
Peregrine Falcon	BCC	BCC	R2SS				WY-I	SGCN	SC	SGCN
Prairie Falcon	BCC	BCC				RC	WY-III	SGCN		
Sandhill Crane								SGCN	SC	SGCN
Willet							WY-III			
Wilson's Phalarope							WY-I	SGCN		
Band-tailed Pigeon						CC		SGCN		
Northern Pygmy-Owl										SGCN
Common Nighthawk						RC				
Common Poorwill							WY-III			
White-throated Swift						CC,RS	WY-II	SGCN		
Black-chinned Hummingbird							WY-II	SGCN		

	USFWS		USFS		BLM	Partners In Flight		CDOW		WGFD
Species	BCR 16	Region 6	Region 2	Individual Forests		BCR 16	WY	WAP[1]	CO TES[2]	WAP[1]
Calliope Hummingbird						CC	WY-II			
Broad-tailed Hummingbird						RS	WY-II	SGCN		
Rufous Hummingbird							WY-II	SGCN		
Williamson's Sapsucker						CS,RS	WY-II	SGCN		
Red-naped Sapsucker				MIS			WY-II	SGCN		
Hairy Woodpecker				MIS						
American Three-toed Woodpecker			R2SS	MIS			WY-II	SGCN		SGCN
Olive-sided Flycatcher			R2SS			CC	WY-II	SGCN		
Willow Flycatcher	BCC	BCC				CC,RC	WY-II	SGCN	FE,SE	SGCN
Hammond's Flycatcher							WY-II			
Gray Flycatcher							WY-II	SGCN		
Dusky Flycatcher							WY-II	SGCN		
Cordilleran Flycatcher						RS	WY-II	SGCN		
Say's Phoebe						RS	WY-III			
Ash-throated Flycatcher							WY-II			SGCN
Cassin's Kingbird							WY-II			
Loggerhead Shrike		BCC	R2SS			RC	WY-II	SGCN		
Gray Vireo	BCC	BCC				CC,RC,RS		SGCN		
Plumbeous Vireo						RS	WY-II			
Warbling Vireo				MIS		RS				
Western Scrub-Jay							WY-II			SGCN
Pinyon Jay	BCC	BCC				CC,RC,CS,RS		SGCN		
Clark's Nutcracker						CS,RS	WY-III			
Black-billed Magpie						RS				
Purple Martin			R2SS					SGCN		
Violet-green Swallow						RS				
Northern Rough-winged Swallow							WY-III			
Juniper Titmouse	BCC					RC,RS	WY-II	SGCN		SGCN
Bushtit							WY-II			SGCN
Pygmy Nuthatch				MIS		RC	WY-II	SGCN		SGCN
Brown Creeper				MIS			WY-II			
Rock Wren						RS	WY-III			
Canyon Wren						RC	WY-III			
Bewick's Wren		BCC					WY-III			

	USFWS		USFS		BLM	Partners In Flight		CDOW		WGFD
Species	BCR 16	Region 6	Region 2	Individual Forests		BCR 16	WY	WAP[1]	CO TES[2]	WAP[1]
American Dipper							WY-II	SGCN		
Golden-crowned Kinglet				MIS			WY-II			
Western Bluebird						RS	WY-II			
Mountain Bluebird				MIS		RC,CS,RS				
Townsend's Solitaire							WY-II			
Veery	BCC						WY-III	SGCN		
Hermit Thrush				MIS						
Sage Thrasher		BCC					WY-II			SGCN
American Pipit				MIS						
Virginia's Warbler				MIS		CC,RC,RS	WY-III	SGCN		
Black-throated Gray Warbler						RC	WY-III	SGCN		
Grace's Warbler	BCC					CC,RC		SGCN		
Ovenbird							WY-III			
MacGillivray's Warbler							WY-II			
Wilson's Warbler				MIS			WY-II			
Green-tailed Towhee						CS,RS				
Cassin's Sparrow			R2SS					SGCN		
Brewer's Sparrow	BCC		R2SS	MIS		CC,RC	WY-I	SGCN		SGCN
Vesper Sparrow				MIS			WY-II	SGCN		
Lark Sparrow							WY-II			
Black-throated Sparrow						RC				
Sage Sparrow		BCC	R2SS			RC	WY-I	SGCN		SGCN
Lark Bunting							WY-II	SGCN		SGCN
Lincoln's Sparrow				MIS						
McCown's Longspur		BCC	R2SS				WY-I	SGCN		SGCN
Lazuli Bunting							WY-III	SGCN		
Bobolink							WY-II	SGCN		SGCN
Bullock's Oriole				MIS			WY-III			
Brown-capped Rosy-Finch	BCC	BCC				CC,CS,RS	WY-III	SGCN		SGCN
Cassin's Finch	BCC	BCC				RC		SGCN		
Red Crossbill								SGCN		
Pine Siskin						RC,RS				
Evening Grosbeak								SGCN		

[1] Wildlife Action Plan; [2] Colorado Threatened/Endangered

Key to codes in Appendix A.

Agency/Organization	Code	Definition	Citation
USDI Fish and Wildlife Service			
	BCC	Bird of Conservation Concern	USDI Fish and Wildlife Service (2008)
USDA Forest Service			
	R2SS	Region 2 Sensitive Species	
	MIS	Management Indicator Species	Individual Forest Land Management Plans
USDI Bureau of Land Management			
	SS	Sensitive Species	
Partners in Flight			Pashley et al. (2000)
	CC	Continental Concern	
	CS	Continental Stewardship	
	RC	Regional Concern	
	RS	Regional Stewardship	
	WY-I	Level I – species in need of conservation action	Nicholoff (2003)
	WY-II	Level II – species in need of monitoring	
	WY-III	Level III – species of local interest	
Colorado Division of Wildlife			Colorado's Comprehensive Wildlife Conservation Strategy
	SGCN	Species of Greatest Conservation Need	
	FE	Federally Endangered	
	SC	Species of Special Concern	
	ST	State Threatened	
Wyoming Game and Fish Department			Wyoming Wildlife Action Plan
	SGCN	Species of Greatest Conservation Need	