

INVENTORY, MONITORING, AND RESEARCH NEEDS

“Monitoring Wyoming’s Birds: The Plan for Count-based Monitoring”

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Introduction

Population monitoring is the foundation of avian conservation. Without reliable monitoring data, conservation efforts may be misguided and inefficient. Monitoring is required under federal and state legislative and agency mandates, as well as a host of long-range plans, forest plans, ecoregional plans, preserve management plans, etc. (Sauer 1993, Manley et al. 1993, Colorado Division of Wildlife 1994). From a global biodiversity perspective, Wyoming hosts many bird species at or near their greatest regional abundances (Table 14) and therefore has a high, long-term responsibility to conserve these species (*sensu* Rosenberg and Wells 2000).

The effective conservation and management of Wyoming’s birds depend on adequate monitoring information, which, to a large extent, does not exist. To date, resource managers have relied on data derived from the Breeding Bird Survey (BBS), currently the best and most extensive bird-monitoring program, to monitor bird populations (Robbins et al. 1989, Sauer 1993). The BBS uses volunteers to conduct roadside surveys of birds across North America and produces indices of population abundance at the continental scale for many common bird species (see Robbins et al. 1986). However, many species and habitats are inadequately sampled by the BBS (Robbins et al. 1993, Sauer 1993) and BBS data do not reliably predict population trends at small geographic scales (Sauer 2000). Additionally, the design and implementation of the BBS is such that results generated from these efforts are often inconclusive due to the difficulty associated with interpreting index counts (Sauer 2000) and numerous confounding variables (Robbins et al. 1986, Bohning-Gaese et al. 1993, Sauer et al. 1994, James et al. 1996, Thomas 1996, Rosenstock et al. in prep.). For these reasons, BBS data are generally insufficient to guide local or regional management decisions.

Several authors have suggested implementing regional habitat-based bird monitoring programs to complement data generated by the BBS (Butcher 1992, Butcher et al. 1993, Sauer 2000, Sauer and Cooper 2000). In cooperation with the agencies charged with protecting and managing Colorado’s birds, Rocky Mountain Bird Observatory (RMBO) proposed and successfully implemented a bird monitoring program for the state, entitled “Monitoring Colorado’s Birds” (MCB), in which every agency/organization has the opportunity to contribute and benefit by assuming

responsibility for the dominant habitats on the lands they manage (Table 15). This nationally-recognized program, often referred to as “The Colorado Model”, is currently being considered for adoption by several states. In Colorado, it is supported by the Colorado Division of Wildlife, U.S. Forest Service, Bureau of Land Management, and National Park Service. Now, in cooperation with Wyoming Partners In Flight (WY-PIF), we propose a similar plan, based on the Colorado model, to monitor the birds of Wyoming. This plan is “Monitoring Wyoming’s Birds: The Plan for Count-based Monitoring” (MWB).

MWB is designed to provide population trend or status data on all regularly-occurring breeding species in the state. A total of 246 species of birds has bred in Wyoming. The first phase of MWB is to ensure that count-based data are obtained for all species that can be monitored effectively through a habitat-based approach, and that species-specific tracking or census programs are employed for those species requiring more specialized techniques. The second phase should include demographic studies to determine the possible reasons for known declines and to develop management information. Herein we develop a plan for Phase I, the count-based monitoring of all of Wyoming’s regularly breeding bird species. This plan was developed using information drawn from BBS data, WY-PIF, and Partners In Flight (PIF) priority scores (Table 14).

MWB has been drafted as a state-based plan, seeking funding only from agencies within Wyoming and focusing solely on habitats within the state. However, an ecoregional approach would provide more meaningful and complete monitoring data on bird populations and would be more cost-effective for states. Therefore, we would like to expand this program to the Bird Conservation Region (BCR) level. BCRs are more ecologically-appropriate management units for birds because they encompass distinct ecoregions in North America that host similar bird communities (NABCI Committee 2000). Partners In Flight has adopted the BCR as the focus unit for ranking conservation priorities among bird species, and the North American Bird Conservation Initiative (NABCI) has stressed the need for regionally-based approaches to bird conservation involving cooperative partnerships within BCRs (NABCI Committee 2000).

Wyoming is comprised of four BCRs: the Northern Rockies (BCR 10), Badlands and Prairies (BCR 17), Shortgrass Prairie (BCR 18), and Southern Rockies/Colorado Plateau (BCR 16), each of which extends into neighboring states. A BCR level plan would require that all states occupying significant portions of the BCR contribute proportionately to fund monitoring efforts in the BCR. Such a plan would be more cost-effective because it would eliminate duplicate efforts by states to obtain independent data sets from habitats they share with other states, while still providing meaningful data on bird populations that could be used at the state level.

Background

Although analyses of BBS data have indicated population declines in some bird species (Robbins et al. 1986), we do not believe that there are wholesale declines in birds as reported by some media, individuals, initiatives, or environmental groups. However, population trend data for many western bird species are lacking (see Table 14).

Using WY-PIF priority scores and criteria established by Carter et al. (2000), we have determined that over 68% of Wyoming's regularly-breeding species are not adequately monitored by the BBS (Table 16). Of the species that are well monitored by the BBS, some species have populations that are declining, some increasing, and some stable (Table 16). If proportions of increasing, decreasing, and stable species are roughly the same in the list of unmonitored species as they are in the list of monitored species, then it is likely that a considerable number of population declines are currently undetected. Furthermore, because declines are more difficult to detect than increases (variance increases as populations decline), the proportion of declining species in the unmonitored list is probably even higher. For these reasons, a comprehensive monitoring program for Wyoming is clearly needed.

Statistical Targets and Assumptions

Monitoring should be efficient, low-level, and permanent, and we have designed this program with these points in mind. To monitor correctly, one needs a target -- a threshold of population change over time that balances statistical rigor with cost-effectiveness. It is desirable to detect a fairly small population change (particularly, a negative one) in a fairly short amount of time. However, the sample sizes required would probably be prohibitively costly. Therefore, as our target, we selected a minimum rate of population change of -3.0% per year and a maximum time period of 30 years in which to detect population changes (see Butcher 1992 and Robbins et al. 1993 for similar trend detection targets). We used the formula:

$$\text{cumulative change} = ((\text{annual change}/100)+1)^{n-1} - 1)(100)$$

to calculate total population loss over a 30-year period with an annual decline of 3.0%. This equates to a 58.7% loss of a population in 30 years, which is probably not large enough to trigger listing under the Endangered Species Act. It is, however, advance warning enough to trigger action.

Along with this target one must determine what levels of statistical rigor (i.e. power and significance) are appropriate. We selected a statistical probability of $p=0.10$ (Askins et al. 1990, Butcher 1992) to indicate a significant population change. A statistical probability of $p=0.10$ gives moderate protection against Type I error (finding trends that are false). For MWB, we provided only moderate protection because it is often more useful and practical for wildlife managers to determine the direction and

magnitude of a trend than establish its significance at a very high level (i.e., traditionally, $p=0.05$). Similarly, we set power at 0.8 (Butcher 1992, Downes et al. 2000), which gives moderate protection against Type II error (failing to find trends that are real).

Considering cost and the need to have a sufficient number of well-dispersed sampling units, we initially designed this program with 30 samples (i.e. transects) per habitat. Then, using pilot data from 1998, we tested this number of samples and confirmed that 30 would be sufficient to meet our target for detecting population changes.

With these assumptions, we used the computer program MONITOR (Patuxent Wildlife Research Center 2000) to model the efficiency of 30 pilot transects run in each of three habitats in 1998 (Leukering and Carter 1999). Specifically, we used MONITOR to determine the threshold for the coefficient of variation (CV; Standard Deviation/Mean) associated with point-transect data that will generate useful monitoring information. A CV reflects the overall variability of data scaled against the mean; that is, species with large abundances but high variability have CVs similar to those of species with low abundance and low variability. CVs are a function of factors inherent to a species (its abundance and variability in nature) and statistical considerations such as sample size and method of sampling. MONITOR indicates that for species with associated CVs of less than 1.00, we will be able to detect 3.0% per year declines within 30 years of monitoring, with a statistical significance of $p=0.1$ and power of 0.8. For species with CVs of less than 0.50, MONITOR indicates that we will be able to detect declines of 3.0% per year within 12 years.

It is the nature of trend data that increases can be detected more quickly than can decreases of equal magnitude. Therefore, with these thresholds we should be able to detect positive trends more quickly than negative trends. Additionally, for species with either large rates of population change or very low CVs, we will be able to detect trends in as few as six years.

Methods

MWB will employ a variety of survey techniques (e.g. point transects, line transects, and colony counts) to obtain trend and status data on Wyoming's birds. Each technique is detailed in Leukering and Levad (2000) and summarized in Table 17. An underlying tenet of MWB is to allocate more effort to those species for which Wyoming is an important breeding area and little effort to species that are peripheral to the area. While most species can be monitored through use of a single technique, the ecologies of some species are such that they are not adequately surveyed through randomized sampling efforts. Therefore, not all species will be monitored by the same technique, nor will every species be monitored. Game species and federally-listed Threatened or

Endangered (T&E) species will not receive specific attention under MWB, as monitoring programs already exist for these species under other mandates. We believe monitoring efforts under MWB should focus on those species currently not monitored under any program. However, data generated by MWB on these species will be available and could be used to supplement other management information for these species.

Although we use the term “monitoring” loosely throughout most of this plan, in the strictest sense, “monitoring” is possible only for those species for which we can obtain a sufficient number of samples (i.e. those species with CVs of <1.00) to meet high levels of statistical rigor when testing for population change. For some species that occur in low relative abundance across the landscape, “monitoring” will not be possible without greatly increasing the amount of funds and effort devoted toward those species. Instead, we intend to “track” populations of low-abundance or localized species, with the implication being that any trends detected for these species will have low statistical power (CVs of >1.00). For data obtained through species-specific techniques, “monitoring” will be possible for those species for which we are able to locate and survey all known breeding locations in a given year (e.g. Eared Grebe, Great Blue Heron, and Franklin’s Gull). For rare or local species whose breeding locations are not known with complete certainty, we will “track” populations using counts at known breeding locations (e.g. Purple Martin and Scott’s Oriole).

MWB relies primarily on transect-based techniques, through which we expect to monitor approximately 35% of Wyoming’s breeding bird species and track an additional 35% (Table 18). Through the use of species-specific techniques, we expect to monitor 6% and track an additional 10% of Wyoming’s breeding birds (Table 18). The remaining 14% of species are designated T&E or game species not covered under MWB.

Standard distance-sampling techniques (Buckland et al. 1993) are used during all transect surveys, and density estimates of bird species are derived using program DISTANCE (Thomas et al. 1998). We have become painfully aware of the many problems associated with sampling bird populations and believe that distance-sampling techniques may be useful in sorting out problems of detectability that could result from myriad factors, including changes to the habitat over the term of this program. We do not intend to use these techniques to develop densities as an end product, but rather as a tool to derive an index that is not confounded by detectability issues. In the event that distance sampling techniques do not prove to be useful, we will analyze our data using more traditional techniques (e.g. via fixed radii).

All diurnal transects are located at randomly-selected sites without bias toward or against roads; starting points and transect bearings are determined randomly. All technicians are highly-skilled field ornithologists and are trained at the beginning of the season to ensure that they fully understand the field protocol and that their distance-estimation skills meet our requirements (within 10% of true value).

Partners

The magnitude of this plan requires that numerous agencies and organizations participate to fully implement all aspects of the program. For this plan, partners (real or potential) include the Bureau of Land Management, U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, Wyoming Game and Fish Department, Audubon Wyoming, Wyoming Department of Agriculture, Wyoming Natural Diversity Database, Wyoming Partners In Flight, and Rocky Mountain Bird Observatory.

Products

Annual summaries of results and periodic trend analyses will be provided to all participating agencies via paper reports, publications, and the World Wide Web. Raw data will be made available to the Wyoming Natural Diversity Database (WYNDD) by the end of the calendar year in which it was collected, whereby WYNDD will add them to previous data and distribute to all contributing participants.

Funding/Cost

For MWB, we estimate that count-based data for each habitat will cost about \$10,500 per year (Table 19). This figure includes only the costs to obtain transect-based data from each habitat and does not include funds for species-specific monitoring. However, when multiple habitats are included in the budget, the synergistic effects of per-habitat funding (i.e. overlap in data management, analysis, report writing, etc.) should provide sufficient funds to cover the cost of most species-specific monitoring techniques. In Colorado, the program has been funded to address 16 habitats, which provides sufficient funds to address most species with the appropriate technique.

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Table 14. Species list with PIF priority scores, habitat, and suggested methods for monitoring each of Wyoming's breeding bird species. Only local scores are included here; global scores are not. Scores provided are: AI = area importance, PT = population trend, PTU = population trend uncertainty (not included in total). Total score is not a sum of scores provided.

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Common Loon	3	3	8	18	Wetlands	Expert survey	Tracked
Pied-billed Grebe	3	3	6	14	Wetlands	Colony count	Tracked
Horned Grebe	3	3	8	16	Wetlands	Colony count	Tracked
Red-necked Grebe	3	3	8	17	Wetlands	Expert survey	Tracked
Eared Grebe	2	3	6	13	Wetlands	Colony count	Monitored
Western Grebe	3	3	6	20	Wetlands	Colony count	Monitored
Clark's Grebe	3	3	8	20	Wetlands	Colony count	Monitored
American White Pelican	3	3	6	21	Wetlands	Expert survey	Monitored
Double-crested Cormorant	2	3	6	13	Wetlands	Colony count	Monitored
American Bittern	2	3	7	17	Wetlands	Line transect	Tracked
Great Blue Heron	3	3	5	14	Plains/Basin Riparian	Colony count	Monitored
Snowy Egret	3	3	8	15	Wetlands	Colony count	Monitored
Cattle Egret	3	3	8	13	Wetlands	Colony count	Monitored
Black-crowned Night-Heron	3	3	8	15	Wetlands	Colony count	Monitored
White-faced Ibis	3	3	8	17	Wetlands	Colony count	Monitored
Turkey Vulture	2	2	3	11	Specialized Habitats	Point transect	Tracked
Canada Goose	5	3	5	15	Wetlands	N/A	Tracked
Trumpeter Swan	3	3	8	26	Wetlands	Expert survey	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Wood Duck	3	3	8	18	Plains/Basin Riparian	N/A	Tracked
Gadwall	3	3	5	15	Wetlands	N/A	Tracked
American Wigeon	4	3	5	17	Wetlands	N/A	Tracked
Mallard	3	3	5	13	Wetlands	N/A	Tracked
Blue-winged Teal	2	2	2	13	Wetlands	N/A	Tracked
Cinnamon Teal	3	4	4	19	Wetlands	N/A	Tracked
Northern Shoveler	2	3	6	14	Wetlands	N/A	Tracked
Northern Pintail	2	3	5	13	Wetlands	N/A	Tracked
Green-winged Teal	4	3	5	15	Wetlands	N/A	Tracked
Canvasback	3	3	8	19	Wetlands	N/A	Tracked
Redhead	2	3	7	19	Wetlands	N/A	Tracked
Ring-necked Duck	4	3	7	20	Wetlands	N/A	Tracked
Lesser Scaup	3	3	6	16	Wetlands	N/A	Tracked
Harlequin Duck	3	3	8	20	Montane Riparian	Expert survey	Tracked
Bufflehead	3	3	8	18	Wetlands	N/A	Tracked
Common Goldeneye	3	3	8	15	Wetlands	N/A	Tracked
Barrow's Goldeneye	3	3	6	22	Wetlands	N/A	Tracked
Hooded Merganser	2	3	8	20	Wetlands	N/A	Tracked
Red-breasted Merganser	2	3	8	15	Wetlands	N/A	Tracked
Common Merganser	5	3	5	17	Montane Riparian	N/A	Tracked
Ruddy Duck	2	3	7	17	Wetlands	N/A	Tracked
Osprey	3	3	6	16	Wetlands	State-wide survey	Tracked

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Bald Eagle	3	3	8	18	Montane Riparian	N/A	Tracked
Northern Harrier	4	3	5	19	Plains/Basin Riparian	Point transect	Tracked
Sharp-shinned Hawk	3	3	8	16	High Elevation Conifer	Point transect	Tracked
Cooper's Hawk	3	3	8	16	Aspen	Point transect	Tracked
Northern Goshawk	4	3	7	19	Mid Elevation Conifer	Point transect	Tracked
Swainson's Hawk	3	3	5	21	Plains/Basin Riparian	Point transect	Tracked
Red-tailed Hawk	4	1	1	12	Plains/Basin Riparian	Point transect	Tracked
Ferruginous Hawk	4	3	5	23	Shortgrass Prairie	Point transect	Tracked
Golden Eagle	5	3	5	19	Specialized Habitats	Point transect	Tracked
American Kestrel	5	2	1	14	Urban/Agricultural	Point transect	Tracked
Merlin	3	3	8	15	Low Elevation Conifer	Point transect	Tracked
Prairie Falcon	5	3	5	23	Specialized Habitats	Point transect	Tracked
Peregrine Falcon	3	3	8	19	Specialized Habitats	Expert survey	Tracked
Gray Partridge	3	3	8	11	Mountain-foothills Shrub	N/A	Tracked
Chukar	3	3	8	11	Mountain-foothills Shrub	N/A	Tracked
Ring-necked Pheasant	3	5	2	13	Urban/Agricultural	N/A	Tracked
Ruffed Grouse	4	3	7	19	Aspen	N/A	Tracked
Sage Grouse	5	3	5	26	Shrub-steppe	N/A	Tracked
Blue Grouse	3	3	8	21	Montane Riparian	N/A	Tracked
White-tailed Ptarmigan	3	3	8	20	Alpine Tundra	Statewide survey	Tracked
Sharp-tailed Grouse	3	3	8	19	Mountain-foothills Shrub	N/A	Tracked
Wild Turkey	3	3	6	18	Plains/Basin Riparian	N/A	Tracked

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Northern Bobwhite	3	3	8	18	Plains/Basin Riparian	N/A	Tracked
Virginia Rail	3	3	8	16	Wetlands	Line transect	Tracked
Sora	2	3	6	13	Wetlands	Line transect	Tracked
American Coot	3	3	5	12	Wetlands	N/A	Tracked
Sandhill Crane	4	1	2	20	Wetlands	Statewide survey	Tracked
Snowy Plover	3	3	8	20	Wetlands	Statewide survey	Tracked
Killdeer	4	2	4	16	Plains/Basin Riparian	Line transect	Monitored
Mountain Plover	4	3	6	28	Shortgrass Prairie	Statewide survey	Tracked
Black-necked Stilt	3	3	8	16	Wetlands	Statewide survey	Tracked
American Avocet	2	4	3	21	Wetlands	Line transect	Tracked
Willet	3	2	3	18	Wetlands	Statewide survey	Tracked
Spotted Sandpiper	5	2	2	14	Plains/Basin Riparian	Line transect	Monitored
Upland Sandpiper	2	2	4	18	Shortgrass Prairie	Point transect	Tracked
Long-billed Curlew	2	3	6	21	Shortgrass Prairie	Statewide survey	Tracked
Common Snipe	4	3	5	15	Wetlands	Point transect	Tracked
Wilson's Phalarope	3	5	2	22	Wetlands	Line transect	Tracked
Franklin's Gull	3	3	8	22	Wetlands	Colony count	Monitored
Ring-billed Gull	2	3	6	13	Wetlands	Colony count	Monitored
California Gull	3	3	5	18	Wetlands	Colony count	Monitored
Caspian Tern	3	3	8	15	Wetlands	Expert survey	Tracked
Forster's Tern	2	3	7	19	Wetlands	Expert survey	Monitored
Black Tern	3	3	8	18	Wetlands	Expert survey	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Rock Dove	3	3	5	11	Urban/Agricultural	Point transect	Tracked
Mourning Dove	3	2	1	10	Plains/Basin Riparian	Point transect	Monitored
Black-billed Cuckoo	2	3	7	18	Plains/Basin Riparian	Expert survey	Tracked
Yellow-billed Cuckoo	3	3	8	18	Plains/Basin Riparian	Line transect	Tracked
Barn Owl	3	3	8	17	Urban/Agricultural	Nocturnal transect	Tracked
Eastern Screech-Owl	3	3	8	18	Plains/Basin Riparian	Nocturnal transect	Tracked
Western Screech-Owl	3	3	8	18	Plains/Basin Riparian	Nocturnal transect	Tracked
Northern Pygmy-Owl	3	3	8	17	Mid Elevation Conifer	Nocturnal transect	Tracked
Great Horned Owl	3	4	4	14	Plains/Basin Riparian	Nocturnal transect	Tracked
Burrowing Owl	2	4	3	19	Shortgrass Prairie	Colony count	Tracked
Great Gray Owl	3	3	8	18	Mid Elevation Conifer	Nocturnal transect	Tracked
Long-eared Owl	3	3	8	16	Plains/Basin Riparian	Nocturnal transect	Tracked
Short-eared Owl	3	3	6	20	Shortgrass Prairie	Nocturnal transect	Tracked
Boreal Owl	3	3	8	18	High Elevation Conifer	Nocturnal transect	Tracked
Northern Saw-whet Owl	3	3	8	15	Aspen	Nocturnal transect	Tracked
Common Nighthawk	4	4	4	17	Shortgrass Prairie	Point transect	Tracked
Common Poorwill	3	3	6	19	Mountain-foothills Shrub	Nocturnal transect	Monitored
Chimney Swift	3	3	8	18	Urban/Agricultural	Point transect	Tracked
White-throated Swift	3	3	6	17	Specialized Habitats	Point transect	Tracked
Black-chinned Hummingbird	2	3	8	20	Plains/Basin Riparian	Point transect	Monitored
Calliope Hummingbird	5	3	7	23	Mid Elevation Conifer	Point transect	Tracked
Broad-tailed Hummingbird	2	2	3	18	Montane Riparian	Point transect	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Rufous Hummingbird	2	3	7	20	Mid Elevation Conifer	Point transect	Tracked
Belted Kingfisher	2	3	6	14	Plains/Basin Riparian	Line transect	Monitored
Lewis' Woodpecker	3	3	8	23	Plains/Basin Riparian	Point transect	Tracked
Red-headed Woodpecker	2	3	6	18	Plains/Basin Riparian	Point transect	Tracked
Red-naped Sapsucker	3	2	2	20	Aspen	Point transect	Tracked
Williamson's Sapsucker	3	3	7	21	Mid Elevation Conifer	Point transect	Tracked
Downy Woodpecker	2	3	6	13	Plains/Basin Riparian	Point transect	Monitored
Hairy Woodpecker	3	3	5	15	Mid Elevation Conifer	Point transect	Monitored
Three-toed Woodpecker	4	3	7	20	Mid Elevation Conifer	Point transect	Tracked
Black-backed Woodpecker	3	3	8	21	Mid Elevation Conifer	Point transect	Tracked
Northern Flicker	5	4	4	16	Plains/Basin Riparian	Point transect	Monitored
Olive-sided Flycatcher	2	3	6	17	High Elevation Conifer	Point transect	Monitored
Western Wood-Pewee	3	2	1	15	Plains/Basin Riparian	Point transect	Monitored
Willow Flycatcher	3	4	4	20	Montane Riparian	Point transect	Tracked
Least Flycatcher	2	3	6	16	Plains/Basin Riparian	Point transect	Tracked
Hammond's Flycatcher	2	3	7	20	High Elevation Conifer	Point transect	Monitored
Dusky Flycatcher	3	2	3	19	Low Elevation Conifer	Point transect	Monitored
Gray Flycatcher	3	3	8	21	Juniper Woodland	Point transect	Tracked
Cordilleran Flycatcher	3	3	6	20	Montane Riparian	Point transect	Monitored
Eastern Phoebe	3	3	8	16	Plains/Basin Riparian	Expert survey	Tracked
Say's Phoebe	4	3	5	18	Shrub-steppe	Point transect	Tracked
Ash-throated Flycatcher	2	3	7	16	Juniper Woodland	Point transect	Tracked

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Cassin's Kingbird	3	3	8	22	Juniper Woodland	Point transect	Tracked
Western Kingbird	3	1	1	15	Plains/Basin Riparian	Point transect	Tracked
Eastern Kingbird	3	2	1	14	Plains/Basin Riparian	Point transect	Monitored
Loggerhead Shrike	3	3	5	18	Shrub-steppe	Point transect	Tracked
Plumbeous Vireo	3	3	6	20	Mid Elevation Conifer	Point transect	Monitored
Warbling Vireo	4	2	2	17	Plains/Basin Riparian	Point transect	Monitored
Red-eyed Vireo	2	3	7	14	Plains/Basin Riparian	Point transect	Monitored
Gray Jay	3	5	2	17	High Elevation Conifer	Point transect	Monitored
Steller's Jay	2	3	6	15	High Elevation Conifer	Point transect	Monitored
Blue Jay	2	3	7	12	Plains/Basin Riparian	Point transect	Tracked
Western Scrub-Jay	3	3	8	18	Juniper Woodland	Point transect	Tracked
Pinyon Jay	2	3	6	17	Juniper Woodland	Point transect	Tracked
Clark's Nutcracker	4	3	5	18	High Elevation Conifer	Point transect	Monitored
Black-billed Magpie	4	5	1	19	Plains/Basin Riparian	Point transect	Monitored
American Crow	2	2	1	9	Urban/Agricultural	Point transect	Tracked
Common Raven	3	2	4	11	Specialized Habitats	Point transect	Monitored
Horned Lark	5	4	4	15	Shrub-steppe	Point transect	Monitored
Purple Martin	3	3	8	16	Aspen	Statewide survey	Tracked
Tree Swallow	3	2	4	14	Aspen	Point transect	Tracked
Violet-green Swallow	3	2	4	16	Aspen	Point transect	Tracked
Northern Rough-winged Swallow	4	4	4	18	Plains/Basin Riparian	Point transect	Tracked
Bank Swallow	2	3	5	13	Plains/Basin Riparian	Point transect	Tracked

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Cliff Swallow	4	2	4	12	Specialized Habitats	Point transect	Tracked
Barn Swallow	3	2	4	11	Urban/Agricultural	Point transect	Tracked
Black-capped Chickadee	2	5	2	15	Plains/Basin Riparian	Point transect	Monitored
Mountain Chickadee	3	5	2	18	High-elevation Conifer	Point transect	Monitored
Juniper Titmouse	3	3	8	21	Juniper Woodland	Point transect	Monitored
Bushtit	3	3	8	16	Juniper Woodland	Point transect	Tracked
Red-breasted Nuthatch	2	2	2	12	High Elevation Conifer	Point transect	Monitored
White-breasted Nuthatch	2	3	6	14	High Elevation Conifer	Point transect	Monitored
Pygmy Nuthatch	3	3	8	20	Low Elevation Conifer	Point transect	Monitored
Brown Creeper	3	3	8	16	Mid Elevation Conifer	Point transect	Monitored
Rock Wren	3	5	1	18	Specialized Habitats	Point transect	Tracked
Canyon Wren	3	4	3	18	Specialized Habitats	Point transect	Tracked
Bewick's Wren	3	3	8	18	Juniper Woodland	Point transect	Monitored
House Wren	3	2	4	11	Plains/Basin Riparian	Point transect	Monitored
Marsh Wren	3	4	3	20	Wetlands	Line transect	Monitored
American Dipper	3	3	7	20	Montane Riparian	Point transect	Tracked
Golden-crowned Kinglet	3	3	6	17	High Elevation Conifer	Point transect	Monitored
Ruby-crowned Kinglet	3	2	4	14	High Elevation Conifer	Point transect	Monitored
Blue-gray Gnatcatcher	3	3	8	15	Juniper Woodland	Point transect	Monitored
Eastern Bluebird	3	3	8	15	Plains/Basin Riparian	Point transect	Tracked
Western Bluebird	3	3	8	19	Juniper Woodland	Point transect	Tracked
Mountain Bluebird	4	2	1	17	Mountain-foothills Shrub	Point transect	Tracked

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Townsend's Solitaire	3	2	3	17	Aspen	Point transect	Tracked
Veery	2	4	3	18	Montane Riparian	Point transect	Monitored
Swainson's Thrush	2	2	2	14	Mid Elevation Conifer	Point transect	Monitored
Hermit Thrush	3	2	2	15	High Elevation Conifer	Point transect	Monitored
American Robin	3	2	1	10	Plains/Basin Riparian	Point transect	Monitored
Gray Catbird	2	4	4	16	Plains/Basin Riparian	Point transect	Tracked
Northern Mockingbird	2	3	7	10	Plains/Basin Riparian	Expert survey	Tracked
Sage Thrasher	5	2	1	19	Shrub-steppe	Point transect	Monitored
Brown Thrasher	2	3	6	17	Plains/Basin Riparian	Point transect	Tracked
American Pipit	3	3	8	14	Alpine Tundra	Point transect	Monitored
Cedar Waxwing	2	3	7	13	Mountain-foothills Shrub	Point transect	Tracked
European Starling	3	3	5	11	Urban/Agricultural	Point transect	Monitored
Orange-crowned Warbler	2	3	6	13	Montane Riparian	Point transect	Tracked
Virginia's Warbler	3	3	8	24	Mountain-foothills Shrub	Point transect	Monitored
Yellow Warbler	4	2	1	13	Plains/Basin Riparian	Point transect	Monitored
Yellow-rumped Warbler	4	3	5	14	High Elevation Conifer	Point transect	Monitored
Black-throated Gray Warbler	3	3	8	22	Juniper Woodland	Point transect	Monitored
Townsend's Warbler	3	3	8	20	High Elevation Conifer	Point transect	Monitored
American Redstart	2	4	3	15	Plains/Basin Riparian	Expert survey	Tracked
Ovenbird	2	3	7	17	Plains/Basin Riparian	Statewide survey	Tracked
MacGillivray's Warbler	3	1	2	17	Montane Riparian	Point transect	Monitored
Common Yellowthroat	2	5	2	15	Wetlands	Point transect	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Wilson's Warbler	2	3	6	15	Montane Riparian	Point transect	Monitored
Yellow-breasted Chat	2	3	5	16	Plains/Basin Riparian	Point transect	Monitored
Western Tanager	3	2	4	17	Mid Elevation Conifer	Point transect	Monitored
Green-tailed Towhee	4	2	1	19	Mountain-foothills Shrub	Point transect	Monitored
Spotted Towhee	2	3	5	16	Mountain-foothills Shrub	Point transect	Monitored
Chipping Sparrow	3	5	1	16	Mid Elevation Conifer	Point transect	Monitored
Clay-colored Sparrow	2	3	6	18	Shrub-steppe	Point transect	Tracked
Brewer's Sparrow	5	5	1	23	Shrub-steppe	Point transect	Monitored
Field Sparrow	2	3	7	17	Shortgrass Prairie	Statewide survey	Tracked
Vesper Sparrow	5	4	4	18	Shrub-steppe	Point transect	Monitored
Lark Sparrow	3	4	4	18	Shrub-steppe	Point transect	Monitored
Black-throated Sparrow	3	3	8	17	Shrub-steppe	Point transect	Tracked
Sage Sparrow	5	2	2	22	Shrub-steppe	Point transect	Monitored
Lark Bunting	4	4	4	22	Shortgrass Prairie	Point transect	Monitored
Savannah Sparrow	3	3	5	13	Shortgrass Prairie	Point transect	Monitored
Baird's Sparrow	3	3	8	26	Shortgrass Prairie	Point transect	Tracked
Grasshopper Sparrow	3	5	1	19	Shortgrass Prairie	Point transect	Monitored
Fox Sparrow	2	3	7	14	Montane Riparian	Point transect	Tracked
Song Sparrow	2	2	1	10	Plains/Basin Riparian	Point transect	Monitored
Lincoln's Sparrow	2	2	4	13	Montane Riparian	Point transect	Monitored
White-crowned Sparrow	3	2	4	12	Montane Riparian	Point transect	Monitored
Dark-eyed Junco	3	3	7	14	Mid Elevation Conifer	Point transect	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
McCown's Longspur	3	2	4	26	Shortgrass Prairie	Point transect	Monitored
Chestnut-collared Longspur	2	3	6	21	Shortgrass Prairie	Point transect	Monitored
Rose-breasted Grosbeak	2	3	8	17	Plains/Basin Riparian	Expert survey	Tracked
Black-headed Grosbeak	3	1	2	18	Mid Elevation Conifer	Point transect	Monitored
Blue Grosbeak	2	3	7	15	Plains/Basin Riparian	Point transect	Tracked
Lazuli Bunting	3	3	5	19	Montane Riparian	Line transect	Monitored
Indigo Bunting	3	3	8	14	Plains/Basin Riparian	Statewide survey	Tracked
Dickcissel	3	3	8	21	Shortgrass Prairie	Point transect	Tracked
Bobolink	2	3	7	19	Shortgrass Prairie	Statewide survey	Tracked
Red-winged Blackbird	3	2	1	11	Wetlands	Line transect	Monitored
Western Meadowlark	4	2	1	16	Shortgrass Prairie	Point transect	Monitored
Yellow-headed Blackbird	2	3	5	17	Wetlands	Line transect	Monitored
Brewer's Blackbird	4	3	5	14	Urban/Agricultural	Point transect	Monitored
Common Grackle	2	2	4	10	Plains/Basin Riparian	Line transect	Tracked
Brown-headed Cowbird	2	2	4	9	Urban/Agricultural	Point transect	Tracked
Orchard Oriole	2	3	7	17	Plains/Basin Riparian	Line transect	Tracked
Bullock's Oriole	3	2	2	17	Plains/Basin Riparian	Line transect	Monitored
Scott's Oriole	3	3	8	21	Juniper Woodland	Statewide survey	Tracked
Gray-crowned Rosy-Finch	2	3	8	16	Alpine Tundra	Point transect	Tracked
Black Rosy-Finch	3	3	8	22	Alpine Tundra	Point transect	Monitored
Brown-capped Rosy-Finch	3	3	8	23	Alpine Tundra	Point transect	Monitored
Pine Grosbeak	2	3	7	15	High Elevation Conifer	Point transect	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Cassin's Finch	3	2	4	17	Mid Elevation Conifer	Point transect	Monitored
House Finch	2	5	2	12	Urban/Agricultural	Point transect	Monitored
Red Crossbill	4	3	6	17	High Elevation Conifer	Point transect	Tracked
White-winged Crossbill	3	3	8	16	High Elevation Conifer	Point transect	Tracked
Pine Siskin	3	3	5	12	High Elevation Conifer	Point transect	Tracked
American Goldfinch	2	3	5	12	Plains/Basin Riparian	Point transect	Tracked
Evening Grosbeak	3	3	8	14	Mid Elevation Conifer	Point transect	Monitored
House Sparrow	2	3	5	10	Urban/Agricultural	Point transect	Monitored

Table 15. Designations by habitat of potential partners with numbers of species expected to be monitored or tracked in each habitat. ^a

Habitat	Agency ^b	Expected Number of Species Monitored or Tracked ^c
Uniform-block Habitats ^d		
Alpine Tundra	National Park Service	19
Juniper Woodland	Bureau of Land Management	28
Mountain-foothills Shrub	Bureau of Land Management	31
Shortgrass Prairie	Bureau of Land Management	33
Shrub-steppe	Bureau of Land Management	28
Aspen	U.S. Forest Service	39
High Elevation Conifer	U.S. Forest Service	39
Low Elevation Conifer	U.S. Forest Service	37
Mid Elevation Conifer	U.S. Forest Service	37
Non-uniform-block Habitats ^e		
Plains/Basin Riparian	WY Department of Agriculture	31
Montane Riparian	WY Game and Fish Department	39
Wetlands	U.S. Fish and Wildlife Service	21
Dispersed, Non-uniform, and/or Anthropogenic Habitats ^f		
Specialized Habitats	WY Game and Fish Department	
Urban/Agricultural	WY Department of Agriculture	

^a Many species occur in several habitats. Therefore, we expect to obtain monitoring data on these species in each of the habitats in which they occur in reasonable abundance. These numbers are based on results from “Monitoring Colorado’s Birds” 2000 data.

^b Agencies which manage a majority (based on total acreage) of a particular habitat are listed next to that habitat. However, all participating agencies will benefit from “Monitoring Wyoming’s Birds” due to the availability of monitoring data to all.

^c See Methods for distinction between “monitored” vs. “tracked”.

^d Uniform-block habitats are those that we believe will be well sampled with random allocation of point transects.

^e Non-uniform-block habitats are those that will require extra effort or somewhat different counting techniques due to the widespread, but localized or narrow aspects of those habitats.

^f These habitats are not vegetation-based, are found across large elevational gradients, and host species specific to the habitat, but not necessarily the associated vegetation type. We do not anticipate allocating transects to these habitats; funding for these will be dispersed among other habitats, devoted to species-specific techniques, and/or used to interpret BBS data.

Table 16. Partners In Flight Breeding Bird Survey population trend scores for Wyoming's breeding birds by habitat. Scores of 4 and 5 indicate declines, 1 and 2 indicate increases or stable populations, and a score of 3 denotes unknown status.

Habitat	Population Trend Score					Number of Species
	1	2	3	4	5	
Wetlands	1	3	46	3	2	55
Plains/Basin Riparian	2	12	31	5	2	52
High Elevation Conifer	1	2	14	0	2	19
Mid Elevation Conifer	1	3	13	0	1	18
Shortgrass Prairie	0	3	10	3	1	17
Montane Riparian	1	3	10	2	0	16
Juniper Woodland	0	0	12	0	0	12
Urban/Agricultural	0	4	6	0	2	12
Shrub-steppe	0	2	5	3	1	11
Specialized Habitats	0	3	4	1	1	9
Mountain-foothills Shrub	0	2	7	0	0	9
Aspen	0	4	4	0	0	8
Alpine Tundra	0	0	5	0	0	5
Low Elevation Conifer	0	1	2	0	0	3
Totals	6	42	169	17	12	246

Table 17. Glossary of survey techniques.

Term	Definition
Transect-based Efforts	
Line transect (Plains/Basin Riparian)	Thirty “float” transects [1 mile (1.6 km) in length] using line-transect methodology (Buckland et al. 1993). Starting points are randomly located on navigable rivers (<5,500 feet in elevation) selected at random from available sites. Density estimates for bird species are derived using program DISTANCE (Thomas et al. 1998).
Line transect (Wetlands)	Thirty line transects [985 feet (300 m) in length] using line-transect methodology (Buckland et al. 1993). Starting points are randomly located in wetland stands randomly selected from available sites. Density estimates for bird species are derived using program DISTANCE (Thomas et al. 1998).
Nocturnal transect	Forty-five road-based transects [19 miles (30 km) in length; 1 mile (1.6 km) between stops] in montane areas (i.e. BCR 16) using point-transect methodology (Buckland et al. 1993). Starting points were determined systematically by overlaying grid intersections and selecting the closest point on a road to each intersection, utilizing only secondary and tertiary roads that are accessible during the requisite seasons. Density estimates for bird species are derived using program DISTANCE (Thomas et al. 1998). Each transect was allocated to early, mid, and/or late season (March/April, June, and September, respectively) in order to survey for different species. The fall transects were conducted solely to obtain data on Boreal and Northern Saw-whet Owls at a season in which roads are accessible in their high elevation habitats (Stahlecker 1997). We attempted to do these transects in BCR 18, but the resultant data were too few for analysis.
Point transect	Thirty 15-point transects [820 feet (250 m) between points] in each of 12 habitats, following point-transect methodology (Buckland et al. 1993). Habitat stands were selected at random from available stands within a habitat type. Start points and transect bearings were determined randomly. Count duration at points is five minutes. Individual transects are the sampling units. Density estimates for bird species are derived using program DISTANCE (Thomas et al. 1998).

Table 17. Continued.

Term	Definition
Species-specific Efforts	
Colony count	A count of all nesting individuals at colony sites. For colonially-breeding herons, this can take the form of one of two methods: 1) actual counts of occupied nests, or 2) counts of adults observed at the colony site, depending on the species and colony site access. Counts are seasonally timed to maximize the number of breeding adults and minimize the number of transient individuals.
Expert survey	We receive information from birders across the state as to locations and numbers of accidental and peripheral breeders. Little or no effort is expended by RMBO in obtaining this information. This includes information gathered from government agencies on species for which surveys are already conducted.
Statewide survey	A statewide estimate of all individuals of a target species, based on counts during prime breeding period at all known breeding localities.
Unmonitored Species	
N/A	This designation implies that these species are either game species or are federally Threatened & Endangered species for which specific legislatively mandated monitoring programs already exist. MWB does not specifically target efforts at these species, which enables us to avoid duplication of effort and focus on currently unmonitored species.

Table 18. Number and percent of regularly-breeding bird species that MWB will monitor and track per survey method.

Method	No. Species Monitored (%)	No. Species Tracked (%)	Total	Percent of Total (n=246)
Transect-based Techniques				
Point transect	76	69	145	58.9
Line transect	8	8	16	6.5
Nocturnal transect	1	10	11	4.5
Total, transect-based techniques	85 (34.5)	87 (35.4)	172	69.9
Species-specific Techniques				
Statewide survey	1	14	15	6.1
Colony count	15	4	19	7.7
Expert survey	0	6	6	2.4
Total, special techniques	16 (6.5)	24 (9.8)	40	16.3
Not Monitored Under MWB				
Threatened & Endangered	0	1	1	0.4
Game species	0	33	33	13.4
Total, political designations	0	34 (13.8)	34	13.8
Total	101	145	246	100.0

Table 19. Proposed budget to perform monitoring in one habitat under MWB based on “Monitoring Colorado’s Birds” 2000 figures.

Item	Cost
Personnel	
45 days ^a (2.25 months) of technician time (\$1,700/month)	\$3,825
Organization/analysis/report (senior staff for 3 weeks @ \$2,800/month)	\$2,100
Taxes and benefits (12.46%)	\$738
Personnel subtotal	\$6,663
Logistics	
Mileage (3,300 miles x 0.28/mile)	\$924
Lodging (18 nights @ \$40/night)	\$720
Field food (45 days x \$15/day)	\$675
Logistics subtotal	\$2,319
 Indirect/overhead (15.10%)	 \$1,356
 Total (per habitat)	 \$10,338

^a Field personnel conduct 1 transect per day in the morning, scout the next day’s transect in the afternoon and, whenever possible, conduct species-specific surveys in the afternoon. Staff time includes pre-season training and post-season data entry.

Monitoring Wyoming's Birds: Year 2002 Final Report

Excerpted from Faulkner, D., and G. Giroir. 2002. *Monitoring Wyoming's Birds: Year 2002 Final Report*. Rocky Mountain Bird Observatory, Brighton, CO.

Introduction

Long-term population monitoring provides information critical to the effective management and conservation of bird populations. Since 1999, Rocky Mountain Bird Observatory (RMBO) and Wyoming Partners In Flight (WY-PIF) have been active partners in developing a plan for habitat-based, bird population monitoring for the state of Wyoming. Adapting the "Colorado Model" (Leukering et al. 2000), RMBO modified its statewide monitoring program using priority habitats identified by WY-PIF's Wyoming Bird Conservation Plan. This new program, entitled *Monitoring Wyoming's Birds (MWB)*, is designed to provide statistically-robust, population trend data for a majority of breeding birds in Wyoming (Leukering et al. 2001). This report describes Year 1 (2002) results of this program.

As with most programs in their first year, some difficulties were encountered that either affected how we surveyed or prevented us from completing the full complement of transects. Two habitats, Plains/Basin Riparian and Montane Riparian, presented unique situations. Some of the general difficulties included: 1) problems with the transect selection process (i.e., hiking/horse trails were erroneously considered roads by the WY GAP program which meant some transects required a 3-mile+ hike to the start point, contradicting the protocol of not more than a 1-mile hike), 2) some transect stands were only accessible via private roads which we avoid since landowners may not grant us permission to use such roads in later field seasons, and 3) problems with the GAP in habitat evaluation such that the mapped habitat was not the actual habitat when ground-truthed. These problems have mostly been resolved and we anticipate that we will be able to conduct the required transects for these habitats in the future.

Year 1 results are limited in scope, providing only transect locations with species distribution and relative abundance. Future reports will build on this information until population trend analysis is possible. Raw data are available from RMBO and Wyoming Natural Diversity Database. Available data include bird detections at each point, habitat variables at each point, and UTM coordinates for points. Habitat information will be compiled in report form when all transects are established for each habitat.

In conclusion, *MWB* yielded valuable data and was successful in building a foundation for future monitoring. This base gives the program the ability to incorporate additional habitats pursuant to the WY-PIF Bird Conservation Plan. We expect that it will take at least three years to firmly establish all habitat-based transects as currently outlined in this program.

Habitats

Based on available funding and time constraints with establishing a large-scale program, WY-PIF selected only the top seven priority habitats (out of a possible 12), as outlined in the Wyoming Bird Conservation Plan, in which to establish and conduct bird monitoring in 2002. These seven habitats were: Aspen, Shortgrass Prairie (Grassland), Juniper Woodland, Plains/Basin Riparian, Mid Elevation Conifer, Montane Riparian, and Shrub-steppe.

Results

Results for the state program are presented here. Data from the Plains/Basin Riparian surveys, conducted for the state program, are not presented here. Raw data for all surveys can be obtained from RMBO or Wyoming Natural Diversity Database.

Point Transects

We conducted a total of 1,871 point counts along 128 point transects in six habitats (Table 20, Figure 62). We detected a total of 9,470 birds of 147 species. The numbers of species varied among habitats, ranging from 50 in Shrub-steppe to 88 in Montane Riparian. In most habitats, many of the species observed were peripheral to that habitat and not well represented in the samples. Other species were observed in such low numbers that it was not possible to estimate density. Because we did not establish 30 transects in each habitat this year (Table 20), we expect sample size to increase for several species in 2003.

Table 20. Survey effort, cumulative species totals, and average number of species per count in habitats surveyed for *MWB*, 2002.

Habitat	# transects	# point counts	# species observed	Avg. species/count
Aspen	23	331	81	4.4
Grassland	21	315	54	2.6
Juniper Woodland	18	270	55	4.0
Mid Elevation Conifer	21	307	67	3.9
Montane Riparian	20	290	88	4.2
Shrub-steppe	25	358	50	2.4
Totals	128	1,871	147	----

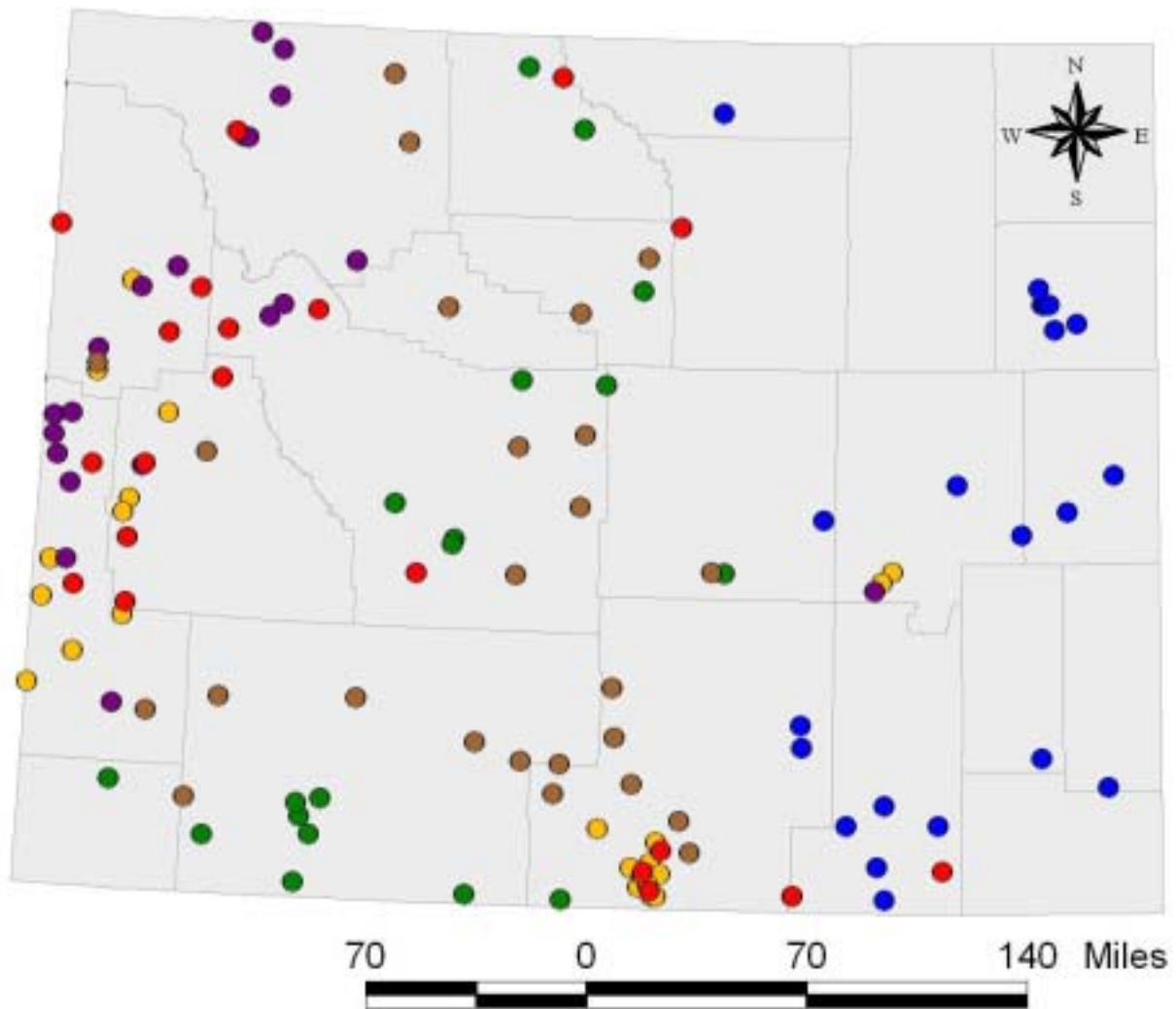


Figure 62. Mapped locations, color-coded by habitat, of 128 sites surveyed in Wyoming, 2002.

Aspen

We established 23 transects and conducted 331 counts along those transects. We detected 81 species with an average of 4.4 species per count station and obtained density estimates for 22 species (Table 21).

Table 21. Estimated densities of breeding birds in Aspen forests in Wyoming, 2002.

Species	D	LCL	UCL	CV (%)	n
Warbling Vireo	187.6	132.2	266.2	18	146
Dark-eyed Junco	103.5	72.9	146.8	18	141
Yellow-rumped Warbler	72.2	50.2	103.9	19	188
Chipping Sparrow	48.0	32.0	72.1	21	77
Dusky Flycatcher	47.0	33.5	65.9	17	75
House Wren	36.5	27.9	47.8	14	103
American Robin	33.8	27.1	42.2	11	163
Pine Siskin	28.5	17.5	46.6	25	52
MacGillivray's Warbler	24.5	10.3	58.2	45	26
Ruby-crowned Kinglet	23.3	19.0	28.7	10	126
Mountain Chickadee	20.9	14.7	29.8	18	80
Black-capped Chickadee	18.3	10.1	33.1	31	55
Western Tanager	16.3	7.8	33.9	38	25
Mountain Bluebird	13.5	6.7	27.4	37	30
Yellow Warbler	13.2	7.4	23.6	30	27
Western Wood-Pewee	12.4	8.9	17.3	17	54
Green-tailed Towhee	10.3	5.7	18.5	30	33
White-crowned Sparrow	8.7	5.0	15.0	28	25
Red-breasted Nuthatch	5.9	4.4	8.2	16	44
Hermit Thrush	5.5	3.5	8.8	24	34
Northern Flicker	3.7	2.0	6.6	31	27
Tree Swallow	2.9	1.6	5.1	30	29

D = density estimate in birds/km²; *LCL* and *UCL* = lower and upper 95% confidence limits on *D*; *CV* = coefficient of variation of *D*; *n* = number of observations used to estimate *D*

Grassland

We established 23 transects and conducted 315 counts along those transects. We detected 54 species with an average of 2.6 species per count station and obtained density estimates for seven species (Table 22).

Table 22. Estimated densities of breeding birds in Grassland in Wyoming, 2002.

Species	D	LCL	UCL	CV (%)	n
Horned Lark	74.1	48.9	112.5	21	285
Lark Bunting	40.1	32.7	49.1	10	344
Brewer's Sparrow	29.8	17.9	49.7	26	67
McCown's Longspur	14.8	8.0	27.2	32	64
Vesper Sparrow	14.5	8.5	24.8	28	72
Chestnut-collared Longspur	11.9	8.1	17.3	19	70
Western Meadowlark	11.9	8.8	16.2	16	237

D = density estimate in birds/km²; **LCL** and **UCL** = lower and upper 95% confidence limits on *D*; **CV** = coefficient of variation of *D*; **n** = number of observations used to estimate *D*

Juniper Woodland

We established 23 transects and conducted 270 counts along those transects. We detected 55 species with an average of 4.0 species per count station and obtained density estimates for 16 species (Table 23).

Table 23. Estimated densities of breeding birds in Juniper Woodland in Wyoming, 2002.

Species	D	LCL	UCL	CV (%)	n
Gray Flycatcher	62.0	46.1	83.3	15	162
Chipping Sparrow	39.8	31.2	50.7	12	130
Blue-gray Gnatcatcher	24.8	15.2	40.6	25	40
Green-tailed Towhee	24.4	17.6	33.7	17	122
Brewer's Sparrow	18.4	11.9	28.5	22	101
Vesper Sparrow	11.0	7.3	16.6	21	77
Black-thr. Gray Warbler	10.9	7.2	16.4	21	54
Mountain Bluebird	6.6	4.6	9.4	18	56
Brown-headed Cowbird	5.5	3.6	8.5	22	42
Bewick's Wren	5.3	3.2	8.7	26	44
Western Meadowlark	4.8	3.4	6.9	19	69
Rock Wren	4.2	2.8	6.4	21	70
Mourning Dove	3.9	3.0	5.0	13	85
House Finch	2.6	1.6	4.1	24	27
American Robin	2.2	1.3	3.5	25	26
Pinyon Jay	0.8	0.4	1.4	29	26

D = density estimate in birds/km²; **LCL** and **UCL** = lower and upper 95% confidence limits on *D*; **CV** = coefficient of variation of *D*; **n** = number of observations used to estimate *D*

Mid Elevation Conifer

We established 23 transects and conducted 307 counts along those transects. We detected 67 species with an average of 3.9 species per count station and obtained density estimates for 11 species (Table 24).

Table 24. Estimated densities of breeding birds in Mid Elevation Conifer in Wyoming, 2002.

Species	D	LCL	UCL	CV (%)	n
Dark-eyed Junco	215.1	150.6	307.2	18	189
Yellow-rumped Warbler	111.2	93.1	132.8	9	259
Mountain Chickadee	79.4	63.3	99.7	12	188
Ruby-crowned Kinglet	38.5	25.0	59.2	22	192
American Robin	38.5	25.0	59.5	22	107
Chipping Sparrow	36.7	20.1	67.1	31	56
Pine Siskin	23.0	15.9	33.4	19	93
Western Tanager	16.9	10.5	27.1	24	45
Red-breasted Nuthatch	12.0	9.1	15.9	14	94
Steller's Jay	5.8	3.2	10.7	31	28
Common Raven	1.2	0.7	2.4	33	25

D = density estimate in birds/km²; **LCL** and **UCL** = lower and upper 95% confidence limits on *D*; **CV** = coefficient of variation of *D*; **n** = number of observations used to estimate *D*

Montane Riparian

We established 23 transects and conducted 290 counts along those transects. We detected 88 species with an average of 4.2 species per count station and obtained density estimates for 18 species (Table 25).

Table 25. Estimated densities of breeding birds in Montane Riparian in Wyoming, 2002.

Species	D	LCL	UCL	CV (%)	n
White-crowned Sparrow	149.0	74.5	298.0	36	137
Song Sparrow	130.5	99.1	171.8	14	193
Yellow Warbler	115.2	77.6	171.0	20	134
Wilson's Warbler	62.2	37.1	104.3	27	88
Lincoln's Sparrow	58.8	39.4	87.8	21	117
Broad-tail. Hummingbird	53.4	23.3	122.2	43	28
American Robin	50.5	38.9	65.5	13	129
Spotted Sandpiper	40.9	22.7	73.6	30	41
Pine Siskin	37.4	24.2	57.9	22	47
MacGillivray's Warbler	19.2	10.9	33.5	29	29
Warbling Vireo	16.8	9.6	29.6	29	30
Dark-eyed Junco	13.1	7.9	21.9	26	33
Dusky Flycatcher	9.0	6.0	13.3	20	33
Yellow-rumped Warbler	8.8	5.3	14.7	26	34
Ruby-crowned Kinglet	8.2	5.3	12.7	23	54
Tree Swallow	7.1	3.9	12.8	31	25
Northern Flicker	6.2	3.5	11.1	30	26
Chipping Sparrow	3.0	1.8	5.0	26	26

D = density estimate in birds/km²; **LCL** and **UCL** = lower and upper 95% confidence limits on *D*; **CV** = coefficient of variation of *D*; **n** = number of observations used to estimate *D*

Shrub-steppe

We established 23 transects and conducted 358 counts along those transects. We detected 50 species with an average of 2.4 species per count station and obtained density estimates for nine species (Table 26).

Table 26. Estimated densities of breeding birds in Shrub-steppe in Wyoming, 2002.

Species	D	LCL	UCL	CV (%)	n
Brewer's Sparrow	45.5	31.5	65.7	19	249
Horned Lark	31.1	26.9	36.0	7	298
Vesper Sparrow	15.9	11.2	22.5	18	149
Lark Bunting	6.0	4.3	8.5	18	89
Sage Sparrow	5.6	3.6	8.6	22	57
Green-tailed Towhee	4.1	2.2	7.6	32	25
Sage Thrasher	3.1	1.9	5.1	25	67
Lark Sparrow	2.7	1.9	4.0	20	40
Western Meadowlark	2.4	1.5	4.1	26	58

D = density estimate in birds/km²; **LCL** and **UCL** = lower and upper 95% confidence limits on *D*; **CV** = coefficient of variation of *D*; **n** = number of observations used to estimate *D*

Discussion

Population trend data take years to gather since individual years are the data points in trend analysis. However, data gathered during this formative stage can be used to impart other information useful to land managers. Habitat associations for individual species, particularly those that are Management Indicator Species or otherwise listed, along with GPS locations for these detections can be used immediately.

This program is designed to provide for early warning of downward population trends. We believe that this early warning will give land managers time to consider options for preventing species being listed under the Endangered Species Act (i.e., land-use decisions to stabilize or reverse trend). However, causes of declines cannot be determined by *MWB*; species-focused research must be done to determine these causal factors.

Lastly, we stress that transect locations should NOT be a factor in determination of future land management (e.g., timber sales, road improvements, prescribed burns), as the goal of the program is to monitor the effects of all disturbances, whether natural (e.g. drought or wildfire) or man-made (e.g. logging). Managing around transects will eliminate the ability of this program to produce valid results.

Research Needs

Research needs will become more apparent once the inventory and monitoring needs have been met. Therefore, research needs will be addressed in a later version of the Wyoming Bird Conservation Plan.