THREATENED, ENDANGERED, AND NONGAME BIRD AND MAMMAL INVESTIGATIONS

Wyoming Game and Fish Department
Nongame Program
Biological Services Section
Wildlife Division

Annual Completion Report

Period Covered:
15 April 2009 to 14 April 2010

Edited by: Andrea C. Orabona

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Funding for the Wyoming Game and Fish Department Nongame Program comes from a variety of agencies, entities, and programs. We wish to credit the following funding sources for their generous contributions, which enable us to complete necessary inventory and monitoring efforts for numerous Species of Greatest Conservation Need in Wyoming.

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Wyoming Landscape Conservation Initiative
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PREFACE

Most Wyoming residents and visitors know and cherish the thought of the State being rich in wildlife diversity. There is strong public interest in wildlife conservation and, along with that interest, are high expectations. A national survey by the U.S. Fish and Wildlife Service found that, in addition to $138.5 million associated with hunting and $373.6 million for fishing in 2006, $392.5 million was added to Wyoming's economy by wildlife watchers. The State is also rich in other natural resources such as livestock forage, timber, and a variety of minerals, all of which contribute greatly to Wyoming's economy. Sometimes the best management of one resource can conflict with the needs of another. Or, worse yet, unknown effects and concerns can sway public opinion and prevent implementation of desired management.

Fortunately, the operating budget of the Wyoming Game and Fish Department (Department) was increased significantly in 2008 by the State Legislature and Governor Dave Freudenthal to boost data collection and strengthen management for Wyoming's nongame species, particularly those considered sensitive. In the past three biennium budget sessions, the Legislature and the Governor have been instrumental in funding wildlife conservation programs such as the Department's Veterinarian Services, the Sage-Grouse Program, and the Wyoming Natural Resources and Wildlife Trust. Their recent funding of nongame efforts is a significant and progressive expansion of their support for natural resources in Wyoming. The expectation that accompanies such welcomed funding is to develop the information base and expertise to allow for effective decision making associated with resource management and to avoid unnecessary conflicts and restrictions.

These new expectations are similar to the expectations associated with the Department's past portfolio of funding sources for nongame, but they are more targeted. In the past, the Department's nongame efforts were funded primarily by user fees collected from hunting and fishing. Most of the hunting and fishing public recognizes that sound management of nongame fish and wildlife helps provide additional support for maintaining functioning ecosystems for game species. Yet, for most of us, there is a limit to how much should be spent on a concept. So, there have been a number of efforts over the past two decades at both the national and the state level to find alternate funding for nongame species conservation. Many of the same individuals contributing to Wyoming's economy through expenditures associated with wildlife watching were, no doubt, involved in intense national lobbying efforts to develop this nongame funding.

In response to these efforts, Congress established the federally funded State Wildlife Grants (SWG) program in 2000. Since then, the Department has received nearly $6 million of SWG funds to address species that have received little attention to-date, and to collect information that may provide an early warning of species heading for a potential listing under the Endangered Species Act. Most states tended to focus SWG projects on species that would grab the attention of supporters and Congress establishing (or slashing) federal budgets on an annual basis. But, the expectations associated with SWG also extend to species like the pika or Harlequin Duck that are high on the interest scale for wildlife watchers but have little potential for conflict with other resource users because of the habitats they occupy in the State.

During the early years of SWG funding, we tended to focus on planning efforts that produced documents such as the Trumpeter Swan Habitat Enhancement Project, Wyoming Bird Conservation Plan, A Plan for Bird and Mammal Species of Greatest Conservation Need in Eastern Wyoming Grasslands, and A Comprehensive Wildlife Conservation Strategy in Wyoming. The latter planning document, approved in 2005, provides guidance for development of more recent SWG proposals and is currently being updated as the 2010 State Wildlife Action Plan. We have used SWG funding to develop and implement inventory methods for sensitive species, such as Harlequin Duck, black-tailed prairie dog, and white-tailed prairie dog. We have also used SWG funds to collect additional information on several species of bats, Canada lynx, pygmy rabbit, swift fox, and wolverine. Recent SWG projects also include initial inventories of raptors in the Wyoming Range and small mammals in southwest Wyoming.

The new funding provided by the Wyoming State Legislature and Governor Freudenthal has greatly enhanced our ability to collect information on Species of Greatest Conservation Need. In addition, the new funding has allowed money generated from hunting and fishing to revert back into Department resources for more traditional wildlife uses, delaying the need for increased license fees. Permanent personnel continue to develop and implement federally funded projects. However they are in a balancing act to produce products past supporters continue to expect, but also expand the focus to meet expectations associated with new State funding. Our current funding base certainly influences our priorities. Not only is State funding allowing us to greatly increase our knowledge of Species of Greatest Conservation Need distribution and abundance, but it is also allowing us to expand our understanding of what is needed for effective and proactive management of those species. Examples of some of this expanded effort include hiring contract biologists to conduct inventories of American Bitterns, colonial nesting waterbirds, Yellow-billed Cuckoos, black-footed ferrets, and bats. This funding has also allowed us to work closely with other entities, such as the University of Wyoming, Audubon Wyoming, the Rocky Mountain Bird Observatory, and private contractors, as well as interested volunteers, to implement projects that will provide population status and trend information on additional Species of Greatest Conservation Need, such as the Ferruginous Hawk, Preble's meadow jumping mouse, and Wyoming pocket gopher. Finally, we have also had the opportunity to implement funds provided by the U.S. Fish and Wildlife Service for several additional projects, including a collaborative survey effort for Northern Goshawks in the Wyoming Range and a study to determine the potential effects of energy development on raptor populations in Wyoming.

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INTRODUCTION

The Nongame Program of the Wyoming Game and Fish Department (Department) was initiated in July 1977. This report summarizes data collected from 15 April 2009 to 14 April 2010 on various nongame bird and mammal surveys and projects conducted by Department personnel, other government agencies, non-governmental organizations, and individuals in cooperation with the Department. Cooperating agencies and individuals are listed in the individual completion reports, but we recognize that the listing does not completely credit the valuable contributions of the many cooperators, including Wyoming Game and Fish Department District Wildlife Biologists and members of the public.

In October of 1987, a Nongame Strategic Plan was distributed; this plan was updated and renamed in May of 1996. The 1996 Nongame Bird and Mammal Plan (Plan) presents objectives and strategies for the management and study of nongame birds and mammals in Wyoming. As part of the State Wildlife Grants funding program to provide long-term conservation planning for those species most in need, information was gleaned from the Plan and other pertinent sources and compiled into A Comprehensive Wildlife Conservation Strategy for Wyoming, which was approved by the Wyoming Game and Fish Commission on 12 July 2005. This Nongame Annual Completion Report presents information in four major sections similar to these planning efforts: threatened and endangered species, species of greatest conservation need, raptors taken for falconry, and other nongame surveys.

Legislative funding has allowed the Department to significantly expand nongame/sensitive species conservation efforts, enhancing our ability to inventory, initiate monitoring, and assess the status of many species of wildlife classified as sensitive in 2005. The FY09/10 biennium budget provided general fund appropriations to the Department for the first time for all aspects of its nongame/sensitive species program: $1,200,000 M&O budget for existing personnel and administrative support, and $609,000 in direct general fund appropriations for sensitive species program projects. In addition, $1,300,000 from the Governor's endangered species administration general fund appropriation was provided to the Department to supplement sensitive species project work. We also used several sources of federal funding for specific projects. General fund appropriations for M&O were essential for normal duties and for personnel to manage all of the special projects in this report. Specific funding sources in addition to M&O budgets are identified for each specific report.

This proactive approach is Wyoming's most effective strategy in reducing the chance that a species will be listed as threatened or endangered under the Endangered Species Act. The Department's Nongame Program is geared toward collecting information that has practical application for understanding the status of each species as well as identifying potential risks and management actions that may be needed to secure the healthy status of those species needing some help.

This report serves several purposes. First, it provides summaries of nongame surveys for the benefit of the Department and other agencies and individuals that need this information for management purposes. Second, it provides a permanent record of summarized data for future use. Although some of this information is in lengthy tables, it was felt that these data should be published rather than kept in the files of the Nongame Program staff. Some information, such as Bald Eagle and Ferruginous Hawk nest sites and bat roost locations, is sensitive and is not provided in this document. Those needing this information for purposes that will lead to better management of these species can request the data from the Nongame Program staff.

Common bird names used in this report follow the most recent American Ornithologists' Union guidelines and supplements cited in Appendix I. Mammal names follow the "Revised checklist of North American mammals north of Mexico, 2003" cited in Appendix I. Scientific names for birds and mammals are presented in Appendix I.

THREATENED AND ENDANGERED SPECIES

SPOTLIGHTING FOR FREE RANGING BLACK-FOOTED FERRETS IN THE SHIRLEY BASIN/MEDICINE BOW MANAGEMENT AREA, WYOMING
COMPLETION REPORT

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need / Endangered Species – Black-footed Ferret

FUNDING SOURCE: USFWS Section 6 Funding, General Fund Appropriation, and/or Governor's ESA Dollars

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Laurie Van Fleet, Nongame Biologist
Martin Grenier, Nongame Mammal Biologist

INTRODUCTION

From 1991 to 1994, 228 black-footed ferrets were released in Shirley Basin, Wyoming. The release of ferrets was halted in 1994 due to a sylvatic plague epizootic and declining white-tailed prairie dog (WTPD) abundance in the Primary Management Zone 1 (PMZ1). Survey efforts outside of the PMZ1 in recent years have documented an increase in WTPD abundance within the Shirley Basin/Medicine Bow WTPD complex (Grenier et al. 2007). Consequently, ferret releases were initiated at two new locations in the fall and winter of 2005/2006 (Grenier et al. 2006, Schell and Grenier 2007).

In 2009, we had two survey objectives. The first objective was to evaluate the Arlington release site to determine if ferrets were persisting. This survey marks the first survey effort at this site since 71 captive-born ferrets were released in 2005 (Grenier et al. 2006). Our second objective was to document the distribution of ferrets southwest of Shirley Basin in a portion of the management area not previously surveyed. Attempts were made to capture and mark all ferrets located during surveys. The Shirley Basin ferret recovery program remains the longest running reintroduction site in North America, spanning nearly 18 years.

METHODS

Surveys in 2009 were conducted on both public and private land at two locations: 1) west of Arlington and approximately 15 miles (24 km) south of Medicine Bow, and 2) in areas that extend southwest approximately 10 miles (16 km) from the Shirley Basin ferret population and west of Medicine Bow (Figure 1). Approximately 10,346 acres (4,187 ha) of WTPD colonies occur in the area west of Arlington. Total acreage of WTPD colonies west of Medicine Bow was not determined prior to spotlight surveys.

We established spotlight survey areas prior to the start of surveys based on available time and personnel, and the interspersion of two-track and other roads within survey areas. All landowners were contacted for permission to conduct surveys on their land prior to surveys. Surveyors were assigned survey area based on accessibility. Areas accessible only by foot were approximately 300 acres (121 ha) in size. Survey areas accessible entirely or partially by vehicle were approximately 600 acres (242 ha) in size. Actual survey areas varied by WTPD colony and were highlighted on photocopies of 7.5-minute quadrangle maps and 2006 color aerial photographs (National Agriculture Imagery Program).

Spotlight surveys were conducted from 2000-2300 hours and 0100-0600 hours in blocks of three consecutive nights (Grenier 2008). Vehicles equipped with roof-mounted spotlights (Model RM 240 Blitz, Lightforce Professional Lighting Systems, Orofino, ID) were driven along existing roads, and portions of the plots not surveyable from a vehicle were traversed on foot by personnel wearing a backpack spotlight unit. Personnel conducting foot surveys were equipped with Lightforce Walkabout portable spotlight kits. After locating ferrets with spotlights, we attempted to capture all ferrets once using an unbaited live trap (Sheets 1972). Traps were checked hourly and all traps were removed at sunrise. Captured ferrets were assigned to juvenile or adult classes by reproductive status and returned to the burrow from which they were trapped (Thorne et al. 1985). Observations of ferrets, non-target carnivores, and Species of Greatest Conservation Need were recorded using a Global Positioning System (GPS) unit (Garmin GPS 12XL or 60 units, Forestry Supplies, Jackson, MS), datum NAD27.

RESULTS

We spent 334 person-hours during five nights spotlighting for ferrets in August and September. A total of 223 hours were spent spotlighting from vehicles and 111 hours on foot (Table 1). We observed seven ferrets 12 times, including one litter, and we captured one lactating female (Figure 2, Table 2). A discrete ferret was observed about every 47.7 person-hours. Discrete observations were determined using guidelines developed by Grenier (2008). In the Arlington area, we surveyed two colonies totaling 2,467 acres (998.4 ha; Figure 2). During approximately 80 hours of spotlighting, we observed five discrete ferrets nine times during two nights (Tables 1 and 2). Additionally, we observed one litter and captured a lactating female. The area west of Medicine Bow was surveyed for three nights. During 254 hours of spotlighting, we observed two discrete ferrets three times. Traps were deployed, but no ferrets were captured.

Observations of species other than ferrets are not presented in this completion report; however, they were entered into the Wyoming Game and Fish Department’s Wildlife Observation System database and are also available from the Nongame Mammal Biologist, Wyoming Game and Fish Department, 260 Buena Vista, Lander, WY 82520.

DISCUSSION

Despite the limited survey effort, our results indicate that ferrets are reproducing and dispersing into new areas within the management area. Our results confirm that ferrets have bred successfully since their initial release in 2005. The Wick Wildlife Habitat Management Area (WHMA), south of the spotlight surveys, was also part of the 2005 releases. Although we made no effort to survey colonies on the WHMA, our results suggest that ferrets occupy many of the larger WTPD colonies in this area. We recommend additional efforts on spotlighting this area in the future.

The area west of Medicine Bow was surveyed for the first time this year. It was encouraging to locate ferrets in the area because few active WTPD burrows were reported by surveyors. It is unknown whether the inactivity by WTPDs was a result of recent disease epizootics or anthropogenic declines. Regardless, this area may be important to dispersing ferrets and may be used as a corridor to access better quality habitats. We recommend placing additional efforts on mapping available habitat outside the survey area in future years prior to surveying for ferrets.

Our results indicate that ferrets continue to expand their range within the management area and now occupy more WTPD colonies than previously estimated by Grenier et al. (2008). It appears that the increase in spatial distribution of ferrets in 2009 is likely a result of two factors: 1) the dispersal of individuals from reintroductions that occurred in the Arlington area in 2005, and 2) dispersal of individuals southwest away from Shirley Basin.

ACKNOWLEDGEMENTS

Special thanks are extended to the Ellis Ranch, the Medicine Bow River Ranch, and the Terrell Ranch, who generously allowed access to their property for black-footed ferret spotlight surveys during the summer of 2009. We would also like to thank the following Wyoming Game and Fish Department personnel: S. Chrisman, H. Cooper, S. Johnson, L. Knox, B. Krueger, C. Matthews, K. Maysilles, C. Moan, L. Schreiber, M. Schroeder, E. Sobel, and J. Thompkins; and volunteer K. Blomberg, for their assistance during the surveys. Funding for this project was provided by the U.S. Fish and Wildlife Service through Section 6 of the Endangered Species Act and the state of Wyoming through the Governor's ESA funding, for which we are extremely grateful.

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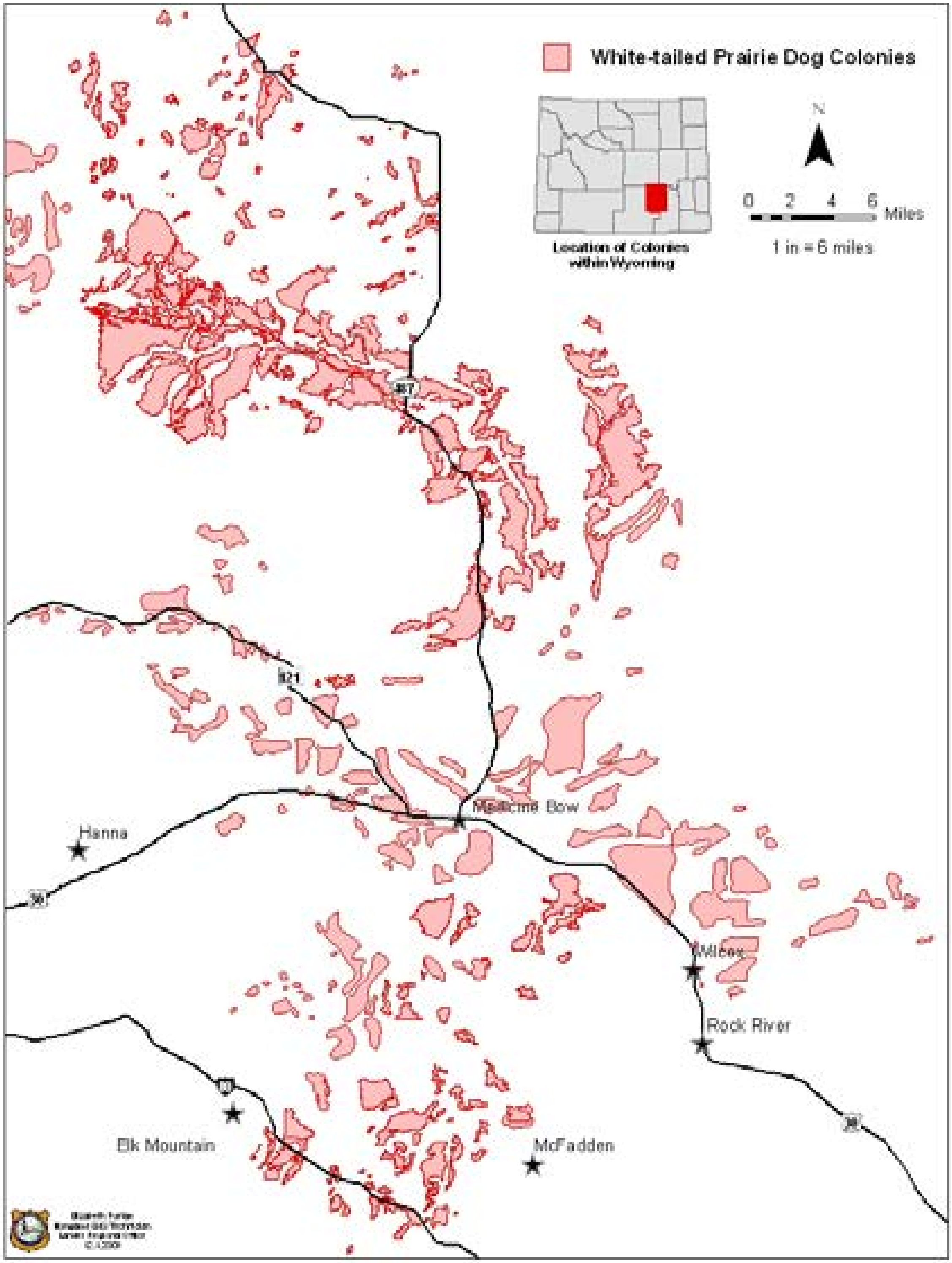

Figure 1. Spatial arrangement and distribution of white-tailed prairie dog colonies in the Shirley Basin/Medicine Bow Management Area, Wyoming, 2009.

Table 1. Survey effort expended while spotlighting for black-footed ferrets in Shirley Basin/Medicine Bow Management Area, during the summer of 2009.

Survey Type	Survey Hours Expended		Total Hours
	Aug. 26-27	Sept. 1-3	
Vehicle	56.25	166.50	222.75
Foot	23.25	88.25	111.50
Total	*79.50*	*254.75*	*334.25*

Table 2. Black-footed ferret observations during spotlight surveys conducted in August and September 2009 in the Shirley Basin/Medicine Bow Management Area, Wyoming.

Obs.	Date	Obs. Time	Colony	Observer	Discrete	Age	Sex	Comments
1	8/26	2300	660	M Schroeder	Yes	J	-	1 of 2
2	8/26	2300	660	M. Schroeder	Yes	J	-	1 of 2
3	8/26	0145	655	K. Blomberg	Yes	U	-	"Blocky" head
4	8/27	2043	660	M. Schroeder	No	J	-	Same litter
5	8/27	2043	660	M. Schroeder	No	J	-	Same litter
6	8/27	0254	660	M. Schroeder	Yes	A	F	Caught at 6am, lactating, not processed
7	8/27	0254	660	H. Cooper	No	J	-	Same litter
8	8/27	0254	660	H. Cooper	No	J	-	Same litter
9	8/27	0340	660	M. Schroeder	Yes	U	M	Likely male, big
10	9/1	0140		J. Tompkins	Yes	U	-	
11	9/2	2126		E. Sobel	Yes	U	-	
12	9/3	0307		J. Tompkins	No	U		

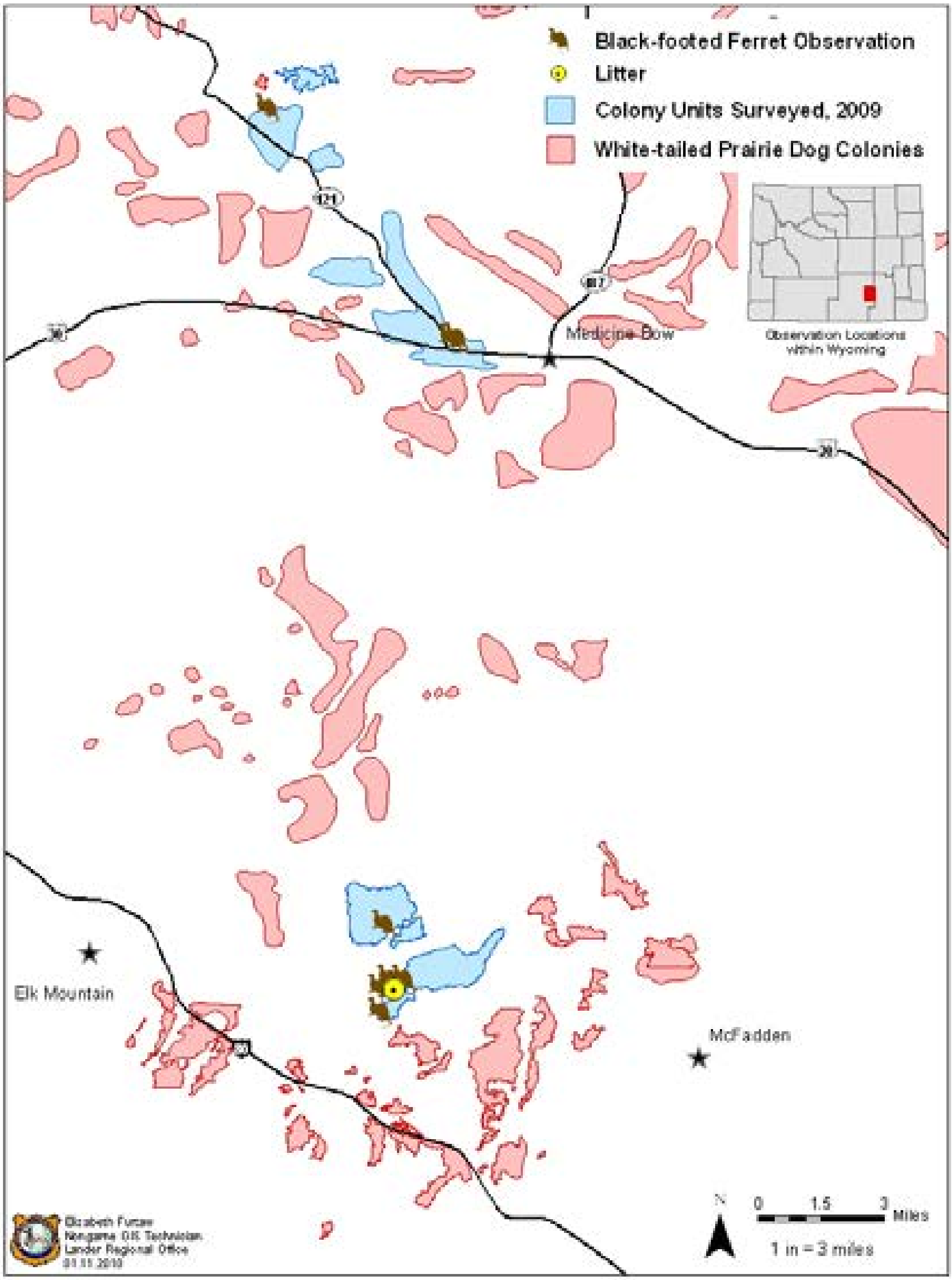

Figure 2. Locations of individual black-footed ferrets and litters that were detected in the Shirley Basin/Medicine Bow Management Area, 2009.

SPECIES OF GREATEST CONSERVATION NEED

ROCKY MOUNTAIN POPULATION OF TRUMPETER SWANS – WYOMING FLOCK COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Trumpeter Swan

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Susan Patla, Nongame Biologist

INTRODUCTION

This report summarizes management activities and monitoring data for Trumpeter Swans in Wyoming for the 2009 nesting season and the 2009/20010 winter season. The Trumpeter Swan is on Wyoming's Species of Greatest Conservation Need (SGCN) list with a Native Species Status ranking of 2 (NSS2). Trumpeter Swans in Wyoming are considered, for management purposes, a breeding segment of the Tri-State Area Flocks of the U.S. segment of the Rocky Mountain Population (RMP) of Trumpeter Swans (USFWS 1998)]. Monitoring swans in western Wyoming requires interagency coordination and effort; a list of individuals who provided data for this effort can be found in the Acknowledgements Section.

This year's report contains updates of tables contained in previous Annual Completion Reports, but extensive text sections have been abbreviated or eliminated. For background and historical data, readers should refer to earlier Annual Completion Reports. These are available from the Wyoming Game and Fish Department (Department) Nongame Program, Lander Regional Office or Jackson Regional Office.

ROCKY MOUNTAIN POPULATION WINTER SURVEY RESULTS 2009/20010

Winter aerial surveys of Tri-State Area Flocks were completed in early February 2009 (Dubovsky 2010, not yet available). The Department flew Wyoming's survey outside of Yellowstone National Park (YNP) on 8-9 February in conjunction with the Pacific Flyway Mid-Winter Goose/waterfowl survey. Weather was calm and clear on both days except for lingering morning fog on February 8th. Total flight time was slightly over 10 hours. In the Tri-State area, a total of 4,280 Trumpeter Swans were counted: 3,593 white birds (yearlings and older age classes) and 687 cygnets (Table 1). Cygnets comprised 16% of the total, compared to 17% the previous year. The number of total swans counted in the Tri-State represents the lowest number counted since winter 2003.

In Wyoming, the total number of swans wintering (n=834) was only six fewer birds than in the previous year (Table 1). Of the total swans counted in Wyoming, 9% were in YNP; 56% in the Snake River drainage in the vicinity of Jackson, Wyoming; 16% in the Salt River drainage (n=126), and 22% in the Green River drainage, including Seedskadee National Wildlife Refuge (NWR; n=165), and 3% near Daniel (n=24; Figure 1). An additional 24 swans were counted in the Central Flyway west of Dubois in the Wind River drainage.

Freeze-up happened quickly in early November 2009, with most non-moving shallow water frozen by mid-November. Migration of winter migrants into the Jackson area started in late October/early November. I counted 64 adults and 5 cygnets on Jackson Lake on 20 November 2009. I also made weekly counts of swans from late October to late November at the Flat Creek Marsh, National Elk Refuge in Jackson, the major staging area for migrants in Wyoming prior to dispersing to wintering locations and presented in the summary below.

Date	# Adults	# Cygnets	Total Number	# of Broods
10/23	22	5	27	2
10/30	97	4	101	1
11/02	151	14	165	5
11/06	143	29	172	12
11/13	168	40	208	19
11/17	145	25	170	15
11/20	150	28	178	15
11/27	121	13	134	6

Numbers peaked at the National Elk Refuge the second week of November as in the previous year, and swans numbers dropped as open water began to freeze. Similar to the previous winter, there was no significant thawing in western Wyoming during the winter season until after March, but I t was a mild winter with few storms and no long periods of Arctic air masses settling into the area.

TRI-STATE FALL SURVEY RESULTS AND PRODUCTIVITY TRENDS – 2009

A cooperative inter-agency survey effort is conducted annually in September to obtain a total count of Trumpeter Swans in the U.S. Breeding Segment of the RMP using both aerial and ground surveys. Results are published by the USFWS (Olson 2009). Aerial surveys in 2009 were conducted from 14-17 September. The Wyoming portion was flown on 17 September.

Total number of resident swans (n=436, adults plus cygnets) in the Tri-state Area Flocks in 2009 was 2% higher than the previous year (n=427; Table 2). Swans counted within the Tri-State Area in 2008 were distributed as follows among the three states: 31% in Wyoming (n=134), 33 % in Idaho (n=143), and 36% in Montana (n=159). The number of white birds decreased in Wyoming and Montana,, and increased in Idaho compared to the previous year. The number of cygnets was up in all states. Total swan numbers continue to remain below objective for the Tri-State flocks (Pacific Flyway Council 2008).

WYOMING FLOCK PRODUCTION OUTSIDE YELLOWSTONE NATIONAL PARK – 2009

A total of 97 white birds (adults/subadults) and 33 cygnets were counted in Wyoming outside of YNP in September 2009 (Table 2). Compared to the previous year, the number of white birds decreased by 20% compared to the previous year, while number of cygnets was similar. As number of nesting pairs was only down 8%, it appears that subadults were lost from the population either due to over-winter mortality or emigration out of the survey area.

In 2009, an aerial survey to document occupancy was conducted on 28 May (Figure 2). A July productivity flight was not flown due to budget reductions, so productivity data were collected by ground surveys; however, a few sites could not be surveyed until September so the number of young hatched per pair is likely higher than documented. Pairs occupied 32 sites, 24 pairs initiated incubation, 15 pairs hatched 50 young, and 11 pairs fledged at least 1 young (Table 3a). Number of nesting pairs and hatched young exceeded the previous year and all productivity parameters exceeded 1990-2008 means (Table 3a). Productivity of successful nests (n=11, those that hatched at least one egg) measured 4.55 young hatched per successful pair and 3.00 young fledged per successful pair.

Production parameters for the Green River expansion flock in 2009 continued to exceed those in the core area, except that number of young hatched per successful pair was higher in the core (Table 3b). Six pairs nested at Seedskadee NWR and fledged four broods for a total of 15 cygnets (Table 4) accounting for 71% of birds fledged in the Green River Basin and 45% of the state's total.

Table 4 provides a summary of occupancy and productivity data for individual nesting territories in Wyoming over the last decade, 1999-2009. Following are site-specific notes for some of the 2009 nesting territories:

Indian Lake, Caribou-Targhee National Forest (CTNF) – a pair occupied this site and hatched four young on 26 June, but lost them within the next few weeks.

Winegar Creek, Caribou-Targhee National Forest (CTNF) – a pair occupied this new site and hatched three young on 30 June, but lost their young by September.

Junco Lake, Caribou-Targhee National Forest (CTNF) – no pair occupied this site early, but was not seen on later flights.

Upper Glade Creek Marsh, J.D. Rockefeller Memorial Parkway, Grand Teton National Park (GTNP) – no swans were seen and the marsh remained mostly frozen on 28 May.

Steamboat Mountain, Nickel and Dime Creeks (GTNP) – a pair was on site, but no nest was observed.

Glade Cliff Slough, Grand Teton National Park (GTNP) – a pair was seen out on the main river channel near a nest structure on 28 May, but no young were reported from this site.

Glade Creek South (GTNP) – for the first time in many years, this site was not occupied.

Arizona Lake, Bridger-Teton National Forest (BTNF) – a pair constructed a nest site in the channel south of the main lake and incubated, but no young were observed. Last year young hatched but disappeared quickly.

Swan Lake (GTNP) – a pair occupied the slough south of the lake and was seen chasing off another pair on the May 28th flight, but no nesting attempt was observed.

Christian Pond (GTNP) – no swans were observed again on this site throughout the season. Water depth continues to decrease and the shallow water wetland will likely dry up if this trend continues. An assessment of hydrology and recreation use is needed at this site.

Two Ocean Lake (GTNP) – no pairs were observed in June or during the summer months.

Emma Matilda Lake (GTNP) – one swan was seen on the May survey.

Elk Ranch Reservoir (GTNP) – a pair occupied the site in early June, but no nest activity was observed. Future plans for this reservoir should include improving the site for nesting swans and other waterfowl. This site is used by a number of swans and ducks in the spring when it opens up, and during fall migration.

Hedrick Pond (GTNP) – no reports of swans on this wetland this season.

Romney Ponds, National Elk Refuge (NER) – a pair initiated nesting by 20 May in the same location as last year's nest on Romney #2. Four young hatched and fledged.

Puzzleface Pond (formerly Skyline) – a few swans were observed in May, but none occupied the site this summer.

South Park WMA Habitat Pond #2 – a pair nested for the first time at this site and raised four young. The Department placed signage and monitored the early goose hunt and duck hunt at South Park to prevent disturbance to this family in September prior to fledging.

Alpine Wetland – a pair occupied the site again this year and incubated, but no young hatched. It is likely that this nest flooded enough to chill eggs this year during spring runoff.

Upper Slide Lake (BTNF) – a pair occupied this site, but did not initiate nesting.

Mosquito Lake (BTNF) – a pair nested again on the slough just east of the lake, but no young were observed.

Mud Lake (BTNF) – water level was low this spring and no swans were observed at this site for the first time in over a decade.

Carney Ranch, Green River Slough – a pair nested again at this site, but the eggs were lost due to flooding at spring runoff. The ranch manager reported that the river was at the highest level he has seen in over 20 years.

Carney Ranch Pond – a pair nested here for the first time this year and three young were hatched but disappeared within a few weeks post-hatch, likely from predation.

Kendall Wetland – a pair nested again this year and raised three young. The ranch manager has been lowering the level of the ponds each fall, which may have stimulated increased productivity.

Kitchen Reservoir, CL Bar Ranch – a pair nested at the traditional site and only one young was observed. Another pair with young was found on the fall flight in the north reservoir, so this is the first time that a second pair has produced on this ranch.

Fayette Ranch Pond, New Fork River – a pair was observed incubating in May, but no young were seen later.

Swift Ranch Paradise Road Pond – a pair occupied the area, but did not appear to nest this year.

Swift Reservoir – nonbreeders were observed throughout the season.

Ferry Island, Green River – a pair nested, but no young were seen in the fall.

La Barge, Voorhees Exxon Road Pond – the pond filled this year, but heavy grazing kept cattails and other cover along shore from growing. Wind caused turbulence that kept sediments stirred up.

MORTALITIES

Only six mortalities were documented in 2009/2010, the lowest number for Wyoming (Table 5). One adult was lost at Seedskadee NWR in late summer, likely from predation, and the other mortalities occurred in late winter/early spring.

SIGHTINGS OF MARKED SWANS

Observations of marked Trumpeter Swans in Wyoming are summarized in Table 6. The total number of neck-collared swans observed continues to decline as older collars and birds are lost. One green-collared swan marked in Idaho (31E) attempted to nest at the Alpine wetland again this year.

HABITAT IMPROVEMENT PROJECTS

Three swan wetland restoration projects totaling almost 40 acres (16 ha) were completed in the Green River Basin in 2008/2009. Funding was obtained from the Wetland Reserve Program for two projects on private land, and the Department secured matching funds through the Wyoming Wildlife and Natural Resource Trust. Additional funding for the Rimfire Ranch ponds was obtained through the Wyoming Landscape Conservation Initiative/Bureau of Land Management Healthy Lands Program. Additional funding was also obtained through the USFWS Partners Program for the Budd Friendly Pond. Construction work was completed in fall 2008 on the Friendly Pond near Big Piney. Construction work and on the Rimfire Ranch near Daniel and Duck Creek Pond near Pinedale was completed in 2009. Vegetation work will be completed in spring 2010. A new project was initiated in winter 2009/2010 on the New Fork River near Boulder, Wyoming.

RANGE EXPANSION EFFORTS IN WYOMING – SALT RIVER

The number of wintering swans declined again this year (n=110 white birds and 16 cygnets = 126 total) in the Salt River drainage after documenting a record number during the Mid-Winter Survey in 2007/2008: 174 adults and 43 cygnets = 217 total. No large group of over 50 swans was found in the Clark's barn area as in the past two winters.

A pair occupied and nested in the Alpine wetland again this year, but did not appear to hatch young.

The formation of the Star Valley Land Trust, affiliated with the Wyoming Stock Growers Agricultural Land Trust, may create funding opportunities in the future to develop wetland restoration projects for swan summer and winter habitat improvements.

RANGE EXPANSION EFFORTS IN WYOMING – GREEN RIVER

In 2009, the number of young hatched in the Green River basin range expansion area (n=29) exceeded that in the core Snake River/Jackson area (n=21; Table 3b). Pairs occupied a total of 18 nest sites in the Green River basin. Four pairs at Seedskadee NWR fledged 15 cygnets, 71% of the total production this year in the Green River Basin. Crowding and disturbance of nesting pairs by subadult non-breeding birds on the main Hawley wetland complex continues to be a concern.

On the Mid-Winter Survey, 166 total swans were observed south of the Fontenelle Dam to Big Island. Brown's Park NWR south of the Flaming Gorge Reservoir reported up to an additional eight swans wintering on the Green River in the refuge.. Twenty one adults and three cygnets wintered along Forty Rod Creek near the Daniel Fish Hatchery, the most northern wintering habitat that stays open along the Green River corridor.

FUTURE MANAGEMENT OBJECTIVES

The Department's Nongame Program will continue to focus on developing and funding wetland habitat improvement and restoration projects in the Green River drainage (Lockman 2005), and also the Salt River and Snake River areas as opportunities arise. This will require forming multiple partnerships and seeking funding from a wide variety of sources. Given the increasing number of pairs and productivity, and continuing drought conditions, it is urgent that the Department plays a lead role in swan habitat work. To obtain funding needed for costly habitat work, large-scale grants from the North American Wetlands Conservation Act should be developed. We have had excellent success obtaining funding in 2007/2008 from the recently created Wyoming Wildlife Natural Resource Trust and from the Wyoming Landscape Conservation Initiative.

Another future management goal is to assess the continued decline in the number of nesting pairs and productivity in the core Tri-state area. A proposal is being considered by the Great Northern Landscape Conservation Cooperative research project, submitted by Red Rock Lakes NWR, to investigate the degree that pre-nesting habitat is limiting swan productivity and nest site occupancy in the Tri-State core area.

Flight money was reduced in 2009, which prevented surveying some nest sites for hatch success in July 2009. Given the low numbers of nesting pairs in the state, it remains important to maintain an on-going adequate monitoring program to understand and manage swan habitat use and reproductive success into the future.

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Table 1. Mid-winter Trumpeter Swan survey for the Rocky Mountain Population in Wyoming and the Tri-State Area, 1990-2009.

Year	Age Group	Yellowstone National Park	Snake River	Other Wyoming	Wyoming Total	Tri-State Total
1990	Adult	78	154	15	247	1591
	Cygnet	32	42	4	78	416
	Total	110	196	19	325	2007
1991	Adult	61	187	38	286	1589
	Cygnet	14	34	13	61	342
	Total	75	221	51	347	1931
1992	Adult	108	63	141	312	1731
	Cygnet	4	17	13	34	472
	Total	112	80	154	346	2203
1993	Adult	178	222	71	471	1780
	Cygnet	39	55	9	103	455
	Total	217	277	80	574	2235
1994	Adult	137	198	55	390	1882
	Cygnet	24	60	14	98	644
	Total	161	258	69	488	2526
1995	Adult	141	256	71	468	2012
	Cygnet	41	61	30	132	668
	Total	182	317	101	600	2680
1996	Adult	130	255	89	474	2129
	Cygnet	24	72	12	108	580
	Total	154	327	101	582	2709
1997	Adult	74	224	59	420	2268
	Cygnet	3	62	16	105	431
	Total	77	286	75	525	2699
1998	Adult	NS [b]	142	124	266	1756
	Cygnet	NS	26	13	39	307
	Total	NS	168	139	305	2063
1999	Adult	291	187	131	609	2698
	Cygnet	54	44	21	119	772
	Total	345	231	152	728	3470
2000	Adult	87	161	46	294	2694
	Cygnet	13	60	5	78	746
	Total	100	221	51	372	3440

Year	Age Group	Yellowstone National Park	Snake River	Other Wyoming	Wyoming Total	Tri-State Total
2001	Adult	53	251	117	421	3198
	Cygnet	11	38	25	74	719
	Total	64	289	142	495	3917
2002	Adult	131	337	110	578	3814
	Cygnet	13	61	11	85	54
	Total	144	398	121	663	4360
2003	Adult	146	254	100	500	3365
	Cygnet	34	45	13	92	532
	Total	180	299	113	592	3897
2004	Adult	149	307	155	611	3785
	Cygnet	33	18	40	91	746
	Total	182	325	195	702	4531
2005	Adult	124	367	194	685	4147
	Cygnet	30	109	57	196	1143
	Total	154	476	246	881	5290
2006	Adult	121	413	242	776	4203
	Cygnet	14	58	53	125	1209
	Total	135	471	295	901	5412
2007	Adult	144	420	280	844	3604
	Cygnet	25	84	71	180	893
	Total	169	504	351	1024	4619
2008	Adult	65	316	287	668	3744
	Cygnet	7	63	79	149	790
	Total	72	379	366	817	4545
2009	Adult	88	321	319	728	4230
	Cygnet	2	63	47	112	872
	Total	90	384	366	840	5102
2010	Adult	49	369	286	704	3593
	Cygnet	20	56	54	130	687
	Total	69	425	340	834	4280

[a] Includes observations from the Salt River, Green River, Wind River, North Platte River, Bighorn River, and Cody lakes.

[b] NS = not surveyed.

Table 2. Fall Trumpeter Swan survey results for the Tri-State Area, 1990-2009. [a]

Year	Age Group	Montana	Idaho	Wyoming YNP	Wyoming Outside YNP	Tri-State Total
1990	Adult	245	92	25	70	432
	Cygnet	108	28	3	8	147
	Total	353	120	28	78	559
1991	Adult	176	138	30	70	414
	Cygnet	60	26	3	2	91
	Total	236	164	33	5	505
1992	Adult	156	109	26	99	390
	Cygnet	74	8	4	6	92
	Total	230	117	30	105	482
1993	Adult	60	94	26	68	248
	Cygnet	16	6	0	8	30
	Total	76	100	26	76	278
1994	Adult	70	79	30	60	239
	Cygnet	48	49	5	18	120
	Total	118	128	35	78	359
1995	Adult	84	118		105	307
	Cygnet	17	21		17	55
	Total	101	139		122	362
1996	Adult	95	127	20	74	316
	Cygnet	36	20	1	6	63
	Total	131	147	21	80	379
1997	Adult	90	112	18	92	312
	Cygnet	22	19	0	17	58
	Total	112	131	18	109	370
1998	Adult	105	110	20	69	304
	Cygnet	35	37	3	15	90
	Total	140	147	23	84	394
1999	Adult	120	103	20	69	312
	Cygnet	21	23	0	12	56
	Total	141	126	20	81	368
2000 [c]	Adult	127	102	20	69	318
	Cygnet	24	40	7	26	97
	Total	151	142	27	95	413

Year	Age Group	Montana	Idaho	Wyoming YNP	Wyoming Outside YNP	Tri-State Total
2001 [d]	Adult	140	124	17	81	362
	Cygnet	9	23	0	22	54
	Total	149	147	17	103	416
2002 [e]	Adult	76	103	22	72	273
	Cygnet	18	14	4	17	53
	Total	94	117	26	89	326
2003	Adult	89	100	16	86	291
	Cygnet	29	27	4	35	95
	Total	118	127	20	121	386
2004	Adult	89	112	16	74	291
	Cygnet	32	23	2	37	94
	Total	121	135	18	111	385
2005	Adult	112	136	18	89	355
	Cygnet	40	22	1	35	98
	Total	152	158	19	124	453
2006	Adult	117	132	14	114	377
	Cygnet	17	39	0	26	82
	Total	134	171	14	140	459
2007	Adult	157	113	10	103	383
	Cygnet	41	15	0	59	115
	Total	198	128	10	162	498
2008	Adult	140	112	6	121	379
	Cygnet	7	5	2	34	48
	Total	147	117	8	155	427
2009	Adult	138	122	4	97	361
	Cygnet	21	21	0	33	75
	Total	159	143	4	130	436

[a] Data from Gomez 2000 and Department Annual Completion Reports.

[b] Wyoming Outside YNP for these years includes data for entire state including YNP.

[c] Wyoming Outside YNP results do not include 12 yearlings and 5 cygnets (grafted to Kitchen Reservoir pair when one day old) released in summer 2000 (Wyoming Wetland Society captive flock).

[d] Wyoming Outside YNP results do not include three yearlings and five cygnets (grafted to Kitchen Reservoir pair when one day old) released in 2001 (Wyoming Wetland Society captive flock). Note: one cygnet was lost at Skyline Pond after fall survey flight.

[e] Wyoming Outside YNP results to not include five yearlings released in 2002 (Wyoming Wetland Society captive flock).

Table 3a. Occupancy and productivity of Trumpeter Swan nesting territories in Wyoming outside of Yellowstone National Park, 1990-2009. Mean and standard deviation are shown for the period 1990-2008.

Year	Sites Occupied	Nesting Pairs	Pairs with Hatchlings	Pairs with Fledglings	Number Hatched	Number Fledged
1990	19	13	4	3	11	8
1991	22	8	2	2	3	2
1992	29	10	5	3	17	9
1993	24	11	7	5	15	8
1994	20	13	8	5	29	18
1995	22	12	7	5	25	15
1996	21	13	5	4	12	4
1997	26	16	3	4	22	17
1998	25	18	10	7	26	15
1999	24	15	6	6	19	12
2000	26	16	10 [a]	9 [a]	35	26 [a]
2001	28	17	10 [a]	8 [a]	29	21 [a]
2002	24	10	9	8	23	17
2003	26	18	13	11	42	35
2004	22	17	14	11	54	37
2005	24	16	11	10	38	35
2006	24	18	12	8	33	26
2007	35	26	20	18	74	59
2008	35	16	12	11	39	34
2009	32	24	15	11	50	33
1990-2008						
Mean	*25.3*	*15.0*	*9.1*	*7.5*	*29.7*	*21.7*
SD	*4.1*	*4.1*	*4.4*	*3.9*	*16.4*	*14.3*

[a] Does not include Kitchen pair, where eggs were collected and five-day-old young were grafted to a pair successfully in 2000 (four fledged) and 2001 (five fledged).

Table 3b. Occupancy and productivity data for Trumpeter Swan nesting territories in Wyoming outside of Yellowstone National Park by drainage, 2007-2009.

Drainage	# Occupied	# Nesting Pairs	# Broods Hatched	# Young Hatched	# Young Fledged	# Hatched / Successful Pair
Snake River Core						
2007	17	11	9	37	31	4.11
2008	15	7	4	13	13	3.25
2009	14	10	6	21	12	2.33
Green River Expansion						
2007	16	13	11	37	28	3.36
2008	18	9	8	26	21	2.62
2009	18	14	9	29	21	2.08
Salt River Expansion						
2007	2	1	0	0	0	0
2008	1	0	0	0	0	0
2009	1	1	0	0	0	0

Table 4. Trumpeter Swan territorial site occupancy and production status for Wyoming outside Yellowstone National Park, 1997-2009. [a]

Site	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Ernest Lake	---	---	---	NB	NB	---	NB	---	---	---	---
Bergman Marsh	N51	N43	N00C	---	NB	---	---	---	---	---	---
Indian Lake	---	---	---	N33	N33	N55	N00	N10	N44	O	N40
Widget Lake	---	---	---	---	F	---	---	---	---	---	---
Winegar Creek											N30
Fall River Slough									N00	---	---
Loon Lake		OL	---	---	F	---	---	---	---	---	---
Rock Lake	---	---	---	---	---	OL	OM	N00	---	O	---
Junco Lake	---	---	---	---	---	---	---	N00	---	---	O
Fish Lake	---	---	---	---	---	---	---	---	---	---	---
Squirrel Meadows		OL	OL	NB	---	---	OL	---	---	---	---
Moose Lake				NB	---	---	---	---	---	---	---
Alpine Wetland north	---	---	OL	1A	NB	NB	NB	NB	N00	---	N00
Alpine Wetland south									NB	O	---
Upper Glade Marsh							N00	OM	---	---	---
Steamboat Mountain				N43	OM	---	N00	---	N43	O	O
Glade Cliff Slough								N00	N10	O	N00
Glade South	N11	O	N22	OM	N00	N10	N22	N00	O	O	---
Christian Pond	N42	N42	OM	1A	---	---	---	---	---	---	---
Arizona Lake	---	---	---	---	---	---	OM	N20	N40	N00	N00
Emma Matilda	---	---	OM	1A	NB	---	---	NB	NB	---	1A
Two Ocean Lake	---	N42	N53	N32	N30	N00	OM	OM	---	---	---
Swan Lake	N00	O	N00	O	N00	N33	NB	OL	OM	N22	O
Hedrick Pond	N00	N20	N20C	O	O	---	NB	1A	O	---	---
Elk Ranch	OM	OM	OM	OM	OM	OM	OM	OM	O	O	O
Cow Lake	---	---	---	---	---	---	---	---	---	---	---
Spread Creek Ponds	---	---	---	NB	---	---	---	---	---	---	---
Cygnet Lake	---	---	---	---	---	---	---	---	---	---	---
Polecat Slough GTNP	---	---	---	---	---	---	---	---	---	1A	1A
Highway Pond NER	O	N44	N32	N11	N10	---	N00	---	N55	---	---
NE Marsh NER	N00	N31	N00	N42	N33	N44	---	N32	NB	O	---
Flat Cr. Island NER											N00
SE Marsh NER	N00	N32	OM	N00	N11	N43	O	N11	N42	N00	N11
Central Marsh NER			N33	N00	---	N22	N44	N33	N57	N33	O
Pierre's Ponds	---	N00	OM	N11	N33	OM	O	OM	---	---	---
Romney Ponds						OM	OL	NB	N44	N44	N43
Skyline/Puzzleface	OM	OM	N30	OM	OM	O	NB	---	---	---	---
WGF South Park	---	---	---	---	---	---	1A	OL	OM	OM	N44
Pinto/Halfmoon	N00	N66	N44	N11	O	N31	N55	N33	N66	N44	N54
Tracy Lake, Buffalo V										OL	OL
Kibby/Salt River Cove	OM	N00	N00	N00	N00	N00	NB	---	---	---	---
Etna/Jackknife area								NB	---	OL	O
Bridger Lake	OL	OL	OL	---	---	---	---	---	---	---	nc
Atlantic Creek	N22	O	O	---	---	---	---	---	---	---	nc
Enos North	---	N22	OM	OM	N44	---	---	NB	NB	NB-3	---
Enos South	N32	---	---	---	---	---	---	---	---	---	---
Lily Lake	OL	OL	OM	N00	N20	---	---	---	---	---	---
Lower Slide Lake	---	---	---	---		---		---	---	---	---
Upper Slide Lake	N00C	N00C	N22	NB	OM	N11	N22	N00	OM	OM	OM
Grizzly Lake pothole	OL	---	---	---	---	---	---	Dry	Dry		**---**
Burnt Fork	---	---	---	---	---	---	---	---	---	---	NB
Soda Lake	---	---	---	---	---	---	---	---	---	---	---
Wagon Creek Lake	---	O	O	NB	O	O	---	---	---	NB	---
Rock Crib	---	---	---	---	O	---	---	---	---	NB	---
Wagon Creek Pothole									N00	---	---
Mosquito Lake	OL	O	N00	OM	1A	OL	---	NB	N32	N00	N00

Site	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Roaring Fork P.	---	OL	O	---	---	---	---	---	---	---	---
Mud Lake	N00	N00	---	N20	---	N50	N20	N20	N52	OE	---
Carney oxbow						N55	N22	N00	N44	N00	N00
Carney pond											N30
Marsh Creek Pothole									N22	---	---
Kendall Wetland			OL	OM	N00	N00	NB	NB	OL	N11	N33
Q Y Bar Reservoir									O	O	---
Kitchen Reservoir South	N00	C N54 grafted	C N55 grafted	N44	N54	N44	N22	N33	N54	N53	N11
Kitchen Reservoir North			NB	NB	NB	NB	OM	OM	OM	O	N22
Fayette New Fork								NB	N33	N40	N00
Barden Slough		N00	N00	---	N00	OM	OM	OM	---		---
Swift New Fork										N54	OL
Big Sandy Reservoir	---	---		---	---	---	---	NS	---	nc	---
Swift Reservoir				OM	NB	NB	---	OL	OL	NB	NB
Jensen Slough										OL	O
Ferry Island									N22	N33	N00
Shafer Slough			OM	---	NB	---	---	NB	---	---	NB
LaBarge Pond				---	---	---	---	---	---	OL	---
Hawley Pool 6	N44	N44	N44	Dry	N44	N65	N77	N00	NB	NB	---
Hawley Pool 1	OM	---	N11	NB	N44	N60	N65	N54	N22	N33	N43
Hawley Pool 2					N44	N54	N00	N66	N33	N66	N44
Hawley Pool 3					N43	---	N33	---	NB	NB	---
Hawley Pool 5											N33
Hawley Pool 7											N10
Hamp Unit							N33	N44	N53	O	N00
Sage Pools									N31	N33	N75
Swamp Lake, Cody	---	1A	1A	1A	1A	---	---	---	---	nc	nc
Colony eastern WY	?	?	OUID	1A	NB	NB	NS	NS	---	---	nc
Trail Lake, Dubois							OM	OM	---	---	---

[a] Key to Table 4 Codes:

O	Pair occupied territory through nest period, did not attempt to nest, and did not molt on site.
OE	Pair only observed early season on site (new code added 2008).
OM	Pair occupied territory through nest period, did not attempt to nest, but molted on site.
OL	Pair appeared late in season (new code added 2000 not counted as an occupied site for season).
OUID	Pair occupied the site, status of pair unidentified or status of site as a territory unidentified.
N42	Pair nested, laid eggs, hatched four eggs, and fledged two cygnets.
---	No occupancy of site by a pair.
C	Eggs collected for captive rearing project (new code added 2000).
1A	Only one adult observed at the site.
?	Number or status of occupancy unknown.
NB	Non-breeding birds present during some portion of nesting season (new category added 2002).
F	Swans present fall survey flight only (category added 2003).
NS	Not surveyed.

Table 5. Summary of Trumpeter Swan annual mortalities in Wyoming showing age class and probable cause of death, 1991 through spring 2010. Mortality of cygnets includes only those lost post fledge count in September; does not include brood reduction during the nesting season.

Year [a]	Total # Died	# of Adults [b]	# of Yearlings	# of Cygnets	Collision	Predation	Shot	Infection	Unknown
1991-1995	38	21		17	12	4	10	1	11
1995/1996	11	9		2	5		2		4
1996/1997	8	3		5	4				4
1997/1998	5	No data							
1998/1999	10	8		2	2	1		1	6
1999/2000	10	7		3	6	2	1		1
2000/2001	34	18	4	12	6	5			23
2001/2002	14	8	3	3	3	2			9
2002/2003	12	6	2	4	1	1	2		8
2003/2004	38	21	7	10	3	5		5	25
2004/2005	9	3	2	4	0	6			3
2005/2006 [c]	49	27	?	11	1		1		47
2006/2007	10	8		2					10
2007/2008	11	7	1	3	4	1	2	1	3
2008/2009	16	11	3	2	4	1			11
2009/2010	6	4	1	1	1	1			4
Total [d]	*219*	*128*	*23*	*57*	*31*	*25*	*6*	*7*	*150*
Percent		*58*	*11*	*26*	*14*	*11*	*3*	*3*	*68*

[a] Mortality total for years 1991-1995 is not broken out by individual years; the following years' data are recorded for 15 April through 14 April for each period, but also includes carcasses/remains found after snow melt in May.

[b] Swans with all white plumage over one year of age; likely some yearlings are included in this group.

[c] Age not determined for 11 reported mortalities. Necropsy reports not completed on 14 specimens submitted to lab.

[d] Summary statistics are calculated only for the years 1998-2010.

Table 6. Summary of Trumpeter Swan neck collars and leg bands observed in Wyoming or eastern Idaho, 15 April 2009 through 14 April 2010. Codes for age at marking: HY = hatch year (cygnet), AHY = after hatch year (yearling or older), SY = second year (yearling), ASY = after second year (adult older than yearling). HSP = Harriman State Park.

Neck Collar	Leg Band or Patagial Tag	Date	Location	Origin / Notes on Current status	Sex	Age
31E green	--	June 2009	Alpine Wetland	Nest attempt last year at same location Collared and released HSP Nov. 14, 2001	F	HY
U640 blue Tundra Swan	--	11/19/09 1 obs	Wilson, Fish Creek south of town	Banded July 26, 2009 Buckland River Delta, NW Alaska	F	ASY
6H3 green	--	11/25/09 First obs 3/15/10	Valley Springs Captive Rearing Facility	Collared HSP Nov. 93 adult, released Summer Lake/ mate + 2 cygnets		ASY
OE9 green	--	1/10/10 First obs 3/15/10 Last obs	Spring Creek 2, Cheyenne Creek Fish Creek and Spring Creek complex South of Crescent H subdivsion	With mate; could not obtain history but likely Idaho release; Idaho is checking to see if they can determine which bird this is		ASY
--	Red leg band fragment Probably 8P6	April 1, 2010	Seedskadee NWR	Blackfoot release captive raised bird		

COMMON LOON SURVEYS
COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Common Loon

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Andrea Orabona, Nongame Bird Biologist

INTRODUCTION

The Wyoming Game and Fish Department (Department) classifies the Common Loon as a Species of Greatest Conservation Need with a Native Species Status of one because of its vulnerability to human disturbance and environmental degradation, and its limited abundance and restricted distribution in Wyoming (Wyoming Game and Fish Department 2005). Loons can be observed statewide during spring and fall migration and nonbreeding loons can be found throughout the state during the summer. However, suitable breeding habitat is restricted to the northwestern corner of Wyoming and is easily lost or degraded due to human disturbance and habitat changes.

In 2009, we surveyed known Common Loon nesting areas to document lake occupancy, productivity, and survival of young. In addition, we asked Department personnel, biologists from other agencies and organizations, and the public to report all loon sightings so we can determine if nesting is occurring on additional lakes in northwest Wyoming or elsewhere in the state.

METHODS

The timeline for Common Loon surveys is as follows: lake occupancy surveys are conducted in early to mid-June, productivity surveys are conducted in mid- to late July, and follow up surveys to determine initial survival of young are conducted in mid-to late August.

Adult and young loons are best observed during early morning and early evening hours. Observers sit quietly in an area that provides a vantage point over the lake to be surveyed, and search the lake and adjacent shoreline for loon activity. Each lake is surveyed for 45 minutes to one hour to ensure that loons that are not immediately visible are not overlooked. Observers record the number of adult and young loons detected, loon activity and behavior (e.g. diving, hunting, feeding self or young, calling, flying, loafing, agitated, defensive), and other species observed or heard. Additional comments, such as human activity; new or on-going disturbances; habitat impacts or degradation; the location of paved, dirt, and two-track roads; and shoreline habitat, are also recorded.

RESULTS

A total of eight lakes outside of Yellowstone National Park were included in the 2009 results for nesting Common Loons. Seven of the lakes have a past history of Common Loon use since surveys were initiated in 1987 (Table 1). In 2008, we added Emma Matilda Lake to the survey schedule after a photograph was submitted in 2007 of an adult loon and loonlet in the southwestern bay of the lake.

During the June lake occupancy survey, we visited five of the eight lakes and detected adult loons or loon pairs on four of the five lakes surveyed. During the July productivity survey, we observed a single adult loon or adult loon pairs on six of the eight lakes visited, but only three loonlets were observed (two on Arizona Lake and one on Indian Lake). During the August survey to verify young survival, we observed adult loons on two of the seven lakes surveyed and the same single loonlet was observed on one lake. We were unable to access Emma Matilda Lake due to downfall that blocked the trail.

Summary data for 2009 and previous years are presented in Table 1. Common Loon lake occupancy and productivity data for Wyoming are presented in Table 2.

DISCUSSION

Between 1987 and 2003, we detected nesting pairs regularly or sporadically on five of the seven lakes (Arizona, Indian, Junco, Loon, and Moose Lakes), and foraging or loafing adults on the remaining two lakes (Bergman Reservoir and Fish Lake). However, the affects of climate change and an increase in disturbance from incompatible human activities appear to have affected the ability of loons to consistently produce young, particularly on Loon and Moose Lakes.

We are especially concerned with the downturn of productivity on Loon Lake, once a nesting stronghold for this species. This lake is directly accessible to humans on both the north and south shores, and has experienced a dramatic increase in human use throughout the breeding season from a recreational outfitter business located immediately adjacent to the north shore. We also noted a new footpath in 2009 that leads directly to the lake and close to where the loons nest. The problems at Moose Lake may also be related to an increase in human activity during the breeding season, as this lake is also directly accessible by vehicle, and humans have created an illegal four-wheeler trail and new primitive camp site adjacent to the lake's north shore. Common Loons are a long-lived species and individuals exhibit high fidelity to breeding areas, making the loss of traditional nesting sites extremely problematic for the viability of this species in Wyoming. Therefore, we are working with U.S. Forest Service personnel to remedy these unfortunate situations before these sites become population sinks rather than population sources.

In 2007, there was a personnel change in Yellowstone National Park and loon surveys were discontinued during 2007 and 2008. In 2009, Park biologists conducted surveys on 11 of the historical nesting lakes in Yellowstone and we continued surveys on Winegar Lake, which is just inside the southern Park boundary and close to several other lakes we routinely visit. Although this does not represent a complete inventory of the historic nesting lakes in the Park, this effort greatly adds to the long-term data set of this Species of Greatest Conservation Need, which is especially important at a time when other factors appear to be threatening the ability of loons to continue to successfully reproduce at these historic sites in the state.

ACKNOWLEDGEMENTS

We would like to acknowledge the following Department personnel for their valuable contributions to the 2009 Common Loon monitoring efforts: Steve Kilpatrick, Ron Lockwood, and Jerry Longobardi. We would also like to thank Sue Wolff from Grand Teton National Park and volunteer Rob Cavallero for providing additional information on Common Loons.

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Table 1. Summary of Common Loon occupancy (June), productivity (July), and young survival (August) surveys from 1987 through 2009. Excludes Yellowstone National Park. Adult loons are depicted by the letter A and juvenile loons are depicted by the letter J.

Year	Arizona Lake		Bergman Reservoir		Emma Matilda Lake		Fish Lake		Indian Lake		Junco Lake		Loon Lake		Moose Lake		Total Loons	
	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J
1987	1	2	2	1	1	ns	0	0	2	2	1	1	2	1	2	2	11	9
1988	2	1	2	2	ns	ns	0	0	2	1	2	2	2	2	2	2	12	10
1989	2	-[a]	2	-	ns	ns	ns[b]	ns	4	1	2	1	2	2	2	-	14	4
1990	4	-	2	-	ns	ns	ns	ns	2	2	2	1	2	1	2	2	14	6
1991	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
1992	2	-	2[c]	-	ns	ns	2	-	2	1?[d]	2	-	2	?[e]	2	?	12	?
1993	2	-	2[c]	?	ns	ns	1	?	3	-	2	-	2	1	2	?	12	?
1994	2	1	2	-	ns	ns	2	-	0	0	0	0	2	1	2	1	10	3
1995	2	1	2[c]	-	ns	ns	0	0	2	-	0	0	1	2	0	0	5	3
1996	2	-	1[c]	-	ns	ns	2[f]	-	2	1	2	-	2	2	2	-	10	3
1997	2	1	0	0	ns	ns	1	-	2	2	0	0	2	2	2	1	9	6
1998	0	0	0	0	ns	ns	0	0	1	2	0	0	1	-	2	1	4	3
1999	2	2	0	0	ns	ns	2	-	2	2	0	0	2	-	2	-	10	4
2000	2	1	1[c]	0	ns	ns	2[f]	-	2	2	2	1	2	1	2	-	10	5
2001	0	0	0	0	ns	ns	2[f]	-	2	1	2	-	2	1	2	1	8	3
2002	1	0	1[c]	0	ns	ns	1[f]	0	2	1	2	-	2	1	1	-	8	2
2003	2	1	1[c]	0	ns	ns	1	0	2	1	1	-	2	0[g]	2	2	10	4
2004	2	0	2[c]	0	ns	ns	3[f]	0	4	0	1	0	2	2	2	0	11	2
2005	2	0	1[c]	0	ns	ns	2	0	2	2	0	0	2	0[g]	2	0[g]	10	2

Year	Arizona Lake		Bergman Reservoir		Emma Matilda Lake		Fish Lake		Indian Lake		Junco Lake		Loon Lake		Moose Lake		Total Loons	
	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J
2006	2	0	2[c]	0	ns	ns	3[f]	0	2	2	0	0	2	2	2	0[g]	8	4
2007	2	2	1[c]	0	1	1	1[f]	0	2	1	2	0	2	0[g]	2	0[g]	11	4
2008	1	0	0	0	2	-	0	0	2	1	0	0	3[h]	0[g]	2	0	9	1[i]
2009	2	2	2[c]	0	2	0	2[f]	0	2	1	0	0	2	0[g]	0	0	8	3[i]

[a] A dash (-) indicates that young were not observed during the survey; however, due to the secretive nature of loons, juveniles may have been present but hidden from view.
[b] ns = not surveyed.
[c] Most likely the adult(s) from the Indian Lake pair using this site for foraging; not included in total.
[d] A nest with 1 egg was observed; it is unknown if the egg hatched and the juvenile loon survived.
[e] A question mark (?) indicates that a June nesting status survey was conducted only; these lakes were not surveyed in July so productivity was unknown.
[f] Most likely the same individual(s) that use several lakes in the vicinity of Fish Lake for foraging and/or nesting; not included in total.
[g] Increased human activities that are incompatible with nesting may be responsible for this pair’s failure to produce young.
[h] The third individual is most likely one of the same loons that nest or forage in the vicinity of Loon Lake.
[i] Lake levels were particularly high, which may have contributed to a reduction in productivity.

Table 2. Common Loon nesting, productivity, and young survival data for Wyoming, 1987-2009 (2007, 2008, and 2009 data are incomplete due to a change of personnel in Yellowstone National Park).

Year	Outside Yellowstone Nat'l Park			Yellowstone National Park			Wyoming Total		
	# Pairs	# Young	# Lakes w/ Young	# Pairs	# Young	# Lakes w/ Young	# Pairs	# Young	# Lakes w/ Young
1987	6	9	6	na[a]	na	na	in[b]	in	in
1988	6	10	6	na	na	na	in	in	in
1989	6	4	3	na	na	na	in	in	in
1990	6	6	4	11	9	9	17	15	13
1991	ns[c]	ns	ns	9	na	na	in	in	in
1992	6	ns	ns	11	6	4	17	in	in
1993	5	ns	ns	12	6	4	17	in	in
1994	5	3	3	12	12	8	17	15	11
1995	3	3	2	13[d]	8	12	16	11	14
1996	5	3	2	5	4	4	10	7	6
1997	4	6	4	5	6	5	9	12	9
1998	2	3	2	12	8	6	14	11	8
1999	4	4	2	14	2	2	18	6	4
2000	5	5	4	9	8	9	14	13	13
2001	4	3	3	9	7	9	13	10	12
2002	3	2	2	9	5	4	12	7	6
2003	4	4	4	8	1	1	12	4	5
2004	5	2	1	9	3	2	14	5	3
2005	5	2	1	8	4	3	13	6	4
2006	4	4	2	9	6	4	13	10	6
2007	6	4	3	na	na	na	in	in	in
2008	5	1	1	na	na	na	in	in	in
2009	4	3	2	7 (in)	4 (in)	3	11 (in)	7 (in)	5 (in)

[a] na = data are not available.
[b] in = State totals are incomplete.
[c] ns = not surveyed.
[d] Two pairs nested on the same lake.

BALD EAGLE
COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Bald Eagle

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Susan Patla, Nongame Biologist
Bob Oakleaf, Nongame Coordinator

INTRODUCTION

The U.S. Fish and Wildlife Service (USFWS) declassified the Bald Eagle in July 2007 so it is no longer listed under the federal Endangered Species Act as a threatened species in the western United States. However, it still receives protection under the federal Bald and Golden Eagle Protection Act. The Wyoming Game and Fish Department (Department) initiated statewide monitoring for Bald Eagles in 1978. In 2009, the Nongame Program monitored nest territories in the Snake River (Greater Yellowstone area) and in the upper Green River basin south to Seedskadee National Wildlife Refuge using aerial and ground surveys to determine occupancy and a subset of these territories for productivity. Regional Department biologists checked a smaller subset of known nests in other drainages in the State for occupancy, and productivity, including the upper North Platte River near Saratoga and several drainages near Sheridan. Federal biologists provided additional data for their respective management units, and a few consultant firms also provide observations from project sites. In 2009, the Department also participated in the first nationwide post-delisting monitoring effort and surveyed one area and one list plot designated by USFWS in western Wyoming (USFWS 2007). The Department continues to receive and respond to numerous requests by other state and federal agencies and the public for information on nesting status, productivity, and mitigation measures for Bald Eagles in Wyoming.

POPULATION TRENDS – NESTING

The distribution of nesting Bald Eagles in Wyoming can be found in previous Annual Completion Reports. Bald Eagles nesting in northwestern Wyoming are part of a significant nesting population in the Rocky Mountain West. The population extends into Idaho and Montana. Recovery of the species is centered in Jackson Hole and the Greater Yellowstone area along the Snake River and its tributaries. The highest density of Bald Eagles still occurs in this part of the state, but nesting pairs are now found along all major drainages in Wyoming. Over the past decade, an increase in the number of nesting pairs has been documented in the Green River Basin. Nesting eagles in the state do face some level of site specific risks from increasing energy development, subdivision construction, recreation pressures, and contaminant levels.

MONITORING METHODS

Occupancy and Productivity

Aerial Surveys in Western Wyoming

In 2009, aerial monitoring surveys were conducted by S. Patla on 27 March (nest occupancy), and 27 May (productivity). Known nest sites were checked along the main stem and tributaries of the Snake River, Gros Ventre River, Salt River, New Fork River, and Green River (from Green River Lakes south to Fontenelle Dam). B. Oakleaf surveyed additional sites for occupancy on the North Platte River during a raptor survey on 13 April. All surveys were flown in a Scout (Sky Aviation, Dave Stinson, pilot). Nongame Section personnel collected data on nest sites at additional locations in conjunction with other aerial survey work. Data collected on aerial surveys included number of adults and young observed, Geographic Positioning System (GPS) nest locations, and nest tree species and condition. New nest trees were photographed, when possible.

Ground Surveys

A number of Department biologists, federal agency biologists, and private consulting firms provided occupancy and productivity data from sites throughout the state. Biologists from Seedskadee National Wildlife Refuge (NWR), the National Elk Refuge (NER), Grand Teton National Park (GTNP), and Bridger-Teton National Forest (BTNF) contributed nest observation data. Ground data were also collected at accessible nest sites by Department biologists in the Jackson, Pinedale, Cody, and Laramie Regions. Volunteers also monitored some territories on a regular schedule. Ground surveys were conducted using spotting scopes or binoculars at sufficient distances from nest sites to prevent disturbance. Observation times range from a few minutes to 1-2 hours, depending on visibility, pair behavior, and nest status.

Banding Effort and Contaminant Study

No banding or sampling for contaminants was completed this year except for an ongoing study in fall 2009 on the National Elk Refuge by Craighead Beringia South, a nonprofit wildlife research organization located in Jackson, WY. As part of their investigation into lead ingestion by scavenging eagles, researchers put out 10 GPS transmitters on different age classes of eagles. These transmitters may last up to three years, so will provide data on movements of migrant eagles that pass through Wyoming in the fall from other nesting locations in the western United States and Canada (see web site: http://www.beringiasouth.org/).

Mortality Data

Reports of injured and dead Bald Eagles are followed up, when possible, to determine cause of injury/death and to collect carcasses. If carcasses are fresh and cause of death uncertain, they are frozen and submitted to the Wyoming State Veterinary Laboratory in Laramie for analysis. Partial and old remains are sent to the National Eagle Repository for distribution to Native Americans for religious purposes. There are likely other eagle mortalities that have been recorded in the Department's Wildlife Observation System database.

MONITORING RESULTS AND DISCUSSION

Occupancy and Productivity

Statewide results are summarized in Table 1. A minimum of 200 Bald Eagle nesting territories have been documented in Wyoming, which includes 12 new sites reported in 2008. In 2009, we checked 76% (n=153) of known nests sites for occupancy. Of these, 80% (n=122) were occupied, 72% of occupied sites (n=88) were later checked for productivity, and 72% of sites checked for productivity (n=63) produced a total of 101 young (Table 1). Average productivity was 1.15 young/checked nest. Seven new territories were documented. Monitoring effort was greatest in western Wyoming, where the majority of known nests were monitored. Yellowstone National Park checked 19 territories; none of the 9 nests on Yellowstone Lake produced young (Baril et al. 2010).

Population management objectives have been exceeded since 1987 and the state population continues to increase but at a slower pace compared to the previous decade. It appears that carrying capacity may have been reached in some areas, such as Grand Teton National Park and along the main stem of the Snake River in Wyoming, and may be declining in Yellowstone National Park. Additional monitoring effort is needed to determine population trend in other areas of the state.

Mortality Data, 2009

A total of five dead Bald Eagles were confirmed; four in the Jackson/Snake River drainage and one at Seedskadee NWR. An adult Bald Eagle that died on the National Elk Refuge in December 2009 was sent to the State Vet Lab and diagnosed as having a lethal level of lead (Wyoming State Veterinary Laboratory, Accession No. 10001530).

ACKNOWLEDGMENTS

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Table 1. Production of Bald Eagles in Wyoming, 2009.

Population Index	Wyoming Portion of GYE [a]	Green River [b]	Bear River	Other Wyoming [c] (N of I-80)	Other Wyoming [d] (S of I-80)	Statewide Total
Territories checked for occupancy	67	37	2	16	31	153
Number of territories occupied	56	24	2	16	24	122
Percent occupied	84%	65%	100%	100%	77%	80%
Territories checked for productivity	51	21	2	10	4	88
Territories that produced young	35	15	2	7	4	63
Percent successful (young produced) [e]	69%	71%	100%	70%	100%	72%
Number of mature young produced [f]	52	25	4	14	6	101
Number of mature young/territory checked	1.02	1.19	2.00	1.40	1.50	1.15
Number of territories considered unoccupied [g]	6	6	0	3	7	22
Number of new territories found in 2009 [h]	1	2	1	1	2	7

[a] Includes three pairs (six fledged) in Lincoln County (Salt River) and data from Yellowstone National Park (Doug Smith).
[b] Aerial surveys from Green River Lakes to Fontenelle Dam; ground surveys on the Seedskadee National Wildlife Refuge.
[c] Includes the Wind River, the Popo Agie River, the Big Horn Basin, Casper, Sheridan, Cody, and Lusk areas.
[d] Includes the North Platte and Little Snake Rivers. Note: an additional 5 nests could not be located.
[e] Percentage of occupied territories checked for productivity that produced mature young; not all occupied territories were monitored for productivity.
[f] Mature young at most territories is the number of fully feathered nestlings counted prior to fledging in June and July.
[g] Territories that have not been occupied for the previous five years and are no longer checked by the Department.(data from 2008)
[h] New territories are included in totals for the year.

STATUS OF BREEDING POPULATIONS OF FERRUGINOUS HAWKS, GOLDEN EAGLES, AND BALD EAGLES IN ALBANY AND CARBON COUNTIES, WYOMING COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRD: Species of Greatest Conservation Need – Ferruginous Hawk, Golden Eagle, Bald Eagle

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars; General Fund Appropriation, Wyoming Game and Fish Department Project Dollars; Federal Funds, U.S. Fish and Wildlife Service Cooperative Agreement #601818J420 / Wyoming Landscape Conservation Initiative

PERIOD COVERED: 1978, 1997-2000, 2009

PREPARED BY: Dave Young, Project Manager, Western Ecosystems Technology
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INTRODUCTION

The state of Wyoming, Wyoming Game and Fish Department (Department) contracted Western Ecosystems Technology, Inc. (WEST) to conduct studies of potential change in species composition, number, and productivity of nesting Ferruginous Hawks, Golden Eagles, and Bald Eagles in an area of south central Wyoming. Certain raptor species, notably the Ferruginous Hawk, are good indicators of overall environmental health, and may be impacted by increased human activities such as expanding energy facilities construction and operation. The Department is investigating the current status of these focal raptor species over an area of Albany and Carbon Counties, Wyoming, with high wind power development potential (Bureau of Land Management 1995), and for which population levels of these same raptor species were intensively monitored during 1978 (Phase I; Oakleaf 1978) and between 1997 and 2000 (Phase II; WEST 2000). The purpose of this study was to examine 10-year changes in key breeding raptor population parameters and prey base in association with area wind energy growth.

Intensive raptor breeding surveys and productivity monitoring are advantageous in providing detailed information of known raptor populations (Craighead 1981). Studies that include multiple raptor species provide further understanding of the ecology of population changes (Craighead 1981). To investigate the status of raptor populations, we conducted intensive raptor breeding surveys and productivity monitoring for three focal raptor species, Ferruginous Hawk, Golden Eagle, and Bald Eagle, throughout an area of increasing wind energy development (Appendix A). Wind energy development may impact raptor species directly (turbine collisions) or indirectly (habitat loss, displacement, or avoidance; Kuvlesky et al. 2007). Direct impacts to raptor species from wind energy development have been observed (Hunt et al. 1998, Erickson et al. 2001, Kerlinger et al. 2006, Smallwood and Karas 2009). Impacts are generally low for most projects, but can be higher for projects in areas with high raptor use (Kerlinger et al. 2006, Smallwood and Karas 2009). There has been some concern that collision mortalities could have negative effects on raptor populations (Kuvlesky et al. 2007). At the one site where population effects have been studied, Hunt (2002) found that the resident Golden Eagle population at the Altamont Pass Wind Resource Area (APWRA) appeared to be self sustaining, in spite of relatively high fatalities, although the effect of these fatalities on eagle populations wintering within and adjacent to the APWRA is unknown. Nest surveys in the APWRA showed all previously identified Golden Eagle territories were still occupied (Hunt and Hunt 2006). The lack of avian density estimates and other population characteristics, the lack of multiyear studies, and the lack of any estimates at most existing wind energy facilities makes it difficult to draw general conclusions about the effect of wind energy related fatalities on avian populations (NRC 2007). In addition, little is known on the indirect or cumulative impacts from wind energy development on raptor populations. Some studies suggest indirect impacts to bird populations (e.g., habitat loss from displacement) are a greater threat to populations than that of collision fatalities (Kuvlesky et al. 2007).

There are five operating wind energy facilities located within the study area; four of which were completed prior to 2009 surveys – Medicine Bow, Foote Creek Rim, Rock River, and Seven Mile Hill. Fatality rates of the focal raptor species are only known for Foote Creek Rim. Fatality monitoring was conducted from November 1998 through June 2002, and no focal raptor species mortalities were recorded during these surveys. Fatality monitoring is ongoing at the Seven Mile Hill facility.

The primary objective of this study is to investigate 10-year population trends in relation to the progression of wind energy development within the study area. To achieve this objective, we: 1) identified nest site occupancy and nesting success, 2) conducted productivity counts, 3) calculated nest density and distance to nearest wind energy facility, and 4) compared raptor population demographics with nest distributions relative to the progression of wind energy development.

Prey Availability

A determination of the potential effects of human development on raptor populations must be tempered with an understanding of the current status and trends in prey resource availability. Many studies have investigated the relationship between principal prey densities and raptor reproduction (Smith et al. 1981, Steenhof and Kochert 1988). Smith and Murphy (1979) and Steenhof et al. (1997) determined that Golden Eagle reproductive rates can fluctuate positively with high prey densities and negatively with low prey densities. Conversely, Steenhof et al. (1997) also found that the numbers of territorial pairs were unrelated to annual rabbit numbers or weather conditions. Ferruginous Hawk breeding populations and productivity also synchronously fluctuates in between changes in major prey species populations, including ground squirrels (Gilmer and Stewart 1983), prairie dogs (Plumpton and Andersen 1998), and rabbits (Smith et al. 1981). Hoff et al. (2004) determined that Bald Eagle population productivity was also dependent on the abundance of preferred prey items.

An index to relative abundance of rabbits (lagomorphs), ground squirrels, and prairie dogs was developed to assist interpretation of nesting parameters for the focal raptor species. Indices derived during Phase II of the study provided an index of abundance for comparison to similar surveys during Phase III. Prey resource availability was not assessed during Phase I of the study. Objectives of the prey studies were to: 1) assess Phase III prey base population conditions, 2) compare Phase III conditions to Phase II to determine prey density changes, and 3) use these prey density parameters to help assess possible differences in breeding pair density, nest occupancy, and nest success between study Phases.

STUDY AREA

The study area was variable throughout all three phases. Phase I study area was determined by potential wind turbine placement sites throughout the entire Medicine Bow/Rock River basin, which was part of an alternative energy research project headed by the United States Department of Energy and the United States Geological Survey (USGS). Phase II (1997-2000) study area was established as part of the pre-construction Wildlife Monitoring Studies for the SeaWest Windpower Project. The SeaWest Windpower project considered two potential sites for placement of a wind energy facility, Simpson Ridge Wind Resource Area (SR) and the eventually completed Foot Creek Rim facility (FCR). The Phase II raptor nest survey area included the proposed project areas and a 10-mile (16-km) buffer because Golden Eagles are known to forage up to 10 miles (16 km) from a nest. In 2009 during Phase III, surveys were initiated to determine long term trends of focal species within the central areas of the first two Phases. Due to multiple study areas, some survey areas from Phase I and II extended beyond the boundaries of Phase III. In order to analyze population trends, a study area boundary was determined by the area surveyed during all three Phases. Nests located within areas outside the consistent boundary were eliminated from the analysis.

The study area that was consistent for all three Phases (hereafter “study area”) is located in south central Wyoming in Carbon and Albany Counties (Figure 1). It lies east of Walcott Junction and west of the Laramie Mountains. The study area extends north of the town of Arlington, Wyoming and south of the Freezeout Mountains. It encompasses approximately 794,503 acres (321,525 ha), mostly comprising of scrub-shrub land cover (84.2%) followed by grassland (8%). Pasture/hay, woody wetlands, and emergent wetlands all comprised 6% of the land cover. Low, medium, and high intensity development comprised less than 1% of all land use.

METHODS

Raptor Nest Surveys

Field Methods

To ascertain nest site occupancy and breeding attempts, the Department conducted intensive helicopter surveys from 13-30 April 2009, similar to the surveys conducted during Phase I and Phase II (April-May). Surveys were concentrated in likely raptor nesting habitat (e.g., rocky outcrops, cottonwood riparian zones), and nest sites recorded previously were specifically checked for occupancy. Nest occupancy was recorded for the three focal species and also recorded for Red-tailed Hawks and Prairie Falcons. However, limited funding precluded follow up production surveys for these two species. Although Swainson's Hawks and American Kestrels nest in the study area, occupancy surveys were conducted prior to their arrival and nesting. During these surveys and throughout the study period, basic nest use, success, and productivity parameters were inventoried and included the following: 1) Unoccupied – a nest with no evidence of recent use or attendance by adult birds of prey; 2) Occupied – a nest site or series of supernumerary nests within a 0.6 mile (1 km) radius that revealed recent refurbishing (e.g., greenery, recent egg cup) and/or is represented by one or more adults on or immediately adjacent to the nest structure(s); 3) Successful – a nest that fledged at least one young, and; 4) Unsuccessful – a nest known to be active but displays addled/infertile eggs, a destroyed clutch, destroyed young, or is empty at a period when dependent young should be present (Steenhof and Kochert 1982).

During all three Phases, helicopter surveys were followed with ground surveys (1-3 territory spot checks) from April through July to confirm species represented and the status of occupied nests. Nest structures and the behavior of adults and/or young were ascertained to determine whether nesting attempts were successful and how many young were produced. Productivity was assessed by comparing the production of young by species for both occupied nests/territories over the study area, and from successful nests alone. For the purposes of this study, young raptors which attained an age of approximately ≥75% of their representative species fledgling period were counted as successfully fledged. Not all occupied nests were monitored for productivity during Phase I and no occupied nests were monitored for productivity during the year 2000 during Phase II. Unlike Phase I and II, the Department's helicopter surveys during Phase III were followed by carefully timed productivity surveys via a Piper Supercub aircraft (Mountain Air Spray Company, Craig, CO). These surveys were performed to get an accurate determination of nest status and final productivity counts. Data on habitat, nest status, and adult presence and behavior were recorded to the extent possible from the air. Ground checks were made to determine the status of any nests where such data could not be conclusively verified from the air (e.g., nests that were visually obscured; or when weather conditions prohibited safe, close aircraft approaches).

Analysis Methods

Nest locations were mapped using USGS Topographic Maps (scale of 1: 250,000) during Phase I aerial surveys. Accuracy of these locations was improved during follow up ground surveys with maps scaled at 1:24,000 and later entered into an excel data base. During Phases II and III, all nest locations were mapped using hand held global positioning system (GPS) units and analyzed using Geographical Information System (GIS) software. All operating wind energy facilities within the study area were mapped using GIS software. To determine possible trends in the status of the focal raptor species populations with the yearly progression of wind energy development within the study area, nest density and mean nest distance to nearest wind energy development were calculated. All nests within a three-mile buffer of each facility were included in the density analysis to determine possible trends in pre-wind energy development and post-wind energy development (Figure 2). Mean occupied nest distances to nearest wind energy development was calculated with the yearly progression of wind development to determine avoidance trends pre- and post-wind energy development.

Prey Availability

Lagomorphs

During Phases II and III, trend counts as described by the Department (1982) were used to estimate lagomorph abundance. A total of six 20-mile (32-km) transects along roads within or near the study area were sampled once in the late summer/early fall of each year. Transects were distributed to provide adequate coverage of habitat types (Figure 3). Transects were driven at approximately 20 miles/hour (32 km/hour) beginning one-half hour after sunset. All lagomorphs observed in the vehicle headlights were identified and counted, and the mileage point at which they were observed was recorded. Only one transect per observer was driven each night so that each transect was surveyed during peak lagomorph activity hours (i.e., the first hour after dark). Data were summarized from the total number of lagomorphs (by species) observed per km of road surveyed on each of the six routes.

Ground Squirrels

During Phases II and III, an index of relative abundance of ground squirrels was determined by conducting roadside ground squirrel burrow surveys. Ground squirrels were surveyed in late August and early September along the same roads used for lagomorph surveys (Figure 3). A systematic sample of points located approximately every 0.5 mile (0.8 km) along the roads was selected. At each point, the observer randomly selected the left or right side of the road and searched a 6,727-foot^2 (625-m^2) [82.02 x 82.02 feet (25 x 25 m)] plot for presence of active ground squirrel burrows. Observers searched the entire plot or until an active burrow was found. Active burrows were defined by direct observation of ground squirrels, presence of fresh scat near burrows, or other evidence of recent use within 1.6 feet (0.5 m) of the burrow entrance. Relative abundance was determined by the number of plots containing at least one active ground squirrel burrow.

Prairie Dogs

During Phase II, prairie dog towns were mapped based on the Department's prairie dog distribution maps and any additional prairie dog towns discovered during other wildlife monitoring studies for the SeaWest Windpower Project. These prairie dog towns were targeted during Phase III in order to compare prairie dog abundance between both Phases. A total of nine prairie dog towns (Figure 3) were selected and surveyed in August and September during Phase II. Four of these prairie dog towns were selected and surveyed during Phase III. Five prairie dog towns were not surveyed due to limited/restricted access and colony inactivity. To ensure sample effort was approximately proportional to prairie dog town size, three transects oriented north-south and equidistant apart were located in each town. Observers counted the number of active burrows within 5 feet (1.5 m) of either side of each transect line. Active burrows were defined by the presence of fresh scat within 1.6 feet (0.5 m) of the burrow entrance, fresh digging, or visual observation of a prairie dog at a burrow. Burrows on the boundary of transects were counted if more than half of the burrow entrance was located within the transect (Biggins et al. 1992). Data derived from these transects were expressed as the density of active prairie dog burrows per colony surveyed.

RESULTS

Raptor Nest Surveys

We initially tested for any significant trend in the number of occupied nests during the four years (1997-2000) to justify averaging that period for subsequent analyses. No significant trend was detected for the three focal species or all nests combined (Figure 4). For Ferruginous Hawk, the positive trend was nearly significant (P=0.056) but the slope was extremely small. Due to the lack of significant trends from 1997-2000, subsequent analyses focus on comparisons primarily of Phase 1 (1978), Phase II (1997-2000), and Phase III (2009).

The number of occupied nest sites was determined for the three focal and two additional species during all three phases and six study years (Figures 5-10). The number of occupied Ferruginous Hawk nest sites were highest during 2009 (n=44) and lowest in 1999 and 2000 (n=24; Table 1). Golden Eagle nesting was highest during 1978 (n=50) and lowest during 1998 (n=24; Table 1). Bald Eagle occupancy increased from 0 in 1978 to 8 in 2009 (Table 1). Ferruginous Hawks were similar between Phase I (n=22) and Phase II (n=25.5), but increased during Phase III (n=44). Golden Eagles decreased during the three Phases, ranging from 50 (Phase I) to 27 (Phase III). However, Bald Eagles increased from Phase I (n=0) to Phase II (n=2.3) and Phase III (n=8; Table 2). Twenty-one occupied sites of Prairie Falcons were located during Phase I, 7.3 in Phase II, and 30 in Phase III. Red-tailed Hawks were not recorded during Phase I, and appeared to decreased from 1997 (n=43) to 2009 (n=16; Table 1). Red-tailed Hawks averaged 25.8 occupied nest sites during Phase II and 16 occupied sites during Phase III (Table 2).

Nest fate and production was determined for the three focal species for all study Phases and years except the year 2000 (Figures 6-8 and 10). During 1978, few nests were monitored for production and success. Out of 17 occupied Golden Eagle nests, 76.5% were successful. Six of 12 (50%) occupied Ferruginous Hawk nests were successful, and no Bald Eagle nest were recorded during 1978. The success rate of Ferruginous Hawk (43% and 56%) and Golden Eagle (63% and 69%) increased from 1997 to 1999, respectively (Table 1), but neither change was statistically significant (P=0.329 and P=0.156, respectively). Overall, success rate of the Golden

Eagles decreased from Phase I (76%) to Phase II (56%) and Phase III (44%; Table 2; Figures 6-8 and 10). The success rates from Phase I and Phase II, or Phase II and Phase III were not statistically different (P=0.168 and P=0.384, respectively). Success rate from Phase I and Phase III was statistically different (P=0.037).

To assess production within the focal raptor species population, we determined number of young fledged from each successful nest, as well as occupied nests (Figures 11-12; Table 2). Sample sizes are limited for these comparisons, and none of these differences were statistically different (t-test, p>0.10), but the observed data are discussed. Golden Eagle productivity per occupied nest was highest during Phase I (0.9) and lowest during Phase II (0.8) and Phase III (0.6l; Figure 12; Table 2). Ferruginous Hawk productivity per occupied nest and per successful nest was similar during Phase I (1.3 and 2.6, respectively) and Phase II (1.5 and 2.7, respectively), but lowest during Phase III (1 and 2.3, respectively; Table 2). Bald Eagle productivity per occupied nest and per successful nest was similar during Phase II (1.3 and 1.8, respectively) and Phase III (1.1 and 1.8, respectively). There were no Bald Eagle nests recorded during Phase I (Table 2).

Nest density and mean distance to nearest wind energy development were calculated for all study years (Table 3 and 4). If there was an effect due to wind development, the density of occupied nests would be expected to decrease over time. The density of occupied nests located within a 3-mile (4.8-km) buffer of each wind energy development was similar between pre-development years and post-development years ranging from 0.03 to 0.32 (Table 3). Density was highest during 2009 (post-development) for all wind energy developments, ranging from 0.6 to 0.25, except for Medicine Bow, which was highest in 1978 (0.32; Table 3; Figure 2). When pooled across all study areas, the density of occupied nests was highest in 2009.

Mean occupied nest distance to nearest wind energy development followed similar trends as the density analysis (Table 4). If there was an effect from the wind facilities, a larger distance would be realized. An increase of mean distances was observed for three wind energy developments, Medicine Bow, Foote Creek Rim, and Rock River, between the years 1997-2000 [mean 25,006 feet (7,622 m), 21,818 feet (6,650 m), and 56,709 feet (17,285 m), respectively] and 2009 [30,233 feet (9,215 m), 30,213 feet (9,209 m) and 68,533 feet (20,889 m), respectively]. Ferruginous Hawk occupied nest distance was similar between pre-development and post-development years, but mean distance to Medicine Bow increased from 1978 [12,224 feet (3,726 m)] to 2009 [38,724 feet (11,803 m)]. Golden Eagle occupied mean nest distance increased for all wind energy developments between the years 1997-2000 and 2009, ranging from 18,585 to 82,342 feet (5,665 to 25,098 m). Few Bald Eagle nests existed during the study years; consequently, mean nest distance showed little to no trends (Table 4).

We tested for the effect of study Phase on mean occupied nest distance to nearest wind energy development for overall nests and for individual focal raptor species nests. There were no statistically significant differences between the three Phases for the mean occupied nest distance to nearest wind energy development area for overall nests (P=0.616, P=0.951, and P=0.622 for Phase I and Phase II, Phase I and Phase III, and Phase II and Phase III, respectively), or for the Ferruginous Hawk (P=0.410, P=0.240, and P=0.734 for Phase I and Phase II, Phase I and Phase III, and Phase II and Phase III, respectively), Golden Eagle (P=0.126, P=0.933, and

P=0.299 for Phase I and Phase II, Phase I and Phase III, and Phase II and Phase III, respectively), and Bald Eagle nests (P=0.610 for Phase II and Phase III).

Prey Availability

Lagomorphs

Lagomorph abundance was recorded along five 20-mile (32-km) routes for each year during Phase II and Phase III of the study. The number of white-tailed jackrabbits observed increased 78.8% from Phase II (n=50.33) to Phase III (n=90). Cottontail rabbit observed abundance was similar between Phase II (n=34.7) and Phase III (n=35; Table 5). The total lagomorphs per km for each route also showed no significant difference (P-value <0.10) between the two Phases, except the Simpson Ridge Route which recorded a significant increase (P-value=0.06) of total lagomorphs per km from Phase II (n=0.68) to Phase III (n=1.56; Table 4). Overall, there was no significant change of total lagomorphs per km during Phase II (n=0.53) and Phase III (n=0.78) of the study (Figures 3 and 13; Table 5).

Ground Squirrels

Ground squirrel abundance was determined by the percent of plots containing active burrows along six, 20-mile (32-km) routes. The average number of plots searched during Phase II (n=214.7) was similar to Phase III (n=245). The mean number of plots with active burrows decreased 14.3% from Phase II (n=151.7) to Phase III (n=130; Table 6). The percent of plots with active burrows significantly decreased (P-value <0.10) for each route from Phase II to Phase III, except the Wheatland Reservoir Route, which showed no significant change (P-value=0.24). The percent of plots with active ground squirrel burrows significantly decreased from Phase II (n=0.71) to Phase III (n=0.53; P-value <0.001; Figures 3 and 13; Table 6).

Prairie Dogs

Five prairie dog towns were surveyed to determine the number of active prairie dog burrows per acre. The mean length of transects surveyed during Phase II [59,078 feet (18,007 m)] was similar to Phase III [60,072 feet (18,310 m)]. The mean number of active burrows increased 21% from Phase II (n=213) to Phase III (n=257.8; Table 6). Three routes, Elk Mountain, Foote Creek Rim, and Raptor Point X, recorded significant (P-value <0.10) increases in prairie dog abundance from Phase II to Phase III. Fetterman Road and Fiddler’s Green Routes showed no significant change (P-value=0.32 and 0.90, respectively) from Phase II to Phase III (Table 6). The overall density of active prairie dog burrows significantly increased from Phase II (n=39.5) to Phase III (n=71.4; P-value=0.02; Figures 3 and 13; Table 6).

DISCUSSION

The objective of this study was to assess the potential change in species composition, number, and productivity of nesting raptors in an area of south central Wyoming subjected to increasing levels of wind energy development. Three raptor species, Ferruginous Hawk, Golden

Eagle, and Bald Eagle, were targeted because they are good indicators of overall environmental health and there is concern that they may be impacted by increased human activities. The study consisted of three phases (periods when surveys took place) over a 31-year period, and included 6 years of data collection. Phase I of the study included data collected during 1978, Phase II consisted of data from 1997-2000, and Phase III consisted of 2009 data.

Data were generally reported for all 6 years but, for the purposes of most of the analyses, we focused on the three primary time periods. The year 1978 represents a period with no wind energy development in the project area. The period 1997-2000 represents the period when much of the development was being constructed. Finally, 2009 provides data on the impacts of both new development since 2000 and the development that had occurred between 1997 and 2000.

Raptor Nest Densities and Reproduction Surveys

The number of occupied Golden Eagle nests decreased from Phase I through Phase III, with the largest decrease occurring between Phase I and Phase II. The Golden Eagle was the only focal raptor species to show decreases in production per occupied nests through the three Phases. The decreasing Golden Eagle population trends, such as number of occupied nests and production, is consistent with trends witnessed throughout the western United States, specifically in the Bird Conservation Regions 9, 10, 16, and 17 (Nielson et al. 2010). The large change in nest densities between Phase I and Phase II suggests that factors independent of wind development in this region may be contributing to the decline. At the APWRA, almost no breeding-age birds are killed at the project. Most of the fatalities are sub-adults and floaters (non-breeding adult birds). In addition, even with these annual fatalities recorded over a 15-year period at the site, the regional population was estimated to be stable (Hunt 2002). In addition, recent raptor nest surveys continue to show all territories near the project to be occupied by breeding Golden Eagles (100% occupancy, Hunt and Hunt 2006). If there is a delayed impact on the floating population, it has not been shown in the 20 years of operation. However, some have suggested that the APWRA may have had breeding territories within the wind resource boundary prior to the development in the early 1980s, and those territories may have been lost.

Bald Eagle populations in Wyoming have experienced an increase in nesting pairs, productivity, and distribution over the last 15 years (Travsky and Beauvais 2004). Range-wide Bald Eagle nesting populations have increased at an average rate of about eight percent per year, ranging from 417 nesting pairs in 1963 to 6,471 nesting pairs in 2000 (Travsky and Beauvais 2004). This trend is also observed in Wyoming, recording 20 Bald Eagle pairs producing 13 young in 1978 and increasing to 97 Bald Eagle pairs producing 85 young during 1999 (Patla et al. 2000). Bald Eagle nesting and productivity within the study area showed similar results, increasing from Phase I through Phase III.

There is very little hard data on Ferruginous Hawk trends in Wyoming, but it is generally accepted that Ferruginous Hawks are widespread and somewhat common across the state (Travsky and Beauvais 2005). The number of nesting Ferruginous Hawks within the study area increased through the three Phases. Productivity per occupied and successful Ferruginous Hawk nest was lower during Phase III than during Phase II. However, there was no significant decline in Ferruginous Hawk production between Phase II and Phase III.

Prey Availability

To assess prey population changes from Phase II to Phase III, we developed an index to relative abundance of rabbits, ground squirrels, and prairie dogs. In general, except for ground squirrels, there were no trends observed in prey availability over the two Phases of study where these surveys were conducted. Cottontail rabbits were similar during Phase II and Phase III, but white-tailed jackrabbits increased from Phase II to Phase III. However, there was no significant change in lagomorphs per km from Phase II to Phase III. The percent of plots with active ground squirrel burrows showed a significant decline from Phase II to Phase III, and prairie dogs recorded an increase in number of active burrows per hectare from Phase II to Phase III.

The effects of the changes in prey availability on the raptor nesting parameters are poorly understood. There is evidence that sylvatic plague has affected prairie dog colonies in and around the study area, and that the jackrabbit population crashed in 1993 and has not returned to the level prior to the population decline (B. Oakleaf, Department, personal communication). These types of prey abundance changes would most likely affect Golden Eagle reproduction, and could be influencing the study results. A decrease in ground squirrels in general may affect Ferruginous Hawk production; however, no significant changes in occupied nests and production for Ferruginous Hawks were noted from Phase II to Phase III when the ground squirrels apparently declined.

Summary of Patterns Related to Wind Energy Impacts

Since the early 1980s, total wind energy development within the study area (using project boundaries) has increased from 2 to 39.5 miles^2 (5 to 102 km^2; 3.2% of the study area) consisting of four operating wind energy facilities which were completed prior to the 2009 raptor nest survey. Medicine Bow, Foote Creek Rim, Rock River I, and Seven Mile Hill wind energy facilities were all included in the analysis. Two additional projects, High Plains and McFadden Ridge I, located immediately adjacent to each other, were constructed in the summer of 2009 (see Appendix A), and were not included in this analysis. Our objective was to begin to understand possible patterns in population trends in relation to the progression of wind energy development within the study area. It appears that large drops in nesting density had occurred from 1978 to the period when many of the developments had occurred (late 1990s) unrelated to wind development. Since the late 1990s, the nest densities have stabilized. Nest density was similar between pre-development years and post-development years. Mean occupied nest distance to nearest wind energy development followed similar trends as the density analysis. The mean distance was similar between pre-development years and post-development years.

Overall, no large apparent effects in the nest occupancy and production have been observed in the overall study areas and in the areas near the wind projects for all focal species combined and for the individual focal species. These results are consistent with some site specific studies (Hunt 2002, Erickson et al. 2004, Hunt and Hunt 2006). Nesting densities for sensitive raptor species (Ferruginous Hawk and Swainson's Hawk) and common *Buteo* raptor species within 1 mile (1.6 km) of the Stateline wind facilities was slightly higher the 2 years after operations began than the year prior to construction (Erickson et al. 2004).

The longer term and cumulative impacts from the wind energy facilities (displacement or longer-term mortality) are still unknown. In addition, the analyses in this report focus on large scale changes in nesting throughout the project site. Most of the projects are generally in areas of low raptor nest density. Small scale effects, such as displacement of nests in close proximity to turbines, were not the focus of the surveys or the analysis. The current level of development in the study area is still relatively low. The effect of higher densities of development, which increases the mortality risk and may increase the level of displacement, is not currently understood. Areas with high nesting densities identified during these studies may be areas to consider for avoidance or minimization of development. It is recommended that these surveys are repeated every 5 years or so to be able to detect trends in these parameters. These focal raptor species continue to nest in areas near these projects.

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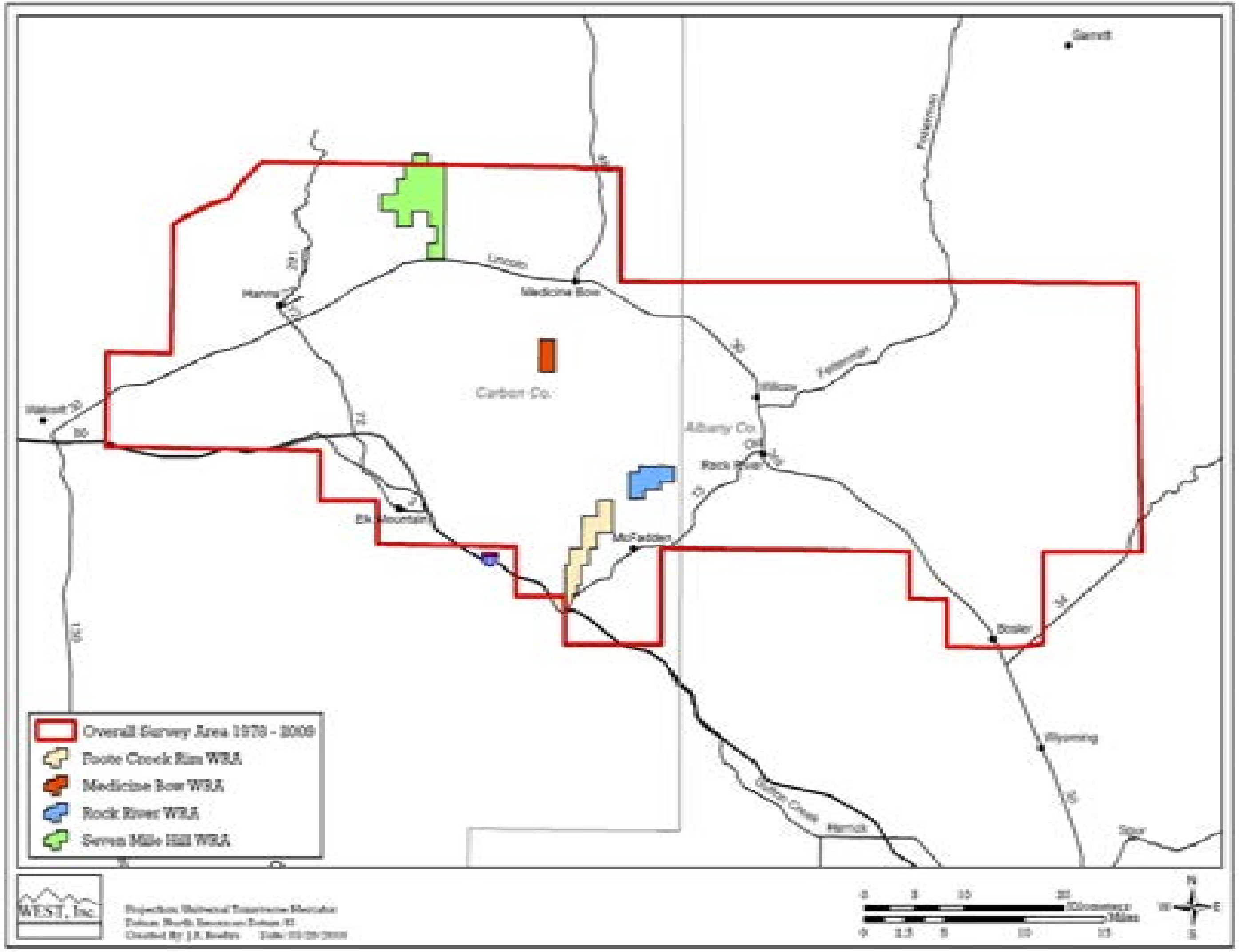

Figure 1. Raptor nest study area that is consistent for all 6 years and three Phases from 1978, 1997-2000, and 2009, including the Simpson Ridge, Seven Mile Hill, Foote Creek Rim, Rock River I, High Plains, and Medicine Bow wind energy development areas.

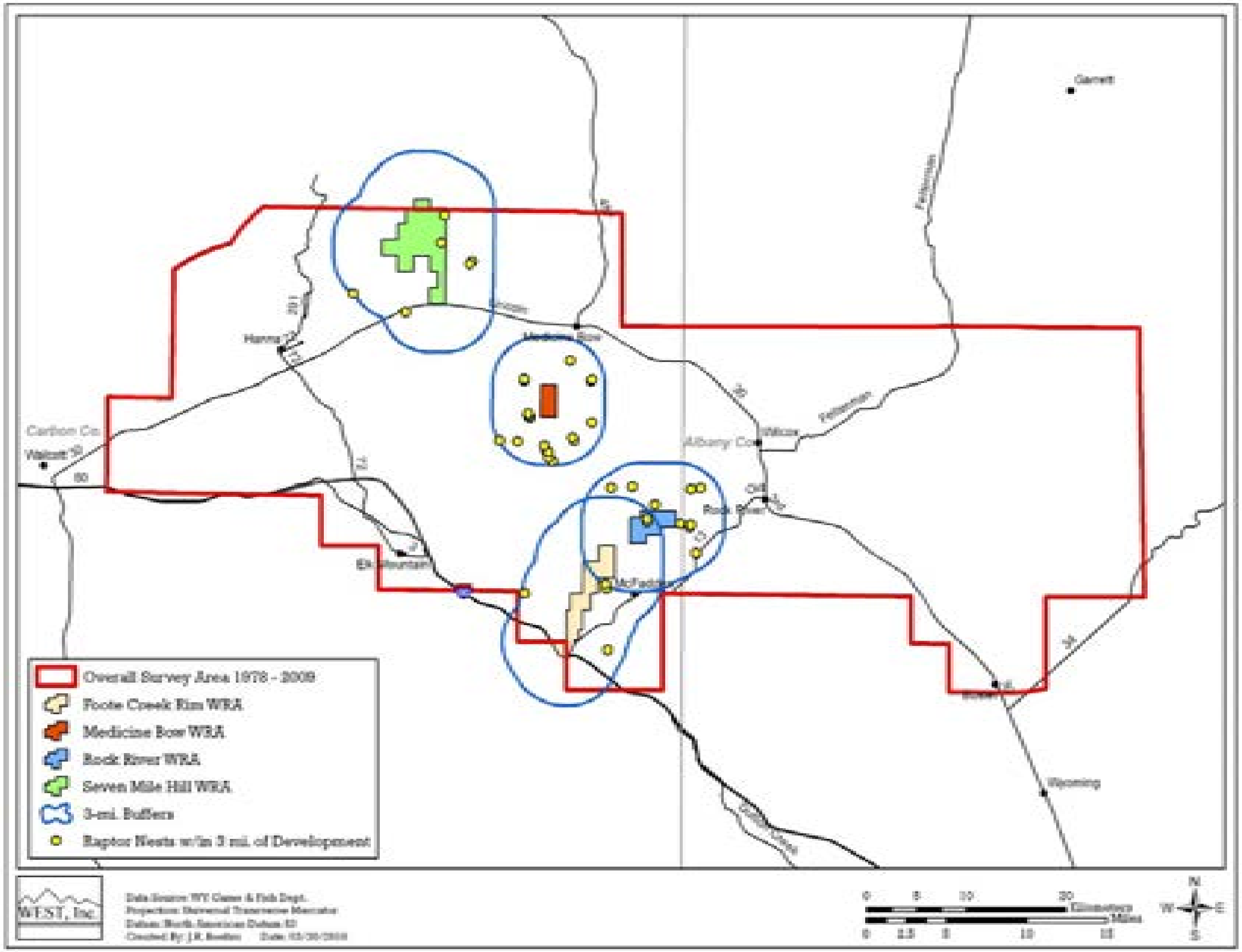

Figure 2. Occupied raptor nests located within three miles of Foote Creek Rim, Medicine Bow, Rock River, and Seven Mile Hill wind energy developments.

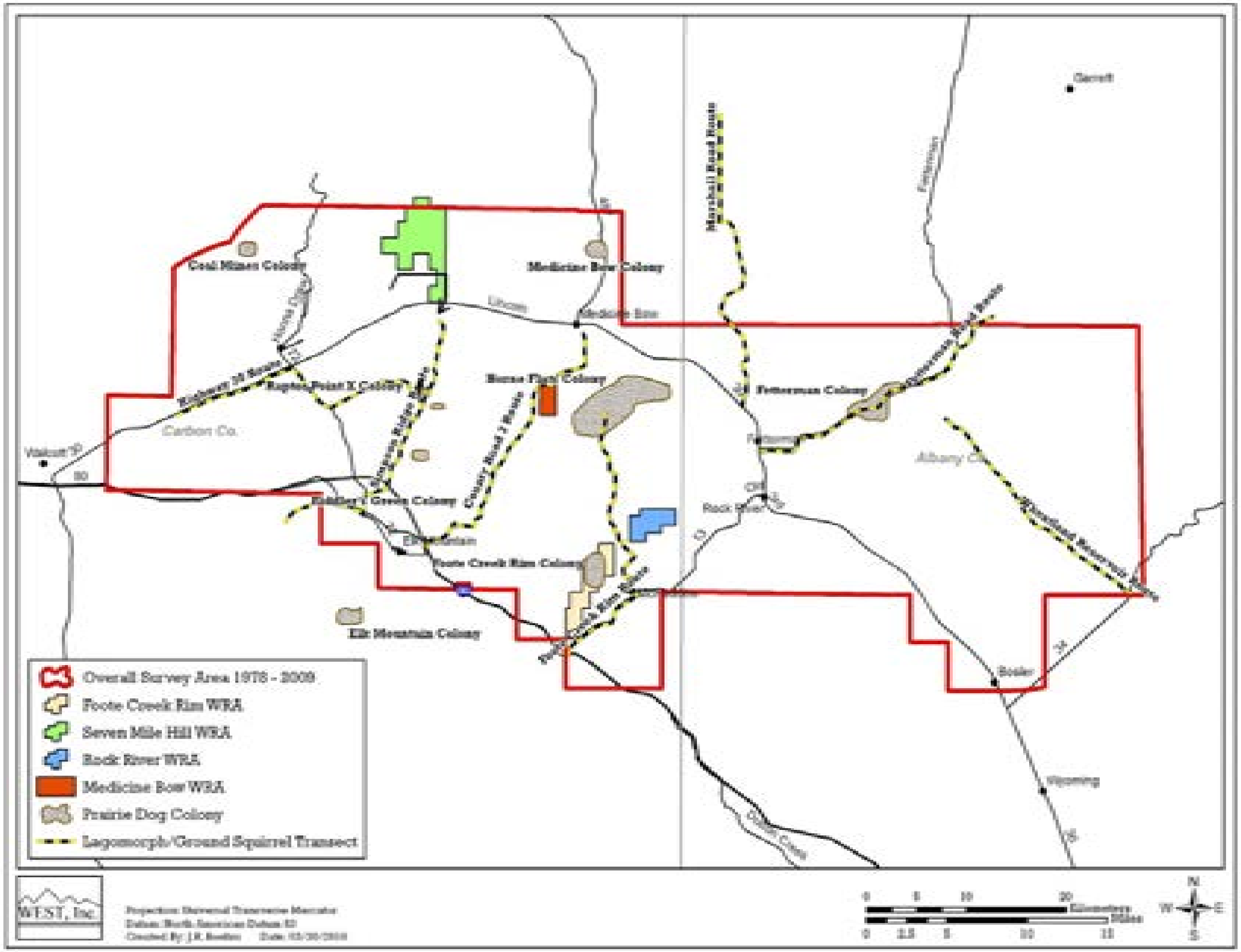

Figure 3. Location of lagomorph and ground squirrel transects and prairie dog town surveys within the study area.

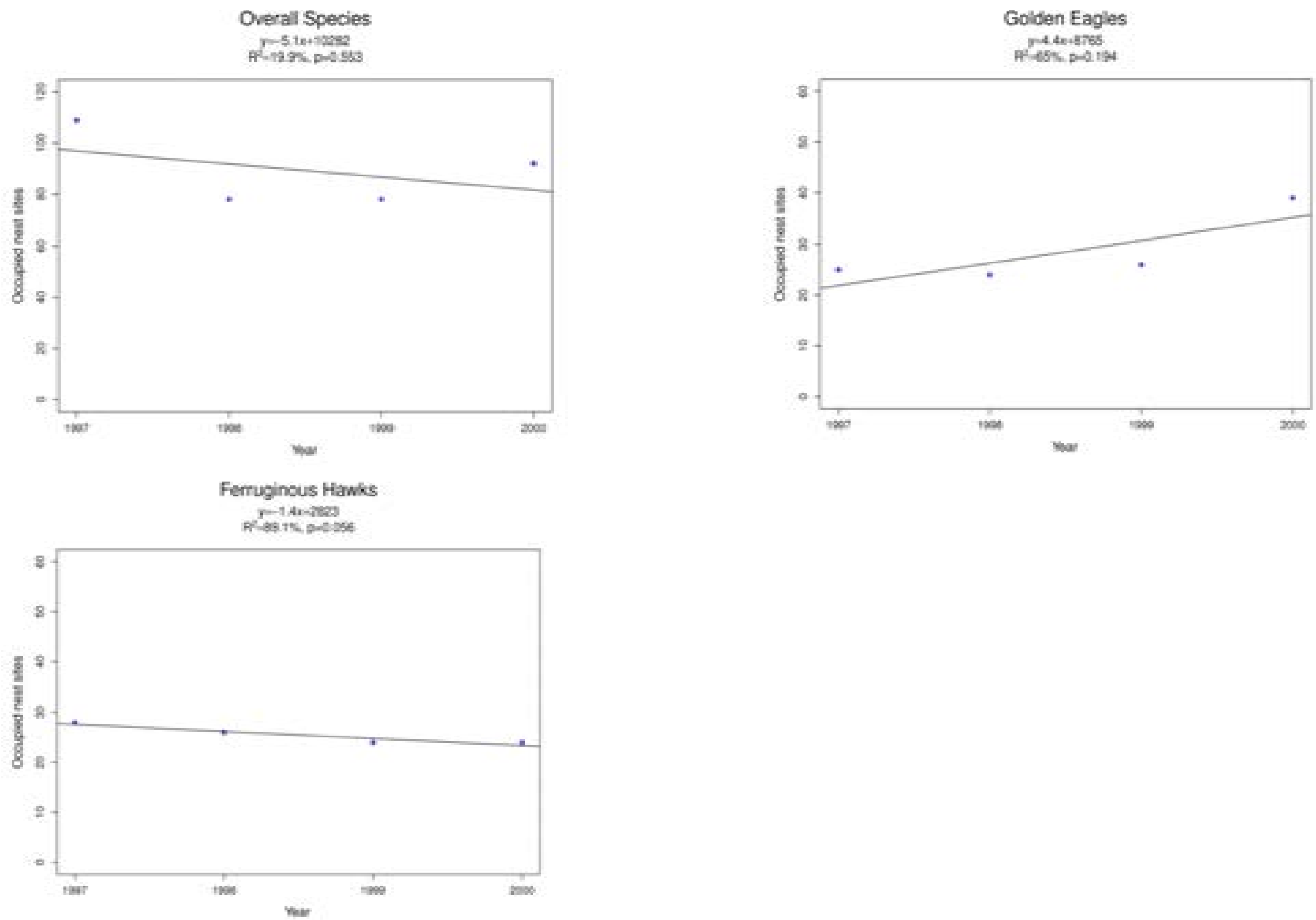

Figure 4. Trends in the number of occupied nests in the study area during the Phase II period.

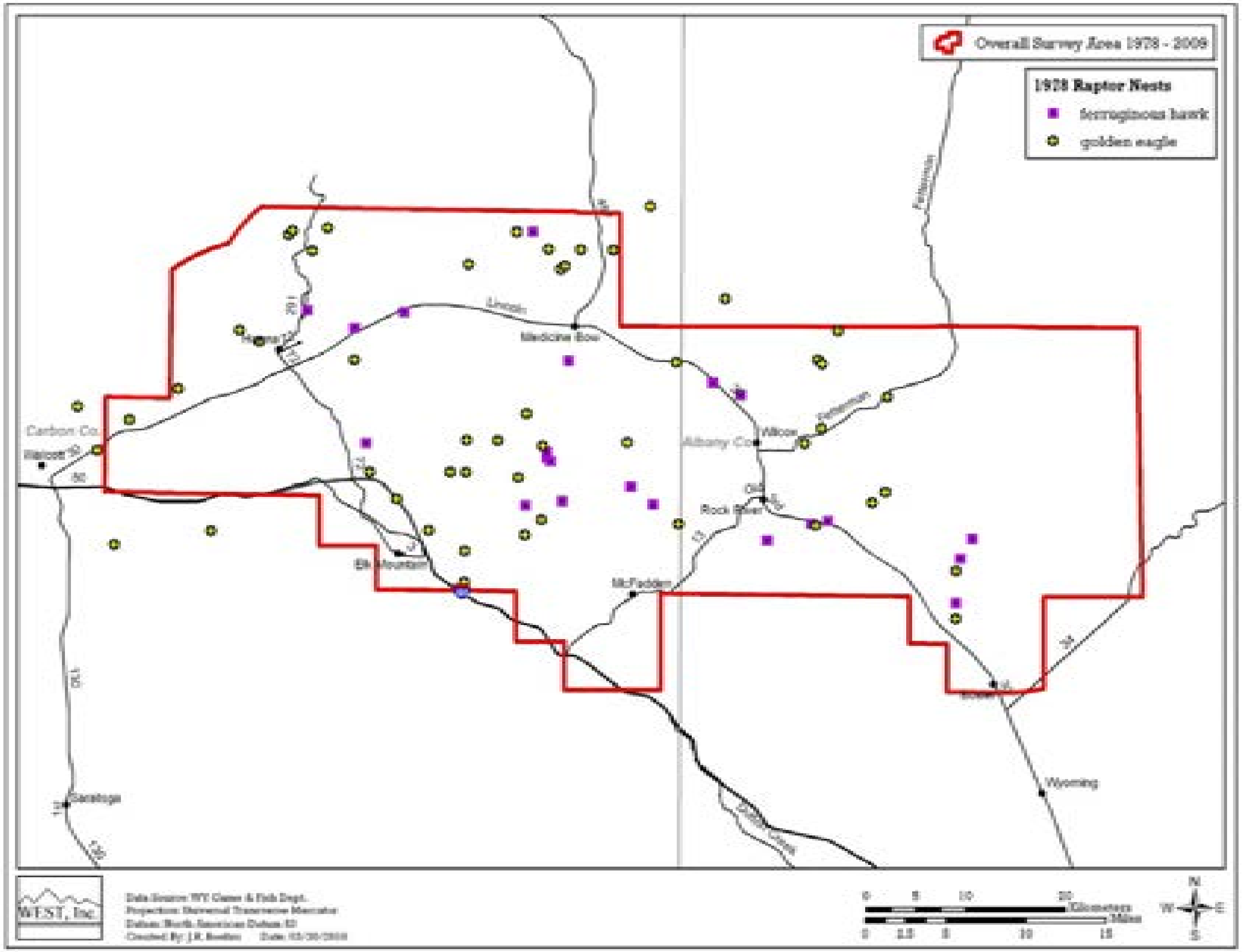

Figure 5. Occupied raptor nests observed during the 1978 survey with the progression of wind energy development.

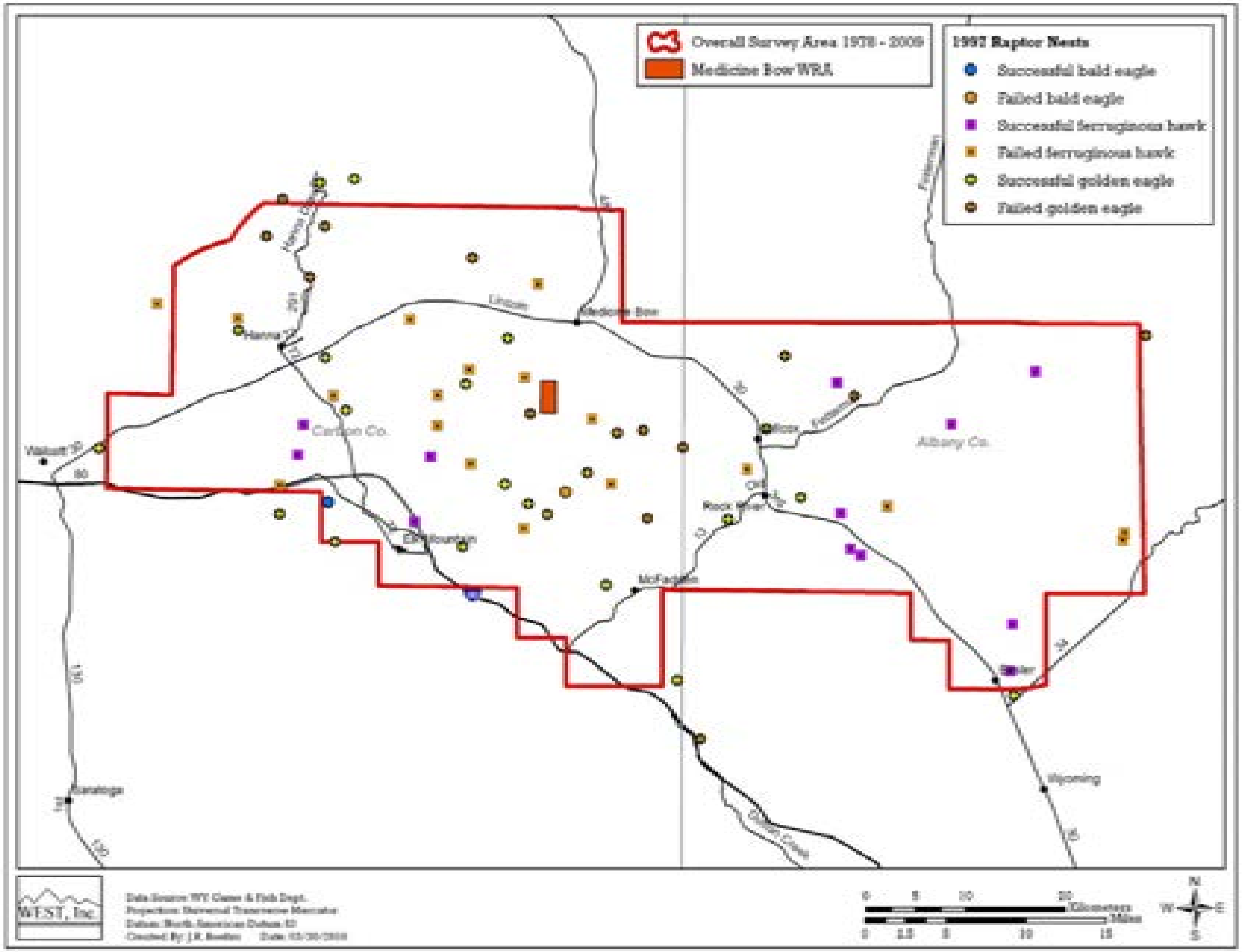

Figure 6. Occupied raptor nests and nest fate observed during the 1997 survey with the progression of wind energy development.

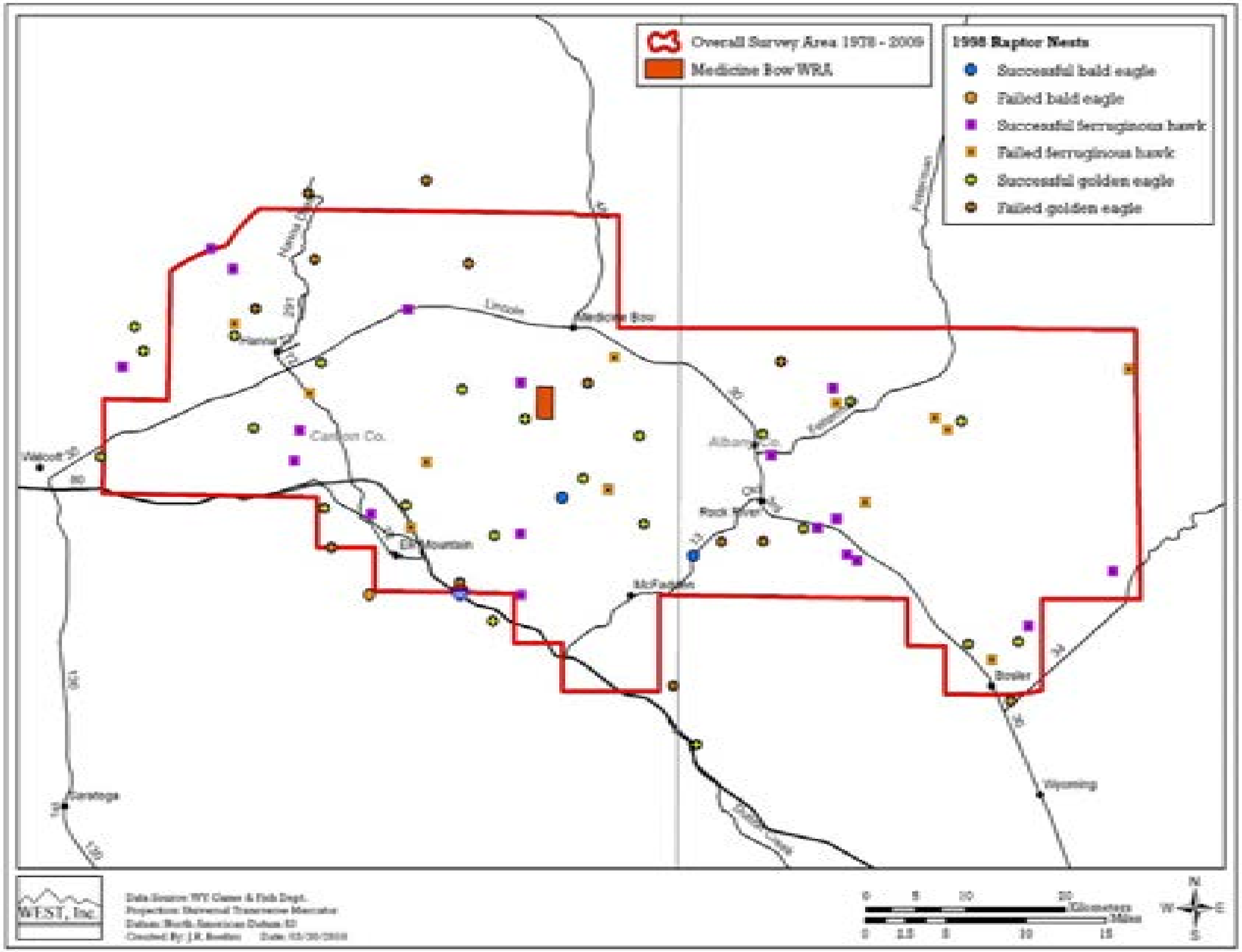

Figure 7. Occupied raptor nests and nest fate observed during the 1998 survey with the progression of wind energy development.

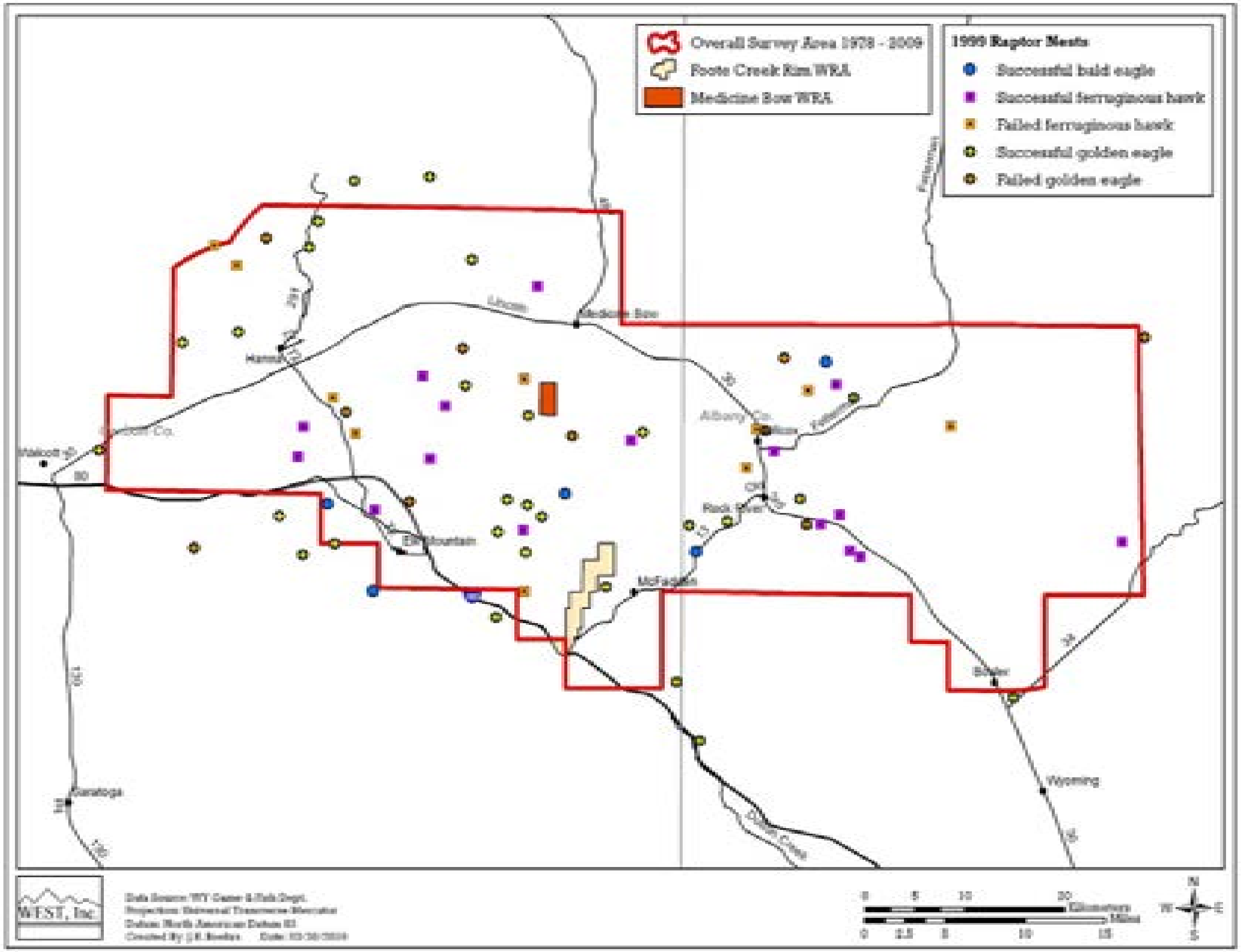

Figure 8. Occupied raptor nests and nest fate observed during the 1999 survey with the progression of wind energy development.

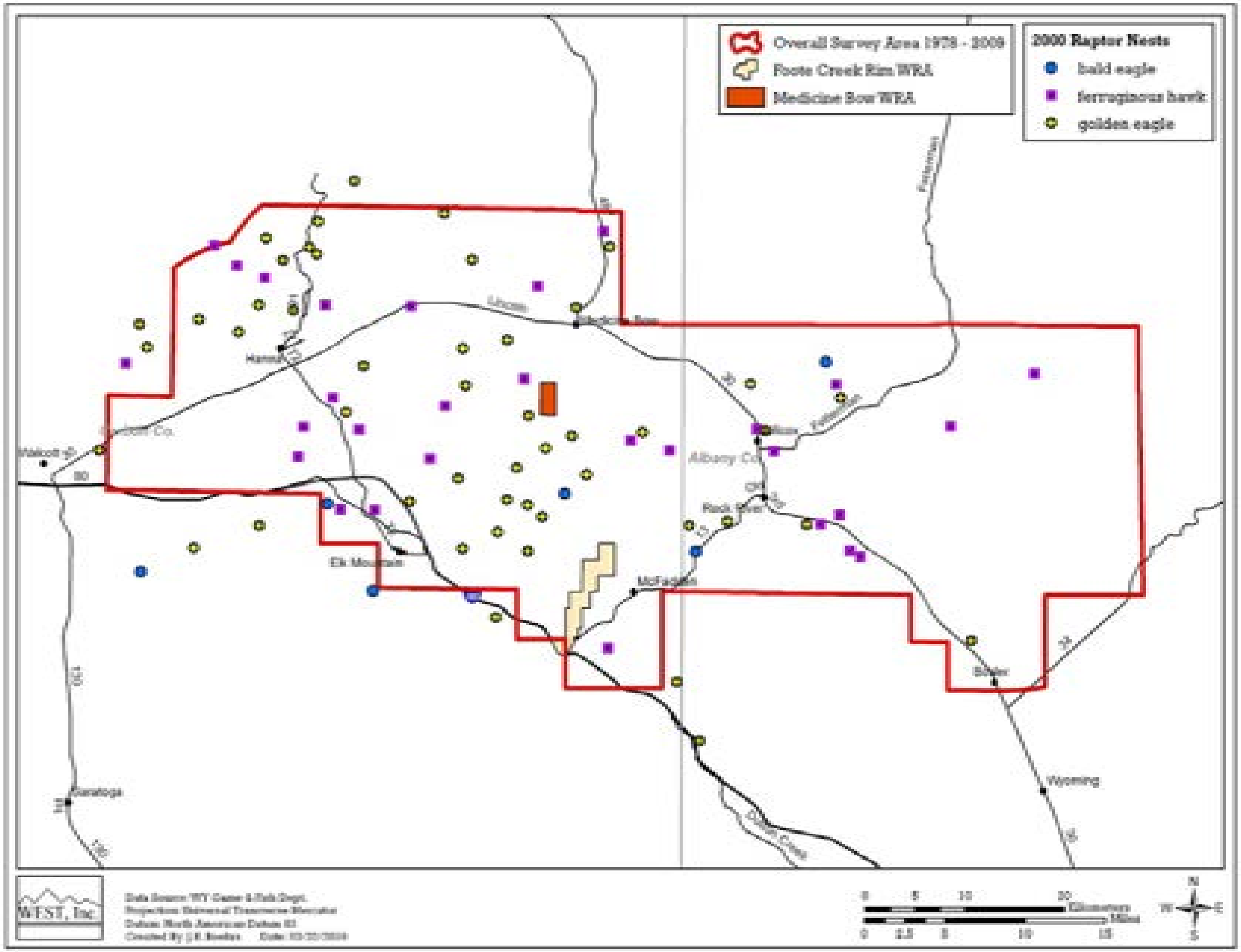

Figure 9. Occupied raptor nests observed during the 2000 survey with the progression of wind energy development.

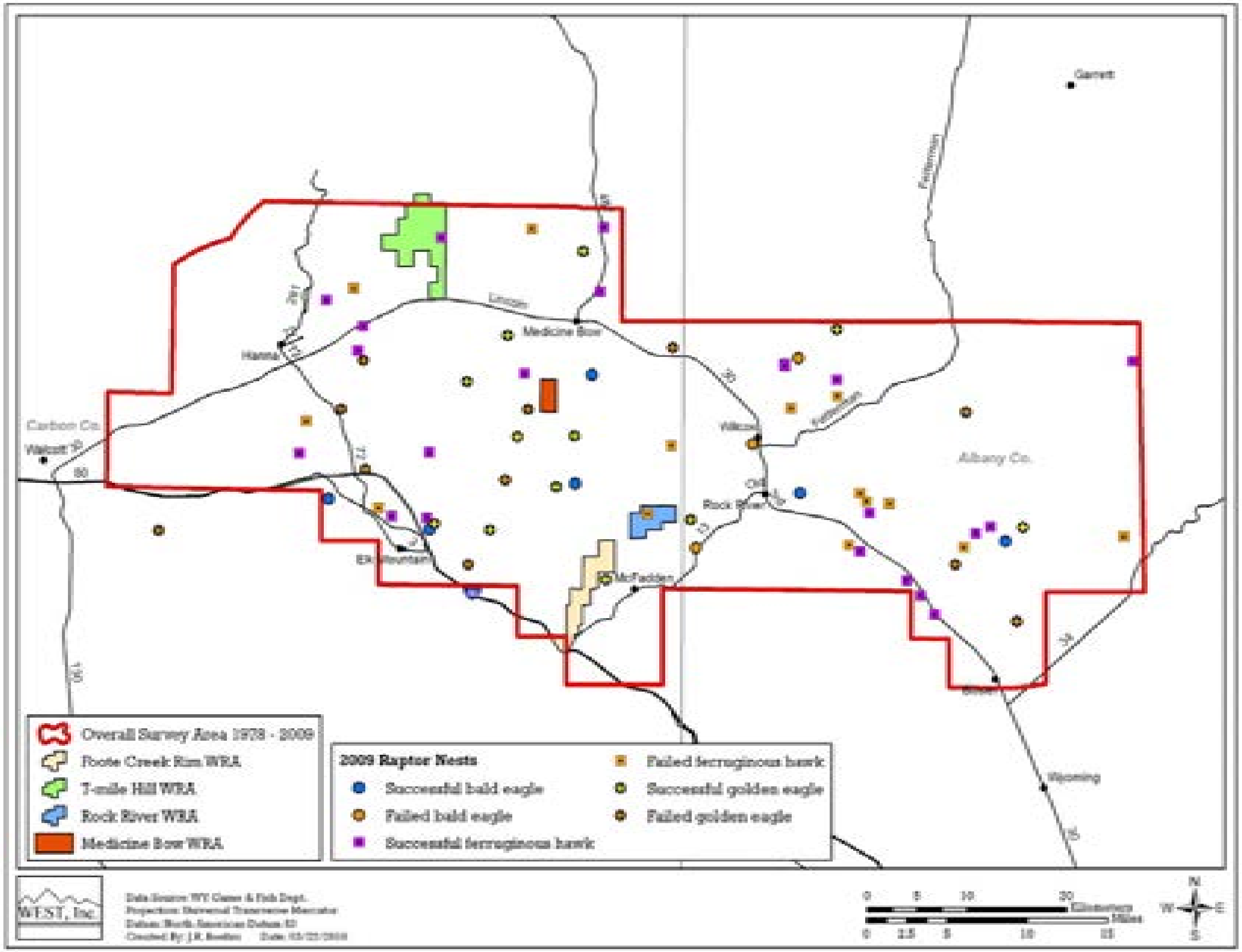

Figure 10. Occupied raptor nests and fates observed during the 2009 survey with the progression of wind energy development.

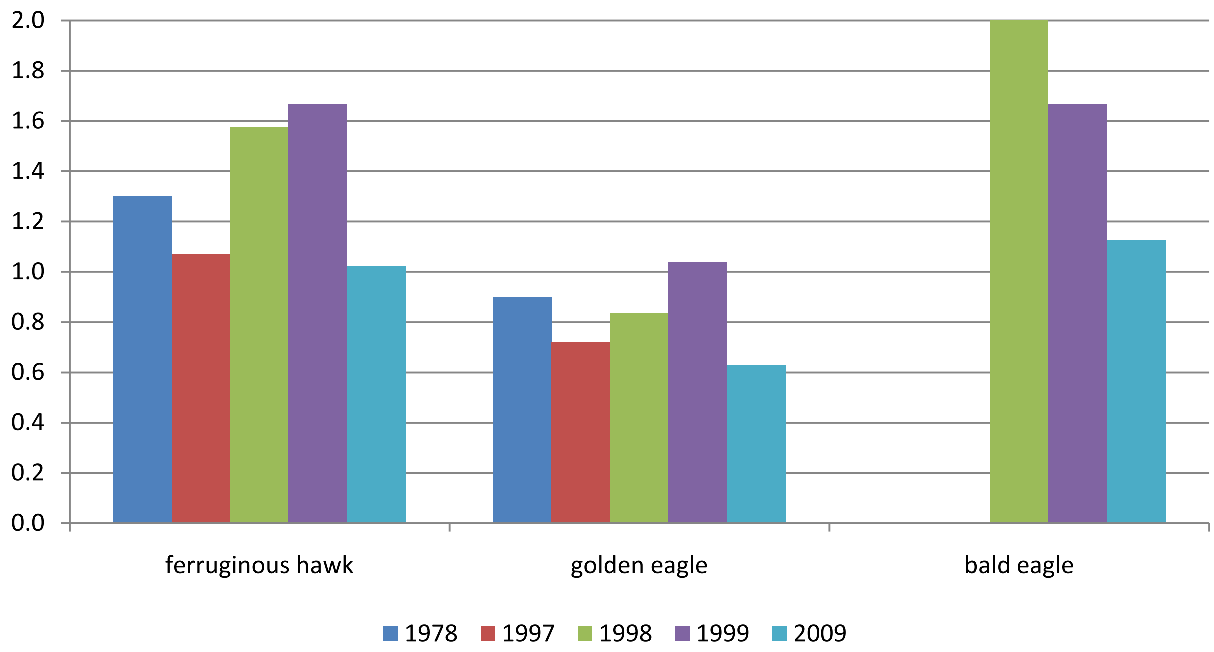

Figure 11. Calculated number of young fledged per occupied nest checked within the study area during the years 1978, 1997-1999, and 2009.

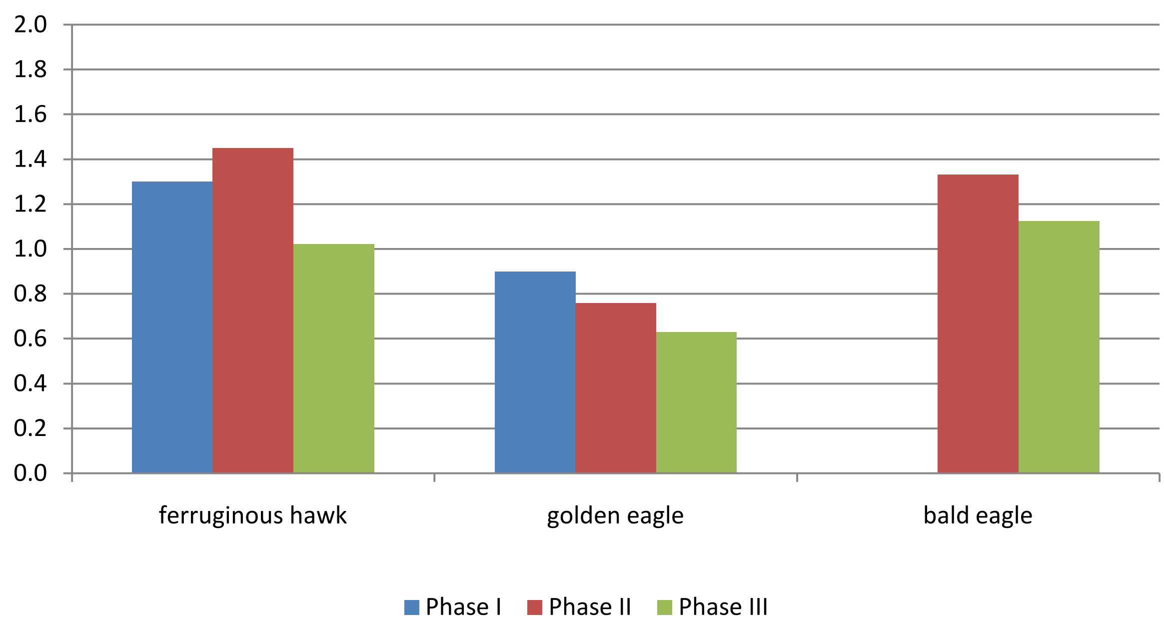

Figure 12. Calculated number of young fledged per occupied nest checked within the study area during Phases I, II, and III.

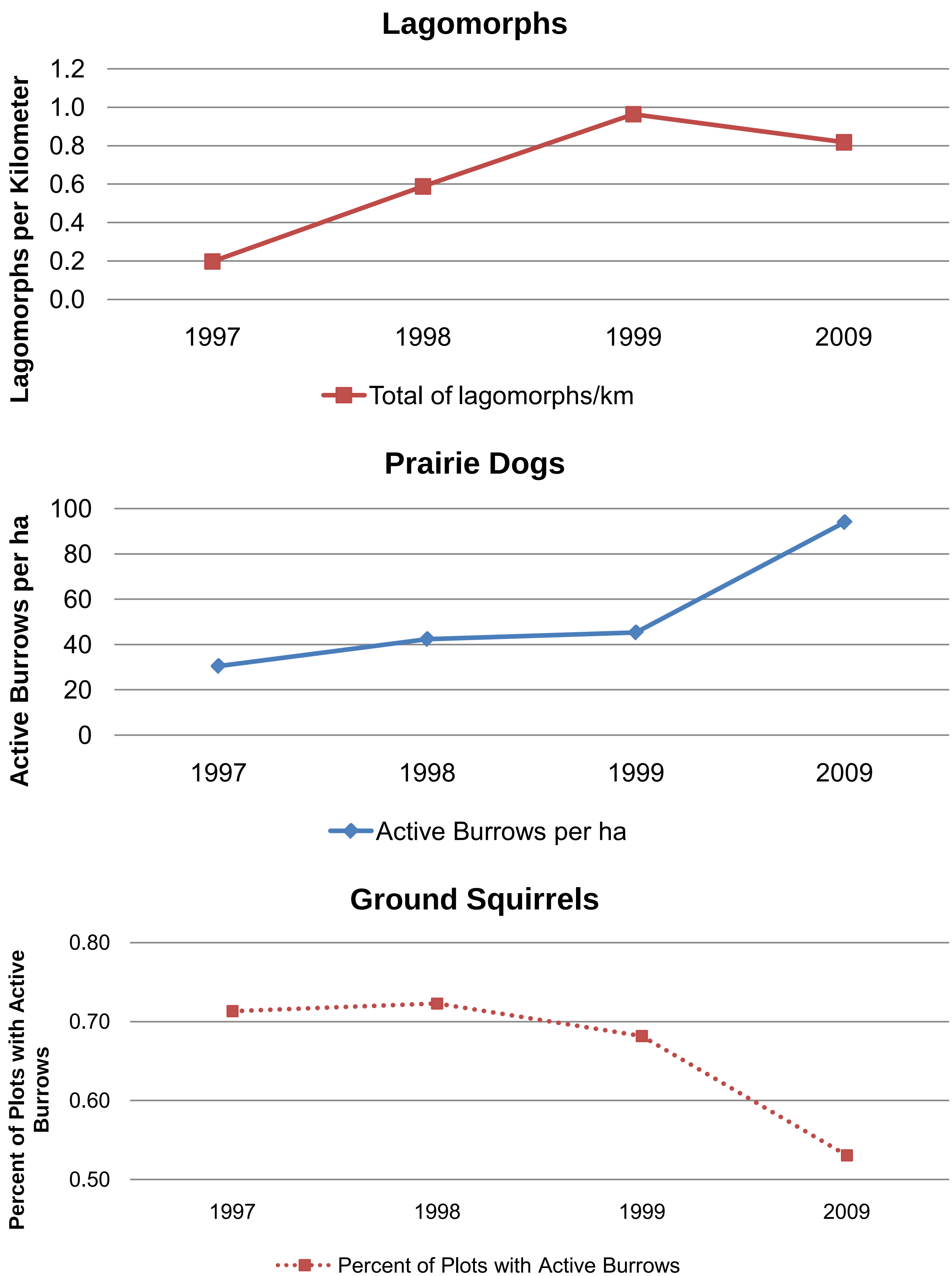

Figure 13. Prey availability within the study area during the years 1997-1999 and 2009.

Table 1. Occupied nests and productivity of focal raptor species within the study area for the years 1978, 1997-2000, and 2009.

Species	Occupied Nest	Successful Nest	Fledged Young	Productivity of Successful Nests*	Productivity of Occupied Nests*
1978					
Ferruginous Hawk	22	n/a	n/a	2.6	1.3
Golden Eagle	50	n/a	n/a	1.1	0.9
Bald Eagle	0	n/a	n/a	0	0
Prairie Falcon	21	n/a	n/a	n/a	n/a
*Productivity was determined from a limited number of nests (Oakleaf 1978)					
1997					
Ferruginous Hawk	28	12	30	2.5	1.1
Golden Eagle	25	14	18	1.3	0.7
Bald Eagle	1	0	0	0	0
Prairie Falcon	12	n/a	n/a	n/a	n/a
Red-tailed Hawk	43	n/a	n/a	n/a	n/a
1998					
Ferruginous Hawk	26	14	41	2.9	1.6
Golden Eagle	24	16	20	1.3	0.8
Bald Eagle	2	2	4	2	2
Prairie Falcon	7	n/a	n/a	n/a	n/a
Red-tailed Hawk	19	n/a	n/a	n/a	n/a
1999					
Ferruginous Hawk	24	15	40	2.7	1.7
Golden Eagle	26	18	27	1.5	1
Bald Eagle	3	3	5	1.7	1.7
Prairie Falcon	4	n/a	n/a	n/a	n/a
Red-tailed Hawk	21	n/a	n/a	n/a	n/a
2000*					
Ferruginous Hawk	24	n/a	n/a	n/a	n/a
Golden Eagle	39	n/a	n/a	n/a	n/a
Bald Eagle	3	n/a	n/a	n/a	n/a
Prairie Falcon	6	n/a	n/a	n/a	n/a
Red-tailed Hawk	20	n/a	n/a	n/a	n/a
*Nest fate was not determined for the year 2000					
2009					
Ferruginous Hawk	44	20	45	2.3	1
Golden Eagle	27	12	17	1.4	0.6
Bald Eagle	8	5	9	1.8	1.1
Prairie Falcon	30	n/a	n/a	n/a	n/a
Red-tailed Hawk	16	n/a	n/a	n/a	n/a

Table 2. Occupied nests and productivity of focal raptor species within the study area for Phases I, II, and III.

Phase I 1978					
Species	**Occupied Nest**	**Successful Nest**	**Fledged Young**	**Productivity of Successful Nests***	**Productivity of Occupied Nests***
Ferruginous Hawk	22	n/a	n/a	2.6	1.3
Golden Eagle	50	n/a	n/a	1.1	0.9
Bald Eagle	0	n/a	n/a	0	0
Prairie Falcon	21	n/a	n/a	n/a	n/a
*Productivity was determined from a limited number of nests (Oakleaf 1978).					
Phase II 1997-2000					
Species	**Occupied Nest**	**Successful Nest**	**Fledged Young**	**Productivity of Successful Nests***	**Productivity of Occupied Nests***
Ferruginous Hawk	25.5	13.7	37	2.7	1.5
Golden Eagle	28.5	16	21.7	1.4	0.8
Bald Eagle	2.3	1.7	3	1.8	1.3
Prairie Falcon	7.3	n/a	n/a	n/a	n/a
Red-tailed Hawk	25.8	n/a	n/a	n/a	n/a
*Productivity does not include data from 2000.					
Phase III 2009					
Species	**Occupied Nest**	**Successful Nest**	**Fledged Young**	**Productivity of Successful Nests**	**Productivity of Occupied Nests**
Ferruginous Hawk	44	20	45	2.3	1
Golden Eagle	27	12	17	1.4	0.6
Bald Eagle	8	5	9	1.8	1.1
Prairie Falcon	30	n/a	n/a	n/a	n/a
Red-tailed Hawk	16	n/a	n/a	n/a	n/a

Table 3. Occupied nest density of Ferruginous Hawk, Golden Eagle, and Bald Eagle within a three mile buffer of each wind energy development occurring within the study area for years 1978, 1997-2000, and 2009. Shading denotes pre-development years.

Development Area	1978		1997		1998		1999		2000		2009	
	Nests	Density	Nests	Density	Nests	Density	Nests	Density	Nests	Density	Nests	Density
Medicine Bow	7	0.32	3	0.14	3	0.14	3	0.14	4	0.18	5	0.23
Foote Creek Rim	0	0	2	0.06	2	0.06	2	0.06	1	0.03	2	0.06
Rock River	3	0.12	2	0.08	3	0.12	2	0.08	2	0.08	6	0.25
Seven Mile	2	0.06	1	0.03	1	0.03	1	0.03	2	0.06	2	0.06
Overall	12	0.11	8	0.07	9	0.08	8	0.07	9	0.08	15	0.13

Table 4. Mean distance (m) of occupied Ferruginous Hawk, Golden Eagle, and Bald Eagle nests to the nearest wind energy development area within the study area for years 1978, 1997-2000, and 2009. Shading denotes pre-development years.

Ferruginous Hawk, Golden Eagle, and Bald Eagle

Development Area	1978	1997	1998	1999	2000	2009
Medicine Bow	9,571	7,379	8,106	7,391	7,611	9,215
Foote Creek Rim	8,951	6,410	7,355	5,817	7,018	9,209
Rock River	17,357	19,259	19,893	15,138	14,852	20,889
Seven Mile	15,099	12,829	14,025	12,202	11,185	12,554

Ferruginous Hawk

Development Area	1978	1997	1998	1999	2000	2009
Medicine Bow	3,726	9,571	9,257	7,680	7,680	11,803
Foote Creek Rim	6,783	6,660	5,581	5,581	3,113	N/A
Rock River	15,639	25,736	24,147	18,081	17,320	20,774
Seven Mile	8,329	15,758	16,629	14,018	13,948	10,357

Golden Eagle

Development Area	1978	1997	1998	1999	2000	2009
Medicine Bow	11,130	5,665	6,954	7,217	7,592	7,712
Foote Creek Rim	9,818	6,456	9,818	5,879	8,007	8,596
Rock River	18,678	9,903	15,951	11,445	12,414	25,098
Seven Mile	17,488	9,901	11,854	10,614	9,409	17,387

Bald Eagle

Development Area	1978	1997	1998	1999	2000	2009
Medicine Bow	N/A	N/A	N/A	N/A	N/A	3,547
Foote Creek Rim	N/A	5,978	5,978	5,978	5,978	10,741
Rock River	N/A	N/A	3,387	12,248	12,248	15,571
Seven Mile	N/A	N/A	N/A	N/A	N/A	N/A

Table 5. Lagomorphs/km by road during prey availability surveys conducted during Phase II and Phase III.

Route Identification	Phase II (1997-1999)			Phase III (2009)			Difference of the Means (90% CI)	t-Statistic (P-value)
	Number of WTJR	Number of CORA	Total Lagomorphs /km	Number of WTJR	Number of CORA	Total Lagomorphs /km		
County Road 3	6.33	8.67	0.47	6	0	0.19	-0.28 (-0.18-0.74)	1.79 (0.215)
Fetterman Road	11	4.67	0.49	12	6	0.56	0.06 (-0.61 – 0.48)	-0.36 (0.755)
Foote Creek Rim	21.67	3.33	0.78	30	11	1.28	0.50 (-1.27 – 0.27)	-1.90 (0.198)
Hwy. 30	4	3.67	0.24	9	1	0.31	0.07 (-0.37 – 0.23)	-0.67 (0.571)
Simpson Ridge	7.33	14.33	0.68	33	17	1.56	0.88 (-1.51 - -0.25)	-4.06 (0.056)
All Routes	*50.33*	*34.67*	*0.53*	*90*	*35*	*0.78*	*0.25 (-0.75-0.26)*	*-1.43 (0.284)*

Table 6. Ground squirrels (percent of plots with active burrows) by road during prey availability surveys conducted during Phase II and Phase III.

Route Identification	Phase II (1997-1999)			Phase III (2009)			Difference of the means (90% CI)	t-Statistic (P-value)
	Number of Plots with Active Burrows	Number of Plots searched	Percent of Plots with Active Burrows	Number of Plots with Active Burrows	Number of Plots searched	Percent of Plots with Active Burrows		
County Road 3	28.67	39.33	0.73	23	40	0.58	-0.15 (0.01 – 0.30)	1.75 (0.081)
Fetterman Road	34	40.33	0.84	29	41	0.71	-0.14 (0.01 – 0.26)	1.73 (0.083)
Foote Creek Rim	24	37.33	0.64	13	41	0.32	-0.33 (0.18 – 0.47)	3.80 (<0.001)
Hwy. 30	18.67	32.67	0.57	11	41	0.27	-0.30 (0.16 – 0.44)	3.55 (<0.001)
Simpson Ridge	29.33	41	0.72	21	41	0.51	-0.20 (0.06 – 0.35)	2.31 (0.021)
Wheatland Res.	17	24	0.71	33	41	0.80	0.10 (-0.23 – 0.04)	-1.18 (0.238)
All Routes	*151.67*	*214.67*	*0.71*	*130*	*245*	*0.53*	*-0.18 (0.12 – 0.24)*	*4.81 (<0.001)*

Table 7. Prairie dogs (active burrows per ha) by town during prey availability surveys conducted during Phase II and Phase III.

Prairie Dog Town	Phase II (1997-1999)			Phase III (2009)			Difference of the Means (90% CI)	t-Statistic (P-value)
	Number of Active Burrows	Mean Length of Transects (m)	Active Burrows per ha	Number of Active Burrows	Length of Transects (m)	Active Burrows per ha		
Elk Mountain	56.67	3630	51.93	152	4000	126.67	74.74 (93.16 - 56.32)	-11.85 (0.007)
Fetterman Road	102.67	2995	113.61	154	3600	142.59	28.98 (93.70 - 35.75)	-1.31 (0.321)
Fiddler's Green	1.67	1822	3.09	1	1250	2.67	-0.42 (-8.60 - 9.43)	0.13 (0.905)
Foote Creek Rim	51.67	8111	21.24	78	8110	70.27	49.03 (66.91 - 31.15)	-8.01 (0.015)
Raptor Point X	0.33	1450	0.68	7	1350	17.28	16.61 (18.56 - 14.67)	-24.92 (0.002)
All Towns	*213*	*18007*	*39.45*	*257.75*	*18310*	*71.36*	*31.91 (45.15 - 18.67)*	*-7.04 (0.020)*

APPENDIX A – SOUTHEASTERN WYOMING WIND ENERGY DEVELOPMENT

Southeastern Wyoming has excellent wind resources and has been experiencing increasing wind energy development over the past 15 years (Figure 1). The first wind energy development, Medicine Bow Wind Turbines (MBWT), occurred during the late 1970s to early 1980s about 6 miles (10 km) southwest of Medicine Bow, Wyoming. Following the MBWT, Foote Creek Rim Wind Project (FCR) became operational in April 1999, delivering the first commercial wind power in Wyoming. Just to the northeast of FCR, Rock River I Wind Farm (RRI) became operational in November 2001. Seven years after completion of RRI, Seven Mile Hill Wind Farm (SMH) became operational in December 2008. The most recent wind development in this region has occurred near the towns of Rock River and McFadden. High Plains Wind Energy Facility (HP) became operational in September 2009 and was followed by McFadden Ridge I (MRI), also in September 2009. In addition, there are two proposed wind energy projects in the Medicine Bow/Rock River area, with construction projected to begin in 2011 and 2012.

Existing Wind Energy Facilities

Medicine Bow Wind Turbines

In the late 1970s and early 1980s, two turbines were built as part of an alternative energy research project headed by the U.S. Department of Energy Bureau of Reclamation. Platte River Power Authority (PRPA) took over all assets of the MBWT in the spring of 1998. During the fall of 1999 and summer of 2000, two 0.60 MW and seven 0.66 MW Vesta turbines were constructed and became operational. In 2005, PRPA leased land to Clipper Wind Power to install and operate a single 2.5 MW prototype turbine. Currently, there are 10 turbines operational at this 1,290 acre (522 ha) facility.

Foote Creek Rim Wind Project

Wyoming's first commercial wind energy facility, FCR, became operational on 22 April 1999. Four subsequent phases have followed the original construction unit of the wind project. Phase I through Phase III became operational during 199, consisting of 105 turbines. The final Phase IV, consisting of 28 turbines, became operational in 2000. FCR currently consists of 133 turbines capable of producing 84.8 MW. The facility is located in Carbon County, north of Interstate-80 near the town of Arlington, Wyoming, and encompasses approximately 5,114 acres (2,070 ha).

Rock River I Wind Farm

Located immediately north and adjacent to FCR, the RRI became operational on 9 November 2001. RRI consists of 50 turbines capable of producing 50 MW, becoming the first facility in the U.S. to operated one MW turbines. Owned by Shell Wind Energy, Inc., RRI became Shell's first commercial scale wind energy facility, and encompasses approximately 2,646 acres (1,071 ha).

Seven Mile Hill Wind Farm

In December 2008, 6 years after completion of RRI, PacifiCorp completed construction of SMH, a 79 turbine facility capable of producing 118.5 MW of power. SMH is located north of U.S. Highway 30 and between the towns of Medicine Bow and Hanna, Wyoming, and encompasses approximately 5,654 acres (2,288 ha).

High Plains Wind Farm

High Plains Wind Farm, owned by PacifiCorp, started construction in July 2009 and became operational on 13 September 2009. This facility uses 66 (1.5 MW) turbines capable of producing 99 MW. HP is located south of the town of Rock River and near the town of McFadden, Wyoming, and encompasses approximately 10,567 acres (4,276 ha).

McFadden Ridge I Wind Farm

McFadden Ridge I Wind Farm is located directly adjacent to HP. Operational on 29 September 2009, MRI consists of 19 (1.5 MW) turbines capable producing 28.5 MW and encompasses approximately 3,040 acres (1,230 ha). Additional phases are proposed to be completed over the next 2 to 3 years, totaling 88.5 MW.

Proposed Wind Energy Facilities

North Rim WRA

AES Wind Generation has proposed a wind facility consisting of 28 (1.5 MW) turbines capable of producing 55.5 MW. Construction is proposed to begin in May or June and end in October 2010. This project is located approximately three miles west of the town of Rock River, Wyoming off Wyoming Highway 13. North Rim is an extension of FCR encompassing approximately 2,143 acres (867 ha) of private property.

Simpson Ridge WRA

Located directly south of SMH, Horizon Wind Energy has proposed a wind energy facility consisting of 154 turbines capable of producing 308 MW of power. The project will consist of three phases constructing 100 MW in each phase. Construction is proposed to begin in 2011 or 2012. The proposed facility encompasses approximately 27,812 acres (11,255 ha) and is located north of Interstate-80 and south of U.S. Highway 30 between the towns of Medicine Bow and Hanna, Wyoming.

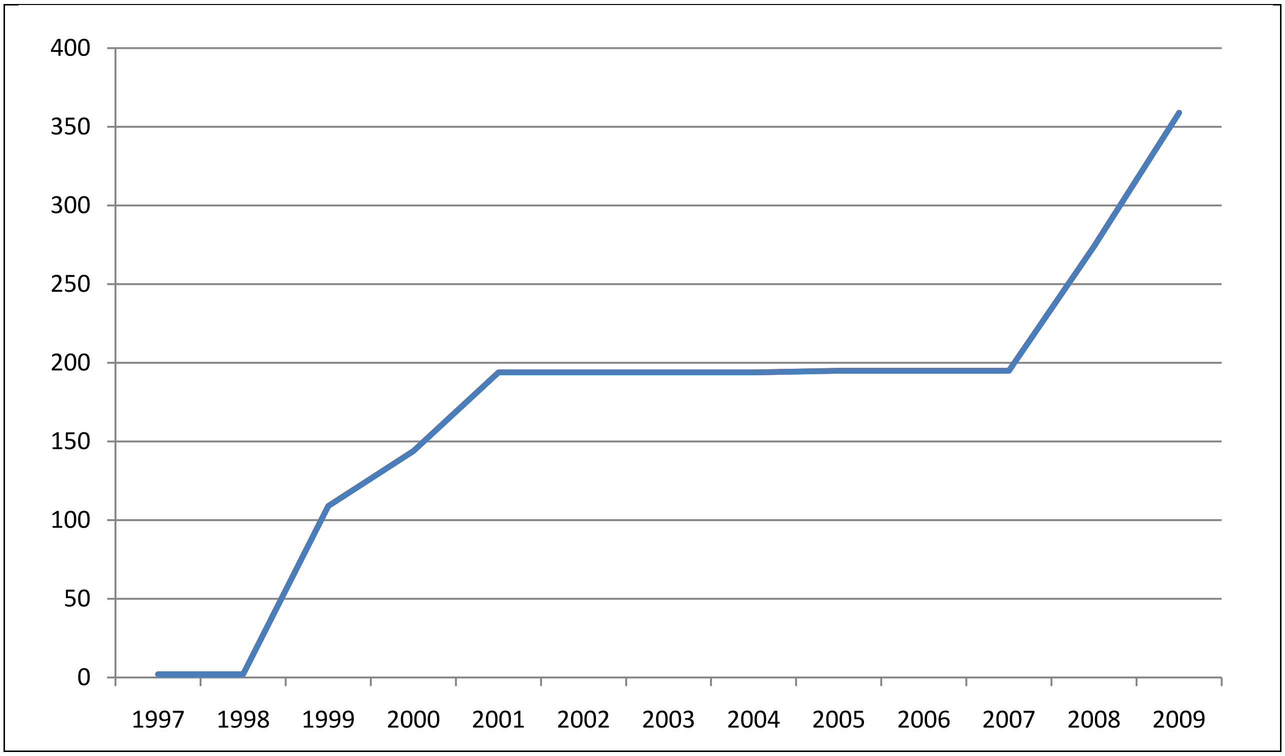

Figure 1. Number of operating turbines within the Medicine Bow/Rock River area.

Table 1. Existing and proposed wind energy facilities located within the Medicine Bow/ Rock River area.

Facility	Number of Turbines	Capacity (MW)	Acres	Completion Year
Existing Wind Energy Facilities				
Medicine Bow	10	8.6	1,290	1999, 2000, 2005
Foote Creek Rim	133	84.8	5,114	1999, 2000
Rock River I	50	50	2,646	2001
Seven Mile Hill	79	118.5	5,654	2008
High Plains	66	99	10,567	2009
McFadden Ridge I	19	28.5	N/A	2009
Total	*357*	*389.4*	*25,271*	--
Proposed Wind Energy Facilities				
North Rim	28	55.5	2,143	TBD
Simpson Ridge	154	308	27,812	TBD
Total	*182*	*363.5*	*29,955*	--

RAPTOR NEST SURVEY COOPERATIVE AGREEMENT COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Raptors

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars, Bureau of Land Management Cooperative Agreement #L08AC15083

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Andrea Orabona, Nongame Bird Biologist

INTRODUCTION

The purpose of this study is to provide baseline data on raptor nesting activity associated with lands administered by the Bureau of Land Management (BLM) Casper and Newcastle Field Offices.

A cost-share agreement to survey for nesting raptors was initiated in 1996 between the BLM and Wyoming Game and Fish Department (Department) and has continued each year since, excluding 2003 and 2007. In 1997-2002, 2004-2006, and 2008-2009, priority survey areas included specific portions of lands administered by the BLM Casper and Newcastle Field Offices that had not been previously surveyed, including lands proposed for and undergoing mineral extraction. Surveys in 2009 focused on two priority areas within the Casper Field Office area and four priority areas within the Newcastle Field Office area that were identified by BLM personnel Shane Gray and Nate West.

Funding for this cooperative effort was provided by the BLM. The Department conducted all aerial surveys and prepared the final report.

METHODS

The 2009 survey followed similar study parameters detailed in previous years' raptor nest survey reports. Survey transects were established at 0.5-mile (0.8 km) intervals in a north-south direction within each priority area. Transects were flown in a fixed-wing aircraft on 12 and 29 May in the Newcastle area (Cessna 6210-S; Laird Flying Service; Bob Laird, pilot) and on 21 and 22 May in the Casper area (Arctic Tern; Sky Aviation; Dave Stinson, pilot). The Department's Nongame Bird Biologist, Andrea Orabona, conducted all aerial surveys. No ground surveys or follow-up aerial surveys were conducted by the Department in 2009.

A handheld Global Positioning System (GPS) unit (Garmin GPSMAP 76S) was used to georeference nest locations during survey flights using Universal Transverse Mercator (UTM) coordinates, NAD 83datum. An on-board GPS unit was used to maintain accurate flight patterns on survey transects. Each located nest was observed for evidence of nesting activity and the presence of adult birds, young birds, or eggs. The physical condition of each observed nest, the substrate on which the nest was constructed, and the primary habitat in which the nest occurred were also noted. All raptor nests encountered were recorded, regardless of occupancy status or condition.

RESULTS

Approximately 32 hours of flight time were expended to search for, locate, and observe raptor nests during the 2009 survey (ferry time to and from the survey areas is not included in this total). Inventories were not completed in all priority areas due the expenditure of all available funds. Surveys were completed in a portion of the Casper BLM's priority one area (Eastern Converse County), all of the Newcastle BLM's priority one area, and a portion of the Newcastle BLM's priority two area (Figures 1 and 2). Approximately 580 $miles^2$ (235 km^2) were surveyed for the BLM's Casper Field Office, and 200 $miles^2$ (81 km^2) were surveyed for the BLM's Newcastle Field Office.

Results of nesting surveys are summarized in Tables 1 and 2 for the Casper and Newcastle BLM Field Offices, respectively. Nest codes used during the survey are presented in Table 3 and substrate codes are presented in Table 4. Specific nest locations and other information recorded during aerial flights are presented in Appendix I.

A total of 128 raptor nests were located within the BLM's Casper Field Office priority area (Table 1). Total nests detected included Ferruginous Hawk (n=52), Golden Eagle (n=25), Swainson's Hawk (n=3), and Red-tailed Hawk (n=48). From these totals, occupied nests included Ferruginous Hawk (n=2), Golden Eagle (n=8), Swainson's Hawk (n=2), and Red-tailed Hawk (n=14).

A total of 28 raptor nests were located within the BLM's Newcastle Field Office priority areas (Table 2). Total nests detected included Ferruginous Hawk (n=7), Golden Eagle (n=6), Swainson's Hawk (n=1), and Red-tailed Hawk (n=14). From these totals, occupied nests included Ferruginous Hawk (n=2), Golden Eagle (n=3), Swainson's Hawk (n=1), and Red-tailed Hawk (n=3). In addition, a rookery was observed with a total of 45 nests, of which 11 were occupied by Great Blue Herons and 23 by Double-crested Cormorants.

DISCUSSION

The 1996, 1997, and 1998 surveys were conducted to coincide with the timing of the incubation, hatching, and pre-fledging stages for Ferruginous Hawks and the nestling stage (post-hatching and pre-fledging) for Golden Eagles. The surveys in 1999-2009 (excluding 2003 and 2007 when surveys were not conducted) were initiated two to three weeks earlier than previous years due to slightly different project objectives in 1999 and to avoid the observation problems with early leaf-out that occurred in 1998. Therefore, the 1999-2005 surveys coincided with the timing of the incubation and hatching stages for Ferruginous Hawks and the incubation, hatching, and nestling stages for Golden Eagles. The 2006, 2008, and 2009 surveys were planned for the same time frame as 1999-2005. However, delays in obtaining the necessary pre-survey paperwork precluded initiating the 2006 inventory until late April and the 2009 survey until early/mid-May. In addition, a prolonged, cool, wet spring in 2008 and 2009 may have affected the initiation of nesting for some raptors, particularly Ferruginous and Swainson's Hawks. Thus, the timing of the start of the survey in early April in 2008 may not have been conducive to the timing of nest initiation and detectability of occupied nests for these species. This was not the case in 2009 because surveys could not be initiated until 12 May and the majority of the work was completed during the latter part of May.

A few biases have been noted during past surveys that should receive consideration during future efforts or evaluations of results. Swainson's Hawk nests often deteriorate during the winter, and their delayed spring arrival compared to other raptors means that this species may be missed during surveys in late April or early May. These may factor into the lack of Swainson's Hawk detections in 2009. In addition, although falcons may occasionally be observed during surveys in fixed-wing aircraft, they cannot be adequately detected during fixed-wing aircraft surveys, requiring ground or helicopter surveys instead, neither of which was conducted in 2009. Due to these biases, the absence of records for raptor species known to occupy habitats in eastern Wyoming should not be considered documentation that they do not occur in the survey areas.

This cooperative project between the Department and BLM will continue for the next several years. This will give us an opportunity to inventory nesting raptors in additional portions of the state for which data are limited or lacking, and allow us to compare raptor nest density within the BLM's priority areas.

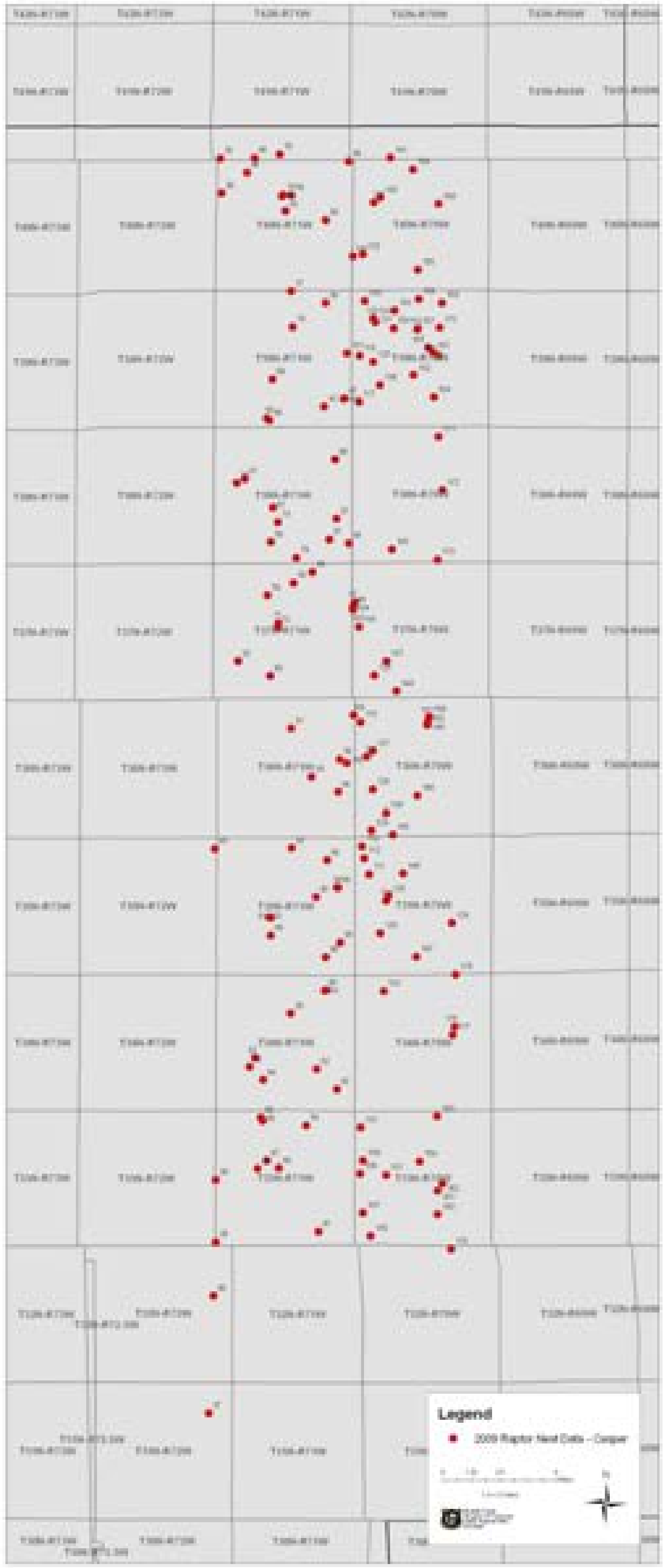

Figure 1. Locations of raptor nests detected during the 2009 aerial survey in the Casper BLM's priority 1 area.

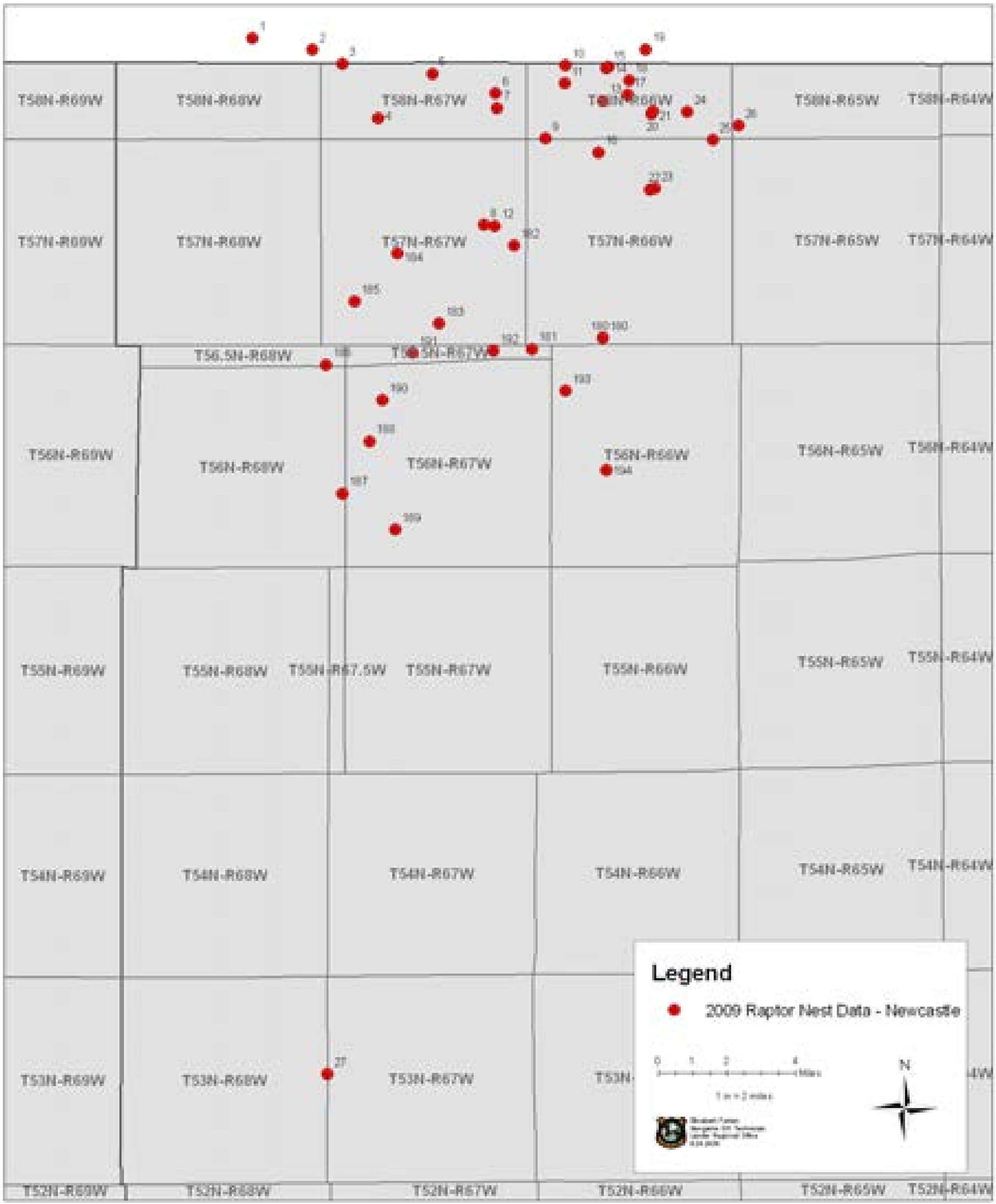

Figure 2. Locations of raptor nests detected during the 2009 aerial survey in the Newcastle BLM's priority 1 area and a portion of the priority 2 area.

Table 1. A summary of the 2009 raptor nest survey for the Bureau of Land Management Casper Field Office Priority Area.

Species	OCCU	UNOC	UNAL	UNDI	UNDE	GONE	Total Nests
Ferruginous Hawk	2	11		11	27	1	52
Golden Eagle	8	14		2	1		25
Swainson's Hawk	2		1				3
Red-tailed Hawk	14	25	2	6	1		48
Total	*26*	*50*	*3*	*19*	*29*	*1*	*128*

Key	
OCCU	An occupied nest in which a breeding attempt was made, indicated by a recent and well-used perch near the nest, the presence of two adults at or near the nest, fresh lining material in the nest, an incubating or brooding adult, eggs or young in the nest, or fledged young near the nest.
UNOC	An unoccupied nest that is in good condition but with no apparent recent use or adult presence at the time of the observation.
UNAL	An unoccupied nest within a territory that contains an occupied nest.
UNDI	An unoccupied, dilapidated nest in a state of ruin due to weather, natural aging, and/or neglect.
UNDE	An unoccupied nest showing no sign of raptor activity that is destroyed to the point that it is no longer useable without major reconstruction. These nests, for all practical purposes, have disappeared.
GONE	A nest that was located during a previous survey but was completely destroyed with no sign of any nest material in a subsequent survey.

Table 2. A summary of the 2009 raptor nest survey for the Bureau of Land Management Newcastle Field Office Priority Areas.

Species	OCCU	UNOC	UNDI	UNDE	Total Nests
Ferruginous Hawk	2	1	2	2	7
Golden Eagle	3	2	1		6
Swainson's Hawk	1				1
Red-tailed Hawk	3	7	4		14
Total	*9*	*10*	*7*	*2*	*28*

Key	
OCCU	An occupied nest in which a breeding attempt was made, indicated by a recent and well-used perch near the nest, the presence of two adults at or near the nest, fresh lining material in the nest, an incubating or brooding adult, eggs or young in the nest, or fledged young near the nest.
UNOC	An unoccupied nest that is in good condition but with no apparent recent use or adult presence at the time of the observation.
UNDI	An unoccupied, dilapidated nest in a state of ruin due to weather, natural aging, and/or neglect.
UNDE	An unoccupied nest showing no sign of raptor activity that is destroyed to the point that it is no longer useable without major reconstruction. These nests, for all practical purposes, have disappeared.

Table 3. Nest code abbreviations used during the 2009 raptor nest survey.

Nest Code	Definition
OCCU	An occupied nest in which a breeding attempt was made, indicated by a recent and well-used perch near the nest, two adults at or near the nest, fresh lining material in the nest, an incubating or brooding adult, eggs or young in the nest, or fledged young near the nest.
OCFA	An occupied nest that failed to fledge any young.
UNOC	An unoccupied nest that is in good condition but with no apparent recent use or adult presence at the time of the observation.
UNAL	An unoccupied nest within a territory that contains an occupied nest.
UNDI	An unoccupied, dilapidated nest in a state of ruin due to weather, natural aging, and/or neglect.
UNDE	An unoccupied nest showing no sign of raptor activity and that is destroyed to the point that it is no longer useable without major reconstruction. These nests, for all practical purposes, have disappeared.
GONE	A nest that was located during a previous study but has been completely destroyed with no sign of nest material during the current study.
?	A nest whose status was undetermined during subsequent surveys in the same nesting season.

Table 4. Substrate code abbreviations used during the 2009 raptor nest survey.

Substrate Code	Definition
ANS	Artificial Nest Structure
CKB	Creek Bank
CLF	Cliff
CTD	Cottonwood (dead)
CTL	Cottonwood (live)
ELL	Elm (live)
GHS	Ground or Hillside
MMS	Manmade Structure
POD	Ponderosa Pine (dead)
POL	Ponderosa Pine (live)
ROC	Rock Outcrop
RUS	Russian Olive
WIL	Willow (live)

NORTHERN GOSHAWK BIOREGIONAL MONITORING IN THE BRIDGER-TETON NATIONAL FOREST COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Northern Goshawk

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars; Federal Funds with State Match, State Wildlife Grant Projects; Federal Funds, U.S. Fish and Wildlife Service Cooperative Agreement #601818J420 / Wyoming Landscape Conservation Initiative

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Jenny Berven, Rocky Mountain Bird Observatory
Susan Patla, Nongame Biologist

INTRODUCTION

The Northern Goshawk is the largest of three accipiter hawks found in North America (Squires and Reynolds 1997). The goshawk inhabits and nests in several classes of woodlands and forests, including coniferous, deciduous, and mixed forests ranging from Alaska to Mexico. Forest and woodland age class and structure preference varies throughout the bird's range and depends on the local forest types. For example, goshawks primarily occupy ponderosa pine, mixed coniferous, and spruce-fir forests in the Southwest, and pine forests interspersed with aspen groves in the forests of Colorado, Wyoming, and South Dakota; whereas in the Great Basin, goshawks inhabit small patches of aspen within the shrub-steppe communities (Squires and Ruggiero 1996). However, a general consistency in the need for large, mature tree stands for nesting has been found, as well as a correlation between prey base and population stability (Reynolds et al. 1992, Anderson et al. 2005).

Due to the difficulties associated with the low density of goshawks [≤12 nesting pairs/39 miles^2 (100 km^2)] mixed with the bird's cryptic behavior (Squires and Reynolds 1997), population estimates are undetermined across vast areas and, therefore, the overall status of the goshawk's population remains unknown (Anderson et al. 2005, Woodbridge and Hargis 2006). For this and other reasons, several agencies have listed the Northern Goshawk as a species of concern within their administrative boundaries (Woodbridge and Hargis 2006). Also, because the goshawk generally requires mature to old growth trees as nesting sites, the species can be used as an indicator of forest health (Reynolds et al. 1992, Anderson et al. 2005).

In 1996, there was a public petition to the U.S. Fish and Wildlife Service (USFWS) to list the Northern Goshawk as threatened or endangered with the findings in 1998 that not enough was known about the species' population to warrant listing (USFWS 1997, 1998). These results catalyzed the development of a national bioregional monitoring program. In 2006, the U.S. Department of Agriculture published the Northern Goshawk Inventory and Monitoring Technical Guide to assist Forest Service biologists in the development and implementation of monitoring programs to determine population trends within large administrative and bio regions (Woodbridge and Hargis 2006).

The Rocky Mountain Region of the U.S. Forest Service(USFS), which includes all National Forests in Colorado, the Big Horn, Medicine Bow, and Shoshone National Forests in Wyoming and the Black Hills National Forest in South Dakota, and the Great Lakes Region have each completed at least one field season implementing bioregional monitoring. In 2009, the Rocky Mountain Region and the Southwest Region (which includes all National Forests in Arizona and New Mexico) completed bioregional surveys.

Rocky Mountain Bird Observatory (RMBO) collaborated with the Rocky Mountain Region to conduct the 2006 and 2009 bioregional surveys. This region stratified Primary Sampling Units (PSUs) between primary habitat (dominant conifer species and status of aspen) and marginal habitat (sub-alpine forests) and easy and difficult access (determined by distance from field offices and/or roads). In 2006, 51 PSUs were surveyed, with an overall occupancy of 0.329 (CI: 0.213-0.445) and occupancy in primary and secondary habitat of 0.811 (SE = 0.113) and 0.124 (SE = 0.067), respectively. Preliminary results for the 109 PSUs surveyed in 2009 produce an overall occupancy of 0.475 (CI: 0.3614-0.5883) and occupancy in primary and secondary habitat of 0.838 (SE = 0.079) and 0.320 (SE = 0.070), respectively.

RMBO also collaborated with the Southwest Region to conduct the 2009 bioregional surveys in all National Forests in Arizona and New Mexico. The Southwest Region delineated four strata; Stratum 1 = easy access ponderosa pine forests, Stratum 2 = easy access piñon juniper woodland/subalpine forests, Stratum 3 = difficult access ponderosa pine forests, and Stratum 4 = difficult access piñon juniper woodland/subalpine forests. Preliminary results for 105 PSUs surveyed in 2009 produce an overall occupancy of 0.258 (CI: 0.133 - 0.383) and occupancy in primary and secondary habitat of 0.418 (SE = 0.108) and 0.118 (SE = 0.054), respectively.

The Wyoming Game and Fish Department (Department) formed goals and objectives to emulate the bioregional survey methods in a more local area within the Bridger-Teton National Forest located in the Greater Yellowstone area. Little research has been completed on goshawk populations within these forests; however, one report suggests that nest occupancy decreased from a baseline period of 1992-1995 to a period of 1998-2002 in the Targhee National Forest located adjacent to the Bridger-Teton National Forest, showing a need for consistent monitoring efforts to determine goshawk occupancy trends in the area (Patla 2005). Furthermore, the Department lists the goshawk as a Species of Greatest Conservation Need because of the vulnerability of the bird's habitat and sensitivity to human disturbance (Wyoming Game and Fish Department 2005).

The Rocky Mountain Bird Observatory was contracted by the Department to assist in the development and implementation of local monitoring for goshawks in the Bridger-Teton

National Forest in congruence with a wider monitoring effort put forth by the Rocky Mountain and Southwest Regions.

Funds for this project were obtained through the Governor's Endangered Species Fund. Our objectives were to obtain results from the Forest Service bioregional survey effort to evaluate methodology and determine if detections resulted in the discovery of new nesting territories in the Wyoming Range. It should be noted that the term "occupancy", as used in the bioregional survey, relates to the statistical method and not the traditional use of the term in raptor monitoring surveys.

Data and verbiage for this report are from the draft report provided by the Rocky Mountain Bird Observatory dated March 2010 (Berven and Pavlacky 2010).

METHODS

Study Area

The Bridger-Teton National Forest is located in western Wyoming south of Yellowstone National Park and within the Greater Yellowstone Ecosystem. Within the USFS administrative boundaries of 3.4 million acres (1.4 million ha), there are approximately 2.4 million acres (1 million ha) of inventoried forested land. Engelmann spruce/subalpine fir comprises the largest portion of forest types, followed by lodgepole pine (44% and 16%, respectively). The survey area was concentrated around the Wyoming and Salt River Mountain Ranges within the National Forest which resulted in most sites being located in the Bridger portion of the Bridger-Teton National Forest. Elevation within these mountain ranges generally exceeds 6,500 feet (~2,000 m), with several peaks above 10,000 feet (3,048 m).

Sampling Design and Method

Sampling design was based on the protocols established by the Northern Goshawk Inventory and Monitoring Technical Guide. The Department designed the PSU grid and randomly selected fifteen PSUs to survey (Figure 1). PSUs were 1,483 acre (600 ha) squares with 10 transect lines evenly spaced 656 feet (200 m) apart and offset by 328 feet (100 m; Figure 2). On each transect line were twelve call stations spaced 820 feet (250 m) apart, for a total of 120 call stations per PSU. No stratification was implemented, and sample size was limited by monetary factors. The 10 most reasonable PSUs were selected by the field crew based on access to the survey location and whether the technicians were capable of surveying the location; limiting factors included distance to roads, terrain, water, and density of forest.

The Northern Goshawk Inventory and Monitoring Technical Guide was used to define survey protocols which were developed by Kennedy and Stahlecker (1993). Technicians were responsible for conducting broadcast acoustical surveys during the nestling and fledgling stages of the goshawk breeding season.

Up to two visits were made to each PSU (one during the nestling season and one during the fledgling season). The window for these two stages usually begins June 1st and continues through August 15th; however, to maximize detectability of goshawks in the region, input was received from district USFS biologists and other scientists monitoring goshawk nests throughout the region to specify when eggs were expected to hatch. The nestling survey ended once the 10 PSUs were surveyed, which occurred before nestling began to fledge. The fledgling survey began once nestlings moved away from the nest (approximately when young were 34 days old). Fledglings typically disperse from the area approximately six weeks after leaving the nest and, from that point, broadcast acoustical surveys are no longer effective.

All 10 PSUs were surveyed during the nestling season and 50% of PSUs with a positive detection were surveyed during the fledgling season. The resurveyed PSUs were randomly selected using an Excel spreadsheet and assigning a randomly generated number (between 0 and 1) to each PSU with a positive detection. PSUs with a number greater than or equal to 0.50 were resurveyed.

Broadcast acoustical surveys were conducted at any time between 30 minutes before sunrise to 30 minutes before sunset, coinciding with goshawk activity. Calling procedure followed protocols described in the monitoring technical guide. Technicians broadcast one of three goshawk calls depending on whether it was during the nestling or fledgling survey. During the nestling survey, an adult alarm call was broadcasted and during the fledgling survey, a juvenile food begging call or wail call was broadcasted. Technicians used FoxPro NX3 digital callers preloaded with the calls at a volume producing 80 to 110 dB output 3.3 feet (1 m) from the speaker.

At each call station, technicians played one call for 10 seconds, then watched and listened for goshawk activity for 30 seconds, then repeated the procedure after rotating 120 degrees. Once this procedure was done three times (and the circle completed), the technician would wait, watch and listen for two minutes, then repeat the cycle. Technicians recorded any significant findings and time spent at each call station on a standardized field form. After two full rounds of playing the call, the technician would then move on to the next call station, observing the surrounding area for any goshawk approach (silent or vocal).

Technicians surveyed all call stations located in suitable habitat [call station within ~500 feet (150 m) of tree cover] and all call stations that could be safely reached and surveyed (call station on a slope <36 degrees, not located in water, etc.) until all surveyable stations were visited or until a goshawk detection was made. A goshawk detection included a visual or aural detection, finding an active nest, and/or finding a freshly molted feather. If a bird was seen, sex and age was recorded, if known, as well as compass bearing, station number, and distance from transect. Aural detections should have been followed by an attempt to get a visual of the bird to determine age and sex.

Field Personnel

Biological field technicians with previous goshawk field experience, including knowledge of goshawk behavior, vocalizations, and sign, were highly desired for each team of two.

However, most applicants did not have such experience and, therefore, individuals were paired according to their overall field experience. Technicians with more experience (usually at least two years of avian fieldwork) were paired with an individual with less avian field research. Furthermore, unpaid interns were hired to assist field crews with surveying. For all individuals, experience hiking in remote areas and a good work ethic were required.

All technicians received training in goshawk identification, including visual, aural, feather, and other indicators of goshawk presence, as well as training in survey and data collection protocol. The training was conducted by USFS personnel in the first week of June in the Steamboat Springs, CO area, while goshawks were occupying known territories but before eggs had hatched. This allowed technicians to see suitable goshawk territory first-hand.

Data Analysis

A presence/absence model was fit in program MARK (White and Burnham 1999) to determine detection probabilities and occupancy for each survey period. The sampling variances and standard errors of the combined estimates were approximated using the delta method (Powell 2007) in program SAS (PROC IML; SAS Institute 2008).

We fit versions of the model that accounted for variation in survey effort because some PSUs contained call points in suitable habitat that were inaccessible. The model included an additional parameter where the probability of detection was modeled as a function of the percentage of call points completed in suitable habitat. The survey effort covariate was calculated for each PSU by dividing the number of completed call points by the total number call points in suitable habitat and multiplying by 100.

Detection probabilities from the Rocky Mountain Region were used to determine occupancy (using the same modeling in program MARK) in the Bridger-Teton National Forest data set as a way to extrapolate an estimate more appropriate than using naïve occupancy estimates. α-levels = 0.05; Confidence Intervals = 95%.

RESULTS

Based on the input from local scientists, hatching occurred on or around 15 June 2009. Birds in monitored nests began leaving the immediate nest area on or around 25 July 2009. This allowed the fledgling survey to continue through 5 September 2009. Specifically, the nestling surveys in the Bridger-Teton National Forest occurred between 6 July and 21 July 2009, and the fledgling surveys occurred between 10 August and 2 September 2009.

Five of the 10 PSUs surveyed during the nestling period had positive detections (Figure 2; Table 1). A total of seven PSUs (five with no detection and two with a detection during the nestling period) were resurveyed during the fledgling period. Five of the seven surveyed PSUs had positive detections during the fledgling surveys (Figure 3; Table 1). The positive detections occurred in the same five PSUs that had positive detections during the nestling surveys. All detections had visual confirmations, and all goshawks sighted were adults. No active nests were found during surveying.

Overall naïve occupancy was 0.412 (CI: 0.151-0.673). Naïve occupancy for the nestling and fledgling surveys were 0.500 (CI: 0.123-0.877) and 0.286 (CI: -0.166-0.737), respectively.

Effort was determined in the field by technicians for each PSU by counting each call station within the PSU that was accessible and located in suitable habitat (Table 2).

As stated in the methods, invalid results, most likely from an inadequate sample size, were returned when running the data through program MARK for both the simple model and the model accounting for variation in survey effort. Using the Rocky Mountain Region's 2009 nestling and fledgling survey detection probabilities (0.722 and 0.632, respectively), overall occupancy of the Bridger-Teton PSUs was calculated as 0.557 (CI: 0.237-0.836; Table 3). Combining the Rocky Mountain Region data and the Bridger-Teton data, occupancy was calculated as 0.545 (CI: 0.233-0.826) with nestling and fledgling survey detection probabilities of 0.754 and 0.663, respectively (Table 3). Using only the Shoshone data in combination with the Bridger-Teton data results in an occupancy estimate of 0.550 (CI: 0.225-0.838), with nestling and fledgling survey detection probabilities of 0.773 and 0.598, respectively (Table 3).

DISCUSSION

Using the naïve occupancy estimates is less appropriate than using occupancy estimates that incorporate detection probabilities because naïve occupancy assumes the detection probability is equal to one. In other words, if any goshawk is located within a PSU, it will be detected 100% of the time. However, due to the goshawk's cryptic nature, size of territory, low densities, human error, and prior bioregional monitoring results, we know that the detection probability is very likely less than 100% and, therefore, the naïve occupancy underestimates true occupancy (MacKenzie and Nichols 2004, Woodbridge and Hargis 2006).

The data collected during this survey need to be molded with other sources of information because program MARK was unable to determine detection probability for the 10 PSUs surveyed in the Bridger-Teton National Forest, and the naïve occupancy estimate is objectionable. One option for data analysis was using the detection probabilities calculated for the Rocky Mountain Region's 2009 surveys. Although habitat varies between the Bridger-Teton National Forest and several of the forests in the Rocky Mountain Region (which include a significant proportion of ponderosa pine forests), it does include the Shoshone National Forest, which, like the Bridger-Teton National Forest, is part of the Greater Yellowstone Ecosystem. Therefore, the Rocky Mountain Region's detection probabilities are averaged across a large bioregion that includes several forest types, including similar types found in the Bridger-Teton National Forest. Furthermore, the data collected for the Rocky Mountain Region was collected at the same time as the Bridger-Teton surveys. The Southwest Region also conducted surveys during the same time; however, the forests in the Southwest Region are almost entirely ponderosa pine forests and piñon-juniper woodlands, and are significantly different than the Bridger-Teton National Forest.

The other applied option was to combine the data collected in the Bridger-Teton National Forest with other Rocky Mountain Region data and incorporate variations in stratification to determine an overall occupancy rate. This method is more accurate than just applying detection probability to the model because it includes the Bridger-Teton National Forest's PSUs as well as PSUs in surrounding areas to determine occupancy by increasing the sample size to a value significant enough to get valid results from program MARK. However, this method also incorporates forest types slightly different from the Bridger-Teton National Forest, such as the Black Hills National Forest, which is mainly composed of ponderosa pine.

The final option for data analysis was using only the Shoshone National Forest PSU information. This method is the most accurate way to analyze the Bridger-Teton data with supplementary data to increase the sample size to a viable number because the Shoshone National Forest is part of the Greater Yellowstone Ecosystem and is comprised of similar forest types.

For future surveying effort, the question remains on how to continue surveying for occupancy within the Bridger-Teton National Forest and obtain valid results from the Bridger-Teton surveys. One option is to increase the sample size within the forest. However, there is no recommended cut-off sample size to obtain valid results because so many factors contribute to the model, including, but not limited to, the number of sites, detection probability, and number of surveys conducted within the survey timeframe. If an acceptable standard error is established and several variables are assumed, a sample size can be determined using the equation

$$\text{var}(\hat{\psi}) = \frac{\psi}{s}\left[(1-\psi) + \frac{p^*(1-p^*)}{(p^*)^2 - K^2p^2(1-p)^{K-1}}\right]$$

where var$(\hat{\psi})$ = asymptotic variance, ψ = occupancy; s = sample size; $p^* = 1-(1-p)^K$; p = detection probability; and K = number of surveys at each site. Furthermore, the suggested number of surveys (K) is dependent upon occupancy and detection probability in removal sampling designs, such as the goshawk monitoring surveys.

Another option would be to increase the number of times each PSU is surveyed within the breeding season. MacKenzie and Royal (2005) suggest that it is actually more precise to perform occupancy studies in this way. However, if this method is used in the future, complications will arise if results from the 2009 surveys are compared to future surveys or if occupancy rates between the Bridger-Teton surveys are compared to other goshawk monitoring surveys that only visit PSUs twice a year. Furthermore, defining a sample size with K as the primary factor still involves the same complications listed in the increasing the sample size suggestion.

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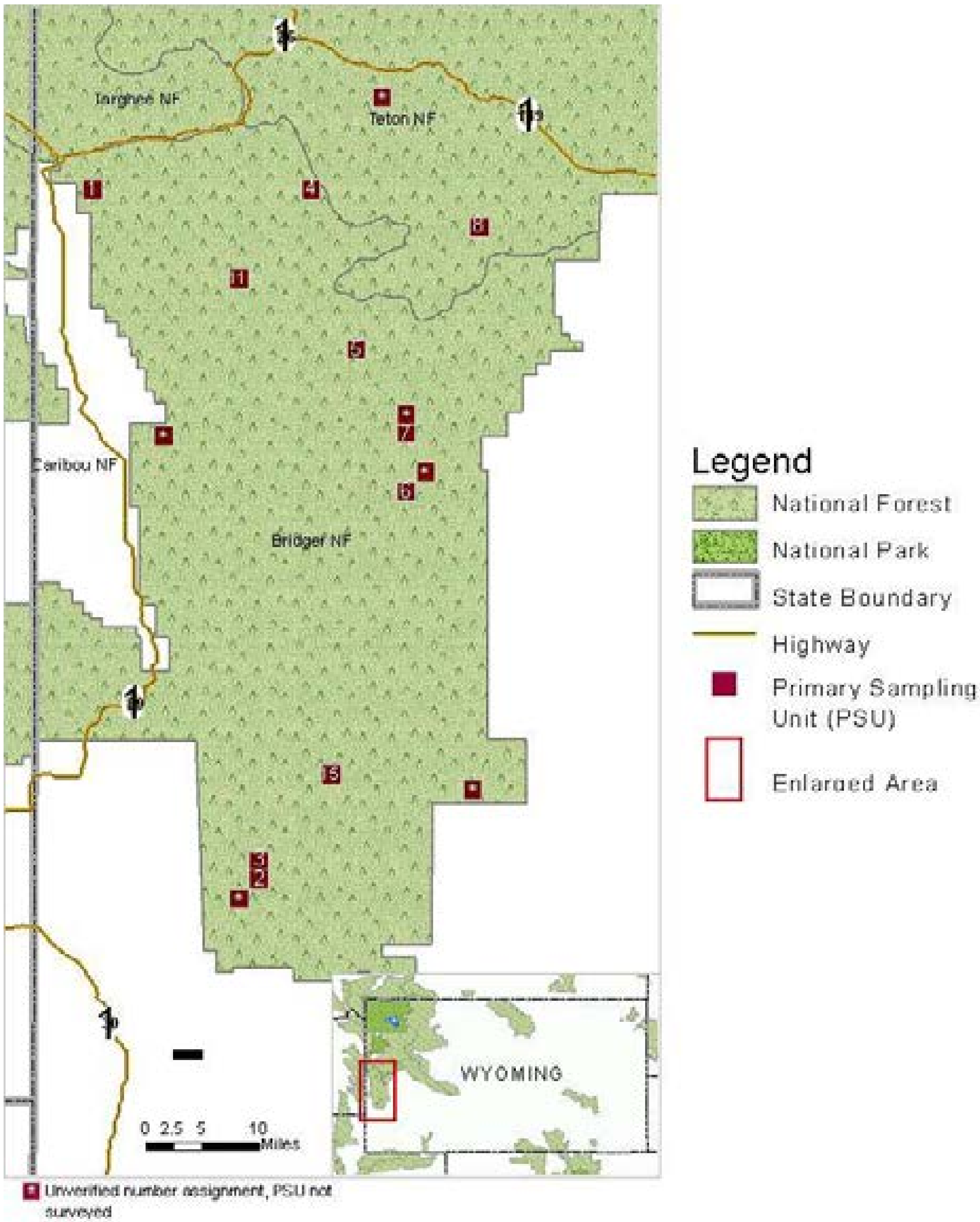

Figure 1. Northern Goshawk monitoring in the Bridger-Teton National Forest, randomly selected Primary Sampling Units.

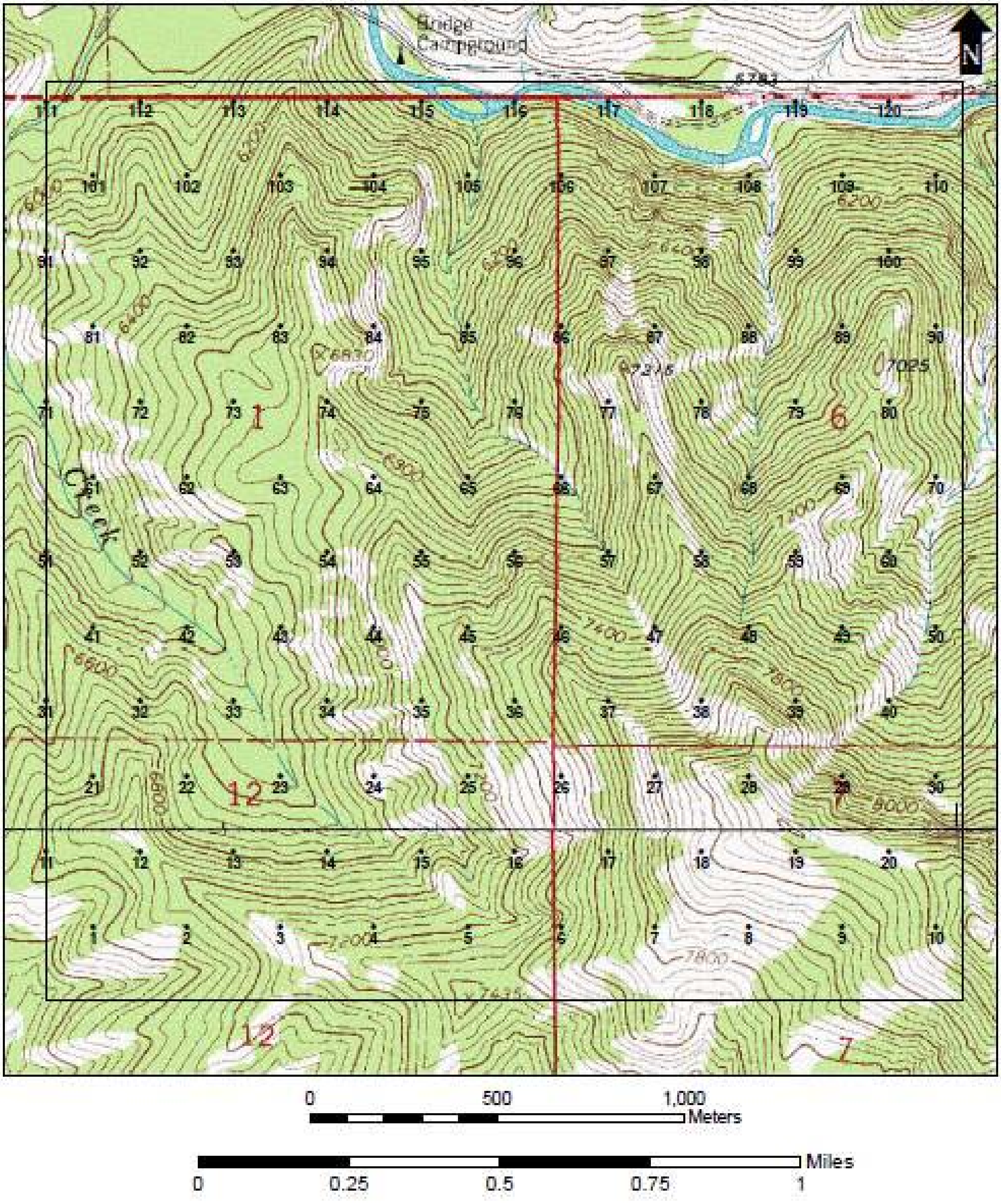

Figure 2. Northern Goshawk monitoring, Primary Sampling Unit example.

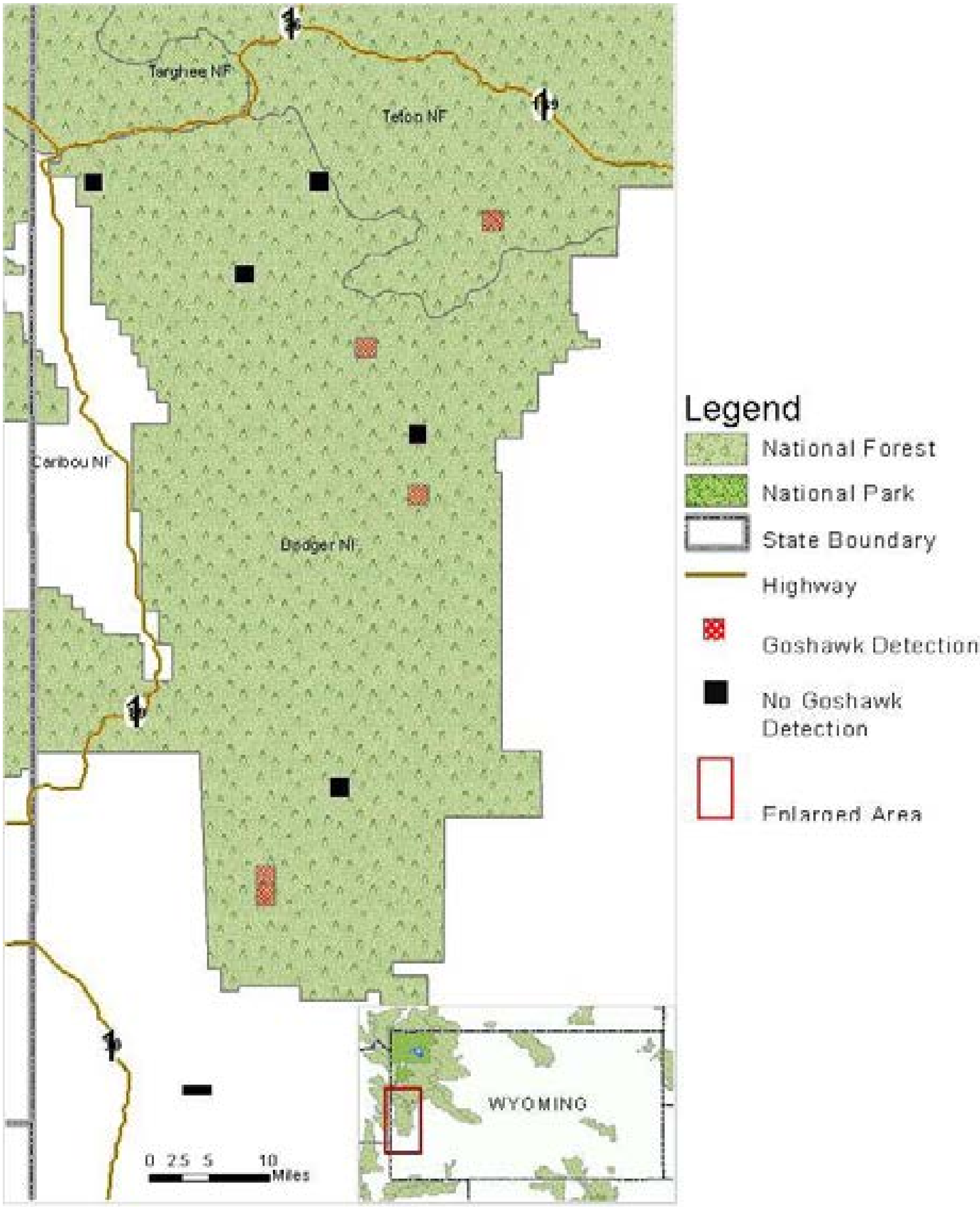

Figure 3. Northern Goshawk monitoring in the Bridger-Teton National Forest, results for nestling surveys.

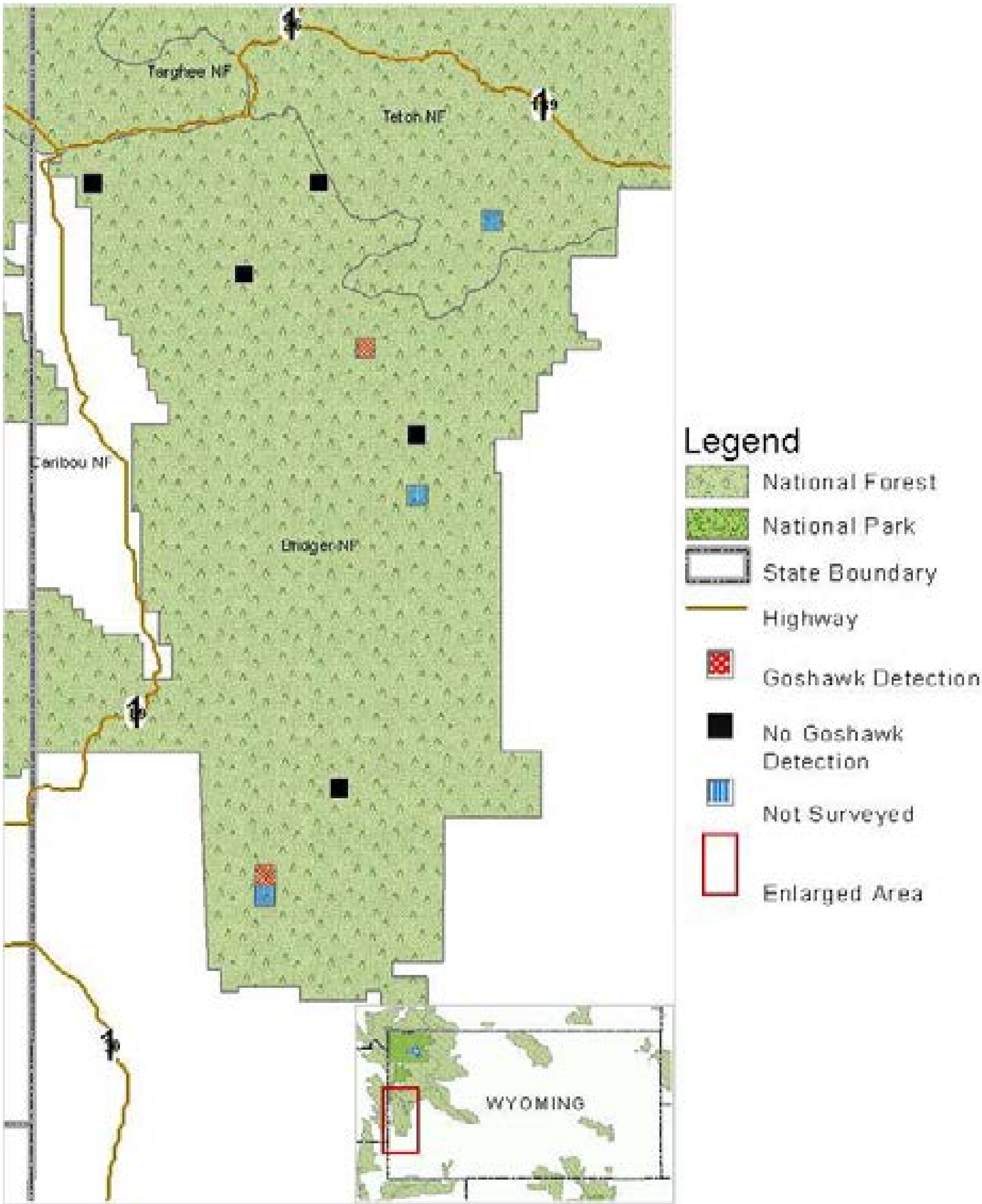

Figure 4. Northern Goshawk monitoring in the Bridger-Teton National Forest, results for fledgling surveys.

Table 1. Survey results for each Primary Sampling Unit (PSU) for Northern Goshawk monitoring.

PSU ID #	Nestling Survey	Fledgling Survey
1	No detection	No detection
2	Detection	N/A[a]
3	Detection	Detection
4	No detection	No detection
5	Detection	Detection
6	Detection	N/A
7	No detection	No detection
8	Detection	N/A
11	No detection	No detection
15	No detection	No detection

[a] N/A = PSU was not surveyed a second time.

Table 2. Survey effort per Primary Sampling Unit (PSU) for Northern Goshawk monitoring.

PSU ID #	# of Surveyed Call Stations[a]	Survey Effort (%)[b]
1	7	6
2	61	51
3	80	67
4	35	29
5	66	55
6	47	39
7	73	61
8	119	99
11	74	62
15	76	63

[a] Call station is in a location that is accessible and has suitable habitat [slope <36^{o} and tree cover <492 feet (150 m) away].

[b] Effort was calculated by dividing the number of accessible and suitable call stations by 120 (total possible number of call stations) and multiplying by 100.

Table 3. Detection results for the Northern Goshawk nestling and fledgling surveys.

Data	N Detection Probability	Fl Detection Probability	Occupancy Estimate	Confidence Interval
B-T, simple	Invalid	Invalid	Invalid	Invalid
B-T, survey effort	Invalid	Invalid	Invalid	Invalid
B-T + R2(det)	0.722	0.632	0.557	0.237-0.836
B-T + R2	0.754	0.663	0.545	0.233-0.826
B-T + Shoshone	0.773	0.598	0.550	0.225-0.838

PEREGRINE FALCON NEST SURVEYS
COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Peregrine Falcon

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars, U.S. Fish and Wildlife Service Cooperative Agreement #60181G446

PERIOD COVERED: 1 April 2009 – 1 November 2009

PREPARED BY: Bob Oakleaf, Nongame Coordinator
Susan Patla, Nongame Biologist

INTRODUCTION

Plans to re-establish Peregrine Falcons in Wyoming were developed from analysis of historical distribution and evaluation of potential habitat during survey work (1978-1980). The goal of reintroduction was to establish and maintain a self-sustaining breeding nucleus in the wild. Objectives were to annually release approximately 15 peregrines and establish 30 breeding pairs in Wyoming by 1996. The program was coordinated with Idaho and Montana to ensure maximum results to re-establish this species. Results of peregrine reintroduction and monitoring efforts are detailed in previous Wyoming Game and Fish Department Nongame Program Annual Completion Reports and annual reports completed by The Peregrine Fund, Inc. In Wyoming, 384 Peregrine Falcons were released (1980-1995), with at least 325 (85%) surviving to dispersal (1 month post-release). No peregrines have been released since 1995 because objectives were attained in 1994-1995 and the species was delisted at the national level in 1999.

Monitoring of nesting performance has continued in Wyoming on an annual basis since 1999. In cooperation with the U. S. Fish and Wildlife Service (USFWS), Wyoming also participates every 3 years in the National Monitoring Plan for delisting of the American Peregrine Falcon. Funding from the USFWS (Agreement #60181G446) in 2003, 2006, and again in 2009 has greatly facilitated the monitoring effort. Specific objectives for this agreement in Wyoming include:

- Collect data on occupancy, nest success, and productivity at 15 peregrine nesting territories randomly selected in 2003.
- Collect the same data to the greatest extent possible at all other known peregrine nesting territories in the state.
- Summarize all data collected in a summary report.

METHODS

Territory occupancy was determined for each of the 15 randomly selected territories during early season visits. Territories that appeared to be not occupied with a breeding pair became the focus of repeated visits following protocol of two or more visits of 4 or more hours before classifying the territory as not occupied. Nest success was determined by at least two visits with the last visit timed to observe chicks that are 28 days or older. Nest productivity was determined during one or more observations of adults feeding young. Eyries that were situated where it was difficult to observe young were visited at fledging to assure a more complete count. While these data are pooled with other states and provide regional trend data, additional sampling is necessary to provide adequate monitoring results specific to Wyoming.

Potential Peregrine Falcon nesting cliffs were recorded in Wyoming during baseline surveys from 1978-1980, and are periodically checked for occupancy during ground surveys. Production data were collected from as many of the known peregrine territories as possible from 1984-2004. Since 2005, annual surveys focus on 30 territories that are annually selected prior to field efforts by using Microsoft's random select excel program. Ten sites are selected for each of three areas: Yellowstone National Park, west of the continental divide outside of Yellowstone National Park, and the rest of Wyoming east of the continental divide. During the years of the National Monitoring Plan, the 15 randomly selected sites are automatically selected, and an additional 15 are randomly chosen so that 30 territories are monitored every year. Additional sites are observed annually as time allows during travels to selected territories or by cooperators with interest in specific sites.

RESULTS AND DISCUSSION

Fourteen of the 15 territories for the national peregrine monitoring program were occupied with adult pairs during 2009 (Table 1). Seven (54%) of these pairs were successful in fledging young. A total of 14 young (1.0 young per occupied site) were produced at these sites (Table 1). Twenty-five of the 30 randomly selected territories in 2009 were occupied with adult pairs, and 15 (60%) of these were successful in fledging young (Table 2). These 25 pairs fledged 36 young (1.4 young per occupied site). Also in 2009, an additional 16 sites were checked, for a statewide total of 46 territories with 41 occupied by breeding adults. Fifty-eight young were successfully produced at 28 (68%) of these sites, for a fledging rate of 1.4 young per occupied territory (Table 3). In addition, one new nesting territory was located in 2009.

Following extirpation and subsequent reintroductions of Peregrine Falcons, nesting was first documented in 1984. At least 839 nesting attempts have been recorded at 91 sites in Wyoming from 1984-2009. At least 1,337 young were produced with a minimum of 1.6 young fledged per nesting attempt.

Implementation of the Monitoring Plan for the American Peregrine Falcon in Wyoming (USFWS Agreement # 601818G446) was addressed again in 2009. Monitoring results of the 15 USFWS randomly selected nesting territories indicated production was lower (1.0 young per occupied site) than in 2003 and 2006, when 1.9 young fledged per occupied site in both years

(Table 1). Two expanded data sets with additional nesting territories showed similar results, with young per occupied site (1.4) being as low or lower than previously recorded (Tables 2 and 3). In addition, occupancy rates of established sites since 1984 have annually held close to 100%. One nesting territory of the 15 National Survey Sites (Table 1) and four additional sites of the expanded effort (Table 3) did not appear to be occupied by breeding pairs in 2009 (Tables 2 and 3). Productivity was expected to be somewhat lower due to snow and cold temperatures during the last half of April and again in June in some parts of the state. However, three eyries with young older than 21 days were recorded and later determined to have failed. Typically eyries with older young continue through the nesting season and are successful. Further evaluation of reproductive performance will be completed following publication of the national effort.

RECOMMENDATIONS

Implementation of the 2003 Monitoring Plan for the American Peregrine Falcon should continue as detailed. This will require monitoring of the same 15 randomly selected nesting territories for the national effort in 2012 and 2015. Although we would not have chosen these sites as the best or most representative of available peregrine nesting sites in Wyoming, additional data and sampling approaches should continue for state-specific analysis and allow for comparative evaluations in 2015.

ACKNOWLEDGEMENTS

Many individuals assisted with the 2009 Peregrine Falcon monitoring effort. Surveys in Yellowstone National Park were completed by Doug Smith, Joel Pagel, Lisa Baril, Leslie Henry, and Katy Duffy. Susan Patla, Sue Wolff, Megan Ruehmann, and Katherine Gura monitored sites in Grand Teton National Park. Susan Patla and Bob Oakleaf were assisted with their survey efforts outside of National Parks by Don Lingle, Andrew Pills, Dale Mutch, and Pat Hnilicka.

Table 1. Peregrine Falcon productivity in Wyoming (National Survey Sites only).

Year	Number of Nest Sites				Young Fledged	Young per Occupied Site
	Known	Checked	Occupied	Successful (%)		
2003	67	15	15	12 (80)	28	1.9
2006	85	14	14	11 (79)	26	1.9
2009	90	15	14	7 (54)	14	1.0

Table 2. Peregrine Falcon productivity of 30 randomly selected sites in Wyoming.

Year	Number of Nest Sites			Young Fledged	Young per Occupied Site
	Checked	Occupied	Successful (%)		
2005	30	30	21 (70)	51	1.7
2006	30	30	22 (73)	49	1.6
2007	30	27	19 (70)	40	1.5
2008	22	22	13 (59)	30	1.4
2009	30	25	15 (60)	36	1.4

Table 3. Peregrine Falcon productivity in Wyoming, 1998-2009 (all sites).

Year	Number of Nest Sites				Young Fledged	Young per Occupied Site
	Known	Checked	Occupied	Successful (%)		
1998	47	44	44	35 (79)	84	1.9
1999	47	42	42	25 (59)	57	1.4
2000	52	46	46	40 (87)	83	1.8
2001	56	42	42	39 (93)	81	1.9
2002	63	60	59	49 (83)	97	1.6
2003	67	58	58	50 (86)	107	1.8
2004	72	66	65	56 (86)	130	2.0
2005	75	64	64	45 (70)	99	1.6
2006	85	61	61	44 (72)	101	1.7
2007	87	54	51	36 (71)	75	1.5
2008	89	29	29	19 (65)	45	1.5
2009	90	46	41	28 (68)	58	1.4

WYOMING RANGE RAPTOR INVENTORY AND MONITORING STUDY COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Northern Goshawk, Great Gray Owl, Boreal Owl, Northern Pygmy Owl

FUNDING SOURCE: Federal Funds with State Match, State Wildlife Grant Projects

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Susan Patla, Nongame Biologist
Sabrina Derusseau, Nongame Biologist

INTRODUCTION

Mature conifer forest habitat in the Wyoming Range provides nesting habitat for raptors designated as Species of Greatest Conservation Need (SGCN) in Wyoming, including Boreal Owl, Great Gray Owl, Northern Goshawk, and Northern Pygmy Owl. In addition, the Flammulated Owl, which has been documented nesting west of the Wyoming Range, is also associated with mature conifer/aspen stands. Past timber harvesting and wild fires have reduced and fragmented mature forest stands, and current and proposed habitat projects such as prescribed burns, urban interface fire control projects, and aspen regeneration projects will contribute to the loss of potential nesting habitat. In addition, unprecedented loss of older conifer trees to insects and disease is occurring throughout the Rocky Mountains. The Comprehensive Wildlife Conservation Strategy for Wyoming (Wyoming Game and Fish Department 2005) recommends raptor surveys prior to large-scale management activities. Four objectives for the Wyoming Range Raptor Survey Project were to:

1. Obtain baseline data on occurrence and distribution of raptor SGCN for planning future habitat projects.
2. Develop methods for standardized surveys to track future population trends.
3. Compile habitat data at Northern Goshawk nest sites to develop adequate management guidelines for this species.
4. Document the presence of other SGCN and goshawk prey species during raptor surveys.

METHODS

Study Area

The Wyoming Range is a range of the Rocky Mountains that runs north-south located in southwestern Wyoming (Figure 1). It is primarily administered by the Bridger-Teton National Forest (BTNF). Our study area is bounded on the north by North Horse Creek, to the south by South Piney Creek, to the west by the spine of the Wyoming Range, and to the east by the BTNF boundary. However, we conducted some surveys outside of the study area on BLM lands to the east and on BTNF lands to the west.

Elevations in the Wyoming Range are approximately 5,000 feet (1,520 m) to 11,360 feet (3,463 m) (Wyoming Peak, the highest peak in the Wyoming Range). However, our survey efforts were focused at elevations less than 9,000 feet (2,740 m). The general climate is characterized by long, cold winters and mild, dry summers. The average snow depth (years 1936 to 1992) during April and May, when Northern Goshawks begin nesting, is 49 and 31 inches (124 and 79 cm), respectively, at Snider Basin (http://www.wcc.nrcs.usda.gov/snow/snotel-wedata.html), which is near the southern boundary of the study area. Tree species include aspen (*Populus tremuloides*), Douglas fir, (*Pseudotsuga menzieseii*), Engelmann spruce (*Picea engelmannii*), lodgepole pine (*Pinus contorta*), subalpine fir (*Abies bifolia*), and whitebark pine (*Pinus albicans*). Non-forested areas are dominated by sagebrush (*Artemisia tridentata*).

Early Season Owl Surveys

Owl broadcast callings surveys were scheduled for March through mid-April. To plan surveys, we created a geographic information systems (GIS) map for the Wyoming Range that displayed all forest stands and associated canopy cover based on the 2007 BTNF remote sensing vegetation data created with Landsat imagery from 1999 through 2004. Survey routes were selected along established roads and trails in areas that had stands of Engelmann spruce/subalpine fir, lodgepole pine, and/or mixed conifer (including Douglas fir) and canopy cover greater than 50%. Survey areas were accessed by snowmobile and/or snowshoes.

Along the survey routes, listening/calling stations were established every 0.5 mile (0.8 km) by georeferencing. Surveys began approximately one-half hour after sunset and continued until no later than 2400 hours. Each station consisted of a series of listening and calling periods based on a modified standardized protocol (Orabona Cerovski and Patla, 2007), which is summarized below.

1	*2*	*3*	*4*	*5*	*6*	*7*
3 minutes of listening	20 seconds of Boreal Owl calling	2 minutes of listening	20 seconds of Boreal Owl calling	2 minutes of listening	20 seconds of Great Gray Owl calling	2 minutes of listening

A FoxPro NX3 caller was used to broadcast owl calls in four cardinal directions at each station. Species, compass direction, estimated distance, and confidence in species identification were recorded at each station. Temperature, time, Beaufort wind level, and noise level were also recorded at each station. In addition, owls heard during station set-up up, travel, or before/after station procedure were recorded. If we detected a small owl during a station period, we ended the calling station and did not broadcast the Great Gray Owl call. If a Great Horned Owl was detected, we completed only the initial 3-minute listening period.

Flammulated Owl Surveys

Using the 2007 BTNF remote sensing vegetation data created with Landsat imagery from 1999 through 2004, a GIS map was created for the Wyoming Range that displayed aspen stands (RSAC 2007). Using this map as a guide, 10 survey routes along roads or trails were selected in and near stands of aspen in the Wyoming Range. We also conducted two surveys along the west side of the Salt River Range and two surveys along the Greys River, which bisects the Wyoming and Salt River Ranges. Survey routes were accessed by vehicle and/or walking.

Along the survey routes, listening/calling stations were established every 1,640 feet (500 m) by georeferencing. Surveys began approximately one-half hour after sunset and continued until no later than 2400 hours. At each station, approximately 10 minutes of a series of listening and calling periods was used according to the procedure below.

1	*2*	*3*	*4*	*5*
2 minutes of listening	1 minute of Flammulated Owl calling	3 minutes of listening	1 minute of Flammulated Owl calling	3 minutes of listening

A FoxPro NX3 caller was used to broadcast owl calls in four cardinal directions at each station. Species, compass direction, estimated distance, and confidence in species identification were recorded at each station. Temperature, time, Beaufort wind level, and noise level were also recorded at each station. In addition, owls heard during station set-up up, travel, or before/after station procedure were recorded. If a Great Horned Owl or Barred Owl was detected at a station, Flammulated Owl calls were not broadcasted.

Wyoming Game and Fish Department (Department) Nongame Biologists S. Derusseau and D. Kilpatrick conducted surveys from 13 May to 1 June 2009. Surveys were not completed if there was too much wind that could interfere with surveyor ability to hear owls or there was heavy precipitation, which inhibits owl calling.

Northern Goshawk Surveys

We conducted surveys for goshawks using standardized broadcast calling procedures (Kennedy and Stahlecker 1993), which is summarized below.

Survey Period	*Dates*	*Goshawk Nesting Chronology*	*Survey Area*	*Survey Methodology*
1	6/11/09 to 7/13/09	Nestling	North-facing stands	Broadcast call (alarm)
2	7/28/09 to 8/03/09	Fledgling	Historic nest sites	Nest stand searching and broadcast call (wail and alarm)
3	8/11/09 to 8/31/09	Post-Fledgling	Previous detections and north-facing stands	Broadcast call (wail only)

For each survey period, we utilized GIS mapping and the 2007 BTNF remote sensing vegetation data created with Landsat imagery from 1999 through 2004 to lay out survey transects and calling station points. These grids and the UTM coordinates for each station were created using ArcGIS by N. Whitford (Department Nongame GIS Analyst). For the calling station grid, stations were separated by 656 feet (200 m) on east to west transects and 820 feet (250 m) north to south. Stations on the east to west transects were also off-set by 328 feet (100 m; Joy et al. 1994). We targeted stands with canopy cover greater than 50% after consulting with Liz Davy, BTNF Forest Silviculturist, who advised that this would be the most efficient method to target existing mature stands of trees using the available GIS vegetation layers. Surveys were targeted primarily on north-facing slopes where most extensive stands of conifers occur. South-facing slopes in the Wyoming Range tend to be non-forested or dominated by stands of small diameter aspen and conifer.

During the first survey period from mid-June to mid-July, the nestling period, we conducted broadcast call (alarm) surveys targeting stands on northerly aspects 1 mile (1.6 km) away from known goshawk nests. Following any goshawk detections, we conducted an immediate search in the area for an active nest. If no nest was found that day, we would return often with one or two additional observers to search stands and conduct additional callings stations within 1,640 feet (500 m) of the original detection for an additional 4 to 6 hours.

During the second survey period from late July to early August, the early fledgling period, we targeted seven historic nest sites in and near the Wyoming Range by nest stand searching and broadcast call surveys (using both wail and alarm calls) within a 1 mile (1.6 km) radius of known nest sites. Plans to do early season nest checks of these historic nest sites could not be completed as a result of late winter conditions and road closures.

During the third survey period from approximately mid- to late August, the late fledgling/pre-dispersal period, we resurveyed areas where we had made goshawk detections earlier in the season but failed to locate active nests. We applied the station grid to an area within a 2-mile (3.2 km) buffer radius around each of our previous detection points (n = 7) where a nest had not been located. Approximately 20 stations were surveyed around the detection points in suitable habitat Also, we continued to use the original grid associated with canopy cover greater than 50% developed for survey period one to survey additional north-facing stands that had not been surveyed during the nestling period (n = 108 survey stations).

Surveys began at approximately 0800 hours and continued until as late as 1800 hours. Survey station UTM coordinates were downloaded into either a Garmin 12 or 76S to navigate to each station. A t each station, the start time and a brief habitat description were recorded. After each station survey, surveyors recorded the presence of goshawk prey species (squirrels, grouse, woodpeckers, large passerines). If a goshawk was detected, the age, detection type, distance, and bearing were recorded. Goshawk detections that were both vocal and visual resulted in a nest search in the area.

Northern Goshawk Habitat Analysis

Habitat data at active goshawk nests were collected in early September. Nest tree specific information collected included tree species, age, diameter at basal height (DBH), and height; and nest type, height, aspect, and nest tree canopy cover were also recorded. Nest site habitat data were collected in a 66-foot or one chain (0.217 ha) radius plot. We measured elevation; slope aspect; slope percent, canopy cover, number of seedlings, downfall, live and dead trees per acre; average ground cover height, dominant ground cover species, average diameter of all live and dead species of trees, average diameter of live mature trees [greater than 7 inches (17.8 cm) DBH for lodgepole pine and greater than 8 inches (20.3 cm) DBH for all other tree species], and live, dead, and live mature stand basal area. We used a concave spherical densiometer to measure canopy cover.

GIS Habitat Analysis

To measure habitat characteristics, we used a hierarchy of spatial scales at 18 new and historic nests on or near the BTNF using the 2007 BTNF vegetation data described previously. Specifically, we determined the percentage and area of vegetative cover, canopy cover, and tree size in three different buffers centered at each nest. The nest area (NA) is a circular buffer [radius 1,665 feet (507.57 m)] around the nest tree of 200 acres (80.9 ha). The post-fledgling family area (PFA) is a donut-shaped buffer around the nest tree that is 400 acres (161.9 ha) in size extending out a 2,884-foot (879.14-m) radius from the nest tree; data for the PFA do not include the embedded NA. The foraging area (FA) is a circular buffer around the nest tree of 6,000 acres (2428 ha) and 28,805-foot (8779.91-m) radius, encompassing both the NA and the PFA. Where the nest tree buffers extended beyond the BTNF boundary, remote sensing vegetation data were not available, so the buffers were clipped to the boundary/data, and percentages and areas were determined for that smaller area. There was a possibility that there could have been logging activity after 1999 that was not reflected in the BTNF vegetation data We converted the ArcMap tables to Excel files, and used Excel to calculate percentages for vegetative cover, canopy cover, and size class.

RESULTS

Boreal and Great Gray Owl Surveys

We completed eight surveys, but had to cancel surveys on many nights due to inclement weather (Figure 2). A total of nine Boreal Owls (BOOW), four Northern Pygmy-Owls (NOPO), and five Great Horned Owls (GHOW) were detected during surveys; no Great Gray Owls (GGOW) were detected (Figure 2; Table 1). The Straight Creek survey had the most owl detects; there were a total of seven owls detected (five Boreal Owls, one Northern Pygmy-Owl, and one Great Horned Owl).

Flammulated Owl Surveys

A total of 14 surveys were conducted, covering a distance of 36 miles 58 km; Figure 3). In summary, 1 possible Flammulated Owl (FLOW), a pair of Barred Owls (BAOW), 8 Great Horned Owls (GHOW), 3 Northern Pygmy-Owls (NOPO), and 11 Northern Saw-whet Owls (NSWO) were detected during surveys (Figure 3; Table 2). The North Mountain survey had the most owl detections; there were a total of seven owls detected (six Northern Saw-whet Owls and one Great Horned Owl). Three of the surveys had no owl detections.

We had a possible Flammulated Owl detection on the Camp Creek transect in conifer/aspen habitat. After the second period of broadcast calling of Flammulated Owl calls, we heard one clear, low hoot from less than 328 feet (100 m) away. However, this owl could not be further confirmed that evening.

Northern Goshawk Surveys

Weather Data

Increased precipitation in April, May, June, and July, and colder February and March temperatures are related to declines in occupancy of nesting territories by breeding goshawks (Fairhurst and Bechard 2005). Precipitation amounts for March, April, May, June, and July in the Green and Bear Climate Division and the average from 1895 to present are in Table 3. June was a very wet month, with over twice as much precipitation relative to the long-term average. Average temperatures for February, March, April, May, and June in the Green and Bear Climate Division and the average from 1895 to present and for the last 5 years are in Table 4. June temperatures were cooler than both the 5-year and the long-term averages. (http://www.wrds.uwyo.edu/sco/data/divisional_precip/divisional_precip.html, http://www.wrds.uwyo.edu/sco/data/divisional_temp/divisional_temp.html).

Snow depth and/or snow water equivalents (SWE) may also result in lower goshawk territory occupany rates (Patla 1997). Table 5 presents snow depth and SWE data from the Snotel site in Snider Basin, which is located near the southern boundary of our study area (http://www.wcc.nrcs.usda.gov/snow/snotel-wedata.html). The May 2009 SWE and depth is higher than the long-term average.

Broadcast Calling Results

Six surveyors spent 78 days and approximately 300 hours broadcast surveying. We surveyed 844 stations (including 108 stations repeated in survey period 3). The average time to broadcast, record data, and walk between each station was 21.6 minutes. The total area surveyed (not including repeated stations) was approximately 14.5 miles^2 (37.5 km^2). On average, we spent 60 hours broadcast surveying, surveyed 170 stations, and surveyed 2.9 $miles^2$ (7.5 km^2) to find one nest.

We had 15 goshawk detections in nine areas and located five active nests (Table 6). There were nine detections during survey period 1, and three detections each in of survey periods 2 and 3. In addition, the Big Piney Ranger District of the BTNF found one nest near McDugal Creek while marking a timber sale. Detections in two areas (Halverson Creek and Sjhoberg Creek) that appeared to be by territorial adults during the nestling period did not lead to location of an active nest. These detections included a male fly-over and a perched female alarm calling, and a perched adult and a fly-over; respectively. Surveyed areas, detection types, and nests/fledglings found are summarized in Figure 4.

Nine fledglings were associated with the six active nests located (Table 7). The number of fledglings per successful nest was 1.8 and the number of fledglings per active nest was 1.5. Only one nest (North Piney Creek) was located during the nestling phase on 12 July 2009. The nestlings were determined to be 14-17 days post-hatching (Boal 1994).

Other Species Detected

The number of species detected and locations have been recorded in the Department's Wildlife Observation System (n = 191). Species recorded included the snowshoe hare Dusky Grouse, Ruffed Grouse, and red squirrel. Red squirrels or red squirrel sign (middens and/or seeds separated from cones) were present at 54% of survey stations. Woodpecker species encountered during goshawk surveys included the American Three-toed Woodpecker, Hairy Woodpecker, Northern Flicker, and Red-naped Sapsucker (Figure 5). Sixty non-goshawk raptor detections occurred during and while traveling to and from goshawk surveys. Raptors detected include the American Kestrel, Cooper's Hawk, Great Horned Owl, Northern Harrier, Osprey, Prairie Falcon, Red-tailed Hawk, Sharp-shinned Hawk, and Short-eared Owl. One Great Horned Owl nest in the Middle Piney drainage and one Red-tailed Hawk nest in the North Horse Creek drainage were located during surveys. Also, one Prairie Falcon eyrie cliff was located in the McDugal Gap Area. The most commonly detected non-goshawk raptors were Red-tailed and Sharp-shinned Hawks. Results are summarized in Figure 6.

Habitat Data Results

We collected data at seven goshawk nesting areas in September 2009 (Figure 7). Habitat data for owl detection locations and goshawk nesting areas will be summarized in detail at the completion of the 2010 field season.

DISCUSSION

We had a relatively successful survey season given the challenges of a late, cold spring, which hampered owl survey efforts and likely resulted in failed raptor nest attempts, which decreases the ability to detect nesting pairs and nest sites. Overall, we documented the occurrence and distribution of numerous forest raptor SGCN in the Wyoming Range. This included seven goshawk nest areas.

Preliminary analyses of habitat data collected at goshawk nest trees indicate that goshawks select predominantly live or dead mature lodgepole pine or Douglas fir nest trees that average 139 years in age. These trees are located in a narrow elevation range between approximately 8,000 and 8,500 feet (2,438 and 2,590 m). The average percent slope at the nest tree is low (16%) and the average canopy cover is high (80%). Our habitat data collected at nest tree plots indicate that nest stands have a high canopy cover (average was 71%) and contain large numbers of mature lodgepole pine and Douglas fir trees [average of 259 live mature trees per 2.5 acres (1 ha)]. Our remote sensing vegetation analysis, despite its limitations, indicates that areas with considerable forested cover, high canopy cover, and a mature size class are important components for nesting and foraging areas of goshawk breeding territories.

In 2010, we plan to continue surveys for forest owls and goshawk through June. Final habitat analyses for this project will include a summary of locations and habitat types for specific owl species detections, and completion of goshawk nest area analysis.

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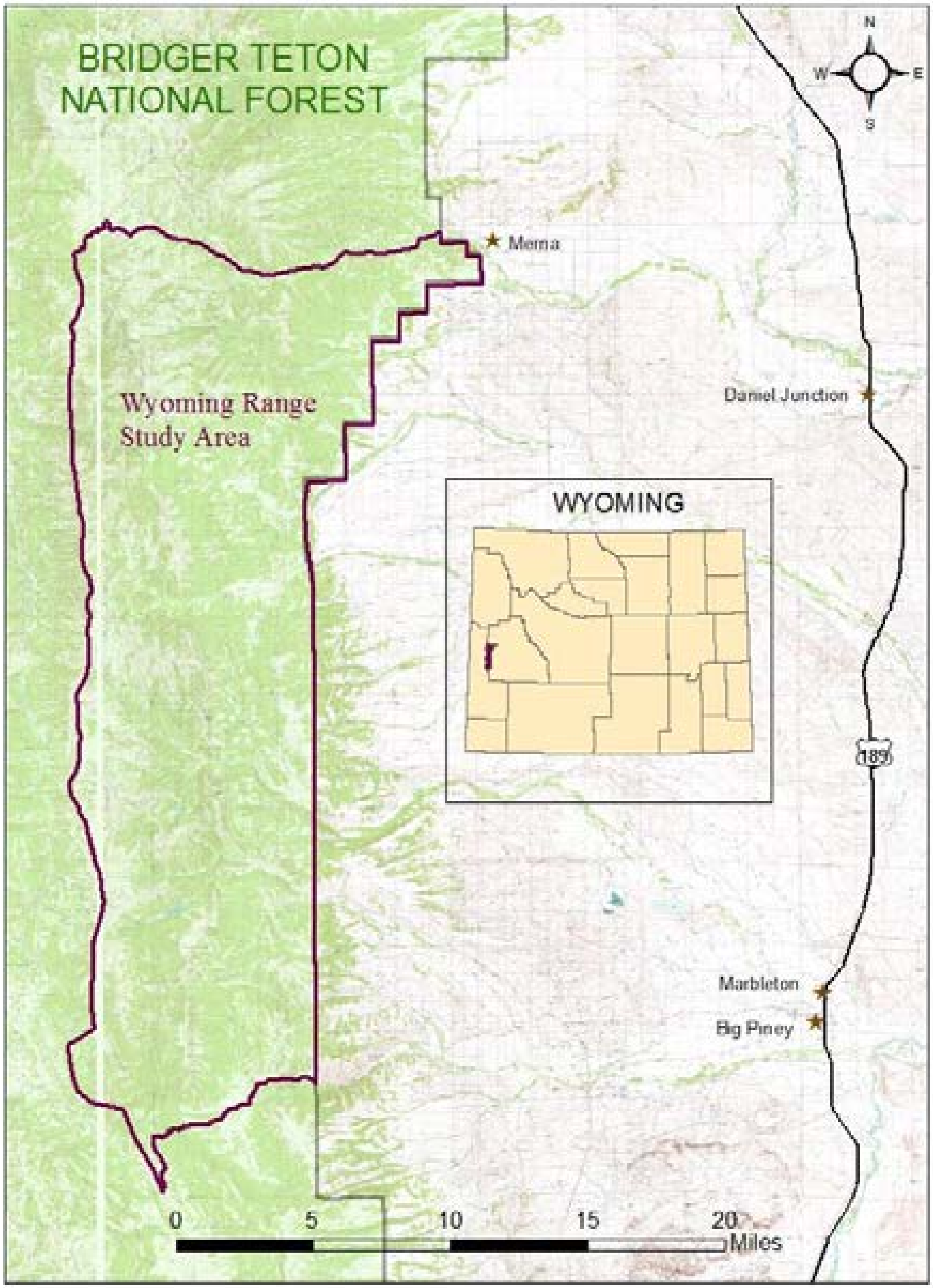

Figure 1. Study area for the 2009 Wyoming Range raptor inventory and monitoring study.

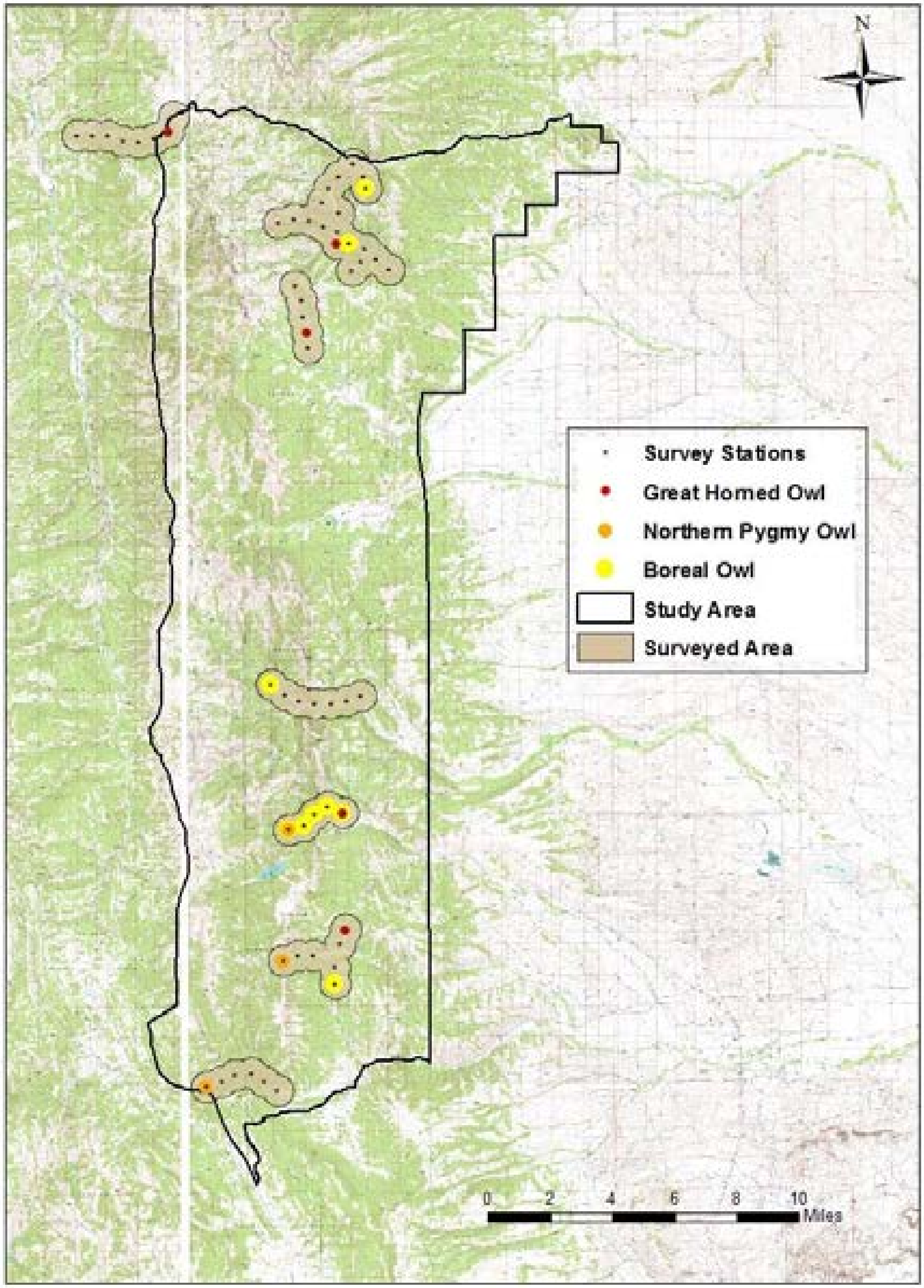

Figure 2. Boreal and Great Gray Owl survey stations, routes, and detections in the Wyoming Range study area during late winter and early spring, 2009.

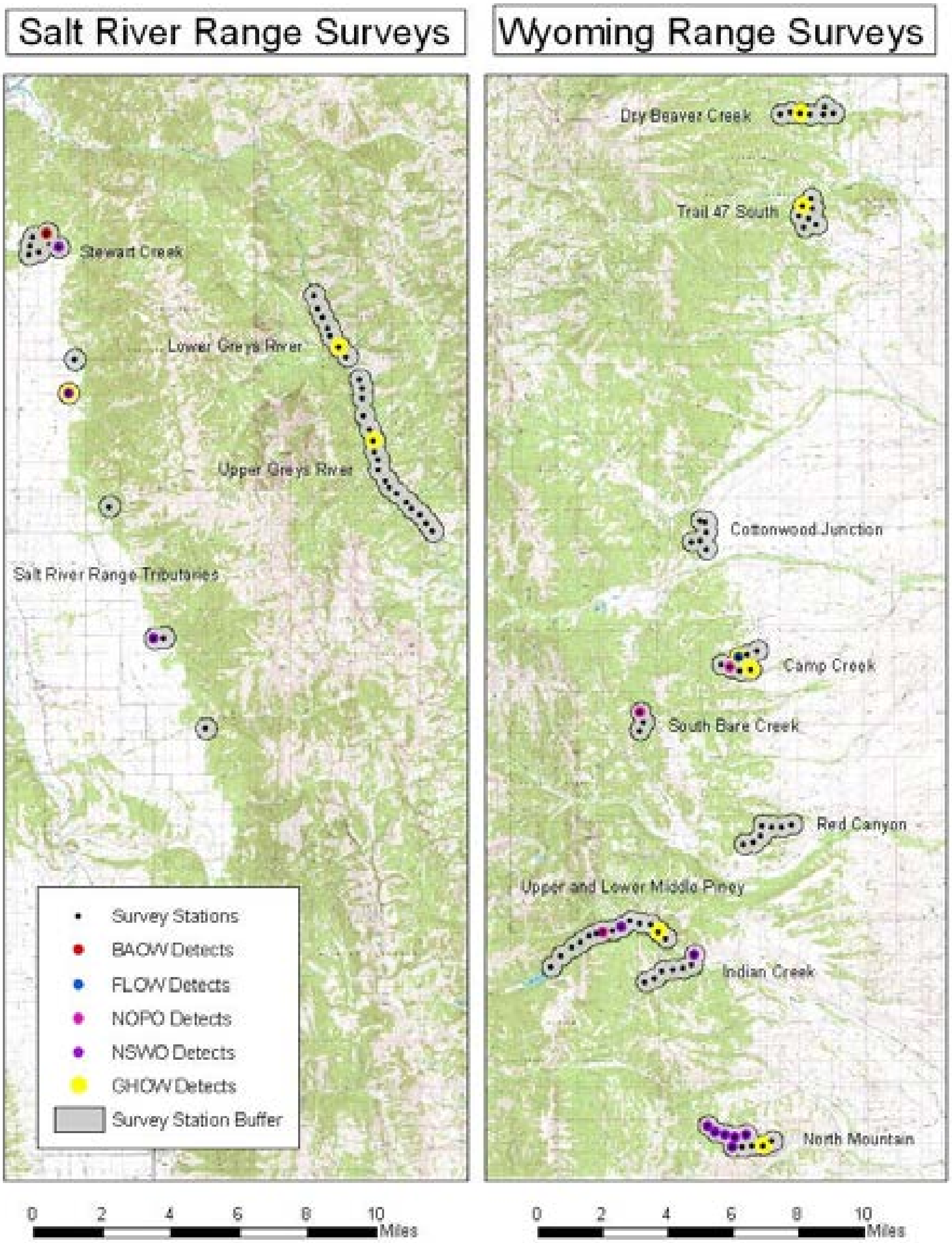

Figure 3. Flammulated Owl survey stations, routes, and detections in the Salt River Range and the Wyoming Range study area during late spring, 2009.

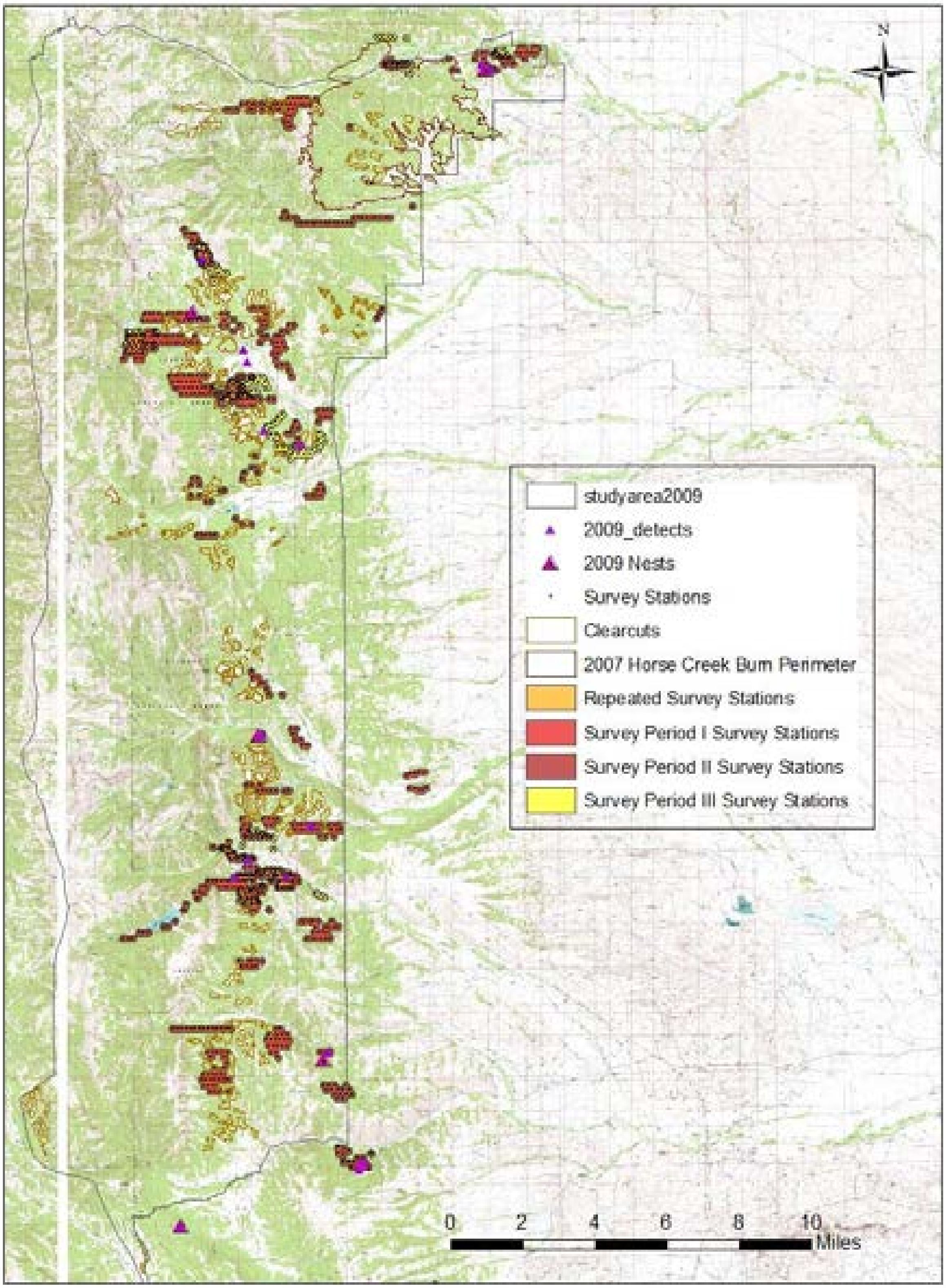

Figure 4. Summer 2009 Northern Goshawk survey stations and areas for survey periods I, II, and II; detections, and nests in the Wyoming Range.

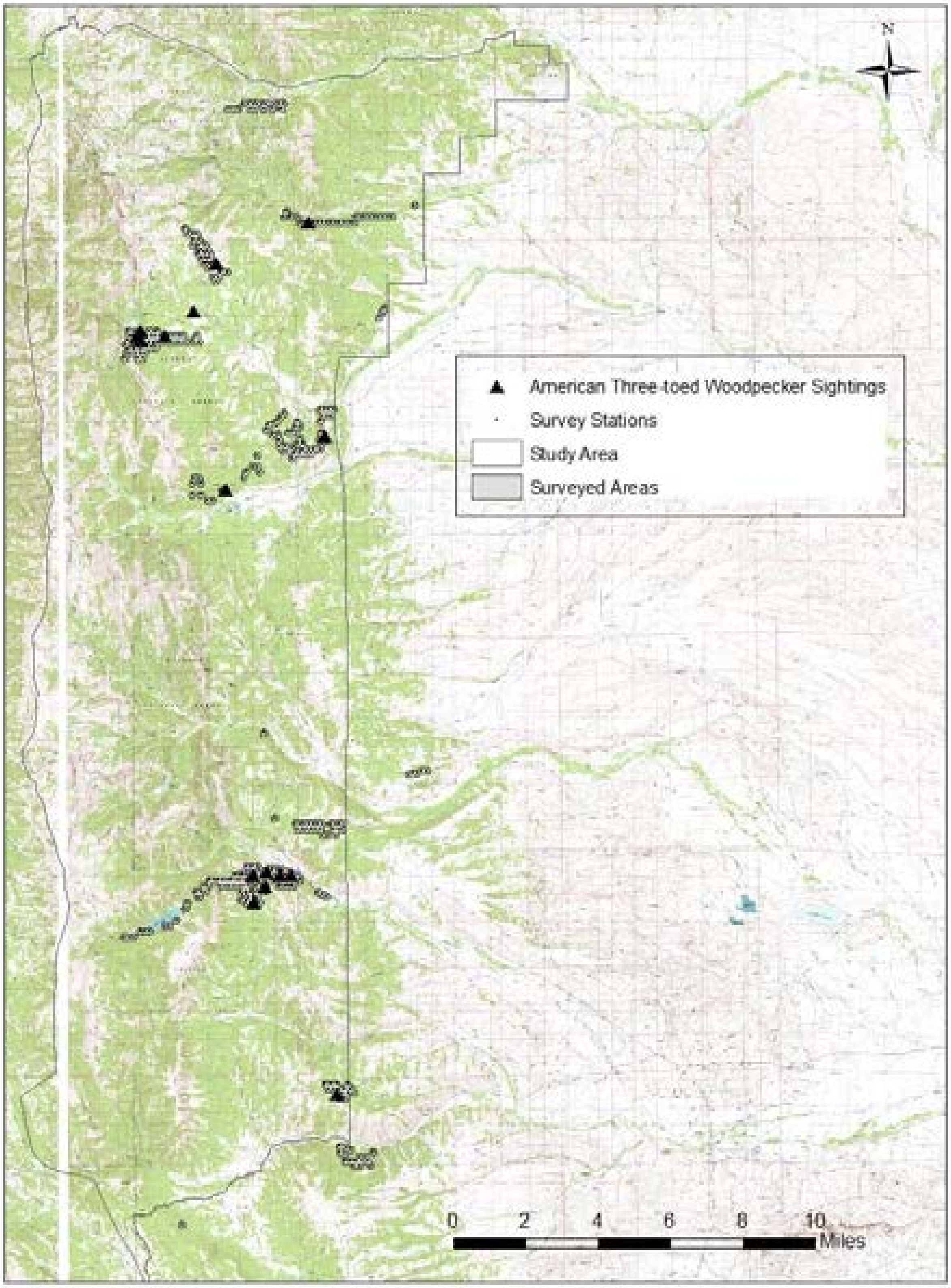

Figure 5. American Three-toed Woodpecker detections in the Wyoming Range during the summer 2009 Northern Goshawk surveys.

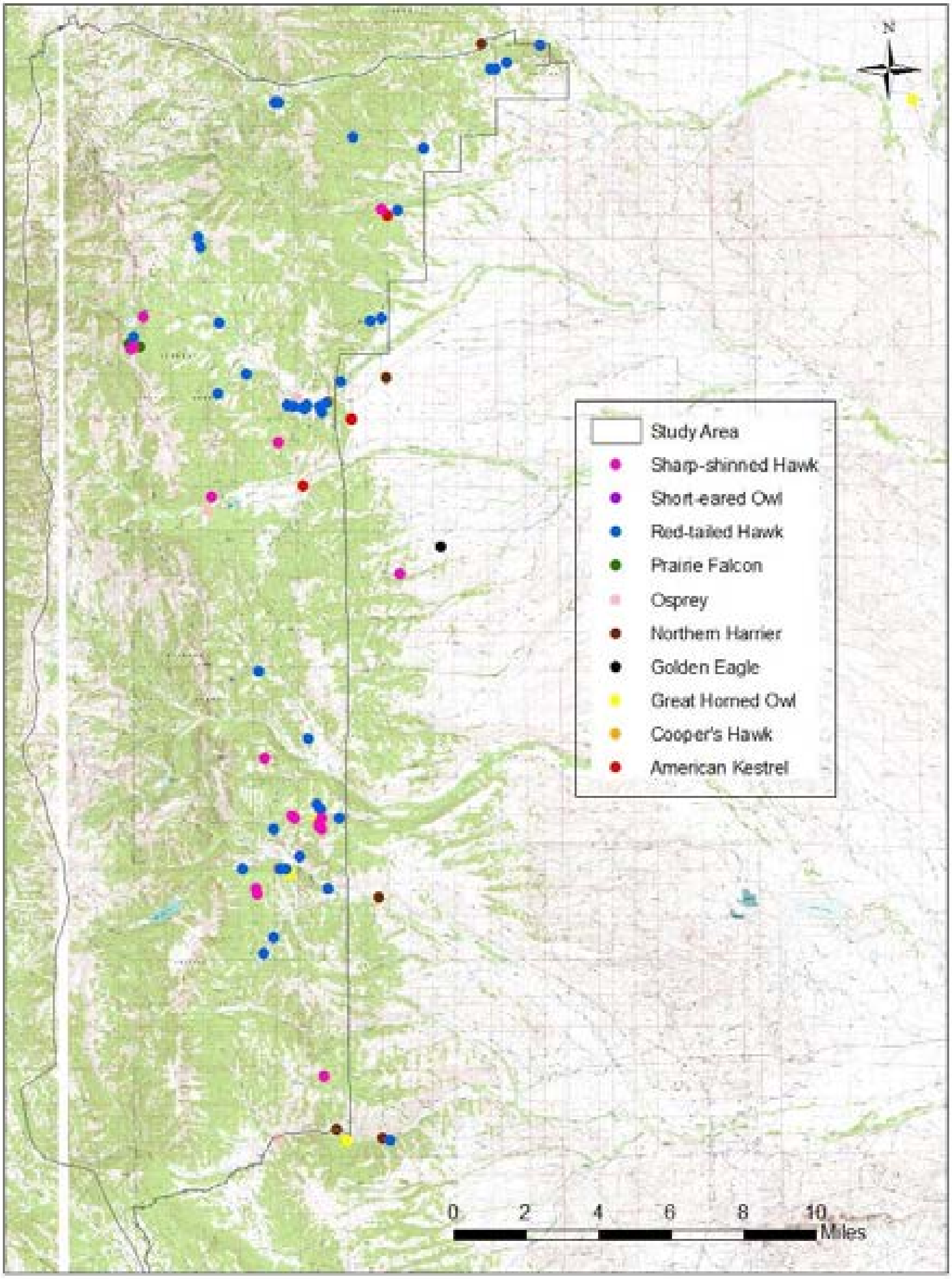

Figure 6. Non-goshawk raptor detections in the Wyoming Range during the summer 2009 Northern Goshawk surveys.

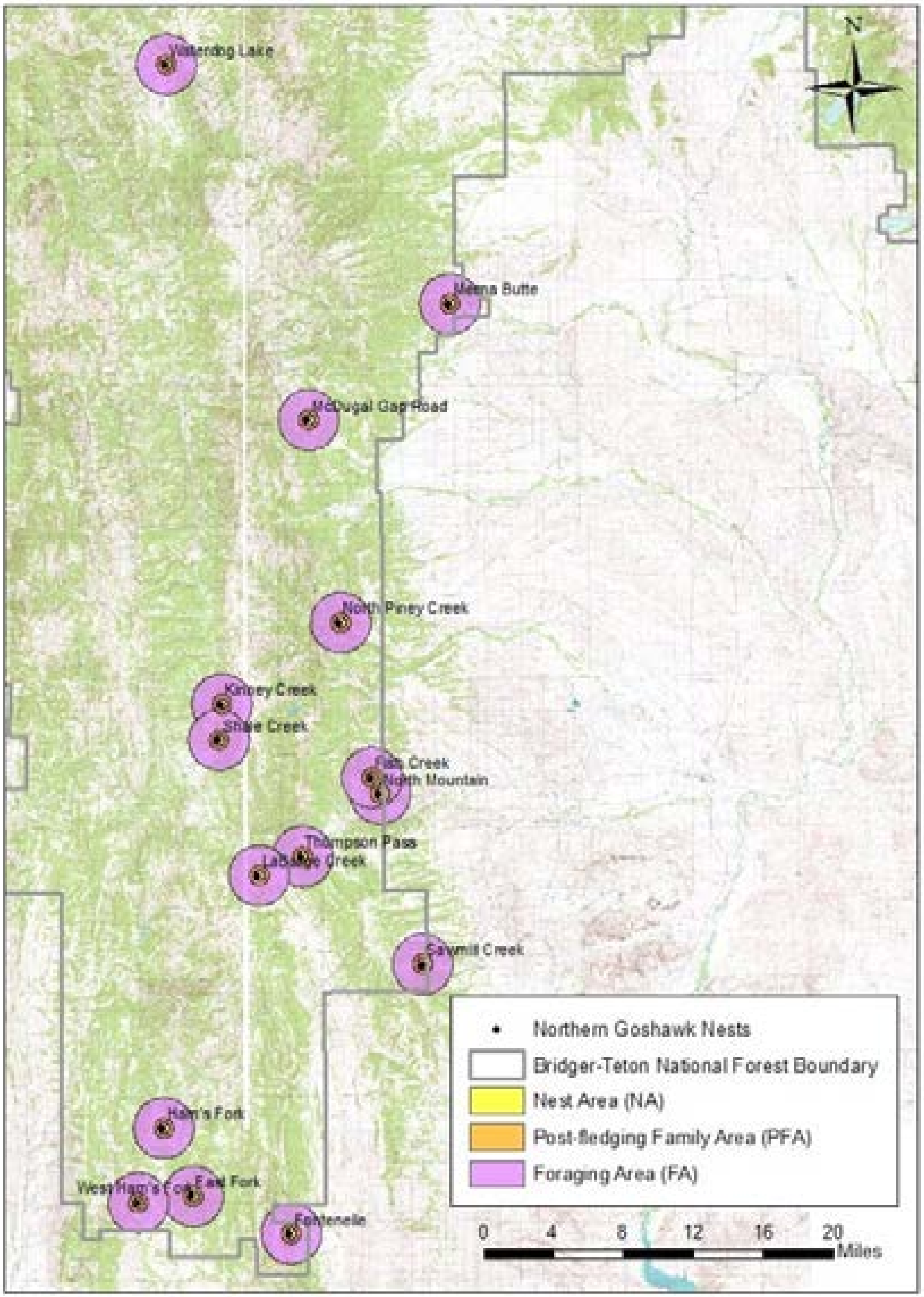

Figure 7. Fifteen recent Northern Goshawk nests on or near the Bridger-Teton National Forest with Nesting Area (NA), Post-fledging Family Area (PFA), and Foraging Area (FA).

Table 1. Survey Areas, dates, distances, and detections during Boreal and Great Gray Owl surveys in the Wyoming Range, late winter and early spring, 2009.

Survey Area	Date	Distance Surveyed (miles)	BOOW	GGOW	GHOW	NOPO
Straight Creek	3/18/09	3	5	0	1	1
Fish Creek	3/19/09	5.5	1	0	1	2
Blind Bull Creek	4/2/09	4.5	0	0	1	0
Sjhoberg Creek	4/3/09	3	0	0	1	0
Prospect Peak	4/4/09	4	1	0	0	0
North Horse Creek	4/5/09	6.5	1	0	1	0
South Piney Creek	4/8/09	3	0	0	0	1
North Piney Creek	4/9/09	3.5	1	0	0	0

Table 2. Survey areas, dates, distances, and detections during Flammulated Owl surveys in the Wyoming and Salt River Ranges, late spring, 2009.

Survey Area	Date	Distance Surveyed (miles)	BAOW	FLOW	GHOW	NOPO	NSWO
Indian Creek	5/13/09	2.4	0	0	0	0	1
North Mountain	5/15/09	3.3	0	0	1	0	6
Lower Middle Piney	5/16/09	2.7	0	0	1	1	1
Camp Creek	5/17/09	2.7	0	1?	1	1	0
Red Canyon	5/18/09	2.4	0	0	0	0	0
Trail 47 South	5/26/09	2.1	0	0	1	0	0
Upper Middle Piney	5/27/09	2.1	0	0	0	0	0
Cottonwood Junction	5/28/09	2.4	0	0	0	0	0
South Bare Creek	5/28/09	0.6	0	0	0	1	0
Dry Beaver Creek	5/29/09	2.4	0	0	1	0	0
Upper Greys River	5/30/09	4.5	0	0	1	0	0
Lower Greys River	5/30/09	3.6	0	0	1	0	0
Salt River Range Tribs	5/31/09	2.1	0	0	1	0	2
Stewart Creek	5/31/09	2.1	2	0	0	0	1

Table 3. Precipitation in inches for March, April, May, June, and July 2009 and the average for 1895 to Present in the Green and Bear Climate Division.

Precipitation Measurements	March	April	May	June	July
2009 Monthly Precipitation in Inches	0.57	1.09	1.04	2.42	0.54
Average Precipitation in Inches for 1895 to Present	0.756	0.879	1.3	1.026	0.786

Table 4. Temperature in Fahrenheit for February, March, April, May, and June 2009 and the average for the last five years and 1895 to present in the Green and Bear Climate Division.

Temperature Measurements	February	March	April	May	June
2009 Monthly Temperature in Fahrenheit	20.7	29.0	38.3	49.2	54.1
Average Monthly Temperature in Fahrenheit for the Last 5 Years	19.4	28.7	38.2	48.4	56.5
Average Monthly Temperature in Fahrenheit for 1895 to Present	18.9	27.0	37.5	47.3	55.9

Table 5. Snider Basin Snotel Site snow depth and snow water equivalents in inches for March, April, May, and June 2009, and long-term averages.

Snow Characteristics	March	April	May	June
2009 Snow Depth in Inches	47	54	35	0
1936-1992 Average Snow Depth in Inches	49	49	31	0
2009 SWE in Inches	11.8	14.4	13.3	0
1971-2000 Average SWE in Inches	12.4	14.7	12.6	0

Table 6. Northern Goshawk detections during goshawk surveys in the Wyoming Range study area, summer 2009.

Detection	Date	Area	Detection Type
1	06/11/09	Merna Butte	Perched adult
2	06/17/09	Hardin Creek	Visual while surveyor driving
3	06/23/09	Hardin Creek	Visual while surveyor driving
4	06/23/09	Straight Creek	Fly-over
5	06/23/09	Middle Piney	Feather
6	06/25/09	Middle Piney	Fly-over and vocal (alarm) only
7	07/07/09	Halverson Creek	Adult female vocal/visual
8	07/08/09	Sjhoberg Creek	Fly-over and perched adult
9	07/12/09	North Piney Creek	Adult female vocal/visual, nest
10	07/31/09	Thompson Pass	Fledglings
11	08/01/09	South Piney Creek	Vocal (alarm) only
12	08/11/09	South Piney Creek	Feather, nest
13	08/12/09	Merna Butte	Fledglings, nest
14	08/17/09	Irene Creek	Fly-over
15	08/25/09	Lower Fish Creek	Fledgling, nest

Table 7. Six Northern Goshawk nests located in the Wyoming Range study area during summer 2009.

Date Found	Area	No. of Fledglings	Found During
7/12/2009	North Piney Creek	2	Survey Period I
8/3/2009	Thompson Pass	3	Survey Period II
8/11/2009	South Piney Creek	0	Survey Period II
8/12/2009	Merna Butte	2	Survey Period III
8/25/2009	Lower Fish Creek	1	Survey Period III
Unknown	McDugal Creek	1	N/A

LONG-BILLED CURLEW SURVEYS IN WESTERN WYOMING COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Long-billed Curlew

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Andrea Orabona, Nongame Bird Biologist

INTRODUCTION

The purpose of the Long-billed Curlew surveys in 2009 was to provide an indication of curlew population trends in portions of their breeding range in Wyoming. Surveys were conducted along the same routes as in previous years so long-term monitoring of Long-billed Curlew populations can be accomplished in the Pinedale/Merna, Cody, and Jackson areas. We may add additional routes in eastern Wyoming as funding, time, and personnel allow.

METHODS

Cochrane (1983) conducted roadside curlew surveys from 8 May to 19 July 1982, modifying the Breeding Bird Survey (BBS) technique (Robbins and VanVelzen 1967) to sample the greatest number of birds over the greatest distance (Cochrane and Oakleaf 1982). Surveys began 20 minutes before sunrise, and visual counts were made every 0.5 mile (0.8 km) along the survey route using nine power binoculars. Curlews that were heard calling but that could not be located during the 3-minute stop were excluded from the count, whereas those observed while driving between stops were included. Flocks were defined as groups of five or more individuals observed together.

In 1987, we replicated Cochrane's Long-billed Curlew survey routes. Since 1991, however, we modified the survey methodology to include both the number of curlews seen and heard to better represent the total number of curlews present along each route. Starting in 2007, we further modified the methodology to correspond with the U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) rangewide survey and monitoring guidelines for Long-billed Curlews (Jones et al. 2003) and subsequent results (Stanley and Skagen 2007).

The number of stops on each route conducted in 2009 depended on the amount of suitable curlew habitat available to survey. As in past years, the Horse Creek survey route contained 17 stops and the New Fork route contained 9 stops. The Chapman Bench route has varied slightly depending on the observer, with 10 stops conducted between 1992 and 1995, 15 stops conducted between 1996 and 2000, and 17 stops conducted between 2001 and the present. The Grand Teton National Park (GTNP) Hayfields route contained 23 stops; however, in past years, this route contained 20 stops but was modified in 1997 due to a washout of the Mormon Row Road and the likelihood that the Ditch Creek crossing may never be repaired. The three additional stops were added to ensure that the route ended in the same place, but the observer has since modified this route back to 20 stops that occur in curlew habitat. Curlew surveys on the National Elk Refuge were discontinued due to lack of curlews on the survey route. However, a new route was located and trial surveys were conducted in 2006, one official survey was conducted in 2009, and 2009 results are included in this report. We reported locations of each survey route in previous Nongame Completion Reports and maintain these in the Nongame files at the Department's Lander Regional Office.

Typically, two Long-billed Curlew surveys are conducted along the same routes that Cochrane surveyed in 1981 and 1982. In 2009, Department personnel conducted each survey twice: Horse Creek on 16 and 22 May, New Fork on 16 and 26 May, Chapman Bench on 24 and 27 May, and GTNP Hayfields on 19 and 20 May. The new route initiated in 2008 on the National Elk Refuge (NER) near Jackson was conducted on 13 May by Eric Cole. Total number of curlews seen at each stop, those that were heard but could not be seen, and those that were both seen and heard was all recorded. For each survey, we converted the results to number of curlews seen per mile (and converted to curlews seen per km) of road surveyed so data can be compared between years for each route.

RESULTS

All Long-billed Curlew survey data (number of curlews seen and heard, and comments made during each survey) are located in the Nongame files at the Department's Lander Regional Office. Total number of individual Long-billed Curlews detected on each survey route is as follows: 45 and 37 on Horse Creek, 13 and 19 on New Fork, 9 and 9 on Chapman Bench, 6 and 7 on the GTNP Hayfields route, and 10 on the NER route. The average number of curlews recorded per mile (and converted to per km) on each route is presented in Table 1. This includes curlews that were observed, those that were heard but not seen, and those that were both observed and heard, but does not include duplicate detections that may have occurred.

Long-billed Curlews have been detected on 27 Breeding Bird Survey (BBS) routes since 1968 when the BBS was initiated in Wyoming. Observers conducted 16 of these routes in 2009 and counted a total of 16 curlews on 3 of the 16 routes (Table 2). Counts in previous years have fluctuated from a low of 1 curlew recorded on 1 of 15 routes completed in 1998, to a high of 19 curlews recorded on 8 of the 16 routes conducted in 1999.

DISCUSSION

Several factors must be considered when comparing survey results between years. Curlew counts vary from one survey to the next due to weather conditions that affect visibility, fluctuations in noise levels, and actual fluctuations in curlew numbers. Therefore, it is beneficial to conduct a minimum of two surveys along each route per year for a better indication of the presence of curlews. Also, starting in 1991, the number of curlews that were seen only, heard only, and those that were both seen and heard have been recorded on each route. When taking audio identification data into consideration, the number of curlews per mile (and converted to per km) is higher than if visual identification alone is used. Therefore, recording both audio and visual curlew observations better represents the actual number of curlews present along each route than either observation alone. In addition, based on the rangewide survey conducted by the USFWS and USGS in 2004 and 2005, it was determined that surveys in Wyoming are better conducted slightly earlier in the season (21 April – 15 May) to better detect curlews during the pre-incubation and courtship stages when they are easier to detect (Jones et al. 2003). Surveys conducted later in the breeding season may not be indicative of the breeding population because they may detect groups of non-breeders and failed nesters loafing in the area (Stephanie Jones, U.S. Fish and Wildlife Service, personal communication). Although the 2009 surveys were conducted earlier than in past years to reflect this methodology change, all were still implemented after the May 15th date due to the availability of time the observers had to complete the surveys.

Although Long-billed Curlews have been detected on 25 BBS routes in Wyoming since 1980, these are typically conducted during the month of June, which is later than the peak period for detecting breeding curlews. In addition, curlews are not detected on enough BBS routes or in high enough numbers to determine accurate population trends using this methodology. Therefore, this accentuates the need to continue these curlew-specific roadside surveys that are timed to occur earlier in their nesting cycle to coincide with peak numbers of breeders.

ACKNOWLEDGEMENTS

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Table 1. Long-billed Curlew (LBCU) survey route results, 1987 and 1991-2009.[a]

Year	Horse Creek Route		New Fork Route		Chapman Bench Route		Grand Teton NP Hayfields Route		National Elk Refuge Route	
	Number of LBCU	LBCU Density No./Mile (Km)	Number of LBCU	LBCU Density No./Mile (Km)	Number of LBCU	LBCU Density No./Mile (Km)	Number of LBCU	LBCU Density No./Mile (Km)	Number of LBCU	LBCU Density No./Mile (Km)
1987	11[b]	1.4 (0.9)	13[b]	3.3 (2.0)	--	--	--	--	--	--
1991	75[b]	9.4 (5.8)	25[b]	6.3 (3.9)	--	--	--	--	--	--
1992	53	6.6 (4.1)	7	1.8 (1.1)	26[b]	5.8 (3.6)	--	--	--	--
1993	65	8.1 (5.1)	5	1.3 (0.8)	14[b]	3.1 (1.9)	10[b]	1.1 (0.7)	--	--
1994	45	5.6 (3.5)	11	2.8 (1.7)	7[b]	1.6 (1.0)	--	--	--	--
1995	53[b]	6.6 (4.1)	12[b]	3.0 (1.9)	0[b]	0.0 (0.0)	19[b]	2.0 (1.2)	--	--
1996	113	14.1 (8.8)	17	4.3 (2.6)	7	1.0 (0.6)	3	0.3 (0.2)	--	--
1997	40	5.0 (3.1)	42	10.5 (6.5)	0[b]	0.0 (0.0)	7	0.6 (0.4)	--	--
1998	43	5.4 (3.3)	10	2.5 (1.6)	5	0.7 (0.4)	14	1.3 (0.8)	--	--
1999	39	4.9 (3.0)	10	2.5 (1.6)	3	0.4 (0.3)	13	1.2 (0.7)	--	--
2000	42	5.3 (3.3)	5	1.3 (0.8)	8	1.1 (0.7)	--	--	--	--
2001	32	4.0 (2.5)	8	2.0 (1.2)	0	0.0 (0.0)	12	1.1 (0.7)	--	--
2002	31	3.9 (2.4)	6	1.5 (0.9)	6	0.8 (0.5)	10	0.9 (0.6)	--	--
2003	33	4.1 (2.6)	9	2.3 (1.4)	7	0.9 (0.5)	5	0.5 (0.3)	--	--
2004	31	3.9 (2.4)	9	2.3 (1.4)	6	0.8 (0.5)	8	0.8 (0.5)	--	--
2004[c]	81	10.1 (6.3)	2	0.5 (0.3)	--	--	--	--	--	--
2005	32	4.0 (2.5)	9	2.3 (1.4)	5	0.6 (0.4)	--	--	--	--
2006	26	2.0 (3.3)	12	1.9 (3.0)	7	0.9 (0.5)	14	1.5 (0.9)	--	--
2007	26	2.0 (3.3)	13	3.3 (2.0)	7	0.9 (0.5)	5	0.5 (0.3)	--	--
2008	37	4.6 (2.9)	4	1.0 (0.6)	10	1.3 (0.8)	9	0.9 (0.6)	6[b]	0.9 (0.5)
2009	41	5.1 (3.2)	16	4.0 (2.5)	9	1.1 (0.7)	7	0.6 (0.4)	10[b]	1.4 (0.9)

[a] If more than one survey was conducted, the average number of curlews recorded was used.
[b] Only one survey was conducted.

Table 2. Breeding Bird Survey data for Long-billed Curlews, 1980-2009. A blank indicates a year when a survey was not conducted. An asterisk identifies the routes most useful for monitoring this species.

Route #	Route Name	Year 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	*Route Total*
9	Dubois	0	0	0	0	0	0		0	0	0	1	0	0	0			0	0					*1*
15	Fontenelle			0	0	0			0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	*3*
28	Yoder	0	0	0				0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	*1*
32	Hunter Peak			0	0			0		0	0	0		0	0	0	0	0	0	0		0	0	*0*
*33	Clark											0	2	3								4	1	*10*
*36	Moose	0	0	0	0	1	0	2	0	1	2	2	2	0	0	0	2	4	4	0	4	0		*24*
45	Recluse	0		0	0			0	0	0		2	1	3	0	0	0	0	0	0	0	0	2	*9*
46	Soda Well	0	0	0	0				0	0	0	0	0	0	0	0	0	0	0	0			0	*0*
48	Seely[a]											2	0	0	0	0	0	0	0	0	0	0	0	*2*
64	Sussex												0	0		0	0	0	0	0				*0*
67	Highlight	0	0	0	0				0		0	0	0	1		0								*1*
*69	Newcastle									1	4	0		2	0	2	0	0	0	0	1	0	0	*10*
71	Soda Lake	0	0	0	0	0	0			0		0	3	1	0	0	0		0				0	*4*
*74	Boulder			0	2	2							0			0	0		0	0	3			*7*
*75	Big Sandy		0		0				0	2	7	5		3		6		8	0	0	3	1	5	*40*
76	Farson				1												0						0	*1*
*82	Lamont								1	0	0	1	1	1	0	0	0	1	0	0	1	2	1	*9*
83	Pathfinder			1	0	0			0	0	0	0	0		0	0	0	0	0	0	0	0	0	*1*
*89	Meadowvale				0	13	0				0	2	0	0		0	0							*15*
*90	Lusk			7	9	0			0	0	0	0	0	1	0	0	0			0	5	1	0	*23*
*93	Mountain View	11	10	9	5				0		0	0	0			0					0		0	*35*
104	Walcott			0			0				0	0	0	0	0	0	0	0	0	0	0	0	0	*0*
150	Gov't. Valley													0	0	0	0	0	3	0	1	0	2	*6*
173	Ryegrass	1	0	0	0	1	0			1						0		0	0	0	0	1	0	*4*
195	Seedskadee	0	2	0	0	0		0						0	1	0	0	0	0	0	0		0	*3*
206	Caballa Creek													4	0	0	0	0	0	1	0	0	0	*5*
Total Observed/Year		*12*	*12*	*17*	*17*	*17*	*0*	*2*	*1*	*7*	*14*	*15*	*9*	*19*	*1*	*8*	*2*	*13*	*7*	*1*	*19*	*9*	*11*	*214*

Route #	Route Name	Year								*Route Total*
		2002	2003	2004	2005	2006	2007	2008	2009	
9	Dubois							1	0	*2*
15	Fontenelle	0	0	0	0	1	0	0	1	*5*
28	Yoder	0	0	0	0	0	0	0	0	*1*
32	Hunter Peak	0	0	0		0	1	0	0	*1*
*33	Clark	1	0	4	0	0	0	0	0	*15*
*36	Moose		1	0						*25*
45	Recluse	2	1	2		0	0			*13*
46	Soda Well					0	4			*4*
48	Seely [a]	--	--	--	--	--	--	--	--	*2*
64	Sussex					2	0	0	0	*2*
67	Highlight						0			*1*
*69	Newcastle					1	7	6	8	*32*
71	Soda Lake	0	0		0					*4*
*74	Boulder	0	0			1	2	0	0	*10*
*75	Big Sandy				0	1	19	6		*66*
76	Farson	5				0	0	0		*6*
*82	Lamont	0		0				0	0	*9*
83	Pathfinder	1	0	0	0	0	0	0	0	*2*
*89	Meadowvale	0	0							*15*
*90	Lusk			4	4	1	1	3	7	*43*
*93	Mountain View	0	1			0				*36*
104	Walcott	0					3	1	0	*4*
148	Seely 2 [a]	0		2	0	0	0	0	0	*2*
150	Gov't. Valley	0	0	0	0		0	0	0	*6*
173	Ryegrass	0	3	1		0	0	0	0	*8*
195	Seedskadee	2	0							*5*
206	Caballa Creek	0	0		0	0		0	0	*5*
Total Observed/Year		11	6	13	4	7	37	17	16	*324*

[a] Route #48 (Seely) was modified in 2002 and is now #148 (Seely 2).

AMERICAN BITTERN SURVEYS
COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – American Bittern

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Lee Knox Nongame Biologist
Andrea Orabona, Nongame Bird Biologist

INTRODUCTION

The Wyoming Game and Fish (Department) classifies 10 species of colonial nesting waterbirds as Species of Greatest Conservation Need (SGCN), including the American White Pelican, American Bittern, Black-crowned Night Heron, Black Tern, Caspian Tern, Forster's Tern, Franklin's Gull, Snowy Egret, and White-faced Ibis (Wyoming Game and Fish Department 2005). We conduct surveys a minimum of every 3 years to determine the presence and estimate the number of nesting pairs of these species at important breeding sites in Wyoming. However, the American Bittern is a loosely colonial, secretive marshbird that is seldom detected during these surveys. Thus, this species requires specialized monitoring techniques to confirm its presence and determine density in preferred breeding habitat.

The American Bittern is a wetland obligate species that prefers tall, emergent vegetation. It nests on a platform of reeds, sedges, or cattails that is typically suspended over water (Gibbs et al. 1992). The American Bittern is found scattered throughout Wyoming's marshes, but is only known to breed in nine latilong blocks. It is a summer resident in Wyoming, and is classified as a Species of Greatest Conservation Need with a Native Species Status of 3 (Wyoming Game and Fish Department 2005).

Survey protocol for the American Bittern has evolved since the first species-specific surveys were conducted in Wyoming in 2004 on the marshland portions of the Cokeville Meadows National Wildlife Refuge (CMNWR). During that year, we established transects on the Thornock, Bartlett, and Diamond-Peterson land tracts on the CMNWR. We delineated each transect according to suitable habitat and American Bittern locations that we detected during passive listening surveys. The following year, as new survey recommendations became available, we established call broadcast stations on each transect (USFWS and USGS 1999). In 2006 and 2007, we again revised our survey approach according to recommendations from Conway and Nadeau (2006). We increased the distance between survey stations from 984 feet

(300 m) to 1,312 feet (400 m) to reduce the probability that an individual bittern would be detected at more than one survey point. We also modified the survey time to include only the evening period, which coincided with the peak of bittern vocalization activity. Lastly, we split the Diamond-Peterson transect into the Diamond transect and the Peterson transect to more efficiently survey both land tracts. We again revised the survey protocol in 2008 by requiring replication of all four transects a minimum of three times. In this report, we present the survey methods and results from our 2009 surveys, and also discuss the implications for the population of American Bitterns at the CMNWR.

METHODS

On 24-26 June 2009, we surveyed four transects for American Bitterns: Thornock, Bartlett, Peterson, and Diamond. Typically, we conducted surveys from 1945 to 2145 hours. If bittern vocalizations were heard earlier or later than 1945, we would adjust the survey start time accordingly to coincide with changes in the vocalization activity of American Bitterns. Every survey point along each transect lasted 7 minutes. At each survey point, we initiated the survey by passively listening for bittern vocalizations for 5 minutes. We then played a recorded American Bittern call for 1 minute, and finished the survey point by listening for a response for 1 minute. We recorded all American Bitterns heard or seen during all phases of the survey point, and marked the approximate location of each individual bittern on a route map. We also noted other species observed or heard at each survey point.

RESULTS

We detected American Bitterns on two of the four transects surveyed (Table 1). We completed the Thornock transect in 1 hour and detected 16 American Bitterns at five survey points. We completed the Bartlett tract in 1 hour and detected five bitterns at six survey points. On the Peterson transect, we were unable to survey three of the nine points due to railroad cars blocking our access, and we did not detect any American Bitterns on the six survey points we were able to conduct. We were also unable to survey the Diamond transect due to flooded road conditions that prevented access to the site. Due to inclement weather and unseasonably high amounts of rain during the survey timeframe (mid-May through June), we were unable to replicate surveys on all transects.

DISCUSSION

On the Thornock transect, American Bittern detections increased in 2009 to 16 individuals from the previous detections of 12 and 10 individuals in 2008 and 2007, respectively. Since 2006, CMNWR personnel have actively improved bittern habitat by controlled flooding, which has expanded the wetlands preferred by this species for nesting. We believe that the increase in American Bitterns on the Thornock transect are directly correlated with habitat improvements.

On the Bartlett transect, we have detected five American Bitterns every year for the last 3 years. We believe that the Bartlett tract may be near carrying capacity for American Bitterns due to limited suitable habitat for nesting.

We have only surveyed the Diamond and Peterson transects 2 out of the last 4 years due to unfavorable weather conditions, time constraints, and available personnel. On occasions when we surveyed the Diamond and Peterson transects, we detected few American Bitterns. We hypothesize that the lack of detections is correlated to a lack of suitable nesting habitat on these land tracts. Suitable habitat on the Bartlett, Diamond, and Peterson tracts has remained marginal for bitterns and other waterbirds due to drought conditions. However, the CMNWR has plans to continue to improve habitat on the Refuge, including the wetlands in the Bartlett, Diamond, and Petersons land tracts. If the CMNWR can successfully improve nesting waterbird habitat on these land tracts, we suspect that this will result in similar increases in nesting American Bitterns.

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Table 1. Number of American Bitterns (AMBI) detected during surveys conducted from 24-26 June 2009 in the Cokeville Meadows National Wildlife Refuge. Transect length for each route is reported in parentheses.

Thornock Transect (1.0 mile / 1.6 km)		Bartlett Transect (1.2 miles / 2.0 km)		Peterson Transect (1.8 miles / 2.9 km)	
Survey Point Number	**No. of AMBI Detected**	**Survey Point Number**	**No. of AMBI Detected**	**Survey Point Number**	**No. of AMBI Detected**
1	1	1	0	1	ns[a]
2	3	2	0	2	ns
3	4	3	0	3	ns
4	4	4	1	4	0
5	4	5	3	5	0
-	-	6	1	6	0
-	-	-	-	7	0
-	-	-	-	8	0
-	-	-	-	9	0
Total AMBI	*16*	-	*5*	-	*0*
AMBI density/mile (km)	*16 (10)*	-	*4.2 (2.5)*	-	*0*

[a] Not surveyed; access to the survey point was blocked by railroad cars.

COORDINATED COLONIAL WATERBIRD INVENTORY AND MONITORING COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Colonial Waterbirds

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars, U.S. Fish and Wildlife Service Cooperative Agreement #601819J311

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Andrea Orabona, Nongame Bird Biologist

SUMMARY

The colonial nature of waterbirds makes these species particularly vulnerable across their range to loss or degradation of nesting sites, stochastic weather events such as drought and flooding, changing land use practices, and pollution. Inventories of colonial nesting waterbirds in Wyoming were conducted from 1984-1986 (Findholt 1985, Findholt and Berner 1987). In 1990, we summarized all information known at that time on colonial nesting waterbirds in Wyoming (Ritter and Cerovski 1990). Since our initial efforts in 1984, we have conducted annual or periodic monitoring at the most important and productive sites for the colonial waterbird Species of Greatest Conservation Need (American Bittern, American White Pelican, Black-crowned Night-Heron, Black Tern, Caspian Tern, Clark's Grebe, Forster's Tern, Franklin's Gull, Great Blue Heron, Snowy Egret, Western Grebe, and White-faced Ibis). All past data and reports are available in the Nongame Bird Biologist files at the Wyoming Game and Fish Department Lander Regional Office.

In 2009, we entered into a 3-year cooperative agreement with the U.S. Fish and Wildlife Service (USFWS) to conduct an intensive survey of all historic, known, potential, and new colonial waterbird breeding sites statewide (Jones 2008). The goals of this rangewide program are to: 1) conduct a comprehensive inventory of breeding colonial waterbird populations and locations in the western United States, and 2) develop a rangewide, long-term monitoring program to track population size, trends, and locations of breeding colonial waterbirds in the western United States (Seto 2008). The western survey area includes the states of Wyoming, Montana, Colorado, Utah, Arizona, New Mexico, Nevada, Idaho, California, Oregon, and Washington. This project also addresses the priority goals and objectives identified in the Intermountain West Waterbird Conservation Plan (Ivey and Herziger 2006), and the Coordinated Bird Monitoring Objectives for aquatic birds in the Partners In Flight Western Working Group Five-year Action Plan (Neel 2007). Data collected in each of the participating states over the

project period will be compiled into an Atlas of all colonial waterbird nesting sites in the western United States.

Sites that will be visited during the cooperative project (n = 142) are identified in Figure 1, excluding Great Blue Heron rookeries. A total of 77 sites were visited and evaluated in 2009; 70 potential colonial waterbird nesting sites and 7 known nesting sites. Very few of the potential sites contained enough emergent vegetation (i.e. bulrush or cattails) to serve as secure nesting areas for colonial waterbirds. Efforts will continue during the 2010 field season, including ground visits to potential and historic colonial waterbird nesting areas, canoe-based surveys at known nesting sites, and ground surveys to document the location and occupancy of known and historic Great Blue Heron rookeries (n = 140). Remaining potential, historic, or known sites that were not visited in 2009 or 2010 will be completed in 2011, as will follow up aerial and canoe surveys in areas that are inaccessible by vehicle or foot, including Great Blue Heron rookeries.

ACKNOWLEDGEMENTS

We would like to extend our sincere thanks to the landowners and land managers who graciously allow us to continue long-term monitoring of colonial nesting waterbirds on their property. Without their cooperation and interest in these species, data collection would not be possible. We would also like to acknowledge the following individuals for their valuable contributions to the 2009 colonial waterbird monitoring effort: Darlene Kilpatrick and Lee Knox. Finally, we would like to thank Stephanie Jones of the U.S. Fish and Wildlife Service for providing funding and support for this project.

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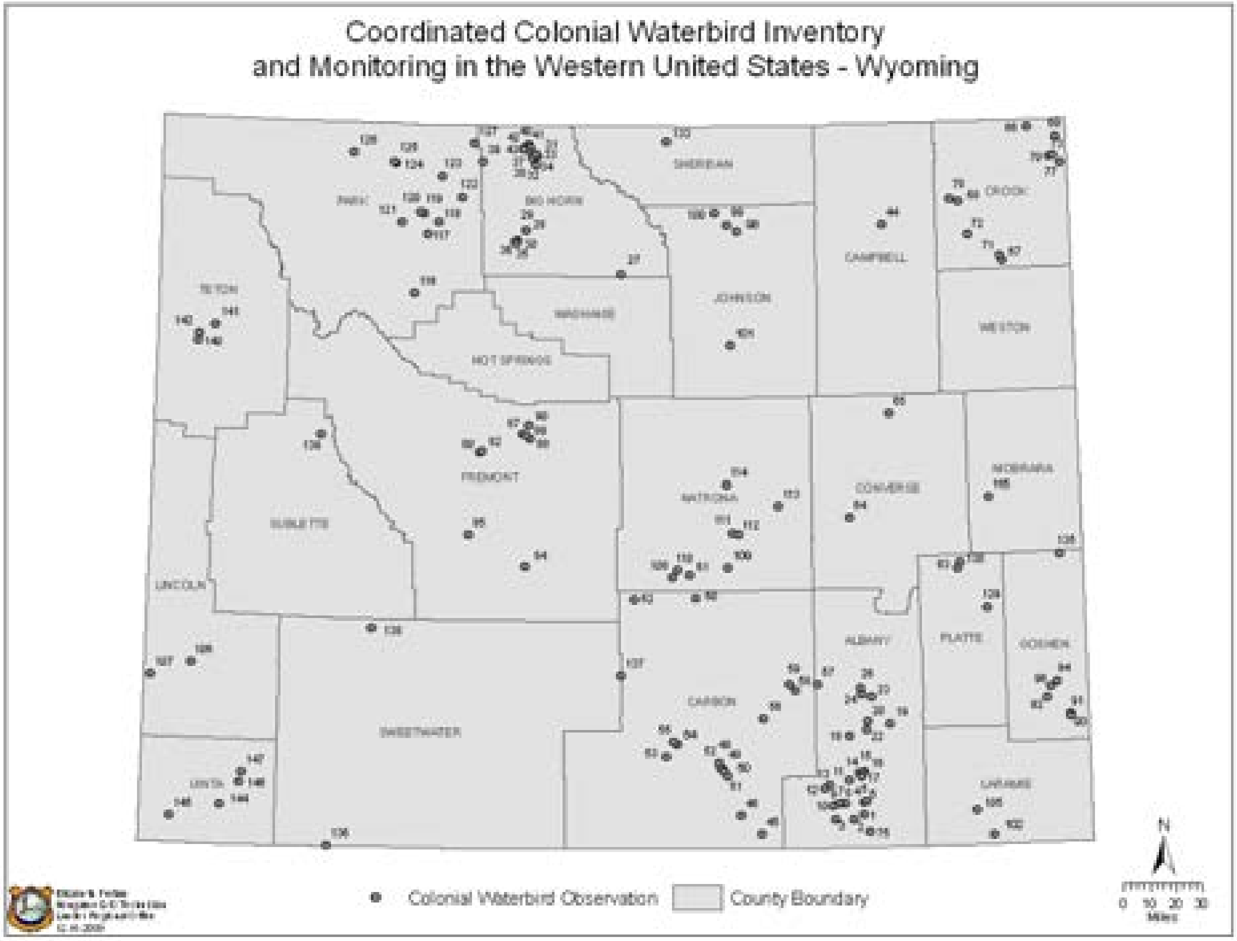

Figure 1. Locations of historic, potential, and known colonial waterbird nesting sites that will be evaluated for suitability during the 2009-2011 cooperative project. Great Blue Heron rookery locations are not included on this map.

CONTRACT SERVICES TO COMPLETE BREEDING BIRD SURVEYS
COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Andrea Orabona, Nongame Bird Biologist

SUMMARY

The Wyoming Game and Fish received Governor's Endangered Species funding to pursue contract agreements with volunteers for Species of Greatest Conservation Need (SGCN) monitoring across the state. In 2009, individuals were partially reimbursed for travel expenses incurred during volunteer work to complete 12 Breeding Bird Survey routes; accomplish one grid-based survey for passerines; and conduct surveys for nesting raptor SGCN in the Baggs, Flaming Gorge, and Sheridan areas. In addition, these funds were used to partially reimburse expenses for launching a new program, Nature Mapping, in the Jackson area.

INFLUENCE OF ENERGY DEVELOPMENT ON SAGEBRUSH-OBLIGATE SONGBIRDS
COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need / Sagebrush Obligate Songbirds – Brewer's Sparrow, Sage Sparrow, Sage Thrasher

FUNDING SOURCE: General Fund Appropriation, Wyoming Game and Fish Department Project Dollars

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Michelle M. Gilbert, Wyoming Cooperative Fish and Wildlife Research Unit
Anna D. Chalfoun, Wyoming Cooperative Fish and Wildlife Research Unit

SUMMARY

This is a Wyoming Cooperative Fish and Wildlife Research Unit Master of Science thesis project, and only the summary is presented here. To access the entire thesis, contact the Department of Zoology and Physiology, Biological Science Building Room 419, 1000 East University Avenue, Department 3166, Laramie, WY, 82071, 307-766-5415.

Sagebrush habitats have experienced extensive human-related habitat loss and degradation. Research on nesting sagebrush bird responses to energy development activity has focused primarily on Greater Sage-Grouse; a comprehensive analysis of energy development effects on nongame birds is lacking. We evaluated whether energy development was associated with changes to the sagebrush-obligate songbird community, and tested hypotheses about potential mechanisms underlying responses. We studied the Brewer's Sparrow, Sage Sparrow, and Sage Thrasher at three energy fields (two natural gas fields and one oil field) in southwestern Wyoming during 2008 and 2009. We collected data on several potential response metrics (abundance, species richness, nesting success, and offspring quality) across a gradient of energy development intensity, characterized by an increasing density of wells. Abundance of two of the three songbird species decreased in higher well density areas, especially in the two natural gas fields (Figure 1). Nest survival rates for all three species also declined with increasing energy development (Figure 2).

We tested two mechanistic hypotheses for responses: altered food availability and increased nest predation. The food availability hypothesis suggests that energy development is affecting habitat condition, which in turn influences prey (insect) abundance. We, therefore, predicted decreased shrub condition and decreased clutch sizes and nestling mass (which are

sensitive to food availability) with increased energy development. We found that shrub vigor, a measure of habitat condition, decreased significantly in the two natural gas fields (Figure 3). Brewer's Sparrow nestling mass, but not clutch size, also decreased with increasing well density at those sites (Figure 4). The nest predation hypothesis suggests that energy development infrastructure is augmenting nest predator assemblages, resulting in increasing nest predation risk. We predicted higher rates of nest predation (which was observed; Figure 2) and increased abundance of nest predator species with increased well density. Abundance of avian nest predators (Corvids) in this system did not vary by well density and, hence, did not directly account for this decreased nest survival. However, there are other nest predator guilds for which we did not measure abundance.

Our results suggest that songbird populations may be responding to changes in food resources and susceptibility to nest predation within areas influenced by natural gas extraction, a major land use in the west. Decreased songbird abundance may also be due to behavioral avoidance of anthropogenic disturbance. Patterns from these and other analyses suggest that energy development can potentially have demographic effects on already declining sagebrush songbird communities.

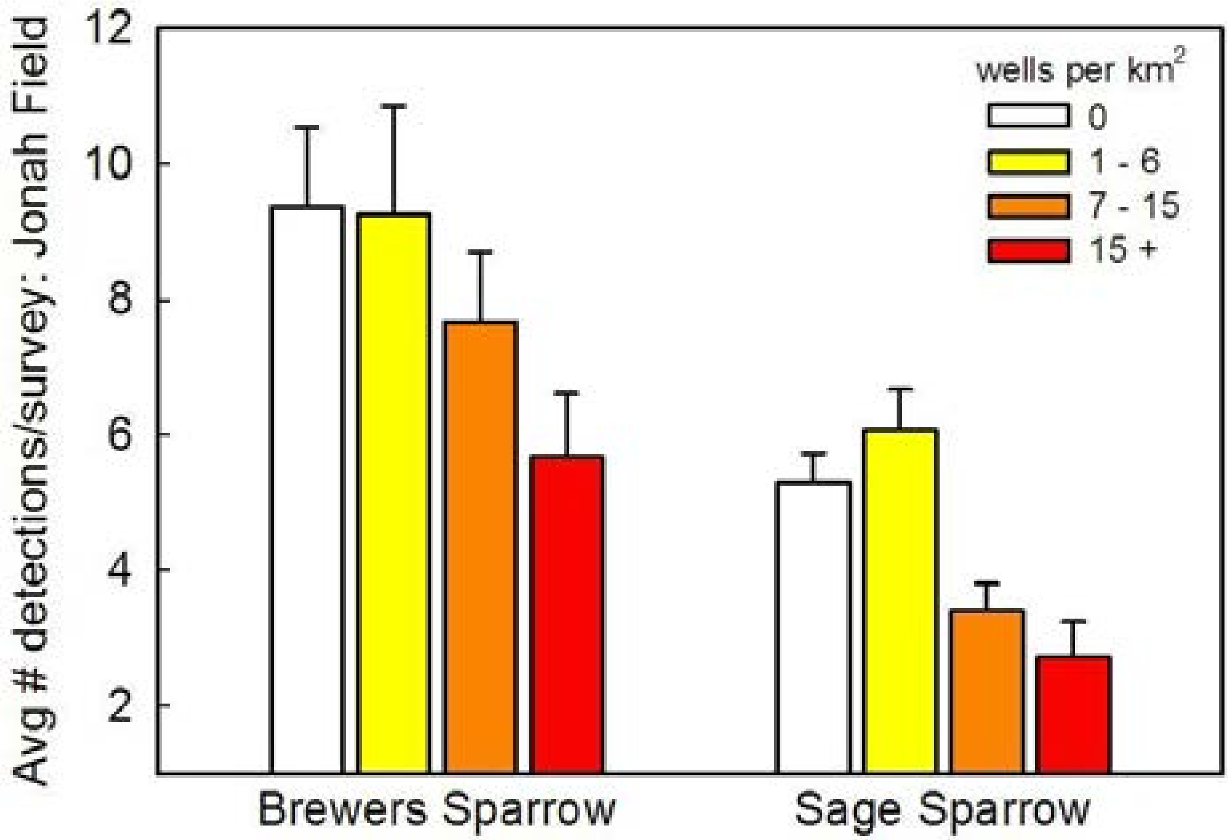

Figure 1. Abundance (means ± 1 SE) of Brewer's Sparrow and Sage Sparrow decreased significantly (*P* =.02 and *P* <.001, respectively) with increasing well density within the Jonah Field natural gas field.

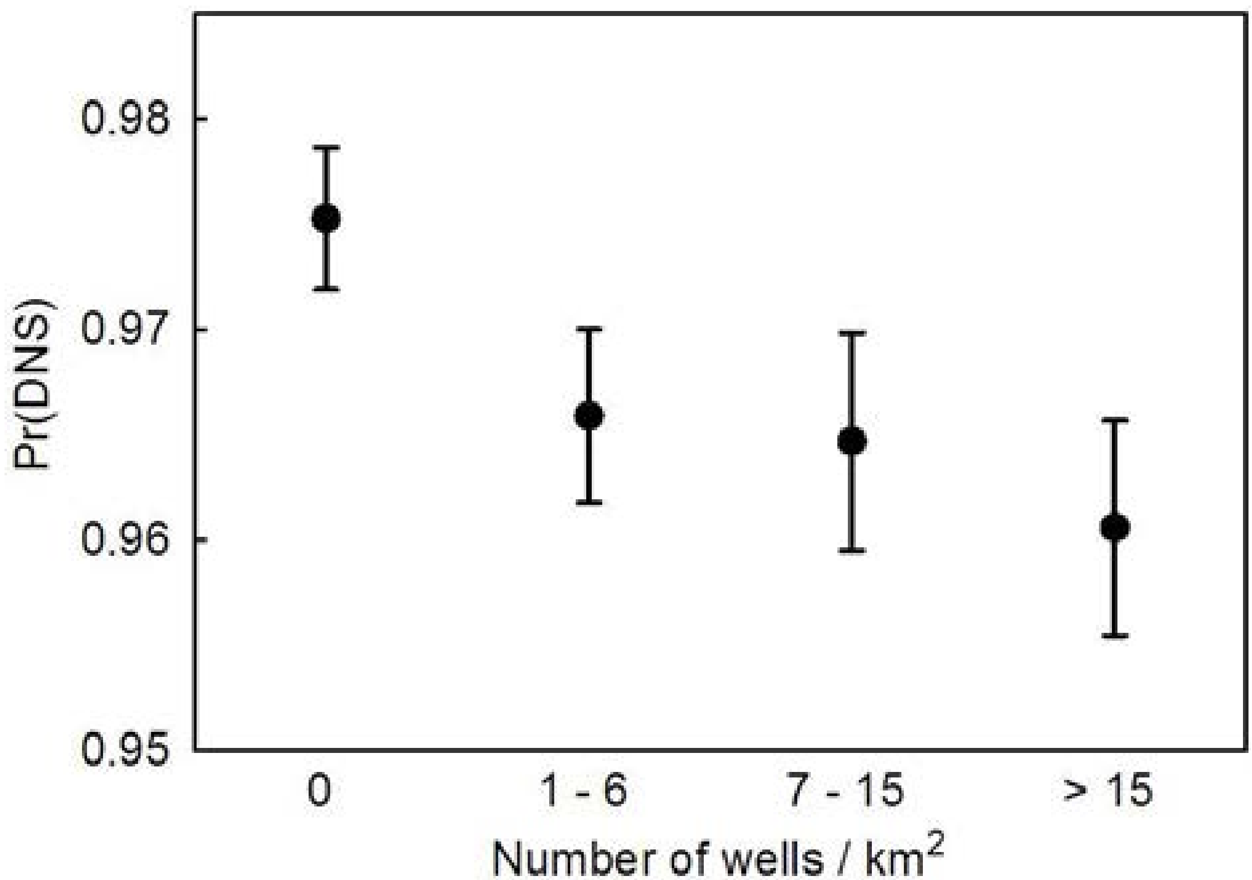

Figure 2. Nest success (daily nest survival; DNS) of the sagebrush-obligate songbird community decreased with increased energy development intensity. Data are means ± 1 SE.

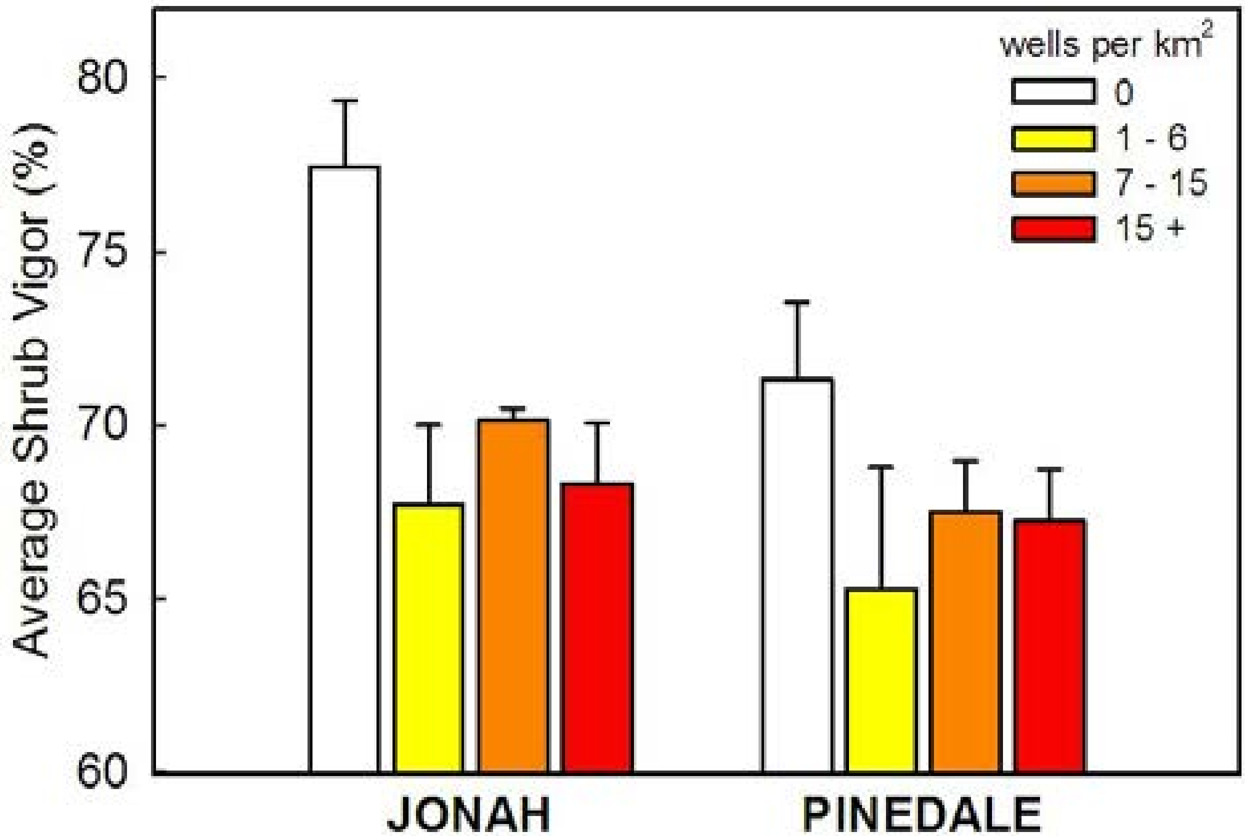

Figure 3. Shrub vigor (% live crown) decreased at the two natural gas areas, the Jonah Field (*P* <.002) and Pinedale Anticline (*P* =.34). Both insect abundance and nest predation can potentially be affected by habitat condition.

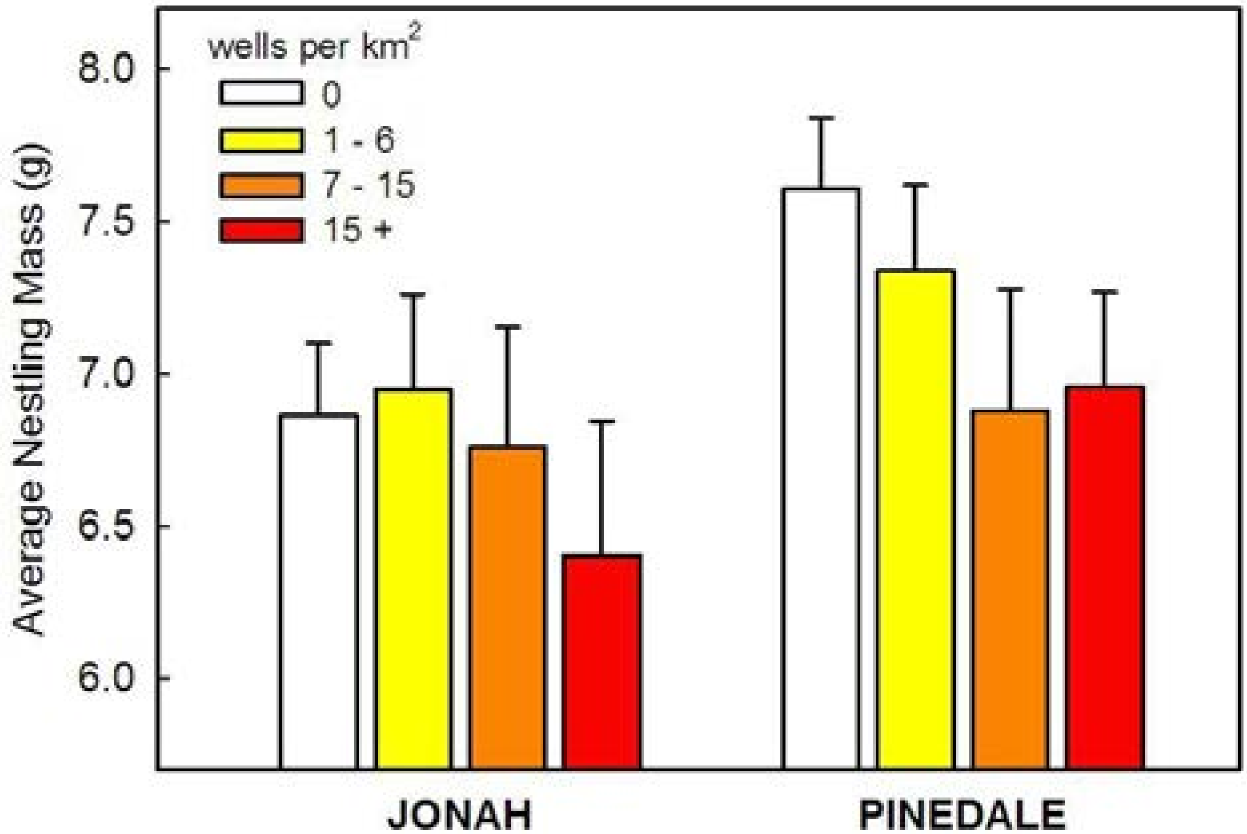

Figure 4. Average mass of day 5 Brewer's Sparrow nestlings declined slightly with increasing energy development intensity. Nestling mass was used as a proxy for offspring quality. Data are marginal means (controlling for Julian date) ± 1 SE.

EVALUATION OF THE IMPACTS OF THE MOUNTAIN PINE BEETLE EPIDEMIC ON AVIAN AND SMALL MAMMAL SPECIES IN SOUTHEAST WYOMING COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS AND MAMMALS: Species of Greatest Conservation Need

FUNDING SOURCE: Federal Funds with State Match, State Wildlife Grant Projects

PERIOD COVERED: 31 December 2009 – 31 March 2010

PREPARED BY: Joslin Heyward, Wyoming Cooperative Fish and Wildlife Research Unit
Anna Chalfoun, Wyoming Cooperative Fish and Wildlife Research Unit

SUMMARY

This is a Wyoming Cooperative Fish and Wildlife Research Unit Master of Science thesis project, and only the summary is presented here. To access the entire thesis, contact the Department of Zoology and Physiology, Biological Science Building Room 419, 1000 East University Avenue, Department 3166, Laramie, WY, 82071, 307-766-5415.

We worked on a study design for the first season of field research in southeast Wyoming. We thoroughly read relevant literature in order to gain an understanding of forest ecology, landscape-scale disturbances, and habitat fragmentation. We corresponded with the USDA Forest Service, Wyoming Game and Fish Department, Rocky Mountain Bird Observatory, and Wyoming Geographic Information Science Center, to gain essential advice and collect important data. We outlined the sampling methods and made the following important changes to our original methods: 1) We will restrict sampling of focal species to songbirds, woodpeckers, and diurnal/nocturnal small mammals due to logistical and time constraints; and 2) We will determine species richness and abundance within a gradient of patch sizes which will enable us to determine the relative value of patches of different size in serving as temporal/spatial refugia within two habitat types (young lodgepole pine stands and spruce/fir) and/or whether there are thresholds beyond which alternative patch types become valuable.

Study area boundaries were finalized for the Snowy Range within the Medicine Bow National Forest. Exact sampling locations are still to be determined. Species richness and abundance of avian and mammalian species will be assessed using point counts and live-trapping, respectively. Training of field technicians will take place from 24-28 May 2010. Avian and diurnal small mammal point counts will be conducted during the first portion of the field season (30 May – 2 July), and nocturnal small mammal trapping will be conducted during the last portion of the field season (5 July – 16 August).

FOREST BAT INVENTORIES: ANABAT ACOUSTIC SURVEYS COMPLETION REPORT

STATE OF WYOMING

NONGAME MAMMALS – Species of Greatest Conservation Need – Bats

FUNDING SOURCE: Federal Funds with State Match, State Wildlife Grant Projects

PERIOD COVERED: 14 May 2009 – 27 August 2009

PREPARED BY: Shelly Johnson, Nongame Biologist
Martin Grenier, Nongame Mammal Biologist

INTRODUCTION

There are an estimated 1,100 species of bats (Order: *Chiroptera*) in the world, comprising almost 20% of all mammal species; 45 species occur in the United States (Nowak 1994). Of the 18 species of bats documented in Wyoming, 12 are considered residents for at least part of the year (Table 1; Hester and Grenier 2005). All of the resident species are designated as Species of Greatest Conservation Need by the Wyoming Game and Fish Department (2005; Orabona et al. 2009; Table 1), and half are considered a federal Species of Concern (formerly Category 2) by the U. S. Fish and Wildlife Service (1994, 1996; Table 1). Statewide inventories for bats that occur in Wyoming forests have previously been lacking, limiting our knowledge of species distributions and the management actions necessary to maintain these species' habitats (Hester and Grenier 2005).

There is a growing concern over the status of many bat populations throughout North America due to habitat loss, wind energy development conflicts, and diseases. Bats are potentially vulnerable to drastic population declines due to their low reproductive rates and specialized requirements (O'Shea and Bogan 2003). Bat populations in Wyoming forests are restricted due to specific habitat needs [i.e., their survival depends on availability of appropriate roosting sites (e.g., trees or foliage) and adequate prey abundance (e.g., moths, beetles, mosquitoes); Lacki et al. 2007). Bats in Wyoming forests are already facing threats from logging, fire suppression, and the bark beetle (Hester and Grenier 2005). With the increase in industrial wind energy production in Wyoming, bat populations may become even more imperiled. The conservation importance of forest bat habitat may not be fully realized until we understand better the distribution and species assemblage of Wyoming bats.

Our objectives were to collect data on distribution, relative abundance, and diversity of bats that occur in forests of western Wyoming. This 2-year inventory project was started in southwest Wyoming in the summer of 2008. This report focuses on the second and final year, conducted in northwest Wyoming in 2009.

METHODS

We selected 75 survey sites in forested areas of northwest Wyoming. To achieve this, we overlaid sixth level Hydrologic Unit Code areas (HUCs; Berelson et al. 2004) with ecological system vegetation layers (Comer et al. 2003) using a Geographic Information System (GIS; ArcGIS v9.2). We identified all HUCs that contained forested habitat, then omitted any HUC with its majority located inside a wilderness area, National Park, or on the Wind River Indian Reservation. This process identified 182 eligible HUCs, from which we randomly selected 75 as sample units (Figure 1).

Sites appropriate for mist netting were identified within each sample unit, and we used these same sites to acoustically monitor for bats between mid-May and late August 2009. To do this, we positioned one acoustic detector (AnaBat SD1 Bat Detector, Titley Scientific, QLD, Australia) within 33 feet (10 m) of the netting area. If a second detector was available (64% of surveys), we placed it nearby 328-9,842 feet (100-3,000 m) in another location suitable for bat activity. Detectors were placed approximately 1.6-3.3 feet (0.5-1 m) above the ground in areas void of dense vegetation to prevent acoustic interference. Detectors were turned on within 30 minutes after civil sunset and left on until 3 hours after sunset or at least 2.5 hours, at a minimum. If precipitation, lightning, or winds greater than 7 mph (11 kph; light breeze on Beaufort scale) were present, we closed the netting site and did not collect acoustic data.

We reviewed all recorded files with AnalookW (version 3.5m; C. Corben, Titley Scientific, QLD, Australia) software program, and eliminated files that did not contain calls by bats or have sequences of bat calls with >2 pulses. We evaluated calls using characteristic frequency (F_c), slope (S_c), and other distinct acoustic characteristics (O'Farrell and Gannon 1999). We identified to species when possible using a Wyoming reference library. We calculated the call rate per hour by survey site for total calls and by F_c.

RESULTS

We acoustically surveyed 70 HUCs within the study area in northwest Wyoming during the summer of 2009 (Figure 2). If a suitable (i.e., accessible, effective) netting site could not be located in a pre-selected HUC, field personnel used their discretion to select a suitable replacement HUC adjacent to the pre-selected HUC. As a result, two HUCs were inadvertently surveyed twice at different locations (site ID Nos. 17 and 18). Additionally, we removed two HUCs from the data set as a result of being relocated outside the target area, and one other was not surveyed with acoustic equipment. In total, we collected data at 72 sites for analysis.

We recorded bat echolocation calls at 71 of the 72 sites surveyed. We recorded 10,745 files and included 86% of files in analysis. We did not use the other 14% of files because they did not contain calls by bats (57%; i.e. static, insect noise, small fragments which could not be identified as originating from a bat) or >2 pulses (43%). The 9,237 files included in analysis contained 9,800 calls of bats, of which 467 were confidently identified to species, with *Eptesicus fuscus*, *Myotis lucifugus*, and *Lasionycteris noctivagans* comprising the majority, and additional identification of eight species. All of the calls were grouped by F_c (Table 2). Overall, bat recordings were well distributed throughout the study area (Figure 3), including previously undocumented locations not listed in the Department's Atlas (Orabona et al. 2009). We recorded new latilong locations for six species that were not physically captured in those areas during the summer 2009 mist net survey, and reconfirmed new locations for three captured species (Table 3). Maps of call distributions by frequency are shown in Figures 4-9.

DISCUSSION

Acoustic bat detection is a useful technique for gathering information regarding bat activity when physical capture is impractical, unlikely, or unnecessary. Investigators can record, view, and quantify search-phase calls, resulting in a relative index of activity for each location or time frame (O' Farrell et al. 1999). Some Wyoming species are known for being adept at avoiding capture in nets, which have been used in the past to conduct inventories (i.e., *M. yumanensis*, *Corynorhinus townsendii*, and *Euderma maculatum*), so acoustic detection can be especially useful for identifying the additional presence of such species (O'Farrell and Gannon 1999). However, it is also important to note that positive identification of species can be difficult in areas where a large species assemblage exists with similar frequency echolocation calls, making them difficult to differentiate (see Table 2 for call frequencies by species). There can also be differences in detectability and call structures due to differences in forest clutter (Schnitzler and Kalko 1998). Despite their limitations, researchers use acoustic surveys because of the ease and efficiency in obtaining basic information on bat activity levels, especially in conjunction with mist net captures.

Previous studies throughout North America have documented all of the recorded species in forested habitats (Lacki et al. 2007). We positively identified calls from 10 of the 12 resident species (Table 1); with no identified calls of *M. ciliolabrum* (which is difficult to distinguish from other 40k species) and *M. septentrionalis* (known primarily from eastern Wyoming; Hester and Grenier 2005). The confirmed recordings of *E. maculatum* were especially important, given the limited information we have on this species in Wyoming and that it was recorded in a previously undocumented area (Hester and Grenier 2005). Furthermore, recordings of *Antrozous pallidus*, *C. townsendii*, and *Tadarida brasiliensis* were valuable, as these species were not captured at all during mist netting surveys and recorded in undocumented latilong locations. Additional recordings of *Lasiurus cinereus* and *M. thysanodes* in latilongs where we did not physically capture these species also expanded our baseline data for bat distribution in Wyoming.

This inventory encompassed a large geographic area in a relatively short time period, which should be considered when interpreting the results. Spatial and temporal variations may cause noticeable differences on capture success for each survey night (Hester and Grenier 2005). We attempted to distribute surveys throughout the study area over the course of the summer, although replications were not feasible. As a result, it is difficult to assess the exact distribution, relative abundance, and diversity of bats in forests of western Wyoming with these data.

However, since inventories for bats in Wyoming forests have previously been lacking, this updated information is significant and beneficial to increasing our current understanding of future management and inventory needs.

ACKNOWLEDGMENTS

Funding for this project was provided by the U.S. Fish and Wildlife Service through State Wildlife Grants, for which the Department is extremely grateful. We also extend a special thanks to Wyoming Game and Fish Department personnel K. Maysilles and S. Chrisman for their assistance in the field, as well as E. Furtaw for her assistance with GIS on this project.

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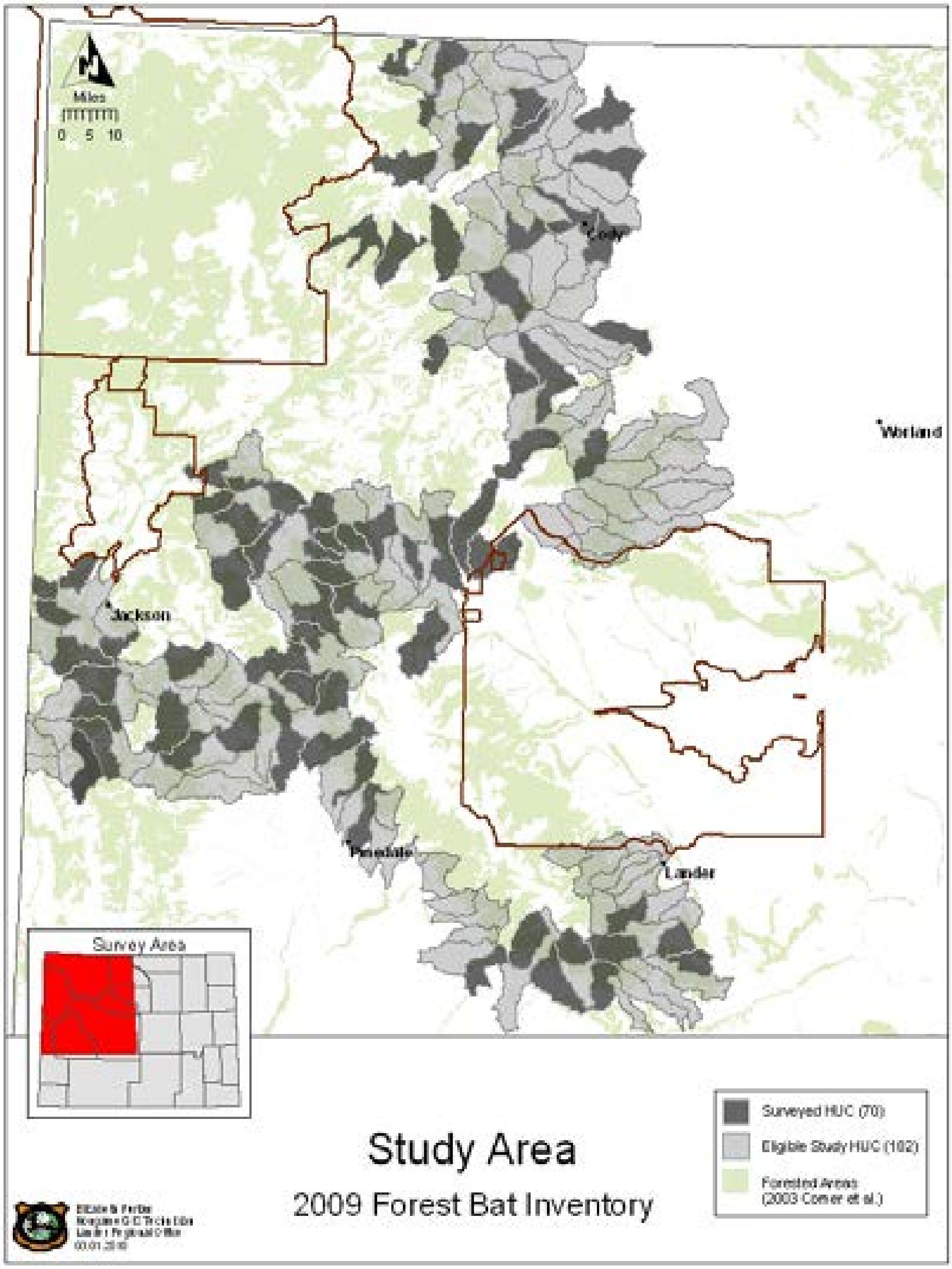

Figure 1. Map of the 2009 study area in northwest Wyoming. The complete eligible study area (by HUC) is shown amongst boundaries of the National Parks and Wind River Indian Reservation, which limit the perimeters of the target study area (wilderness boundaries are not shown).

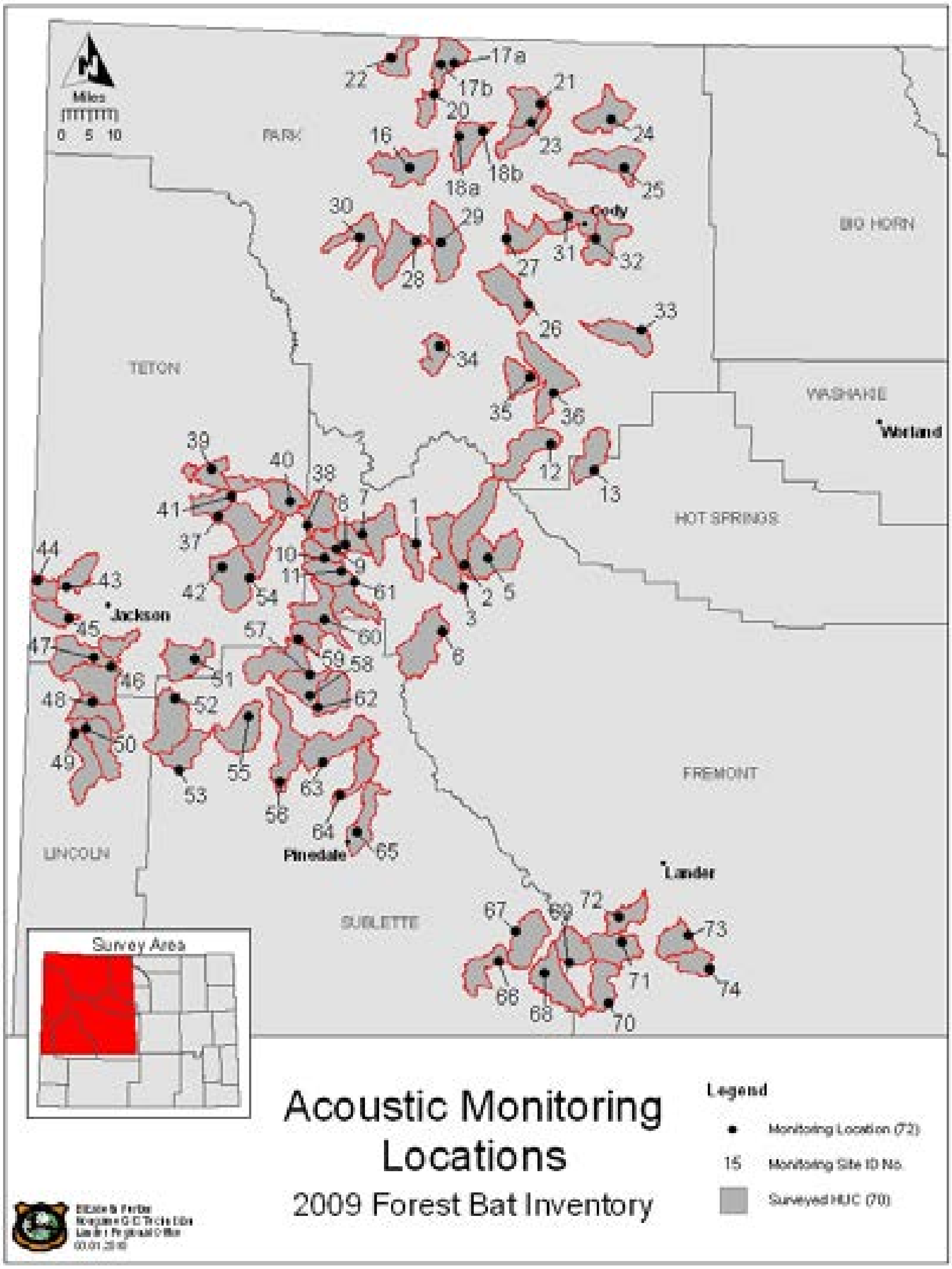

Figure 2. Monitoring locations for the 2009 forest bat inventory shown within their respective HUCs and identified by arbitrarily assigned site numbers. HUC Nos. 17 and 18 contain two netting locations each (a and b).

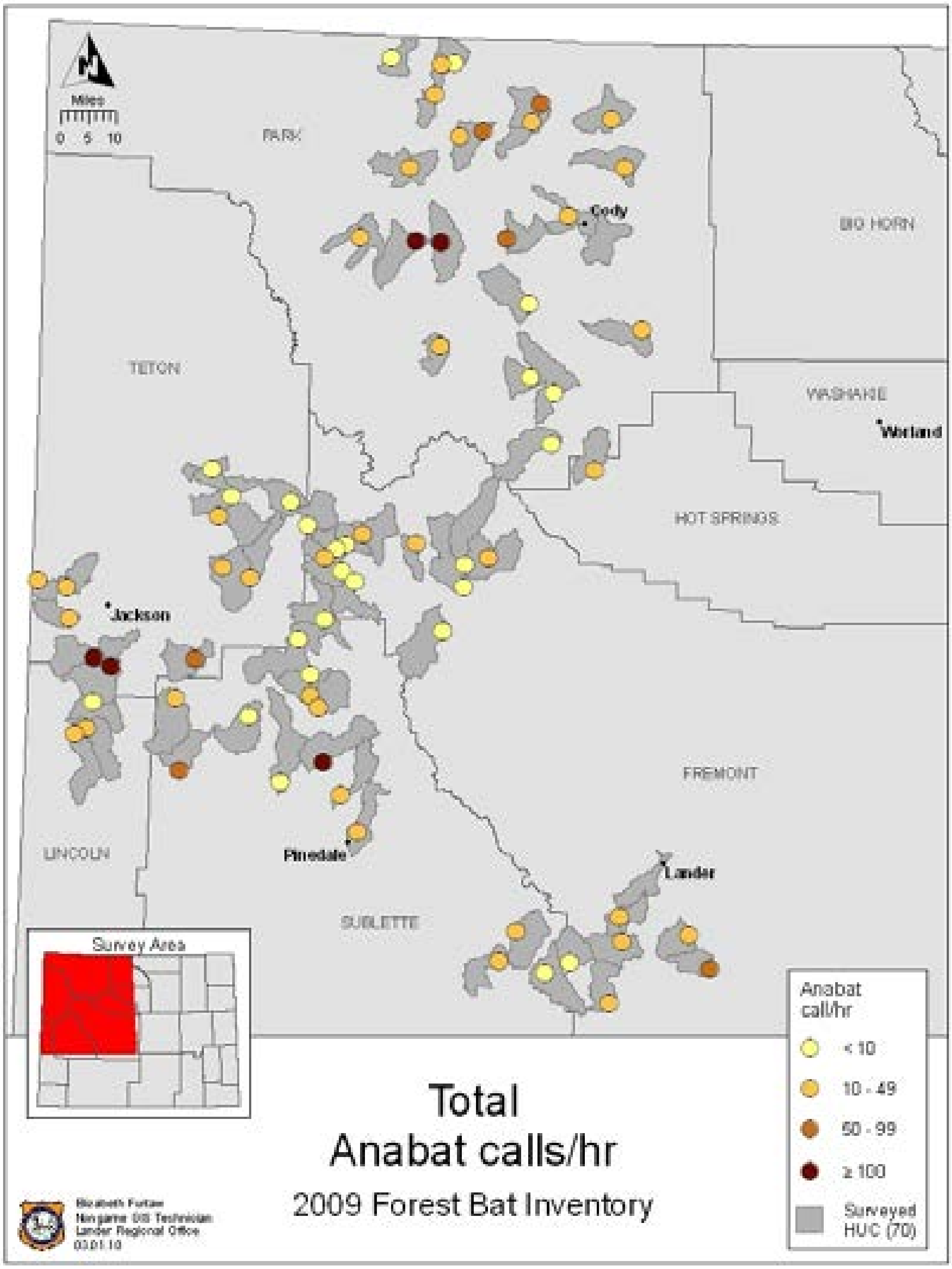

Figure 3. Number of bat calls recorded per hour at approximate locations in northwest Wyoming during the 2009 forest bat inventory.

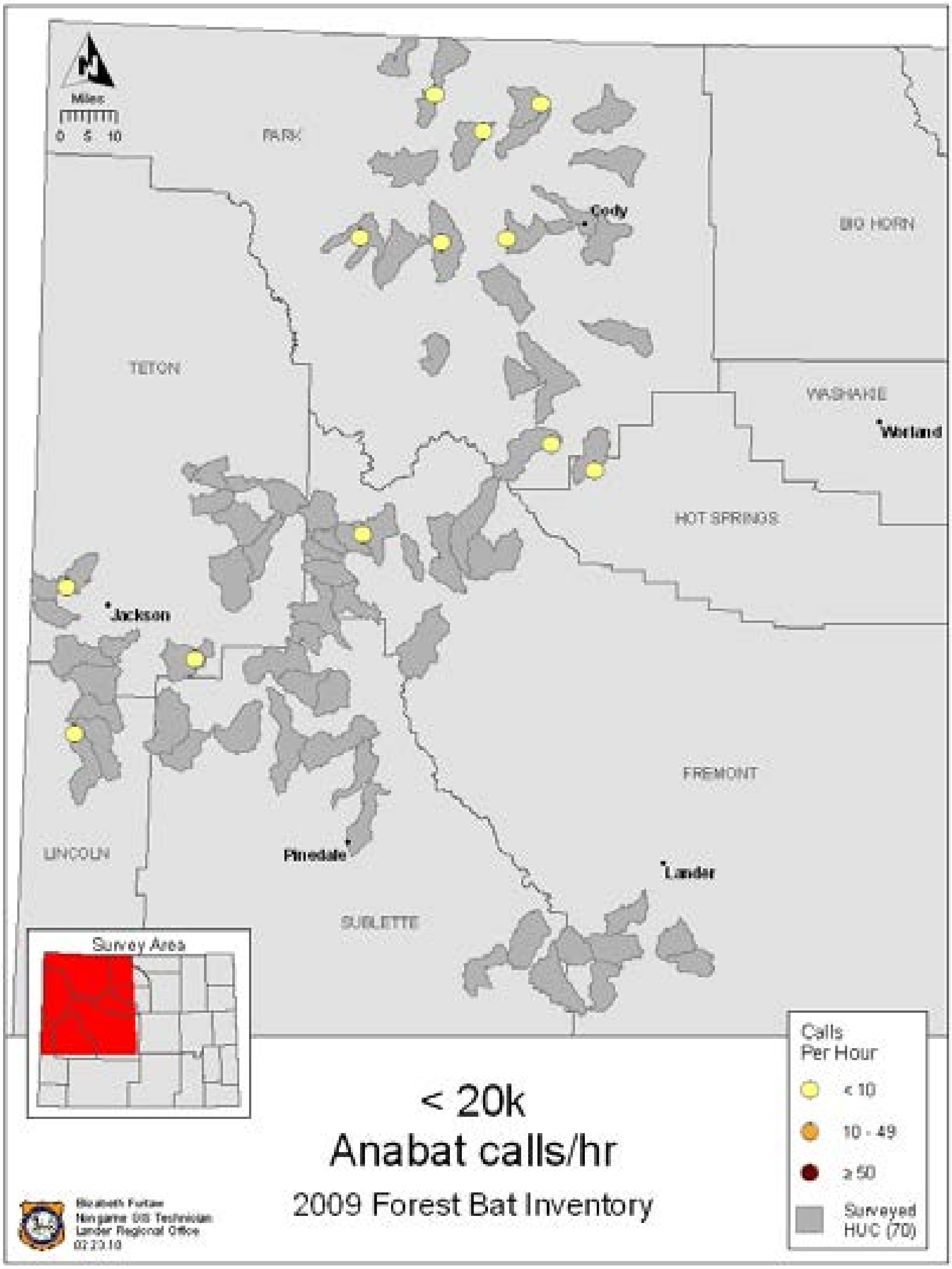

Figure 4. Number of <20k bat calls recorded per hour at approximate locations in northwest Wyoming during the 2009 forest bat inventory. Potential species include *Euderma maculatum* and *Lasiurus cinereus*.

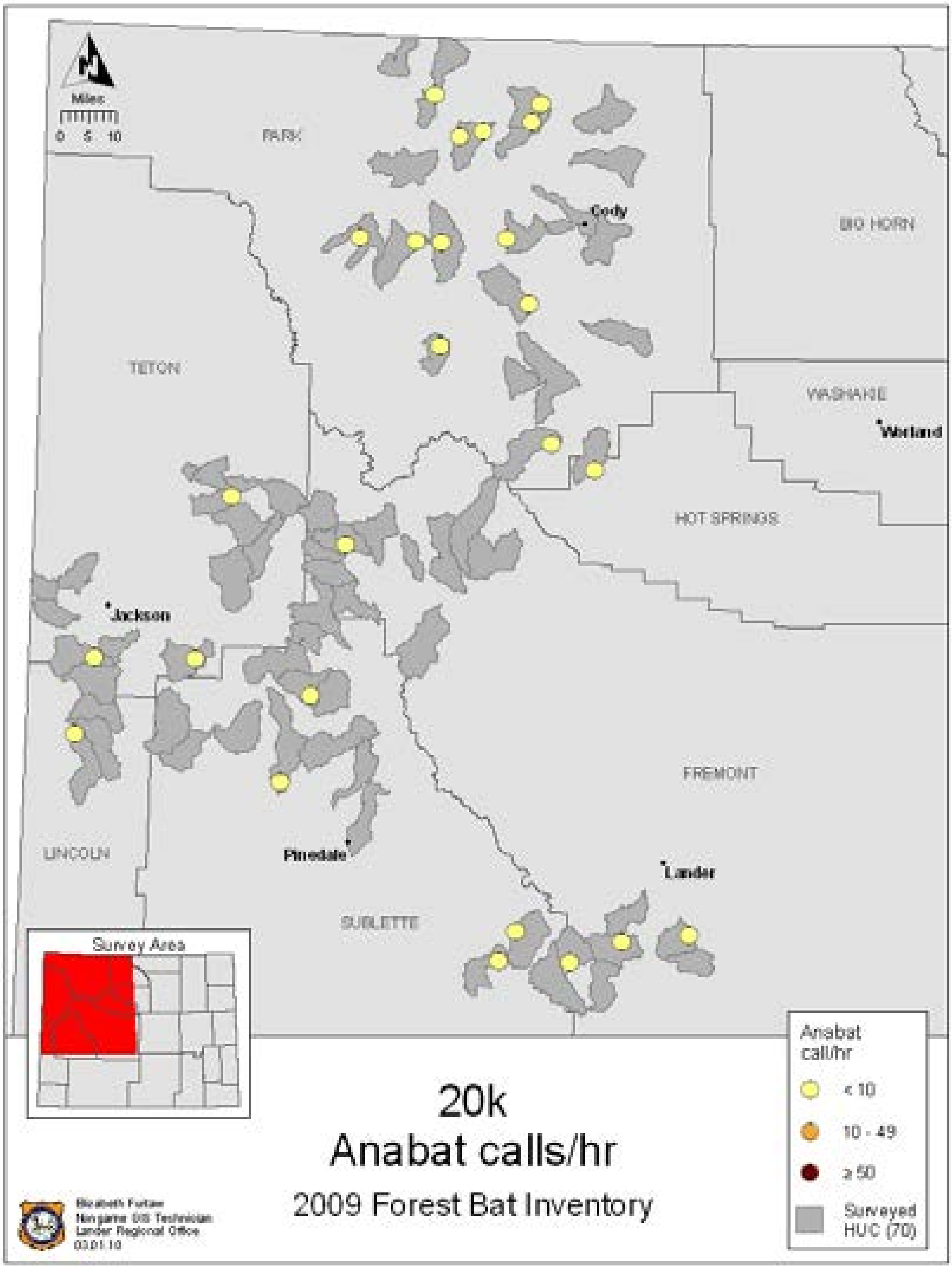

Figure 5. Number of 20k bat calls recorded per hour at approximate locations in northwest Wyoming during the 2009 forest bat inventory. Potential species include *Eptesicus fuscus*, *Lasiurus cinereus*, and *Myotis thysanodes*.

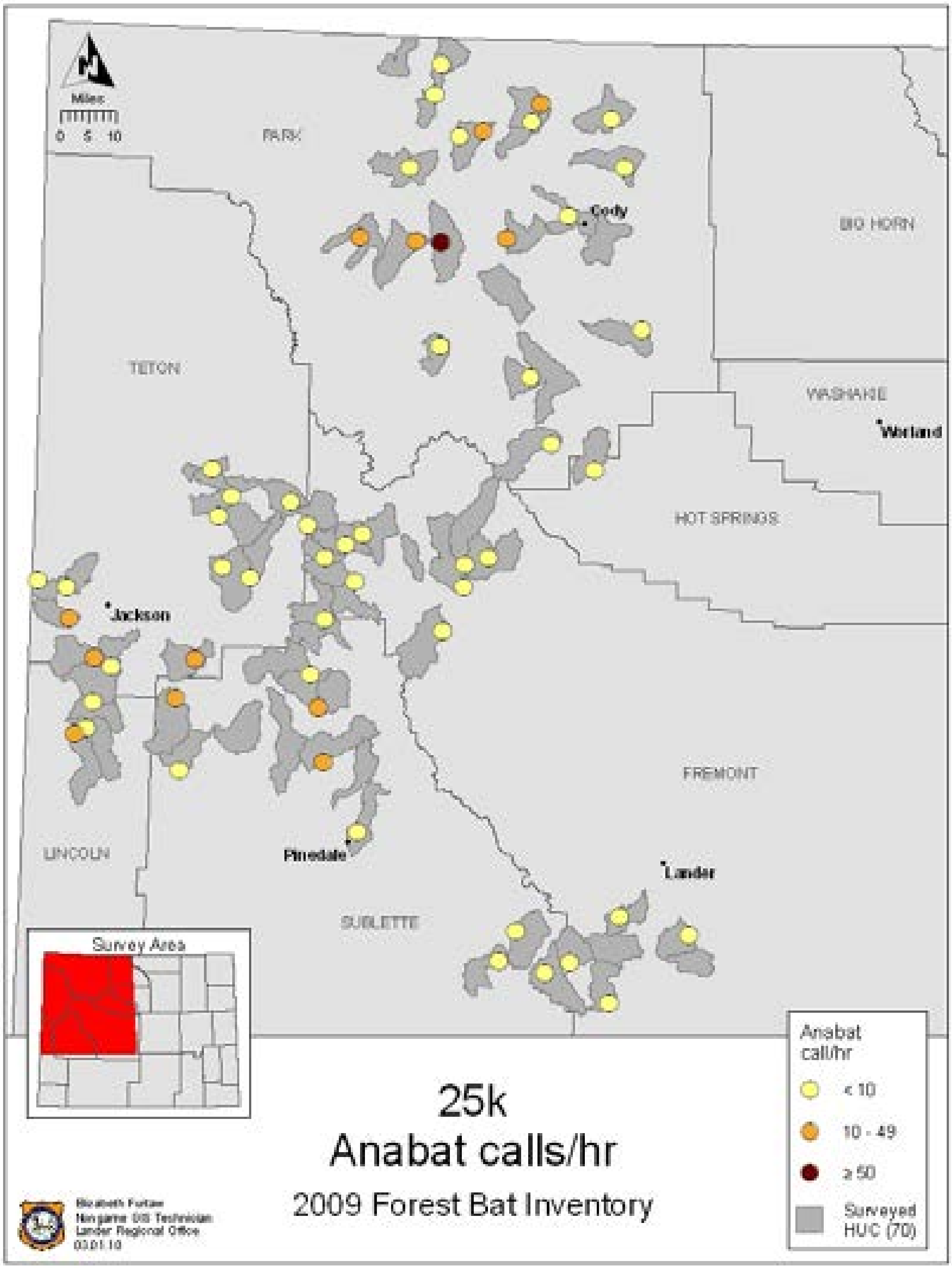

Figure 6. Number of 25k bat calls recorded per hour at approximate locations in northwest Wyoming during the 2009 forest bat inventory. Potential species include *Antrozous pallidus*, *Eptesicus fuscus*, *Lasionycteris noctivagans*, *Myotis thysanodes*, and *Tadarida brasiliensis*.

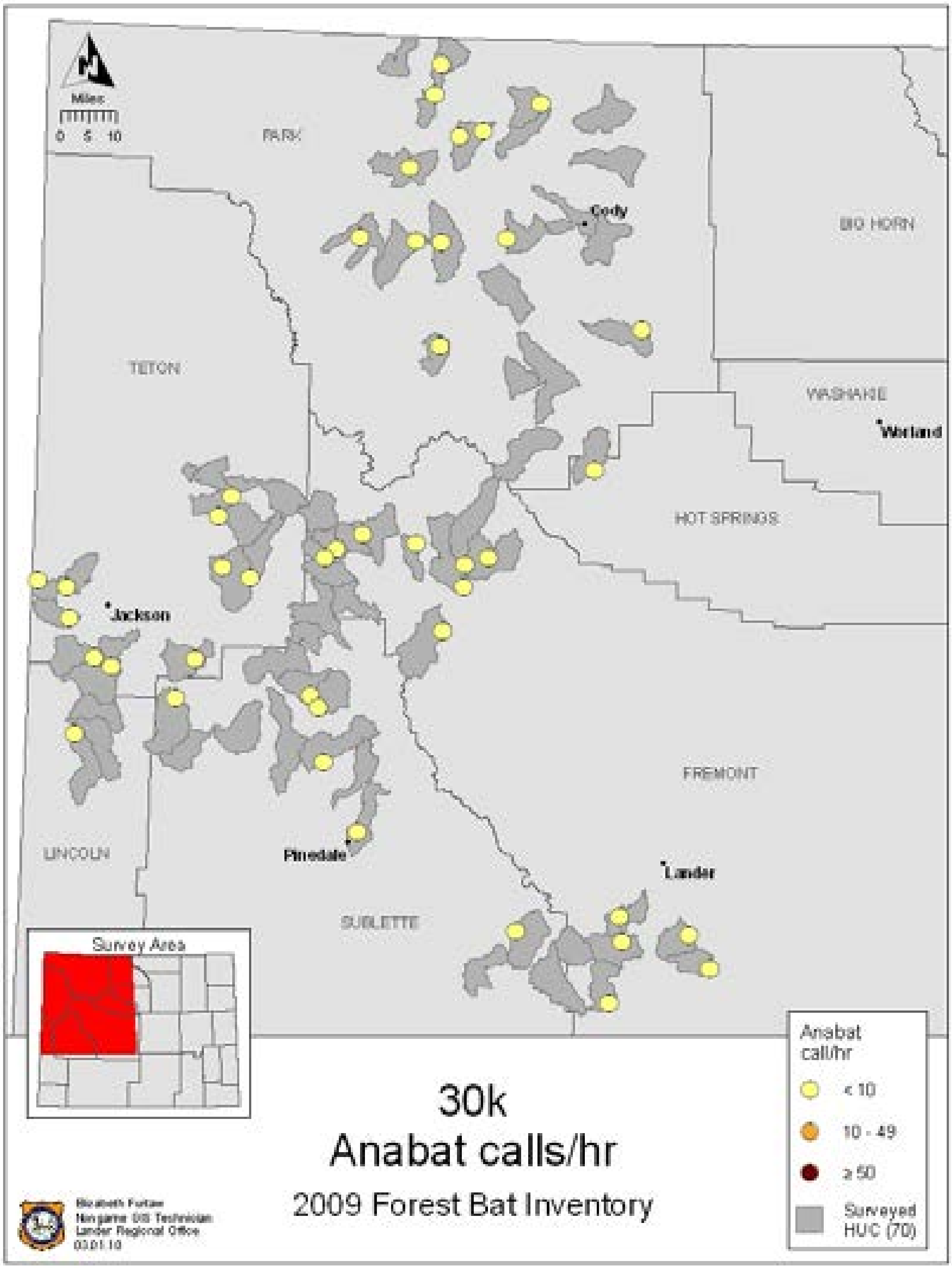

Figure 7. Number of 30k bat calls recorded per hour at approximate locations in northwest Wyoming during the 2009 forest bat inventory. Potential species include *Antrozous pallidus*, *Corynorhinus townsendii*, *Eptesicus fuscus*, *Lasiurus borealis*, and *Myotis evotis.*

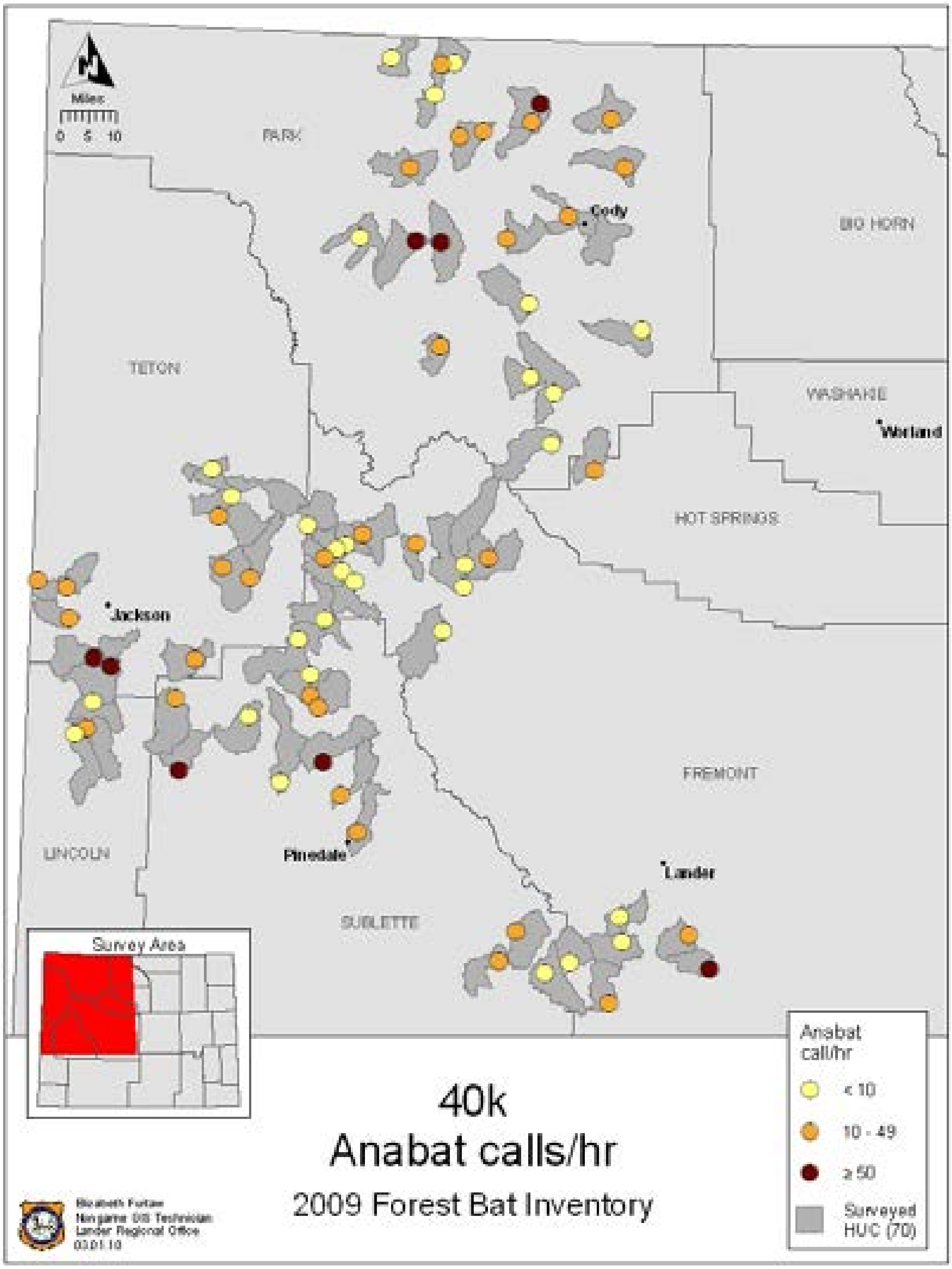

Figure 8. Number of 40k bat calls recorded per hour at approximate locations in northwest Wyoming during the 2009 forest bat inventory. Potential species include *Myotis ciliolabrum*, *M. lucifugus*, and *M. volans*.

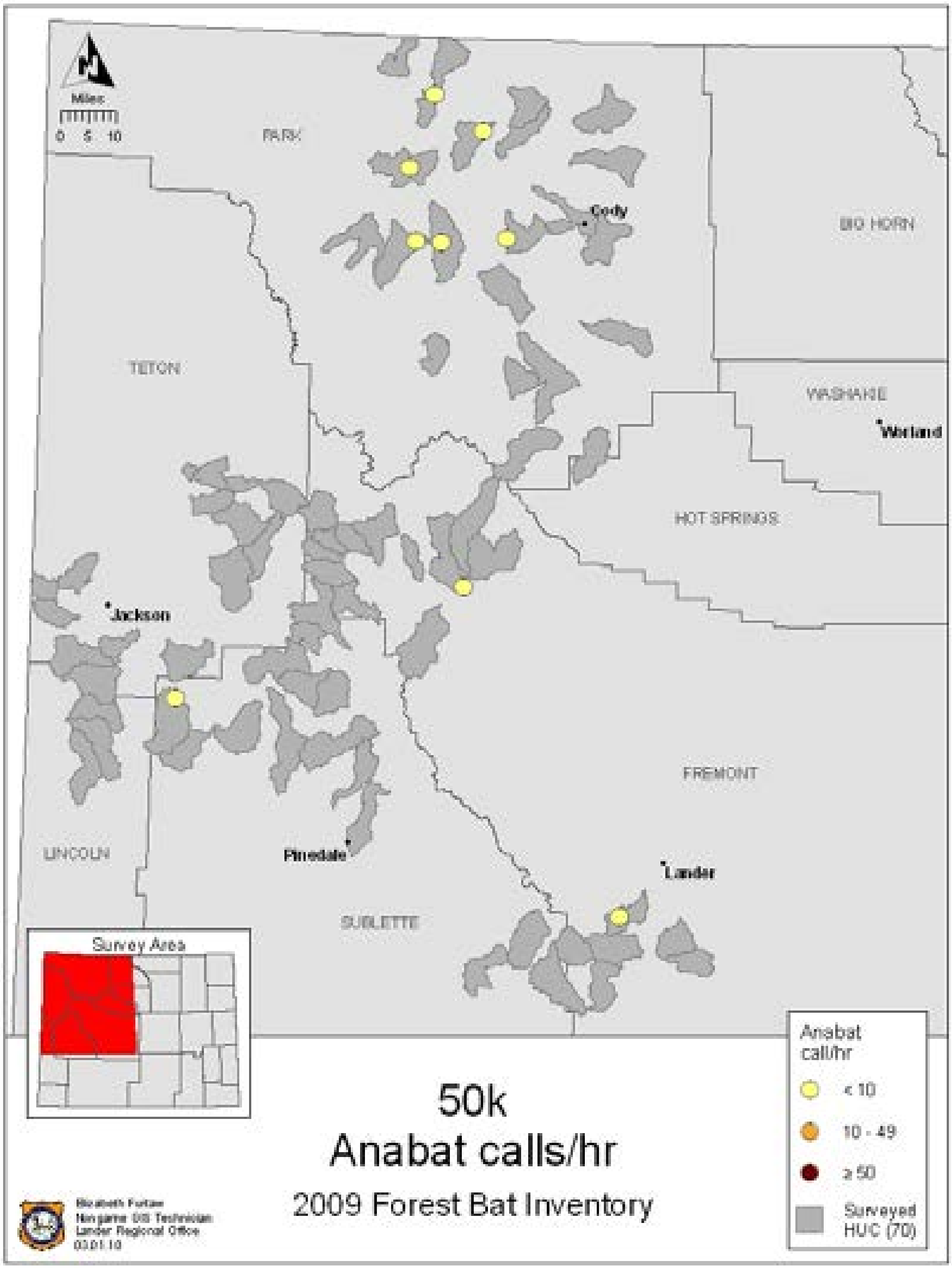

Figure 9. Number of 50k bat calls recorded per hour at approximate locations in northwest Wyoming during the 2009 forest bat inventory. Potential species include *Myotis californicus* and *M. yumanensis.*

Table 1. Bat species (Chiropteran) documented in Wyoming, listed by scientific and common name (* indicates positively identified call recorded during 2009 study), Wyoming residency status, USFWS Species of Concern (SC) status, and Wyoming Game and Fish Department Native Species Status (NSS).

Scientific Name	Common Name	WYBWG Status [a]	USFWS Status [b]	Native Species Status [c]
*Antrozous pallidus**	Pallid Bat	R	-	NSS2
*Corynorhinus townsendii**	Townsend's Big-eared Bat	R	SC	NSS2
*Eptesicus fuscus**	Big Brown Bat	R	-	NSS3
*Euderma maculatum**	Spotted Bat	R	SC	NSS2
*Lasionycteris noctivagans**	Silver-haired Bat	R	-	NSS4
Lasiurus borealis	Eastern Red Bat	P	-	NSSU
*Lasiurus cinereus**	Hoary Bat	R	-	NSS4
Myotis californicus	California Myotis	P	-	-
Myotis ciliolabrum	Western Small-footed Myotis	R	SC	NSS3
*Myotis evotis**	Long-eared Myotis	R	SC	NSS2
*Myotis lucifugus**	Little Brown Myotis	R	-	NSS3
Myotis septentrionalis	Northern Myotis	R	-	NSS2
*Myotis thysanodes**	Fringed Myotis	R	SC	NSS2
*Myotis volans**	Long-legged Myotis	R	SC	NSS2
Myotis yumanensis	Yuma Myotis	P	SC	-
Nyctinomops macrotis	Big Free-tailed Bat	A	SC	-
Pipistrellus subflavus	Eastern Pipistrelle	A	-	-
*Tadarida brasiliensis**	Brazilian Free-tailed Bat	P	-	-

[a] As listed in A Conservation Plan for Bats in Wyoming (Hester and Grenier 2005), compiled by the Wyoming Bat Working Group (WYBWG) and Wyoming Game and Fish Department Nongame Program, R = resident (year-round or seasonally), P = peripheral, and A = accidental occurrence.

[b] United States Fish and Wildlife Service (USFWS; 1994, 1996).

[c] Wyoming Game and Fish Department Species of Greatest Conservation Need with a Native Species Status (NSS) of 1, 2, 3, or 4, as listed in Wyoming Game and Fish Department's Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming (Orabona et al. 2009) and A Comprehensive Wildlife Conservation Strategy for Wyoming (Wyoming Game and Fish Department 2005).

Table 2. Total calls and calls per hour by characteristic echolocation frequency recorded with Anabat SD1 detectors in northwestern Wyoming from May through August 2009. The species of bats which may potentially be recorded within the study area and the number of sites at which they were recorded are listed by frequency.

Frequency (F_c)	Total Calls	Calls / Hour	# of Sites	Potential Bat Species
< *20k*	30	0.1	12	*Euderma maculatum, Lasiurus cinereus*
20k	122	0.4	25	*Eptesicus fuscus, L. cinereus, Myotis thysanodes*
25k	1801	5.7	57	*Antrozous pallidus, E. fuscus, Lasionycteris noctivagans, M. thysanodes, Tadarida brasiliensis*
30k	252	0.8	43	*A. pallidus, Corynorhinus townsendii, E. fuscus, Lasiurus borealis, M. evotis*
40k	7571	24.1	70	*M. ciliolabrum, M. lucifugus, M. volans*
50k	24	0.1	9	*M. californicus, M. yumanensis*
Total	*9800*	*31.2*	*71*	**--**

Table 3. Updates to the Department's Atlas of current distribution status by latilong degree blocks, based on individuals recorded with Anabat SD1 detectors in northwestern Wyoming from May through August 2009, summarized by species and site ID number (* indicates locations where the species was also physically captured). [a]

Species	Latilong Degree Block	Current Status	Updated Status	Site Number
Antrozous pallidus	2, 9	–	O	13,21,27,30
Corynorhinus townsendii	9	–	O	5,6,18b,20,30,72
Eptesicus fuscus	2*	–	O	7,8,12,13,16,17b,18a,18b,20,21,23, 24,25,27,29,30,33,34,37,38,43,44,454 7,49,51,57,58,62,63,66,72,73
Euderma maculatum	9	–	O	13
Lasionycteris noctivagans	•	•	•	2,5,6,7,10,12,13,18a,18b,20,21,24, 27,28,30,37,43,45,47,49,51,54,60,63
Lasiurus cinereus	2*,9,16*	–	O	12,13,18a,18b,20,21,27,28,29,30,41,4 3,47,49,51,56,58,62,66,67,69,71
Myotis evotis	2*	h	O	1,16,17b,20,46,51,71,74
Myotis lucifugus	.	.	.	1,3,6,7,10,12,13,17a,17b,18b,20,23,27 ,28,30,31,33,34,37,39,42,43,44,4648,4 9,51,52,53,54,55,58,62,63,64,6667,68, 70,71,74
Myotis thysanodes	8	–	O	20,45,46
Myotis volans	•	•	•	7,13
Tadarida brasiliensis	2	–	O	23,25,28,30

[a] O = the species was observed; h = historical record of occurrence before 1965, but no recent data to suggest occurrence; – = no verified records.

FOREST BAT INVENTORIES: MIST NETTING
COMPLETION REPORT

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Bats

FUNDING SOURCE: Federal Funds with State Match, State Wildlife Grant Projects

PERIOD COVERED: 14 May 2009 – 27 August 2009

PREPARED BY: Shelly Johnson, Nongame Biologist
Martin Grenier, Nongame Mammal Biologist

INTRODUCTION

There are an estimated 1,100 species of bats (Order: *Chiroptera*) in the world, comprising almost 20% of all mammal species; 45 species occur in the United States (Nowak 1994). Of the 18 species of bats documented in Wyoming, 12 are considered residents for at least part of the year (Table 1; Hester and Grenier 2005). All of the resident species are designated as Species of Greatest Conservation Need by the Wyoming Game and Fish Department (2005; Orabona et al. 2009; Table 1), and half are considered a federal Species of Concern (formerly Category 2) by the U.S. Fish and Wildlife Service (1994, 1996; Table 1). Bats in Wyoming forests are restricted by species-specific requirements; their survival depends on the availability of appropriate roosting sites (e.g., trees or foliage) and adequate prey abundance (e.g., moths, beetles, mosquitoes; Lacki et al. 2007). Statewide inventories for bats that occur in Wyoming forests have previously been lacking, limiting our knowledge of species distributions and the management actions necessary to maintain these species' habitats (Hester and Grenier 2005).

There is a growing concern over the status of bat populations within the United States (Ellison et al. 2003). Bats are difficult to study because they are small, nocturnal, and volant, making conservation and management challenging (Kunz and Racey 1998). Bats are potentially vulnerable to drastic population declines due to their low reproductive rates and specialized habitat requirements (O'Shea and Bogan 2003). Bats have many important ecological roles. Moths, beetles, and other nocturnal arthropods, which can cause economic and ecological damage to forests, are preyed upon by bats. Additionally, the consumption of mosquitoes (up to 1,200 per night for each little brown myotis (Fascione et al. 1991) could potentially reduce the spread of mosquito-borne disease. Bats in Wyoming forests are already facing threats from logging, fire suppression, and bark beetle infestation (Hester and Grenier 2005). With the increase in industrial wind power production in Wyoming, maintaining bat populations may become an even greater challenge. The conservation importance of forest bat habitat may not be fully realized until we understand better the distribution and species assemblage of Wyoming bats.

Our objectives were to collect data on distribution, relative abundance, and diversity of bat species that occur in forests of western Wyoming. This goal includes providing information on population attributes (e.g., sex ratios, age structure) and individuals' characteristics (e.g., reproductive status, morphometric measurements). This 2-year inventory project was started in southwest Wyoming in the summer of 2008. This report focuses on the second and final year, conducted in northwest Wyoming in 2009.

METHODS

We selected 75 survey sites in forested areas of northwest Wyoming. To achieve this, we overlaid sixth level Hydrologic Unit Code areas (HUCs; Berelson et al. 2004) with ecological system vegetation layers (Comer et al. 2003) using a Geographic Information System (GIS; ArcGIS v9.2). We identified all HUCs that contained forested habitat, then omitted any HUC with its majority located inside a wilderness area, National Park, or on the Wind River Indian Reservation. This process identified 182 eligible HUCs, from which we randomly selected 75 as sample units. While in the field, we identified exact netting sites within each HUC based on 1) habitat features that encourage bat concentrations (e.g., water sources, flyways, roosting areas), 2) accessibility (e.g., road access, land ownership), and 3) the ability to effectively capture bats with mist nets at a specific site (Hester and Grenier 2005).

Field personnel worked in crews of two or three people to mist net bats within selected HUCs between mid-May and late August 2009. We positioned mist nets (Avinet, Inc., Dryden, NY) using various configurations, dependent on the type and size of available habitat (i.e., water, flyway) and the surrounding landscape. Mist nets were set roughly 1.6 feet (0.5 m) above ground level and ranged in width [8.5-59 feet (2.6 to 18 m)]. A combination of low nets [8.5 feet (2.6 m) high] and triple high nets [25.5 feet (7.8 m high)] were used, when appropriate, to optimize the potential for bat captures. We opened nets within 30 minutes after civil sunset and kept them open until 3 hours after sunset or at least 2.5 hours. If precipitation, lightning, or winds greater than 7 mph [11 kph (light breeze on Beaufort scale)] were present, nets were kept closed. The above methods were developed in reference to those outlined by Hester and Grenier (2005).

All captured bats were promptly removed from the nets by field personnel and processed at the netting site. We recorded species, sex age, and reproductive status for all bats captured. We identified bats as adult or juvenile based on the absence of cartilaginous epiphyseal plates in the phalanges of juveniles (Anthony 1982). Reproductive status for females was determined by palpation of the abdomen to determine pregnancy, and examination of the mammary glands to determine lactation or post-lactation. When time allowed, we also collected additional morphometric data for forearm length, thumb length, ear length, and weight. We released bats at the netting site immediately after recording data, within 30 minutes from time of capture.

We recorded additional information at each netting site regarding the location and conditions present during each nightly survey. We recorded the location and elevation with a handheld GPS (GPSMap 76S, Garmin Ltd.) in datum NAD 83. Field personnel also diagramed net configurations, described surrounding vegetation, and recording weather conditions (i.e., temperature, wind speed, and cloud cover) at the start and end of each survey.

RESULTS

We successfully surveyed 71 HUCs within the study area in northwest Wyoming during the summer of 2009 (Figure 1). If a suitable (i.e., accessible, effective) netting site could not be located in a pre-selected HUC, field personnel used their discretion to select a suitable replacement HUC adjacent to the pre-selected HUC. As a result, two HUCs were inadvertently surveyed twice at different locations (site ID Nos. 17 and 18; Figure 2). We removed two additional HUCs from the data set as a result of being relocated outside the target area.

We captured bats in 46 of the 71 HUCs and 291 individuals representing eight different species (Table 2). The average number of individuals captured per site was 3.98 ± 0.74 *SE* (range: 0-29). The most commonly captured bats were *Myotis lucifugus (*37%), *Lasionycteris noctivagans* (31%), and *Eptesicus fuscus* (14%), with the remaining six species comprising 18% of the captures (Table 2). For all species combined, more males (57%) were captured than females, with a considerable bias towards males of *Lasiurus cinereus* (13:1) and *E. fuscus* (10:1) (Table 3). Most individuals were non-reproductive adults (70%), while 20% were reproductive females (pregnant, lactating, or post-lactating), 2% were males with descended testes, and 8% were juveniles (Table 3). Means of morphometric measurements (forearm length, thumb length, ear length, and weight) are reported in Table 4 for each species.

Overall, bat captures were well distributed throughout the study area (Figure 3), including previously undocumented locations not listed in the Department's Atlas (Orabona et al. 2009). We recorded new latilong locations for observations of *E. fuscus*, *L. cinereus*, *M. ciliolabrum*, and *M. evotis* (Table 5). We observed evidences of reproduction for all eight captured species in new latilong locations, including the first record of a reproductive *M. thysanodes* by the Department in Wyoming (Table 5). Maps of individual species' distributions are shown in Figures 4-11.

DISCUSSION

Previous studies throughout North America have documented all of the captured species in forested habitats (Lacki et al. 2007). We did not capture 4 of the 12 resident species; however, some species are adept at avoiding capture in nets (e.g., *Corynorhinus townsendii*, *Euderma maculatum*; O'Farrell and Gannon 1999). Additionally, *Antrozous pallidus* is more commonly associated with habitats at lower elevation and *M. septentrionalis* is known primarily from eastern Wyoming (Hester and Grenier 2005). It is not surprising that we failed to capture the peripheral or accidental species, given the extent of their range and low probability of occurrence in the study area.

This inventory encompassed a large geographic area in a relatively short time period, which should be considered when interpreting the results. Spatial and temporal variations may cause noticeable differences on capture success for each survey night (Hester and Grenier 2005). We attempted to distribute surveys throughout the study area over the course of the summer, although replications were not feasible. As a result, it is difficult to assess the exact distribution, relative abundance, and diversity of bats in forests of western Wyoming with these data. However, since inventories for bats in Wyoming forests have previously been lacking, this updated information is significant and beneficial to increasing our current understanding of future management and inventory needs.

Some results may warrant further investigation. The disproportionately high number of male *L. cinereus* and *E. fuscus* was not observed in other species captured. We are possibly witnessing a reflection of the hypothesis that *L. cinereus* segregate during summer, with males occurring primarily in mountainous regions of North America, and females occupying more eastern areas (Hester and Grenier 2005). Additionally, *E. fuscus* are known to roost and forage in forest habitat, but are also considered generalists and found throughout the state (Hester and Grenier 2005). Roosting habitat is especially critical during reproduction, thus, it is plausible that *E. fuscus* maternity colonies are found in more favorable locations elsewhere in the state (e.g., lower elevation with warmer mean temperatures).

Current forest management practices may affect forested landscapes that bats use for foraging or roosting. Many recent studies have evaluated habitat use throughout different forested regions of North America. Information obtained from studies is often species- and site-specific, demonstrating the importance of conducting localized studies on bat species within regions of concern. Once we better understand the distribution, relative abundance, and diversity of Wyoming bat species, we can further investigate how bat habitat may change in the presence of logging, fire suppression, bark beetle infestation, and industrial wind power production in Wyoming (Hester and Grenier 2005).

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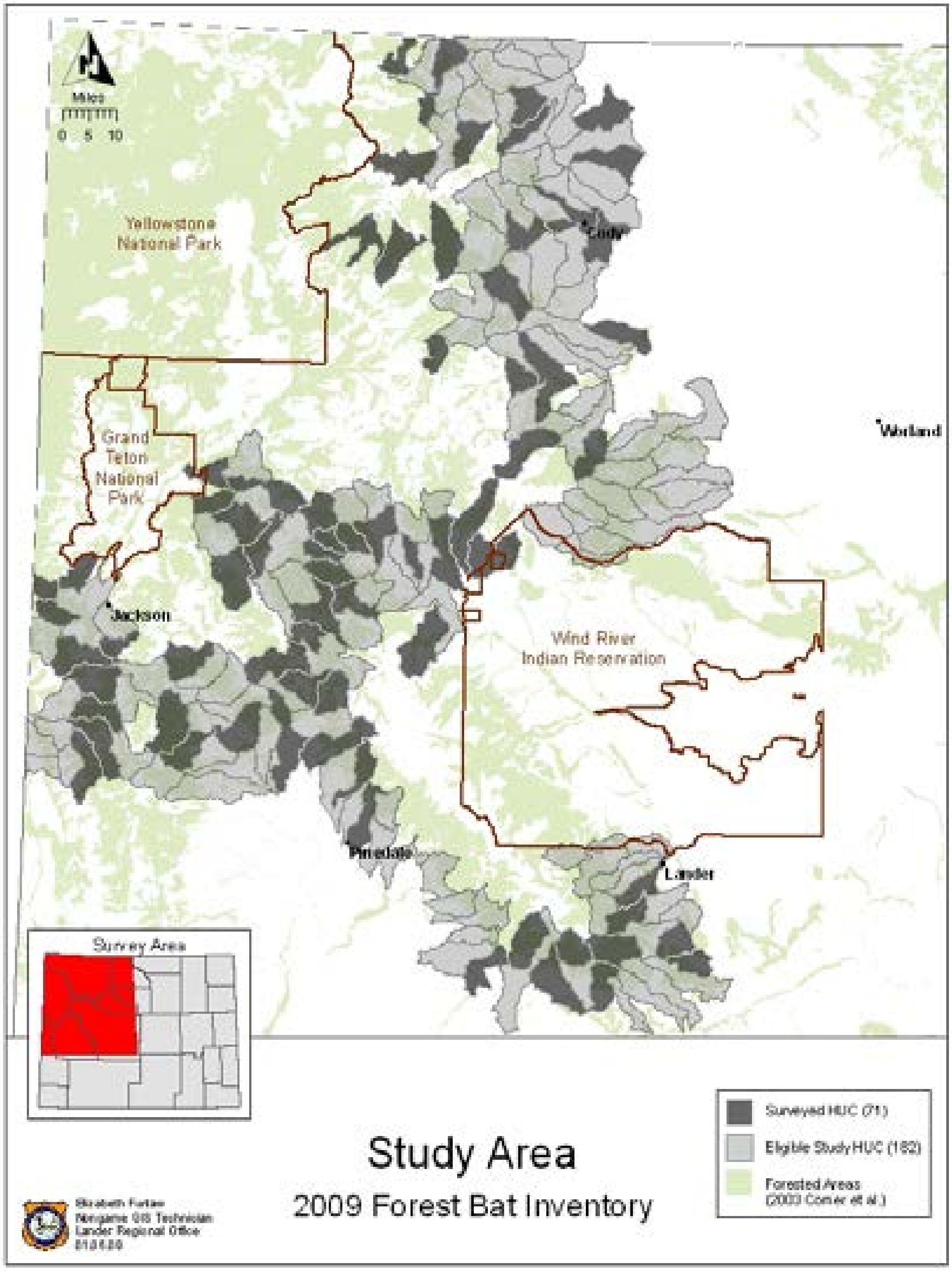

Figure 1. Map of the 2009 study area in northwest Wyoming. The complete eligible study area (by HUC) is shown amongst boundaries of the National Parks and Wind River Indian Reservation, which limit the perimeters of the target study area (wilderness boundaries are not shown).

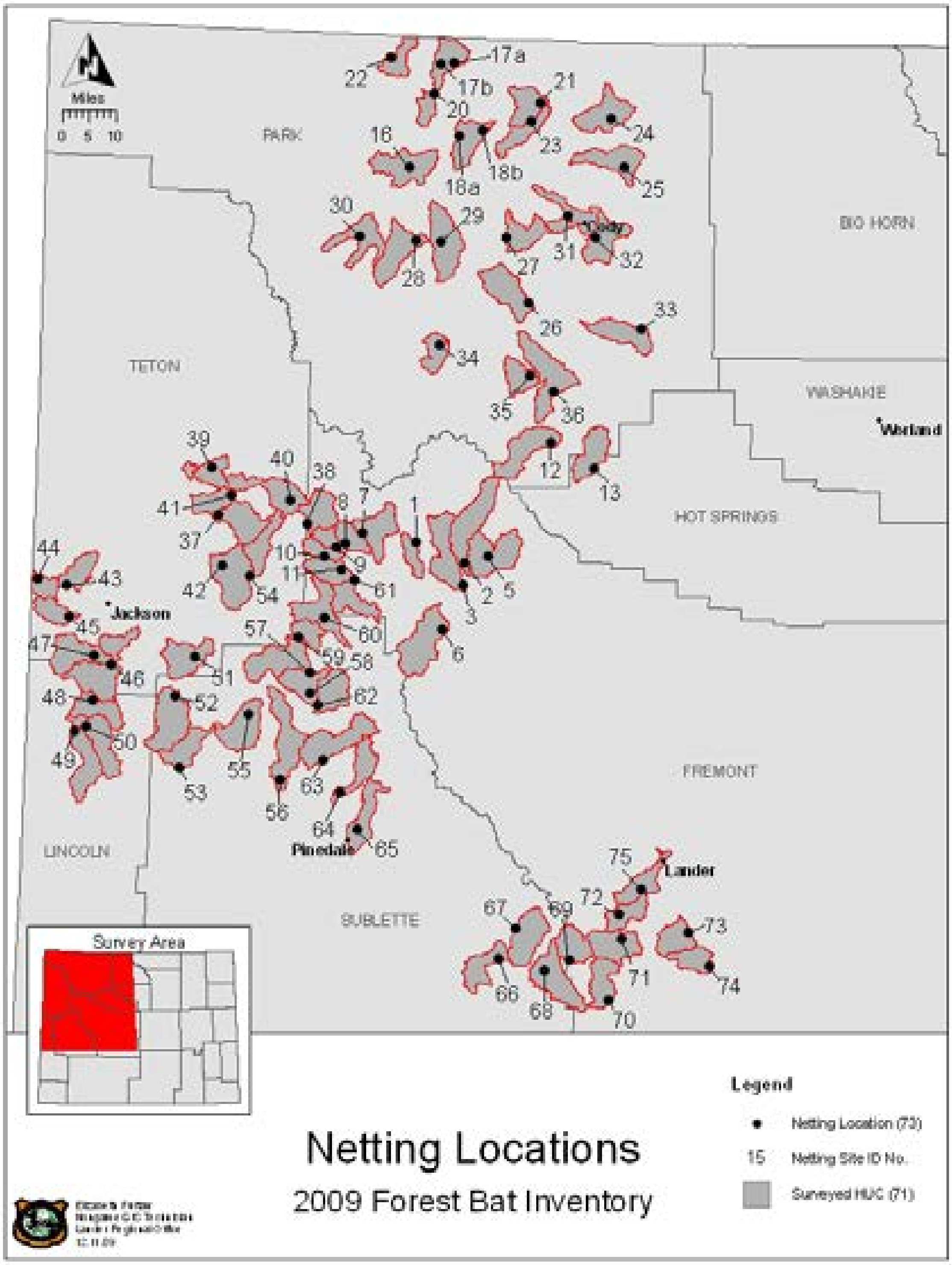

Figure 2. Netting locations for the 2009 forest bat inventory shown within their respective HUCs and identified by arbitrarily assigned site numbers. HUC Nos. 17 and 18 contain two netting locations each (a and b).

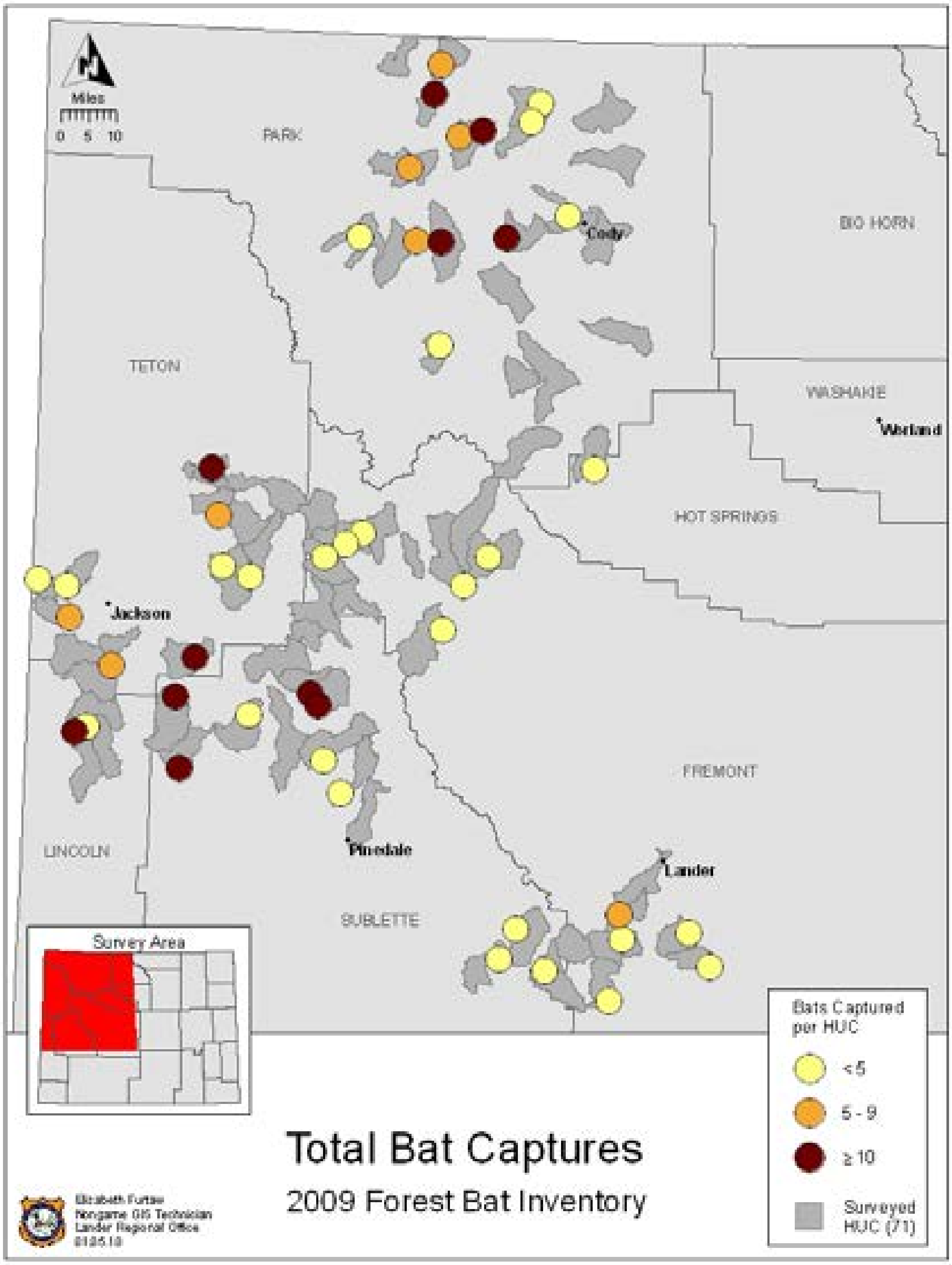

Figure 3. Number of individuals captured and approximate locations of bats in northwest Wyoming during the 2009 forest bat inventory.

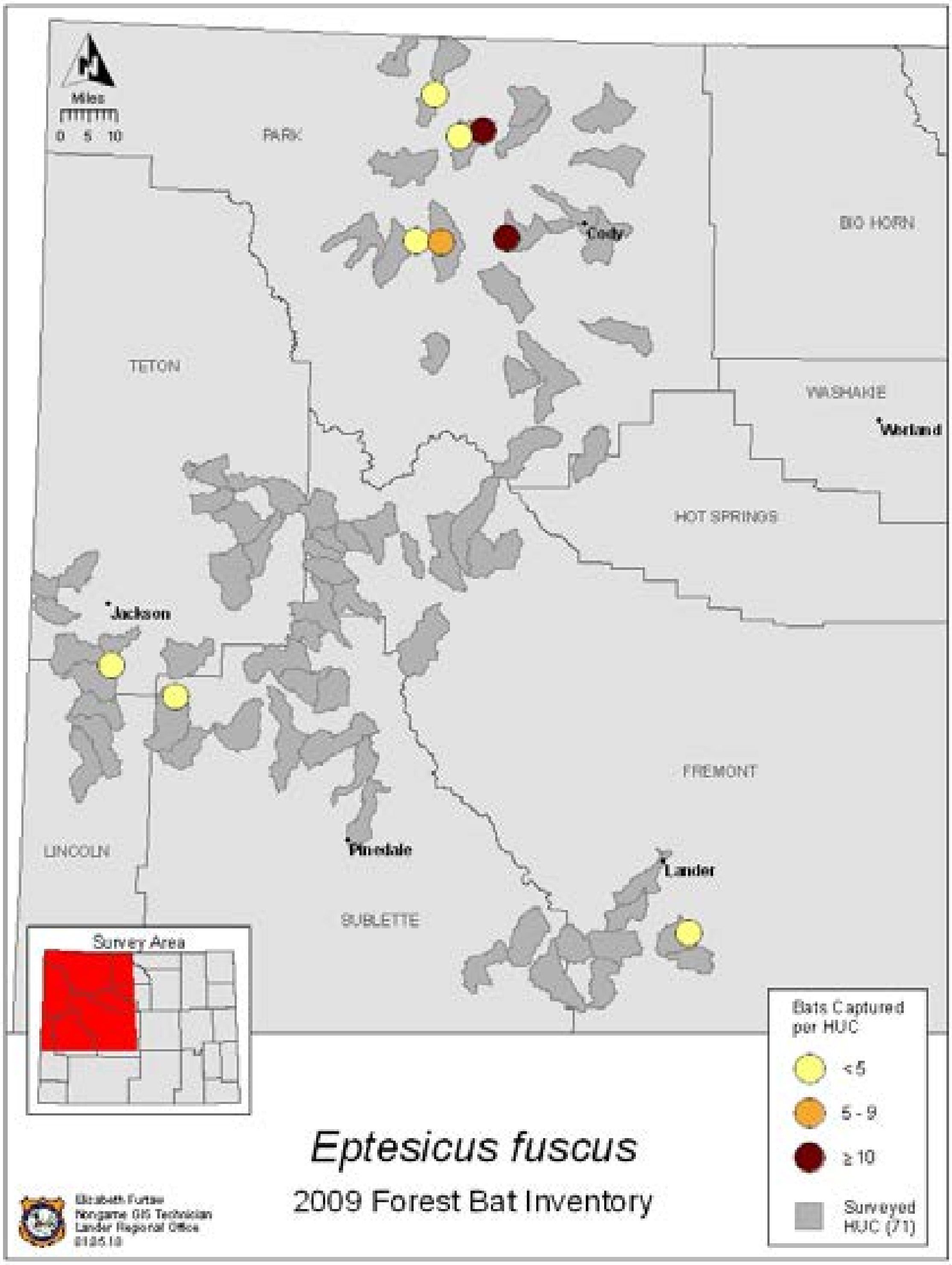

Figure 4. Number of individuals captured and approximate locations of big brown bats (*Eptesicus fuscus*) in northwest Wyoming during the 2009 forest bat inventory.

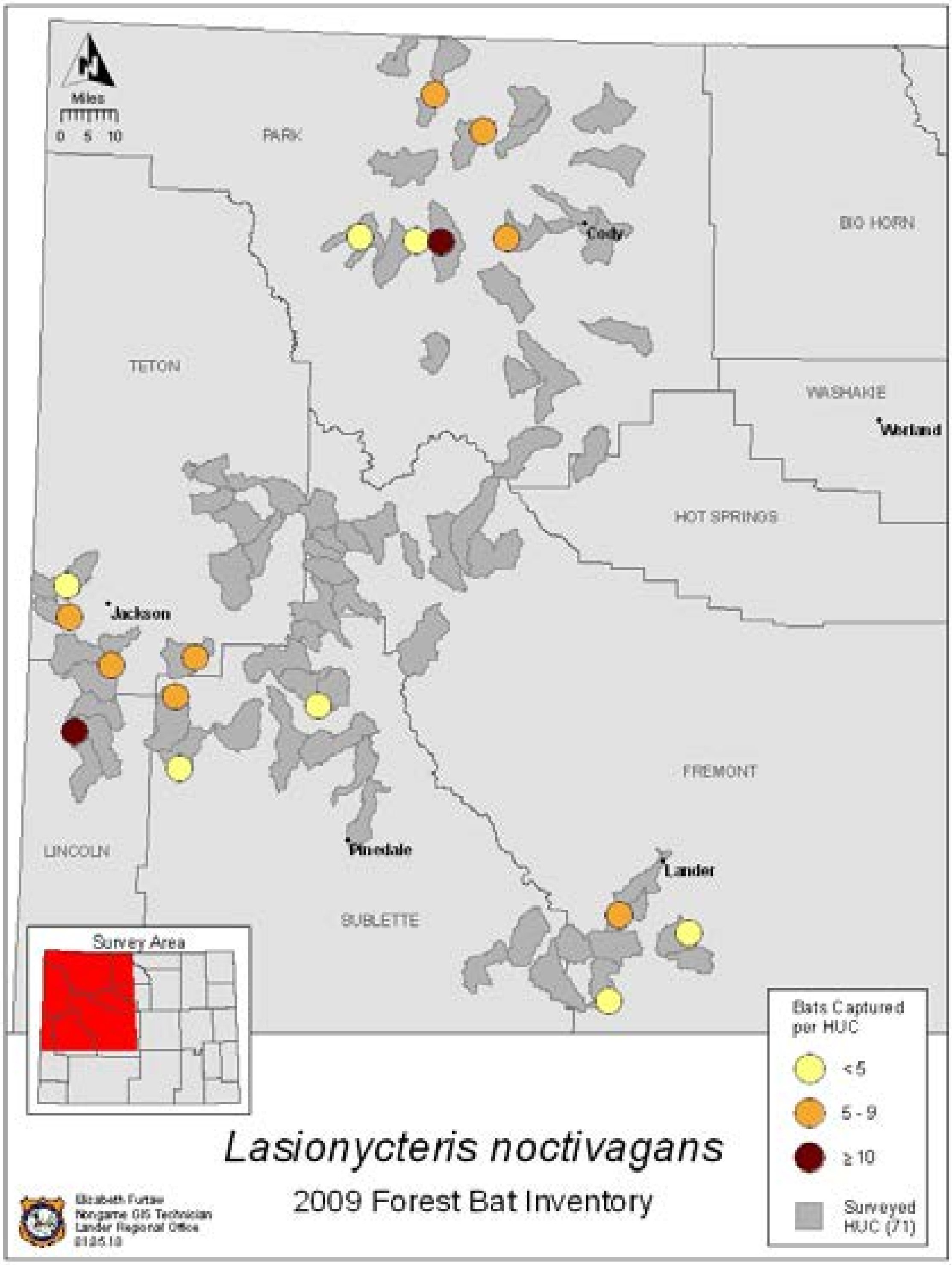

Figure 5. Number of individuals captured and approximate locations of silver-haired bats (*Lasionycteris noctivagans*) in northwest Wyoming during the 2009 forest bat inventory.

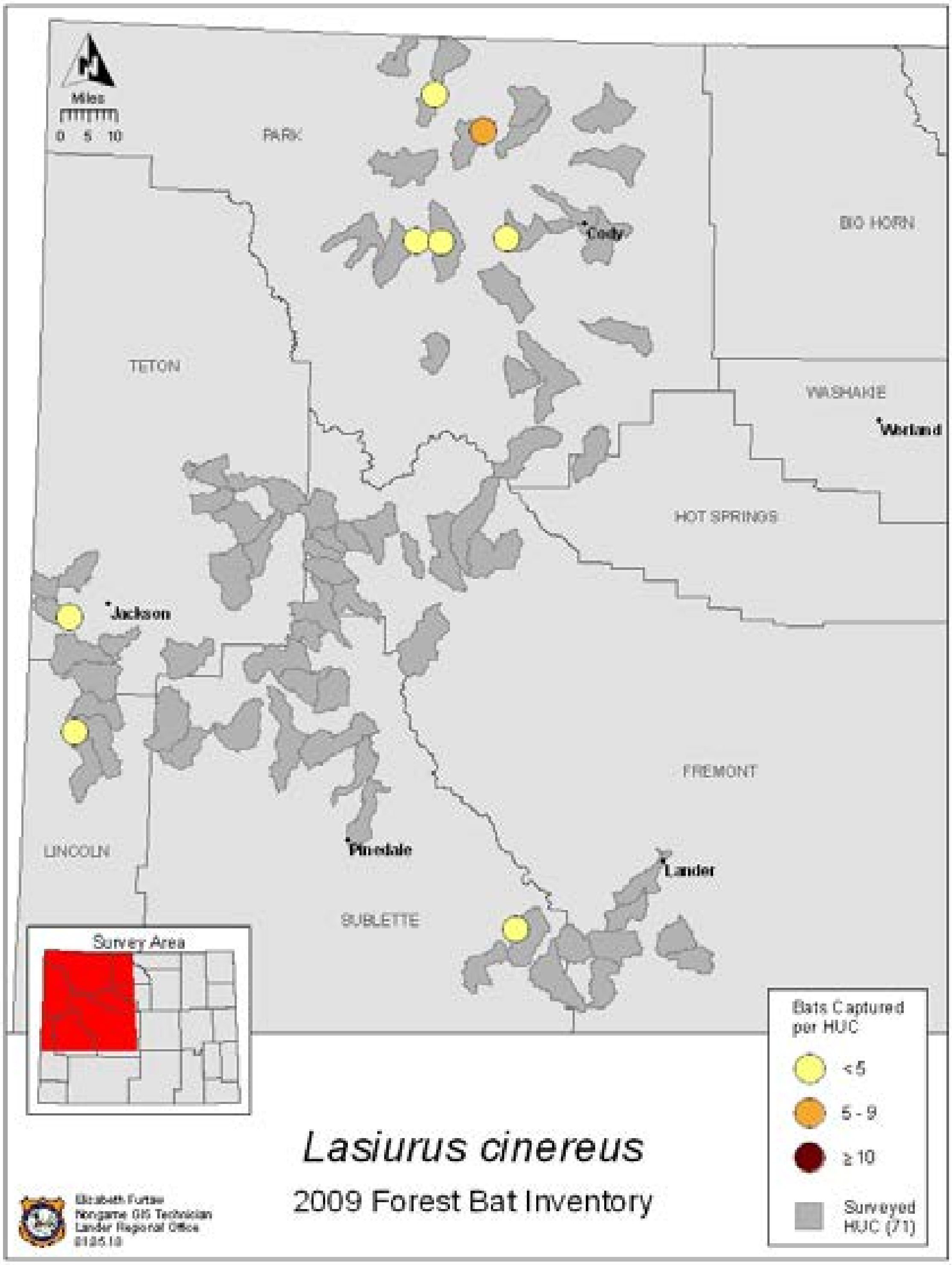

Figure 6. Number of individuals captured and approximate locations of hoary bats (*Lasiurus cinereus*) in northwest Wyoming during the 2009 forest bat inventory.

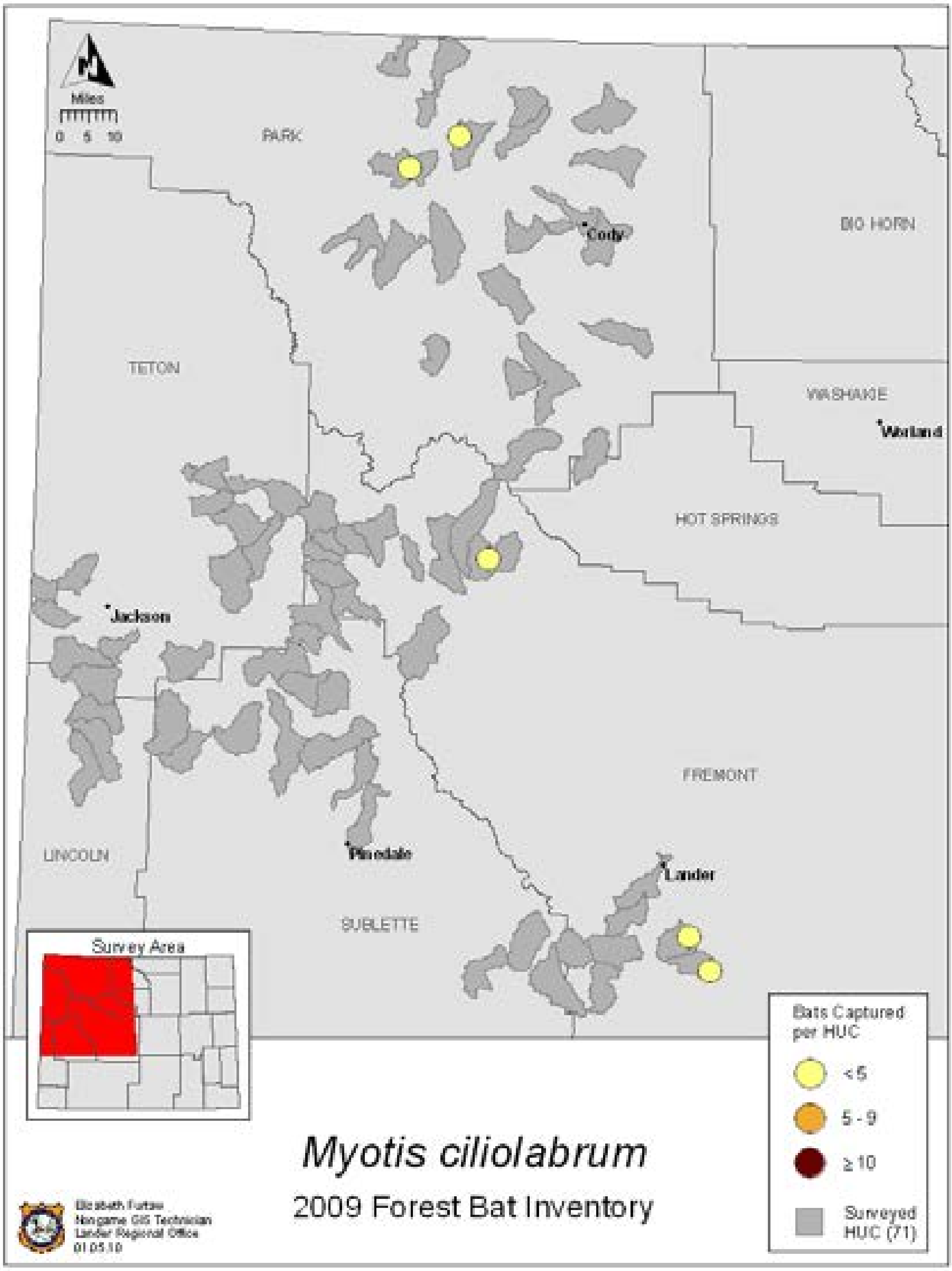

Figure 7. Number of individuals captured and approximate locations of western small-footed myotis (*Myotis ciliolabrum*) in northwest Wyoming during the 2009 forest bat inventory.

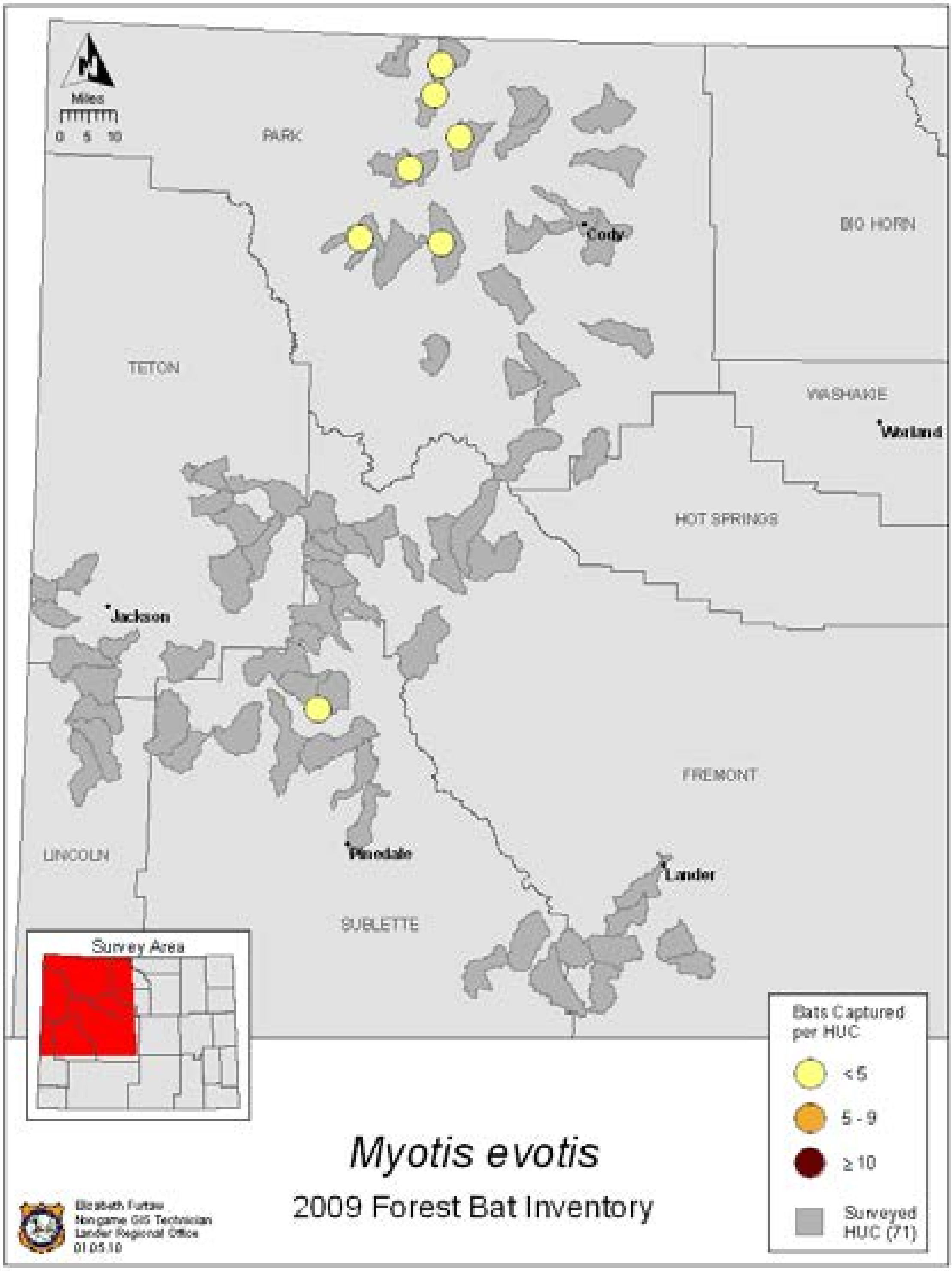

Figure 8. Number of individuals captured and approximate locations of long-eared myotis (*Myotis evotis*) in northwest Wyoming during the 2009 forest bat inventory.

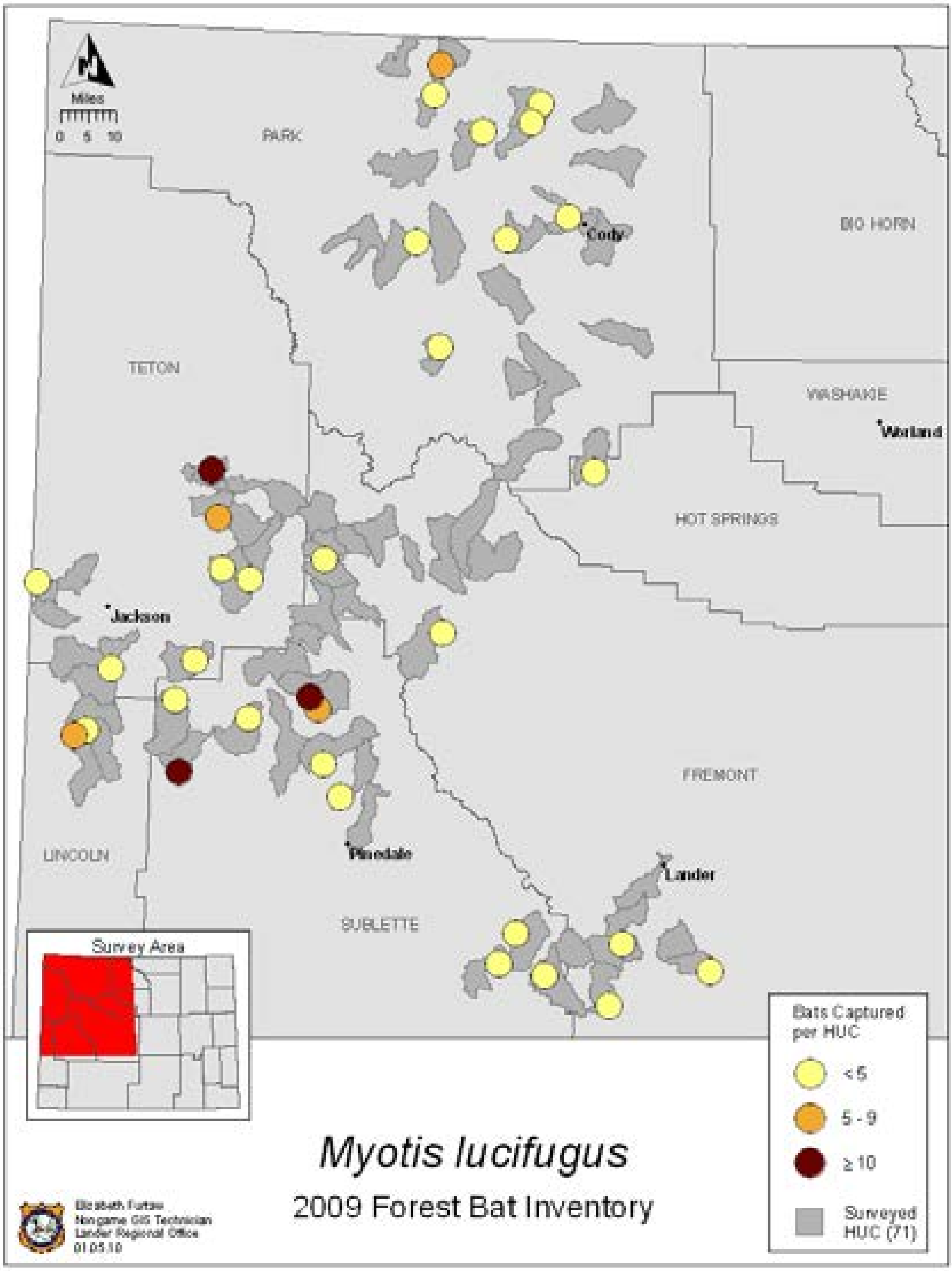

Figure 9. Number of individuals captured and approximate locations of little brown myotis (*Myotis lucifugus*) in northwest Wyoming during the 2009 forest bat inventory.

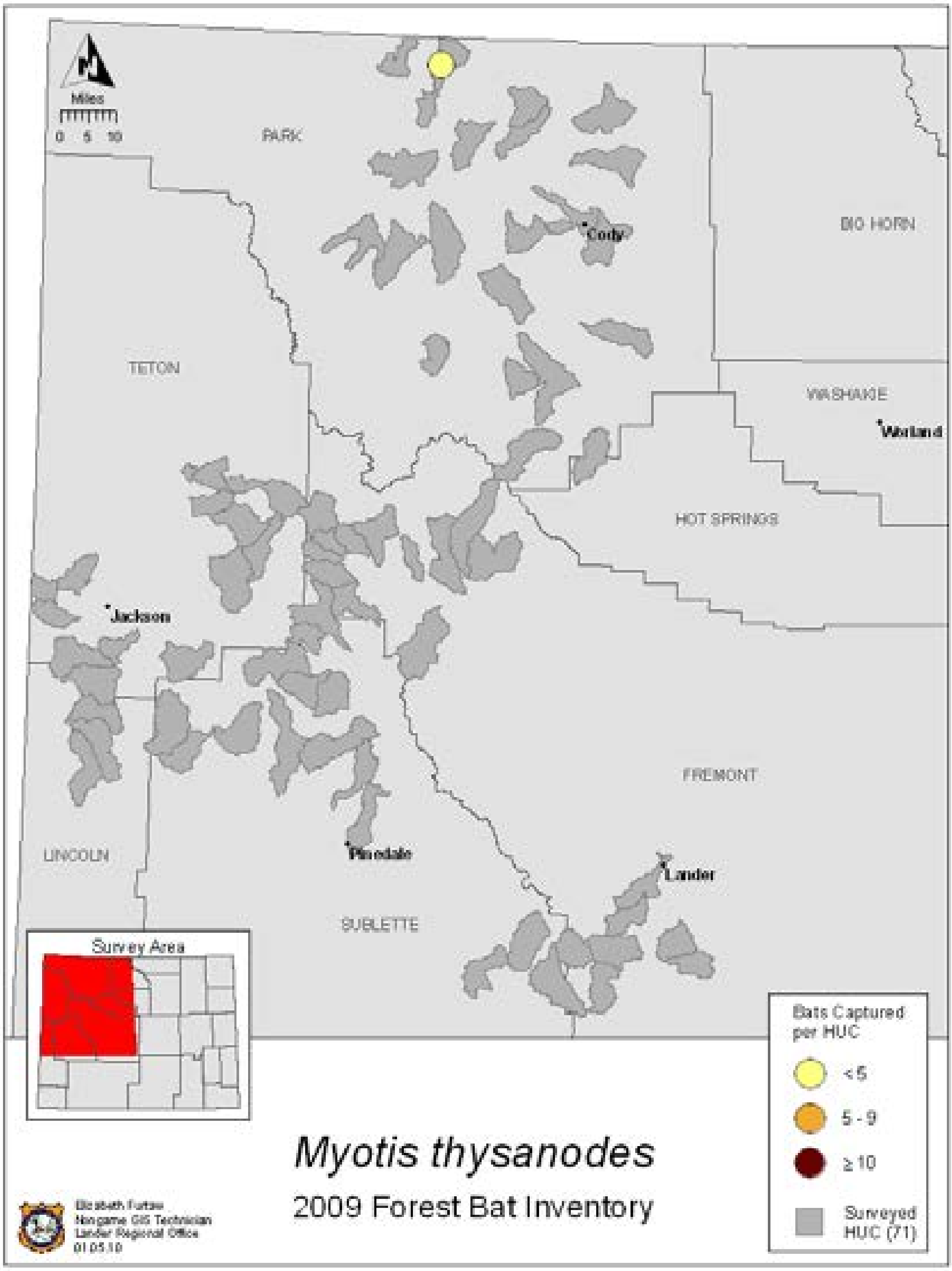

Figure 10. Number of individuals captured and approximate locations of fringed myotis (*Myotis thysanodes*) in northwest Wyoming during the 2009 forest bat inventory.

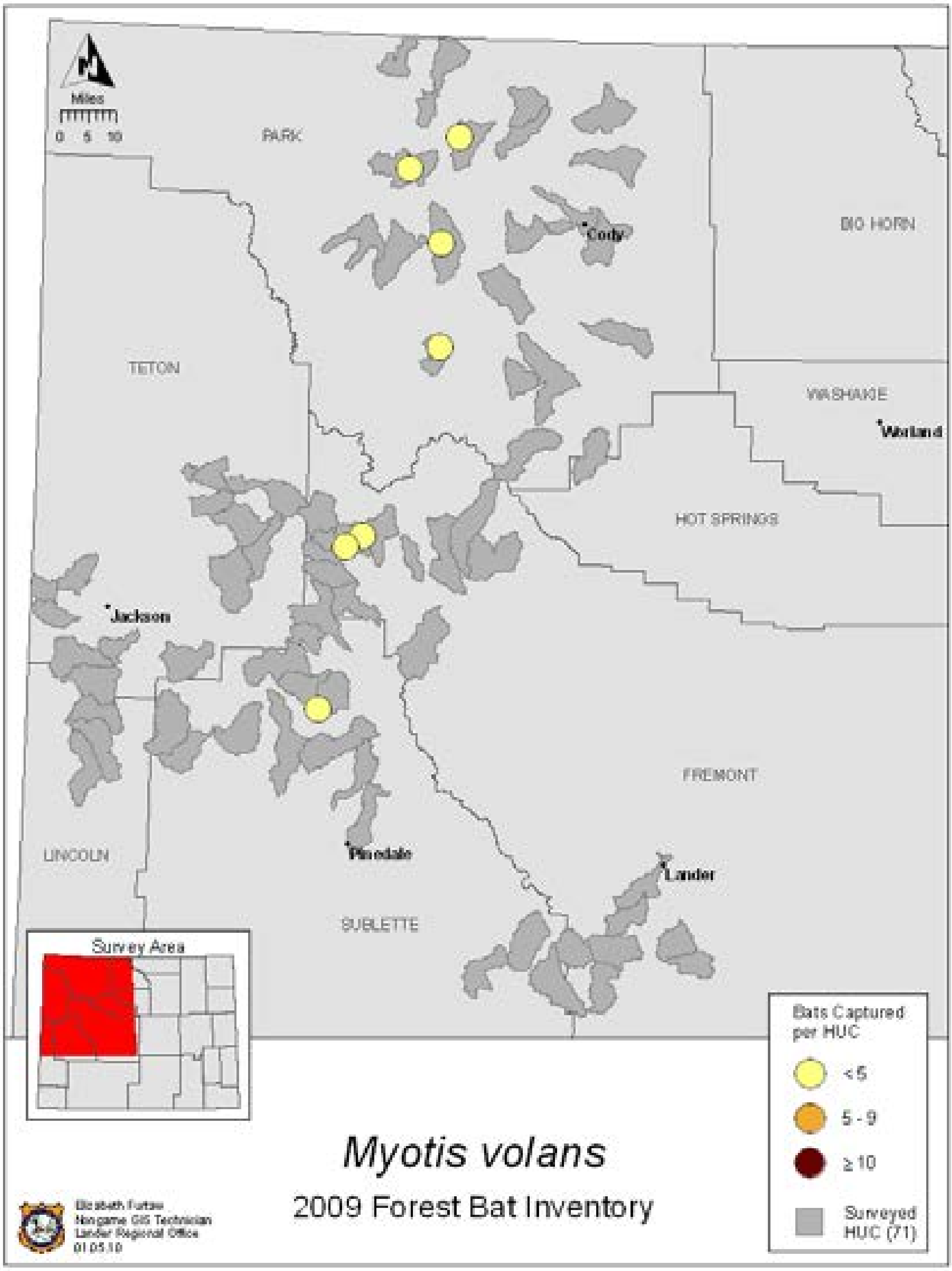

Figure 11. Number of individuals captured and approximate locations of long-legged myotis (*Myotis volans*) in northwest Wyoming during the 2009 forest bat inventory.

Table 1. Bat species (Chiropteran) documented in Wyoming, listed by scientific and common name (* indicates species captured during the 2009 study), Wyoming residency status, USFWS Species of Concern (SC) status, and Wyoming Game and Fish Department Native Species Status (NSS).

Scientific Name	Common Name	WYBWG Status[a]	USFWS Status[b]	Native Species Status[c]
Antrozous pallidus	Pallid Bat	R	-	NSS2
Corynorhinus townsendii	Townsend's Big-eared Bat	R	SC	NSS2
*Eptesicus fuscus**	Big Brown Bat	R	-	NSS3
Euderma maculatum	Spotted Bat	R	SC	NSS2
*Lasionycteris noctivagans**	Silver-haired Bat	R	-	NSS4
Lasiurus borealis	Eastern Red Bat	P	-	NSSU
*Lasiurus cinereus**	Hoary Bat	R	-	NSS4
Myotis californicus	California Myotis	P	-	-
*Myotis ciliolabrum**	Western Small-footed Myotis	R	SC	NSS3
*Myotis evotis**	Long-eared Myotis	R	SC	NSS2
*Myotis lucifugus**	Little Brown Myotis	R	-	NSS3
Myotis septentrionalis	Northern Myotis	R	-	NSS2
*Myotis thysanodes**	Fringed Myotis	R	SC	NSS2
*Myotis volans**	Long-legged Myotis	R	SC	NSS2
Myotis yumanensis	Yuma Myotis	P	SC	-
Nyctinomops macrotis	Big Free-tailed Bat	A	SC	-
Pipistrellus subflavus	Eastern Pipistrelle	A	-	-
Tadarida brasiliensis	Brazilian Free-tailed Bat	P	-	-

[a] As listed in A Conservation Plan for Bats in Wyoming (Hester and Grenier 2005), compiled by the Wyoming Bat Working Group (WYBWG) and Wyoming Game and Fish Department Nongame Program, R = resident (year-round or seasonally), P = peripheral, and A = accidental occurrence.

[b] United States Fish and Wildlife Service (USFWS; 1994, 1996).

[c] Wyoming Game and Fish Department Species of Greatest Conservation Need with a Native Species Status (NSS) of 1, 2, 3, or 4, as listed in the Wyoming Game and Fish Department's Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming (Orabona et al. 2009) and A Comprehensive Wildlife Conservation Strategy for Wyoming (Wyoming Game and Fish Department 2005).

Table 2. Mist net captures of bats (Chiropteran), listed by capture site #, in western Wyoming from May through August 2009. [a]

Site #	EPFU	LACI	LANO	MYCI	MYEV	MYLU	MYSP	MYTH	MYVO	Total
1										*0*
2										*0*
3							1			*1*
5				1						*1*
6						1				*1*
7									1	*1*
8									1	*1*
9										*0*
10						3				*3*
11										*0*
12										*0*
13						1	1			*2*
16				1	3				1	*5*
17a										*0*
17b					1	6		1		*8*
18a	1			2	2		1		2	*8*
18b	16	5	7			1				*29*
20	1	1	6		1	1				*10*
21						2				*2*
22										*0*
23						3				*3*
24										*0*
25										*0*
26										*0*
27	14	2	5			3				*24*
28	1	1	1			3				*6*
29	5	2	18		1				3	*29*
30			1		3					*4*
31						1	1			*2*
32										*0*
33										*0*
34						1			1	*2*
35										*0*
36										*0*
37						8				*8*
38										*0*
39						10				*10*
40										*0*
41										*0*
42						4				*4*
43			1							*1*
44						2				*2*
45		1	5							*6*
46	1		6			1				*8*
47										*0*
48						2				*2*
49		2	12			5				*19*
50										*0*
51			8			4				*12*
52	2		8			2				*12*
53			2			10				*12*
54						1				*1*
55						2				*2*
56										*0*
57										*0*
58						11				*11*
59										*0*
60										*0*
61										*0*
62			2		2	5			1	*10*
63						3				*3*
64						2				*2*
65										*0*
66						1				*1*
67		1				3				*4*
68						1	1			*2*
69										*0*
70			1			3				*4*
71						1				*1*
72			6							*6*
73	1		1	1						*3*
74				2		1				*3*
75										*0*
Total	*42*	*15*	*90*	*7*	*13*	*108*	*5*	*1*	*10*	*291*

[a] EPFU: *Eptesicus fuscus*, LACI: *Lasiurus cinereus*, LANO: *Lasionycteris noctivagans*, MYCI: *Myotis ciliolabrum*, MYEV: *Myotis evotis*, MYLU: *Myotis lucifugus*, MYTH: *Myotis thysanodes*, MYVO: *Myotis volans*, MYSP: undetermined *Myotis* species.

Table 3. Demographic data for bats (Chiropteran) captured with mist nets in western Wyoming from May through August 2009.

Species	Capture Total	Sex Ratio (Male:Female)	Age Ratio (Adult:Juvenile)	Reproductive Ratio (No:Yes)
Eptesicus fuscus	42	38:4	42:0	41:1
Lasionycteris noctivagans	90	58:31[a]	76:12[b]	64:25[a]
Lasiurus cinereus	15	13:1[a]	14:0[a]	12:2[a]
Myotis ciliolabrum	7	5:2	7:0	5:2
Myotis evotis	13	3:10	13:0	9:4
Myotis lucifugus	108	43:64[a]	96:11[a]	84:23[a]
Myotis thysanodes	1	0:1	1:0	0:1
Myotis volans	10	6:4	9:1	10:0
Myotis species	5	1:4	5:0	2:3
Total	*291*	*167:121*	*263:24*	*227:61*

[a] One bat released before determination.
[b] Two bats released before determination.

Table 4. Means of morphometric measurements (forearm length, thumb length, ear length, and weight) for individuals captured with mist nets in western Wyoming from May through August 2009, summarized by species. [a]

Species	Forearm Length (mm)	± SE (*n*)	Thumb Length (mm)	± SE (*n*)	Ear Length (mm)	± SE (*n*)	Weight (g)	± SE (*n*)
EPFU	46.5	± 0.19 (*33*)	7.4	± 0.13 (*17*)	14.0	± 0.27 (*24*)	17.2	± 0.49 (*30*)
LANO	41.3	± 0.18 (*42*)	5.8	± 0.15 (*21*)	12.7	± 0.24 (*23*)	12.2	± 0.36 (*36*)
LACI	52.9	± 0.51 (*9*)	10.4	± 0.34 (*6*)	13.2	± 0.66 (*5*)	26.6	± 1.01 (*9*)
MYCI	32.0	± 0.31 (*7*)	4.4	± 0.15 (*5*)	12.4	± 0.61 (*7*)	4.7	± 0.19 (*6*)
MYEV	38.7	± 0.24 (*13*)	6.7	± 0.20 (*10*)	19.3	± 0.33 (*13*)	7.1	± 0.22 (*12*)
MYLU	38.3	± 0.15 (*105*)	6.1	± 0.06 (*63*)	12.7	± 0.12 (*99*)	7.8	± 0.15 (*87*)
MYTH	38.8	± n/a (*1*)	6.7	± n/a (*1*)	18.0	± n/a (*1*)	8.0	± n/a (*1*)
MYVO	39.1	± 0.21 (*10*)	6.1	± 0.17 (*9*)	11.2	± 0.25 (*10*)	8.0	± 0.32 (*10*)

[a] EPFU *Eptesicus fuscus*
LANO *Lasionycteris noctivagans*
LACI *Lasiurus cinereus*
MYCI *Myotis ciliolabrum*
MYEV *Myotis evotis*
MYLU *Myotis lucifugus*
MYTH *Myotis thysanodes*
MYVO *Myotis volans*

Table 5. Updates to the Department's Atlas of current distribution status by latilong, based on individuals captured with mist nets in western Wyoming from May through August 2009, summarized by species. [a]

Species	Latilong	Current Status	Updated Status
Eptesicus fuscus	2	–	O
	8	O	B
Lasionycteris noctivagans	2, 8, 9, 17	O	B
Lasiurus cinereus	2	–	B
	16	–	O
Myotis ciliolabrum	17	O	B
Myotis evotis	2	h	B
Myotis lucifugus	2, 9, 17	O	B
Myotis thysanodes	2	O	B
Myotis volans	2	O	B

[a] B = Dependent young, juvenile animals, lactating or post-lactating females, or males in breeding condition were observed.
O = The species was observed but, due to the mobility of the species and lack of factors listed under "B", breeding cannot be assumed.
h = Historical record of occurrence before 1965, but no recent data to suggest occurrence.
– = No verified records.

DEVELOPMENT OF INVENTORIES OF PYGMY RABBITS AND SAGEBRUSH HABITATS AT THE LANDSCAPE SCALE
COMPLETION REPORT

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Pygmy Rabbit

FUNDING SOURCE: Federal Funds with State Match, State Wildlife Grant Projects, Wyoming Game and Fish Commission Grant Agreement #000606

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Steve Buskirk, University of Wyoming
Amanda Thimmayya, University of Wyoming

SUMMARY

This is a University of Wyoming Master of Science thesis project, and only the summary is presented here. To access the entire thesis, contact the Department of Zoology and Physiology, University of Wyoming, 1000 East University Avenue, Department 3166, Laramie, WY, 82071, 307-766-4207, zprequest@uwyo.edu.

The objectives of this study are to:

1. Test and evaluate multiple possible methods for surveying for the presence of pygmy rabbits across sagebrush-dominated habitats of southwestern Wyoming.
2. Investigate population genetic structure of pygmy rabbits in southwestern Wyoming.
3. Describe and compare diets of sympatric pygmy rabbits and cottontail rabbits using stable isotopic analyses.

We collected pellets groups of captured rabbits, as well as pellet groups from the ground, but were unable to amplify quality DNA that would allow species identification from fecal pellets through a DNA marker.

Our inability to extract DNA from fecal pellets caused us to increase our trapping effort. We trapped 53 pygmy rabbits and 43 cottontails from seven locations each (Figure 1). Trap success was greater for pygmy rabbits during winter than summer (five captures versus one capture per 100 trap nights). We measured hind foot length (HFL) of captured rabbits (pygmy rabbit n=46; cottontail n=41), and collected fecal pellets from traps that did not contain edible bait (pygmy rabbit n=38/585; cottontail rabbit n=13/175; sample sizes are number of individuals per total number of pellets). Using HFL as a proxy for track length and individual mean pellet

diameter (MPD) as predictor variables, we developed two separate logistic models that predicted the probability of pygmy rabbit presence based on sign. HFL and MPD both showed separation between species, even when juvenile cottontail rabbits were include in the analysis (Figure 2).

We extracted DNA from tissue samples collected from captured rabbits from all locations. However, if only a single pygmy rabbit or cottontail was captured in a location, then that location and corresponding sample were removed from further analyses. There were five locations for each species where we caught >1 rabbit (Figure 1): Fossil Butte National Monument (pygmy rabbit n=16; cottontail rabbit n=16), Slate Creek (cottontail rabbit n=6), Boulder (pygmy rabbit n=15), South Pass (pygmy rabbit n=5), Agate Flat (cottontail rabbit n=9), south of Creston Junction (pygmy rabbit n=10), north of Creston Junction (pygmy rabbit n=5), Mineral X Road (cottontail rabbit n=6), and north of Sinclair (cottontail rabbit n=5).

We optimized 15 and 8 previously developed microsatellite primers (Surridge et al. 1997; Estes-Zumpf et al. 2008) for pygmy rabbit and cottontail rabbit, respectively. We submitted PCR products (two to five replicates per sample) to the Nucleic Acid Exploration Facility, University of Wyoming for genotyping. Preliminary analysis suggests that there was no population structure for pygmy rabbit in Wyoming, nor was there a strong isolation by distance effect. Additionally, genetic analysis of cottontails indicated that two different species were present across sampling locations, most likely desert cottontail (*Sylvilagus audubonii*) and mountain cottontail (*S. nuttallii*), though only a single species was found in a single location.

Sampling and geographic considerations would not allow us to make within-season comparison between diets of pygmy rabbit and cottontail rabbit. We will discuss this with the Wyoming Game and Fish Department Nongame Coordinator before proceeding with this objective.

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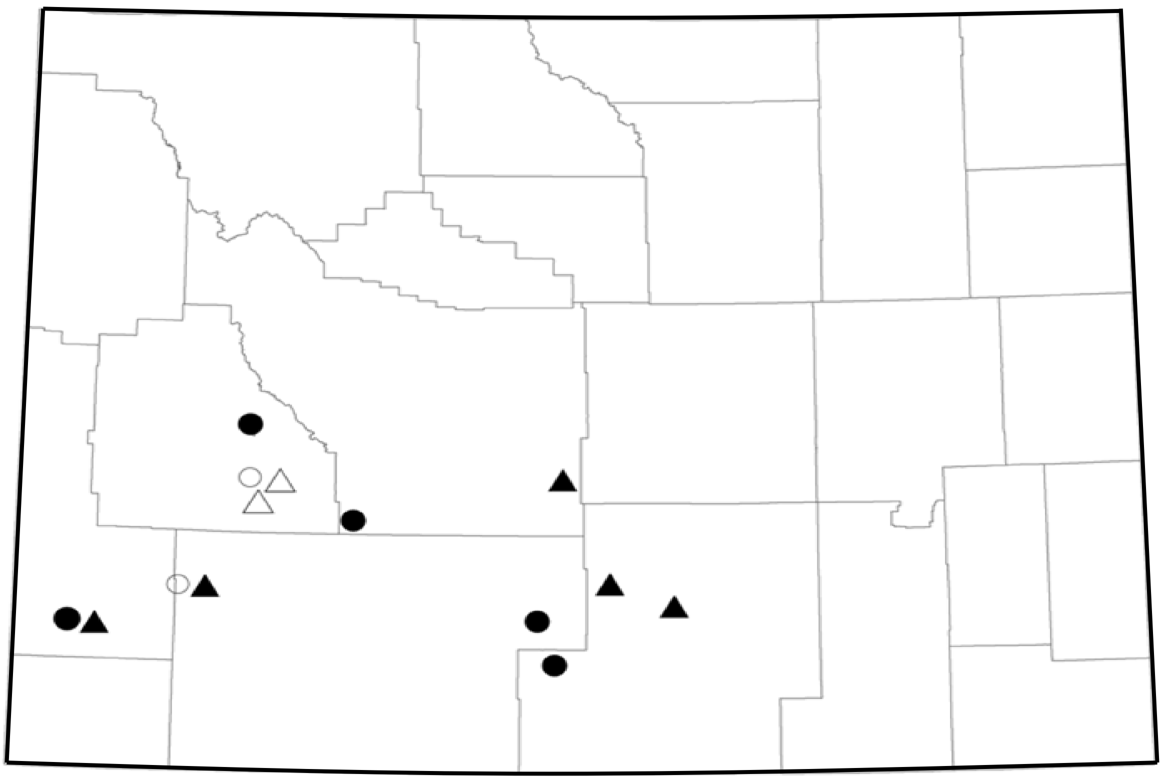

Figure 1. Sampling locations of pygmy rabbit (●) and cottontail rabbit (▲) within Wyoming. Open symbols indicate locations that were excluded from genetic analysis because only one rabbit was captured.

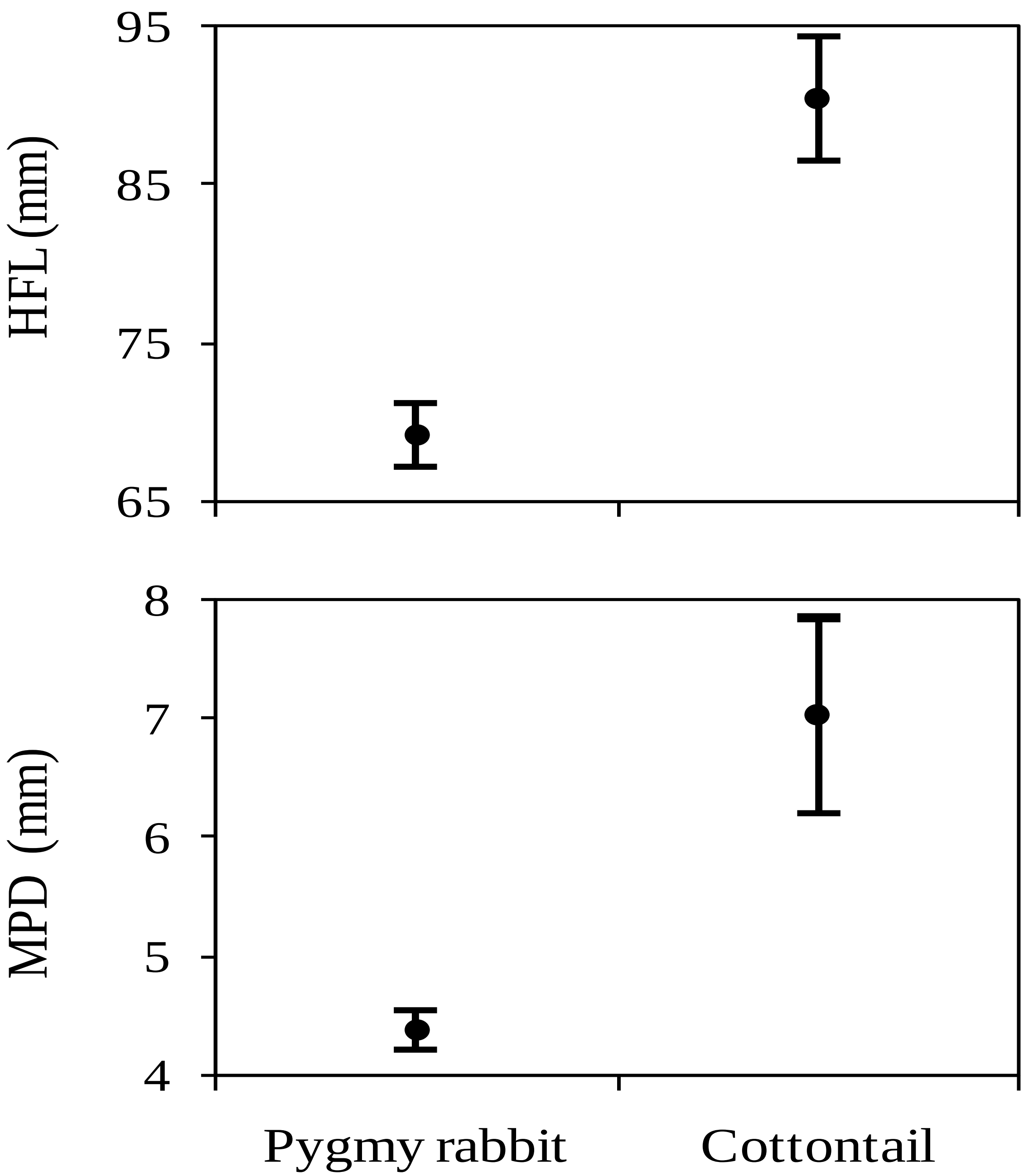

Figure 2. Mean hind foot length (HFL) and mean pellet diameter (MPD) of pygmy rabbits (HFL n=47, MPD n=38) and cottontail rabbits (HFL n=41, MPD n=13) captured June 2008-July 2009 in southwestern and south central Wyoming. Error bars indicate 95% confidence intervals.

ABUNDANCE ESTIMATE OF THE BLACK-TAILED PRAIRIE DOG IN EASTERN WYOMING COMPLETION REPORT

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Black-tailed Prairie Dog

FUNDING SOURCE: Wyoming Governor's Big Game License Coalition

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Martin Grenier, Nongame Mammal Biologist

INTRODUCTION

The U.S. Fish and Wildlife Service recently determined that the black-tailed prairie dog (BTPD) was not warranted for listing under the Endangered Species Act. However, the species continues to garner a high degree of interest from the public. Since 2000, the Western Association of Fish and Wildlife Agencies (WAFWA) has worked cooperatively to conduct surveys throughout the range of the species. Under the existing WAFWA Memorandum of Understanding, survey efforts for the BTPD will be conducted on a 3-year interval. Results from previous surveys for the BTPD in Wyoming are available in other reports (Grenier et al. 2004a, 2004b, 2007).

Recently, Grenier and Filipi (2009) developed a new approach for estimating abundance of the closely related white-tailed prairie dog. This new approach combined aerial and remote sensing techniques. We modified the Grenier and Filipi (2009) approach and implemented it for the BTPD because previous methods could not detect increases in distribution.

METHODS

A predictive model for the BTPD distribution in Wyoming was developed by the Wyoming Natural Diversity Database (WYNDD). WYNDD developed a MaxEnt model using the dataset from Grenier et al. (2004b) for the BTPD using Geographic Information Systems (GIS; ArcMap 9.3, ESRI, Redwood City, CA). We stratified the MaxEnt model into two strata. Areas with a probability of occurrence value of $\geq$0.5 were assigned to the high strata, while areas with a probability of occurrence value <0.5 were assigned to the low strata. Using GIS, we overlaid a grid comprised of 547 x 547 yard (500 x 500 m) quadrats and clipped the grid to the MaxEnt model. We then allocated our effort to each strata proportionally; 33% of our effort was allocated to the high strata and 67% to the low.

Survey methodology follows general descriptions by Grenier and Filipi (2009). Each selected quadrat was overlaid onto a 2006 National Agricultural Imagery Program (NAIP) color photograph using ArcMap 9.3. We printed each quadrat and photograph onto an 8.5. x 11 inch (21.6 x 28.0 cm) sheet of paper at a scale of 1 inch = 410 feet (2.54 cm = 125 m). The centroid of each quadrat was uploaded into a handheld Global Positioning System unit as a waypoint. We visited each quadrat using a fixed-wing aircraft (e.g., Supercub, Cessa 210) during peak green-up (i.e., mid-May – mid-June). The observer and pilot flew to the center of each quadrat to evaluate the quadrat and record the presence of BTPD colonies. We approached all quadrats in the cardinal directions to facilitate observer orientation and maximize efficiency. When the observer was 820 feet (250 m) from the waypoint (i.e., edge of quadrat), the observer looked for prairie dog mounds until the other edge of the plot [i.e., 820 feet (>250 m) from centroid] had been crossed. Ancillary data were collected between 820 feet (250 m) from the centroid to a distance of 1,640 yards (1,500 m) beyond the quadrat boundary. Colonies observed beyond the boundaries of the quadrat did not contribute to the estimate and no effort was made to quantify the hectares for these colonies.

When a colony was located within a quadrat, the observer recorded the portion of the colony that was contained within the quadrat onto the corresponding photograph. This was easily done using landmarks (e.g., roads) and natural features (e.g., drainages) because the observer was able to see the entire quadrat as it was transected. If the observer needed additional passes to correctly delineate the colony onto the NAIP photograph, additional passes were made. Most quadrats only required a single pass. We made no effort to delineate BTPD colonies that extended beyond the grid. The survey results were digitized, using heads up approaches, in ArcMap 9.3 onto the corresponding NAIP Digital Ortho Quads. We then used ArcMap to summarize the data and calculate acreages for the colonies that occurred within the plots.

We also recorded other ancillary data during our surveys. First, we recorded the presence of colonies that were near the quadrats. When an observer saw a white-tailed prairie dog colony near a quadrat, we recorded whether it was <547 yards (500 m) or 547 yards (500 m) < x >1,640 yards (1,500 m). We made no attempts to quantify the acreage of these colonies. Distance to the quadrat was easily monitored by the pilot as we approached and left the quadrat. The observer also determined whether the colony acres within the plot were healthy or impacted using methods developed by Grenier et al. (2004a).

RESULTS

We randomly selected 300 quadrats and surveyed 299 quadrats from our sampling frame (Table 1). One quadrat occurred in restricted airspace (i.e., Wyoming National Guard) and could not be surveyed. Consequently, we dropped it from the survey. We spent approximately $15,000 in aerial survey time to complete the surveys. BTPD colonies were present on 31 (10%) quadrats. About 67% of the BTPD colonies identified within the quadrat extended beyond the boundary. Of the colonies overlapping quadrats, 42% were classified as healthy and 68% were impacted. Additional BTPD colonies were recorded within 1,640 yards (1,500 m) of the quadrat only 23% of the time. The mean size of quadrats in the high stratum was 52.03 acres (21.19 ha) and the mean in the low strata was 55.62 acres (22.51 ha). Quadrats in the high stratum had a mean of 5.01 acres (2.03 ha) BTPD colony area, while those in the low stratum had a mean of 0.32 acres (0.13 ha).

The MaxEnt habitat model we used estimated potential habitat of for the BTPD in Wyoming to be 19,213,641 acres (7,775,654 ha). We estimated that there were 671,314 acres (271.677 ha) of BTPD colony area [95 % CI: 277,698-1,064,953 acres (112,381-430,973 ha)] in Wyoming in 2009. We digitized 552 acres (223 ha) of BTPD colony area from the quadrats we surveyed.

DISCUSSION

Our results suggest that the BTPD occupied area in Wyoming was probably underrepresented. We estimate that there could be as many as two to three times as many BTPD colonies than previously believed. This is not surprising since preliminary assessment of the mapping efforts conducted in 2004 appeared to have fairly large omission error rates (G. Beauvais, WYNDD, personal communication).

We believe that additional resources need to be secured for future surveys. The sample size we selected was too small to account for the variance in our sample. Consequently, the confidence intervals are large and their usefulness for monitoring trend is questionable. We believe the sample size can be increased considerably with little to no additional costs. Sample quadrats were dispersed across the landscape and often required long commutes (e.g., >30 minutes). Additional quadrats could easily be included in the sample to decrease variance. We hypothesize that the sample size could easily be increased by two to three times without seeing major increases in costs.

The health status of colonies appeared to have decreased again in 2009. The majority (>50%) of the colonies we evaluated were impacted. We suspect that this is a result of on-going sylvatic plague epizootics in Converse, Niobrara, and Campbell Counties (e.g., Thunder Basin National Grasslands) and anthropogenic impacts (e.g., toxicant application) resulting from the recent listing petition in 2008. Given results from previous survey years, we believe these abundance declines to be temporary, and hypothesize them to have little impact on the species' persistence in Wyoming.

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GENETICS OF THE WYOMING POCKET GOPHER
COMPLETION REPORT

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Wyoming Pocket Gopher

FUNDING SOURCE: General Fund Appropriation, Wyoming Game and Fish Department Project Dollars

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: David B. McDonald, University of Wyoming
Thomas L. Parchman, University of Wyoming

INTRODUCTION

The Wyoming pocket gopher occurs in southcentral Wyoming. Until 2009, it was known from only two locations: just south of Rawlins, in Carbon County, and approximately 100 miles (161 km) further west, in Sweetwater County (Thaeler and Hinesley 1979). Due to its restricted range and the existing and potential energy development in the region, the species is listed as a Species of Greatest Conservation Need in Wyoming's Comprehensive Wildlife Conservation Strategy (Wyoming Game and Fish Department 2005). Recently, the species received a positive 90-day finding from the U.S. Fish and Wildlife Service (USFWS), meaning that the process of consideration for listing as endangered is ongoing (USFWS 2010). In earlier genetic analyses, we determined that the Wyoming pocket gopher is genetically quite distinct from the northern pocket gopher, whose range completely encloses that of the Wyoming pocket gopher (Figure 1).

The objective of the most recent analyses, funded by the Wyoming Game and Fish Department and Hayden-Wing Associates, was to determine whether field identification of putative Wyoming pocket gophers, Idaho pocket gophers, and northern pocket gophers was consistent with the genetic profiles of those species from our previous analyses.

METHODS

With the collaboration of personnel from the Wyoming Natural Diversity Database and Hayden-Wing Associates, we collected tissue from live animals that were field-trapped and tail-clipped. DNA from the samples was extracted using DNEasy extraction kits (Quiagen, Inc.). Genetic data were generated for 14 Wyoming pocket gophers (*Thomomys clusius*) and 12 northern pocket gophers (*T. talpoides ocius*) from the 2009 capture season, along with 124 other pocket gophers sampled from taxa across the genus *Thomomys*. This included five species in addition to Wyoming and northern pocket gophers, and nine additional subspecies of the northern pocket gopher.

After polymerase chain reaction amplification, the samples were analyzed using the Amplified Fragment Length Polymorphism (AFLP) technique following protocols very similar to those described in McDonald et al. (2008) for genetic analyses of suckers from Muddy Creek, WY. The AFLP analysis provided the basis for genotyping each of the sampled pocket gophers at 456 dominant markers that provide the basis for analysis of genetic relationships. These markers are highly variable across the genus, and many demonstrated fixed differences (absence of band in all individuals of one species versus presence in all members of another species) between different species of *Thomomys* and between the different subspecies of *T. talpoides*. We used Nei and Li's (1979) restriction distance method to calculate pair-wise genetic distances among all individual pocket gophers in order to construct a neighbor-joining tree in Phylogenetic Analysis Using Parsimony (PAUP; Swofford 2003).

RESULTS

With the collaboration of the laboratory at the Department of Pathology at Ohio State University, we found a difference in chromosome number between the two species – 2N=56 in northern pocket gopher (*T. talpoides rostralis*) and 2N=46 in the Wyoming pocket gopher – from samples collected near Bitter Creek in Sweetwater County, an area not sampled for karyotypes by Thaeler and Hinesley (1979). A neighbor-joining tree using Nei and Li (1979) restriction site distances is shown in Figure 2. All samples collected in 2009 and field-identified as Wyoming pocket gophers clustered as expected with the previous samples for which we had genetic data from a combination of field-collected specimens and museum specimens. In addition, all field-identified specimens of the Idaho pocket gopher clustered with known individuals of the same species from the Museum of Vertebrate Zoology at the University of California, Berkeley. In the phylogenetic tree, the Wyoming pocket gopher forms a well-resolved clade together with the Idaho pocket gopher. The "southeastern" group of subspecies (*ocius* and *rostralis* of southcentral WY, *agrestis* and *meritus* from CO, *kaibabensis* from AZ, and *fossor* from CO) of the northern pocket gopher form a monophyletic clade (Figure 2), as do the "northwestern" group of subspecies (*bridgeri* from southwestern WY, *uinta* from UT, *falcifer* from NV, *quadratus* from CA, and *fuscus* from WA). The tree, therefore, has a pleasing correspondence to the geographic distributions of the species and subspecies.

DISCUSSION

Our genetic analyses provide two major results of importance to managers and decision-makers.

1) The Wyoming pocket gopher, *Thomomys clusius*, is clearly genetically distinct from the much more widespread northern pocket gopher, *T. talpoides*.
2) Reliable field identification of the Wyoming pocket gopher is possible and straightforward using the guidelines suggested by the Wyoming Natural Diversity Database (WYNDD 2009).

Not only is the Wyoming pocket gopher distinct from the northern pocket gopher, it is actually more closely related to the Idaho pocket gopher than it is to the northern pocket gopher. Our results, therefore, suggest that the common ancestor of the Idaho and Wyoming pocket gophers diverged from the northern pocket gopher before the radiation of the northern pocket gopher subspecies over much of the western United States. The current range of the Idaho and Wyoming pocket gophers is completely surrounded by that of the northern pocket gopher, and one subspecies of northern pocket gopher, *T. talpoides ocius*, largely overlaps the range of the Wyoming pocket gopher, with no evidence of hybridization. The absence of hybridization is not surprising, given the difference in chromosome number between the two species (2N=56 in the northern pocket gopher and 2N=46 in the Wyoming pocket gopher in our study), consistent with the results of Thaeler (1968) and Thaeler and Hinesley (1979) for *T. talpoides ocius*, *T. talpoides rostralis*, and *T. clusius*.

Our results confirm the ability of biologists in the field to reliably distinguish Wyoming pocket gophers (white rim to ear and small size) from the northern pocket gopher (larger and with dark rim to ear and dark auricular patch) and from the Idaho pocket gopher (color of ear rim matching the pelage of the dorsum), as demonstrated on the web page of the Wyoming Natural Diversity Database (WYNDD 2009).

ACKNOWLEDGEMENTS

We thank Mat Seymour for field help, map-making, and extraordinary skill in the lab. Bryan Kluever of Hayden-Wing provided samples and helped secure funding. Aaron Clarke showed interest early on and helped secure the majority of the funding, which came from the Office of the Governor of the state of Wyoming. Hannah Griscom, Doug Keinath, and Dr. Gary Beauvais of the Wyoming Natural Diversity Database provided logistical and field support. John Emmerich of the Wyoming Game and Fish Department helped expedite the funding process. Sue Horton and Jadwiga Labanowska were enthusiastic and extremely gracious and efficient in helping produce the karyotypes. Dr. Jim Patton and the staff of the Museum of Vertebrate Zoology at the University of California, Berkeley provided logistical support and access to key specimens. Dr. Peter Houde and Dr. Elizabeth Fry at the New Mexico State Museum in Las Cruces provided critical samples of *T. clusius* specimens collected by Dr. Charles Thaeler.

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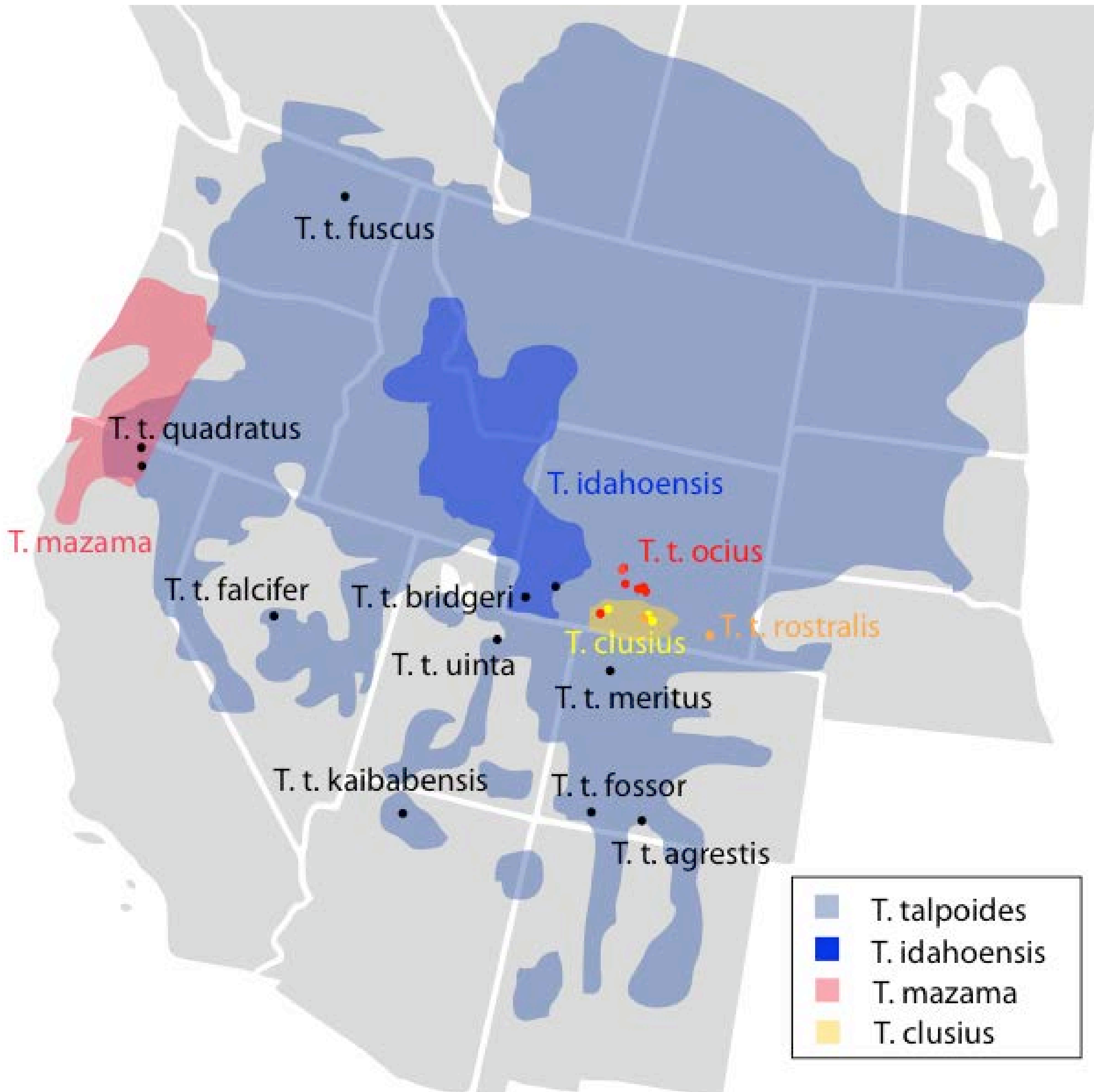

Figure 1. Ranges of *Thomomys* pocket gophers in the western United States. The current study analyzed samples from all the species and subspecies marked on the map, as well as *T. townsendii*, *T. monticola*, and *T. bottae*, whose ranges are not shown.

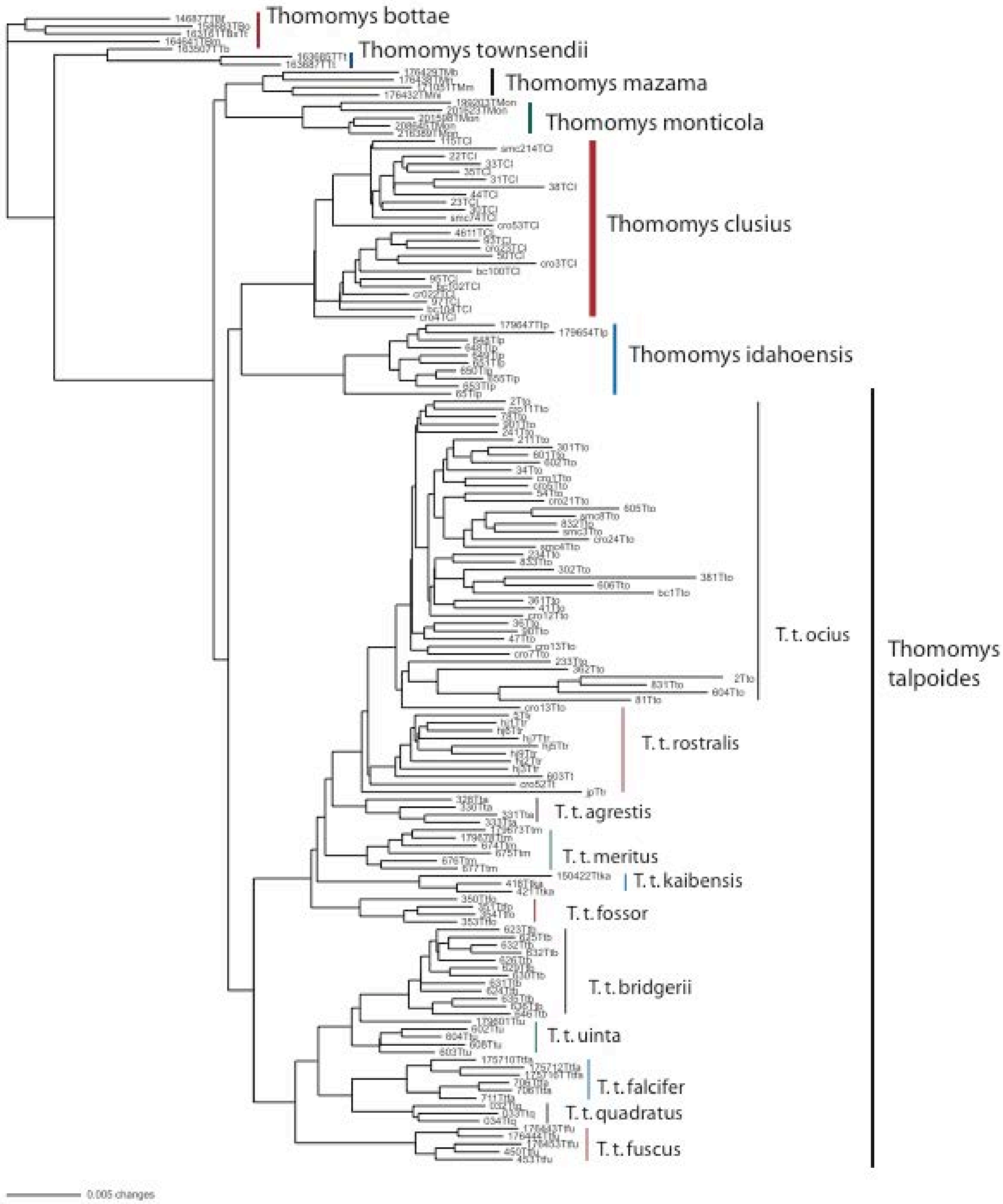

Figure 2. Phylogenetic tree for 150 *Thomomys* pocket gophers. Data from 456 AFLP markers served as the basis for a neighbor-joining tree using Nei and Li's (1979) restriction site distances. Note that *Thomomys clusius* (red bar near the upper right) form a monophyletic clade, with the Idaho pocket gopher, *T. idahoensis*, as the sister species. Also of considerable interest is that each of the currently named subspecies forms a reciprocally monophyletic clade.

LIVE TRAPPING OF JUMPING MICE IN SOUTHEASTERN WYOMING
COMPLETION REPORT

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Preble's Meadow Jumping Mouse

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Joel Thompson, Western EcoSystems Technology, Inc.
Martin Grenier, Nongame Mammal Biologist

INTRODUCTION

Definitive records of the Preble's meadow jumping mouse (*Zapus hudsonius preblei*; PMJM) are lacking in Wyoming. Many of the existing records are suspected to be PMJM; however, the species is nearly impossible to distinguish from the closely related western jumping mouse (*Z. princeps*) in the field. Further, the genetic validity of the sub-species has been in dispute since the species was petitioned for listing in 1998. Consequently, the Wyoming Game and Fish Department (Department) tabled all field activities for this species until the taxonomy of the species was settled. King et al. (2006) resolved the taxonomic debate and concluded that the sub-species designation was valid for PMJM.

In July 2008, the PMJM was removed from the federal Endangered Species list. The Department continues to classify the PMJM as a Species of Greatest Conservation Need with a Native Species Status of 4 (NSS4). The species is endemic to southeast Wyoming, and occupies structurally diverse plains riparian vegetation and grasslands near water below 8,000 feet (2,438 m). Western EcoSystems Technology, Inc. (WEST) was contracted by the Department to conduct live-trapping for Preble's meadow jumping mouse throughout southeastern Wyoming. The objective of the project was to sample potentially suitable habitat throughout the southeastern region of the state and document occurrence of PMJM through photographs and genetic sampling.

METHODS

Site Selection

Previously documented PMJM locations were obtained from the Wyoming Natural Diversity Database (WYNDD 2008) and mapped in a Geographic Information System. Drainages with potentially suitable habitat were also mapped using known habitat characteristics of PMJM [i.e., heavily vegetated riparian areas near water at elevations of 4,650-7,600 feet (1,417-2,316 m)]. The mapped range, as defined by the known locations obtained from WYNDD, was then divided into six equal sized areas. One watershed with previously documented PMJM was randomly selected in each area. The known site was paired with a watershed that showed potential habitat based on Wyoming Gap Analysis habitat data (WYGAP 1996), but where PMJM had not been previously documented (according to data obtained from WYNDD). This sampling scheme provided for surveys to be distributed throughout the known range of PMJM in Wyoming, with trapping conducted in watersheds with and without known PMJM occurrence.

Trapping

Sites were sampled according to methods described in the U.S. Fish and Wildlife Service guidelines (USFWS 2004). Sherman live-traps were arranged in parallel transects through suitable habitat. Typically, one transect was located on each side of the creek channel, with transects spaced approximately 33 feet (10 m) apart. Traps were spaced 16 feet (5 m) apart along individual transects. Traps were baited with livestock feed (Ranchway Feeds, Inc. Laramie 3-Way) and a 1 inch (2.5 cm) ball of polyester fiber was added for bedding material. Traps were set in late afternoon (within 3 hours of sunset) and checked in the early morning (within 3 hours of sunrise). Each set of paired transects consisted of 275 traps. Trapping was conducted for three nights, until either ≥750 trap nights were recorded or ≥2 *Zapus* spp. were captured.

Data were recorded nightly and included locality data for each transect (i.e., start and stop locations), date of survey, collector, and demographic data for captured specimens. General descriptions of the survey sites were also recorded. Universal Transverse Mercator (UTM) locations were recorded in NAD27 in the field and converted to NAD83, which is presented in the Excel spreadsheets for individual sites and the summary table of all sites. Trap mortalities were documented with detailed information regarding locality, species, age, sex, and reproductive status. Specimens were double-bagged, frozen, and delivered to the Department with the final report.

Photographic Documentation

Because PMJM are easily confused with the western jumping mouse (WJM), each captured *Zapus* spp. was photographed against a sheet of white paper for identification purposes. Photographs included dorsal, profile, and some ventral views. Due to miscommunications, not all specimens were recorded with a ventral view as requested by the Department. The date and location (UTMs) were recorded with each photograph (i.e., on the white background). Photographs were in digital format, recorded on compact disk, and delivered to the Department with the final report.

Genetic Sampling

Genetic material was collected from each *Zapus* spp. captured. This included both tissue and blood samples. A tissue sample was collected from an ear using a 0.04 inch (2 mm) diameter ear punch. The ear punch was disinfected with a 10% bleach solution between samples. Ear punch samples were stored in small [0.08 ounce (2.5 ml)] vials containing 95% ethyl alcohol. Samples were clearly labeled with appropriate capture details (e.g., date, location, specimen number). Samples were stored in a cool, dry environment and delivered to the Department with the final report.

Blood samples were collected using Whatman FTA Cards. After each ear punch was taken, the FTA card was pressed against the wound to collect a blood sample. Each FTA card was labeled with appropriate capture details and stored in a sealable plastic bag. Samples were stored in clear, re-sealable plastic bags and kept in a cool, dry environment until delivered to the Department with the final report. Blood samples were not collected from all individuals due to a shortage of FTA cards and the inability to purchase additional cards in small quantities.

Data Analysis/Summaries

Data were summarized and presented separately for *Zapus* spp. and non-target species at each survey location. Results were reported in terms of total numbers of captures and catch per unit effort (i.e., captures/100 trap nights). Closed and empty traps were subtracted from the total number of traps in determining number of trap nights. Demographic data were also reported for captured specimens (*Zapus* spp. and non-target species). Copies of original datasheets and an Excel spreadsheet with all capture data, summarized for each survey, were submitted to the Department with the final report.

RESULTS

Twelve sites were sampled for PMJM from June-August 2009. *Zapus* spp. were captured at 9 of the 12 locations (Table 1). At sites where *Zapus* were captured, capture success varied from 0-10 *Zapus* captures per night. Catch per effort varied from 0-3.67*Zapus*/100 trap nights across all 12 sites. *Zapus* were captured throughout the region from the northern Laramie Range, south and west to the northern slopes of the Sierra Madre. Thirty individual *Zapus* spp. were captured. Blood and tissue samples were taken from 24 individuals, tissue only was taken from 5 individuals, and blood only was taken from 1 individual.

DISCUSSION

Jumping mice appear to be common and widespread throughout south eastern Wyoming. Genetic analysis for the 30 *Zapus* spp. individuals was pending when this report was written. Therefore, implications of these results are limited pending the lab results.

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Table 1. Watersheds trapped for Preble's meadow jumping mouse in southeast Wyoming, summer 2009.

Watershed	Previous PMJM	*Zapus* Captured 2009	General Location (T,R, S)	County
S. Lodgepole Creek (SLP)	Yes	Yes	15N, 71W, 16	Albany
Dale Creek Tributary (DCT)	No	Yes	14N, 72W, 36	Albany
N. Brush Creek (NBC)	Yes	Yes	16N, 81W, 8	Carbon
Encampment River (ERS)	No	Yes	15N, 83W, 16	Carbon
Jack Creek (JCS)	Yes	Yes	16N,86W, 16	Carbon
S. Spring Creek (SPCS)	No	Yes	15N, 85W, 16	Carbon
Hill/Sullivan Creek (HCSC)	Yes	No	26N, 81W, 25	Carbon
Stinking Creek (SCS)	No	Yes	29N,80W, 28	Carbon
La Prele Creek (LPC)	Yes	Yes	29N, 75W, 1	Carbon/Natrona
Smith Creek (SMC)	No	No	32N,78W, 36	Natrona
N. Sybille Creek (NSC)	Yes	No	21N, 71W, 29	Albany
Laramie River (LRTR)	No	Yes	23N,72W, 36	Albany

INFLUENCE OF HABITAT AND ENERGY DEVELOPMENT ON SMALL MAMMALS IN SAGEBRUSH STEPPE COMPLETION REPORT

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Small Mammals

FUNDING SOURCE: General Fund Appropriation, Wyoming Game and Fish Department Project Dollars

PERIOD COVERED: 14 April 2009 – 15 April 2010

PREPARED BY: Ian Abernethy, Wyoming Cooperative Fish and Wildlife Research Unit
Anna Chalfoun, Wyoming Cooperative Fish and Wildlife Research Unit

SUMMARY

This is a Wyoming Cooperative Fish and Wildlife Research Unit Master of Science thesis project, and only the summary is presented here. To access the entire thesis, contact the Department of Zoology and Physiology, Biological Science Building Room 419, 1000 East University Avenue, Department 3166, Laramie, WY, 82071, 307-766-5415.

Sagebrush habitats have been extensively altered and are currently being developed for natural gas extraction. Research on sagebrush faunal communities has primarily focused on game birds and big game animals, while little is known about nongame species. Small mammals are ideal for studying large-scale anthropogenic disturbances because they are locally abundant and have short generation times. Micro-habitat characteristics within areas dominated by sagebrush also vary considerably and may influence abundance and species diversity of small mammal communities and how these communities respond to disturbance. Our study is focused on the effects of habitat characteristics and energy development on the abundance and diversity of small mammals in sagebrush steppe.

Data were collected during May to August 2009 within two natural gas fields (Jonah and Pinedale Anticline) and adjacent areas away from energy development in Sublette County, Wyoming. We collected abundance and diversity data from 18 trapping grids on two occasions across a habitat gradient of sagebrush height and cover. Important habitat characteristics, including shrub density and percent cover of grass, forbs, bare ground and others, were assessed for use as covariates in analyses.

Preliminary results from 2009 suggest differences in small mammal abundance and species composition across habitat gradients. Overall abundance was higher in tall, high cover

sagebrush than in areas with short and medium sagebrush with low and intermediate shrub cover (Figure 1). Deer mice, western harvest mice, and least ground squirrels were more abundant in tall sagebrush. Sagebrush voles and northern grasshopper mice were slightly more abundant in short and medium sagebrush with low and intermediate shrub cover, respectively. We also observed different responses to energy development among species. In tall sagebrush in energy development areas, least ground squirrel abundance was lower than in control areas. Conversely, deer mice and western harvest mice increased in abundance in energy development areas. Mean species richness was lower in energy development areas with low and medium sagebrush height and cover than in control areas. However, species richness was the same at control and energy development sites in areas with taller sagebrush and higher cover (Figure 2), suggesting that taller sagebrush areas may be more buffered from disturbance. Our preliminary results suggest that micro-habitat characteristics influence the abundance and community composition of small mammals in sagebrush steppe, and that the effects of energy development may depend on local structural habitat characteristics. We will repeat all methods during 2010 to examine potential year effects and obtain greater sample sizes to increase our statistical power.

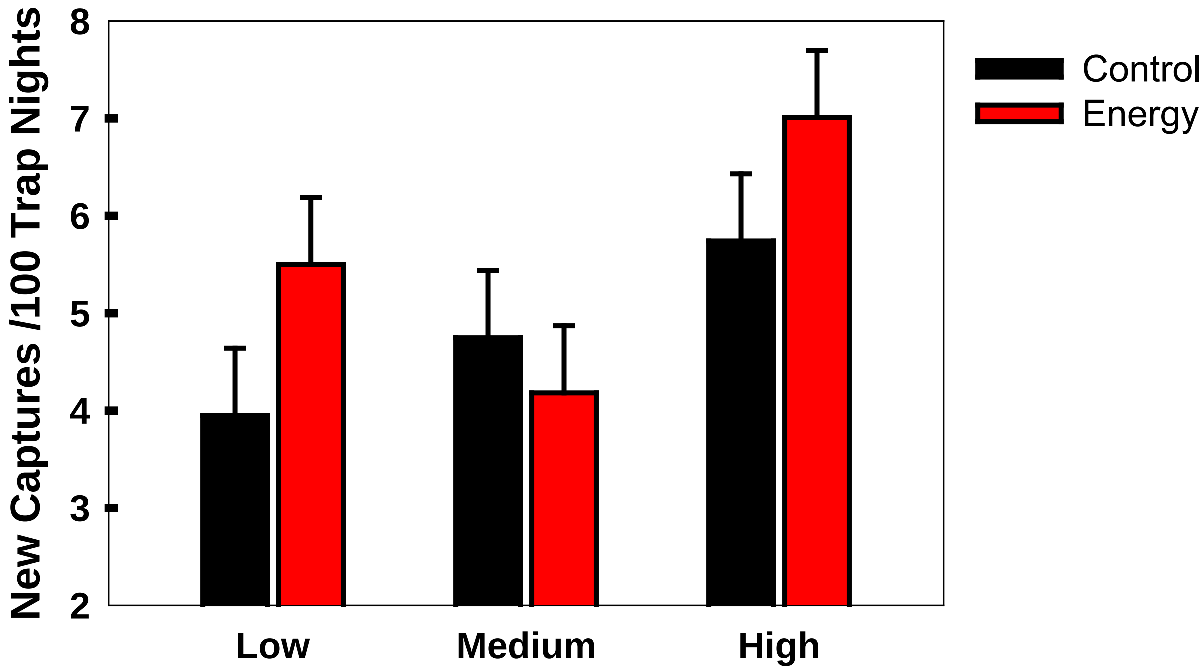

Figure 1. Mean number of captures of new individuals per 100 trap nights for all species within energy development areas and areas away from energy development for sites with low, medium, and high sagebrush height and percent cover.

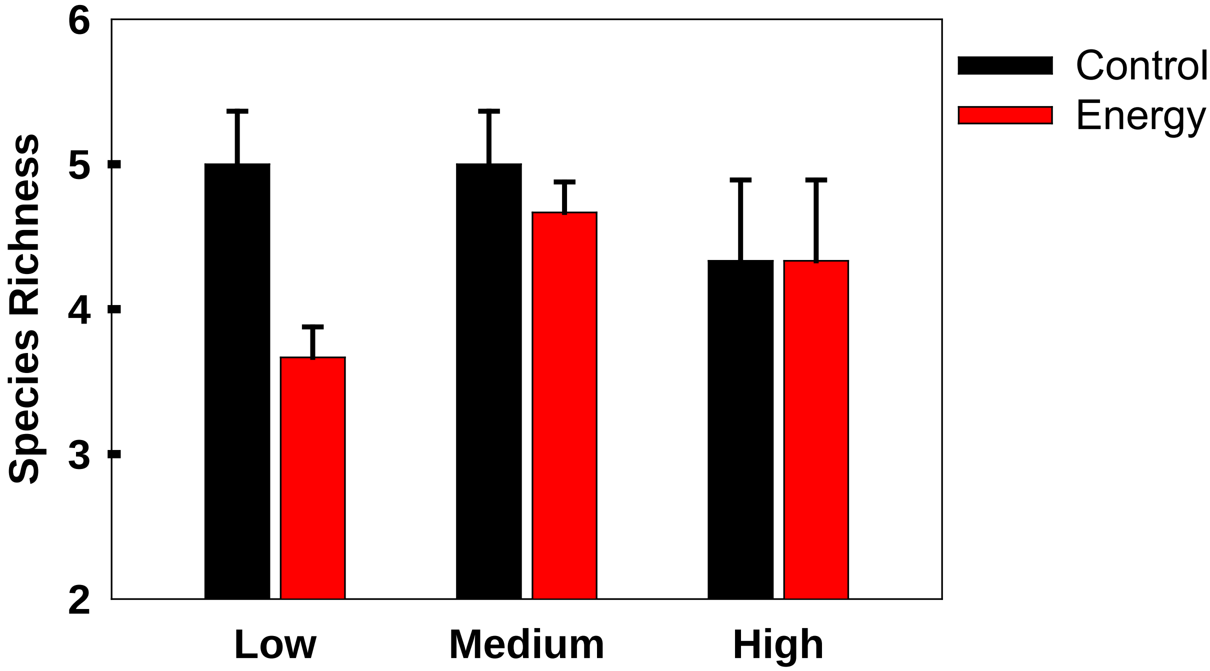

Figure 2. Mean number of species captured within energy development areas and areas away from energy development for sites with low, medium, and high sagebrush height and percent cover.

EVALUATION OF SWIFT FOX SURVEY TECHNIQUES
COMPLETION REPORT

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Swift Fox

FUNDING SOURCE: Federal Funds with State Match, State Wildlife Grant Projects

PERIOD COVERD: 15 April 2009 – 14 April 2010

PREPARED BY: Lee Knox, Nongame Biologist
Martin Grenier, Nongame Mammal Biologist

INTRODUCTION

The swift fox is a small Canid that historically occupied the short- and mixed-grass prairie from northern Texas to southern Canada (Scott-Brown et al. 1987). The distribution covered 12 states, including areas east of the Continental Divide in Wyoming. Swift fox densities and distribution declined greatly in the 19th and late 20th centuries due to loss of native prairie habitat, and predator control (Scott-Brown et al. 1987). The swift fox was petitioned for listing as Endangered under the Endangered Species Act (ESA) in 1992, and the U.S. Fish and Wildlife Service issued a "warranted but precluded" finding in 1995. Due, in large part, to efforts from the Swift Fox Conservation Team and new data, the swift fox was removed from the ESA Candidate List in 2002. The swift fox is classified as a Species of Greatest Conservation Need with a Native Species Status of 4 (NSS4) by the Wyoming Game and Fish Department (Department; 2005). Population status and trends for the swift fox in Wyoming are unknown but suspected to be stable, and habitat is restricted or vulnerable without recent or on-going significant loss (Wyoming Game and Fish Department 2005).

Several conservation efforts and planning processes for the swift fox are currently underway. The Department has identified several objectives under the Comprehensive Wildlife Conservation Strategy for Wyoming (Wyoming Game and Fish Department 2005) that are consistent with the Conservation Assessment and Conservation Strategy for Swift Fox in North America (Kahn et al. 1997). Under guidance of these documents, the Department is working to improve the knowledge of swift fox abundance and distribution in Wyoming. Previously, we utilized track plates [methodology described by Olsen et al. (1999)] to conduct surveys throughout eastern Wyoming. However, ethyl alcohol, which is required to implement this survey method, can no longer be transported in large volumes because it is considered a hazardous material by the state of Wyoming. As such, our objectives for this project were to evaluate several survey methodologies that could be utilized by the Department to conduct future swift fox surveys. We describe three survey methods that were implemented in 2009 as part of this pilot study, and provide recommendations to implement and improve surveys in the future.

METHODS

We evaluated infrared cameras, hair snares, and live trapping as potential survey methods for swift fox between May and November 2009 in south-central Wyoming. Our study area was east of Rawlins to the Albany county line, south to the Colorado border, and north to Hwy 220. Habitat characteristics were previously described by Olson et al. (1999). We contrasted performance of these methods using several metrics. We calculated latency to first detection (LTD) by taking the mean number of trap nights until first detection (Forseman and Pearson 1998), and calculated probability of detection by dividing the number of swift fox detected by the number of trap nights. We compared the cost of the materials and the amount of person-hours required to implement each method. We did not account for travel related expenses (e.g., drive time, gas, etc.) during our cost estimates, as these were constant for all techniques.

Infrared Cameras

We used 40 infrared cameras (Reconyx, PM35, Holmen, WI) available from the Department's Trophy Game section to conduct our surveys. We programmed each camera to take a picture every second for 10 seconds, and then pause for 30 seconds before taking another picture. About 3.3 feet (1 m) from the camera, we inserted a 1.6 foot (0.5 m) wooden stake about 4 inches (10 cm) into the ground to serve as a reference and focal point for the camera. We placed each camera about 1.6 feet (0.5 m) aboveground using two pieces of 0.5 x 24-inch (1.4 x 61 cm) rebar, and used an elastic cord to secure the camera to the rebar. We created a skunk based attractant by heating 13 ounces (385 ml) of petroleum jelly to liquid form and adding 0.5 ounce (15 ml) of skunk essence (F&T Fur Harvester's Trading Post, Alpena, MI). The attractant was then allowed to solidify. We applied two attractants to each stake. The top of the stake received about 0.5 ounce (15 ml) of the solidified attractant, and the base received a few sprays of fish oil. We surveyed six random quadrats in our study area. Each quadrat measured about 77 acres (31 ha; Finley et al. 2005). We surveyed quadrats twice, once using an array of 5 cameras, and once using an array of 15. We left each array out for seven consecutive nights, and varied the location of cameras based on available habitat and roads contained within each quadrat. At the end of 7 days, we retrieved cameras, downloaded pictures to a laptop computer, and erased each memory card. We left quadrats vacant for a minimum of 1 week between sampling periods.

Hair Snares

Hair snares were modeled after the single-sampling hair snare designed by Pauli et al. (2007). We tested two diameters of hair snares, 4-inch (10.2 cm; i.e., white sewer pipe), and 6-inch (15.2 cm; i.e., SDS-35 sewer pipe). We modified the design by leaving the pipe intact, and drilled 0.8 inch (20 mm) holes to insert the two wire brushes with 1 inch (26 mm) rubber stoppers near the top half of the pipe. We surveyed two locations where swift fox were known to occur to determine if swift fox would enter the snares. At each location, we placed a 4-inch

(10.2 cm) snare and a 6-inch (15.2 cm) snare, each baited with chicken wings. We put a piece of 0.5 x 24-inch (1.4 x 61 cm) rebar through the center of the back of the snare, and hammered it into the ground as an anchor. We also placed an infrared camera about 1.6 feet (0.5 m) aboveground using two pieces of 0.5 x 24-inch (1.4 x 61 cm) rebar with an elastic cord used to secure the camera to the rebar to document swift fox response. Snares were left out for seven consecutive nights. At the end of the sampling period, we checked the wire brushes for hair, and examined the pictures.

Live Trapping

We selected trap sites based on known swift fox locations. We baited 40 traps, each 8 x 9 x 24 inches (20 x 23 x 61 cm) (True-Catch traps Belle Fourche, SD), with small chunks of deer meat and a commercial attractant (O'Gorman Powder River paste, Broadus, MT). Traps were wrapped in burlap and set every 0.2 mile (0.4 km) along roads and two tracks. We set traps at 1930 hours and checked them at 0700 hours the next morning. Trapping occurred in conjunction with a swift fox translocation project for the Pine Ridge Reservation in South Dakota. All captured swift fox were translocated to the reservation. We report only data for traps that were operated by Department personnel.

RESULTS

Infrared Cameras

We detected 88 swift fox during 741 camera nights. Cameras were easily deployed and took about 8 person-hours (range 4-12) to set up and take down (Table 1). In quadrats 7, 8, and 9, we detected swift fox using both arrays of 5 and 15 cameras (Tables 2 and 3). We failed to detect any swift fox in quadrats 3 and 4. In quadrat 1, we failed to detect swift fox using an array of 5 cameras but were successful using an array of 15 cameras (Tables 2 and 3). Our mean LTD was 1.2 and 2.8 for arrays of 5 and 15 cameras, respectively (Tables 2 and 3). The mean swift fox detection was 4.7 and 10 for quadrats with arrays of 5 and 15 cameras, respectively (Tables 2 and 3). The probability of detecting a swift fox was 0.2 and 0.1 using arrays of 5 and 15 cameras, respectively (Tables 2 and 3).

Hair Snares

We failed to collect any swift fox hair samples during 48 trap nights. Hair snares were easily deployed and required about 3 person-hours (range1-4) per sampling period (Table 1). Swift fox were documented investigating both the 4-inch (10.2 cm) and the 6-inch (15.2 cm) hair snares; however, swift fox never entered the snares. On one occasion we documented a swift fox attempting to enter the 6-inch (15.2 cm) hair snare, but the individual stopped at its shoulders, failing to leave a hair sample.

Live Trapping

Live trapping required about 16 person-hours (range 15-20) per survey to operate (Table 1). We captured two swift fox during 80 trap nights, for a trap efficiency of less than 0.1%. Although LTD was one, few swift fox were captured.

DISCUSSION

In 2009, the most efficient survey method for determining swift fox presence in south-central Wyoming was infrared cameras. Cameras were easily deployed by one person and require minimal person-hours to set up and take down. The infrared cameras were available at no cost to the project, but personnel considering this approach should consider the potentially large start up costs (i.e., ≥$500 per camera). Infrared cameras effectively documented swift fox when other methods failed to do so. Of the methods tested, cameras had the highest probability of detection of 0.2, and the quickest LTD of 1.2 days. Our results suggest that this method is more effective then methods previously used by the Department (i.e., track plates), which had a mean LTD of 5 days and a probability of detection of 0.04 (Grenier and Van Fleet 2004). Among the camera arrays tested, we found 5 cameras to be more efficient than 15 cameras. Our results indicate that increasing the density of cameras had little effect on detection probability. We hypothesize that this is correlated to the small number (i.e., <3) of swift fox home ranges available per quadrat. Our results demonstrate that increasing camera densities only resulted in an increase in repeat detections, not increased efficiency.

Our results for the hair snares are surprising, given that a similar approach was used for the closely related San Joaquin kit fox. Using this method with a hair snare diameter of 4 inches (10.2 cm), Bremner-Harrison et al. (2006) reported a probability of detection of 0.3 hair samples per night. However, Bremner-Harrison et al. (2006) used adhesive paper on the inside of the snare to collect hair, whereas we used wire brushes. We hypothesize that the wire brushes could have caused the hair snare to appear to be too constrictive to swift fox, making them wary of entering, and likely contributed to our lack of success. Consequently, we also investigated the cost of building these snares using larger materials. The costs increased dramatically for PVC pipe with a diameter larger than the 6 inches (15.2 mm) because these materials are not widely used for other applications. In addition to pipe costs, the materials, including wire brushes, are more difficult to purchase because their applications are also very specialized. Notably, one of the benefits of using the Pauli et al. (2008) approach was the low cost of materials. Consequently, constructing these snares using larger diameter PVC pipe is difficult and cost prohibitive.

Live trapping required extensive person-hours to set and check traps and process captured swift fox. The initial cost of the live traps (≥$50.00 per unit) is more than the hair snares, but was considerably less than the cost of infrared cameras. Most of the issues we encountered were due to using the wrong size of traps (i.e., too small) for the swift fox. Although our trap efficiency is within the range of 0.01-0.2 reported by other studies (Harrison et al. 2002, Schauster et al. 2002, Finley et al. 2005), we believe that, with a larger trap size, we would have had results consistent with the upper end of this range.

Although cameras were the most effective method tested, we encountered several technical issues. Like Foresman and Pearson (1998), we often struggled to keep the cameras functioning for seven consecutive nights. This was likely due to improper programming. As a result, we encountered issues with the memory cards filling up with non-target pictures and rapid depletion of batteries. Most of these non-target pictures resulted from non-animal triggers during the day (e.g., moving vegetation due to wind). We believe this problem can easily be resolved by programming the cameras to only take pictures during peak swift fox activity (e.g., dusk till dawn) and by decreasing the sensitivity of the trigger. This will greatly reduce the non-target pictures and conserve battery life. We encountered other minor issues, such as livestock and ungulates bumping cameras and causing the frame of reference to shift out of view. We believe this can easily be remedied by being more vigilant and careful placement of the infrared cameras.

For future surveys, we recommend that the Department utilize the infrared camera method with an array of five cameras per quadrat using a petroleum jelly based skunk essence as the attractant. By using arrays of five cameras, more quadrats can be surveyed simultaneously, thus reducing costs and duration of the survey. Care should be taken to ensure that cameras are programmed to maximize data storage and battery life. We recommend that surveys should occur during the fall dispersal period (September-December) when swift fox detection rates are reported to be high (Olsen et al. 1999, Finley et al 2005).

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Table 1. Comparison of the three swift fox survey methods tested in south central Wyoming, May through November 2009. For each survey method, we compared three common metrics to evaluate the effectiveness of the method.

Survey Method	Latency to First Detection (days)	Probability of Detection	Person-Hours
Infrared Cameras	1.2	0.1	8
Hair Snares	N/A	N/A	3
Live Trapping	1	0.1	16

Table 2. Results of infrared camera survey for swift fox (VUVE) using arrays of five cameras per quadrat in south-central Wyoming from October through November 2009.

Quadrat Number	Total VUVE Observations	Total VUVE Detections	Total Camera Nights (days)	Mean Camera Nights (days)	SE + / -	Latency to First Detection (days + / - SE)		Probability of Detection
1	0	0	30	6	1	na	na	0.00
3	0	0	35	7	0	na	na	0.00
4	0	0	35	7	0	na	na	0.00
7	23	18	27	5.4	0.8	1	0	0.67
8	3	3	31	6.2	0.8	1.5	0.5	0.10
9	9	7	31	6.2	0.8	1	0	0.23
Mean	*5.83*	*4.67*	*31.50*	*6.30*	*0.57*	*1.17*	*0.17*	*0.16*

Table 3. Results of infrared camera survey for swift fox (VUVE) using arrays of 15 cameras per quadrat in south-central Wyoming from October through November 2009.

Quadrat Number	Total VUVE Observations	Total VUVE Detections	Total Camera Nights (days)	Mean Camera Nights (days + / - SE)	SE + / -	Latency to First Detection (days + / - SE)		Probability of Detection
1	1	1	103	6.9	1.3	7	0	0.01
3	0	0	89	5.9	0.5	na	na	0.00
4	0	0	99	6.6	0.4	na	na	0.00
7	39	29	105	7.0	0.0	2.15	0.36	0.28
8	4	4	94	6.3	0.5	1	0	0.04
9	34	26	72	4.8	0.7	1	0	0.36
Mean	*13.00*	*10.00*	*93.67*	*6.24*	*0.57*	*2.79*	*0.00*	*0.11*

RAPTORS TAKEN FOR FALCONRY

FALCONRY
COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Raptors

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars

PERIOD COVERED: 1 January 2009 – 31 December 2009

PREPARED BY: Lee Knox, Nongame Biologist
Matt Withroder, Permitting Officer

SUMMARY

In 2009, the Wyoming Game and Fish Department (Department) issued a total of 15 falconry permits. This represents a decrease from 2008 and 2007, when 39 and 33 permits were issued, respectively. Of the 15 licenses that the Department issued, permittees successfully captured eight raptors (Table 1). The number of birds captured in 2009 is lower than the mean capture rates from 1981-2008 ($\bar{x}$ = 24.4 raptors). However, the success rate in 2009 (53%) is similar to the past 29 years (Table 2).

Overall, nonresidents had a higher capture success rate than Wyoming residents. The Department issued eight licenses to nonresidents and seven to residents. A total of 10 raptors were captured, 5 by nonresidents and 5 by residents. Capture success was higher for nonresidents (63%) than for residents (43%). Ferruginous Hawk, Northern Goshawk, and Red-tailed Hawk were the most frequently captured species (, followed by the American Kestrel and the Merlin (Table 1). In 2009, an additional five falconry permits were allocated specifically for Peregrine Falcons; however, none were issued by the Department.

Table 1. Wyoming falcons captured by species, 2009.

Species Captured	Number of Resident Captures	Number of Nonresident Captures	Total Captures
American Kestrel	1	0	1
Ferruginous Hawk	0	2	2
Goshawk	0	2	2
Merlin	0	1	1
Red-tailed Hawk	2	0	2
Total Captures	*3*	*5*	*8*

Table 2. The number of raptors captured and the capture rate (%) in Wyoming, 1981-2009.

Year	Number of Raptors Captured	Capture Rate (%)
1981	27	37
1982	40	52
1983	18	18
1984	25	33
1985	39	53
1986	33	35
1987	19	36
1988	28	51
1989	26	55
1990	32	68
1991	29	66
1992	22	53
1993	13	37
1994	21	33
1995	12	30
1996	25	47
1997	19	61
1998	31	63
1999	27	55
2000	24	57
2001	21	45
2002	29	58
2003	21	49
2004	33	48
2005	13	31
2006	14	40
2007	15	45
2008	27	69
2009	8	53

OTHER NONGAME

BREEDING BIRD SURVEY
COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Other Nongame

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars, National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, Bureau of Reclamation

PERIOD COVERED: 15 April 2009 – 14 April 2010

PREPARED BY: Andrea Orabona, Nongame Bird Biologist
U.S. Geological Survey – Biological Resources Division

INTRODUCTION AND METHODS

The Breeding Bird Survey (BBS) is sponsored jointly by the U.S. Geological Survey – Biological Resources Division (USGS-BRD; formerly the U.S. Fish and Wildlife Service) and the Canadian Wildlife Service. Data from the BBS are used to monitor population trends of bird species that nest in North America. These data are especially useful if a species is adequately monitored using this survey method and if routes are conducted annually over the long term, especially by the same observer.

Over 4,400 BBS routes are located throughout the Unites States and Canada. In Wyoming, there are 108 available BBS routes. The Wyoming Game and Fish Department (Department) Nongame Bird Biologist serves as the state BBS coordinator.

All BBS routes are 24.5 miles (39.4 km) long and consist of 50 stops spaced 0.5 mile (0.8 km) apart. Beginning at sunrise, observers record every bird seen within a 0.25 mile (0.4 km) radius and all birds heard at each stop during a three-minute time period. Data are submitted to the USGS-BRD for analysis. To view these data and additional route information, visit the BBS Internet web site at www.pwrc.usgs.gov/bbs.

RESULTS AND DISCUSSION

The USGS-BRD conducts detailed statistical analyses of BBS data from the survey's inception in 1966 in the East and 1968 in the West to the current year. From these analyses, population trends for individual species can be examined on a continental, western region, statewide, and physiographic region scale. The Department uses these BBS data to monitor populations of many bird species, especially terrestrial species whose population trends can be adequately tracked using this survey method, including Species of Greatest Conservation Need (Figures 1 and 2; Table 1). For reference, Species of Greatest Conservation Need whose populations can be moderately tracked are also included (Figures 3 and 4).

In 2009, 2,563 of the 3,485 (74%) total routes available in the United States were conducted. In Wyoming, observers agreed to conduct 80 of the 108 (74%) available routes in 2009; 56 (70%) of the route were completed, 12 (15%) of the routes were completed but were not included in the data analysis at this time due to a late return date, 11 (14%) of routes were not conducted, and 1 (1%) of the routes had to be rerouted due to excessive noise and dangerous traffic on a portion of the route (Table 2).

A total of 29,847 individual birds representing 181 different species were detected on the 56 BBS routes conducted in 2009 in Wyoming for which data are currently available (Table 3). As in 2007 and 2008, the Western Meadowlark was again the most abundant species detected on BBS routes in Wyoming in 2009, with 4,102 individuals detected on 53 of the 56 (95%) routes completed (Table 4).

A complete history of the BBS observers and years routes were conducted in Wyoming from 1968 through 2009 are available from the Department's Nongame Bird Biologist in the Lander Regional Office. Fewer than 20 routes have been run continuously, or with only a few scattered years missing, for 10 or more years. A majority of the routes contain gaps of two or more years or have had more than one observer or a succession of observers. The primary purpose of the BBS is to monitor population trends of avian species. Therefore, it is important that each route is conducted annually, and preferably by the same observer, which is a primary goal of BBS coordinators.

Population trend analysis data are only significant for species occurring in large enough numbers and on 14 or more separate BBS routes in the state. Therefore, we also employ other survey methods that are necessary to determine population trends for those species that are not adequately monitored by the Breeding Bird Survey.

ACKNOWLEDGEMENTS

We would like to thank the volunteers and biologists from this and other natural resources management agencies for their valuable contributions to the 2009 Breeding Bird Survey (see names in Table 2). The continued dedication of these individuals to this monitoring effort makes it possible to collect long-term population trend data on numerous avian species in Wyoming.

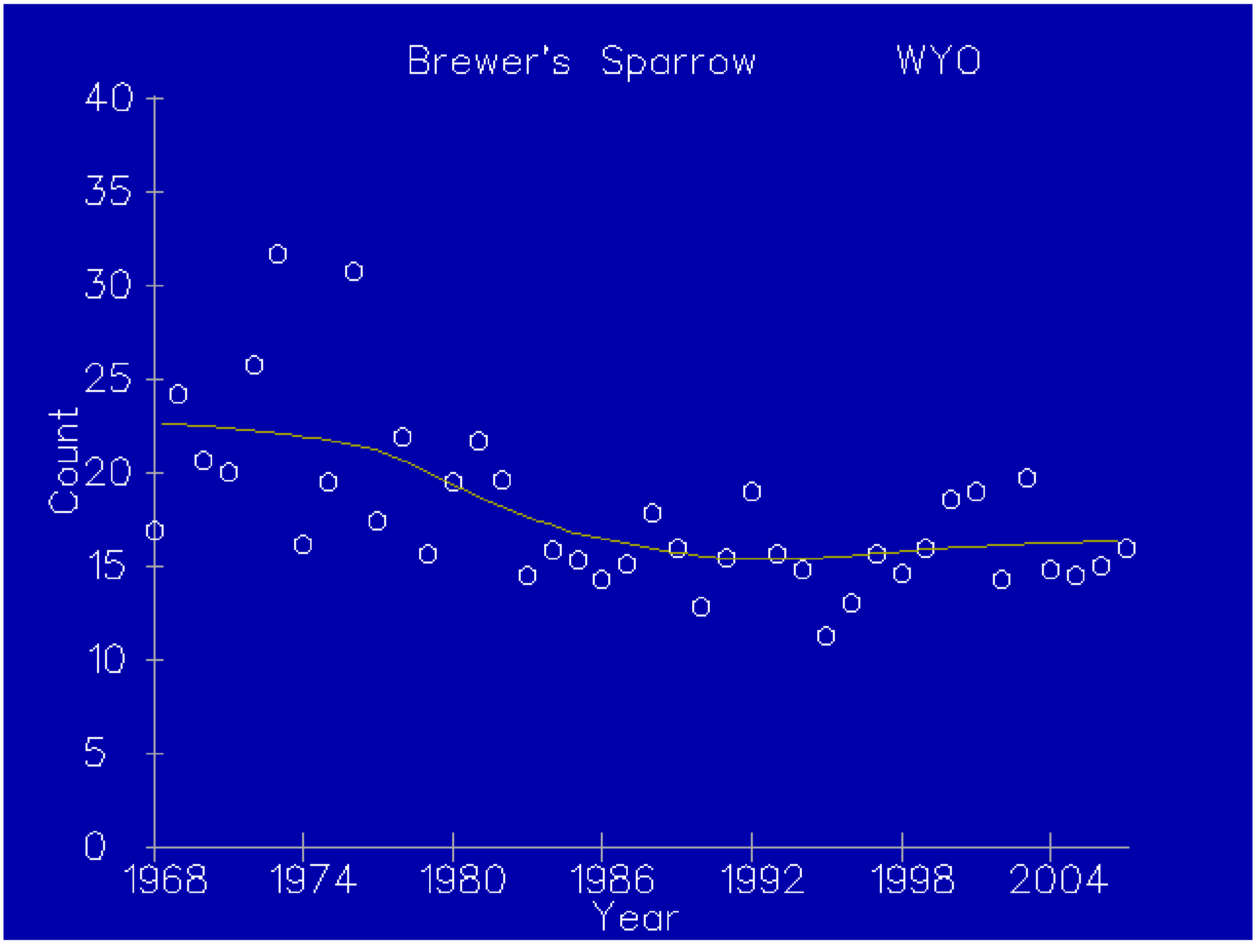

Figure 1. Population trend data for the Brewer's Sparrow in Wyoming, 1968-2007. (Note: this graph reflects data with at least 14 samples in the long term, of moderate precision, and of moderate abundance on routes.)

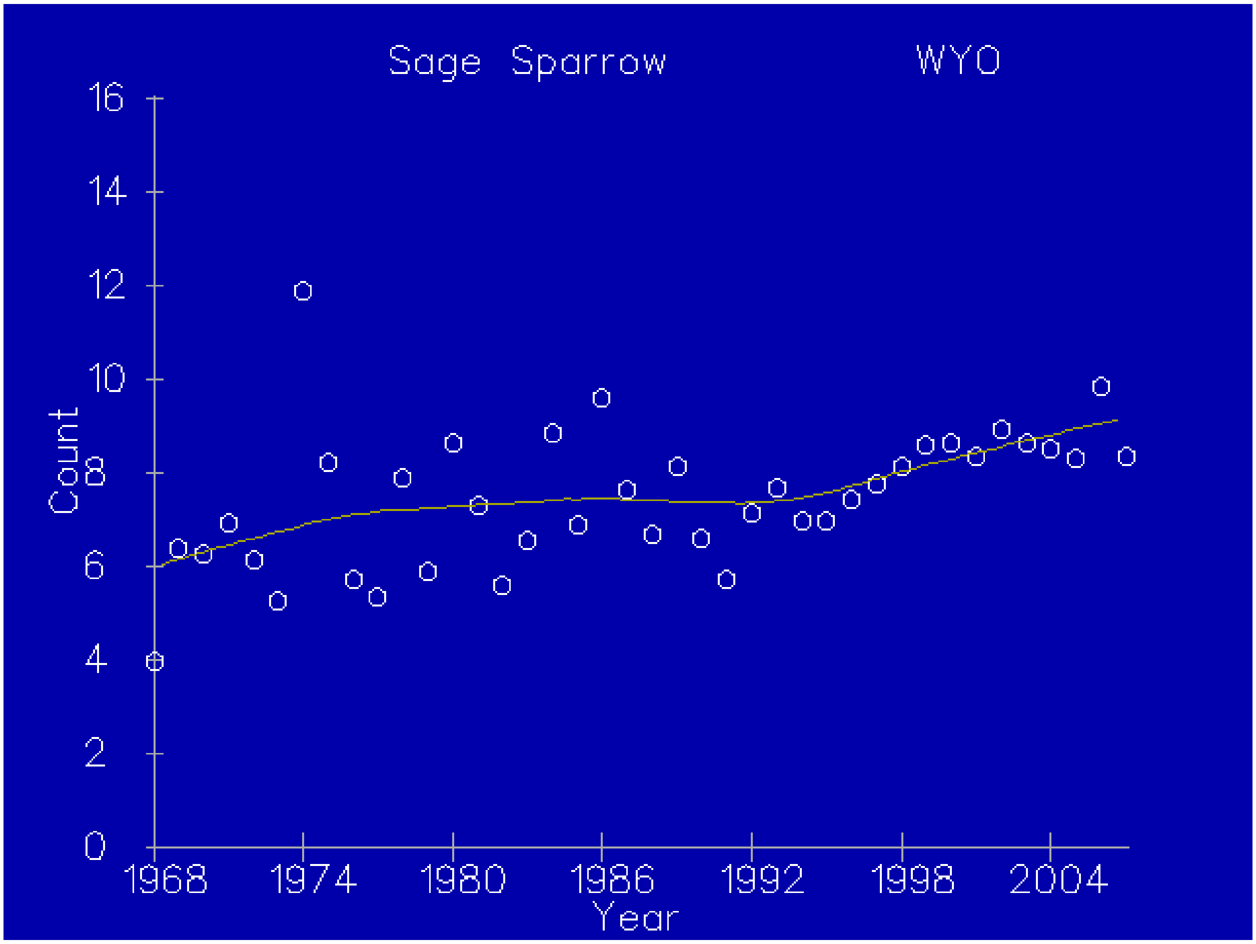

Figure 2. Population trend data for the Sage Sparrow in Wyoming, 1968-2007. (Note: this graph reflects data with at least 14 samples in the long term, of moderate precision, and of moderate abundance on routes.)

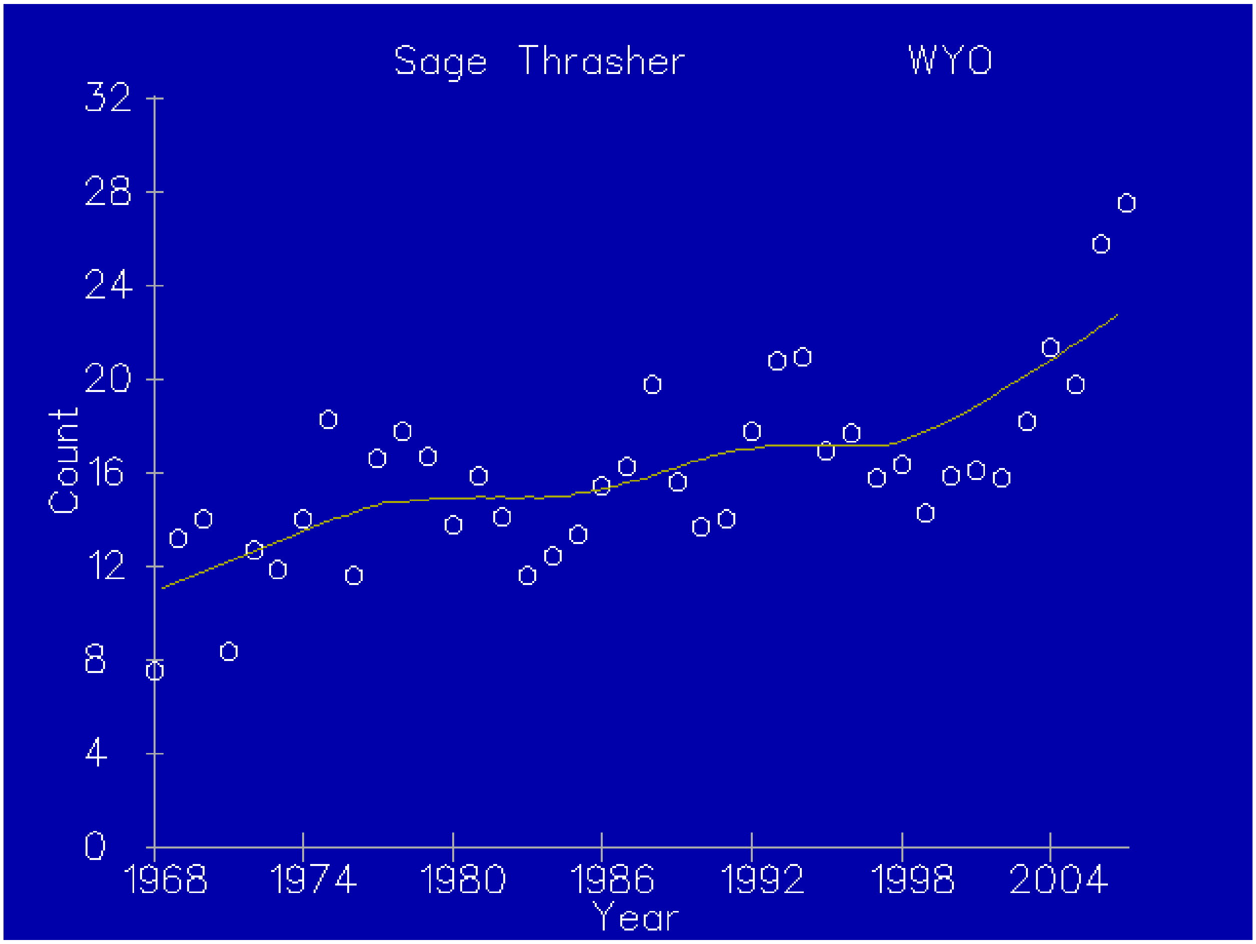

Figure 3. Population trend data for the Sage Thrasher in Wyoming, 1968-2007. (Note: this graph reflects data with a deficiency. In particular, the regional abundance is less than 1.0 birds/route (low abundance), the sample is based on less than 14 routes for the long term (small sample size), the results are so imprecise that a 3%/year change would not be detected over the long-term (quite imprecise), or the sub-interval trends are significantly different from each other (P less than 0.05, based on a z-test). This suggests inconsistency in trend over time).

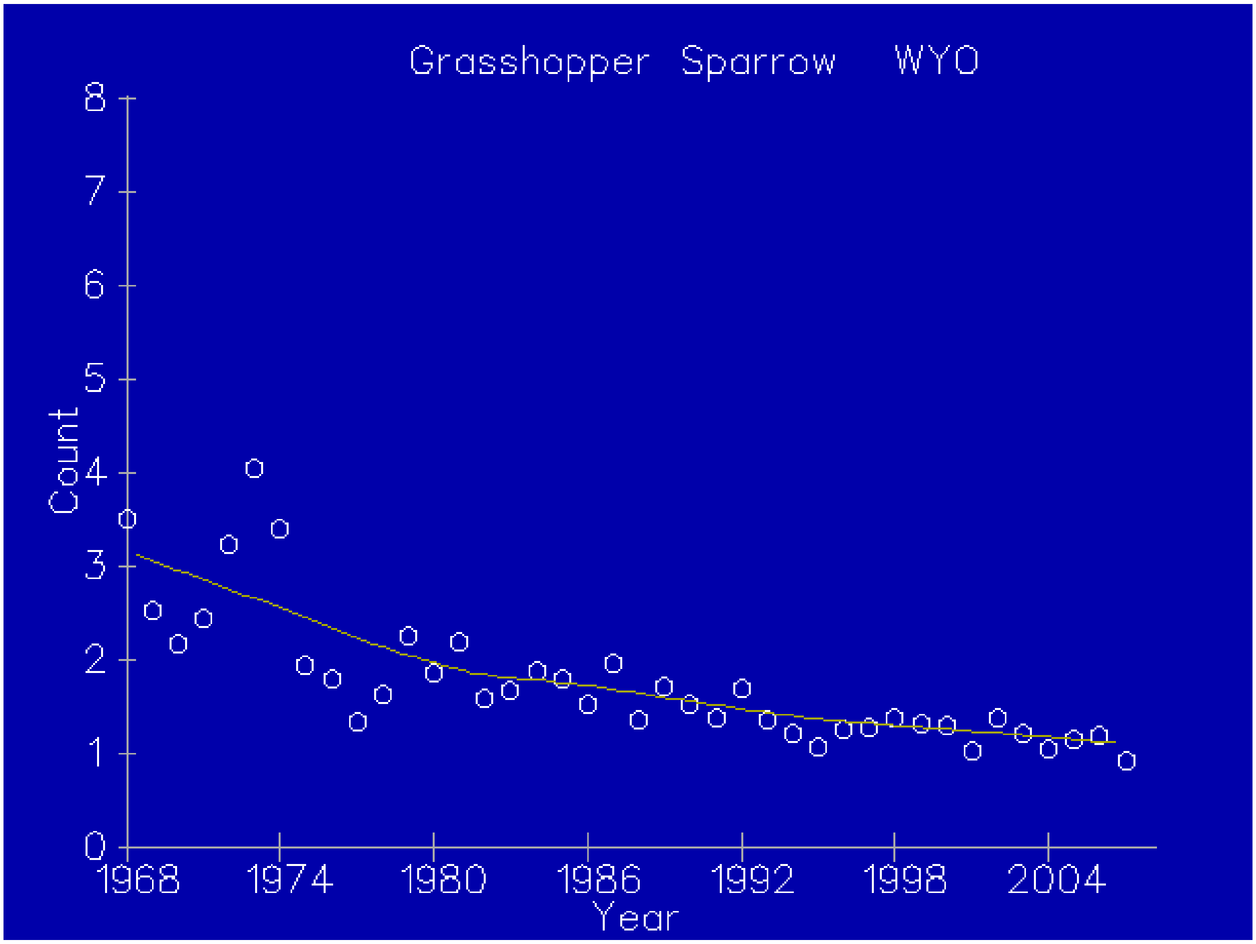

Figure 4. Population trend data for the Grasshopper Sparrow in Wyoming, 1968-2007. (Note: this graph reflects data with a deficiency. In particular, the regional abundance is less than 1.0 birds/route (low abundance), the sample is based on less than 14 routes for the long term (small sample size), the results are so imprecise that a 3%/year change would not be detected over the long-term (quite imprecise), or the sub-interval trends are significantly different from each other (P less than 0.05, based on a z-test). This suggests inconsistency in trend over time).

Table 1. Species in Wyoming whose population trends are adequately monitored by the Breeding Bird Survey. Species with significant (P <0.05) long-term (1968-2007) trends are denoted in blue with light shading for increasing populations, and in red with dark shading for declining populations. [a]

Species	Trend	P	N	95% CI	R.A.
Mallard	2.2	0.06	94	0.1 – 4.5	3.39
Red-tailed Hawk	1.2	0.24	96	-0.8 – 3.1	1.11
American Kestrel	-0.6	0.51	97	-2.4 – 1.2	1.59
Greater Sage-Grouse	4.0	0.04	40	0.3 – 7.7	1.39
Killdeer	-0.6	0.42	105	-2.0 – 0.8	6.04
Common Snipe	1.6	0.23	63	-1.0 – 4.1	2.78
Mourning Dove	0.7	0.47	107	-1.3 – 2.80	17.364
Common Nighthawk	-0.2	0.89	94	-3.0 – 2.6	2.46
Northern Flicker	-0.3	0.77	86	-2.2 – 1.6	3.02
Say's Phoebe	2.1	0.38	73	-2.6 – 6.9	2.21
Eastern Kingbird	-0.5	0.72	58	-3.3 – 2.3	1.46
Loggerhead Shrike	-0.1	0.97	65	-2.9 – 2.8	1.12
Clark's Nutcracker	2.0	0.12	28	-0.4 – 4.4	1.33
Common Raven	5.5	0.01	59	1.36 –9.8	2.92
Horned Lark	-1.6	0.00	97	-2.6 – -0.6	50. 18
Tree Swallow	1.6	0.44	49	-2.4 – 5.7	3.20
Violet-green Swallow	5.4	0.05	50	0.1 – 10.6	2.73
Cliff Swallow	1.0	0.43	90	-1.4 – 3.3	22.21
Barn Swallow	-2.3	0.06	93	-4.8 – 0.1	4.41
Mountain Chickadee	-1.8	0.26	19	-4.7 – 1.2	1.58
Rock Wren	-1.0	0.38	84	-3.7 – 1.4	4.44
Mountain Bluebird	-0.4	0.83	82	-3.9 – 3.2	3.852
American Robin	-0.4	0.43	99	-1.4 – 0.6	18.95
European Starling	1.7	0.17	78	-0.7 – 4.1	9.23
Yellow Warbler	1.3	0.17	79	-0.5 – 3.1	5.60
Western Tanager	3.9	0.05	28	0.3 – 7.6	1.43
Chipping Sparrow	-3.7	0.00	64	-5.4 – -1.9	4.25
Brewer's Sparrow	-0.7	0.37	100	-2.1 – 0.8	17.19
Lark Sparrow	-1.2	0.28	76	-3.3 – 1.0	4.12
Sage Sparrow	0.8	0.72	38	-3.4 – 4.9	7.31
Lark Bunting	-2.3	0.02	84	-4.3 – 0.4	50.99
Savannah Sparrow	1.7	0.49	64	-3.1 – 6.6	2.57
Song Sparrow	1.4	0.25	68	-1.0 – 3.8	1.96
Dark-eyed Junco	-1.3	0.32	28	-3.8 – 1.2	3.10
Red-winged Blackbird	0.8	0.14	100	-0.3 – 2.0	21.38
Western Meadowlark	0.1	0.79	107	-0.8 – 1.1	77.06

Species	**Trend**	**P**	**N**	**95% CI**	**R.A.**
Yellow-headed Blackbird	-1.0	0.61	54	-4.9 – 2.9	2.73
Brewer's Blackbird	0.0	0.96	107	-1.3 – 1.2	21.57
Common Grackle	-2.6	0.28	64	-7.3 – 2.1	5.47
Brown-headed Cowbird	-1.1	0.31	89	-3.2 – 1.0	4.09
American Goldfinch	-2.3	0.01	57	-4.0 – -0.5	1.05
House Sparrow	1.7	0.46	49	-2.7 – 6.0	6.42

[a] Key to the Statistical Analysis Codes:

Trend	Estimated trend summarized as a percent change per year.
P	Because the trends are estimates, a statistical test is conducted to determine whether the trend is significantly different from 0, and results of the test are presented as p values, indicating the significance of the trend. P >0.05 indicates that we cannot reject the null hypothesis that the trend is different from 0.
N	Number of survey routes in the analysis.
95% CI	95% confidence interval for the trend estimate, given as a multiplicative (constant rate) change in counts over time, with covariables to adjust for differences in observer quality. Regional trends are estimated as a weighted average of the route trends.
R.A.	Relative abundance for the species, in birds per route. This number is an approximate measure of how many birds are seen on a route in the region.

Table 2. 2009 Breeding Bird Survey (BBS) route information.

Route Number – Name	Latilong	Observer	Species	Individuals
1 – NE Entrance, YNP	1	Lisa Baril	50	399
2 – Cody	2	Grace Nutting	52	416
3 – Otto	3	Observer needed	--	--
4 – Basin	4	N/A - discontinued	--	--
5 – Wyarno	5	John Berry	45	1104
6 – Clarkelen	6	N/A - discontinued	--	--
7 – Sundance	7	Jennifer Adams	53	581
8 – Colter Bay	8	N/A - discontinued	--	--
9 – Dubois	9	Jazmyn McDonald	61	364
10 – Midvale	10	Jim Downham	Not available	Not available
11 – Nowood	11	Donna Walgren	37	429
12 – Natrona	12	N/A - discontinued	--	--
13 – Bill	13	Observer needed	--	--
14 – Redbird	14	N/A - discontinued	--	--
15 – Fontenelle	15	Carol Deno	55	746
16 – Elk Horn	16	Brad Meyer	Not conducted	Not conducted
17 – Bear Creek	17	Andrea Orabona	Not available	Not available
18 – Ervay	18	Jazmyn McDonald	37	332
19 – Brookhurst	19	Bruce Walgren	55	457
20 – Glenrock	20	N/A - discontinued	--	--
21 – Dwyer	21	Martin Hicks	Not available	Not available
22 – Cumberland	22	Carol Deno	22	235
23 – McKinnon	23	N/A - discontinued	--	--
24 – Patrick Draw	24	Laurie Van Fleet	17	280
25 – Savery	25	Marie Adams	45	469
26 – Riverside	26	Steve Loose	48	635
27 – Buford	27	Suzanne Fellows	32	310
28 – Yoder	28	Jim Lawrence	47	1014
29 – Canyon	--	N/A - discontinued	--	--
30 – Mammoth, YNP	1	Lisa Baril	56	421
31 – West Thumb	--	N/A - discontinued	--	--
32 – Hunter Peak	2	Kathryn Hicks	56	261
33 – Clark	2	Kathryn Hicks	44	219
34 – no route	--	N/A – no route	--	--
35 – Frannie	3	Bill Anderson	Not conducted	Not conducted
36 – Moose	8	Observer needed	--	--
37 – Lovell	3	Observer needed	--	--
38 – Meeteetse	3	Observer needed	--	--
39 – Ten Sleep	4	C.J. Grimes	58	485
40 – Dayton	4	Tracey Ostheimer	55	686
41 – Bald Mountain	4	Observer needed	--	--
42 – Crazy Woman	5	Grace Nutting	38	229

Route Number – Name	Latilong	Observer	Species	Individuals
43 – Schoonover	5	Observer needed	--	--
44 – Arvada	5	Donald Brewer	26	803
45 – Recluse	6	Rene Schell	Not available	Not available
46 – Soda Well	6	Rene Schell	Not available	Not available
47 – Piney	--	N/A - discontinued	--	--
48 – Seely	--	N/A - discontinued	--	--
49 – Upton	7	Laurie Van Fleet	26	687
50 – Moskee	--	N/A - discontinued	--	--
51 – Alpine	8	Susan Patla	55	467
52 – Wilson	8	Richard Lucas	Not available	Not available
53 – Horse Creek	9	Eva Crane	45	319
54 – no route	--	N/A – no route	--	--
55 – Crowheart	9	Pat Hnilicka	Not conducted	Not conducted
56 – Ethete	10	Jim Downham	Not available	Not available
57 – Anchor	10	Pat Hnilicka	Not conducted	Not conducted
58 – Gebo	10	Observer needed	--	--
59 – Arminto	11	Justin Binfet	22	337
60 – Lysite	11	Greg Anderson	25	504
61 – Worland	11	C.J. Grimes	42	463
62 – Teapot Dome	12	Observer needed	--	--
63 – Mayoworth	12	Deane Bjerke	50	961
64 – Sussex	12	Bill Ostheimer	41	712
65 – Harland Flats	13	Observer needed	--	--
66 – Pine Tree	13	Observer needed	--	--
67 – Highlight	--	N/A - discontinued	--	--
68 – Riverview	14	Nate West	Not available	Not available
69 – Newcastle	14	Laurie Van Fleet	23	691
70 – Raven	14	Observer needed	--	--
71 – Soda Lake	15	Observer needed	--	--
72 – Buckskin Mountain	15	Lara Oles	Not available	Not available
73 – Daniel	--	N/A - discontinued	--	--
74 – Boulder	16	Susan Patla	55	496
75 – Big Sandy	16	Susan Patla	Not conducted	Not conducted
76 – Farson	16	Observer needed	--	--
77 – Fiddler Lake	17	Eva Crane	45	364
78 – Sand Draw	17	Observer needed	--	--
79 – Sweetwater	17	Stan Harter	39	822
80 – Gas Hills	18	Observer needed	--	--
81 – Bairoil	18	Greg Hiatt	25	403
82 – Lamont	18	Greg Hiatt	31	341
83 – Pathfinder	19	Laurie Schwieger	33	350
84 – Leo	19	Donna Walgren	30	306
85 – Shirley	19	Ann Hines	16	140
86 – Warbonnet	20	Jim Lawrence	47	351
87 – Fletcher Peak	20	Gloria Lawrence	54	528

Route Number – Name	Latilong	Observer	Species	Individuals
88 – Shawnee	20	Observer needed	--	--
89 – Meadowdale	21	Martin Hicks	Not available	Not available
90 – Lusk	21	Gloria Lawrence	28	939
91 – Lingle	21	Bryce Krueger	33	817
92 – Diamondville	--	N/A - discontinued	--	--
93 – Mountain View	22	Observer needed	--	--
94 – no route	--	N/A - discontinued	--	--
95 – Green River	--	N/A - discontinued	--	--
96 – Reliance	23	Observer needed	--	--
97 – Rock Springs	23	Fern Linton	29	195
98 – Black Rock	24	Andrea Orabona	Rerouted	Rerouted
99 – no route	--	N/A – no route	--	--
100 – no route	--	N/A – no route	--	--
101 – Wamsutter	25	Observer needed	--	--
102 – Rawlins	25	Bill Falvey	Not conducted	Not conducted
103 – Baggs	25	Tim Woolley	Not available	Not available
104 – Walcott	26	Frank Blomquist	51	495
105 – Fox Park	26	Scott McConnell	Not conducted	Not conducted
106 – Ryan Park	26	Francis Bergquist	Not conducted	Not conducted
107 – Sybille Canyon	27	Scott McConnell	Not conducted	Not conducted
108 – Rock River	27	Scott McConnell	Not conducted	Not conducted
109 – Harmony	27	Bryce Krueger	41	671
110 – Cheyenne	28	Alisa Coffin	21	413
111 – Chugwater	28	Observer needed	--	--
112 – Pine Bluff	28	Bryce Krueger	27	662
120 – Welch	20	Chris Michelson	39	556
123 – Flaming Gorge	23	Kathleen Paulin	Not conducted	Not conducted
147 – Rozet	6	Observer needed	--	--
148 – Seely 2	7	Mary Yemington	46	592
150 – Government Valley	7	Jennifer Adams	35	689
167 – Thunder Basin	13	Observer needed	--	--
173 – Rye Grass	15	Rebecca Fogerty	33	543
192 – Carter	23	Observer needed	--	--
195 – Seedskadee	23	Observer needed	--	--
204 – Basin 2	4	Observer needed	--	--
206 – Caballa Creek	6	Sandra Johnson	20	525
208 – Moran	8	Susan Wolff	57	431
212 – Bucknum	12	Larry Keffer	Not available	Not available
214 – Hampshire	14	Observer needed	--	--
250 – Moskee 2	7	Jennifer Adams	53	736
900 – Hayden Valley	--	N/A - discontinued	--	--
901 – Yellowstone, YNP	1	Lisa Baril	52	908
902 – Pryor Flats	1	Observer needed	--	--

Table 3. 2009 Breeding Bird Survey results in Wyoming in phylogenetic order.

Species	Number Detected	Relative Abundance (%)
Canada Goose	663	2.22
Trumpeter Swan	4	0.01
Gadwall	29	0.10
American Wigeon	51	0.17
Mallard	143	0.48
Blue-winged Teal	19	0.06
Cinnamon Teal	9	0.03
Northern Shoveler	2	0.01
Northern Pintail	20	0.07
Green-winged Teal	12	0.04
Canvasback	5	0.02
Redhead	4	0.01
Ring-necked Duck	9	0.03
Lesser Scaup	37	0.12
Bufflehead	17	0.06
Common Goldeneye	2	0.01
Barrow's Goldeneye	5	0.02
Common Merganser	17	0.06
Ruddy Duck	13	0.04
Chukar	1	0.00
Gray Partridge	3	0.01
Ring-necked Pheasant	194	0.65
Ruffed Grouse	6	0.02
Greater Sage-Grouse	69	0.23
Sharp-tailed Grouse	2	0.01
Wild Turkey	80	0.27
Common Loon	1	0.00
Pied-billed Grebe	1	0.00
Eared Grebe	6	0.02
Western Grebe	13	0.04
American White Pelican	128	0.43
Double-crested Cormorant	16	0.05
Great Blue Heron	37	0.12
White-faced Ibis	1	0.00
Turkey Vulture	52	0.17
Osprey	6	0.02
Bald Eagle	13	0.04
Northern Harrier	18	0.06
Northern Goshawk	2	0.01

Species	Number Detected	Relative Abundance (%)
Broad-winged Hawk	2	0.01
Swainson's Hawk	30	0.10
Red-tailed Hawk	125	0.42
Ferruginous Hawk	23	0.08
Golden Eagle	37	0.12
American Kestrel	81	0.27
Prairie Falcon	14	0.05
Sora	17	0.06
American Coot	10	0.03
Sandhill Crane	83	0.28
Killdeer	271	0.91
Mountain Plover	5	0.02
American Avocet	18	0.06
Willet	32	0.11
Spotted Sandpiper	73	0.24
Upland Sandpiper	38	0.13
Long-billed Curlew	16	0.05
Wilson's Snipe	164	0.55
Wilson's Phalarope	19	0.06
California Gull	79	0.26
Rock Pigeon	79	0.26
Eurasian Collared-Dove	39	0.13
Mourning Dove	1035	3.47
Black-billed Cuckoo	1	0.00
Great Horned Owl	8	0.03
Burrowing Owl	5	0.02
Northern Saw-whet Owl	1	0.00
Common Nighthawk	173	0.58
Common Poorwill	2	0.01
White-throated Swift	53	0.18
Calliope Hummingbird	2	0.01
Broad-tailed Hummingbird	17	0.06
Belted Kingfisher	2	0.01
Lewis's Woodpecker	1	0.00
Red-headed Woodpecker	4	0.01
Red-naped Sapsucker	28	0.09
Williamson's Sapsucker	2	0.01
Downy Woodpecker	11	0.04
Hairy Woodpecker	21	0.07
American Three-toed Woodpecker	1	0.00
Black-backed Woodpecker	2	0.01
Northern Flicker	103	0.35

Species	Number Detected	Relative Abundance (%)
Olive-sided Flycatcher	6	0.02
Western Wood-Pewee	115	0.39
Willow Flycatcher	26	0.09
Least Flycatcher	17	0.06
Hammond's Flycatcher	17	0.06
Dusky Flycatcher	70	0.23
Cordilleran Flycatcher	14	0.05
Say's Phoebe	54	0.18
Ash-throated Flycatcher	2	0.01
Cassin's Kingbird	7	0.02
Western Kingbird	228	0.76
Eastern Kingbird	95	0.32
Loggerhead Shrike	38	0.13
Plumbeous Vireo	9	0.03
Warbling Vireo	379	1.27
Red-eyed Vireo	12	0.04
Gray Jay	9	0.03
Steller's Jay	1	0.00
Blue Jay	8	0.03
Pinyon Jay	6	0.02
Clark's Nutcracker	45	0.15
Black-billed Magpie	344	1.15
American Crow	170	0.57
Common Raven	237	0.79
Horned Lark	2514	8.42
Tree Swallow	164	0.55
Violet-green Swallow	140	0.47
Northern Rough-winged Swallow	103	0.35
Bank Swallow	133	0.45
Cliff Swallow	869	2.91
Barn Swallow	273	0.91
Black-capped Chickadee	51	0.17
Mountain Chickadee	109	0.37
Red-breasted Nuthatch	69	0.23
White-breasted Nuthatch	4	0.01
Rock Wren	258	0.86
House Wren	207	0.69
Marsh Wren	6	0.02
American Dipper	1	0.00
Ruby-crowned Kinglet	256	0.86
Mountain Bluebird	183	0.61
Townsend's Solitaire	30	0.10

Species	Number Detected	Relative Abundance (%)
Veery	25	0.08
Swainson's Thrush	37	0.12
Hermit Thrush	66	0.22
American Robin	1111	3.72
Gray Catbird	47	0.16
Sage Thrasher	602	2.02
Brown Thrasher	5	0.02
European Starling	1185	3.97
Cedar Waxwing	14	0.05
Orange-crowned Warbler	4	0.01
Yellow Warbler	363	1.22
Yellow-rumped Warbler	231	0.77
American Redstart	70	0.23
Ovenbird	84	0.28
MacGillivray's Warbler	32	0.11
Common Yellowthroat	68	0.23
Wilson's Warbler	7	0.02
Yellow-breasted Chat	28	0.09
Western Tanager	68	0.23
Green-tailed Towhee	175	0.59
Spotted Towhee	110	0.37
Chipping Sparrow	317	1.06
Clay-colored Sparrow	10	0.03
Brewer's Sparrow	898	3.01
Field Sparrow	2	0.01
Vesper Sparrow	1116	3.74
Lark Sparrow	272	0.91
Sage Sparrow	249	0.83
Lark Bunting	1781	5.97
Savannah Sparrow	189	0.63
Grasshopper Sparrow	108	0.36
Fox Sparrow	10	0.03
Song Sparrow	119	0.40
Lincoln's Sparrow	79	0.26
White-crowned Sparrow	73	0.24
Dark-eyed Junco	202	0.68
McCown's Longspur	85	0.28
Chestnut-collared Longspur	18	0.06
Black-headed Grosbeak	36	0.12
Blue Grosbeak	12	0.04
Lazuli Bunting	28	0.09
Dickcissel	3	0.01

Species	Number Detected	Relative Abundance (%)
Bobolink	25	0.08
Red-winged Blackbird	1640	5.49
Western Meadowlark	4102	13.74
Yellow-headed Blackbird	110	0.37
Brewer's Blackbird	824	2.76
Common Grackle	484	1.62
Brown-headed Cowbird	289	0.97
Orchard Oriole	1	0.00
Bullock's Oriole	77	0.26
Pine Grosbeak	5	0.02
Cassin's Finch	21	0.07
House Finch	11	0.04
Red Crossbill	55	0.18
Pine Siskin	200	0.67
American Goldfinch	97	0.32
House Sparrow	251	0.84
Total Individuals	*29,847*	*100*
Total Species	*189*	*--*

Table 4. The top 30 species detected on Breeding Bird Survey routes conducted in Wyoming in 2009.

Species	Total Detected	Relative Abundance (%)	Number of Routes Detected On
Western Meadowlark	4102	17.64	53
Horned Lark	2514	10.81	42
Lark Bunting	1781	7.66	28
Red-winged Blackbird	1640	7.05	47
European Starling	1185	5.10	24
Vesper Sparrow	1116	4.80	51
American Robin	1111	4.78	51
Mourning Dove	1035	4.45	46
Brewer's Sparrow	898	3.86	40
Cliff Swallow	869	3.74	33
Brewer's Blackbird	824	3.54	47
Canada Goose	663	2.85	15
Sage Thrasher	602	2.59	29
Common Grackle	484	2.08	25
Warbling Vireo	379	1.63	22
Yellow Warbler	363	1.56	38
Black-billed Magpie	344	1.48	35
Chipping Sparrow	317	1.36	21
Brown-headed Cowbird	289	1.24	41
Barn Swallow	273	1.17	33
Lark Sparrow	272	1.17	33
Killdeer	271	1.17	45
Rock Wren	258	1.11	34
Ruby-crowned Kinglet	256	1.10	14
House Sparrow	251	1.08	19
Sage Sparrow	249	1.07	16
Common Raven	237	1.02	32
Yellow-rumped Warbler	231	0.99	13
Western Kingbird	228	0.98	19
House Wren	207	0.89	28
Totals	*23,249*	*100*	*56 routes conducted*

WYOMING PARTNERS IN FLIGHT
COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Wyoming Partners In Flight and Monitoring Wyoming's Birds

FUNDING SOURCE: General Fund Appropriation and/or Governor's ESA Dollars, Bureau of Land Management Cooperative Agreement #L08AC13184

PERIOD COVERED: 15 April 2008 – 14 April 2009

PREPARED BY: Andrea Orabona, Nongame Bird Biologist

INTRODUCTION

Analysis of long-term data indicates that population trends of many landbirds are declining due to changes in land use; habitat loss, fragmentation, and deterioration; pesticide use; and human disturbance. The international Partners In Flight program, of which Wyoming is an active participant, was initiated in 1990 to address and reverse these declines. State, regional, national, and international Bird Conservation Plans comprehensively address the issues of avian and habitat conservation on a landscape scale.

Wyoming Partners In Flight (WY-PIF) is comprised of participants from the Wyoming Game and Fish Department (Department), Bureau of Land Management (BLM), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), Bureau of Reclamation, National Park Service, Rocky Mountain Bird Observatory (RMBO), Audubon Wyoming and affiliate chapters, Wyoming Natural Diversity Database, University of Wyoming, and The Nature Conservancy. The Department's Nongame Bird Biologist has served as the state's WY-PIF chairperson since its inception in 1991.

BIRD CONSERVATION PLANNING AND BEST MANAGEMENT PRACTICES

The Wyoming Bird Conservation Plan, Version 2.0 (Nicholoff 2003) is available on the Partners In Flight web site at www.blm.gov/wildlife/plan/WY/menu.htm. The Plan presents population objectives for birds, habitat objectives for the major habitat groups in the state, Best Management Practices (BMPs) to benefit birds, and recommendations to ensure that landbirds and the habitats they require remain intact and viable into the future through proactive and restorative management techniques.

We have used various funding sources, including State Wildlife Grants funding during this reporting period, to design and print BMPs as separate publications for distribution to the public. Currently, BMPs are available for sagebrush-steppe, riparian, grassland, forest, wetland, juniper, mountain-foothills shrub, aquatic, meadow, and alpine tundra grassland habitats. These are available at any of the Department's Regional Offices or by contacting the Nongame Bird Biologist in the Lander Regional Office. The BMPs are also available for viewing and downloading on the Department's website under the Nongame link at http://gf.state.wy.us/wildlife/nongame/index.asp.

We continue to receive inquiries from and provide information to agency biologists, private consultants, and members of the public regarding both the Wyoming Bird Conservation Plan and the Best Management Practices to benefit birds in various habitat types. These inquiries reinforce the importance of these publications for avian conservation and management statewide.

MONITORING WYOMING'S BIRDS

One of the highest priority population objectives throughout the Plan is to implement Monitoring Wyoming's Birds: The Plan for Count-based Monitoring (Leukering et al. 2001). For the ninth consecutive year, we worked with the BLM, RMBO, and Audubon Wyoming to continue a BLM cooperative assistance agreement that provides funding for collaborative efforts between these entities to conduct a statewide monitoring protocol for birds, determine the distribution and abundance of selected avian species, and develop educational and outreach materials on birds in Wyoming.

Through this agreement, we continued contract agreements with RMBO and Audubon Wyoming. RMBO implements the Monitoring Wyoming's Birds (MWB) program, which originally focused on six habitats in Wyoming (aspen, grassland, juniper woodland, mid-elevation conifer, montane riparian, and shrub-steppe), and is now a statewide, stratified, grid-based system (Hanni et al. 2009). Audubon Wyoming assists with implementing the MWB program on the highest priority Important Bird Areas, inventory and monitoring efforts for those species that require techniques other than point-counts, producing and distributing educational materials on birds and their habitats, and implements the Citizen Science program in cooperation with the Department's Nongame Bird Biologist. We also received a portion of the funds and contributed in-kind services to conduct surveys and provide data for Common Loons, American Bitterns, songbirds, and raptors and to compile, print, and distribute Partners In Flight educational materials.

Between 17 May and 20 July 2009, RMBO conducted 1,934 point counts on 168 of the 174 (97%) attempted grid transects statewide (Rehm-Lorber et al. 2009). Although this was the eighth season of the Monitoring Wyoming's Birds program, it was the first season of spatially balanced, 0.6 mile (1 km), grid-based sampling transects. In 2009, 15,799 individual birds of 158 species were detected in various habitats under several land management administrations, including BLM, USFS National Forests and National Grasslands, National Park Service, USFWS National Wildlife Refuge, and private ownerships (Table 1). Grid-based transects in Wyoming will also contribute to the broader Bird Conservation Region (BCR) monitoring effort in five BCRs (9 – Great Basin, 10 – Northern Rockies, 16 – Southern Rockies/Colorado Plateau, 17 – Badlands and Prairies, and 18 – Shortgrass Prairie).

Annual and multi-year reports, species accounts, and density estimate tables and graphs from this monitoring program are available on the RMBO Avian Data Center web site at http://www.rmbo.org/public/monitoring/.

NORTH AMERICAN MIGRATION COUNT

International Migratory Bird Day is an annual Partners In Flight event that celebrates migratory birds and supports efforts to conserve them. The North American Migration Count (NAMC) is part of this celebration, and takes place on the second Saturday each May. Participants are asked to record and submit all birds detected on the official count form, as well as the number of participants, total hours spent counting, and total miles covered during the count day. Participation in the NAMC provides: 1) a snapshot in time of the progress of spring migration, 2) information on species abundance and distribution during spring migration, 3) an opportunity for more participation among birders within and between states, and 4) the ability to organize and centralize the data collected. The official count form and a summary of the species detected each year are available from the Nongame Bird Biologist in the Lander Regional Office.

LITERATURE CITED

Hanni, D. J., C. M. White, R.A. Sparks, J. A. Blakesley, G. J. Levandoski, and J. J. Birek. 2009. Field protocol for spatially-balanced sampling of landbird populations. Unpublished report. Rocky Mountain Bird Observatory, Brighton, CO. 33pp.

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Nicholoff, S. H., compiler. 2003. Wyoming Bird Conservation Plan, Version 2.0. Wyoming Partners In Flight. Wyoming Game and Fish Department, Lander.

Rehm-Lorber, J. A., J. A. Blakesley, D. C. Pavlacky Jr., and D. J. Hanni. 2010. Monitoring the Birds of Wyoming: 2009 Field Season Report. Technical Report M-MWB-09-01. Rocky Mountain Bird Observatory, Brighton, CO. 64pp.

Table 1. Species (in alphabetical order) and number of detections pooled across Wyoming during the 2009 Monitoring Wyoming's Birds effort.

Species	Total Detections Statewide	Relative Abundance (%)
American Avocet	10	0.06
American Coot	1	0.01
American Crow	37	0.23
American Goldfinch	27	0.17
American Kestrel	53	0.34
American Pipit	47	0.30
American Redstart	56	0.35
American Robin	704	4.46
American Three-toed Woodpecker	25	0.16
American White Pelican	1	0.01
Bald Eagle	1	0.01
Barn Swallow	27	0.17
Belted Kingfisher	1	0.01
Black Rosy-Finch	13	0.08
Black-backed Woodpecker	1	0.01
Black-billed Magpie	64	0.41
Black-capped Chickadee	87	0.55
Black-headed Grosbeak	20	0.13
Blue Grosbeak	1	0.01
Blue Jay	5	0.03
Blue-gray Gnatcatcher	16	0.10
Blue-winged Teal	4	0.03
Brewer's Blackbird	110	0.70
Brewer's Sparrow	1048	6.63
Broad-tailed Hummingbird	30	0.19
Brown Creeper	40	0.25
Brown Thrasher	1	0.01
Brown-headed Cowbird	136	0.86
Bullock's Oriole	5	0.03
Burrowing Owl	1	0.01
California Gull	3	0.02
Canada Goose	19	0.12
Canyon Wren	4	0.03
Cassin's Finch	37	0.23
Cedar Waxwing	9	0.06
Chestnut-sided Warbler	1	0.01
Chipping Sparrow	348	2.20

Species	Total Detections Statewide	Relative Abundance (%)
Chukar	1	0.01
Cinnamon Teal	1	0.01
Clark's Nutcracker	108	0.68
Clay-colored Sparrow	2	0.01
Cliff Swallow	15	0.09
Common Grackle	5	0.03
Common Nighthawk	21	0.13
Common Poorwill	1	0.01
Common Raven	238	1.51
Common Yellowthroat	68	0.43
Cooper's Hawk	5	0.03
Cordilleran Flycatcher	26	0.16
Dark-eyed Junco	594	3.76
Downy Woodpecker	27	0.17
Dusky Flycatcher	114	0.72
Dusky Grouse	8	0.05
Eastern Bluebird	1	0.01
Eastern Kingbird	17	0.11
Eurasian Collared-Dove	2	0.01
European Starling	36	0.23
Evening Grosbeak	1	0.01
Ferruginous Hawk	16	0.10
Fox Sparrow	2	0.01
Golden Eagle	29	0.18
Golden-crowned Kinglet	20	0.13
Grasshopper Sparrow	66	0.42
Gray Catbird	1	0.01
Gray Jay	30	0.19
Great Blue Heron	6	0.04
Great Horned Owl	4	0.03
Greater Sage-Grouse	4	0.03
Green-tailed Towhee	329	2.08
Green-winged Teal	1	0.01
Hairy Woodpecker	153	0.97
Hermit Thrush	340	2.15
Horned Lark	1103	6.98
House Finch	11	0.07
House Sparrow	4	0.03
House Wren	212	1.34
Killdeer	30	0.19
Lark Bunting	1054	6.67

Species	Total Detections Statewide	Relative Abundance (%)
Lark Sparrow	107	0.68
Lazuli Bunting	5	0.03
Least Flycatcher	3	0.02
Lewis's Woodpecker	2	0.01
Lincoln's Sparrow	69	0.44
Loggerhead Shrike	18	0.11
MacGillivray's Warbler	58	0.37
Mallard	13	0.08
McCown's Longspur	28	0.18
Mountain Bluebird	193	1.22
Mountain Chickadee	421	2.66
Mountain Plover	12	0.08
Mourning Dove	203	1.28
Northern Flicker	155	0.98
Northern Goshawk	2	0.01
Northern Harrier	8	0.05
Northern Pintail	1	0.01
Northern Rough-winged Swallow	1	0.01
Northern Shoveler	1	0.01
Olive-sided Flycatcher	32	0.20
Orange-crowned Warbler	2	0.01
Ovenbird	148	0.94
Peregrine Falcon	1	0.01
Pine Grosbeak	18	0.11
Pine Siskin	231	1.46
Pinyon Jay	4	0.03
Plumbeous Vireo	36	0.23
Prairie Falcon	5	0.03
Pygmy Nuthatch	4	0.03
Red Crossbill	70	0.44
Red Squirrel	242	1.53
Red-breasted Nuthatch	211	1.34
Red-eyed Vireo	12	0.08
Red-headed Woodpecker	3	0.02
Red-naped Sapsucker	49	0.31
Red-tailed Hawk	56	0.35
Red-winged Blackbird	44	0.28
Ring-necked Pheasant	2	0.01
Rock Pigeon	4	0.03
Rock Wren	247	1.56
Ruby-crowned Kinglet	434	2.75

Species	**Total Detections Statewide**	**Relative Abundance (%)**
Ruffed Grouse	6	0.04
Sage Sparrow	329	2.08
Sage Thrasher	262	1.66
Sandhill Crane	5	0.03
Savannah Sparrow	73	0.46
Say's Phoebe	12	0.08
Sharp-shinned Hawk	3	0.02
Short-eared Owl	1	0.01
Song Sparrow	35	0.22
Spotted Sandpiper	7	0.04
Spotted Towhee	121	0.77
Steller's Jay	12	0.08
Swainson's Hawk	12	0.08
Swainson's Thrush	102	0.65
Townsend's Solitaire	56	0.35
Tree Swallow	19	0.12
Turkey Vulture	30	0.19
Unknown Accipiter	2	0.01
Unknown bird	130	0.82
Unknown finch	1	0.01
Unknown flycatcher	7	0.04
Unknown hawk	8	0.05
Unknown hummingbird	2	0.01
Unknown raptor	4	0.03
Unknown sparrow	35	0.22
Unknown swallow	7	0.04
Unknown warbler	8	0.05
Unknown woodpecker	46	0.29
Upland Sandpiper	2	0.01
Veery	1	0.01
Vesper Sparrow	417	2.64
Violet-green Swallow	41	0.26
Warbling Vireo	252	1.60
Western Bluebird	3	0.02
Western Kingbird	93	0.59
Western Meadowlark	1602	10.14
Western Tanager	212	1.34
Western Wood-Pewee	127	0.80
White-breasted Nuthatch	31	0.20
White-crowned Sparrow	139	0.88
White-throated Swift	19	0.12

Species	**Total Detections Statewide**	**Relative Abundance (%)**
Wild Turkey	7	0.04
Willet	28	0.18
Williamson's Sapsucker	8	0.05
Wilson's Phalarope	2	0.01
Wilson's Snipe	8	0.05
Wilson's Warbler	24	0.15
Yellow Warbler	67	0.42
Yellow-breasted Chat	13	0.08
Yellow-rumped Warbler	514	3.25
Totals	*15,799*	*100*

WYOMING BIRD RECORDS COMMITTEE
COMPLETION REPORT

STATE OF WYOMING

NONGAME BIRDS: Rare and Unusual Birds

FUNDING SOURCE: General Fund Appropriation

PERIOD COVERED: 1 January 2009 – 31 December 2009

PREPARED BY: Andrea Orabona, Nongame Bird Biologist

SUMMARY

The Wyoming Bird Records Committee (WBRC) was established in 1989 to accomplish the following goals.

1) To solicit, organize, and maintain records, documentation, photographs, tape recordings, and any other material relative to the birds of Wyoming.
2) To review records of new or rare species or species difficult to identify and offer an intelligent, unbiased opinion of the validity or thoroughness of these reports. From these reviews, the WBRC will develop and maintain an Official State List of Birds in Wyoming.
3) To disseminate useful and pertinent material concerning the field identification of Wyoming birds in order to assist Wyoming birders in increasing their knowledge and skill.

The WBRC is interested in promoting and maintaining quality and integrity in the reporting of Wyoming bird observations, and it treats all bird records as significant historical documents. The Wyoming Bird Records Committee operates under a set of bylaws approved in 1991 and updated in 1992 and 1998.

As of 31 December 2009, the WBRC has reviewed 1,132 reports of rare and unusual birds in Wyoming. Of the 1,132 reports, 902 (80%) have been accepted and 225 (20%) have not been accepted. Twenty reports were recently sent to WBRC members and are awaiting review.

The Wyoming Bird Records Committee Database is a dynamic document, updated once or twice a year following the WBRC meetings. The 2009 WBRC report is available Nongame link of the Department's web site at http://gf.state.wy.us/wildlife/nongame/index.asp. All reports of rare and unusual birds reviewed by the WBRC are presented in this report.

We wish to thank all observers for taking the time to submit their sightings to the WBRC. We are also indebted to the following Wyoming Bird Records Committee members for their invaluable efforts: Jean Adams, Greg Johnson, Jim Lawrence, Chris Michelson, and Susan Patla.

A record of the Official State List of Birds in Wyoming and the avian species for which documentation is requested is presented in Appendix I. How to document rare and unusual birds and a WBRC Rare Bird Form appear below.

To improve the accuracy and breadth of Wyoming's ornithological record, the following suggestions are given to assist with documentation of sightings.

1) Read "How to Document Rare Birds", by Donna L. Dittman and Greg W. Lasley (pages 145-159 in the 1992 issue of Birding, Vol. 24, No. 3).

2) Acceptable documentation must eliminate all similar species. Remember that immatures or juveniles of one species can be very similar to adults of another species. Examples that might cause confusion are gulls, jaegers, sparrows, and longspurs. Species that exhibit multiple color morphs can also be problematic.

3) Study and learn bird topography. Most field guides provide a schematic of avian body parts and feather groups. Specialized identification guides also provide specific structural and anatomical detail. A thorough grasp of this subject will heighten your general birding skill and facilitate accurate, detailed documentation.

4) Take meticulous and thorough field notes during or immediately after the observation. Alternatively, you can also use a tape recorder or digital camera to capture identification details. If the bird is cooperative, write your notes during the observation period. Try not to consult your field guide while you are writing to avoid predisposing your identification. Do not rely on memory to document a rare or unusual bird.

5) A good physical description of the bird is most crucial and you should include everything you observe. Include all details concerning plumage, shape, relative size, eyes, legs, and bill. Note the colors, including color distribution, color density, and color contrast between different feather groups. It is helpful to consider proportional details, i.e., bill length compared to head width, tail length as a proportion of body length, and length of primary projection compared to tail length. Record plumage characteristics such as degree of wear or signs of molt. When describing size, try to compare nearby known species or some other object of known dimensions. Avoid trying to estimate size in actual units (inches, feet) since this is very subjective.

6) Observe and record the subject bird's behavior. While behavior is seldom diagnostic by itself, in combination with other details, it is often conclusive. One of the few documented observations of the Connecticut Warbler in Wyoming was accepted by the WBRC, in part, because it was observed walking, not hopping.

7) If possible, take photographs. Take a number of shots to capture a complete portrait. The advent of digital photography has greatly increased the number of records the WBRC receives with photographs, which greatly helps our work. However, a photograph should always be accompanied by a written description, as one photograph will likely not display all the diagnostic features.

8) If you do not have a camera, consider making a sketch. You do not need the talent of Rembrandt or Audubon to draw a convincing and diagnostic sketch. Utilize your knowledge of bird topography and you will be surprised how well you do. Draw this sketch in the field during the observation. Do not rely on memory.

9) Vocalizations can be extremely important for identification, especially for some groups such as flycatchers. Describe what you hear while you are listening. Better yet, record the bird, even if you do not have professional recording equipment. A hand-held recorder or cellular phone with a built in microphone or a digital camera with a video recording feature can provide reliable results. There are many excellent collections of bird songs and calls that can prepare birders for the unexpected find by ear alone.

10) Specimens that can be identified and reposited at the University of Wyoming Zoological Museum are still the most convincing evidence of an occurrence. If you encounter a dead rare or unusual bird in the field, please deliver the specimen to an appropriate authority, e.g. Wyoming Game and Fish Department, National Park Service, or U.S. Fish and Wildlife Service personnel. Note the exact date and location of the discovery. Freeze the specimen if delivery is to be delayed. Always use gloves or a plastic bag to pick up dead birds and double-bag with a note inside with date and location and your contact information.

LITERATURE CITED

Dittman, D. L., and G. W. Lasley. 1992. How to document rare birds. Pages 145-159 in Birding 24(3).

Rare and Unusual Bird Sighting Form
WYOMING BIRD RECORDS COMMITTEE
260 BUENA VISTA, LANDER, WY 82520

The Wyoming Bird Records Committee sincerely thanks all observers for submitting this form to help keep Wyoming's bird records up-to-date and accurate. It is not necessary to complete every block if some details are lacking, but please provide all the details you can and attach photographs, if available.

Common Name:	Specific location of observation:
Scientific Name:	
Observation Date:	
Observation Time:	UTM E UTM N Datum Zone T
Length of Observation:	Latitude ⁰ ' "N/Longitude ⁰ ' "W
Distance from Bird:	T N / R W / Sec. / ¼ Sec. / ¼ ¼ Sec.
Light Conditions:	Weather at time of observation:
Optical Equipment:	
Notes made: ______During sighting ______From memory	Prior weather and number of days since last change:
Date report prepared:	

Give a general description of the bird seen and any other details of interest relating to the observation.

GENDER	AGE	PLUMAGE		PHOTO/TAPE/DRAWING
Male:	Adult:	Breeding:	Juvenal:	Enclosed:
Female:	Juvenile/Immature:	Winter:	Dark Morph:	Available:
Unknown:	2-3 year bird:	Eclipse:	Light Morph:	Please submit a copy of your field drawings.
Total Number:	Unknown:	Other:		

If possible, please include in the sections below details of the specific body parts actually observed during the sighting.

BILL:

HEAD:

NECK:

UPPERPARTS:

UNDERPARTS:

Please do not write below here; for WBRC use only. *Form updated January 2008*

Record Number	Category	Latilong	Date Received

WINGS:	
TAIL:	
LEGS & FEET:	
List similar species and describe how or why you eliminated them.	
Describe the behavior of this bird and the interaction with others.	
What is the habitat at this location?	
If heard, describe the bird's song or vocalizations.	Reporter's name, address, phone number, and e-mail address.
How many years have you birded?	Corroborating observers who are not reporting separately.
Have you observed this species before?	

Please do not write below here; for WBRC use only. *Form updated January 2008*

Record Number	**Latilong**	**Atlas Update**	**Sighting Entered in WGFD WOS Database**

THANK YOU FOR SUBMITTING YOUR SIGHTING TO THE WYOMING BIRD RECORDS COMMITTEE!

APPENDICES

THE OFFICIAL STATE LIST OF THE COMMON AND SCIENTIFIC NAMES OF THE BIRDS AND MAMMALS IN WYOMING

Spp. Code	Common Name	Scientific Name	Doc. Type	Seasonal Status and Additional Information [a, b]
		BIRDS [c, d]		
Waterfowl **Order: Anseriformes** **Family: Anatidae**				
171.0	Greater White-fronted Goose *	*Anser albifrons*	(FL)	M
169.0	Snow Goose *	*Chen caerulescens*		M
170.0	Ross's Goose *	*Chen rossii*	(FL)	M
173.0	Brant	*Branta bernicla*	(AS)	A, Includes Black Brant (174.0)
172.2	Cackling Goose	*Branta hutchinsii*	(FL)	A
172.0	Canada Goose *	*Branta canadensis*		R
181.0	Trumpeter Swan *	*Cygnus buccinator*	(FL)	R, No season, NSS2
180.0	Tundra Swan *	*Cygnus columbianus*		W, No season
179.0	Whooper Swan	*Cygnus cygnus*	(AS)	A
144.0	Wood Duck *	*Aix sponsa*		S
135.0	Gadwall *	*Anas strepera*		R
136.0	Eurasian Wigeon	*Anas penelope*	(AS)	A
137.0	American Wigeon *	*Anas americana*		R
133.0	American Black Duck	*Anas rubripes*	(AS)	A
132.0	Mallard *	*Anas platyrhynchos*		R
140.0	Blue-winged Teal *	*Anas discors*		S
141.0	Cinnamon Teal *	*Anas cyanoptera*		S
142.0	Northern Shoveler *	*Anas clypeata*		S
143.0	Northern Pintail *	*Anas acuta*		R, NSS3
139.2	Garganey	*Anas querquedula*	(AS)	A
139.0	Green-winged Teal *	*Anas crecca*		R
147.0	Canvasback *	*Aythya valisineria*		S, NSS3
146.0	Redhead *	*Aythya americana*		S, NSS3
150.0	Ring-necked Duck *	*Aythya collaris*		S
149.1	Tufted Duck	*Aythya fuligula*	(AS)	A
148.0	Greater Scaup *	*Aythya marila*	(FL)	M
149.0	Lesser Scaup *	*Aythya affinis*		S, NSS3
155.0	Harlequin Duck *	*Histrionicus histrionicus*		S, NSS3
166.0	Surf Scoter *	*Melanitta perspicillata*	(FL)	M
165.0	White-winged Scoter *	*Melanitta fusca*	(FL)	M
163.0	Black Scoter	*Melanitta nigra*	(AS)	A
154.0	Long-tailed Duck *	*Clangula hyemalis*	(FL)	M
153.0	Bufflehead *	*Bucephala albeola*		R
151.0	Common Goldeneye *	*Bucephala clangula*		R
152.0	Barrow's Goldeneye *	*Bucephala islandica*		R, NSS3
131.0	Hooded Merganser *	*Lophodytes cucullatus*		R
129.0	Common Merganser *	*Mergus merganser*		R
130.0	Red-breasted Merganser *	*Mergus serrator*		S
167.0	Ruddy Duck *	*Oxyura jamaicensis*		S

Spp. Code	Common Name	Scientific Name	Doc. Type	Seasonal Status and Additional Information [a, b]
Gallinaceous Birds **Order: Galliformes**				
Family: Odontophoridae				
289.0	Northern Bobwhite *	*Colinus virginianus*	(AS)	R
Family: Phasianidae				
288.2	Chukar *	*Alectoris chukar*		R
288.1	Gray Partridge *	*Perdix perdix*		R
309.1	Ring-necked Pheasant *	*Phasianus colchicus*		R
300.0	Ruffed Grouse *	*Bonasa umbellus*		R
309.0	Greater Sage-Grouse *	*Centrocercus urophasianus*		R, NSS2
304.0	White-tailed Ptarmigan *	*Lagopus leucura*	(AS)	R, No season
297.0	Dusky Grouse *	*Dendragapus obscurus*		R
308.0	Sharp-tailed Grouse *	*Tympanuchus phasianellus*		R, NSS3, Includes Columbian subspecies
305.0	Greater Prairie-Chicken	*Tympanuchus cupido*	(AS)	A
310.0	Wild Turkey *	*Meleagris gallopavo*		R
Loons **Order: Gaviiformes** **Family: Gaviidae**				
011.0	Red-throated Loon	*Gavia stellata*	(AS)	M
010.0	Pacific Loon	*Gavia pacifica*	(FL)	M
007.0	Common Loon	*Gavia immer*		S, NSS1
008.0	Yellow-billed Loon	*Gavia adamsii*	(AS)	A
Grebes **Order: Podicipediformes** **Family: Podicipedidae**				
006.0	Pied-billed Grebe	*Podilymbus podiceps*		S
003.0	Horned Grebe	*Podiceps auritus*		S
002.0	Red-necked Grebe	*Podiceps grisegena*	(AS)	S
004.0	Eared Grebe	*Podiceps nigricollis*		S
001.0	Western Grebe	*Aechmophorus occidentalis*		S, NSS4
001.1	Clark's Grebe	*Aechmophorus clarkii*		S, NSS4
Shearwaters **Order: Procellariiformes** **Family: Procellariidae**				
088.1	Streaked Shearwater	*Calonectris leucomelas*	(AS)	A
Pelicans, Cormorants, and Frigatebirds **Order: Pelecaniformes** **Family: Pelecanidae**				
125.0	American White Pelican	*Pelecanus erythrorhynchos*		S, NSS3
126.0	Brown Pelican	*Pelecanus occidentalis*	(AS)	A, Endangered
Family: Phalacrocoracidae				
120.0	Double-crested Cormorant	*Phalacrocorax auritus*		S
Family: Fregatidae				
128.2	Lesser Frigatebird	*Fregata ariel*	(AS)	A
Wading Birds **Order: Ciconiiformes** **Family: Ardeidae**				
190.0	American Bittern	*Botaurus lentiginosus*	(FL)	S, NSS3

Spp. Code	Common Name	Scientific Name	Doc. Type	Seasonal Status and Additional Information [a, b]
191.0	Least Bittern	*Ixobrychus exilis*	(AS)	A
194.0	Great Blue Heron	*Ardea herodias*		S, NSS4
196.0	Great Egret	*Ardea alba*	(AS)	A
197.0	Snowy Egret	*Egretta thula*		S, NSS3
200.0	Little Blue Heron	*Egretta caerulea*	(AS)	A
199.0	Tricolored Heron	*Egretta tricolor*	(AS)	A
200.1	Cattle Egret	*Bubulcus ibis*	(FL)	S
201.0	Green Heron	*Butorides virescens*	(AS)	M
202.0	Black-crowned Night-Heron	*Nycticorax nycticorax*		S, NSS3
203.0	Yellow-crowned Night-Heron	*Nyctanassa violacea*	(AS)	A
Family: Threskiornithidae				
184.0	White Ibis	*Eudocimus albus*	(AS)	A
186.0	Glossy Ibis	*Plegadis falcinellus*	(AS)	A
187.0	White-faced Ibis	*Plegadis chihi*		S
Family: Ciconiidae				
188.0	Wood Stork	*Mycteria americana*	(AS)	A, Endangered
Diurnal Birds of Prey **Order: Ciconiiformes** **Family: Cathartidae**				
325.0	Turkey Vulture	*Cathartes aura*		S
Order: Falconiformes **Family: Accipitridae**				
364.0	Osprey	*Pandion haliaetus*		S
328.0	White-tailed Kite	*Elanus leucurus*	(AS)	A
329.0	Mississippi Kite	*Ictinia mississippiensis*	(AS)	A
352.0	Bald Eagle	*Haliaeetus leucocephalus*		R, NSS2
331.0	Northern Harrier	*Circus cyaneus*		S
332.0	Sharp-shinned Hawk	*Accipiter striatus*		S
333.0	Cooper's Hawk	*Accipiter cooperii*		S
334.0	Northern Goshawk	*Accipiter gentilis*		R, NSS4
335.0	Harris's Hawk	*Parabuteo unicinctus*	(AS)	A
339.0	Red-shouldered Hawk	*Buteo lineatus*	(AS)	A
343.0	Broad-winged Hawk	*Buteo platypterus*	(FL)	S
342.0	Swainson's Hawk	*Buteo swainsoni*		S, NSS4
337.0	Red-tailed Hawk	*Buteo jamaicensis*		R, Includes Harlan's Hawk (338.0)
348.0	Ferruginous Hawk	*Buteo regalis*		R, NSS3
347.0	Rough-legged Hawk	*Buteo lagopus*		W
349.0	Golden Eagle	*Aquila chrysaetos*		R
Family: Falconidae				
362.0	Crested Caracara	*Caracara cheriway*	(AS)	A
360.0	American Kestrel	*Falco sparverius*		S
357.0	Merlin	*Falco columbarius*		R, NSS3
354.0	Gyrfalcon	*Falco rusticolus*	(AS)	W
356.0	Peregrine Falcon	*Falco peregrinus*	(FL)	R, NSS3
355.0	Prairie Falcon	*Falco mexicanus*		R

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<u>Marshbirds</u> **Order: Gruiformes** **Family: Rallidae**				
215.0	Yellow Rail	*Coturnicops noveboracensis*	(AS)	A
212.0	Virginia Rail *	*Rallus limicola*		S, NSS3
214.0	Sora *	*Porzana carolina*		S
218.0	Purple Gallinule	*Porphyrio martinica*	(AS)	A
219.0	Common Moorhen	*Gallinula chloropus*	(AS)	A
221.0	American Coot *	*Fulica americana*		S
Family: Gruidae				
206.0	Sandhill Crane *	*Grus canadensis*		S, NSS3, Includes Greater Sandhill Crane subspecies
204.0	Whooping Crane	*Grus americana*	(AS)	S, Endangered
<u>Shorebirds</u> **Order: Charadriiformes** **Family: Charadriidae**				
270.0	Black-bellied Plover	*Pluvialis squatarola*		M
272.0	American Golden-Plover	*Pluvialis dominica*	(FL)	M
278.0	Snowy Plover	*Charadrius alexandrinus*	(AS)	S
274.0	Semipalmated Plover	*Charadrius semipalmatus*		M
277.0	Piping Plover	*Charadrius melodus*	(AS)	M, Endangered
273.0	Killdeer	*Charadrius vociferus*		S
281.0	Mountain Plover	*Charadrius montanus*		S, NSS4
Family: Recurvirostridae				
226.0	Black-necked Stilt	*Himantopus mexicanus*		S
225.0	American Avocet	*Recurvirostra americana*		S
Family: Scolopacidae				
263.0	Spotted Sandpiper	*Actitis macularius*		S
256.0	Solitary Sandpiper	*Tringa solitaria*		M
254.0	Greater Yellowlegs	*Tringa melanoleuca*		M
258.0	Willet	*Tringa semipalmata*		S
255.0	Lesser Yellowlegs	*Tringa flavipes*		M
261.0	Upland Sandpiper	*Bartramia longicauda*	(FL)	S, NSS4
265.0	Whimbrel	*Numenius phaeopus*	(FL)	M
264.0	Long-billed Curlew	*Numenius americanus*		S, NSS3
251.0	Hudsonian Godwit	*Limosa haemastica*	(AS)	M
249.0	Marbled Godwit	*Limosa fedoa*		M
283.0	Ruddy Turnstone	*Arenaria interpres*	(FL)	M
234.0	Red Knot	*Calidris canutus*	(AS)	M
248.0	Sanderling	*Calidris alba*		M
246.0	Semipalmated Sandpiper	*Calidris pusilla*		M
247.0	Western Sandpiper	*Calidris mauri*		M
242.0	Least Sandpiper	*Calidris minutilla*		M
240.0	White-rumped Sandpiper	*Calidris fuscicollis*	(FL)	M
241.0	Baird's Sandpiper	*Calidris bairdii*		M
239.0	Pectoral Sandpiper	*Calidris melanotos*		M
243.0	Dunlin	*Calidris alpina*	(FL)	M
233.0	Stilt Sandpiper	*Calidris himantopus*		M
262.0	Buff-breasted Sandpiper	*Tryngites subruficollis*	(AS)	M

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231.0	Short-billed Dowitcher	*Limnodromus griseus*	(AS)	M
232.0	Long-billed Dowitcher	*Limnodromus scolopaceus*		M
230.0	Wilson's Snipe	*Gallinago delicata*		S
228.0	American Woodcock	*Scolopax minor*	(AS)	A
224.0	Wilson's Phalarope	*Phalaropus tricolor*		S
223.0	Red-necked Phalarope	*Phalaropus lobatus*		M
222.0	Red Phalarope	*Phalaropus fulicarius*	(AS)	A
<u>Gulls and Terns</u> **Order: Charadriiformes** **Family: Laridae**				
040.0	Black-legged Kittiwake	*Rissa tridactyla*	(AS)	A
062.0	Sabine's Gull	*Xema sabini*	(FL)	M
060.0	Bonaparte's Gull	*Chroicocephalus philadelphia*		M
055.1	Black-headed Gull	*Chroicocephalus ridibundus*	(AS)	A
060.1	Little Gull	*Hydrocoloeus minutus*	(AS)	A
061.0	Ross's Gull	*Rhodostethia rosea*	(AS)	A
058.0	Laughing Gull	*Larus atricilla*	(AS)	A
059.0	Franklin's Gull	*Larus pipixcan*		S, NSS3
057.0	Heermann's Gull	*Larus heermanni*	(AS)	A
055.0	Mew Gull	*Larus canus*	(AS)	A
054.0	Ring-billed Gull	*Larus delawarensis*		S
053.0	California Gull	*Larus californicus*		S
051.0	Herring Gull	*Larus argentatus*		M
043.1	Thayer's Gull	*Larus thayeri*	(AS)	A
050.0	Lesser Black-backed Gull	*Larus fuscus*	(AS)	A
044.0	Glaucous-winged Gull	*Larus glaucescens*	(AS)	A
042.0	Glaucous Gull	*Larus hyperboreus*	(AS)	A
047.0	Great Black-backed Gull	*Larus marinus*	(AS)	A
074.0	Least Tern	*Sternula antillarum*	(AS)	A, Endangered
064.0	Caspian Tern	*Hydroprogne caspia*		S, NSS3
077.0	Black Tern	*Chlidonias niger*		S, NSS3
070.0	Common Tern	*Sterna hirundo*	(FL)	M
071.0	Arctic Tern	*Sterna paradisaea*	(AS)	A
069.0	Forster's Tern	*Sterna forsteri*		S, NSS3
Family: Stercorariidae				
036.0	Pomarine Jaeger	*Stercorarius pomarinus*	(AS)	A
037.0	Parasitic Jaeger	*Stercorarius parasiticus*	(AS)	A
<u>Seabirds</u> **Order: Charadriiformes** **Family: Alcidae**				
023.0	Long-billed Murrelet	*Brachyramphus perdix*	(AS)	A
021.0	Ancient Murrelet	*Synthliboramphus antiquus*	(AS)	A
<u>Doves and Pigeons</u> **Order: Columbiformes** **Family: Columbidae**				
313.1	Rock Pigeon	*Columba livia*		R
312.0	Band-tailed Pigeon	*Patagioenas fasciata*	(AS)	M
315.4	Eurasian Collared-Dove	Streptopelia decaocto	(FL)	R
319.0	White-winged Dove	*Zenaida asiatica*	(AS)	A
316.0	Mourning Dove *	*Zenaida macroura*		S

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315.0	Passenger Pigeon	*Ectopistes migratorius*		Extinct
<u>Cuckoos</u> **Order: Cuculiformes** **Family: Cuculidae**				
387.0	Yellow-billed Cuckoo	*Coccyzus americanus*	(FL)	S, NSS2
388.0	Black-billed Cuckoo	*Coccyzus erythropthalmus*	(FL)	S
<u>Owls</u> **Order: Strigiformes** **Family: Tytonidae**				
365.0	Barn Owl	*Tyto alba*	(AS)	S, (AS) except L21
Family: Strigidae				
374.0	Flammulated Owl	*Otus flammeolus*	(AS)	S
373.2	Western Screech-Owl	*Megascops kennicottii*	(AS)	R, (AS) except L8
373.0	Eastern Screech-Owl	*Megascops asio*	(FL)	R
375.0	Great Horned Owl	*Bubo virginianus*		R
376.0	Snowy Owl	*Bubo scandiacus*	(AS)	W
377.0	Northern Hawk Owl	*Surnia ulula*	(AS)	A
379.0	Northern Pygmy-Owl	*Glaucidium gnoma*	(FL)	R, NSS4
378.0	Burrowing Owl	*Athene cunicularia*		S, NSS4
368.0	Barred Owl	*Strix varia*	(AS)	A
370.0	Great Gray Owl	*Strix nebulosa*		R, NSS4
366.0	Long-eared Owl	*Asio otus*		R
367.0	Short-eared Owl	*Asio flammeus*		R, NSS4
371.0	Boreal Owl	*Aegolius funereus*	(FL)	R, NSS4
372.0	Northern Saw-whet Owl	*Aegolius acadicus*	(FL)	R
<u>Goatsuckers</u> **Order: Caprimulgiformes** **Family: Caprimulgidae**				
420.0	Common Nighthawk	*Chordeiles minor*		S
418.0	Common Poorwill	*Phalaenoptilus nuttallii*		S
<u>Swifts</u> **Order: Apodiformes** **Family: Apodidae**				
423.0	Chimney Swift	*Chaetura pelagica*	(FL)	S
425.0	White-throated Swift	*Aeronautes saxatalis*		S
<u>Hummingbirds</u> **Order: Apodiformes** **Family: Trochilidae**				
426.0	Magnificent Hummingbird	*Eugenes fulgens*	(AS)	A
428.0	Ruby-throated Hummingbird	*Archilochus colubris*	(AS)	A
429.0	Black-chinned Hummingbird	*Archilochus alexandri*	(FL)	S
431.0	Anna's Hummingbird	*Calypte anna*	(AS)	A
436.0	Calliope Hummingbird	*Stellula calliope*		S
432.0	Broad-tailed Hummingbird	*Selasphorus platycercus*		S
433.0	Rufous Hummingbird	*Selasphorus rufus*		S
<u>Kingfishers</u> **Order: Coraciiformes** **Family: Alcedinidae**				
390.0	Belted Kingfisher	*Megaceryle alcyon*		R

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<u>Woodpeckers</u> **Order: Piciformes** **Family: Picidae**				
408.0	Lewis's Woodpecker	*Melanerpes lewis*		S, NSS3
406.0	Red-headed Woodpecker	*Melanerpes erythrocephalus*	(FL)	S
407.0	Acorn Woodpecker	*Melanerpes formicivorus*	(AS)	A
409.0	Red-bellied Woodpecker	*Melanerpes carolinus*	(AS)	A
404.0	Williamson's Sapsucker	*Sphyrapicus thyroideus*		S
402.0	Yellow-bellied Sapsucker	*Sphyrapicus varius*	(AS)	A
402.1	Red-naped Sapsucker	*Sphyrapicus nuchalis*		S
394.0	Downy Woodpecker	*Picoides pubescens*		R
393.0	Hairy Woodpecker	*Picoides villosus*		R
399.0	White-headed Woodpecker	*Picoides albolarvatus*	(AS)	A
401.0	American Three-toed Woodpecker	*Picoides dorsalis*		R, NSS4
400.0	Black-backed Woodpecker	*Picoides arcticus*	(FL)	R, NSS4
412.0	Northern Flicker	*Colaptes auratus*		R, Includes Red-shafted and Yellow-shafted
405.0	Pileated Woodpecker	*Dryocopus pileatus*	(AS)	A
<u>Passerines</u> **Order: Passeriformes** **Family: Tyrannidae**				
459.0	Olive-sided Flycatcher	*Contopus cooperi*		S
462.0	Western Wood-Pewee	*Contopus sordidulus*		S
461.0	Eastern Wood-Pewee	*Contopus virens*	(AS)	A
466.0	Willow Flycatcher	*Empidonax traillii*		S, NSS3
467.0	Least Flycatcher	*Empidonax minimus*	(FL)	S
468.0	Hammond's Flycatcher	*Empidonax hammondii*	(FL)	S
469.1	Gray Flycatcher	*Empidonax wrightii*	(FL)	S
469.0	Dusky Flycatcher	*Empidonax oberholseri*		S
464.0	Cordilleran Flycatcher	*Empidonax occidentalis*		S
456.0	Eastern Phoebe	*Sayornis phoebe*	(AS)	S
457.0	Say's Phoebe	*Sayornis saya*		S
471.0	Vermilion Flycatcher	*Pyrocephalus rubinus*	(AS)	A
454.0	Ash-throated Flycatcher	*Myiarchus cinerascens*	(FL)	S, NSS3
452.0	Great Crested Flycatcher	*Myiarchus crinitus*	(AS)	A
448.0	Cassin's Kingbird	*Tyrannus vociferans*	(FL)	S
447.0	Western Kingbird	*Tyrannus verticalis*		S
444.0	Eastern Kingbird	*Tyrannus tyrannus*		S
443.0	Scissor-tailed Flycatcher	*Tyrannus forficatus*	(AS)	A
Family: Laniidae				
622.0	Loggerhead Shrike	*Lanius ludovicianus*		S
621.0	Northern Shrike	*Lanius excubitor*		W
Family: Vireonidae				
631.0	White-eyed Vireo	*Vireo griseus*	(AS)	A
634.0	Gray Vireo	*Vireo vicinior*	(AS)	S
628.0	Yellow-throated Vireo	*Vireo flavifrons*	(AS)	A
629.1	Plumbeous Vireo	*Vireo plumbeus*		S
629.2	Cassin's Vireo	*Vireo cassinii*	(AS)	M
629.3	Blue-headed Vireo	*Vireo solitarius*	(AS)	M

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627.0	Warbling Vireo	*Vireo gilvus*		S
626.0	Philadelphia Vireo	*Vireo philadelphicus*	(AS)	M
624.0	Red-eyed Vireo	*Vireo olivaceus*		S
Family: Corvidae				
484.0	Gray Jay	*Perisoreus canadensis*		R
478.0	Steller's Jay	*Cyanocitta stelleri*		R
477.0	Blue Jay	*Cyanocitta cristata*		R
481.0	Western Scrub-Jay	*Aphelocoma californica*	(FL)	R, NSS3
492.0	Pinyon Jay	*Gymnorhinus cyanocephalus*		R
491.0	Clark's Nutcracker	*Nucifraga columbiana*		R
475.0	Black-billed Magpie	*Pica hudsonia*		R
488.0	American Crow	*Corvus brachyrhynchos*		R
486.0	Common Raven	*Corvus corax*		R
Family: Alaudidae				
474.0	Horned Lark	*Eremophila alpestris*		R
Family: Hirundinidae				
611.0	Purple Martin	*Progne subis*	(AS)	S
614.0	Tree Swallow	*Tachycineta bicolor*		S
615.0	Violet-green Swallow	*Tachycineta thalassina*		S
617.0	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*		S
616.0	Bank Swallow	*Riparia riparia*		S
612.0	Cliff Swallow	*Petrochelidon pyrrhonota*		S
613.0	Barn Swallow	*Hirundo rustica*		S
Family: Paridae				
735.0	Black-capped Chickadee	*Poecile atricapillus*		R
738.0	Mountain Chickadee	*Poecile gambeli*		R
733.0	Juniper Titmouse	*Baeolophus ridgwayi*	(FL)	R, NSS3
Family: Aegithalidae				
743.0	Bushtit	*Psaltriparus minimus*	(FL)	S, NSS3
Family: Sittidae				
728.0	Red-breasted Nuthatch	*Sitta canadensis*		R
727.0	White-breasted Nuthatch	*Sitta carolinensis*		R
730.0	Pygmy Nuthatch	*Sitta pygmaea*		R, NSS4
Family: Certhiidae				
726.0	Brown Creeper	*Certhia americana*		R
Family: Troglodytidae				
715.0	Rock Wren	*Salpinctes obsoletus*		S
717.0	Canyon Wren	*Catherpes mexicanus*		R
718.0	Carolina Wren	*Thryothorus ludovicianus*	(AS)	A
719.0	Bewick's Wren	*Thryomanes bewickii*	(FL)	S
721.0	House Wren	*Troglodytes aedon*		S
722.0	Winter Wren	*Troglodytes troglodytes*	(FL)	M
724.0	Sedge Wren	*Cistothorus platensis*	(AS)	A
725.0	Marsh Wren	*Cistothorus palustris*		S
Family: Cinclidae				
701.0	American Dipper	*Cinclus mexicanus*		R
Family: Regulidae				
748.0	Golden-crowned Kinglet	*Regulus satrapa*		R
749.0	Ruby-crowned Kinglet	*Regulus calendula*		S

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Family: Sylviidae				
751.0	Blue-gray Gnatcatcher	*Polioptila caerulea*		S
Family: Turdidae				
766.0	Eastern Bluebird	*Sialia sialis*	(FL)	S
767.0	Western Bluebird	*Sialia mexicana*	(AS)	S
768.0	Mountain Bluebird	*Sialia currucoides*		S
754.0	Townsend's Solitaire	*Myadestes townsendi*		R
756.0	Veery	*Catharus fuscescens*		S
757.0	Gray-cheeked Thrush	*Catharus minimus*	(AS)	M
758.0	Swainson's Thrush	*Catharus ustulatus*		S
759.0	Hermit Thrush	*Catharus guttatus*		S
755.0	Wood Thrush	*Hylocichla mustelina*	(AS)	M
761.0	American Robin	*Turdus migratorius*		R
763.0	Varied Thrush	*Ixoreus naevius*	(AS)	M
Family: Mimidae				
704.0	Gray Catbird	*Dumetella carolinensis*		S
703.0	Northern Mockingbird	*Mimus polyglottos*		S
702.0	Sage Thrasher	*Oreoscoptes montanus*		S, NSS4
705.0	Brown Thrasher	*Toxostoma rufum*		S
Family: Sturnidae				
493.0	European Starling	*Sturnus vulgaris*		R
Family: Motacillidae				
697.0	American Pipit	*Anthus rubescens*		S
700.0	Sprague's Pipit	*Anthus spragueii*	(AS)	M
Family: Bombycillidae				
618.0	Bohemian Waxwing	*Bombycilla garrulus*		W
619.0	Cedar Waxwing	*Bombycilla cedrorum*		R
Family: Parulidae				
641.0	Blue-winged Warbler	*Vermivora pinus*	(AS)	A
642.0	Golden-winged Warbler	*Vermivora chrysoptera*	(AS)	A
647.0	Tennessee Warbler	*Vermivora peregrina*	(FL)	M
646.0	Orange-crowned Warbler	*Vermivora celata*		S
645.0	Nashville Warbler	*Vermivora ruficapilla*	(FL)	M
644.0	Virginia's Warbler	*Vermivora virginiae*	(FL)	S
648.0	Northern Parula	*Parula americana*	(FL)	M
652.0	Yellow Warbler	*Dendroica petechia*		S
659.0	Chestnut-sided Warbler	*Dendroica pensylvanica*	(FL)	M
657.0	Magnolia Warbler	*Dendroica magnolia*	(FL)	M
650.0	Cape May Warbler	*Dendroica tigrina*	(AS)	A
654.0	Black-throated Blue Warbler	*Dendroica caerulescens*	(FL)	M
655.0	Yellow-rumped Warbler	*Dendroica coronata*		S
665.0	Black-throated Gray Warbler	*Dendroica nigrescens*	(FL)	S
667.0	Black-throated Green Warbler	*Dendroica virens*	(AS)	A
668.0	Townsend's Warbler	*Dendroica townsendi*		S
669.0	Hermit Warbler	*Dendroica occidentalis*	(AS)	A
662.0	Blackburnian Warbler	*Dendroica fusca*	(AS)	M
663.0	Yellow-throated Warbler	*Dendroica dominica*	(AS)	A
671.0	Pine Warbler	*Dendroica pinus*	(AS)	A
673.0	Prairie Warbler	*Dendroica discolor*	(AS)	A

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672.0	Palm Warbler	*Dendroica palmarum*	(AS)	M
660.0	Bay-breasted Warbler	*Dendroica castanea*	(AS)	M
661.0	Blackpoll Warbler	*Dendroica striata*	(FL)	M
636.0	Black-and-white Warbler	*Mniotilta varia*	(FL)	M
687.0	American Redstart	*Setophaga ruticilla*		S
637.0	Prothonotary Warbler	*Protonotaria citrea*	(AS)	A
639.0	Worm-eating Warbler	*Helmitheros vermivorum*	(AS)	A
674.0	Ovenbird	*Seiurus aurocapilla*		S
675.0	Northern Waterthrush	*Seiurus noveboracensis*		M
677.0	Kentucky Warbler	*Oporornis formosus*	(AS)	A
678.0	Connecticut Warbler	*Oporornis agilis*	(AS)	A
679.0	Mourning Warbler	*Oporornis philadelphia*	(AS)	A
680.0	MacGillivray's Warbler	*Oporornis tolmiei*		S
681.0	Common Yellowthroat	*Geothlypis trichas*		S
684.0	Hooded Warbler	*Wilsonia citrina*	(AS)	A
685.0	Wilson's Warbler	*Wilsonia pusilla*		S
686.0	Canada Warbler	*Wilsonia canadensis*	(AS)	A
690.0	Red-faced Warbler	*Cardellina rubrifrons*	(AS)	A
683.0	Yellow-breasted Chat	*Icteria virens*		S
Family: Emberizidae				
590.0	Green-tailed Towhee	*Pipilo chlorurus*		S
587.0	Spotted Towhee	*Pipilo maculatus*		S
591.0	Canyon Towhee	*Pipilo fuscus*	(AS)	A
578.0	Cassin's Sparrow	*Aimophila cassinii*	(AS)	A, (AS) except Torrington area
559.0	American Tree Sparrow	*Spizella arborea*		W
560.0	Chipping Sparrow	*Spizella passerina*		S
561.0	Clay-colored Sparrow	*Spizella pallida*		S
562.0	Brewer's Sparrow	*Spizella breweri*		S, NSS4
563.0	Field Sparrow	*Spizella pusilla*	(AS)	S
540.0	Vesper Sparrow	*Pooecetes gramineus*		S
552.0	Lark Sparrow	*Chondestes grammacus*		S
573.0	Black-throated Sparrow	*Amphispiza bilineata*	(AS)	S
574.0	Sage Sparrow	*Amphispiza belli*		S, NSS4
605.0	Lark Bunting	*Calamospiza melanocorys*		S, NSS4
542.0	Savannah Sparrow	*Passerculus sandwichensis*		S
546.0	Grasshopper Sparrow	*Ammodramus savannarum*		S, NSS4
545.0	Baird's Sparrow	*Ammodramus bairdii*	(AS)	S
548.0	Le Conte's Sparrow	*Ammodramus leconteii*	(AS)	M
549.1	Nelson's Sparrow	*Ammodramus nelsoni*	(AS)	A
585.0	Fox Sparrow	*Passerella iliaca*		R
581.0	Song Sparrow	*Melospiza melodia*		R
583.0	Lincoln's Sparrow	*Melospiza lincolnii*		S
584.0	Swamp Sparrow	*Melospiza georgiana*	(FL)	M
558.0	White-throated Sparrow	*Zonotrichia albicollis*		M
553.0	Harris's Sparrow	*Zonotrichia querula*		W
554.0	White-crowned Sparrow	*Zonotrichia leucophrys*		S
557.0	Golden-crowned Sparrow	*Zonotrichia atricapilla*	(AS)	A

Spp. Code	Common Name	Scientific Name	Doc. Type	Seasonal Status and Additional Information [a, b]
567.0	Dark-eyed Junco	*Junco hyemalis*		R, Includes White-winged (566.0), Slate-colored (567.0), Oregon (567.1), Pink-sided (568.0), and Gray-headed (569.0)
539.0	McCown's Longspur	*Calcarius mccownii*		S, NSS4
536.0	Lapland Longspur	*Calcarius lapponicus*		W
537.0	Smith's Longspur	*Calcarius pictus*	(AS)	A
538.0	Chestnut-collared Longspur	*Calcarius ornatus*	(FL)	S, NSS4
534.0	Snow Bunting	*Plectrophenax nivalis*		W
Family: Thraupidae				
609.0	Hepatic Tanager	*Piranga flava*	(AS)	A
610.0	Summer Tanager	*Piranga rubra*	(AS)	M
608.0	Scarlet Tanager	*Piranga olivacea*	(AS)	A
607.0	Western Tanager	*Piranga ludoviciana*		S
Family: Cardinalidae				
593.0	Northern Cardinal	*Cardinalis cardinalis*	(AS)	M
594.1	Yellow Grosbeak	*Pheucticus chrysopeplus*	(AS)	A
595.0	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	(FL)	S
596.0	Black-headed Grosbeak	*Pheucticus melanocephalus*		S
597.0	Blue Grosbeak	*Passerina caerulea*		S
599.0	Lazuli Bunting	*Passerina amoena*		S
598.0	Indigo Bunting	*Passerina cyanea*	(FL)	S
601.0	Painted Bunting	*Passerina ciris*	(AS)	A
604.0	Dickcissel	*Spiza americana*	(FL)	S, NSS4
Family: Icteridae				
494.0	Bobolink	*Dolichonyx oryzivorus*		S, NSS4
498.0	Red-winged Blackbird	*Agelaius phoeniceus*		S
501.0	Eastern Meadowlark	*Sturnella magna*	(AS)	A
501.1	Western Meadowlark	*Sturnella neglecta*		S
497.0	Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*		S
509.0	Rusty Blackbird	*Euphagus carolinus*	(AS)	M
510.0	Brewer's Blackbird	*Euphagus cyanocephalus*		S
511.0	Common Grackle	*Quiscalus quiscula*		S
512.0	Great-tailed Grackle	*Quiscalus mexicanus*	(AS)	A
495.0	Brown-headed Cowbird	*Molothrus ater*		S
506.0	Orchard Oriole	*Icterus spurius*	(FL)	S
508.0	Bullock's Oriole	*Icterus bullockii*		S
507.0	Baltimore Oriole	*Icterus galbula*	(AS)	A
504.0	Scott's Oriole	*Icterus parisorum*	(AS)	S, NSS3
Family: Fringillidae				
514.1	Brambling	*Fringilla montifringilla*	(AS)	A
524.0	Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*		R
525.0	Black Rosy-Finch	*Leucosticte atrata*		R
526.0	Brown-capped Rosy-Finch	*Leucosticte australis*	(FL)	R
515.0	Pine Grosbeak	*Pinicola enucleator*		R
517.0	Purple Finch	*Carpodacus purpureus*	(AS)	W
518.0	Cassin's Finch	*Carpodacus cassini*		R

Spp. Code	Common Name	Scientific Name	Doc. Type	Seasonal Status and Additional Information [a, b]
519.0	House Finch	*Carpodacus mexicanus*		R
521.0	Red Crossbill	*Loxia curvirostra*		R
522.0	White-winged Crossbill	*Loxia leucoptera*	(FL)	R
528.0	Common Redpoll	*Acanthis flammea*		W
527.0	Hoary Redpoll	*Acanthis hornemanni*	(AS)	W
533.0	Pine Siskin	*Spinus pinus*		R
530.0	Lesser Goldfinch	*Spinus psaltria*	(FL)	M
531.0	Lawrence's Goldfinch	*Spinus lawrencei*	(AS)	A
529.0	American Goldfinch	*Spinus tristis*		R
514.0	Evening Grosbeak	*Coccothraustes vespertinus*		R
Family: Passeridae				
688.2	House Sparrow	*Passer domesticus*		R
Note: the following avian species have been documented in Wyoming, but these are human-assisted species and, as such, are not recognized as wild, naturally occurring species in the State.				
Waterfowl **Order: Anseriformes** **Family: Anatidae**				
178.2	Mute Swan	*Cygnus olor*	(AS)	A, Controlled
141.2	Ruddy Shelduck	*Tadorna ferruginea*	(AS)	A, Controlled
141.1	Common Shelduck	*Tadorna tadorna*	(AS)	A, Controlled
Doves and Pigeons **Order: Columbiformes** **Family: Columbidae**				
315.2	African Collared-Dove	*Streptopelia roseogrisea*	(AS)	A, Controlled
Passerines **Order: Passeriformes** **Family: Fringillidae**				
526.1	European Goldfinch	*Carduelis carduelis*	(AS)	A, Controlled

Spp. Code	Common Name	Scientific Name	Doc. Type	Seasonal Status and Additional Information [a, b]
MAMMALS [d, e]				
Marsupials **Order: Marsupialia** **Family: Didelphidae**				
800.0	Virginia Opossum	*Didelphis virginiana*		A
Insectivores **Order: Insectivora** **Family: Soricidae**				
801.0	Masked Shrew	*Sorex cinereus*		R
801.1	Hayden's Shrew	*Sorex haydeni*		R, NSS4
806.0	Pygmy Shrew	*Sorex hoyi*		R, NSS2
805.0	Merriam's Shrew	*Sorex merriami*		R
807.0	Dusky Shrew	*Sorex monticolus*		R
803.0	Dwarf Shrew	*Sorex nanus*		R, NSS3
804.0	American Water Shrew	*Sorex palustris*		R, NSS4
804.1	Preble's Shrew	*Sorex preblei*		R, NSS3
802.0	Vagrant Shrew	*Sorex vagrans*		R, NSS3
Family: Talpidae				
810.0	Eastern Mole	*Scalopus aquaticus*		R
Bats **Order: Chiroptera** **Family: Vespertilionidae**				
815.1	California Myotis	*Myotis californicus*		U
816.0	Western Small-footed Myotis	*Myotis ciliolabrum*		U, NSS3
818.0	Long-eared Myotis	*Myotis evotis*		U, NSS2
819.0	Northern Myotis	*Myotis septentrionalis*		U, NSS2
815.0	Little Brown Myotis	*Myotis lucifugus*		U, NSS3
826.0	Fringed Myotis	*Myotis thysanodes*		U, NSS2
817.0	Long-legged Myotis	*Myotis volans*		U, NSS2
817.1	Yuma Myotis	*Myotis yumanensis*		U
821.0	Eastern Red Bat	*Lasiurus borealis*		S, NSS4
822.0	Hoary Bat	*Lasiurus cinereus*		S, NSS4
820.0	Silver-haired Bat	*Lasionycteris noctivagans*		U, NSS4
820.1	Eastern Pipistrelle	*Pipistrellus subflavus*		U
825.0	Big Brown Bat	*Eptesicus fuscus*		U, NSS3
824.0	Spotted Bat	*Euderma maculatum*		S, NSS2
823.0	Townsend's Big-eared Bat	*Corynorhinus townsendii*		U, NSS2
827.0	Pallid Bat	*Antrozous pallidus*		S, NSS2
Family: Molossidae				
828.0	Brazilian Free-tailed Bat	*Tadarida brasiliensis*		A
829.0	Big Free-tailed Bat	*Nyctinomops macrotis*		A
Lagomorphs **Order: Lagomorpha** **Family: Ochotonidae**				
830.0	American Pika	*Ochotona princeps*		R
Family: Leporidae				
837.0	Pygmy Rabbit	*Brachylagus idahoensis*		R, NSS3
833.0	Desert Cottontail *	*Sylvilagus audubonii*		R
834.0	Eastern Cottontail *	*Sylvilagus floridanus*		R
835.0	Mountain Cottontail *	*Sylvilagus nuttallii*		R

Spp. Code	Common Name	Scientific Name	Doc. Type	Seasonal Status and Additional Information [a, b]
836.0	Snowshoe Hare *	*Lepus americanus*		R
832.0	Black-tailed Jackrabbit *	*Lepus californicus*		R, Predatory animal
831.0	White-tailed Jackrabbit *	*Lepus townsendii*		R, Predatory animal
<u>Rodents</u> **Order: Rodentia** **Family: Sciuridae**				
841.0	Yellow-pine Chipmunk	*Neotamias amoenus*		R
842.0	Cliff Chipmunk	*Neotamias dorsalis*		R, NSS3
840.0	Least Chipmunk	*Neotamias minimus*		R
843.0	Uinta Chipmunk	*Neotamias umbrinus*		R
844.0	Yellow-bellied Marmot	*Marmota flaviventris*		R
846.0	Uinta Ground Squirrel	*Spermophilus armatus*		R
845.0	Wyoming Ground Squirrel	*Spermophilus elegans*		R
849.0	Golden-mantled Ground Squirrel	*Spermophilus lateralis*		R
847.0	Spotted Ground Squirrel	*Spermophilus spilosoma*		R, NSS3
848.0	Thirteen-lined Ground Squirrel	*Spermophilus tridecemlineatus*		R
851.0	White-tailed Prairie Dog	*Cynomys leucurus*		R, NSS4
850.0	Black-tailed Prairie Dog	*Cynomys ludovicianus*		R, NSS3
855.0	Abert's Squirrel	*Sciurus aberti*		R, NSS3
856.0	Eastern Gray Squirrel *	*Sciurus carolinensis*		R
852.0	Eastern Fox Squirrel *	*Sciurus niger*		R
854.0	Red Squirrel *	*Tamiasciurus hudsonicus*		R
853.0	Northern Flying Squirrel	*Glaucomys sabrinus*		R, NSS4
Family: Geomyidae				
862.0	Wyoming Pocket Gopher	*Thomomys clusius*		R
863.0	Idaho Pocket Gopher	*Thomomys idahoensis*		R, NSS3
860.0	Northern Pocket Gopher	*Thomomys talpoides*		R
861.0	Plains Pocket Gopher	*Geomys bursarius*		R, NSS4
Family: Heteromyidae				
865.0	Olive-backed Pocket Mouse	*Perognathus fasciatus*		R, NSS3
893.0	Plains Pocket Mouse	*Perognathus flavescens*		R, NSS3
866.0	Silky Pocket Mouse	*Perognathus flavus*		R, NSS3
867.0	Great Basin Pocket Mouse	*Perognathus parvus*		R, NSS3
868.0	Hispid Pocket Mouse	*Chaetodipus hispidus*		R, NSS3
869.0	Ord's Kanagroo Rat	*Dipodomys ordii*		R
Family: Castoridae				
875.0	Beaver *	*Castor canadensis*		R
Family: Muridae				
877.0	Western Harvest Mouse	*Reithrodontomys megalotis*		R
876.0	Plains Harvest Mouse	*Reithrodontomys montanus*		R, NSS3
878.0	Canyon Mouse	*Peromyscus crinitus*		R, NSS3
881.0	White-footed Mouse	*Peromyscus leucopus*		R
880.0	Deer Mouse	*Peromyscus maniculatus*		R
879.0	Piñon Mouse	*Peromyscus truei*		R, NSS3
882.0	Northern Grasshopper Mouse	*Onychomys leucogaster*		R
883.0	Bushy-tailed Woodrat	*Neotoma cinerea*		R
884.0	Southern Red-backed Vole	*Clethrionomys gapperi*		R
885.0	Western Heather Vole	*Phenacomys intermedius*		R, NSS3
888.0	Long-tailed Vole	*Microtus longicaudus*		R

Spp. Code	Common Name	Scientific Name	Doc. Type	Seasonal Status and Additional Information [a, b]
887.0	Montane Vole	*Microtus montanus*		R
890.0	Prairie Vole	*Microtus ochrogaster*		R, NSS3
886.0	Meadow Vole	*Microtus pennsylvanicus*		R
889.0	Water Vole	*Microtus richardsoni*		R, NSS3
891.0	Sagebrush Vole	*Lemmiscus curtatus*		R, NSS4
892.0	Common Muskrat *	*Ondatra zibethicus*		R
894.2	Norway Rat	*Rattus norvegicus*		R
894.1	House Mouse	*Mus musculus*		R
Family: Zapodidae				
895.0	Meadow Jumping Mouse	*Zapus hudsonius*		R
895.1	Preble's Meadow Jumping Mouse	*Zapus hudsonius preblei*		R
896.0	Western Jumping Mouse	*Zapus princeps*		R
Family: Erethizontidae				
900.0	North American Porcupine *	*Erethizon dorsatum*		R, Predatory animal
Carnivores **Order: Carnivora** **Family: Canidae**				
901.0	Coyote *	*Canis latrans*		R, Predatory animal
902.0	Gray Wolf *	*Canis lupus*		R, Threatened, No season
904.0	Swift Fox	*Vulpes velox*		R, NSS4
903.0	Red Fox *	*Vulpes vulpes*		R, Predatory animal
905.0	Common Gray Fox	*Urocyon cinereoargenteus*		R
Family: Ursidae				
940.0	Black Bear *	*Ursus americanus*		R
941.0	Grizzly Bear *	*Ursus arctos*		R, NSS3
Family: Procyonidae				
906.0	Ringtail	*Bassariscus astutus*		R
907.0	Northern Raccoon *	*Procyon lotor*		R, Predatory animal
Family: Mustelidae				
908.0	American Marten *	*Martes americana*		R, NSS4
909.0	Fisher	*Martes pennanti*		R
910.0	Short-tailed Weasel (Ermine) *	*Mustela erminea*		R
911.0	Long-tailed Weasel *	*Mustela frenata*		R
913.0	Black-footed Ferret	*Mustela nigripes*		R, Endangered, NSS1
919.0	Least Weasel	*Mustela nivalis*		R, NSS3
912.0	American Mink *	*Mustela vison*		R
914.0	Wolverine	*Gulo gulo*		R, NSS3
915.0	American Badger *	*Taxidea taxus*		R
916.1	Western Spotted Skunk *	*Spilogale gracilis*		R, Predatory animal
916.0	Eastern Spotted Skunk *	*Spilogale putorius*		R, Predatory animal
917.0	Striped Skunk *	*Mephitis mephitis*		R, Predatory animal
918.0	Northern River Otter	*Lontra canadensis*		R, NSS4
Family: Felidae				
922.0	Mountain Lion (Puma) *	*Puma concolor*		R
920.0	Canada Lynx	*Lynx canadensis*		R, Threatened, NSS1
921.0	Bobcat *	*Lynx rufus*		R

Spp. Code	Common Name	Scientific Name	Doc. Type	Seasonal Status and Additional Information [a, b]
<u>Ungulates</u> **Order: Artiodactyla** **Family: Cervidae**				
930.0	Elk (Wapiti) *	*Cervus canadensis*		R
932.0	Mule Deer (Black-tailed Deer) *	*Odocoileus hemionus*		R
933.0	White-tailed Deer *	*Odocoileus virginianus*		R
931.0	Moose *	*Alces alces*		R, NSS3
Family: Antilocapridae				
935.0	Pronghorn *	*Antilocapra americana*		R
Family: Bovidae				
925.0	Bison *	*Bos bison*		R
926.0	Mountain Goat *	*Oreamnos americanus*		R
927.0	Bighorn Sheep (Mountain Sheep) *	*Ovis canadensis*		R, NSS3

APPENDIX II

LATILONGS (DEGREE BLOCKS) IN WYOMING

From: Dorn, J. L., and R. D. Dorn. 1990. Wyoming Birds. Mountain West Publishing, Cheyenne, WY. 138pp.