# 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 2010 to 14 April 2011**

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Wyoming Game and Fish Department
Wyoming Governor's Big Game License Coalition
Wyoming Governor's Endangered Species Account Funds
Wyoming Landscape Conservation Initiative
Wyoming State Legislature General Fund Appropriations

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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 2006 national survey by the U.S. Fish and Wildlife Service (http://library.fws.gov/pubs/wildlifewatching_natsurvey06.pdf) reported that, in addition to $138.5 million associated with hunting and $373.6 million for fishing, $392.5 million was added to Wyoming's economy by wildlife watchers. The State is also rich in other natural resources that contribute to Wyoming's economy such as livestock forage, timber, a variety of minerals and energy. Sometimes the best management of one or more resources can conflict with the needs of another.

Over the past few decades, public expectations of wildlife managers have diversified. Unfortunately, traditional funding sources were not sufficient to meet these new demands. Beginning in 2008, Wyoming's Legislature and former Governor Freudenthal agreed to increase funding in order 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 Governor have funded the Department's Veterinarian Services, Sage-Grouse, and Terrestrial Nongame Programs, and the Wyoming Natural Resources and Wildlife Trust. Funding of nongame efforts is a significant and progressive expansion of their support for natural resources in Wyoming. The expectation that accompanies such 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 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. Many 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 user's fees should be spent on management of non-target wildlife.

Similarly, a number of efforts have been attempted, both at the national and state levels, to allocate alternate funding for nongame wildlife conservation. Many of the same individuals contributing to Wyoming's economy through expenditures associated with hunting, fishing and wildlife watching were, no doubt, involved in intense national lobbying efforts to develop funding for nongame wildlife.

In response, 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 data needs for nongame species and to collect information that may provide an early warning of species that may be proposed for additional protections under the Endangered Species Act. Most states tended to focus SWG projects on species that would grab the attention of supporters and Congress who debate 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, wolverine and Mountain Plover. Recent SWG projects also include initial inventories of raptors in the Wyoming Range and small mammals in southwest Wyoming.

The funding provided by the Wyoming State Legislature has greatly enhanced our ability to collect information on Species of Greatest Conservation Need. Not only is State funding allowing us to greatly increase our knowledge of Species of Greatest Conservation Need distribution and abundance, it is also allowing us to expand our understanding of what is needed for effective and proactive management of those species. This funding has also allowed us to work closely with other entities, such as the University of Wyoming and the Wyoming Natural Diversity Database, 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.

# 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 personnel 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.  Mammal names follow the "Revised checklist of North American mammals north of Mexico, 2003".

# THREATENED AND ENDANGERED SPECIES

**SPOTLIGHTING FOR BLACK-FOOTED FERRETS IN THE SHIRLEY BASIN/MEDICINE BOW MANAGEMENT AREA**

STATE OF WYOMING

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

FUNDING SOURCE: United States Fish and Wildlife Service Section 6 Funds, Wyoming State Legislature General Fund Appropriations

PROJECTION DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

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

## ABSTRACT

The black-footed ferret (*Mustela nigripes*) faces numerous challenges to recovery. Diseases remain the biggest threat to the persistence of the black-footed ferret in Shirley Basin, Wyoming. Releases of black-footed ferrets were terminated in 1994 as a result of sylvatic plague and disease epizootics, which reduced abundance of its prey, the white-tailed prairie dog (*Cynomys leucurus*) within Shirley Basin. During this period, the reintroduced population was characterized by slow population growth. However, the black-footed ferret survived this bottleneck, and the population increased exponentially from 2000-2006. In 2010, we surveyed a portion of the Shirley Basin prairie dog complex as part of our annual commitment to recovery of the species and monitor the reintroduced population. Similar to previous years, we spotlighted and captured black-footed ferrets in August and September 2010. We then compared estimates of abundance for the black-footed ferret, sex and age class structure, and results of serological tests for diseases to data collected in previous years. We collected blood samples from 29 of 57 captured black-footed ferrets. Two adult females and one adult male tested positive for tularemia. All black-footed ferrets were negative for canine distemper and sylvatic plague. Using mark-recapture analyses, we estimated that 203 (95% CI: 137-270) black-footed ferrets occupied the 8,094 ha study area in 2010. This population estimate is similar to that of previous surveys, 229 (95% CI: 169-289) in 2006 and 240 (95% CI: 176-303) in 2008. Results suggest the population of black-footed ferrets in Shirley Basin continues to thrive and has stabilized within the study area.

## INTRODUCTION

In 1991, Shirley Basin, Wyoming was selected as the first reintroduction site for black-footed ferrets (*Mustela nigripes*; ferret). Shirley Basin was selected for reintroduction due to its extensive complex of white-tailed prairie dogs (*Cynomys leucurus*; prairie dog) and the high level of support from private landowners in the area. Between 1991 and 1994, 228 ferrets were released in Shirley Basin. Releases were terminated in 1994 as a result of sylvatic plague and canine distemper epizootics, which decreased abundance of prairie dogs within Primary Management Zone 1. During this period, the reintroduced ferret population was characterized by slow population growth. Few (i.e., ≤20) ferrets were located annually prior to 2000. However, spotlight surveys were conducted between 2003 and 2006. During this period we estimated an annual growth rate of 35% (Grenier et al. 2007). Survey results documented an increasing population of ferrets within the Shirley Basin/Medicine Bow prairie dog complex (Grenier et al. 2006a). Because prairie dog distribution had increased in other portions of Shirley Basin where ferrets were believed to be absent, an additional 250 ferrets were released into areas north and south of Shirley Basin during the fall and winter of 2005, 2006, and 2007 (Grenier et al. 2006b, Schell and Grenier 2007).

Primary monitoring interests have remained focus on a small portion of the prairie dog complex totaling about 8,000 ha (Grenier 2008). By 2006 the population had grown rapidly within the study area to 229 (95% CI: 169-289; Grenier et al. 2009). Although estimates were slightly higher in 2008, (240; 95% CI: 176-303) the growth rate of the population appeared to have slowed (Van Fleet and Grenier 2009). This report quantifies results of summer spotlight surveys. We compare estimates of abundance, serology results, and population structure (i.e., age, sex, and mass of captured ferrets) to previous years. We discuss the implications of our findings for recovery of the ferret in Shirley Basin, Wyoming.

## METHODS

We conducted spotlight surveys in 2010 within the same area we surveyed in 2006 and 2008. We selected specific survey routes based on available resources, personnel, and the interspersion of two-track and other roads within prairie dog colonies. We contacted all landowners for permission to trespass prior to the initiation of surveys. We used correlated density estimates (CDE) to estimated abundance of the ferret and followed recommendations developed by Grenier et al. (2009). We subdivided prairie dog colonies into sampling plots based on accessibility and assigned them to two strata based on abundance of ferrets. Sampling plots accessible only by foot were approximately 121 ha in size, while those accessible by vehicle were approximately twice as large (i.e., approximately 242 ha). Actual size of the survey plots varied due to size and shape of the prairie dog colony as well as other geographical boundaries (Grenier 2008). We did not survey colonies < 61 ha (Fig. 1). We allocated survey effort to each strata proportionally and sampled 24 plots (Fig. 2; Grenier 2008).

We surveyed from 2000 – 2300 hrs and 0100 – 0600 hrs in blocks of three consecutive nights (Grenier 2008, Grenier et al. 2009). To locate ferrets, we drove vehicles equipped with roof-mounted spotlights (Model RM 240 Blitz, Lightforce Professional Lighting Systems, Orofino, ID) along existing roads. Field personnel used a backpack spotlight unit (Walkabout Kit, Lightforce Professional Lighting Systems, Orofino, ID) to traverse portions of the colony that could not be surveyed from a vehicle.

After we located ferrets, we used an unbaited live trap to attempt to capture observed individuals (Sheets 1972). We checked traps hourly throughout the night, and removed all traps at sunrise. We transported captured ferrets to a mobile processing trailer, where we used isoflurane gas to anesthetize individuals (Kreeger et al. 1998). Ferrets were assigned to juvenile or adult age classes by palpation of the sagittal crest, examination of dentition and tooth wear, and reproductive status (Thorne et al. 1985). We marked ferrets with passive integrated transponders (PIT tags; AVID Microchip I.D. Systems, Folsom, LA) and hair dye (Grenier 2008). We collected blood samples when possible. Following a brief recovery period, we returned the ferret to the burrow from which it was captured. We sent blood samples to the Wyoming Game and Fish Department Wildlife Veterinary Laboratory to test for the presence of tularemia (*Francisella tularemia*), canine distemper virus (CDV), and sylvatic plague antibodies.

We used the Huggins conditional likelihood models (Huggins 1989, 1991), available in program MARK (White and Burnham 1999), to analyze capture histories for ferrets and estimate capture ($p$) and recapture ($c$) probabilities. Sampling plot data were pooled to obtain model-based estimates for each plot (Bowden et al. 2003, Grenier et al. 2009). Models with full heterogeneity were not included due to small sample sizes. We used an information theoretic approach and based model selection on Akaike's Information Criterion adjusted for small sample sizes ($AIC_{\mathbf{c}}$; Burnham and Anderson 2002). We investigated the effects of moonlight, effort, wind speed, relative humidity, barometric pressure and temperature after standardizing the covariates (Franklin 2001). We used equations and recommendations provided by Grenier (2008), and Bowden et al. (2003), to calculate variance, var $(\hat{N}_R)$, for the estimated total population size.

## RESULTS

We spent 556.25 person•hrs, during 9 nights, spotlighting for ferrets in August and September (Table 1). We observed 93 ferrets a total of 169 times, a discrete ferret approximately every 5.9 person•hrs, and a minimum of 27 litters. Tables for total observed ferrets and litters are available from the Nongame Mammal Biologist, Wyoming Game and Fish Department, 260 Buena Vista, Lander, WY 82520.

We captured 57 ferrets, 5 of which, all females, were recaptures from previous years (Table 2). We collected blood samples from 29 of the captured ferrets. Three recaptures tested positive for tularemia (Table 3). Blood samples were negative for all other pathogens. We detected no abnormalities and very few (i.e., ≤10) ectoparasites (i.e., fleas and ticks) on most ferrets handled in 2010. The sex and age classes of captured ferrets were similar among years, with juvenile males captured most often and adult males least (Fig. 3). Mean body weights among years were also similar, with adult males having the largest variation among years (i.e., 70 g) and adult females the least (i.e., 7 g; Figs. 4-7).

Our mark-recapture estimates were derived from a candidate model set which included 12 closed-capture models. The best model did not include a behavioral response or timing effect (i.e., we estimated *p* and *c* simultaneously). Using our mark-recapture estimates, we estimated the density of ferrets on individual sampling plots in 2010 to be between 0 and 0.2 ferrets per ha. Mean density of ferrets for the high-density stratum was 0.03 (SE = 0.007) ferrets per ha and for the low-density stratum was 0.01 (SE = 0.006) ferrets per ha. We estimated 203 (95% CI: 137-270) ferrets within the 8,094 ha study area (Fig. 3; Table 4). Observations of species other than ferrets were entered into the Wyoming Game and Fish Department's Wildlife Observation System and are available from the Nongame Mammal Biologist.

## DISCUSSION

Ferrets continue to be in good physical and reproductive condition. All adult females we observed showed signs of lactation or were in the presence of juveniles. We failed to detect any physical abnormalities for any ferrets captured in 2010. Serology results also supported our conclusions that this population is healthy and doing well. Our results showed little evidence of impacts as a result of infectious diseases. Undoubtedly, infectious diseases remain a major biological obstacle facing the recovery of the ferret; however, at Shirley Basin the impacts appear to be minimal in recent years. What the impacts of these stochastic events will be given the current distribution of ferrets is unknown; however, in the absence of major epizootics, ferrets and prairie dogs are thriving in Shirley Basin. Three ferrets tested positive for Tularemia in 2010. This is similar to previous years. Undoubtedly, a small fraction of the population will always show titers for this common disease; however, we believe the impacts to the population are likely minimal and not a reason for concern at this time.

We now have three sets of demographic data spanning six years for ferrets in Shirley Basin. Notably, capture results were similar among all years as were the proportion of individuals within each age- and sex-class. Juvenile males were captured more often than all other groups. These results are consistent with previous years and results reported by Buskirk and Lindstedt (1989) who determined that mustelids commonly exhibit sex-biased capture-rates that favor juvenile males. Juvenile males also exhibited more variation in body mass than all other groups. Adult females, on the other hand, had less variation in body mass among years, suggesting the high energy costs of raising a litter likely constrain females to the minimum range of expected weights.

Although we observed a slight decrease in the growth rate of this population compared to previous surveys, and our population estimate was lower than previous years, the population estimate for 2010 still falls well within the upper and lower confidence limits of previous years, suggesting there is no change in population size. Remarkably, these data show strong evidence of the population transitioning from exponential growth to logistical growth. Consequently, we hypothesize that we will continue to record minor fluctuations in the population size in future years within the study area unless a catastrophic stochastic event occurs. Notably, there remain plenty of available and suitable habitats outside of the study area to which colonizing ferrets can disperse.

## ACKNOWLEDGEMENTS

Special thanks are extended to the Heward Ranch and Q Creek Land and Cattle Company, who generously allowed access to their property for black-footed ferret spotlight surveys during the summer of 2010. We would also like to recognize E. Furtaw who graciously digitized all our survey routes and assisted with spotlight surveys. And finally, a huge thanks to the following Wyoming Game and Fish Department personnel, C. Atkinson, K. Blomberg, N. Cudworth, N. Hogberg, C. Howard, R. Lawrence, C. Matthews, H. Meador, C. Moan, T. Riedle, L. Tomb, Z. Walker, Z. Wallace, D. Wilckens, and M. Wilson, as well as the following volunteers, J. Leal, C. Nebbeling and D. Rush 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, for which we are extremely grateful.

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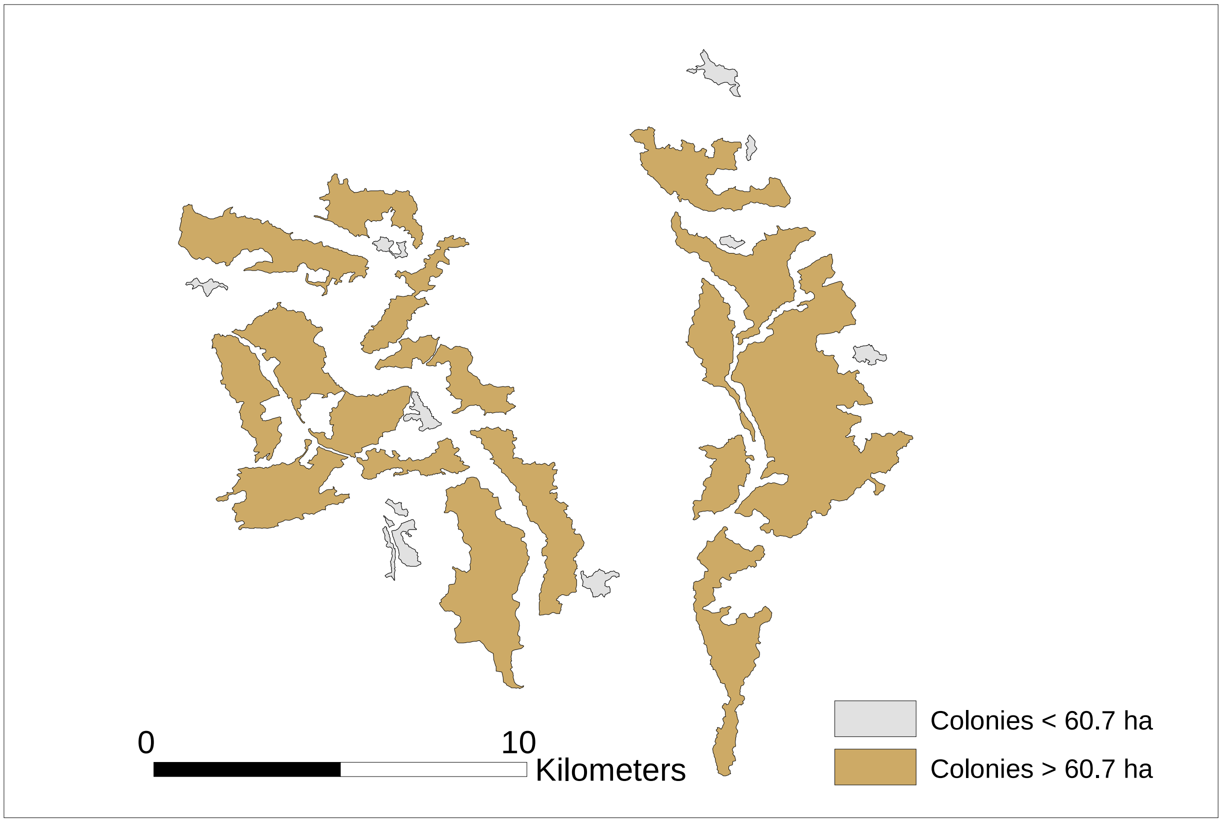


Figure 1. Spatial arrangement of white-tailed prairie dog colonies (*Cynomys leucurus*) that were spotlighted for black-footed ferrets (*Mustela nigripes*) in Shirley Basin, Wyoming, 2010. Colonies ≤61 ha in size were not surveyed. Not all colonies surveyed contribute to the abundance estimator.

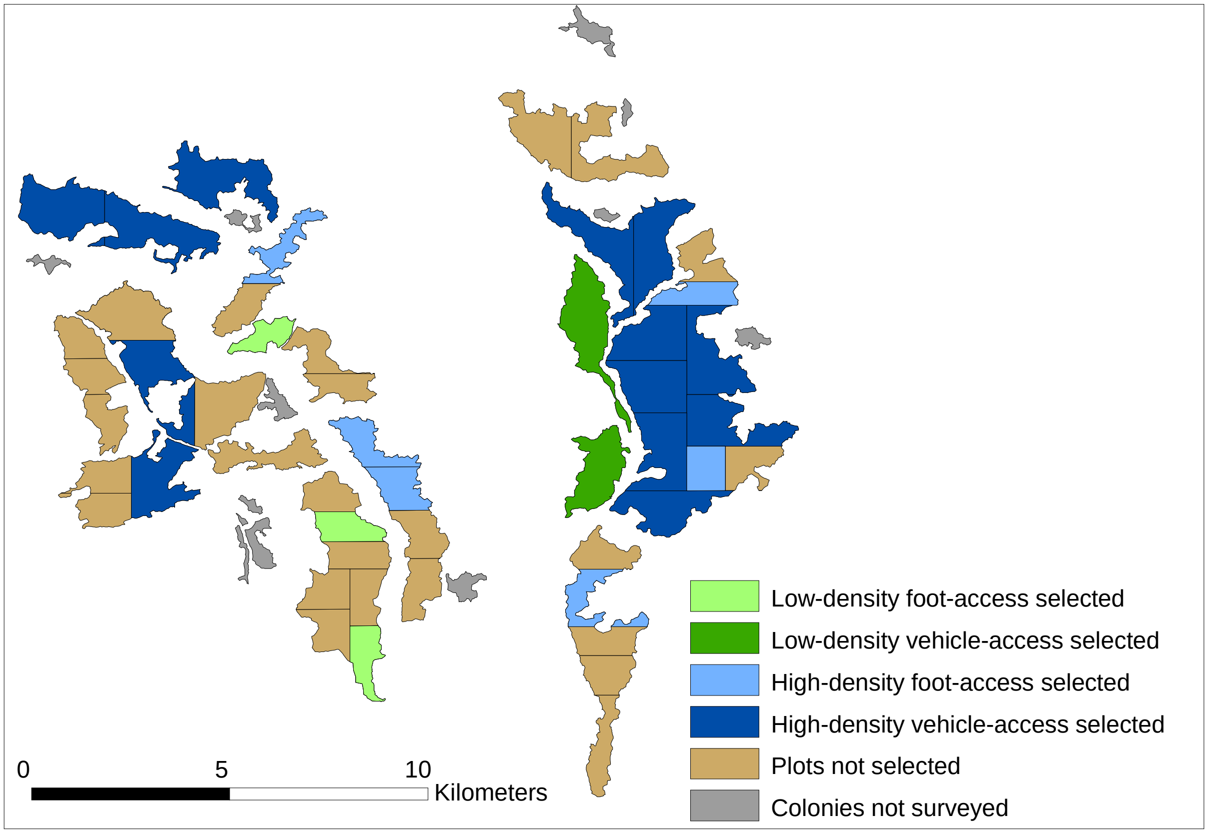


Figure 2. Distribution of survey plots that were spotlighted for the presence of black-footed ferrets (*Mustela nigripes*) in Shirley Basin, Wyoming 2010. Colonies ≤61 ha in size were not surveyed, and no inference to these colonies is made.

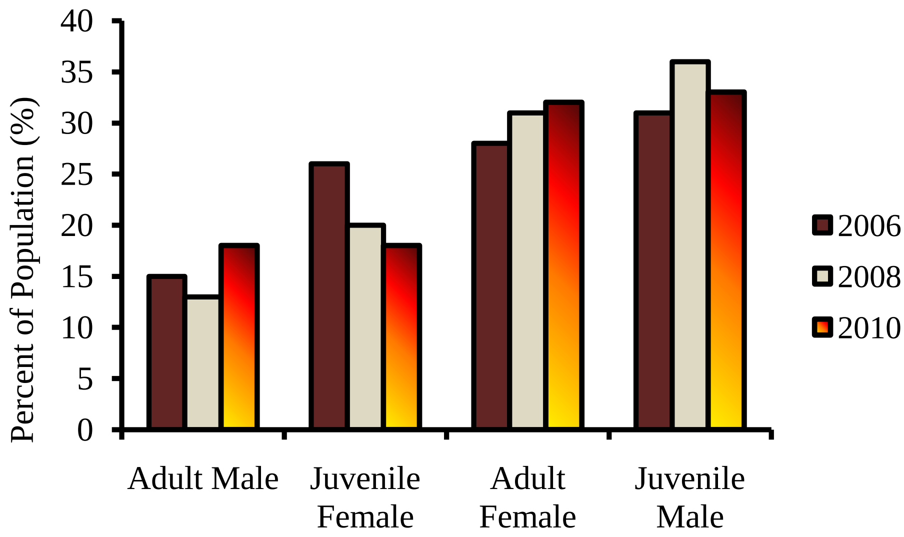


Figure 3. Proportions of black-footed ferrets (*Mustela nigripes*) captured during summer spotlight surveys in Shirley Basin, Wyoming were similar among three survey years. Notably, juvenile males were captured most frequently, while adult males were captured approximately half as often.

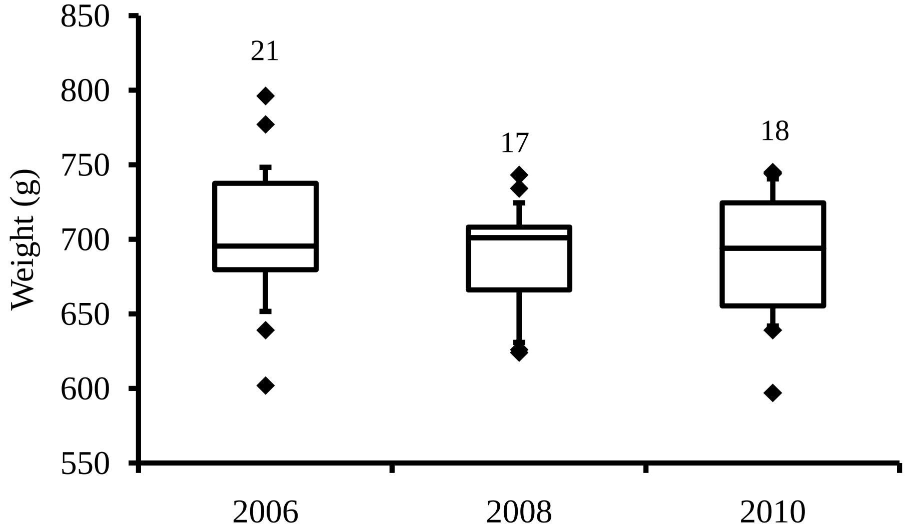


Figure 4. Body weights of adult female black-footed ferrets (*Mustela nigripes*) captured during 2006, 2008, and 2010 spotlight surveys in Shirley Basin, Wyoming. Mean body weights were similar among years, 695.5 g (SE =10.53) in 2006, 701 g (SE = 8.65) in 2008, and 694 g (SE = 10.10) in 2010. The line within the box marks the median, the box represents 50%, and the horizontal bars represent 90% of all observations around the median. The circles represent observations outside of the $10^{th}$ and $90^{th}$ percentiles. Sample size is indicated above each box.

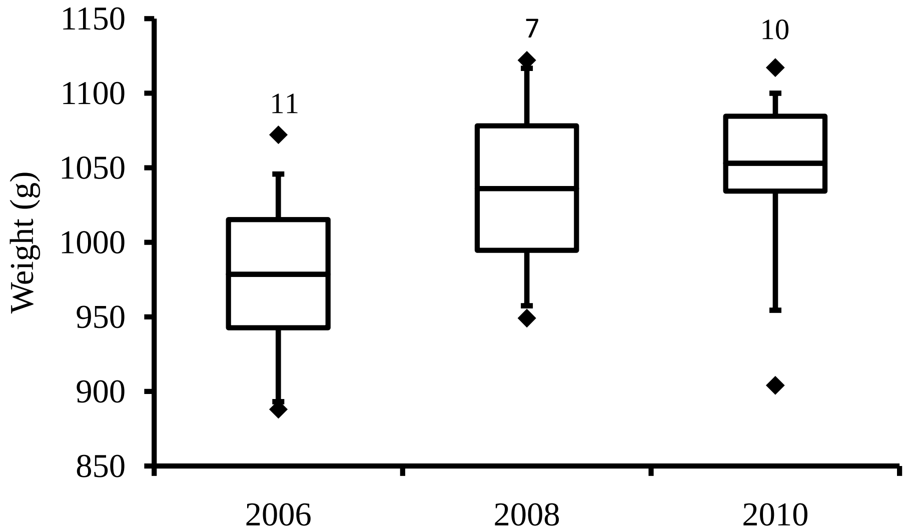


Figure 5. Body weights of adult male black-footed ferrets (*Mustela nigripes*) captured during 2006, 2008, and 2010 spotlight surveys in Shirley Basin, Wyoming. Mean body weights were similar among years, 983 g (SE = 16.07) in 2006, 1036 g (SE = 25.06) in 2008, and 1053 g (SE = 20.56) in 2010. The line within the box marks the median, the box represents 50%, and the horizontal bars represent 90% of all observations around the median. The circles represent observations outside of the 10$^{th}$ and 90$^{th}$ percentiles. Sample size is indicated above each box.

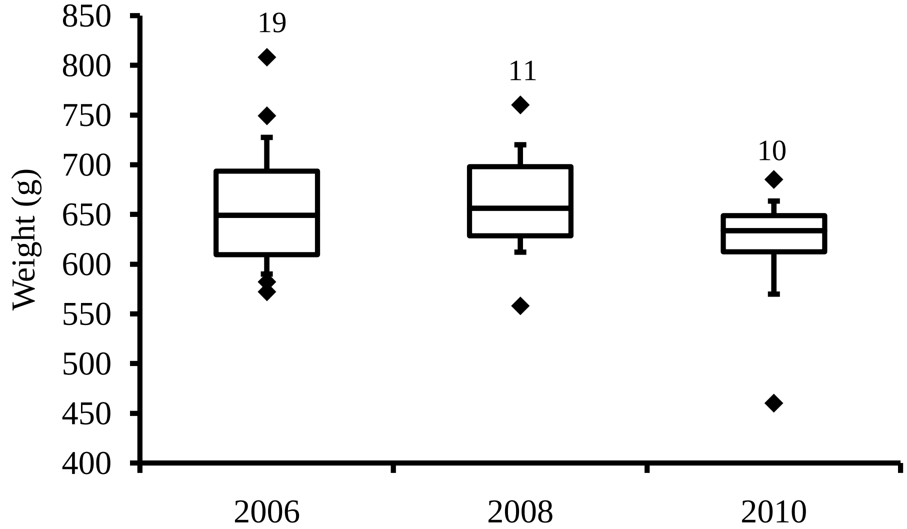


Figure 6. Body weights of juvenile female black-footed ferrets (*Mustela nigripes*) captured during 2006, 2008, and 2010 spotlight surveys in Shirley Basin, Wyoming. Mean body weights were similar among years, 649 g (SE =13.97) in 2006, 656 g (SE =16.89) in 2008, and 633.5 g (SE = 19.66) in 2010. The line within the box marks the median, the box represents 50%, and the horizontal bars represent 90% of all observations around the median. The circles represent observations outside of the $10^{th}$ and $90^{th}$ percentiles. Sample size is indicated above each box.

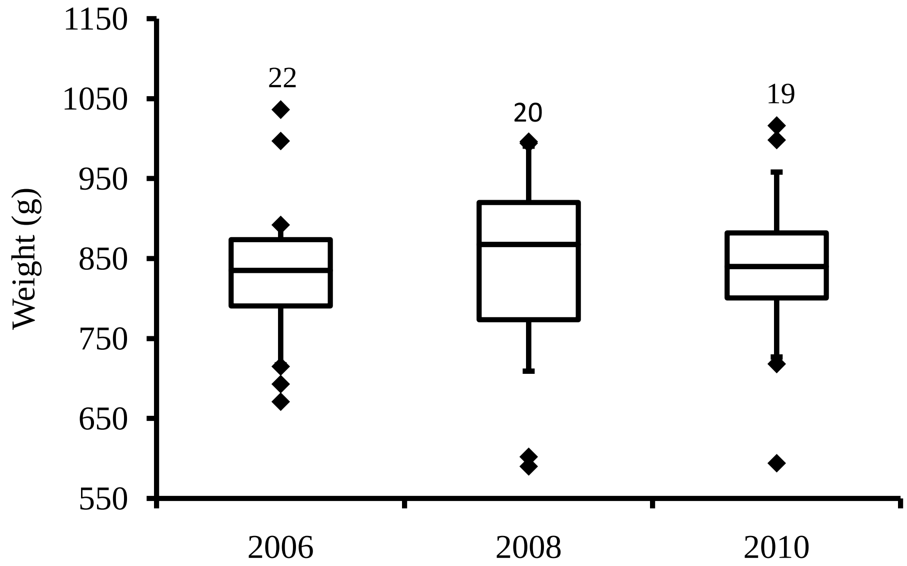


Figure 7. Body weights of juvenile male black-footed ferrets (*Mustela nigripes*) captured during 2006, 2008, and 2010 spotlight surveys in Shirley Basin, Wyoming. Mean body weights were similar among years, 835 g (SE = 18.64) in 2006, 867.5 g (SE = 26.53) in 2008, and 840 g (SE = 22.58) in 2010. The line within the box marks the median, the box represents 50%, and the horizontal bars represent 90% of all observations around the median. The circles represent observations outside of the 10$^{th}$ and 90$^{th}$ percentiles. Sample size is indicated above each box.

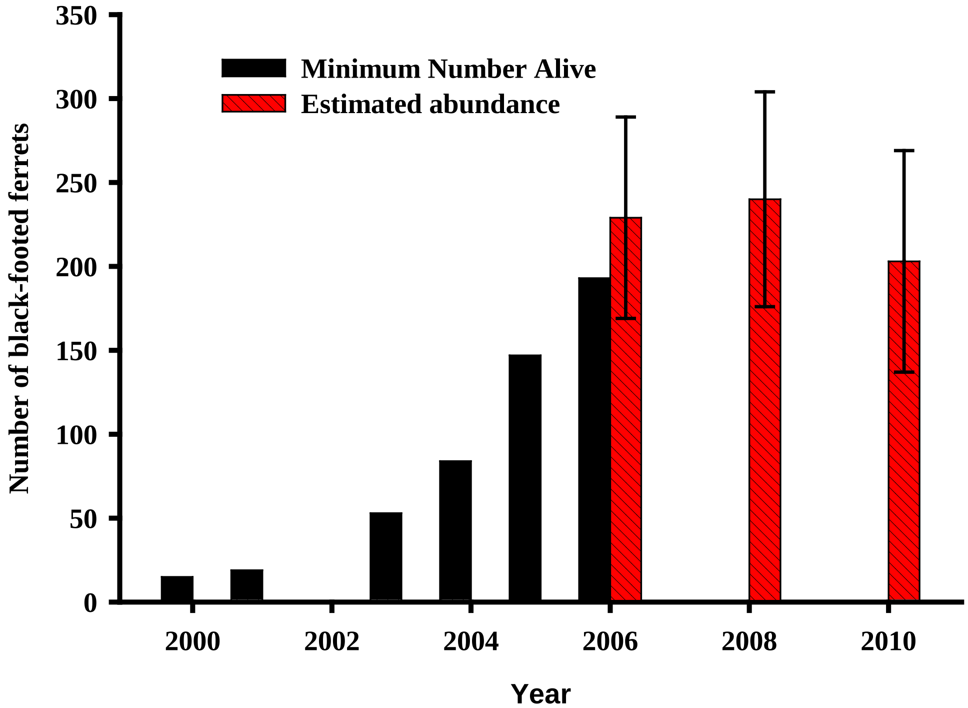


Figure 8. Abundance of black-footed ferrets (*Mustela nigripes*) in Shirley Basin, Wyoming, 2000-2010. In 2006, abundance was estimated at 229 (95% CI: 169-289), in 2008 at 240 (95% CI: 176-303), and in 2010 at 203 (95% CI: 137-270). Abundance surveys were not conducted in 2002, 2007, or 2009.

Table 1. Survey effort expended while spotlighting for black-footed ferrets (*Mustela nigripes*) in Shirley Basin, Wyoming during the summer of 2010. A total of 556.25 hours of spotlighting was accomplished by vehicle and on foot through white-tailed prairie dog (*Cynomys leucurus*) towns.

| Survey Type | Aug. 17 - 20 | Aug. 24 - 27 | Aug. 31 -Sept. 3 | Total |
|---|---|---|---|---|
| Vehicle | 72.25 | 65.75 | 87 | 225 |
| Foot | 91.5 | 120.5 | 119.25 | 331.25 |
| Total | 163.75 | 186.25 | 206.25 | 556.25 |

Table 2. Capture details for 57 black-footed ferrets (*Mustela* nigripes) we captured in Shirley Basin, Wyoming 2010. Blood samples were taken from 29 of the captured black-footed ferrets. ***** = Recapture from 8/19/2010.

| Capture No. | Transponder no. - head | | | Capture date | Colony no. | Observer | Stud book no. | Sex | Age |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 95 | 806 | 872 | 8/17/2010 | 556-7 | D. Wilckens | SB1001 | M | J |
| 2 | 95 | 816 | 587 | 8/17/2010 | 556-7 | D. Wilckens | SB0901 | F | A |
| 3 | 95 | 818 | 771 | 8/17/2010 | 556-4 | L. Van Fleet | SB0902 | F | A |
| 4 | 95 | 826 | 377 | 8/17/2010 | 556-10 | N. Cudworth | SB0903 | M | A |
| 5 | 95 | 820 | 311 | 8/17/2010 | 556-7 | D. Wilckens | SB1002 | F | J |
| 6 | 95 | 809 | 017 | 8/17/2010 | 556-8 | L. Tomb | SB1003 | M | J |
| 7 | 95 | 796 | 275 | 8/17/2010 | 556-4 | L. Van Fleet | SB1004 | M | J |
| 8 | 95 | 831 | 014 | 8/17/2010 | 556-2 | T. Riedle | SB0904 | M | A |
| 9 | 95 | 816 | 631 | 8/17/2010 | 556-2 | T. Riedle | SB0905 | M | J |
| 10 | 95 | 826 | 365 | 8/17/2010 | 556-8 | L. Tomb | SB1005 | F | J |
| 11 | 95 | 812 | 047 | 8/18/2010 | 556-10 | N. Cudworth | SB0825 | F | A |
| 12 | 95 | 832 | 291 | 8/18/2010 | 556-3 | N. Hogberg | SB0906 | M | A |
| 13 | 95 | 829 | 332 | 8/19/2010 | 556-4 | L. Van Fleet | SB1006 | M | J |
| 14 | 95 | 802 | 059 | 8/19/2010 | 556-4 | L. Van Fleet | SB1007 | F | J |
| 15 | 95 | 827 | 634 | 8/19/2010 | 556-4 | L. Van Fleet | SB0827 | F | A |
| 16 | 95 | 812 | 775 | 8/19/2010 | 556-5 | D. Wilckens | SB0907 | M | A |
| 17 | 95 | 821 | 126 | 8/19/2010 | 556-7 | D. Wilckens | SB0908 | F | A |
| 18 | 95 | 829 | 786 | 8/19/2010 | 556-5 | M. Grenier | SB1008 | M | J |
| 19 | 95 | 815 | 855 | 8/19/2010 | 556-10 | N. Cudworth | SB1009 | M | J |
| 20 | 95 | 819 | 830 | 8/19/2010 | 556-6 | H. Meador | SB0909 | F | A |
| 21 | 95 | 831 | 770 | 8/19/2010 | 556-8 | L. Tomb | SB0910 | F | A |
| 22 | 95 | 800 | 093 | 8/19/2010 | 556-8 | L. Tomb | SB1010 | M | J |
| 23 | 95 | 795 | 583 | 8/19/2010 | 556-7 | D. Wilckens | SB1011 | M | J |
| 24 | 95 | 792 | 126 | 8/19/2010 | 556-7 | D. Wilckens | SB1012 | M | J |
| 25 | 95 | 794 | 272 | 8/24/2010 | 554-2 | L. Van Fleet | SB1013 | M | J |
| 26 | 95 | 793 | 803 | 8/24/2010 | 554-2 | L. Van Fleet | SB0760 | F | A |
| 27 | 95 | 827 | 024 | 8/24/2010 | 554-1 | J. Leal | SB0911 | F | A |

Table 2. Continued.

| Capture No. | Transponder no. - head | | | Capture date | Colony no. | Observer | Stud book no. | Sex | Age |
|---|---|---|---|---|---|---|---|---|---|
| 22 | 95 | 800 | 093 | 8/19/2010 | 556-8 | L. Tomb | SB1010 | M | J |
| 23 | 95 | 795 | 583 | 8/19/2010 | 556-7 | D. Wilckens | SB1011 | M | J |
| 24 | 95 | 792 | 126 | 8/19/2010 | 556-7 | D. Wilckens | SB1012 | M | J |
| 25 | 95 | 794 | 272 | 8/24/2010 | 554-2 | L. Van Fleet | SB1013 | M | J |
| 26 | 95 | 793 | 803 | 8/24/2010 | 554-2 | L. Van Fleet | SB0760 | F | A |
| 27 | 95 | 827 | 024 | 8/24/2010 | 554-1 | J. Leal | SB0911 | F | A |
| 28 | 95 | 791 | 768 | 8/24/2010 | 559-2 | Z. Wallace | SB0912 | F | A |
| 29 | 95 | 812 | 884 | 8/24/2010 | 559-3 | D. Wilckens | SB0913 | F | A |
| 30 | 95 | 832 | 616 | 8/24/2010 | 558 | K. Blomberg | SB1014 | M | J |
| 31 | 95 | 809 | 818 | 8/24/2010 | 554 | J. Leal | SB1015 | F | J |
| 32 | 95 | 817 | 022 | 8/24/2010 | 554 | J. Leal | SB1016 | F | J |
| 33 | 102 | 821 | 598 | 8/24/2010 | 555-1 | C. Atkinson | SB0914 | F | A |
| 34 | 102 | 855 | 088 | 8/24/2010 | 558 | K. Blomberg | SB1017 | M | J |
| 35 | 102 | 823 | 828 | 8/24/2010 | 559-1 | Z. Walker | SB0915 | F | A |
| 36 | 102 | 807 | 530 | 8/24/2010 | 559-3 | D. Wilckens | SB1018 | M | J |
| 37* | 95 | 827 | 634 | 8/25/2010 | 554-1 | J. Leal | SB0827 | A | F |
| 38 | 95 | 820 | 541 | 8/25/2010 | 559-2 | D. Wilckens | SB1019 | F | J |
| 39 | 102 | 804 | 806 | 8/25/2010 | 559-2 | D. Wilckens | SB0916 | F | A |
| 40 | 102 | 808 | 848 | 8/25/2010 | 554-2 | L. Van Fleet | SB0917 | M | A |
| 41 | 102 | 836 | 846 | 8/25/2010 | 559-1 | Z. Wallace | SB1020 | M | J |
| 42 | 102 | 852 | 875 | 8/26/2010 | 559-1 | C. Moan | SB1021 | M | J |
| 43 | 102 | 805 | 103 | 8/26/2010 | 559-1 | C. Moan | SB1022 | M | J |
| 44 | 102 | 806 | 312 | 8/26/2010 | 559-2 | Z. Wallace | SB1023 | M | J |
| 45 | 102 | 851 | 594 | 8/26/2010 | 558-1 | C. Atkinson | SB0918 | M | A |
| 46 | 102 | 851 | 326 | 8/26/2010 | 559-1 | C. Moan | SB1024 | M | J |
| 47 | 102 | 814 | 366 | 8/26/2010 | 559-1 | C. Moan | SB0919 | F | A |
| 48 | 102 | 839 | 527 | 8/31/2010 | 527-2 | N. Cudworth | SB1025 | F | J |

Table 2. Contniued.

| Capture No. | Transponder no. - head | | | Capture date | Colony no. | Observer | Stud book no. | Sex | Age |
|---|---|---|---|---|---|---|---|---|---|
| 49 | 102 | 860 | 122 | 9/1/2010 | 519-1 | M. Wilson | SB1026 | F | J |
| 50 | 102 | 838 | 800 | 9/1/2010 | 527-2 | N. Cudworth | SB0920 | M | A |
| 51 | 95 | 830 | 565 | 9/1/2010 | 529-1 | T. Riedle | SB0751 | F | A |
| 52 | 102 | 838 | 091 | 9/2/2010 | 520-2 | L. Van Fleet | SB1027 | F | J |
| 53 | 102 | 840 | 105 | 9/2/2010 | 529-1 | T. Riedle | SB1028 | M | J |
| 54 | 102 | 850 | 357 | 9/2/2010 | 550-2 | L. Van Fleet | SB0921 | M | A |
| 55 | 102 | 818 | 380 | 9/2/2010 | 550-2 | L. Van Fleet | SB0922 | M | A |
| 56 | 95 | 831 | 372 | 9/2/2010 | 510-2 | D. Wilckens | SB0754 | F | A |
| 57 | 102 | 844 | 077 | 9/2/2010 | 529-1 | T. Riedle | SB1029 | F | J |
| 58 | 102 | 847 | 516 | 9/2/2010 | 519-1 | M. Wilson | SB1030 | M | J |

Table 3. Test results and their interpretation for 29 blood samples we collected from black-footed ferrets (*Mustela nigripes*) captured in Shirley Basin, Wyoming 2010.

| Disease | Number tested | Number positive | Stud book no. | Titer level | Age | Sex | Previously vaccinated |
|---|---|---|---|---|---|---|---|
| Canine Distemper | 29 | 0 | - | - | - | - | - |
| Sylvatic Plague | 29 | 0 | - | - | - | - | - |
| Tularemia | 29 | 3 | 805R /(0754) | 1:256 | A | F | No |
| | | | 0915 | 1:256 | A | F | No |
| | | | 0906 | 1:512 | A | M | No |

Table 4. Population estimates for black-footed ferrets (*Mustela nigripes*) in Shirley Basin, Wyoming using correlated density estimate developed by Grenier (2008). Estimates were developed for the same area and were similar among years.

| Survey Year | $\hat{N}$ (Estimated population size) | Lower CI (95 %) | Upper CI (95 %) | High strata density (No. per ha) | Low strata density (No. per ha) |
|---|---|---|---|---|---|
| 2006 | 229 | 169 | 289 | 0.033 | 0.017 |
| 2008 | 240 | 176 | 303 | 0.030 (SE=0.001) | 0.026 (SE=0.002) |
| 2010 | 203 | 137 | 269 | 0.029 (SE=0.002) | 0.013 (SE=0.002) |

# SPECIES OF GREATEST CONSERVATION NEED

# SPECIES OF GREATEST CONSERVATION NEED - BIRDS

## ROCKY MOUNTAIN POPULATION OF TRUMPETER SWANS – WYOMING FLOCK

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Trumpeter Swan

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations, Wyoming Governor's Endangered Species Account Funds, United States Fish and Wildlife Service Cooperative Agreements

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Susan Patla, Nongame Biologist

## ABSTRACT

Since the late 1980s, the Wyoming Game and Fish Department has been actively involved in monitoring and managing Trumpeter Swans (*Cygnus buccinator*). Trumpeter Swans are one of the rarest avian species that nests in Wyoming and are classified as a Species of Greatest Conservation Need with Native Species Status of 2 by the Wyoming Game and Fish Department. Monitoring efforts for this species are coordinated with U.S. Fish and Wildlife Service, Pacific Flyway Council, and Idaho and Montana because year-round resident Trumpeter Swans in Wyoming comprise part of the historic population that nests in the Greater Yellowstone area. We completed four survey flights during 2010 and winter 2011 to collect data on total number of adults and young detected in summer and winter, and to document occupancy and productivity of all known nest sites. In 2010, we also obtained funding from U.S. Fish and Wildlife Service to conduct an extended fall aerial survey. We counted a record number of resident Trumpeter Swans outside of Yellowstone National Park (i.e., $n$ = 143, adults and 48 mature young) and documented the highest number of occupied nests since we initiated surveys in Wyoming ($n$ = 37). This included finding seven pairs of Trumpeter Swan at new locations. We also counted a record number of wintering birds in February 2011 ($n$ = 1,208). Growth of the resident population of Trumpeter Swans that nest in Wyoming can be attributed to the Wyoming Game and Fish Department's range expansion efforts in the 1990's in the Green River Basin (Patla and Oakleaf 2004). To accommodate the growing number of swans in this area, we initiated a habitat project in 2004 in the Green River Basin which focused on cooperating with landowners to develop shallow-water wetland ponds that provided additional summer habitat for this species and other wildlife associated with this rare habitat type (Patla and Lockman 2004, Lockman 2005). We obtained funding to initiate construction of a new pond and island for nesting on a private reservoir near Boulder, Wyoming in fall 2010. We also received a grant to construct a dike and improve vegetation at two older wetland projects in the Pinedale area. Finally, we monitored ponds that were constructed in previous years to document growth of vegetation and use by other wildlife species.

## INTRODUCTION

This report summarizes management activities and monitoring data for Trumpeter Swans (*Cygnus buccinator*; swan) in Wyoming for the 2010 nesting season and the 2010-2011 winter season. The swan is designated a Species of Greatest Conservation Need (SGCN) with Native Species Status ranking NSS2 (WGFD 2010). Although swans were never listed under the Endangered Species Act of 1973, they have been a focal management species since the establishment of Red Rock Lakes National Wildlife Refuge in Montana in 1932. This refuge was created to conserve approximately 70 swans in the Greater Yellowstone Area (GYA) which were believed to be the last remaining swans in the world. Due to conservation efforts, the number of swans in the GYA increased to >600 by the 1950's (USFWS 1998). However, the population has fluctuated since that time and total number of adult birds is currently <400 (Olson 2010). The Pacific Flyway Council coordinates management of this species and has designated swans that nest and reside year-round in the GYA including western Wyoming as the Tri-State Area Flocks (TSAF). The TSAF are managed as part of the U.S. segment of the Rocky Mountain Population (RMP) of swans which includes those that nest in interior Canada and migrate south to over-winter in the GYA (USFWS 1998). The Wyoming Game and Fish Department (Department) coordinates with the U.S. Fish and Wildlife Service (USFWS) Mountain-Prairie Region Migratory Bird Office, and the states of Idaho and Montana to census the number of mature swans and young of the year (i.e., cygnets) in the GYA. Surveys are conducted twice annually using aerial surveys in September and February. In addition to counts, the Department determines occupancy and productivity of all known nest sites in Wyoming using a combination of aerial and ground surveys. A large number of agency biologists and volunteers provide data for this effort; a list of individuals can be found in the acknowledgements section. Since the late 1980s, the Department has worked to expand summer and winter distribution of swans in Wyoming (Patla and Oakleaf 2004). These efforts have established many new nesting pairs in the Green River Basin. Since 2004, the Department has cooperated with willing landowners to restore and create summer habitat in the Upper Green River Basin to accommodate this expanding population. The Department is a member of the Greater Yellowstone Trumpeter Swan Working Group, consisting of state and federal agencies, non-government organizations and interested citizens. The working group meets annually in October to review and discuss productivity trends, as well as to coordinate management actions.

## METHODS

We conducted a minimum of four surveys from a fixed- wing airplane to collect data on swans in western Wyoming. All aerial surveys in 2010 were conducted in cooperation with Sky Aviation using a Scout airplane. Flying elevation averaged 30-70 m above ground level depending on terrain and surface winds. Flight speed was between 135-160 kph. During the survey, the observer counted white birds (i.e., adults and sub-adults) and gray cygnets. We surveyed all known nest sites on 7-8 June to determine occupancy and again on 6 July to count number of young hatched (i.e., cygnets) in the Snake River, Salt River and Green River drainages. Additional observations were made at some sites in the upper Snake River Basin during flights for molting geese (i.e., 29 June; *Branta* spp.) and grizzly bears (i.e., 5 August; *Ursus arctos*). For the annual fall GYA coordinated survey flight, the USFWS Mountain-Prairie Region Migratory Bird Office provided additional funding to expand survey efforts in western Wyoming because 2020 was the Pacific Flyway Five Year Trumpeter Swan Continental Survey. We conducted aerial surveys for a total of 18.3 hours on 13, 15, and 16 September. Efforts were expanded to include Henrys Fork, Blacks Fork, Big Sandy River, Farson area, and Wind River. We conducted the winter survey on 2 and 11 February 2011 to census swans in the Snake, Salt and Green River drainages. We presented survey results to the Greater Yellowstone Trumpeter Swan Working Group in West Yellowstone on 13-14 October 2010. The USFWS Mountain-Prairie Region Migratory Bird Office produced two reports summarizing results for the coordinated RMP surveys (Olson 2010, 2011).

We also monitored three wetland projects completed in the Green River Basin to determine growth of vegetation and use by wildlife during August 2010. We established photo points to document growth of vegetation along the perimeter of ponds and recorded all wildlife we observed. We conducted additional waterfowl surveys during the fall migration period. Private landowners also provided observational data of wildlife species. We also continued to work with with private landowners and funding programs to plan and obtain funding for wetland ponds in the Green River Basin. Results from the Trumpeter Swan Summer Habitat Project were presented to the Wyoming Wildlife and Natural Resource Trust Board and the Wyoming Landscape Conservation Initiative Sublette County working group.

**RESULTS**

During February 2011, we counted a total of 1,041 swans wintering in Wyoming outside of Yellowstone National Park (YNP): 812 white birds (i.e., yearlings and older age classes) and 229 cygnets (Table 1). This represents the highest winter count since records were kept in 1967. The number of wintering swans in Wyoming has increased 7.0% per year between 1972 and 2010 ($P < 0.01$; Olson 2011). Overall for the TSAF, number of wintering swans has increased 5.7% in the GYA during this same time period. We counted a record high number of 145 adults and 48 cygnets during expanded fall survey including YNP (Table 2) which represents a 44% increase from the previous year. Number of swans in Wyoming (1993-2009) has increased by 1.3% ($P = 0.05$) for white birds and 8.4% ($P < 0.01$) for cygnets (Olson 2010). However, in the traditional Snake River core area (1999-2010), number of swans has declined by 0.7% annually ($P = 0.53$). In the Green River expansion area, however, the number of swans has increased by 6.8% annually ($P = 0.27$). Overall the TSAF fall count represented a 10.6% increase from the previous year. TSAF have shown a slight annual increase of 2.0% for white birds ($P < 0.01$) but not a significant trend in cygnets (increase of 2.6%, $P = 0.17$) between 1993 and 2010 (Olsen 2010).

The number of nest sites that were occupied, the number of nesting pairs, and number of young hatched and fledged in Wyoming outside of YNP in 2010 exceeded 10-year averages for 2000-2009 (Table 3). The total number of young fledged ($n = 48$) was the second highest on record for Wyoming. Swans in the Green River Basin accounted for 75% of the young fledged

(Fig 1; Table 4). Number of occupied sites and nesting pairs in the Green River Basin now exceeds those in the Snake River core area.
We present results for specific nest for occupancy and productivity in Table 5 for all known swan nests in Wyoming outside of YNP. In the fall expanded survey area, we found three pairs at new locations including one pair in the Farson area with two young and two pairs without young in the Wind River drainage (i.e., Dinwoody Lake, Lake Julia). Four pairs were found at new sites in the Pinedale area including two near Daniel, Wyoming, one pair with young on the New Fork River, and one pair on the East Fork. Single brids were recorded at Eden Reservoir and, for the first time, on the Green River near the city of Green River, Wyoming.

We present locations of current Trumpeter Swan nest sites and wetland habitat project sites in the Green River Basin in Figure 2. Work completed in 2010 for the ongoing Trumpeter Swan Summer Habitat Project in the Green River Basin included the construction of a new wetland pond of approximately 2.5 ha for swans during fall and winter 2010-2011 on a private ranch near Boulder, Wyoming. On this same ranch, a nesting island was also constructed for nesting on an older reservoir where non-breeding swans have been observed for many years. Funding was obtained for this project through the Wyoming Wildlife and Natural Resource Trust and the Wyoming Landscape Conservation Initiative. We initiated planning efforts for a new project on an adjacent ranch in the New Fork River drainage. We received an additional grant from National Fish and Wildlife Foundation in October 2010 to improve dikes and install pre-planted vegetation mats on two ponds that were constructed in 2009 in the Pinedale area.

In August 2010, we completed monitoring surveys of wetland ponds including the Budd Friendly Pond in Big Piney, the Rimfire Ranch wetland pond complex in Daniel, and the Fenn Duck Creek Pond south of Cora, Wyoming to set up monitoring photo points for vegetation growth and to document vegetation establishment and wildlife use of these projects completed for the Department's Trumpeter Swan Summer Habitat Project in the Green River Basin.

## DISCUSSION

During the winter of 2010-2011, we documented a record number of swans in Wyoming. Fifty percent of the swans occurred in the Snake River Basin and associated wetlands (Table 1). Only 12.6% of these swans were resident Snake River core area birds ($n$ = 76) with the majority being swans that migrated from Canada or elsewhere. The high number of wintering swans in 2011 may be a single season event but is consistent with the increase in number of wintering swans documented in western Wyoming over the past decade. We hypothesize that this increase in swans that winter in Wyoming could negatively impact swans that reside and breed in Wyoming if habitat is degraded. The observed decline of numbers of breeding swans in the Snake River core area could be an indication that migratory swans are negatively impacting available late winter and early spring habitat needed by resident swans prior to the opening up of nest sites later in spring. Generally, most migrant swans depart by the end of March leaving resident swans to forage on remaining aquatic vegetation until additional wetlands thaw. Especially in cold springs when the thaw can be delayed until late May or early June, available aquatic vegetation may be scarce as a result of increased foraging pressure from migrant swans.

Conversely, increasing productivity in the Green River expansion area in Wyoming indicates that winter and early spring conditions in the Green River drainage likely provide adequate The expanded fall survey effort in 2010 provided an opportunity to locate swans in new areas of Green River and Wind River Basins. It is important that we continue to find new sites to identify types of wetland that are attractive to pioneering swans and to determine which sites are successful over time. While the total number of swans in Wyoming in 2010 was the highest on record since counts began in the late 1960s, the swan remains one of the rarest breeding birds in Wyoming. Swans now comprise 40% of the total TSAF and therefore constitute an important portion of the current GYA resident population. Although, the success of our Green River range expansion program has resulted in growth of numbers in that area of the state, we are concerned about declining numbers and productivity in northwestern Wyoming including Yellowstone National Park. We plan to work with members of the Greater Yellowstone Trumpeter Swan Working Group to monitor this situation and possibly to develop joint research proposals to investigate the reasons for this decline.

In the future, we plan to continue to focus on cooperative management ventures with private landowners to improve and restore wetland habitats in the Green River, Salt River, and Snake River drainages as opportunities arise (Lockman 2005). Given the increasing number of swans, and increasing productivity in the Green River basin, and possible long-term drought conditions, it is important that we continue to be a leader in habitat improvement projects for swans. Recently, we cooperated with The Conservation Fund to obtain a capacity grant from the Intermountain Joint Venture to continue to build partnerships and develop new proposals for conserving and restoring wetland habitat in the Upper Green River basin. We have had excellent success obtaining funding since 2007 from the Wyoming Landscape Conservation Initiative and the Wyoming Wildlife Natural Resource Trust and will continue to develop grant proposals for individual projects through these programs as well.

## ACKNOWLEDGEMENTS

We would like to thank the following individuals for their valuable contributions to the Trumpeter Swan monitoring effort: N. Fath, and C. Millegan with Seedskadee National Wildlife Refuge; S. Wolff, M. Ruehmann, K. Gura and S. Dewey with Grand Teton National Park; E. Cole with the National Elk Refuge; S. Langston with Bridger-Teton National Forest; P. Hnilick with U.S. Fish and Wildlife Service; B. Long and D. Reed with Wyoming Wetlands Society; D. Stinson, pilot with Sky Aviation; B. Raynes and the Jackson Hole Bird Club; and volunteers D. Patla in Buffalo Valley and B. Jones of the Jackson Treatment Plant. Many other Department personnel and interested citizens contributed observations of swans throughout the state, and we appreciate their efforts. We also greatly appreciate the efforts of D. Olson, U.S. Fish and Wildlife Service for providing funding for the expanded fall survey flight.

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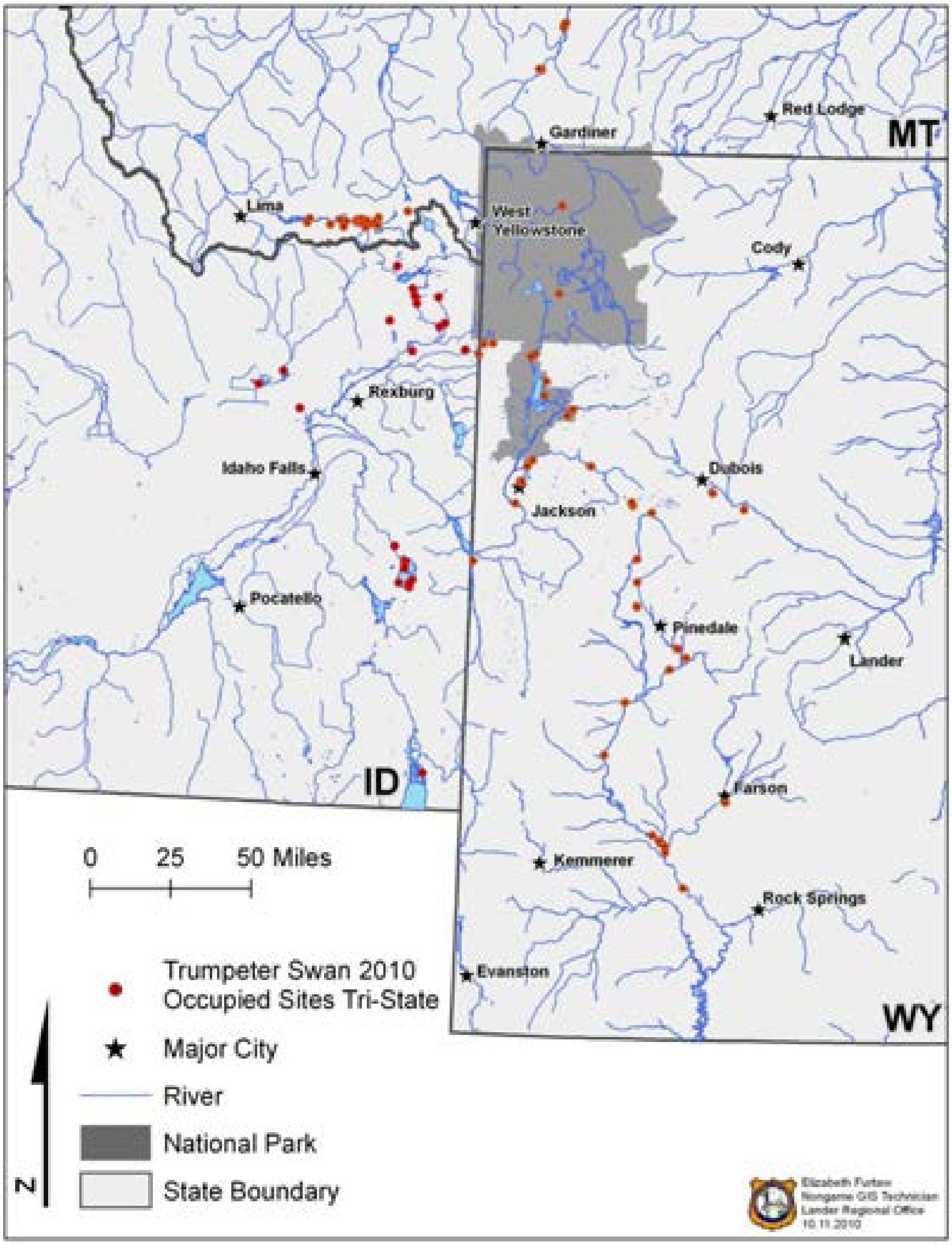


Figure 1. Locations of Trumpeter Swan nests in Wyoming, Idaho and Montana where swans have attempted to nest at least one time in 2010 or previous years. In Wyoming, the traditional core area includes nests in the Jackson area (i.e., Snake River drainage). Nests in the Green River Basin were established through a range expansion program, 1994-2003. Sites in the Farson and Dubois area were first documented in fall 2010.

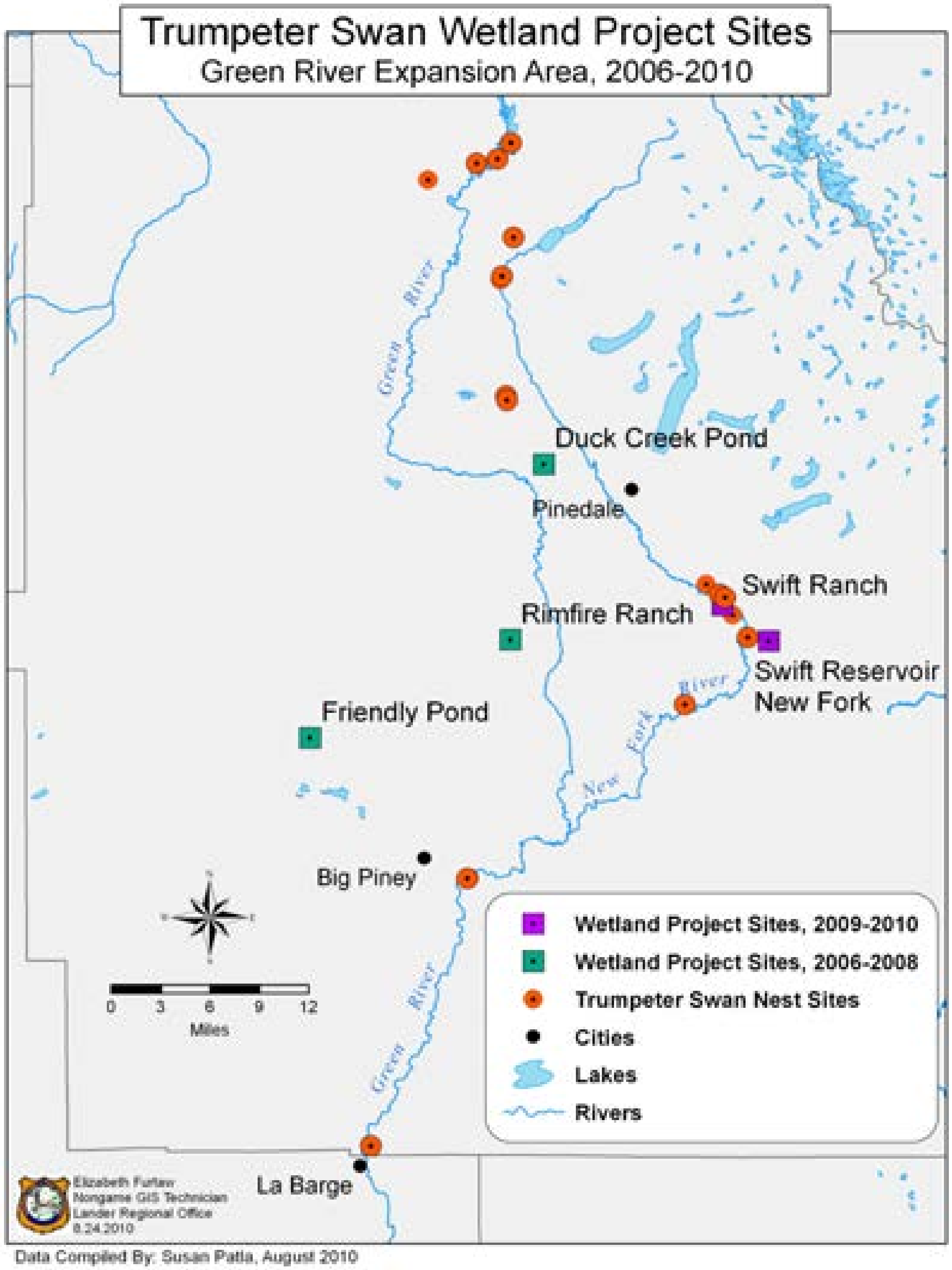


Figure 2. Locations of nest sites occupied by Trumpeter Swan in the Green River range expansion area, and wetland projects constructed to met objectives of the Trumpeter Swan Summer Habitat Project in the Green River Basin The map includes the expansion area from Cora, WY south to La Barge, Wyoming. Seedskadee National Wildlife Refuge, which is not shown, is located south of La Barge. Up to seven additional nest sites are located on the refuge.

Table 1. Number of adults and cygnets counted during aerial surveys in February, 2001-2011 for the Rocky Mountain Population Trumpeter Swan winter survey. Results are shown for specific survey areas in Wyoming, and the entire Tri-State Area which includes portions of southwestern Montana and southeastern Idaho (Olson 2011). "Other Wyoming" includes data from the Salt, Green and Wind River drainages.

| Year | Age group | Yellowstone National Park | Snake River | Other Wyoming | Wyoming total | Tri-State total |
|---|---|---|---|---|---|---|
| | Adult | 53 | 251 | 117 | 421 | 3198 |
| 2001 | Cygnet | 11 | 38 | 25 | 74 | 719 |
| | Total | 64 | 289 | 142 | 495 | 3917 |
| | Adult | 131 | 337 | 110 | 578 | 3814 |
| 2002 | Cygnet | 13 | 61 | 11 | 85 | 54 |
| | Total | 144 | 398 | 121 | 663 | 4360 |
| | Adult | 146 | 254 | 100 | 500 | 3365 |
| 2003 | Cygnet | 34 | 45 | 13 | 92 | 532 |
| | Total | 180 | 299 | 113 | 592 | 3897 |
| | Adult | 149 | 307 | 155 | 611 | 3785 |
| 2004 | Cygnet | 33 | 18 | 40 | 91 | 746 |
| | Total | 182 | 325 | 195 | 702 | 4531 |
| | Adult | 124 | 367 | 194 | 685 | 4147 |
| 2005 | Cygnet | 30 | 109 | 57 | 196 | 1143 |
| | Total | 154 | 476 | 246 | 881 | 5290 |
| | Adult | 121 | 413 | 242 | 776 | 4203 |
| 2006 | Cygnet | 14 | 58 | 53 | 125 | 1209 |
| | Total | 135 | 471 | 295 | 901 | 5412 |
| | Adult | 144 | 420 | 280 | 844 | 3604 |
| 2007 | Cygnet | 25 | 84 | 71 | 180 | 893 |
| | Total | 169 | 504 | 351 | 1024 | 4619 |
| | Adult | 65 | 316 | 287 | 668 | 3744 |
| 2008 | Cygnet | 7 | 63 | 79 | 149 | 790 |
| | Total | 72 | 379 | 366 | 817 | 4545 |
| | Adult | 88 | 321 | 319 | 728 | 4287 |
| 2009 | Cygnet | 2 | 63 | 47 | 112 | 873 |
| | Total | 90 | 384 | 366 | 840 | 5160 |
| | Adult | 18 | 369 | 261 | 648 | 3553 |
| 2010 | Cygnet | 5 | 56 | 50 | 111 | 676 |
| | Total | 23 | 425 | 311 | 759 | 4229 |
| | Adult | 125 | 467 | 345 | 937 | 4285 |
| 2011 | Cygnet | 42 | 138 | 91 | 271 | 1302 |
| | Total | 167 | 605 | 436 | 1208 | 5587 |

Table 2. Fall survey results for Rocky Mountain Population Trumpeter Swans that are resident year-round in the Tri-State Area, 2001-2011 (Olson 2010). [a] - Total does not include captive raised swans released by Wyoming Game and Fish Department and the Wyoming Wetland society. (i.e., three yearlings and five cygnets in 2001 and five yearlings in 2002).

| Year | Age group | Montana | Idaho | Wyoming YNP | Wyoming outside YNP | Tri-State total |
|---|---|---|---|---|---|---|
| 2001 | Adult | 140 | 124 | 17 | 81 | 362 |
| | Cygnet | 9 | 23 | 0 | 22 | 54 |
| | Total | 149 | 147 | 17 | 103 [a] | 416 |
| 2002 [e] | Adult | 76 | 103 | 22 | 72 | 273 |
| | Cygnet | 18 | 14 | 4 | 17 | 53 |
| | Total | 94 | 117 | 26 | 89 [a] | 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 |
| 2010 | Adult | 129 | 101 | 2 | 143 | 375 |
| | Cygnet | 30 | 29 | 0 | 48 | 107 |
| | Total | 159 | 130 | 2 | 191 | 482 |

Table 3. Occupancy and productivity data for Trumpeter Swans that nest in Wyoming but outside of Yellowstone National Park, 1990-2010. Shown are number of sites occupied, number of nesting pairs, number of pairs that hatched young, number of pairs with fledged young (i.e., mature young in September), number of young hatched, and number of young fledged (counted in the fall survey) per year. Mean and standard deviation (SD) are shown for the ten-year period 2000-2009. [a] - Does not include one site in the Green River drainage where eggs were collected and five-day-old young were grafted to a pair successfully in 2000 (four fledged) and in 2001 (five fledged).

| Year | Sites occupied | No. Nesting pairs | No. Pairs with hatchlings | No. Pairs with fledglings | No. hatched | No. 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 |
| 2010 | 37 | 24 | 18 | 12 | 66 | 48 |
| *2000-2009* | | | | | | |
| *Mean* | *27.6* | *17.8* | *12.6* | *10.5* | *41.7* | *32.3* |
| *SD* | *4.8* | *4.4* | *3.2* | *3.0* | *14.6* | *11.5* |

Table 4. Comparison of Trumpeter Swan nest site occupancy and productivity data for core and expansion areas in Wyoming outside of Yellowstone National Park, 2007-2010. Expansion areas include drainages where Wyoming Game and Fish Department worked to expand both summer and winter distribution within the state by translocation of wild swans or release of captive-raised swans from 1986-2003 (Patla and Oakleaf 2004). Core area is where swans nested in the Snake River drainage and its tributaries prior to range expansion efforts. Number of young fledged are the number of mature young counted on the September aerial survey conducted annually. The term successful pair refers to those nesting pairs that hatched young.

| Drainage | No. of occupied | No. of nesting pairs | No. of broods hatched | No. of young hatched | No. of young fledged | No. of young hatched per 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 |
| 2010 | 15 | 8 | 6 | 24 | 12 | 4.00 |
| *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 |
| 2010 | 21 | 15 | 12 | 42 | 36 | 3.50 |
| *Salt River Expansion* | | | | | | |
| 2007 | 2 | 1 | 0 | 0 | 0 | 0 |
| 2008 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 1 | 0 | 0 | 0 | 0 |
| 2010 | 1 | 1 | 0 | 0 | 0 | 0 |

Table 5. Annual summary of occupancy and production status for all known Trumpeter Swan nests in Wyoming outside Yellowstone National Park, 2000-2010. Key to the table codes includes: O - pair occupied site through nest period, did not attempt to nest, did not molt on site; OM - pair occupied territory through nest period, did not attempt to nest, molted on site; OL - pair occupied site late after nest initiation period, Nxy - pair nested, x = number of young hatched, y = number of mature young in September; OUID - pair reported on site but status not determined; NB - nonbreeding swans present, likely subadults; F - swans observed only on fall (September) flight only; 1A - only one adult present; NS - not surveyed; --- - no swans observed all season.

| Site | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ernest Lake | --- | --- | NB | NB | --- | NB | --- | --- | --- | --- | --- |
| Bergman Marsh | N43 | N00 | --- | NB | --- | --- | --- | --- | --- | --- | --- |
| Indian Lake | --- | --- | N33 | N33 | N55 | N00 | N10 | N44 | O | N40 | N30 |
| Widget Lake | --- | --- | --- | F | --- | --- | --- | --- | --- | --- | --- |
| Winegar Creek | | | | | | | | | | N30 | N20 |
| Fall River Slough | | | | | | | | N00 | --- | --- | --- |
| Loon Lake | OL | --- | --- | F | --- | --- | --- | --- | --- | --- | OL |
| Rock Lake | --- | --- | --- | --- | OL | OM | N00 | --- | O | --- | --- |
| Rock Lake slough | | | | | | | | | | | N41 |
| Junco Lake | --- | --- | --- | --- | --- | --- | N00 | --- | --- | O | --- |
| Fish Lake | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Squirrel Meadows | OL | OL | NB | --- | --- | OL | --- | --- | --- | --- | --- |
| Moose Lake | | | NB | --- | --- | --- | --- | --- | --- | --- | --- |
| Alpine Wetland N | --- | OL | 1A | NB | NB | NB | NB | N00 | --- | NB | NB |
| Alpine Wetland S | | | | | | | | NB | O | N00 | N00 |
| Upper Glade | | | | | | N00 | OM | --- | --- | --- | --- |
| Steamboat Mountain | | | N43 | OM | --- | N00 | --- | N43 | O | O | OL |
| Glade Cliff Slough | | | | | | | N00 | N10 | O | N00 | O |
| Glade South | O | N22 | OM | N00 | N10 | N22 | N00 | O | O | --- | --- |
| Christian Pond | N42 | OM | 1A | --- | --- | --- | --- | --- | --- | --- | --- |
| Arizona Lake | --- | --- | --- | --- | --- | OM | N20 | N40 | N00 | N00 | N30 |
| Emma Matilda | --- | OM | 1A | NB | --- | --- | NB | NB | --- | 1A | OM |

Table 5. Continued.

| Site | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Two Ocean Lake | N42 | N53 | N32 | N30 | N00 | OM | OM | --- | --- | --- | --- |
| Swan Lake | O | N00 | O | N00 | N33 | NB | OL | OM | N22 | O | OM |
| Hedrick Pond | N20 | N20C | O | O | --- | NB | 1A | O | --- | --- | --- |
| Elk Ranch | OM | OM | OM | OM | OM | OM | OM | O | O | O | OL |
| Cow Lake | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Spread Creek Ponds | --- | --- | NB | --- | --- | --- | --- | --- | --- | --- | --- |
| Cygnet Lake | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Polecat Slough | --- | --- | --- | --- | --- | --- | --- | --- | 1A | 1A | --- |
| Highway Pond NER | N44 | N32 | N11 | N10 | --- | N00 | --- | N55 | --- | --- | N00 |
| NE Marsh NER | N31 | N00 | N42 | N33 | N44 | --- | N32 | NB | O | --- | --- |
| Flat Cr. Island NER | | | | | | | | | | N00 | N10 |
| SE Marsh NER | N32 | OM | N00 | N11 | N43 | O | N11 | N42 | N00 | N11 | --- |
| Central Marsh NER | | N33 | N00 | --- | N22 | N44 | N33 | N57 | N33 | O | N55 |
| Pierre's Ponds | N00 | OM | N11 | N33 | OM | O | OM | --- | --- | --- | NB |
| Romney Ponds | | | | | OM | OL | NB | N44 | N44 | N43 | NB |
| Skyline/Puzzleface | OM | N30 | OM | OM | O | NB | --- | --- | --- | --- | NB |
| WGF South Park | --- | --- | --- | --- | --- | 1A | OL | OM | OM | N44 | N66 |
| Pinto/Halfmoon | N66 | N44 | N11 | O | N31 | N55 | N33 | N66 | N44 | N54 | OM |
| Tracy Lake, Buffalo | | | | | | | | | OL | OL | OL |
| Kibby/Salt R Cove | N00 | N00 | N00 | N00 | N00 | NB | --- | --- | --- | --- | --- |
| Etna/Jackknife | | | | | | | NB | --- | OL | O | --- |
| Bridger Lake | OL | OL | --- | --- | --- | --- | --- | --- | --- | nc | --- |

Table 5. Continued.

| Site | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlantic Cr. | O | O | --- | --- | --- | --- | --- | --- | --- | nc | OUID |
| Enos North | N22 | OM | OM | N44 | --- | --- | NB | NB | NB-3 | --- | NB |
| Enos South | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Atlantic Cr. | O | O | --- | --- | --- | --- | --- | --- | --- | nc | OUID |
| Lily Lake | OL | OM | N00 | N20 | --- | --- | --- | --- | --- | --- | --- |
| Lower Slide Lake | --- | --- | --- | | --- | | --- | --- | --- | --- | NB |
| Upper Slide Lake | N00C | N22 | NB | OM | N11 | N22 | N00 | OM | OM | OM | OM |
| Grizzly L pothole | --- | --- | --- | --- | --- | --- | Dry | Dry | | --- | --- |
| Burnt Fork | --- | --- | --- | --- | --- | --- | --- | --- | --- | NB | --- |
| Soda Lake | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Wagon Creek Lake | O | O | NB | O | O | --- | --- | --- | NB | --- | --- |
| Rock Crib | --- | --- | --- | O | --- | --- | --- | --- | NB | --- | --- |
| Wagon Cr Pothole | | | | | | | | N00 | --- | --- | N42 |
| Mosquito Lake | O | N00 | OM | 1A | OL | --- | NB | N32 | N00 | N00 | O |
| Roaring Fork P. | OL | O | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mud Lake | N00 | --- | N20 | --- | N50 | N20 | N20 | N52 | OE | --- | OL |
| Circle S slough | | | | | | | | | | | N00 |
| Carney oxbow | | | | | N55 | N22 | N00 | N44 | N00 | N00 | N22 |
| Carney pond | | | | | | | | | | N30 | --- |
| Marsh Creek Pothole | | | | | | | | N22 | --- | --- | --- |
| Kendall Wetland | | OL | OM | N00 | N00 | NB | NB | OL | N11 | N33 | OM |
| Q Y Bar Reservoir | | | | | | | | O | O | --- | --- |

Table 5. Continued

| Site | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kitchen South | N54 graft | N55 graft | N44 | N54 | N44 | N22 | N33 | N54 | N53 | N11 | N22 |
| Kitchen North | | NB | NB | NB | NB | OM | OM | OM | O | N22 | N55 |
| Vichory Pond | | | | | | | | | | | F |
| Webb Draw | | | | | | | | | | | F |
| Fayette | | | | | | | NB | N33 | N40 | N00 | --- |
| Barden Slough | N00 | N00 | --- | N00 | OM | OM | OM | --- | | --- | --- |
| Kitchen South | N54 graft | N55 graft | N44 | N54 | N44 | N22 | N33 | N54 | N53 | N11 | N22 |
| Kitchen North | | NB | NB | NB | NB | OM | OM | OM | O | N22 | N55 |
| Vichory Pond | | | | | | | | | | | F |
| Swift New Fork | | | | | | | | | N54 | OL | N33 |
| Swift Reservoir | | | OM | NB | NB | --- | OL | OL | NB | NB | OL |
| Jensen Slough | | | | | | | | | OL | O | N22 |
| Ferry Island | | | | | | | | N22 | N33 | N00 | N44 |
| Shafer Slough | | OM | --- | NB | --- | --- | NB | --- | --- | NB | NB |
| LaBarge Pond | | | --- | --- | --- | --- | --- | --- | OL | --- | N00 |
| Big Sandy Reservoir | --- | | --- | --- | --- | --- | NS | --- | nc | --- | --- |
| Eden Res. | | | | | | | | | | | 1A |
| Farson | | | | | | | | | | | N22 |
| Seedskadee NWR | | | | | | | | | | | |
| Hamp Unit | | | | | | N33 | N44 | N53 | O | N00 | N00 |

Table 5. Continued.

| Site | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hawley 1 | --- | N11 | NB | N44 | N60 | N65 | N54 | N22 | N33 | N43 | NB |
| Hawley 2 | | | | N44 | N54 | N00 | N66 | N33 | N66 | N44 | N55 |
| Hawley 2 S | | | | | | | | | | | N43 |
| Hawley 3 | | | | N43 | --- | N33 | --- | NB | NB | --- | NB |
| Hawley 5 | | | | | | | | | | N33 | NB |
| Hawley 6 | N44 | N44 | Dry | N44 | N65 | N77 | N00 | NB | NB | --- | N44 |
| Hawley 7 | | | | | | | | | | N10 | --- |
| Sage Pools | | | | | | | | N31 | N33 | N75 | N42 |
| Dunkle Wetland | | | | | | | | | | | O |
| South of OMC pond | | | | | | | | | | | O |
| Swamp Lake, Cody | 1A | 1A | 1A | 1A | --- | --- | --- | --- | NC | NC | NC |
| Other Wyoming | | | | | | | | | | | |
| Colony eastern WY | ? | OUID | 1A | NB | NB | NS | NS | --- | --- | NC | NC |
| Trail Lake, Dubois | | | | | | OM | OM | --- | --- | --- | --- |
| Dinwoody Lake | | | | | | | | | | | F |
| Lake Julia, Dubois | | | | | | | | | | | O |

## BALD EAGLE

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Bald Eagle

FUNDING SOURCE: U.S. Army Corp of Engineers, Bridger-Teton National Forest, Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

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

## ABSTRACT

The Bald Eagle occurs throughout most of North America from Alaska to central Mexico, wintering generally throughout the breeding range except in the far north. It nests along major river drainages and lakes throughout Wyoming with the most significant concentrations in Teton, Sublette, and Carbon counties including significant number of nesting pairs in Grand Teton and Yellowstone National Parks. We initiated monitoring for Bald Eagle (*Haliaeetus leucocephalus*) statewide in 1978. The Bald Eagle, although no longer designated a Threatened species under the Endangered Species Act of 1973, remains protected under the Bald and Golden Eagle Protection Act, and is classified as a Species of Greatest Conservation Need with Native Species Status of 2 in Wyoming. We currently monitor the population of nesting Bald Eagles in the western portion of the state (i.e., Snake and Green River drainages) annually and obtain data when available from other areas of the state. We have detected a minimum of 139 nest sites to date. However, we believe there is potential for ≥200 territories statewide (WGFD 2010). In 2010, we obtained occupancy data for 132 territories and productivity data for 91 nest sites. We did not obtain data from many known sites in the eastern portion of the state. As in previous years, Bald Eagles occupied a high proportion (i.e., 83%) of nesting territories we checked, but only 60% of nests monitored for productivity successfully produced young. We hypothesized that these results were due in large part to cold and wet weather conditions in March-May, especially in the Snake River drainage where a majority of nests are located. We documented a total of 76 mature young during our surveys. Bald Eagles that nest in Wyoming continue to experience some site specific risks due to increasing energy development, rural development, recreational activities, and environmental contaminants. We continue to receive and process numerous requests for information and management recommendations for Bald Eagle nest and roost sites.

## INTRODUCTION

The Bald Eagle (*Haliaeetus leucocephalus*) nests along all major river systems in Wyoming, but the largest number of nesting pairs is found in northwestern Wyoming in the Greater Yellowstone Area (GYA), along the Snake River drainage and its tributaries. Bald Eagles in the northwestern part of the state have long been recognized as part of a distinct population that nests in the Rocky Mountain West. This genetically distinct population extends into Idaho and Montana (Swenson et al 1986). Recovery of the species in Wyoming centered in the Jackson area beginning in the 1980s. The numerous territories located along the Snake River continue to serve as a source of Bald Eagles for other areas of the GYA and other parts of Wyoming (Harmata and Oakleaf 1992). Since 2000, we have documented a substantial increase in the number of pairs that nest in the Green River Basin. Nesting Bald Eagles in Wyoming continue to experience some site specific risks from increasing energy development, rural development, recreational activities, and environmental contaminants.

The U.S. Fish and Wildlife Service (USFWS) removed the Bald Eagle as a Threatened species in the western United States under the Endangered Species Act in July 2007. However, it continues to be protected under the Bald and Golden Eagle Protection Act. The Wyoming Game and Fish Department (Department) initiated statewide monitoring for Bald Eagles in 1978. Currently, we monitor a majority of territories that are known to occur in the Snake River and upper Green River Basin, south to Seedskadee National Wildlife Refuge. We use both aerial and ground surveys to evaluate occupancy and productivity. The Department's Regional Wildlife Biologists monitor occupancy and productivity for a proportion of nests known to occur in other drainages throughout Wyoming. Areas that are surveyed by Regional Wildlife Biologists include the upper North Platte River near Saratoga, and several drainages near Sheridan. Federal agency biologists provide additional data for their respective management units, and a few private consultants provide observations from other sites. We continue to receive numerous requests by other state and federal agencies, and the public for information on status of nests of Bald Eagles and provide recommendations on mitigation measures to conserve nest sites in Wyoming. Management guidelines have been developed for the GYA (Greater Yellowstone Bald Eagle Working Group 1996). Additional national guidelines are being developed by USFWS to address monitoring and management of Bald Eagles near wind energy developments. We are also actively involved in reviewing new federal regulations through participation in the Pacific and Central Flyways' Nongame Technical Committees.

## METHODS

Monitoring surveys for occupancy and productivity include aerial and supplemental ground checks of a majority of known nests for Bald Eagles in the GYA, south of Yellowstone National Park (YNP), and in the Green River Basin. Surveys of historic locations of nest sites in other areas of Wyoming occur on a less frequent basis and largely depend on other constraints. We conduct a minimum of two fixed-wing aircraft surveys in late March and early June to document number of occupied sites with incubating adults, and number of mature young produced per site. During aerial surveys, we record the number of adult and young Bald Eagles observed, UTM coordinates of nests, condition of nests, species of nest tree, and photograph new sites. We also record locations of other Species of Greatest Conservation Need (WGFD 2010).

In 2010, one observer conducted surveys in a Scout fixed-wing airplane on 26 March (i.e., nest occupancy), and 7-8 June (i.e., productivity). Surveys were conducted approximately 100-200 m above ground and at speeds of 120-160 kph. We combined the second flight in early June with the occupancy survey flight for Trumpeter Swan (*Cygnus buccinator*) to reduce overall survey costs. We surveyed all known nest sites along the main stem and tributaries of the Snake River, Gros Ventre River, Salt River, New Fork River, and the Green River from Green River Lakes south to Fontenelle Dam.

Biologists from YNP, Grand Teton National Park, Seedskadee National Wildlife Refuge, National Elk Refuge, and Bridger-Teton National Forest contributed data from their respective monitoring efforts. Regional Wildlife Biologists from the Department's Jackson, Pinedale, Cody and Laramie Regions collected data for nests that were accessible from the ground. A few volunteers also surveyed specific territories on a regular basis. Observers conducted ground based surveys using spotting scopes or binoculars from observation points that were sufficiently far away to prevent disturbance to nesting Bald Eagles. Survey duration ranged up to 2 hrs, depending on visibility, behavior of adult birds, and status of the nest.

We investigated reports of injured and dead Bald Eagles, whenever possible to determine cause of injury or death and to collect carcasses. If carcasses were fresh and cause of death uncertain, they were frozen and submitted to the Wyoming State Veterinary Laboratory in Laramie for analysis. Partial and old remains were sent to the National Eagle Repository for distribution to Native Americans for religious purposes. There were likely other Bald Eagle mortalities that have been recorded by the Department's personnel in the Wildlife Observation System that are not included in this annual report.

Craighead Beringia South, a nonprofit wildlife research organization located in Jackson, WY, conducted the only trapping and marking of bald eagles in Wyoming as part of their investigation into lead ingestion by scavenging eagles.

## RESULTS

We present the statewide results for surveys of Bald Eagles in Table 1. In 2010, we surveyed 132 nest sites to determine occupancy and 91 sites to determine productivity. Monitoring effort was greatest in western Wyoming where the majority of nests are known to occur. Some additional nest sites, in other parts of Wyoming, may have been surveyed and not reported; consequently this report represents a minimum survey effort. Bald Eagles occupied 82% of sites we surveyed; 60% of sites subsequently checked for productivity produced young. Nest success was lowest in the GYA in 2010 averaging only 53% compared to 76% in the Green River Basin. Average productivity was also lower in the GYA compared to the Green River Basin.

Biologists from Craighead Beringia South attached GPS backpack transmitters to three female adult Bald Eagles in August 2010. These individuals were believed to be resident birds from territories along the Snake River south of Wilson, Wyoming. GPS transmitters are expected to last up to 3 years. These data will supplement those from other migrant Bald Eagles that were captured and affixed with GPS collars by Craighead Beringia in previous years. To obtain information and data on this program see: http://www.beringiasouth.org/.

## DISCUSSION

Bald eagle productivity in the GYA has been shown to be correlated with temperature and inversely correlated with precipitation in March-May (Swenson et al. 1986; Harmata and Oakleaf 1992). Severe spring weather can affect nest building activities, availability of food, and also can result in mortality of young birds. Effects of weather are greater for Bald Eagles that nest at high elevations along lake shores compared to those that nest on rivers and streams. Typically, lakes remain frozen longer in cold years decreasing the availability of prey. In 2010, only 1 out of 6 nest sites on Jackson Lake produced young, and almost 50% of occupied nests in the Snake River drainage failed. Overall, productivity was lower in 2010 (0.84 mature young per site) compared to 2009 when Bald Eagles produced an average of 1.10 young per site.

The number of nesting pairs of Bald Eagles appears to have stabilized in the Snake River drainage in Wyoming but the nesting population is still increasing in the Green River Basin and possibly elsewhere in the state. Additional surveys are needed in areas where energy developments (i.e., oil, gas, and wind) occur or are proposed along major drainages or along known migration routes and wintering areas. We hypothesize that in areas undergoing high levels of development Bald Eagles could experience higher mortality rates, lower productivity, or loss of nest sites if adequate mitigation measures are not applied.

Department biologists on the Pacific and Central Flyway Nongame Technical Committees participated in a review of new federal guidelines currently under development to conserve Bald and Golden Eagles in areas where wind energy developments may occur in the western United States. Having current data on nest sites, migration routes, and wintering areas will be critical for developing adequate mitigation measures in the future. The Department has also proposed a study in the Pinedale area in partnership with Craighead Beringia South to use satellite technology to investigate the ecology of Bald Eagles in the Green and New Fork River drainages and how the species responds to natural gas energy development during different seasons of the year.

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Table 1. Results of all statewide surveys of Bald Eagles that were reported in Wyoming 2010. We present data by major drainages or by geographic boundaries in Wyoming. [a] Includes 3 pairs (6 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. Data incomplete for 2010. [d] Includes the North Platte and Little Snake Rivers, 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.

| | 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 |
|---|---|---|---|---|---|---|
| No. of territories checked for occupancy | 83 | 35 | 3 | 11 | Not available | 132 |
| No. of territories occupied | 65 | 31 | 3 | 10 | | 109 |
| Percent of territories occupied | 78% | 89% | 100% | 88% | | 83% |
| No. of Territories surveyed for productivity | 60 | 29 | 2 | 0 | | 91 |
| No. of territories that produced young | 32 | 22 | 1 | nc | | 55 |
| Percent of successful nests [e] | 53% | 76% | 50% | | | 60% |
| No. of mature young produced [f] | 44 | 30 | 2 | | | 76 |
| No. of mature young per territory | 0.73 | 1.03 | 1.00 | | | 0.84 |
| No. of territories considered unoccupied [g] | 12 | 4 | 0 | | | 16 |
| No. of new territories detected in 2010[h] | 1 | 2 | 1 | 1 | | 4 |

# EVALUATION OF POPULATION TRENDS OF LONG-BILLED CURLEWS IN WESTERN WYOMING

STATE OF WYOMING

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

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations, Wyoming Governor's Endangered Species Account Funds

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Nichole Cudworth, Nongame Biologist
Andrea Orabona, Nongame Bird Biologist

## ABSTRACT

Long-billed Curlew (*Numenius americanus*) populations declined in Wyoming in the late 19th and early 20th centuries due to uncontrolled hunting, habitat conversion, and pesticides, all of which have contributed to their classification as a Species of Greatest Conservation Need by the Wyoming Game and Fish Department. To monitor curlew populations, the Wyoming Game and Fish Department initiated annual roadside surveys in 1991 in western Wyoming during the breeding season. In 2010, we detected 98 unique individuals on established survey routes in addition to 8 individuals detected by Breeding Bird Survey participants. In general, curlew numbers have remained stable among survey years, although the relatively poor fit of trendlines suggests these results should be interpreted cautiously. Consequently, modifying current field and statistical methods to account for detection probability is likely necessary to obtain accurate Long-billed Curlew counts and improve our ability to evaluate trends.

## INTRODUCTION

Long-billed Curlews (*Numenius americanus*; curlews) are found throughout much of Wyoming during migration, but only breed in areas with suitable habitat. Uncontrolled hunting in the late 19th and early 20th centuries, widespread conversion of prairie to agricultural fields in the 1930s, and the use of organochlorine pesticides resulted in severe declines in populations of curlews throughout the state (Nicholoff 2003). As a result, the curlew is classified as a Species of Greatest Conservation Need by the Wyoming Game and Fish Department (Department).

Our objectives for the surveys of curlews in 2010 were two-fold. Our first objective was to continue to accumulate annual count data for curlews for five survey routes in western Wyoming where breeding populations are known to occur. Our second objective was to use data collected during the past 20 years to analyze population trends and assess the efficacy of the current methodology for monitoring curlew populations.

## METHODS

We conducted surveys for curlews along five established routes in northwestern Wyoming. Although the length of each route was dependent upon the amount of available suitable habitat, survey protocol generally followed that of the Breeding Bird Survey (Robbins and VanVelzen 1967). We initiated surveys 20 min before sunrise and observed curlews at stops located every 0.8 km. At each stop, we recorded the number of curlews seen and heard during a 3-min period, but did not recount individuals observed at previous stops. We also recorded the number of individuals observed while driving between stops. We divided the total number of curlews detected by distance driven to index the number of curlews per km for each survey route. For routes that were surveyed twice, we used the average number of curlews detected to determine the number of curlews per km.

We attempted to conduct surveys between 21 April and 15 May to correspond with the U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) range-wide survey and monitoring guidelines for curlews (Jones et al. 2003, Stanley and Skagen 2007). However, surveys were not attempted when observers were unavailable and weather conditions were not conducive (e.g., rain).

Four of the survey routes, Horse Creek, New Fork, Chapman Bench, and Grant Teton National Park Hayfields (GTNP), have been surveyed since the early 1990s; the National Elk Refuge (NER) route was initiated in 2008. To evaluate trends, we developed a 3-yr average of curlew detections per km for each route with a minimum of 15 yrs of data. We excluded the 1987 survey, where we only recorded the number of curlews seen, and the 2004 survey, which was conducted by the USFWS, from our analysis. This was done to ensure that only those years in which methods of detection were consistent were used in the analysis. We report the slope and $R^2$ value of trendlines to investigate population trends for each survey route and evaluate current monitoring methods for curlews in Wyoming.

The Breeding Bird Survey (BBS) is used to monitor trends of breeding birds across North America. The 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. The USGS-BRD has reviewed and analyzed data collected from the BBS since the survey's inception in 1968 in the West. Volunteers typically conduct BBS routes in June, when birds are breeding and most vocal. To evaluate trends of curlews statewide, we plotted the mean number of curlew detections per BBS route (i.e., 27 total routes) since 1991 and reported the slope and $R^2$ value for BBS data in Wyoming.

## RESULTS

In 2010, we surveyed four of the five curlew routes twice during the breeding season. The Horse Creek route (12.8 km; 17 stops) was surveyed on 21 and 28 May; the New Fork route (6.4 km; 9 stops) was surveyed on 17 and 28 May; the Chapman Bench route (12.8 km; 17 stops) was surveyed on 29 and 30 May; and the GTNP Hayfields route (15.2 km; 20 stops) was surveyed on 19 and 27 May. The NER route (11.2 km; 15 stops) was only surveyed once on 21 May. All survey data (i.e., number of curlews seen, heard, as well as comments made during each survey) for curlews are located in the Nongame Bird Biologist's files at the Department's Lander Regional Office.

Total number of curlews detected in 2010 on each survey route is as follows: 41 and 37 on Horse Creek, 18 and 24 on New Fork, 8 and 10 on Chapman Bench, 29 and 17 on GTNP Hayfields, and 6 on NER. In general, populations of curlews have remained relatively stable over the survey period. Horse Creek demonstrated slight declines of 0.22 individuals per km per year ($R^2$ = 0.298; Fig. 1) and Chapman Bench demonstrated declines of 0.21 individuals per km per year ($R^2$ = 0.264; Fig. 2). New Fork demonstrated slight increases of 0.01 individuals per km per year ($R^2$ = 0.000; Fig. 3) and GTNP Hayfields increased by 0.01 individuals per km per year ($R^2$ = 0.02; Fig. 4). The NER has not been surveyed for a sufficient amount of time to allow for trend comparison.

Participants detected curlews on 27 BBS routes since initiation of the BBS in Wyoming in 1968. Observers surveyed 14 of these routes in 2010 and detected 8 curlews on 4 of the 14 routes. Counts in previous years have fluctuated from a low of 1 curlew detected on 6.5% of 15 routes in 1998 to a high of 19 curlews detected on 50% of 16 routes surveyed in 1999. Overall, BBS routes have shown a slight increase of 0.03 individuals per route per year ($R^2$ = 0.181; Fig. 5) since 1991.

## DISCUSSION

Curlews have been detected on 27 BBS routes in Wyoming since 1980; however, the timing of the BBS (i.e., during the month of June) corresponds with the latter stages of the breeding cycle for curlews. Consequently, detections of curlews during this time may reflect a clumped distribution, which could increase variance and decrease precision of trend estimates (Fellows and Jones 2009). Although the number of curlews detected on BBS routes appears to be increasing, the reported increase is slight, and trend is masked by the high variance in number of detections per year. These results suggest that surveys specifically designed for detecting and monitoring curlews are warranted, as we are unable to accurately determine population trends using BBS results.

Cochrane (1983) first conducted roadside surveys for curlews in 1982 using BBS techniques (Robbins and VanVelzen 1967). However, minor modifications were made, including counting birds observed between stops, and only recording individuals that could be visually identified (Cochrane and Oakleaf 1982). Over time, we have made multiple modifications to the guidelines provided by Cochrane and Oakleaf (1982) to reflect updated survey techniques. Beginning in 1991, we began recording individuals we heard but did not see, in addition to individuals we observed. Since 2005, we have attempted to initiate surveys earlier in the season, as recommended by a range-wide study by the USFWS and USGS, which suggested that surveys in Wyoming should be conducted during the pre-incubation and courtship stages (i.e., 21 April–15 May) when curlews are easier to detect (Jones et al. 2003).

Although the modifications to our survey methodology were intended to maximize detections of curlews and conform to range-wide recommendations, our results are confounded by variations in weather conditions, observer availability, modifications to the length of some survey routes, and noise levels. Although, curlew numbers appear stable, with only slight increases or decreases along a specific survey route, the low $R^2$ values suggests that these results are weak and should be interpreted with caution. Notably, the influence of year only explained 0.0% to 29.8% of the variation observed in averaged curlew numbers. This variation is especially apparent on the Chapman Bench survey route, where a high number of curlew detections from 1991–1993 influenced the entire trend estimate.

The precision of the trend estimates could be increased by modifying the current field and statistical methods. An estimate of detection probability is needed to determine abundance or population size. This can be accomplished by using the double-observer, removal-model, or distance sampling approaches (Jones et al. 2003, Stanley and Skagen 2007). One drawback to using these techniques however, is that sample sizes need to be increased to detect declines using current roadside counts (Stanley and Skagen 2007). Another drawback is the required increase in field personnel needed to perform the double-observer technique, along with the associated costs of time and funding. Occupancy modeling may provide another alternative to population estimation and allow for the inclusion of covariates, such as vegetation structure and composition, weather, and distance to important landscape features (Jones et al. 2003). Regardless, modification of the current survey approach is needed to improve our ability to evaluate population trends of curlews in Wyoming.

## ACKNOWLEDGEMENTS

We would like to acknowledge the following Wyoming Game and Fish Department personnel for their valuable contributions to the 2010 curlew monitoring effort: D. Brimeyer, D. Clause, S. Patla, and S. Smith.

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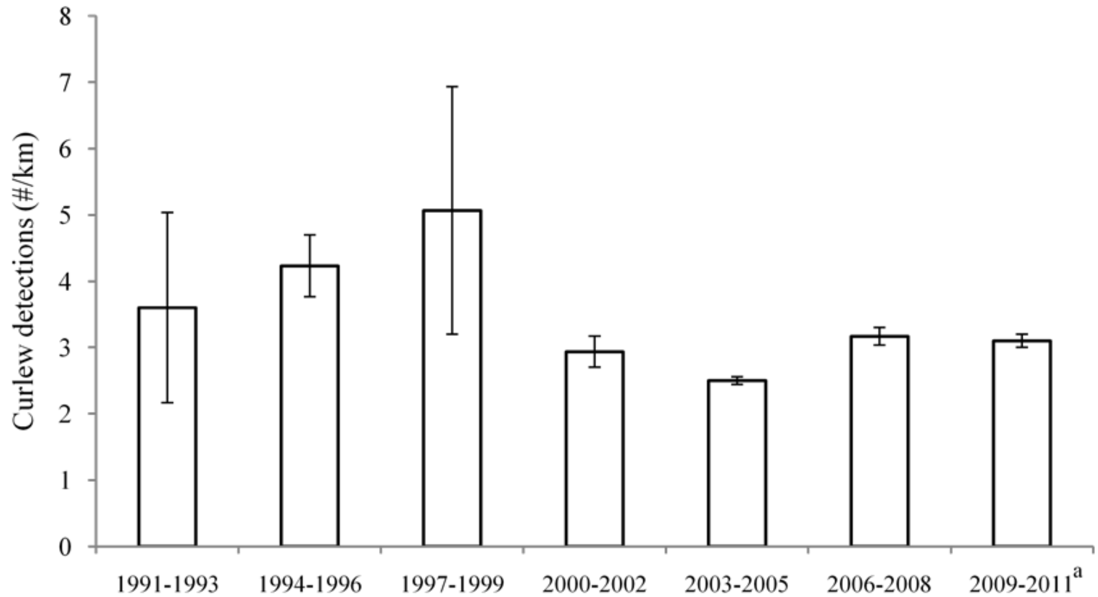


Figure 1. Three-year average of number of Long-billed Curlews (*Numenius americanus*) detected per km (± SE) along the Horse Creek survey route in western Wyoming, 1991-2010. [a] indicates an average over only two years.

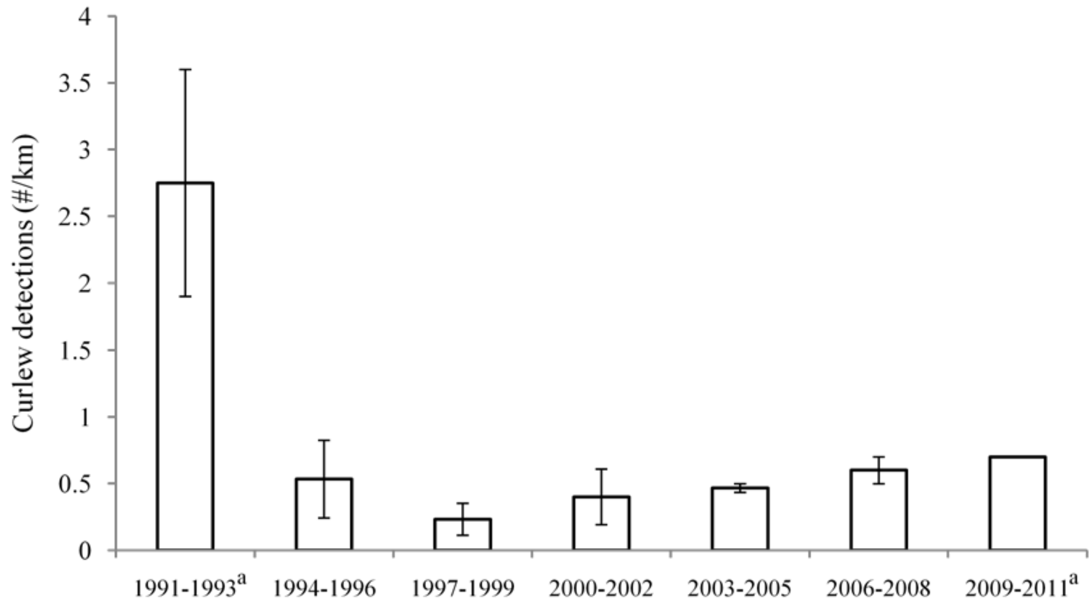


Figure 2. Three-year average of number of Long-billed Curlews (*Numenius americanus*) detected per km (± SE) along the Chapman Bench survey route in western Wyoming, 1991-2010. [a] indicates an average over only two years.

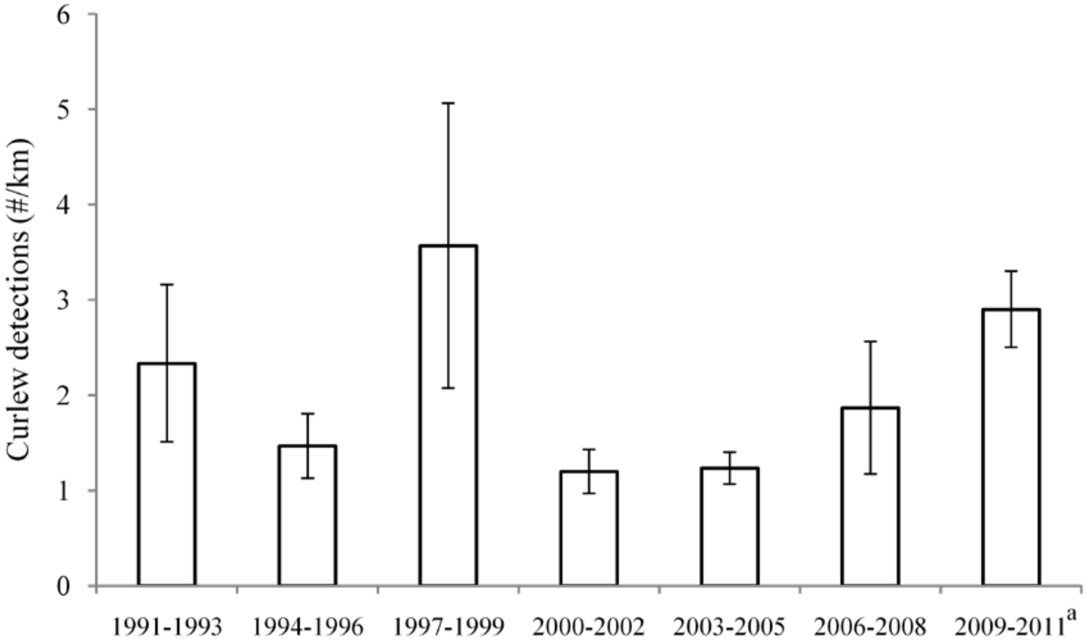


Figure 3. Three-year average of number of Long-billed Curlews (*Numenius americanus*) detected per km (± SE) along the New Fork survey route in western Wyoming, 1991-2010. [a] indicates an average over only two years.

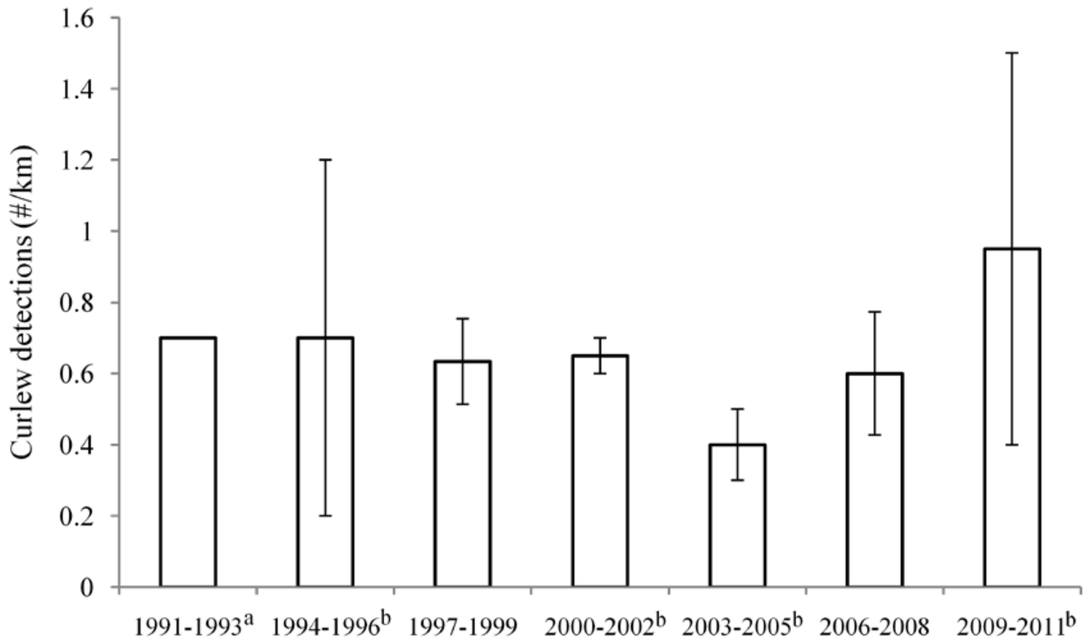


Figure 4. Three-year average of number of Long-billed Curlews (*Numenius americanus*) detected per km (± SE) along the Grand Teton National Park (GTNP) Hayfields survey route in western Wyoming, 1991-2010. [a] indicates only one survey in the three-year span; [b] indicates an average over only two years.

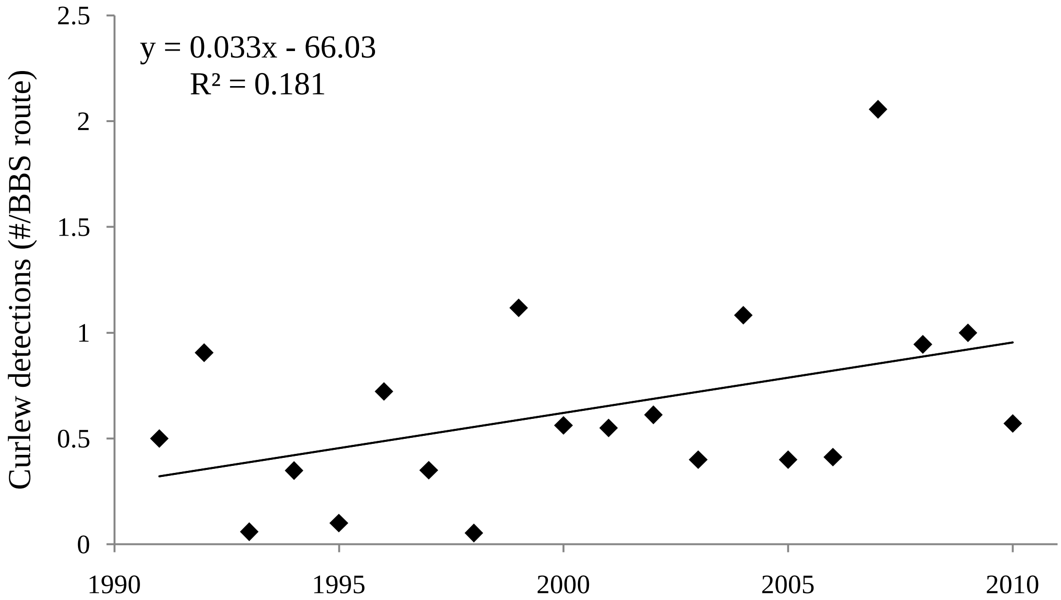


Figure 5. Average number of Long-billed Curlews (*Numenius americanus*) detected per Breeding Bird Survey (BBS) route in Wyoming, 1991-2010. Only routes that have resulted in a curlew detection since surveys were initiated in Wyoming in 1968 were included in the figure. The trendline is included for reference.

## SURVEYS FOR AMERICAN BITTERN IN WESTERN WYOMING

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – American Bittern

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations, Wyoming Governor's Endangered Species Account Funds

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Andrea Orabona, Nongame Bird Biologist
Nichole Cudworth, Nongame Biologist

## ABSTRACT

The American Bittern (*Botaurus lentiginosus*) is a secretive, semicolonial wetland obligate that requires a species-specific call playback survey technique to detect presence. Results are used to develop population density and compare trends. In 2010, we conducted replicate surveys on four transects within the Cokeville Meadows National Wildlife Refuge. Unlike previous years, American Bitterns were detected on all transects. We detected 18 American Bitterns on the Thornock, 3 on the Bartlett, 4 on the Diamond, and 16 on the Peterson transects. Although results should be interpreted cautiously until additional data can be accumulated and analyzed, we suggest that habitat improvements have been successful in increasing the number of nesting American Bitterns on the refuge.

## INTRODUCTION

The Wyoming Game and Fish (Department) classifies 12 species of colonial nesting waterbirds as Species of Greatest Conservation Need (SGCN), including the American White Pelican (*Pelecanus erythrorhynchos*), American Bittern (*Botaurus lentiginosus*), Black-crowned Night-Heron (*Nycticorax nycticorax*), Black Tern (*Chlidonias niger*), Caspian Tern (*Hydroprogne caspia*), Clark's Grebe (*Aechmophorus clarkii*), Forster's Tern (*Sterna forsteri*), Franklin's Gull (*Larus pipixcan*), Great Blue Heron (*Ardea herodias*), Snowy Egret (*Egretta thula*), Western Grebe (*Aechmophorus occidentalis*), and White-faced Ibis (*Plegadis chihi*) (WGFD 2010). We conduct surveys for a majority of these species a minimum of every 3 years to record presence and count the number of nesting pairs at important breeding sites in Wyoming. However, the American Bittern is loosely colonial, secretive, and seldom detected during these surveys. Thus, we use a specialized survey to record presence and report density of American Bitterns in their 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 or degree blocks (Orabona et al. 2009). It is a summer resident in Wyoming and is classified as a Species of Greatest Conservation Need with a Native Species Status of 3 (WGFD 2010).

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 count stations from 300 m to 400 m to reduce the probability that an individual American 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 activity of American Bittern vocalization. Lastly, we split the Diamond-Peterson transect into the Diamond transect and the Peterson transect in an effort to more efficiently survey both. We again revised the survey protocol in 2008 by requiring replication of all four transects a minimum of three times to obtain a more accurate count, as American Bitterns may not vocalize during any given period within the survey timeframe. In this report, we present the current survey methodology used, survey results, cumulative results from the 2007-2010 survey efforts, and a discussion of trend of American Bittern populations on the CMNWR.

## METHODS

We conducted annual surveys of American Bitterns during the breeding season between 15 May and 30 June when they were most vocal and responsive to the call-playback technique. We attempted to survey each transect three times, with a minimum of 2 weeks between replicates. Count points along each transects were 400 m apart, and transect length was determined by the amount of available American Bittern habitat. All surveys were conducted between 1945 and 2145 hrs. However, if American Bitterns were heard calling before or after this timeframe, surveys were adjusted accordingly. At each survey point, we initiated the survey by passively listening for American Bittern vocalizations for 5 min. We then played a recorded American Bittern call for 1 min, and finished the survey point by listening for a response for 1 min. We recorded all American Bitterns heard or seen during all phases of the survey and marked the approximate location of each individual American Bittern on a map. We also noted other SGCN species observed or heard at each survey point.

On the CMNWR, we established four American Bittern survey transects: Thornock was 1.6 km, Bartlett was 2.0 km, Diamond was 2.8 km, and Peterson was 3.2 km in length. Due to the limited number of survey years and the elimination of some surveys due to flood conditions in previous years, we only analyzed data for transects with a minimum of three years of survey data (i.e., Thornock and Bartlett transects). We report the slope and $R^2$ value of trendlines to investigate population trends for each transect.

## RESULTS

In 2010, three replicate call playback surveys were conducted for American Bitterns between 18 May and 25 June 2010 on each of four transects located within the CMNWR. We detected American Bitterns on all four transects (Table 1). As in previous years, the greatest density (i.e., No. detected per km surveyed) of American Bitterns occurred on the Thornock transect. Notably this is the shortest of the four transects.

The number of American Bitterns has increased on the Thornock transect since the initiation of this species-specific survey in 2007, with an increase of 1.26 individuals per km per year ($R^2 = 0.729$; Fig. 1). Detections of American Bitterns on the Bartlett transect, however, have decreased by an average of 0.31 individuals per km per year ($R^2 = 0.454$; Fig. 2). The Diamond transect was only surveyed for 1 yr and Peterson transect for only 2 years, consequently they were not included in the analysis.

## DISCUSSION

On the Thornock transect, detections of American Bittern increased in 2010 to 18 individuals from the previous survey years, 16 in 2009, 10 in 2008, and 12 in 2007. Since 2006, CMNWR personnel have actively improved American Bittern habitat by controlled flooding, which has expanded the wetlands preferred by this species for nesting. We hypothesize that the increase in American Bitterns on the Thornock transect are directly correlated with these habitat improvements and the increase in suitable habitat.

On the Bartlett transect, we detected three American Bitterns in 2010, which is similar to the four or five individuals counted every year for the previous 3 years. We hypothesize that the American Bitterns may be saturated and approaching carrying capacity on the Bartlett transect because suitable habitat for nesting is limited.

We have only surveyed the Diamond transect once out of the last 4 years and the Peterson transect twice out of the last 4 years due to unfavorable weather conditions, time constraints, available personnel, and difficult access. On occasions when we surveyed the Diamond and Peterson transects prior to 2010, we detected few American Bitterns and hypothesized that the lack of detections was correlated to a limited amount of suitable nesting habitat on these wetlands. However, CMNWR personnel have recently started to enhance habitat on the refuge for numerous wildlife species and conditions for American Bitterns appeared to have improved in 2010. Notably, we detected more American Bitterns in 2010 than in previous years, four on the Diamond and 16 on the Peterson transects.

It is difficult to infer trend with only 3 years of data, and results should be interpreted cautiously. However, our efforts to continue annual call-playback surveys for the American Bittern will likely increase the precision of the trend analyses and allow for better trend estimation.

## ACKNOWLEDGEMENTS

We would like to thank Nongame Biologist, L.S.Tomb, for her valuable contributions to the 2010 American Bittern survey effort.

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Table 1. Total number and number per kilometer of American Bitterns (*Botarus lentiginosus*) detected during surveys conducted on the Cokeville Meadows National Wildlife Refuge in 2010. Length of transect for each route is reported in parentheses.

| Thornock transect (1.6 km) | | Bartlett transect (2.0 km) | | Diamond transect (2.8 km) | | Peterson transect (3.2 km) | |
|---|---|---|---|---|---|---|---|
| Total No. detected | No. per km | Total No. detected | No. per km | Total No. detected | No. / km | Total No. detected | No. per km |
| 18 | 11.3 | 4 | 1.4 | 3 | 1.5 | 16 | 5.0 |

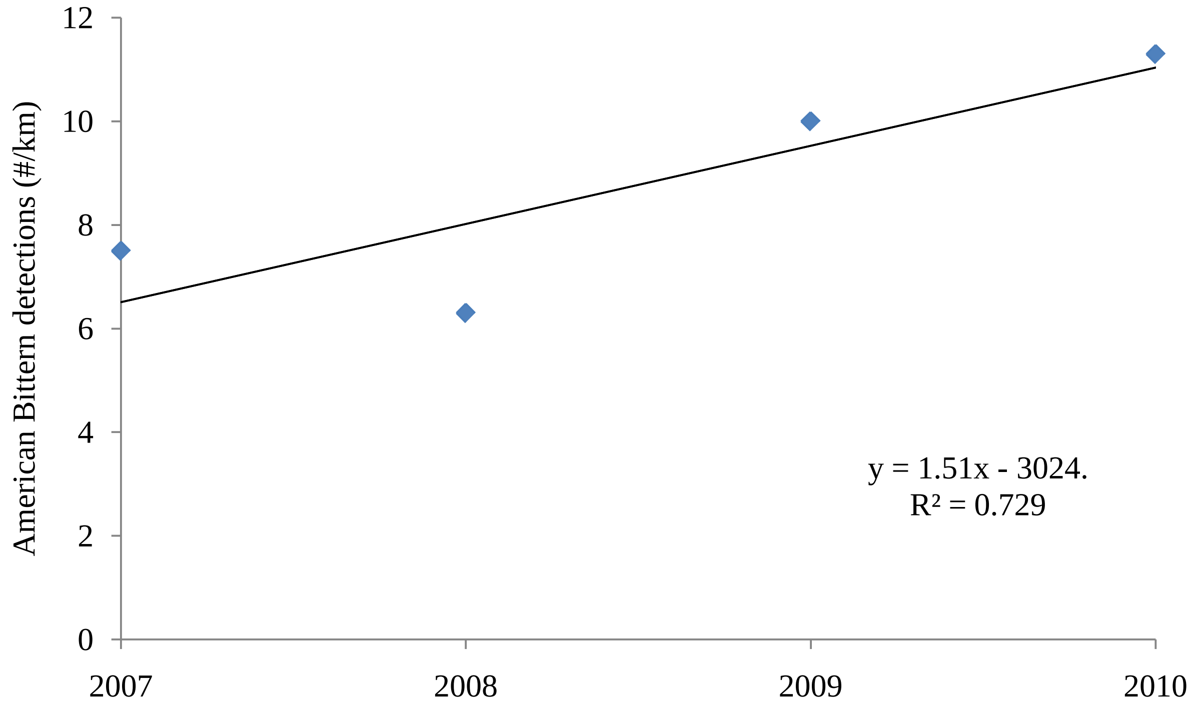


Figure 1. Number of American Bittern (*Botaurus lentiginosus*) detections per km on the Thornock transect in the Cokeville Meadows National Wildlife Refuge, 2007-2010. The trendline is shown for reference.

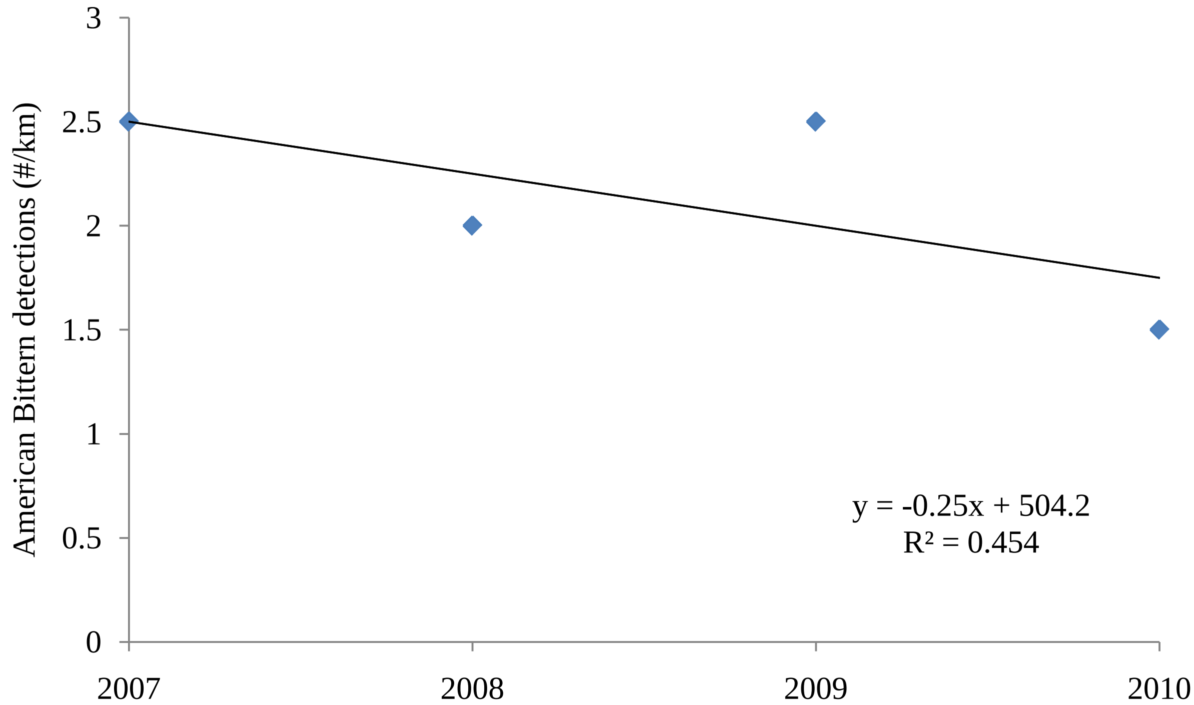


Figure 2. Number of American Bitterns (*Botaurus lentiginosus*) detections per km on the Bartlett transect in the Cokeville Meadows National Wildlife Refuge, 2007-2010. The trendline is shown for reference.

# EFFECTS OF ENERGY DEVELOPMENT ON THE PRODUCTIVITY AND DISTRIBUTION OF FERRUGINOUS HAWKS AND GOLDEN EAGLES IN WYOMING BASED ON GPS TELEMETRY AND CONSERVATION GENETICS

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Ferruginous Hawk

FUNDING SOURCES: Rocky Mountain Research Station, U.S. Forest Service, Bureau of Land Management, Wyoming Wildlife Heritage Foundation, PacifiCorp, Pathfinder Renewable Wind Energy, LLC, Wyoming Game and Fish Department ,Wyoming Governor's Endangered Species Account Funds, Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: 1 January 2010 – 30 June 2013

PERIOD COVERED: 1 January 2010 – 14 April 2011

PREPARED BY: Robert J. Oakleaf, Nongame Coordinator, Wyoming Game and Fish Dept.
Lucretia E. Olsen, Rocky Mountain Research Station, Forestry Science Lab
John R. Squires, Rocky Mountain Research Station, Forestry Science Lab

## ABSTRACT

From 2000 to 2006, the number of oil wells increased by 73% and natural gas wells by 318% in Wyoming. Current energy development coincides almost entirely with the distribution of Ferruginous Hawks (*Buteo regalis*) and lowland nesting Golden Eagles (*Aquila chrysaetos*). The population status of both species in Wyoming is currently unknown. Our three-year project will estimate the number of nesting pairs of Ferruginous Hawks and Golden Eagles as well as quantify the effects of energy development on population genetics, habitat, and key prey species. This progress report presents results from the first field season, and includes preliminary estimates of nesting pairs. We do not include an assessment of the effects of energy development in this progress report as additional data will be collected in 2011. We selected our study area by predicting distribution of Ferruginous Hawk across Wyoming using an updated nest database and suitable habitat model. Using the predicted distribution, we attempted to locate Ferruginous Hawks and Golden Eagles that nested in Wyoming. We used two fixed-wing aircraft to search for nests of Ferruginous Hawk and Golden Eagle in April and May 2010. Systematic surveys were conducted in 60 randomly selected townships. An additional five townships were surveyed to address objectives for other projects. We detected during our surveys 74 nest occupied by Ferruginous Hawk and 31 occupied by Golden Eagle. Of these, 48 Ferruginous Hawk and 21 Golden Eagle nests were located during surveys of randomly selected

townships. Twenty-six (41%) of 63 previously known territories for Ferruginous Hawks in the townships we surveyed were occupied while 10 (27%) of 37 known territories for Golden Eagle were occupied. Our results for statewide abundance of nesting pairs should be considered preliminary until additional data are obtained to increase sample size, especially for Golden Eagles. We estimated 1,894 (95% CI: 1,304-3,536) nesting pairs of Ferruginous Hawks in Wyoming and 798 (95% CI: 541-1552) nesting pairs of Golden Eagles within the predicted distribution of Ferruginous Hawks.

## INTRODUCTION

The number of oil wells increased by 73%, and the number of natural gas wells increased by 318% between 2000 and 2006 in Wyoming. Current energy development coincides almost entirely with the predicted distribution of Ferruginous Hawks and part of the Golden Eagles distribution in Wyoming. Ferruginous Hawks are very sensitive to human disturbance, and Golden Eagles are sensitive to energy development, especially electrocution and collisions with power lines (Franson et al. 1995, Lehman et al. 2007, Lehman et al. 2010). Our understanding of the impacts of energy development on these species is currently lacking.

Ferruginous Hawks are only found in North America and the continental population is estimated between 6,000 to 14,000 individuals (Schmutz et al. 1992). Although Ferruginous Hawks still occupy a large proportion of their historic range in North America, range contractions have been reported in south-central Canada (Bechard and Schmutz 1995), Utah and eastern Nevada (Olendorff 1993), North Dakota (Stewart 1975), and Arizona (Glinski 1998). Consequently, Wyoming, a state which may support >800 nesting pairs (Oakleaf 1985), is central to the conservation of this species in the continental United States and throughout North America.

Ferruginous Hawks prefer to nest in flat, rolling grasslands, deserts, and shrubsteppe regions while high elevations, interior forests, and narrow canyons are generally avoided (Bechard and Schmutz 1995). Ferruginous Hawks are also sensitive to the degradation and loss of grasslands and will avoid areas that have been largely converted from native prairie (Olendorff 1993, Bechard and Schmutz 1995, Dechant et al. 2001). However, they are generally tolerant of grazing and cattle ranching (Kantrud and Kologiski 1982, Bechard and Schmutz 1995).

Golden Eagles are afforded federal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d), which prohibits the take of eagles including killing, injuring or disturbing eagles to a degree that results in decreased productivity or nest abandonment. Despite this protection, however, abundance of Golden Eagles is hypothesized to be declining; however data are lacking. Because Golden Eagles are slow to mature and have low reproductive rates, populations are particularly sensitive to the loss of adult birds (Kochert et al. 2002). Some breeding surveys indicate stable populations, while other migration and post production counts reported declining abundance in the western U.S. (Kochert and Steenhof 2002, Good et al. 2009). The number of nesting pairs of Golden Eagles in a part of California declined from 85 in 1900 to 40 in 1999 due to increased urbanization (Bittner and Oakley 1999), and the number of nesting eagles in Idaho declined due to a loss of shrub habitat (Kochert et al. 1999). Due to a poor understanding of population trends for Golden Eagles in North America, additional data are warranted to accurately assess long term population status and viability.

This is the first year of a multi-year project in Wyoming and surveys will be conducted between 2010 and 2013. Our objectives during this project are:

- Objective 1 - Estimate statewide distribution, number of nesting pairs, occupancy, and productivity of Ferruginous Hawks in Wyoming relative to oil, gas, and wind energy development and provide a minimum estimate of nesting pairs for Golden Eagles in lowland habitats.
- Objective 2 - Evaluate the influence of energy development on population vital rates of Ferruginous Hawks using genetic sampling.
- Objective 3 - Evaluate the influence of disturbance associated with energy development on Ferruginous Hawk nest site selection and foraging behavior, efficiency and rates.
- Objective 4 - Estimate relative density of key various prey at Ferruginous Hawk nest sites and evaluate the influence of energy development on the abundance of these species.

With the completion one field season, we have preliminary data to address Objective 1. We also initiated data collection efforts for Objective 2and Objective 4. Objective 3 will not be addressed in this report.

## METHODS

In this study we used terminology and definitions provided by Steenhof and Newton (2007). The definitions of occupied nest and nesting territory are especially important. A nest is the structure where eggs are laid and young sheltered. A nesting territory is an area that contains, or historically contained, one or more nests of a mated pair of raptors and where no more than one pair is known to have bred at one time. We are aware of the many different definitions that have been used synonymously and we use the more restricted ethological definition of a territory which is a defended area but agree with Steenhof and Newton (2007) as to the appropriateness of this definition. In order to classify a nest as occupied, one or more of the following observations were necessary: one adult associated with a freshly repaired nest, two adults associated with a nest, one adult incubating or brooding, or the presence of eggs or young. A nesting territory was classified as occupied if it contained an occupied nest.

We further defined a nesting territory as the area that included all nests within 1 km of a nest or the centroid of a cluster of nests. This distance was selected based on our professional experience with Ferruginous Hawk and Golden Eagle, data we collected in 2010, and other data collected in 2009 by Young et al. (2010). Using ArcGIS 9.3 (Esri, Broomfield, CO), we determined minimum distance between nests of Ferruginous Hawks, by analyzing only nests classified as occupied from which we calculated the distance from each nest in the dataset to its nearest neighbor, with the maximum search limit set at 12 km.

The area of overlap between energy development and the distribution of nesting Ferruginous Hawks included most of the state, excluded forested areas and intensively farmed areas **(**Figure 1). Thus, our area of inference is statewide and our sampling frame extends across Wyoming within the predicted distribution of Ferruginous Hawk. Although Golden Eagles nest in most habitat types statewide, the study area defined by the distribution of Ferruginous Hawks represents most (~ 50%) of Wyoming (Phillips et al. 1984). These habitats are also predicted to have a fluctuating prey base and be most vulnerable to anthropogenic impacts. Assessing the status of populations of Golden Eagles in these lowland habitats targets the most vulnerable segment of the nesting population in Wyoming. Notably, this segment of the population is markedly different than others that occur in stable environments of northwestern Wyoming where numerous pairs of nesting Golden Eagle were recorded during Peregrine Falcon (*Falco peregrinus*) surveys, 1978 – 1995 (Oakleaf and Graig 2003).

We began by updating the database of nests for Ferruginous Hawk and Golden Eagle maintained by the Wyoming Game and Fish Department (WGFD). This database included records of nesting activity dating back to the early 1970s. We updated the database by including results from other surveys for nest conducted by other agencies. Because historic records of nest represented varying levels of quality, search, and monitoring effort, identifying any subsets of nesting territories that received consistent monitoring over time was difficult. However, we believe it is important to document these nests to provide anecdotal evidence of potential changes in occupancy relative to increased energy development. This anecdotal information may prove useful in corroborating the empirical results of this study.

We predicted the distribution of Ferruginous Hawk across Wyoming using the updated database of nests and GIS modeling was completed by the Wyoming Natural Diversity Database (Keinath et al. 2010). Within the predicted distribution we stratified townships into three strata, LOW , MEDIUM , and HIGH based on the density of oil and gas wells per township. We attempted to distribute our sample effort with equal portions across the three strata. We randomly selected 20 townships from each strata. Our samples were distributed spatially within each strata based on four regions and the proportion of area they represented within each strata (Knight 1994). These regions are consistent with naturally occurring breaks in the ferruginous hawk distribution model and relate to potential oil and gas development areas (Copeland et al 2009**).**

We conducted systematic surveys for nesting Ferruginous Hawks and Golden Eagles in townships we randomly selected. We used two fixed-wing aircraft (i.e., Bellanca Scout and Piper PA 18) to search for nests in April and May, 2010. Surveys were conducted in 60 townships (93.3 $km^2$, 9.66 km on a side) with 16 transects running the length of the township and spaced 600 m apart, to allow complete coverage of each township (Figure 2). We selected townships that had centroids that were contained within the known distribution of Ferruginous Hawks included any additional townships that contained Ferruginous Hawk nest records ($n$ = 1230). We attempted to address concerns raised by Smith et al. (2010) to ensure unbiased results. An additional five townships were surveyed to address objectives of other projects. While these townships were included in efforts to calculate detection probabilities, only results from randomly selected townships were used to generate estimates of the number of nesting pairs.

Pilots were instructed to maintain an air speed of 128 kph and remain on established transects. Observers used GPS units (i.e., Garmin GPS60) to record the exact flight route within each township and to plot all observed nest locations. We treated each aircraft as a survey team and included nests observed by the pilot in addition to the observer. Every other township was assigned to a survey team with team 1 starting in the southwestern part of the state, while team 2 started in the northcentral part of the state. Following completion of all transects in a township, survey teams flew to waypoints of historic nest locations contained within the township to determine occupancy of known territories. If historic nests were not located we did not include the territory in calculations of occupancy rates. We used this approach to reduce biases associated with varying degrees of data quality. Nests located outside of transects and during commutes between townships were recorded but not used to calculate detection probabilities or abundance estimates. Although Ferruginous Hawks and Golden Eagles were the primary focal species, we also recorded all raptor stick nests, whether occupied or not. In addition to the two focal species, these included Red-tailed Hawks (*Buteo jamaicensis),* Swainson's Hawks (*B. swainsoni*), Bald Eagles (*Haliaeetus leucocephalis*) Prairie Falcons (*Falco mexicanos),* and Great Horned Owls (*Bubo virginianus*). Corvid nests were not recorded.

Much of our survey methodology (e.g., transect spacing, aircraft speed, minimum qualifications or experience of observers and timing that corresponds with peak nesting) was similar to techniques developed by Ayers and Anderson (1999). However, we differed in that we only used a single observer instead of two, due to the difficulites in finding qualified observers during peak nesting periods for all years of the study. To develop our detection index we we used a single observer and pilot in fixed-wing airplanes, and then randomly resampled some of the transects using a different observer and a helicopter (i.e., Team 3).

We used a helicopter (i.e., Bell 47 Soloy) to re-survey 58 townships to assess variation in detection rates among observer and species (MacKenzie et al. 2002, Pollock et al. 2002, Royle and Nichols 2003). Each helicopter survey followed three of the previously surveyed transects in each township. One transect was randomly selected for helicopter survey, and adjacent transects to the east and west were also flown. The helicopter flew at an approximate speed of 80 kph during the surveys.

We used an independent observer mark-recapture technique to estimate detection probability and bird abundance (Pollock and Kendall 1987, Nichols et al. 2000). This method provides an estimate of absolute detection probability for each observer or species. The weakness of this approach, however, is that it does not account for availability bias; that is nests that are out of sight to both observers due to vegetative cover or some other obstruction (Pollock and Kendall 1987). We used the program DOBSERV (White 1983, Nichols et al. 2000) to estimate detection probabilities of each observer and for each species (i.e., Golden Eagle and Ferruginous Hawk) separately. DOBSERV attempts to fit our data to one of four candidate models: $P(.,.)$: equal detection among observers and species, $P(.,i)$: equal detection among species but not observers, $P(s,.)$: equal detection among observers but not species, and $P(s,i)$: different detection among observers and species (Hines 2000, Nichols et al. 2000). DOBSERV then estimates detection probabilities using each of these models, and derives AIC values for model selection.

Since we had three survey teams, we executed program DOBSERV twice, once for teams 1 and 3 and again for teams 2 and 3. We used this pairing because survey teams 1 and 2 were in fixed-wing planes, while team 3 acted as a secondary observer in the helicopter. We also estimated detection probabilities for stick nests of all raptor species we detected, regardless of status of the nest, and for a restricted data set consisting of only occupied nests of all species. We selected the model with the lowest AIC value, and used this model to estimate nest abundance with 95% confidence intervals for each species. We then extrapolated our results to estimate number of occupied nests per square km of the survey area for each species.

To verify the precision of the abundance estimate using DOBSERV, we also used program DISTANCE v 6.0 (Thomas et al. 2009), to estimate probabilities of detection and density of nests. Our candidate model set included half-normal or hazard-rate key functions and cosine or hermite polynomial series expansion. We fit these models to the data, and used AIC to determine the model with the best fit. We also stratified the data by observer and species. This allowed us to estimate a separate detection function for each observer, and thus a separate detection probability for each observer and species. Stratifying the data, however, reduced the sample size, and thus estimates derived from this method should be considered a very rough approximation until sample sizes can be increased. We used only nest occupied by Ferruginous Hawk and Golden Eagle for this analysis, and truncated the highest 5% of the data to avoid problems fitting the model to a long-tailed distribution (Thomas et al. 2010).

After completion of the detection surveys, June 23-26, we flew to all occupied nests of Ferruginous Hawk to record chronology and number of young. Results provided information for ground crews to prioritize and schedule efforts to complete productivity surveys and additional field work. Young were not included in production calculations until they were more than half feathered.

We collected blood or tissue samples ($n$ = 12) for genetic primer development. Blood and tissue samples were collected from 2-3 week-old nestlings, or adult and nestling carcasses located near nests. We primarily targeted occupied nests that were not located within the randomly selected townships. We searched occupied nests we detected aerially for molt feathers between June-August. All feathers and other genetic samples were labeled by territory and UTM location before being sent to the Rocky Mountain Research Station Wildlife Genetics Laboratory in Missoula, MT, where they extracted and catalogued DNA.

We indexed prey abundance at 26 occupied nesting territories for Ferruginous Hawks. which included the following prey species, white-tailed prairie dog (*Cynomys leucurus*), black-tailed prairie dog (*C. ludovicianus*), ground squirrel (*Spermophilus* spp.), jackrabbit (*Lepus* spp.), and cottontail (*Sylvilagus* spp.) within territories throughout the study. Within nesting territories, we used distance sampling methods to index jackrabbit, cottontail, prairie dog, and ground squirrel abundance using combined line and point counts (Buckland et al. 1993). To determine whether differences in prey abundance accounted for differences in nesting activity, we also indexed prey abundance at 10 random sites where nests of Ferruginous Hawk were known to be absent. We collected all pellet and prey remains that were present whenever we visited nest sites to confirm that these taxa comprise the diet of Ferruginous Hawks in Wyoming.

Two technicians indexed abundance of prey on transects located >0.5 km from the nest site to minimize disturbance to Ferruginous Hawks. We used ArcGIS to plot the random start points and azimuths for each transect. All transects were however, located within 2 km of the nest to ensure that sampling was representative of availability of prey within a putative foraging area. Each observer walked four 1-km transects, stopping to conduct a 5-min point count at the transect origin, terminus, and every 250 m intervals.

We used line transects to index abundance of jackrabbits and cottontails, since these species must be flushed to be detected (Wywialowski and Stoddart 1988). Observers used point-counts to index abundance of ground squirrels and prairie dogs since both species are active above-ground and visible (Andelt 2007, McDonald et al. 2010). Point counts entailed standing in a fixed location for 5 min and using binoculars to survey the surrounding area in a circle about the point. The perpendicular distance from prey species to the transect line or point was precisely measured using a laser rangefinder (accurate to ±1 m; Morrison and Kennedy 1989). Detections of minor species of prey such as pocket gophers (*Thomomys spp*) on transects were also recorded. Transects were sampled between 0700 and 1000 hrs when jackrabbits and cottontails were sedentary and ground squirrels and prairie dogs were active.

We mapped spatial extent of prairie dog colonies within a 2-km circle around nest sites using GPS units. We also counted burrows on two, 3-m wide strip transects that were parallel to and a random distance from the major and minor axes of each colony (McDonald et al. 2010). The ratio of active burrows (i.e., as defined by visual observation of a prairie dog, fresh scat within 1.5 m of a burrow entrance, or fresh digging) to inactive burrows was also used as an index of abundance (Young et al. 2010).

## RESULTS

We compiled 9,631 observations of nests occupied by Ferruginous Hawks and 5,499 by Golden Eagles. These records included repeat observations of the same nest and alternate nests of the same territory. After applying our 1-km rule, we identified 1,606 Ferruginous Hawk and 2,405 Golden Eagle nesting territories. Notably, since these records in the database dated back to 1977, it was conceivable that some territories were no longer viable and certainly only a portion of these territories would be occupied in any given year. Accordingly, efforts to eliminate duplicate data, add new data, and edit questionable records are still on-going.

A total of 74 occupied Ferruginous Hawk and 31 occupied Golden Eagle nests were detected during our aerial surveys. Of these, 48 Ferruginous Hawk and 21 Golden Eagle occupied nests were located during surveys of transects in randomly selected townships (Figure 3). Crude densities, those that do not account for probability of detection, were 116.6 $km^2$ per occupied nest of Ferruginous Hawks and 266 $km^2$ per occupied nest of Golden Eagles. Most Ferruginous Hawks observed during surveys were associated with nesting territories, with the exception of 13 individuals observed soaring or perching but not associated with a nest. In contrast, we recorded many more (*n* = 101) Golden Eagles soaring or perching and not associated with nests. Thirty one of these Golden Eagles were classified as either adults (*n* = 23) or subadults (*n* = 8).

Our results of the nearest neighbor analysis estimated a mean distance of 4.3 km (min: 1.5 km) between Ferruginous Hawk occupied nests. We did not complete this analysis for Golden Eagles due to small sample size. Extensive data sets of other studies, however, document that occupied eagle nests are typically over 2 km apart and alternate nests occur within a 1.8 km radius (Phillips et al. 1984, Kochert and Steenhof 2010).

Twenty-six (41%) of 63 previously known Ferruginous Hawk territories in the townships we surveyed were occupied. Thirty seven (59%) territories were located during fixed-wing surveys of transects, while the remaining 26 (41%) territories were missed and recorded during follow-up surveys of known nests. Ten (27%) of 37 known nesting territories for Golden Eagle were occupied. Seventeen (46%) territories for Golden Eagle were located during fixed-wing surveys of transects, while the remaining 20 (54%) were missed and later recorded during follow up surveys of known nest sites.

During June aerial surveys of 74 occupied nests for Ferruginous Hawk, we documented various age-classes of nestlings, which varied from small downy to completely feathered young. We also recorded a high number of failed nests (*n* = 36). We were unable to determine the outcome of four nests. Twenty-one (30%) of the 70 nests that were successful, fledged 60 young (0.9 young per occupied nest). We made no attempt to evaluate productivity of nests of Golden Eagles.

On transects that were surveyed by team 1 (i.e., plane) and team 3 (i.e., helicopter), 79 stick nests were detected by one or both teams, and 17 of these nests were determined to be occupied at some point during the season. On transects that were surveyed by team 2 (i.e., plane) and team 3 (i.e., helicopter), 111 total raptor stick nests were detected, and 32 were determined to be occupied.

The model results from the program DOBSERV indicated that for 3 out of 4 observer per nest detection scenarios, model $P(.,i)$ was the most parsimonious (Table 1). The exception was for all stick nests detected for survey team 2 and 3, in which model $P(s,i)$ had the smallest AIC value, and $P(.,i)$ had the next smallest value. To facilitate comparison between teams, we used the results from model $P(.,i)$ to calculate observer detection probabilities and confidence intervals for all scenarios (Table 2). Using the probabilities of detection estimated for each primary survey team, we calculated about one occupied nest for Ferruginous Hawk per 60.3 $km^2$ and one nest for Golden Eagle per 143.2 $km^2$ (Table 3).

We surveyed 65 townships and located 278 nests for Ferruginous Hawk and 59 for Golden Eagles, of these, 48 of the Ferruginous Hawk nests were occupied at some point during the season, as well as 21 Golden Eagle nests (Figure 3). We used only the 48 nest occupied by Ferruginous Hawk and 21 for Golden Eagles for analysis in DISTANCE. The most parsimonious model was a conventional distance analysis with half-normal key function and cosine series expansion. For survey team 1, the probability of detecting occupied nests for

Ferruginous Hawk was 0.69 (95% CI = 0.47–1.0) and for Golden Eagle was 0.25 (95% CI: 0.11–0.56). For survey team 2, probability of detection for Ferruginous Hawk was 0.63 (95% CI: 0.43–0.93) and for Golden Eagles was 0.40 (95% CI: 0.27–0.59). Nest density calculated using program DISTANCE is shown in Table 4.

There was little difference between estimated number of nest for Ferruginous Hawk and Golden Eagle per square km using DISTANCE (Table 4), while density of nests for Ferruginous Hawk was approximately twice that of Golden Eagles using DOBSERV (Table 3). Because the sample sizes used in for DISTANCE were small, we believe that results from DOBSERV are more reliable at this time.

Estimated probabilities of detection for each survey team were similar between our two methods. When averaged over both species, the estimated detection probability fro Team 1, calculated using DISTANCE, was 0.47, and using DOBSERV (i.e., on occupied nests only) was also 0.47. The estimated detection probability for Team 2 using DISTANCE was 0.52, and using DOBSERV was 0.50.

We recorded few nests that were occupied by Golden Eagles ($n$ = 21). Consequently, we believed these results should be interpreted cautiously until additional data are available. We used estimates of density of nests from DOBSERV to estimate abundance of Ferruginous Hawk and Golden Eagle (95% CI) in Wyoming (i.e., 1,230 townships; 114,216 $km^2$). We estimated 1,894 (95% CI: 1,304-3,536) nesting pairs of Ferruginous Hawks and 798 (95% CI: 541-1552) nesting pairs of Golden Eagles within the predicted statewide distribution of Ferruginous Hawks in Wyoming.

We collected blood or tissue samples ($n$ = 12) for genetic primer development (Table 5). We collected primer samples from six active nests outside of surveyed townships, three samples from study townships, and three samples came from contributors around the state. At present, the DNA from these samples has been extracted and sent to Genetic Identification Services for primer development.

We visited 38 occupied nests to search for feathers and prey remains. Access was denied to four nests and two nests could not be located from the ground. We successfully recovered at least one biological sample (i.e.,feather, carcass, egg shell, blood draw) from 27 nests. The remaining 17 nests either contained no molt feathers at the time of our visit ($n$ = 11) or were inaccessible ($n$ = 6).

We performed distance sampling for prey species in putative nesting territories for 26 occupied nests and 10 randomly generated territories. Prey remains or pellets were recovered from only eight nests.

## DISCUSSION

Our goal this year was to locate a minimum of 60 to 100 occupied nests that were spatially distributed across three strata for both Ferruginous Hawks and Golden Eagles. Based on results of previous studies, we estimated that a sample size of 60 randomly selected townships would enable us to reach this goal (Phillips et al. 1984, Ayers and Anderson 1999, Young et al. 2010). However, we only located 48 nesting pairs of Ferruginous Hawks and 21 pairs of Golden Eagles within randomly selected townships; consequently we will need to increase our sample size in future years to facilitate evaluation of impacts due to energy development. Therefore, estimates of statewide populations of 1,894 nesting pairs of Ferruginous Hawks and 798 pairs of Golden Eagles in lowland habitats are considered preliminary.

Estimated probabilities of detection between methods and survey teams were similar, ranging from 0.47-0.52 when averaged over both species. These results were also similar to our estimates of probability of detection used for estimating occupancy rates and somewhat higher than results previously reported (Ayers and Anderson 1999). Naive densities of 116.6 $km^2$ per occupied nest of Ferruginous Hawk and an occupancy rate of 41% are similar to unpublished data of long term project in the Medicine Bow area (Young et al. 2010). Within our project area, only 30% of the occupied nests were classified as successful and fledged a mean of 0.9 young per occupied nest. This was somewhat lower than the 1.5 young per occupied nest reported during the early years of the Medicine Bow project, but similar to the 1.0 young per occupied nest observed in 2009 (Young et al. 2010). Low productivity in 2010 may have been associated with spring snow storms that occurred on 3, 4, 10, 11, and 12 May 2010. Between 5-15 May, we observed several nests with unattended clutches. When we included results from repeat surveys, we documented a total of 12 failed nests. By the end of June, a total of 36 nests had failed. None of the occupied nests north of T36N, R71W were successful in 2010. Similar results were reported by other survey efforts in northeast Wyoming (G. Mckee and T. Byers personal communication).

Occupancy rates are typically used as an index for the size and status of a nesting population for some long-lived species with high fidelity to mates and nesting territories (Steenhof and Newton 2007). Although these criteria apply to Golden Eagles, they do not apply to Ferruginous Hawks (Lehman et al. 1998). Other biases are associated with occupancy rates. We did not include territories in our calculations if surveys failed to locate appropriate stick nests. Some legitimate territories with nests that may have been destroyed were probably excluded, resulting in temporally truncating calculations and artificially raising occupancy rates. However, occupancy was determined from only a single brief aerial check. Territories may not have been initiated or were abandoned by the pair when we checked the nest. Omitting these territories from calculations lowers occupancy rates. This is potentially important for Golden Eagles since they initiate nesting in March, prior to our surveys that were timed for optimizing results with Ferruginous Hawks.

We estimated that there were 798 occupied nests of Golden Eagles in lowland habitats of Wyoming during 2010 and 27% of known nesting territories were occupied. Phillips et al. (1984) conducted surveys for nesting Golden Eagles in Wyoming from 1976 to 1982 and their project focused on 12 areas scattered throughout the state collectively representing 8% of the state. They recorded 320 locations of occupied nesting territories or pairs of Golden Eagles and calculated a mean naive density of 60 $km^2$ per pair for an estimate of 3,381 to >4,174 breeding pairs in Wyoming. They also reported high occupancy rates during this time period, varying from 88% to 100%, and concluded that available eagle habitat was saturated. Other published results potentially contradict these results. Boeker (1974) studied Golden Eagles nesting along the front range of the Rocky Mountains in Wyoming, Colorado, and New Mexico, 1964 - 1973. Many of the nests Boeker (1974) located are in the Medicine Bow area and are still occupied periodically. He reported a mean of 44.9% active nests in any given year but did not define the term “active”.

We suspect that this year’s data may have been collected during lows of nesting activity for Ferruginous Hawks and Golden Eagles. Fedy and Doherty (2010) found Greater Sage-grouse (*Centrocercus urophasianus*) and cottontail rabbit populations (i.e., potential prey) were cycling on an approximate 8 year cycle in Wyoming. Their evaluations and recent hunter harvest survey results (http://gf.state.wy.us/downloads/pdf/HarvestRpt) indicate these cycles are again near population lows in many parts of the state, especially in northeast Wyoming. Long term datasets for nesting raptors and lagomorphs have been collected in areas associated with coal mines in northeast Wyoming. Unpublished data were provided by Thunderbird Wildlife Consulting, Inc., as compiled by McKee (Thunderbird Wildlife Consulting 2010). These data clearly show highs of nesting Ferruginous Hawks and Golden Eagles in 2006-07 and lows in 2010 along with peaks in lagomorphs in 2006-07 and troughs in 2010 (Thunderbird Wildlife Consulting 2010, ICF International 2010a, ICF International 2010b).

This project will continue as proposed. However, sample sizes of occupied nests will need to be increased. Therefore, we will continue to perform aerial surveys to detect Ferruginous Hawk and Golden Eagle nests in spring of 2011. We intend to sample approximately 40 new townships using a fixed-wing plane and a single observer. This increased sample size will allow us to improve the accuracy of statewide abundance estimates for both focal species and improve our effort to use resource selection functions for comparing known nest sites to random landscapes (Manly et al. 2002, Keating and Cherry 2004). We also plan to collect additional data on genetics and prey abundance to enable us to evaluate remaining objectives. Our success rate for obtaining genetic samples was affected by nests being abandoned before molt due to inclement weather, or to molt feathers being blown away from nests. In future seasons, we recommend more frequent visits to nests to collect molt feathers before they are dispersed.

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Table 1. AIC values for each DOBSERV model for all stick nests and only occupied nests of all raptor species detected in Wyoming, 2010. Model with the best fit are bolded for each team combination. Model *P*(.,.) represents equal detection among observers and species. Model *P*(.,*i*) represents equal detection among species but not observers. Model *P*(*s*,.) represents equal detection among observers but not species. Model *P*(*s*,*i*) represents different detection among observers and species.

| | | P(.,.) | P(.,*i*) | P(*s*,.) | P(*s*,*i*) |
|---|---|---|---|---|---|
| All nests | Teams 1 & 3 | 42.59 | 0.0 | 43.48 | 3.58 |
| | Teams 2 & 3 | 16.32 | 6.67 | 14.29 | 0.0 |
| Occupied nests | Teams 1 & 3 | 3.56 | 0.0 | 6.03 | 21.26 |
| | Teams 2 & 3 | 0.35 | 0.0 | 5.09 | 4.67 |

Table 2. Probabilities of detection (P) and 95% Confidence Interval (CI) for each survey team pair (plane and helicopter) for all stick nests or only occupied nests of all raptor species detected in Wyoming, 2010, estimated using program DOBSERV.

| | | $P_{team1,2}$ | Lower CI | Upper CI | $P_{team3}$ | Lower CI | Upper CI |
|---|---|---|---|---|---|---|---|
| All nests | Teams 1 & 3 | 0.48 | 0.36 | 0.6 | 0.73 | 0.6 | 0.86 |
| | Teams 2 & 3 | 0.32 | 0.21 | 0.72 | 0.74 | 0.61 | 0.87 |
| Occupied nests | Teams 1 & 3 | 0.47 | 0.23 | 0.41 | 0.78 | 0.51 | 1.0 |
| | Teams 2 | 0.5 | 0.31 | 0.69 | 0.68 | 0.48 | 0.89 |

Table 3. Estimated number of square kilometers per occupied Ferruginous Hawk and Golden Eagle nest detected in Wyoming, 2010 for each survey team. Estimated were derived using program DOBSERV. The lower and upper 95% confidence intervals are also presented.

| | | $km^2$ per nest | Lower CI | Upper CI |
|---|---|---|---|---|
| Ferruginous hawk | Team 1 | 58.4 | 26.1 | 89.5 |
| | Team 2 | 62.2 | 38.5 | 85.8 |
| | Mean | 60.3 | 32.3 | 87.6 |
| Golden Eagle | Team 1 | 175.3 | 78.3 | 268.5 |
| | Team 2 | 111.2 | 68.9 | 153.4 |
| | Mean | 143.2 | 73.6 | 211.0 |

Table 4. Estimated number of square kilometers per occupied Ferruginous Hawk and Golden Eagle nest detected in Wyoming, 2010 for each survey team.  Estimated were derived using program DISTANCE.  The lower and upper 95% confidence intervals are also presented.

| | | $km^2$ per nest | Lower CI | Upper CI |
|---|---|---|---|---|
| Ferruginous hawk | Team 1 | 165.8 | 96.3 | 285.5 |
| | Team 2 | 153.6 | 88.1 | 267.5 |
| | Mean | 159.7 | 92.2 | 276.5 |
| Golden Eagle | Team 1 | 171.9 | 65.4 | 452.0 |
| | Team 2 | 164.3 | 87.6 | 308.4 |
| | Mean | 168.1 | 76.5 | 380.2 |

Table 5. List of Ferruginous Hawk genetic samples collected and used for primer development in Wyoming, 2010. We present the date the sample was collected, initials of the collector, identification number used by the genetics lab, unique identifier of the sample, township number, sample type, and UTM coordinates of the location the sample was collected. UTM datum is NAD83, Zone 13.

| Date | Collector | UNIQUE ID | Township | Comment | UTM N | UTM E |
|---|---|---|---|---|---|---|
| 8/24/2009 | JB | 1506431001 | 1564 | Tissue | | |
| 10/19/2009 | TK | 1506621001 | 1566 | Tissue | | |
| 6/25/2010 | ZW | 1609302001 | 1693 | Blood | 4585471 | 263287 |
| 6/24/2010 | ZW | 1710404001 | 17104 | Blood | 4594171 | 654064 |
| 6/25/2010 | ZW | 2109028001 | 2190 | Blood | 4626372 | 285452 |
| 7/21/2010 | ZW | 2109028002 | 2190 | Tissue | 4626372 | 285452 |
| 5/14/2009 | BO | 2510502001 | 25105 | Tissue | 4670801 | 640565 |
| 6/26/2010 | ZW | 2609036004 | 2690 | Blood | 4673186 | 291621 |
| 6/24/2010 | MW, | 2710327001 | 27103 | Blood | 4683412 | 656775 |
| 6/23/2010 | MW | 3009528001 | 3095 | Blood | 4714255 | 729871 |
| 7/1/2010 | ZW | 3208636001 | 3286 | Blood | 4729355 | 330161 |
| 8/4/2010 | ZW | 4810130001 | 48101 | Blood | 4885079 | 658674 |

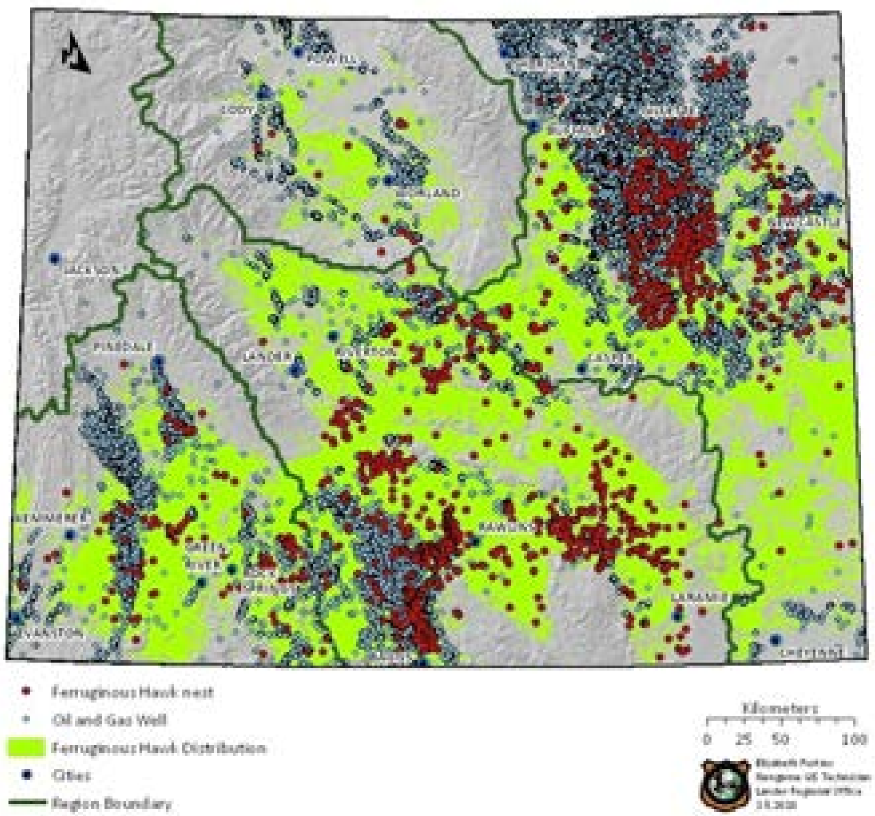


Figure 1. Predicted distribution of Ferruginous Hawk in Wyoming which was developed for the State Wildlife Action Plan (WGFD 2010). Red dots indicate Ferruginous Hawk nests and blue dots represent oil and gas wells in Wyoming 2010.

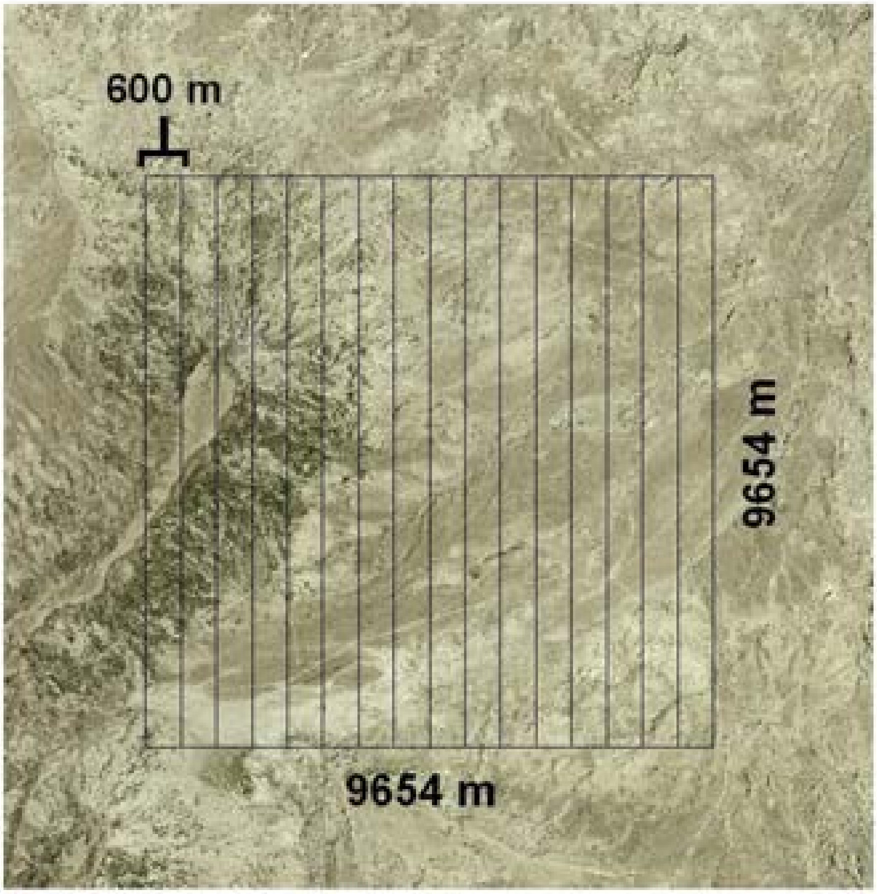


Figure 2. Example of a township for Ferruginous Hawk and Golden Eagle we surveyed using aircraft in Wyoming 2010. Aerial survey flight lines depicted vertically within the township are 9,654 m in length and spaced 600 m apart. We assumed that observers were able to detect nests up to 300 m on either side of the aircraft (Ayers and Anderson 1999).

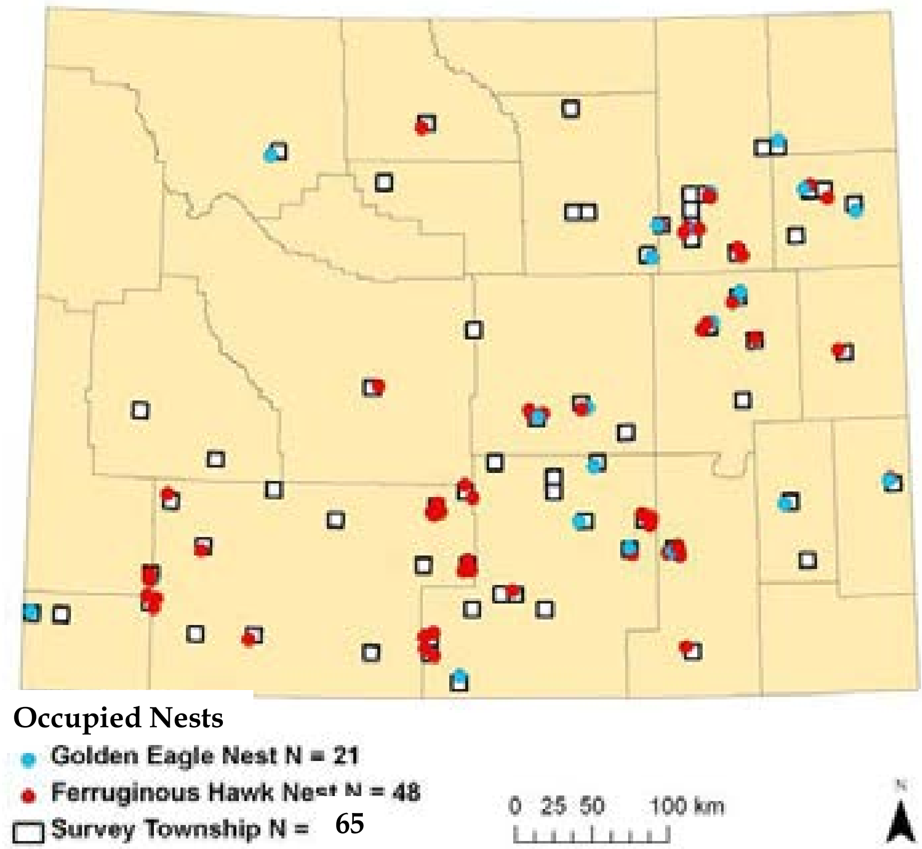


Figure 3. Location of occupied Ferruginous Hawk (red dots) and Golden Eagle (blue dots) nests and townships surveyed in Wyoming, 2010.

**WYOMING RANGE RAPTOR SURVEY AND INVENTORY PROJECT**

STATE OF WYOMING

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

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants, Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: 1 July 2010 – 30 June 2013

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Susan Patla, Nongame Biologist
Nick Dobric, Nongame Technician
Rod Lawrence, Nongame Technician

## ABSTRACT

This project is a continuation of work initiated in 2009. Our objectives were to obtain baseline data on the occurrence and distribution of forest raptors in the Wyoming Range to facilitate planning of on-going and future habitat projects and to develop standardized survey methods to assess population trend (Berven and Pavlacky 2010, Patla and Derusseau 2010). In 2010 survey we concentrated our efforts in the early part of the nesting season (March-June), to document locations of forest owls and to evaluate status of previously occupied Northern Goshawk nest stands. We conducted surveys for owls between February 28 and April 27, 2010 at night, traveling over snow on groomed roads from access points on the eastern side of the Wyoming Range on land managed by U.S. Forest Service. We surveyed for Northern Goshawk at six historic nesting locations and in previously unsurveyed habitat following protocols in the Northern Goshawk Inventory and Monitoring Technical Guide (Woodbridge and Hargis 2006). We surveyed 158 individual stations on survey routes for owls resulting in an average of 8.3 stations per survey night. We detected 97 owls, 87 on survey routes, including 76 detections of Species of Greatest Conservation Need. Boreal Owl (*Aegolius funereus*) was detected most frequently ($n$ = 55), and Great Gray Owl (*Strix nebulosa*) was the second most common ($n$ = 16). Few Northern Pygmy Owl (*Glaucidium gnoma*) were detected ($n$ = 5). For Northern Goshawk, we surveyed six known nest sites that had been active in 2009 to determine occupancy and productivity. A total of four had active nests during the incubation period (67% occupancy rate) and three were successful, producing two young each. We surveyed a total of 410 broadcast calling stations at randomly selected points but failed to discover any additional nests for Northern Goshawks, however, we documented two adults and one immature at new locations. This project is funded through 2012. In the future, we plan to analyze locations of detections in

an effort to identify factors that may improve our ability to identify potential nesting areas for SGCNs in the Wyoming Range.

## INTRODUCTION

This project is a continuation of work initiated in 2009. Our objectives were to obtain baseline data on the occurrence and distribution of forest raptors in the Wyoming Range to facilitate planning of on-going and future habitat projects and to develop standardized survey methods to assess population trend (Berven and Pavlacky 2010, Patla and Derusseau 2010). Mature conifer forests in the Wyoming Range provides nesting habitat for raptors designated as Species of Greatest Conservation Need (SGCN), including Northern Goshawk (*Accipiter gentilis*), Boreal Owl (*Aegolius funereus*), Great Gray Owl (*Strix nebulosa*), and Northern Pygmy Owl (*Glaucidium gnoma*). Goals in the Wyoming State Wildlife Action Plan (SWAP) for forest ecological systems call for working cooperatively with federal land management agencies and private landowners to ensure that SGCN are considered in all forest habitat projects, and to encourage cooperative management for raptors using systematic survey techniques at least two years prior to large-scale management activities (WGFD 2010).

Data for raptors classified as SGCNs that occur in forest habitats are lacking for the Wyoming Range where a number of timber projects and prescribed burns have been implemented and large landscape- level habitat assessments are currently being proposed. Most habitat work focuses primarily on stimulating aspen regeneration and improving habitat for ungulates through a combination of prescribed fire and timber harvest. Specific examples include the Wyoming Range Habitat Initiative, Wyoming Range Mule Deer Habitat Assessment, Wyoming Range Aspen Restoration Project, and the Piney Vegetation Management Project. Implementation of these projects will result in the reduction and fragmentation of older age forest and woodland stands within the Wyoming Range that provide habitat for Northern Goshawk and other wildlife species. Extensive timber harvest and large-scale fire events have already reduced the amount of older-age forests to an undetermined extent over the past 40 years. Additional cumulative loss and fragmentation of these stands is occurring as a result of accelerated mortality of older-aged conifers due to recent drought, disease and insect outbreaks.

In 2010 survey we concentrated our efforts in the early part of the nesting season (March-June), to document locations of forest owls and to evaluate status of previously occupied Northern Goshawk nest stands. We also surveyed portions of 10 randomly selected survey grids in June and August for Northern Goshawks using a standardized broadcast survey method.

## METHODS

The Wyoming Range, part of the Rocky Mountains, runs north-south in southwestern Wyoming (Figure 1). It is primarily administered by the Bridger-Teton National Forest (BTNF). Our study area is bounded to 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. Elevations range from approximately 1,520 - 3,463 m. We focused our survey effort at elevations <2,740 m. The climate is characterized by long, cold winters, and mild, dry summers. Mean snow depth, 1936-1992 at Snyder Basin, located near the southern boundary of the study area, was 124 cm during April and 79 cm during May (i.e. during the time when Northern Goshawks initiate incubation). Tree species in the area 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*) at lower elevations and forb meadows at higher elevations.

We conducted surveys for owls between February 28 and April 27, 2010 at night, traveling over snow on groomed roads from access points on the eastern side of the Wyoming Range on lands managed by U.S. Forest Service (FS). We selected survey routes within or adjacent to potential habitat treatment units in proposed project areas. We also selected additional routes in mature conifer stands not proposed for treatment. All survey routes were conducted along FS roads that were accessible by snow machines, skis, or snowshoes. We used GIS vegetation cover layer developed by Bridger-teton National Forest to identify potential mature forest stands.

We initiated surveys 30 min after sunset and ended no later than midnight (i.e., 0000 hr). We generally spaced survey stations every 0.8 km along survey routes. However, for some stations that we surveyed on skis or snowshoes we spaced them more closely (e.g., 0.5 km). We collected data on snow depth, temperature, noise level, and wind speed at the first and last station of each survey route. At every station, we recorded UTM, start and end times, and elevation using a handheld Garmin GPS unit.

Survey protocol required approximately 10 min. of listening periods interspersed with call playback periods for Boreal and Great Gray Owls (Table 1). We broadcasted recorded calls of owls using a FoxPro NX3 digital caller (http://www.gofoxpro.com/) and directed calls in four cardinal directions during each playback period. When we detected an owl, we recorded species, and compass bearing and estimated distance to the individual. We also recorded a confidence level for that species identification (high, medium, low). When we heard an owl response during any listening period, we ceased playing broadcast calls at that station to avoid potential predation of small owls or disturbance of territorial pairs. We would, however, continue to listen for additional responses for the remaining survey period. We ended surveys early when weather conditions became unfavorable (e.g., high wind, heavy snowfall, etc.) or when conditions impeded ability to hear or created hazardous travel conditions.

After each survey, we downloaded GPS waypoints using Garmin Mapsource and plotted approximate locations of detections of forest owls based on recorded estimates of bearing and distance for each detection. We eliminated obvious duplicate locations to avoid double counting. As a final step, we used Google Earth to review and make minor adjustments to estimated locations based on the assumption that detections originated from stands or small clusters of trees.

We surveyed for Northern Goshawk at six historic nesting locations and in previously unsurveyed habitat following protocols in the Northern Goshawk Inventory and Monitoring Technical Guide (Woodbridge and Hargis 2006). At four known nesting areas, we conducted surveys during the early nesting season using the dawn survey protocol (i.e., March 26-April 27).

We completed nest searches at all six areas and associated stands during the incubation period (i.e., May 21-June 6). During the subsequent nesting and fledgling periods (i.e., late June-August), we used the standardized broadcast call survey method to re-survey areas where we failed to detect an active nest.

We overlaid a grid over the entire study area to divide it into Primary Survey Units (Woodbridge and Hargis 2006; PSU). We randomly selected 15 PSUs to survey but eliminated five that were located at elevations >2,743 m or had a preponderance of non-forested or extremely steep terrain (i.e., >60% slope). Within PSUs, parallel transects were set 200 m apart, and survey stations were established at 250 m intervals along transects. We conducted surveys during the nesting period from 16 to 30 June and during the fledgling period from 10 to 21 August.

At each survey station located in forest habitat with trees at least 9 m in height, we broadcasted calls following a standardized protocol (Table 2). Due to budget constraints, not all PSU survey stations in suitable habitat were surveyed twice in 2010 as required for statistical analysis. In August, given limited survey time, effort was concentrated in areas with the highest quality habitat (i.e., mature stands with canopy closure >50%)

## RESULTS

We surveyed a total of 106 km for owls between 28 February and 27 April, 2010 (Table 3). Also shown in Table 3 are point locations where we detected owls during pre-dawn surveys for Northern Goshawk ($n$ = 3) and during non-survey periods at U.S. Forest Service cabins (USFS; $n$ = 2). We surveyed 158 individual stations on survey routes resulting in an average of 8.3 stations per survey night. Weather in 2010 was excellent, as compared to the previous survey year when we had to cancel many surveys due to high wind speeds and poor snow conditions.

We detected 97 owls (Table 4), 87 on survey routes, including 76 detections of SGCNs. Boreal Owl was detected most frequently ($n$ = 55), and Great Gray Owl was the second most common ($n$ = 16). Few Northern Pygmy Owl were detected ($n$ = 5). Other owl species we detected included: Northern Saw-Whet Owl (*Aegolius acadicus*; n = 9); Great Horned Owl (*Bubo virginianus*; $n$ = 5); and Long Eared Owl (*Asio otus*; $n$ = 3). We were unable to determine species on four other occasions. The probability of detecting an owl at one of the survey points was 61%.

Number of detections per km on survey transects was 0.82 per km. We recorded the highest number of owl detections ($n$ = 12) on the Spring Creek and Horse Mountain routes with nine Boreal and three Great Gray Owls. Other routes where we detected at least 10 owls included Fish Creek, Snyder Cabin, and Lead Creek. The only transect where we did not detect any owls was along Packsaddle Ridge, USFS Road 10139.

For Northern Goshawk, we surveyed six known nest sites that had been active in 2009 to determine occupancy and productivity. We conducted five surveys at dawn to listen for Northern Goshawk during the courtship period at four of these six nest areas, and detected a goshawk at one site on March 26. We later found an occupied nest at this site on May 21 about 100 m from where we heard a bird in March. We found three additional active nests during the incubation period in late May or early June for a total occupancy rate of 67%. Great Gray Owls occupied one of the six sites checked. Three of the four active Northern Goshawk nests were successful and produced two young each.

We did not detect any new nests in 2010, from surveys in the randomly selected PSUs or in additional new areas. During the nesting period prior to 15 July, we surveyed 212 stations during 80.25 hrs of survey time. During the fledgling period in August, we surveyed an additional 198 stations during 75.1 hrs of survey time. Average number of stations covered per hr was similar in both periods: 2.6 station per hr. We detected an adult Northern Goshawk in PSU 1 on 16 June, an adult in PSU 12 on 1 July, and a yearling Northern Goshawk in PSU 13 on 30 June. We also recorded locations of a number of other SGCN wildlife species. A complete summary and assessment of survey work for Northern Goshawk in the Wyoming Range will be prepared after surveys are completed in 2012.

## DISCUSSION

Raptors associated with mature forest habitat occur throughout the Wyoming Range, however because nesting pairs occur at low densities, terrain is rugged, and these species are generally secretive, it was difficult to locate nest and assess population trends. Favorable weather conditions during the early part of the nesting season in 2010 enabled us to detect numerous forest owls. Results will be provided to biologists who are planning future vegetation treatments. In the future, we plan to analyze locations of detections in an effort to identify factors that may improve our ability to identify potential nesting areas for SGCNs in the Wyoming Range. This project is funded through 2012. Our goal is to construct a predictive model for nesting habitat of Northern Goshawk in the Wyoming Range after completion of surveys in summer 2012. We hope through the development of landscape predictive habitat models for raptors that utilize mature forests we will be able to provide land managers with the necessary information to improve planning for the conservation of these species.

## ACKNOWLEDGEMENTS

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Table 1. Sequence of listening and duration of survey periods used to survey for owls at designated survey points in the Wyoming Range, February-April, 2010.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Listen (3 min) | Broadcast Boreal Owl call (20 s) | Listen (2 min) | Broadcast Boreal Owl call (20 s) | Listen (2 min) | Broadcast Great Gray Owl call (20 s) | Listen (2 min) |

Table 2. Sequence of listening and duration of survey periods used to survey for Northern Goshawk at designated survey points in the Wyoming Range, June-August 2010.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Listen (1 min) | Broadcast Goshawk call straight ahead (10 s) | Listen (30 s) | Broadcast Goshawk call, 60º to the right (10 s) | Listen (30 s) | Broadcast Goshawk call, 60º to the left (10 s) | Listen (1 min) |

Table 3. Shown are owl survey route and point location names, survey dates, survey start and end times and survey route starting and ending UTM's completed for the State Wildlife Grant Wyoming Range Raptor Survey and Inventory Project 2010. All locations were collected in NAD83.

| Survey Area | Date | Distance (km) | Start time | End time | Starting UTM | Ending UTM |
|---|---|---|---|---|---|---|
| Apperson | 2/28 | 6.4 | 1845 | 2134 | 537485 4727427 | 540451 4725854 |
| Fish Cr. | 3/1 | 8.9 | 1837 | 2121 | 539409 4707015 | 538553 4712713 |
| M. Piney | 3/8 | 4.8 | 1840 | 2019 | 535625 4716829 | 538753 4718606 |
| Snyder | 3/9 | 10.1 | 1845 | 2236 | 536026 4696941 | 536461 4703440 |
| Lander Cutoff | 3/10 | 4.3 | 1905 | 2043 | 544910 4706391 | 540685 4706599 |
| M. Piney N | 3/11 | 7.6 | 1925 | 2148 | 539792 4725672 | 539953 4719747 |
| N. Piney Cr. | 3/12 | 3.2 | 1845 | 2122 | 536823 4724972 | 539616 4725409 |
| Horse Cr. | 3/13 | 2.4 | 1855 | na | 534899 4753277 | 539682 4753170 |
| Spring Cr. | 3/14 | 9.2 | 1850 | 2252 | 539910 4755962 | 548845 4755571 |
| Straight Cr. | 3/22 | 5.8 | 2003 | 2202 | 538064 4720104 | 542709 4717391 |
| Bare Mt. | 3/23 | 9.2 | 2037 | 2317 | 542102 4725714 | 541194 4724320 |
| Snyder Cabin | 3/24 | 1 point | 1920 | | 538412 4704926 | |
| Packsaddle Rd 10173 | 3/24 | 6.0 | 2025 | 2247 | 538913 4699327 | 538913 4699327 |
| Cottonwood (North) | 3/27 | 2.3, 5.6 | 2014 | 2349 | 532612 4744372 | 536833 4743508 |
| Packsaddle Rd 10139 | 4/7 | 5.6 | 2118 | 2239 | 540202 4700657 | 537965 4701947 |
| Labarge Cr. | 4/9 | 3.5 | 1950 | 2142 | 527513 4705457 | 532100 4702235 |
| Fish Cr. | 4/10 | 3.5 | 1852 | 2131 | 540732 4711361 | 538734 4712383 |
| Middle Piney (S) | 4/20 | 4.8 | 2040 | 2215 | 539339 4707094 | 540529 4716203 |
| Lander Mt. | 4/21 | 1.6 | 2014 | 2042 | 539108 4714035 | 539550 4714727 |
| McDougal Gap | 4/24 | 1 point | 0605 | | 540040 4715475 | |
| Sherman Cabin | 4/24 | 1 point | 2100 | | 540529 4716203 | |
| Myrna Butte | 4/25 | 1 point | 0550 | | 535858 4733785 | |
| Lead Cr. | 4/25 | 4.0 | 2029 | 2222 | 546896 4757369 | 550278 4755652 |
| S Piney Cr. | 4/27 | 1 | 0548 | | 547589 4757017 | |

Table 4. Forrest owl surveys conducted for the State Wildlife Grant Wyoming Range Raptor Survey and Inventory Project 2010. Shown are survey routes, date of survey, total number of detections, and number of detection per owl species. Key to owl species: GGOW Great Gray Owl, NOPO Northern Pygmy Owl, BOOW Boreal Owl, LEOW Long-eared Owl, NSOW Northern Saw-whet Owl, GHOW Great Horned Owl.

| Survey Area | Date | No. of detections | GGOW | NOPO | BOOW | LEOW | NSOW | GHOW | Unknown |
|---|---|---|---|---|---|---|---|---|---|
| Apperson | 2/28 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Fish Ck | 3/1 | 10 | 3 | 0 | 6 | 0 | 0 | 1 | 0 |
| M. Piney | 3/8 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Snyder | 3/9 | 10 | 4 | 0 | 4 | 0 | 1 | 0 | 1 |
| Lander Cutoff | 3/10 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| M. Piney N | 3/11 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| N. Piney Ck | 3/12 | 6 | 1 | 1 | 2 | 2 | 0 | 0 | 0 |
| Horse Ck | 3/13 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Spring Ck | 3/14 | 12 | 3 | 0 | 9 | 0 | 0 | 0 | 0 |
| Straight Ck | 3/22 | 4 | 0 | 1 | 1 | 0 | 2 | 0 | 0 |
| Bare Mt. | 3/23 | 5 | 1 | 0 | 2 | 0 | 1 | 1 | 0 |
| Snyder Cabin | 3/24 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Packsaddle Rd 10173 | 3/24 | 5 | 0 | 0 | 3 | 0 | 2 | 0 | 0 |
| Cottonwood (North) | 3/27 | 4 | 1 | 0 | 2 | 0 | 0 | 0 | 1 |
| Packsaddle Rd 10139 | 4/7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Labarge Ck | 4/9 | 5 | 1 | 0 | 2 | 0 | 1 | 0 | 1 |
| Fish Ck | 4/10 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| Middle Piney (S) | 4/20 | 4 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |

Table 4. Continued.

| Survey Area | Date | No. of Detections | GGOW | NOPO | BOOW | LEOW | NSOW | GHOW | Unknown |
|---|---|---|---|---|---|---|---|---|---|
| Lander Mt. | 4/21 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| McDougal Gap | | | | | | | | | |
| | 4/24 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sherman Cabin | | | | | | | | | |
| | 4/24 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Myrna Butte | | | | | | | | | |
| | 4/25 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Lead Ck | 4/25 | 10 | 0 | 0 | 6 | 0 | 1 | 3 | 0 |
| S Piney Ck | 4/27 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

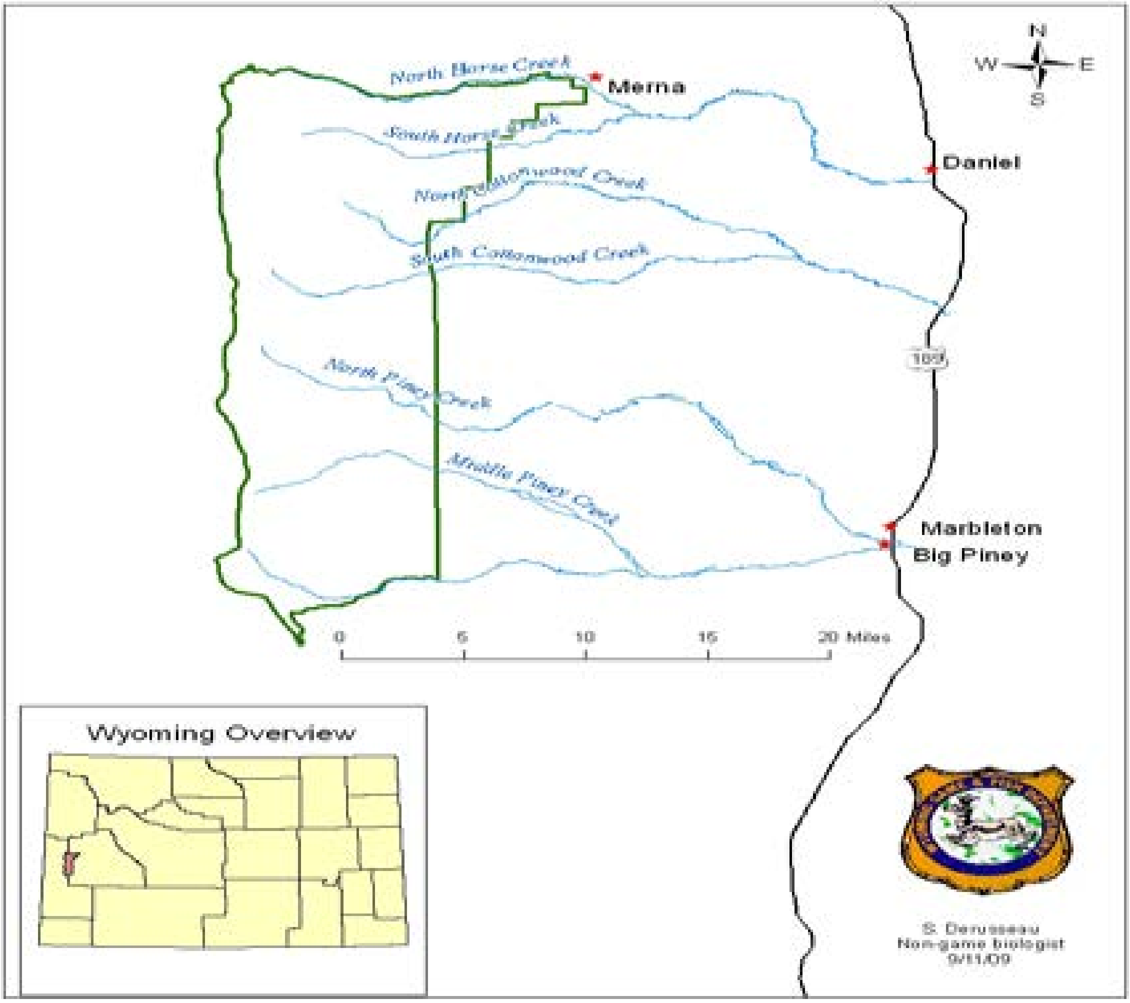


Figure 1. Map of study area for the State Wildllife Grant Wyoming Range raptor survey and inventory project 2009-2010. Study area is outlined in green**.**

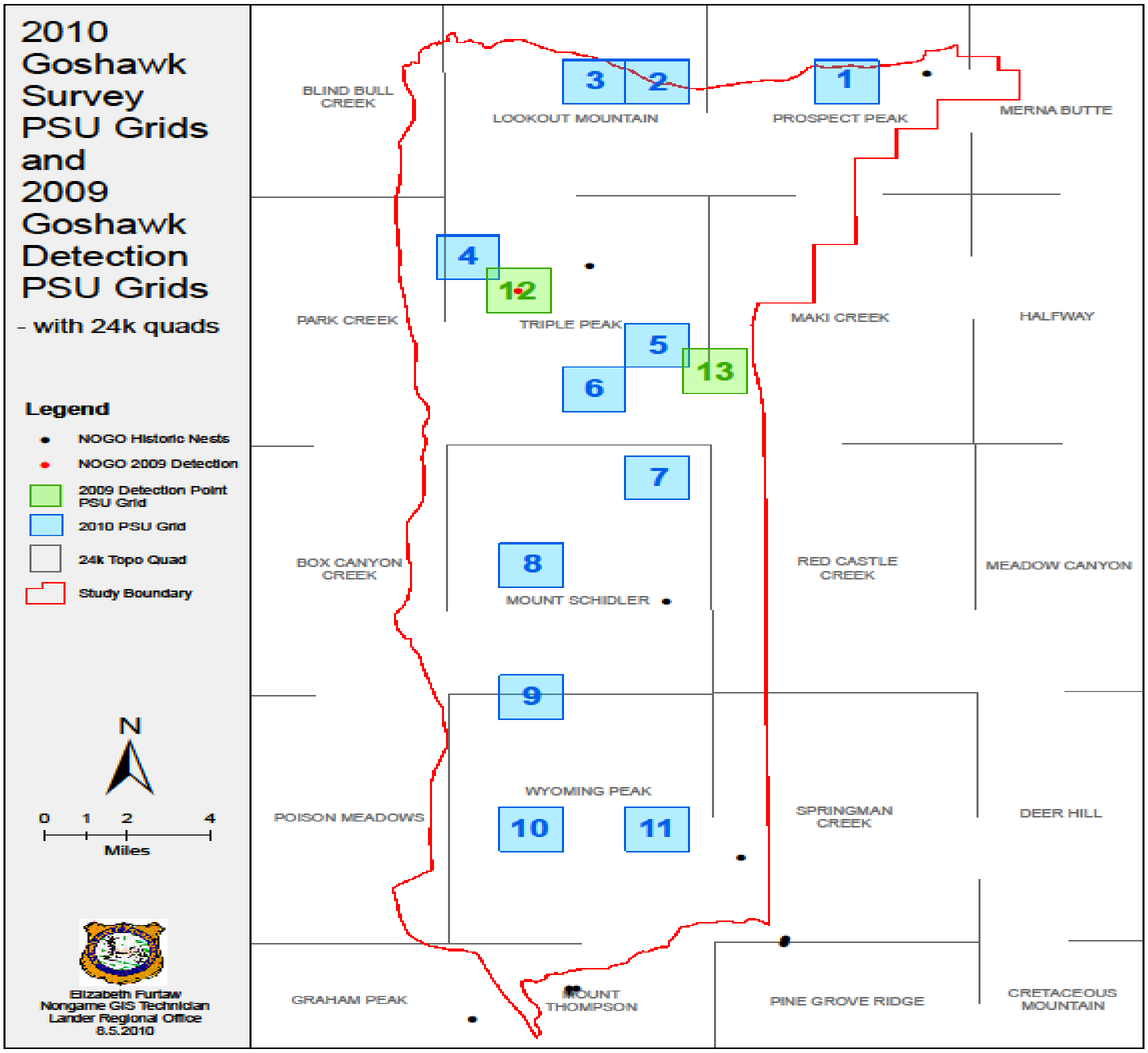


Figure 2. Randomly selected survey grids for Northern Goshawk surveys in the Wyoming Range 2010.

**PRODUCTIVITY SURVEYS FOR PEREGRINE FALCON**

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Peregrine Falcon

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Bob Oakleaf, Nongame Coordinator
Susan Patla, Nongame Biologist
Doug Smith, Senior Wildlife Biologist, Yellowstone National Park

## ABSTRACT

We have monitored nesting Peregrine Falcons (*Falco peregrines*) in Wyoming since the species was removed from the Endangered Species list in 1999. This report describes activities conducted during the 2010 nesting season. We monitored 36 nesting pairs for productivity. A total of 30 (83%) were successful and produced 66 young with a mean of 1.8 young per pair. Our results are similar to previous years and long term averages.

## INTRODUCTION

In cooperation with The Peregrine Fund, Inc we developed plans to re-establish Peregrine Falcons in Wyoming from analysis of historical distribution and evaluation of potential habitat 1978-1980. Our goal of reintroduction was to establish and maintain a self-sustaining breeding nucleus in the wild. We set objectives to annually release approximately 15 Peregrine Falcons and establish 30 breeding pairs in Wyoming by 1996. We coordinated the program with Idaho and Montana to maximize efforts to re-establish this species. Reintroduction and monitoring efforts for Peregrine Falcon 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, we released 384 Peregrine Falcons between1980-1995 with at least 325 (85%) individuals surviving to dispersal (i.e., 1 month post-release). We have not released peregrines since 1995 because we attained our programmatic objectives between 1994 and 1995. As a result of this reintroduction effort, the species was removed from the Endangered Species Act in 1999. We do, however, continue to monitor populations because their distribution is restricted. We have monitored performance of nesting Peregrine Falcons in Wyoming on an annual basis since reintroduction efforts were initiated in cooperation with the U.S. Fish and

Wildlife Service (USFWS). We also participate every 3 years in the National Monitoring Plan for delisting of the American Peregrine Falcon with supplemental funding from the USFWS (Agreement #60181G446; Table 1).

## METHODS

We recorded potential cliffs where Peregrine Falcons could nest in Wyoming during baseline surveys from 1978-1980, and periodically checked sites for occupancy using ground surveys. We collected production data from as many of the known territories as possible from 1984-2004. Since 2005, we focused annual surveys on 30 territories that are 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, 15 previously selected sites are automatically selected, and an additional 15 are randomly chosen so that we attempt to annually monitor at least 30 territories. We observe additional sites as time allows during travels to selected territories or by cooperators with interest in specific sites.

We evaluated occupancy for each of the selected territories during early season visits and record productivity during one or more observations of adults feeding young later in the season. Territories that appeared to be not occupied with a breeding pair received additional survey effort (i.e., repeated visits following protocol of two or more visits of 4 or more hours) before we classified the territory as not occupied. Nest success was determined by at least two visits with the last visit occuring in time to observe chicks that are 28 days or older. Eyries that were situated where it was difficult to observe young were visited after fledging to assure a more complete count.

## RESULTS AND DISCUSSION

We addressed the Monitoring Plan for the American Peregrine Falcon in Wyoming (USFWS Agreement # 601818G446) in 2009, but not in 2010 (Table 1). We conducted surveys in 2010 resulting in two expanded data sets (Tables 2 and 3). In 2010, we surveyed only 28 of the 30 randomly selected nesting territories and classified 24 of these territories as occupied. Pairs fledged 42 young with a mean of 1.7 young per occupied territory (Table 2). We also surveyed an additional 14 nesting territories in 2010 for a statewide total of 42 territories. We classified 36 territories as occupied with breeding adults (Table 3). These 36 pairs produced 66 young with a mean 1.8 young per occupied territory.

Following extirpation and subsequent reintroductions of the Peregrine Falcon, we documented nesting in Wyoming beginning in 1984. Since then, ≥875 nesting attempts have been recorded at 93 territories in Wyoming. At least 1,337 young were produced with a minimum mean of 1.6 young fledged per nesting pair.

Production indexes of randomly selected territories and all sites observed continue to be similar and in 2010. Our results were also similar to long term averages and what is hypothesized to be the minimum threshold for maintaining a stable population.

## ACKNOWLEDGEMENTS

S. Langston, L. Van Fleet and M. Wilson assisted peregrine surveys during 2010. M. Ruehmann, C. Paige, K. Gura, and S. Wolff assisted surveys in Grand Teton National Park. Peregrine monitoring in Yellowstone National Park was conducted by J. Pagel, L. Henry, L. Baril, N. Bowersock, B. Cassidy, and J. Parker.

Table 1. Productivity of Peregrine Falcon in Wyoming for the past 3 survey intervals. We present only data for sites that we monitored as part of the cooperative National Survey with the US Fish and Wildlife Service.

| Year | No. territories. checked | Number occupied | No. successful (%) | No. young fledged | No. young per occupied territory |
|---|---|---|---|---|---|
| 2003 | 15 | 15 | 12 (80) | 28 | 1.9 |
| 2006 | 14 | 14 | 11 (79) | 26 | 1.9 |
| 2009 | 15 | 14 | 7 (54) | 14 | 1.0 |

Table 2. Productivity of Peregrine Falcon at 30 randomly selected sites in Wyoming 2010. We present data for the last six survey years.

| Year | No. Territories. Checked | No. Occupied | No. Successful (%) | No. Young Fledged | No. Young / Occupied Territory |
|---|---|---|---|---|---|
| 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 |
| 2010 | 28 | 24 | 19 (79) | 42 | 1.7 |

Table 3. Productivity of Peregrine Falcon at all known sites in Wyoming, 1998-2009.

| Year | No. Territories. Checked | No. Occupied | No. Successful (%) | No. Young Fledged | No. Young / Occupied Territory |
|---|---|---|---|---|---|
| 1998 | 44 | 44 | 35 (79) | 84 | 1.9 |
| 1999 | 42 | 42 | 25 (59) | 57 | 1.4 |
| 2000 | 46 | 46 | 40 (87) | 83 | 1.8 |
| 2001 | 42 | 42 | 39 (93) | 81 | 1.9 |
| 2002 | 60 | 59 | 49 (83) | 97 | 1.6 |
| 2003 | 58 | 58 | 50 (86) | 107 | 1.8 |
| 2004 | 66 | 65 | 56 (86) | 130 | 2.0 |
| 2005 | 64 | 64 | 45 (70) | 99 | 1.6 |
| 2006 | 61 | 61 | 44 (72) | 101 | 1.7 |
| 2007 | 54 | 51 | 36 (71) | 75 | 1.5 |
| 2008 | 29 | 29 | 19 (65) | 45 | 1.5 |
| 2009 | 46 | 41 | 28 (68) | 58 | 1.4 |
| 2010 | 42 | 36 | 30(83) | 66 | 1.8 |
| MEAN | | | 77.3 | | 1.68 |
| SD | | | 10.1 | | 0.19 |

## DOCUMENTING PRESENCE OF FOREST OWLS IN THE SHOSHONE NATIONAL FOREST

STATE OF WYOMING

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

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations

PERIOD COVERED: 15 April 2010 – 14 April 2011

PROJECT DURATION: Annual

PREPARED BY: Nichole Cudworth, Nongame Biologist
Andrea Orabona, Nongame Bird Biologist

## ABSTRACT

Owls are excellent indicators of forest health, but are also extremely vulnerable to habitat loss and conversion. Forests in Wyoming are exposed to a variety of threats, including outbreaks of pine and bark beetles and incompatible logging practices. Boreal Owls (*Aegolius funereus*) and Great Gray Owls (*Strix nebulosa*) are both dependent upon mature coniferous forests for nesting and foraging. In 2010, we used broadcast calls to survey for both owl species in the Shoshone National Forest. Boreal Owls were detected seven times and on all four survey routes. Great Gray Owls were not detected during our surveys. We hypothesize that the low snowfall recorded in the winter of 2009-2010 resulted a decrease of anthropogenic disturbance from snowmobiles. This may have resulted in an increase in the number of detections of Boreal Owls compared to previous years; however, the impact of recreationalists on presence and detection rates of forest owls has not been quantified and warrants further investigation. Regardless of the cause, maintaining areas of mature forest containing trees with cavities and broken-off snags for nesting and open areas for foraging is likely crucial to maintaining breeding populations of Boreal and Great Gray Owls in Wyoming.

## INTRODUCTION

As birds of prey, owls are located at the top of the food chain, which makes them excellent indicators of ecosystem health, but also vulnerable to stress and changes in their habitat (Takats et al. 2001). Three species of forest owls are currently classified by the Wyoming Game and Fish Department (Department) as Species of Greatest Conservation Need: Boreal Owls (*Aegolius funereus*), Great Gray Owls (*Strix nebulosa*), and Northern Pygmy-Owls (*Glaucidium gnoma*; WGFD 2010). Boreal and Great Gray Owls are also classified as Sensitive by the U.S. Forest Service (USFS 2005). Boreal Owls typically inhabit mature and old-growth, high elevation subalpine forests comprised of Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), and mature lodgepole pine (*Pinus contorta*), with interspersed mature aspen (*Populus tremuloides*) stands (Garber et al. 1991). Small openings provide foraging habitat, while large trees with cavities created by Northern Flickers (*Colaptes auratus*) provide nesting areas. Similarly, Great Gray Owls are associated with mature, dense coniferous forests with open meadows for foraging and large, broken-off snags for nesting (WGFD 2010).

Forests in Wyoming are exposed to a variety of threats, including disrupted fire regimes, outbreaks of bark and pine beetles, drought and climate change, and incompatible logging practices (e.g., clearcutting; WGFD 2010). Both Boreal and Great Gray Owls are particularly sensitive to habitat loss and conversion, which reduce prey abundance; change or remove the vegetative structure needed for foraging, roosting, cover, and protection; and reduce or eliminate trees with suitable nest cavities (Bull and Duncan 1993, Hayward and Hayward 1993). Consequently, conducting multiple surveys for these species over time will not only provide information on presence and distribution, but also allow for a general understanding on forest health. In 2010, we continued surveys for Boreal and Great Gray Owls in the Shoshone National Forest (SNF) to document presence of owl species and compare number of detections in 2010 to previous years.

## METHODS

In 2010, we conducted surveys for forest owls along four pre-defined routes in the SNF near Dubois, Fremont County, Wyoming. Transect length depended upon amount of habitat and time available to conduct surveys. We used fluorescent flagging to mark routes approximately every 0.8 km prior to sunset, and used snowmobiles, ATVs, and snowshoes to traverse routes after sunset (Cerovski 1999). We began surveys no earlier than ½ hr after sunset and continued no later than 0000 hrs, because the first few hours after dark appeared to be the most vocal period. We only conducted surveys during calm weather conditions (i.e., wind <8 km/hr and without heavy precipitation).

We conducted night-time surveys during peak breeding season (i.e., 1 March – 15 April for the Boreal Owl and 1 February – 31 March for the Great Gray Owl) when male owls were calling. We used call-broadcast surveys to record presence of owls along predefined transects. The call-broadcast survey method is a widely recognized technique for detecting owls during the breeding season and a more effective method for detecting owls when compared to passive observational techniques (Fuller and Mosher 1981, 1987; Johnson et al. 1981; Takats et al. 2001). We extinguished all lights prior to starting the broadcast survey and broadcasted calls on each side of the route at approximately twice the volume of a normal owl call. After arriving at each stop, we listened for owl vocalizations for 3 min and then attempted to illicit a response by completing three repetitions of playbacks for 20-30 sec. After each playback, we listened for 2 min before initiating additional playbacks. When we surveyed for multiple species, we started with calls from the smaller owl species before proceeding to those of the larger owl species. We always ended the survey if a larger owl responded to the call of a smaller owl to reduce the likelihood of predation. We recorded all owl detections, as well as habitat type, elevation, moon phase, weather conditions, and any additional comments. All survey data (number of owls detected and comments made during each survey) are located in the Nongame Bird Biologist's files at the Department's Lander Regional Office.

We completed four routes in 2010: Brooks Lake Creek (6.4 km; 8 stops) on 20 March, Middle Fork of Long Creek (6.4 km; 9 stops) on 27 March, Moccasin Basin (5.6 km; 7 stops) on 23 February, and Pelham Lake Road (8.0 km; 11 stops) on 26 February. In order to draw comparisons to previous years, we divided the total number of owls detected by distance surveyed to determine an estimate of the number of owls per km for each survey route. Although 12 routes in the SNF and Bridger-Teton National Forest have been surveyed sporadically since 1998, we only present results from routes surveyed in 2010 in this report.

## RESULTS

We detected three Boreal Owls on the Brooks Lake Creek route, two on the Moccasin Basin route, and one each on the Middle Fork of Long Creek and Pelham Lake Road routes. We did not detect any Great Gray Owls (Table 1). We also recorded a Northern Saw-whet Owl (*Aegolius acadicus*) responding to playbacks on the Middle Fork of Long Creek route. Similar to surveys conducted in 1998 and 1999, we detected Boreal Owls on 100% of survey routes in 2010 and in similar numbers. This differs drastically from surveys conducted in 2008 and 2009, when no owls of either species were detected on any routes (Table 1).

## DISCUSSION

We detected Boreal Owls on each of the four routes we surveyed in 2010, two of which resulted in multiple detections. These high numbers of detections differed drastically from surveys in 2008 and 2009, when no owls were detected. The lack of detections in 2008 and 2009 were suggested to be due to three potential factors: increased anthropogenic disturbance from snowmobiles, changes in habitat suitability due to beetle kill, and late survey dates resulting in lower response rates of males (Knox and Orabona 2009). Surveys in 2010 were conducted along the same routes and at approximately the same dates as previous surveys, suggesting that low detections were likely not due to habitat shifts or timing. However, the low snowfall in winter of 2009-2010 resulted in less frequent trail grooming and lower snowmobile use throughout SNF, potentially leading to the higher detections that survey year. Consequently, the potential impacts of human disturbance and noise on presence and detections of forest owls should be explored further. Although we are not able to distinguish between the effects of weather, which potentially influenced prey availability, and lower use by recreationalists, the multiple detections during 2010 surveys are promising.

Survey routes were designed to target important breeding habitat for both Boreal and Great Gray Owls, specifically, areas of mature Engelmann spruce and subalpine fir as well as areas of mature spruce-fir and lodgepole pine with scattered small to large openings. The importance of maintaining these mature forest habitat conditions within the SNF cannot be overstated, and care should be taken to restrict habitat loss via removal of mature spruce-fir and lodgepole pine stands. Forest owls may be able to successfully reproduce in logged areas (Hakkarainen et al. 1997), likely due to a more variable prey base. However, maintaining habitat with suitable sites for nesting (e.g., areas of mature, old-growth forest with large trees and snags), security from predators, and dense prey populations is likely critical to maintaining breeding populations of forest owls in the SNF (Franklin 1988, Hakkarainen et al. 1997, Hipkiss et al. 2008).

## ACKNOWLEDGEMENTS

We would like to thank U.S. Forest Service – Shoshone National Forest personnel D. Probasco and J. Leisy for their valuable contributions to the 2010 Boreal and Great Gray Owl surveys.

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[WGFD] Wyoming Game and Fish Department. 2010. State wildlife action plan. Wyoming Game and Fish Department, Cheyenne, USA.

Table 1. Survey route, year, and number of detections per km for Boreal Owl (*Aegolius funereus)* and Great Gray Owl (*Strix nebulosa*) broadcast surveys on the Shoshone National Forest, Wyoming. Blank cells indicate this species was not included in the survey.

| Survey route | Survey year | Boreal Owl | Great Gray Owl |
|---|---|---|---|
| Brooks Lake Creek | 1998 | 0.4 | |
| | 2009 | 0 | 0 |
| | 2010 | 0.5 | |
| Middle Fork of Long Creek | 1999 | 0.2 | |
| | 2009 | 0 | 0 |
| | 2010 | 0.2 | |
| Moccasin Basin Road | 1998 | 0.4 | |
| | 2008 | 0 | 0 |
| | 2010 | 0.4 | |
| Pelham Lake Road | 1998 | 0.3 | |
| | 2008 | 0 | 0 |
| | 2008 | 0 | 0 |
| | 2010 | 0.1 | 0 |

**SUMMARY OF MOUNTAIN PLOVER SURVEYS IN FIVE BREEDING CONCENTRATION AREAS IN WYOMING**

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need – Mountain Plover

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Andrea Orabona, Nongame Bird Biologist

## SUMMARY

As part of a Master of Science thesis project at the University of Wyoming, Plumb (2004) estimated breeding bird density on five concentration areas for Mountain Plover (*Charadrius montanus*) in Wyoming and pooled the data to estimate population size for the State. The surveys were repeated in 2004 by Stephens (2006), although only a single observer, rather than a double observer was used. In 2010, due to a U.S. Fish and Wildlife Service decision to reinstate a portion of their 5 December 2002 proposed rule concerning the listing of the Mountain Plover as federally threatened, we establish a permanent plover monitoring program in these five breeding concentration areas using results provided by Plumb (2004) and Stephens (2006). Our goal was to identify and implement standard survey techniques that can be used to estimate population size and evaluate trend statewide.

The five breeding concentration areas for Mountain Plover included two grassland landscapes (i.e., Laramie and Shirley Basins) and three mixed desert-shrub/grassland landscapes (i.e., Big Horn, Great Divide, and Washakie Basins). We followed methodology from Plumb (2004), as modified by Stephens (2006), to establish permanent transects for conducting surveys for Mountain Plovers. We visited four of the five concentration areas in 2010 and initiated surveys on three of the four areas visited. Inclement weather precluded our ability to complete the planned surveys in all five areas. Mountain Plovers were detected within all breeding concentration areas visited in 2010. Counts of Mountain Plover were lower than recorded in 2004 and 2006. We hypothesize that uncharacteristically high amounts of spring rainfall and the subsequent excessive growth of graminoid species may have reduced detection of Mountain Plovers during our surveys.

Future efforts will include finalizing permanent survey transects for Mountain Plovers within the five known breeding concentration areas, conducting annual surveys using a

standardized and peer-reviewed protocol, and prioritizing additional sites for expanding survey efforts based on known and historic plover locations.

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## EVALUATION OF IMPACTS OF WIND ENERGY DEVELOPMENT ON NESTING GRASSLAND BIRDS

STATE OF WYOMING NON-GAME BIRDS: Species of Greatest Conservation Need

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants

PROJECT DURATION: Masters Thesis Research

PERIOD COVERED: 1 January 2011 – 31 March 2011

PREPARED BY: Anika Mahoney, 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 to establish specific study objectives and design for the first season of field research examining potential differences in the abundance, diversity and/or nesting productivity of breeding grassland birds at sites with and without wind energy development and along a spatial gradient of proximity to wind energy development. We thoroughly read relevant literature in order to gain an understanding of grassland and avian ecology, patch and landscape-scale disturbances, and habitat fragmentation. A field crew of three technicians has been hired. We are working to establish a relationship with PacifiCorp Energy to gain access to wind farm sites. We made a change to our original objectives: since PacifiCorp already conducts mortality surveys at wind farm sites we have eliminated this component from our study. A tentative agreement for use of the Glenrock I, Glenrock III and Rolling Hills wind farms as study sites has been made. Exact site boundaries within these areas and paired sites with no wind energy development are still to be determined.

Avian abundance, species richness, and diversity will be assessed using line-transect surveys or point count clusters. Nesting success will be assessed by nest searching and monitoring. Microhabitat characteristics including percent grass and forb cover, litter depth, and maximum vegetation height will be measured at survey sites, nest sites, and paired non-nest sites (to evaluate potential variation in nest site selection across treatments). Training of field technicians will take place during May 2011. Surveys will be conducted during the first portion of the field season (May – June), and nest searching and monitoring will be conducted throughout the breeding season (May- mid-August). Habitat sampling will be conducted at nests and paired sites after nest fate has been established.

**GRASSLAND CONSERVATION AND OUTREACH FOR SPECIES OF GREATEST CONSERVATION NEED IN SOUTHEASTERN WYOMING**

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: July 2008 – December 2010

PERIOD COVERED: July 2008 – December 2010

PREPARED BY: Laura Quattrini, Rocky Mountain Bird Observatory
Seth Gallagher, Rocky Mountain Bird Observatory

## SUMMARY

Outreach plays a critical role in the mission of the Rocky Mountain Bird Observatory (RMBO) Stewardship Division. Increasing awareness among landowners and other resource professionals about Species of Greatest Conservation Need (SGCN) and their habitat requirements is critical to reaching new audiences and ultimately achieving conservation on the ground. To meet this goal, we attended and presented at various professional and agricultural meetings and conferences, visited with private landowners, held private landowner workshops, located funding, and worked with partners to conduct on-the-ground habitat enhancement projects.

With financial assistance provided by the Wyoming Game and Fish Department (Department), RMBO has been able to perform outreach activities throughout southeastern Wyoming. We have reached well over 700 people, both private landowners and resource professionals, by giving over 10 presentations, holding 3 private lands management workshops, visiting 3 private landowners, having a booth at several public events and agriculture meetings, and writing an editorial for the Wyoming Livestock. Through support from the Department and time spent increasing awareness for SGCN in Wyoming, we are now assisting conservation partners in both outreach efforts and on-the-ground habitat enhancement efforts. Since 2008, RMBO has been working with the Natural Resources Conservation Service (NRCS) in Wyoming to place Private Lands Wildlife Biologists in NRCS field offices in the state. These positions will increase partner capacity to raise awareness about wildlife needs and the Farm Bill's conservation programs that provide funds to allow private landowners to achieve habitat enhancement goals.

**MECHANISTIC STUDY OF ENERGY DEVELOPMENT IMPACTS TO SONGBIRDS**

STATE OF WYOMING

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

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants

PROJECT DURATION: Masters Thesis Research

PERIOD COVERED: April 4 2010 – April 4 2011

PREPARED BY: Matthew G. Hethcoat, 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.

In response to significant trends in sagebrush-obligate songbird nest predation identified in a prior Wyoming Game and Fish Department funded project completed in 2010 (Michelle Gilbert's work), this project is a follow up study to identify specific mechanisms driving observed increases in nest predation associated with energy development proximity and density.

We worked on a study design for the first season of field research in southwest Wyoming. We thoroughly read relevant literature in order to gain an understanding of shrub-steppe ecology, habitat fragmentation, predator-prey dynamics, and the effects of energy development on game species in Wyoming. We corresponded with Wyoming Game and Fish Department, Wyoming Geographic Information Science Center, and U.S. Geological Survey to gain essential advice and collect important data. We presented our methods and obtained valuable feedback via a poster presentation at the 2010 annual meeting of The Wildlife Society Wyoming Chapter and an oral presentation at a University of Wyoming Zoology Department seminar series.

We will study nest predation patterns of the Brewer's Sparrow, Sage Sparrow, and Sage Thrasher within the Jonah-Pinedale Development Area (JPDA) in southwestern Wyoming during May - August 2011 and 2012. Nest searching plots will be categorized by the number of wells within $1km^2$ (0, 5-10, and >20). To examine temporal patterns in nest predation risk we will re-use a majority of sites sampled in 2008 and 2009 by Michelle Gilbert. Additional replicate plots will be identified to strengthen statistical inference and to sharpen nest survival estimates. In

order to assess potential differences in nest predator abundance and richness across a gradient of energy development intensity we will: (1) use miniature continuous infra-red video recording systems to document predation events at nests and identify nest predator species; (2) conduct diurnal nest predator surveys using point counts and area searches; and (3) maintain scent stations to sample nocturnal meso-predators adjacent to nest searching plots. In addition, habitat metrics such as shrub cover, shrub vigor, and number of potential nest shrubs will be collected within vegetation sampling plots (5m radius) at nest sites and at random non-nest locations in order to examine whether birds alter nesting habitat choices in the vicinity of human disturbance and to examine differences in nest predation associated with habitat structure.

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

STATE OF WYOMING

NONGAME BIRDS AND MAMMALS: Species of Greatest Conservation Need

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants

PROJECT DURATION: Masters Thesis Research

PERIOD COVERED: 31 March 2010 – 31 March 2011

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 completed the first season of field research in the Medicine Bow National Forest of Wyoming (May- August 2010). We sampled songbirds, woodpeckers, and diurnal/nocturnal small mammals across a gradient of patch sizes in two stand types (i.e., young, previously harvested lodgepole and spruce-fir) in order to evaluate the relative value of these alternative stand types as spatiotemporal refugia for lodgepole wildlife and potential critical patch size thresholds prior to mature lodgepole regeneration. We organized and analyzed data, presented results at The Wildlife Society National Conference (Oct 2010), University of Wyoming student seminar series (Nov 2010), and the Wyoming Chapter of The Wildlife Society (Nov 2010).

We are currently preparing for the second and final field season for the project. Abundance and diversity of avian and mammalian species will be assessed using point counts and live-trapping, respectively. Training of field technicians will take place from June 13- 15. Avian and diurnal small mammal point counts will be conducted during the first portion of the field season (17 June – 22 July), and nocturnal small mammal trapping will be conducted during the last portion of the field season (25 July – 16 September).

# SPECIES OF GREATEST CONSERVATION NEED - MAMMALS

# INVENTORIES OF FOREST BATS IN NORTHEASTERN WYOMING: MIST NETTING

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Bats

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants, Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: 1 July 2010 – 30 June 2012

PERIOD COVERED: 1 July 2010 – 14 April 2011

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

## ABSTRACT

Wyoming hosts 12 species of resident bats, all of which are recognized as Species of Greatest Conservation Need by the Wyoming Game and Fish Department. Inventories for bats in forests of eastern Wyoming have previously been lacking, limiting our understanding of species distributions and our ability to manage populations. In 2010, we surveyed forests of northeastern Wyoming to document distribution, relative abundance, and diversity of bat species. We captured 495 individuals, representing 12 species, on 41 survey grids. Our captures included two peripheral species, the eastern red bat (*Lasiurus borealis*) and Yuma myotis (*Myotis yumanensis*). Consistent with previous surveys in western Wyoming, male captures were overrepresented, possibly due to sexual segregation during the summer season. Improving our understanding of distribution and abundance of forest bats in Wyoming is essential for conservation planning, species status review, and minimizing potential impacts to bats from large-scale habitat changes due to logging, fire suppression, mountain pine beetle infestation, and energy development.

## INTRODUCTION

There are an estimated 1,100 species of bats in the world, comprising almost 20% of all mammalian 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 (Hester and Grenier 2005; Table 1). All resident species are designated as Species of Greatest Conservation Need (SGCN) by the Wyoming Game and Fish Department (Department; Orabona et al. 2009; Table 1). Bats in Wyoming's forests are restricted by species-specific requirements; survival depends on the availability of appropriate roosting sites (e.g., caves, crevices, trees, and foliage), adequate prey abundance (e.g., moths, beetles, and mosquitoes), and foraging sites (e.g., forest interiors, edges, and clearings; Lacki et al. 2007). Inventories for bats throughout forests of eastern Wyoming have previously been lacking, limiting our knowledge of species distributions and potential management actions necessary to maintain habitats (Hester and Grenier 2005).

There is growing concern over the status of bat populations within the United States (Ellison et al. 2003). Most bats are difficult to study due to their small size and nocturnal and volant behavior, thus making conservation and management challenging (Kunz and Racey 1998). Additionally, bats are potentially vulnerable to drastic population declines due to their low reproductive rates and specialized habitat requirements (O'Shea and Bogan 2003). The decline of bat populations could have far-reaching consequences, as bats are important to maintaining functional ecosystems. Bats frequently prey on moths, beetles, and other nocturnal arthropods that can cause economically and ecologically damaging forest diseases. Additionally, the consumption of mosquitoes (up to 1,200 per night for each little brown myotis [*Myotis lucifugus*]; Fascione et al. 1991) could potentially reduce the spread of mosquito-borne disease. However, bats in forests of Wyoming are potentially losing habitat due to logging, fire suppression, and bark beetle infestation (Hester and Grenier 2005). With increases in the development of wind energy in Wyoming, maintaining sustainable bat populations may become an even greater challenge. The conservation importance of habitat for forest bats may not be fully realized until we better understand the distribution and species assemblage of bats in Wyoming.

Our objectives in 2010 were to collect data on distribution, relative abundance, and diversity of bat species that occur in forests of northeastern Wyoming. This goal included collecting data on population demography (i.e., reproductive and sex ratios and age structure) and morphometric measurements of individuals. This is the first year of a two-year project to survey bats in eastern Wyoming.

## METHODS

We selected 100 survey grids in forested areas of eastern Wyoming. To achieve this, we used a ArcGIS v9.3 (Environmental Systems Research Institute, Redlands, CA, USA) to digitally overlay 10 $km^2$ survey grids with ecological system vegetation layers (by NatureServe from existing GAP and ancillary data) and identified all survey grids that contained forested habitat. In 2010, we focused our surveys on those grids in northeastern Wyoming. While in the field, we identified specific netting locations within each grid based on: 1) habitat features that encourage bat concentrations (e.g., water sources, flyways, and roosting areas), 2) accessibility (e.g., road access and land ownership), and 3) the ability to effectively capture bats with mist nets at the specific site (Hester and Grenier 2005).

Field personnel worked in crews of two people to mist net bats between early June and mid-August 2010. We used various configurations to position mist nets (Avinet, Inc., Dryden, NY) depending on the type, size, and configuration of targeted habitat (i.e., waterway, flyway, etc.) and the surrounding landscape. Mist nets were set roughly 0.5 m above ground level and varied in width (i.e., 2.6, 6, 9, 12, or 18 m). We used a combination of low nets (i.e., 2.6 m high) and triple high nets (i.e., 7.8 m high) to optimize the potential for bat captures. We opened nets ≤30 min after civil sunset and kept them open 2.5 – 3 hrs after sunset. If precipitation, lightning, or wind ≥7 mph (i.e., light breeze on Beaufort scale) was present, we closed nets. The above methods were developed in reference to those outlined by Hester and Grenier (2005).

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

We recorded additional information at each netting site regarding the location and conditions present during each nightly survey. We recorded our location and elevation with a GPS using datum NAD 83. Field personnel also diagramed net configurations, described surrounding vegetation, and recorded weather conditions (i.e., temperature, wind speed, and cloud cover) at the start and end of each survey. All means are reported ± SE.

## RESULTS

We successfully surveyed 41 grids within the study area in northeastern Wyoming during the summer of 2010 (Fig. 1). If accessible and effective netting locations were not available in a pre-selected survey grid, field personnel used their discretion to select a suitable replacement site in an adjacent survey grid. Unfortunately, one survey grid was inadvertently surveyed twice at different netting locations (i.e., site ID No. 11 and 12; Fig. 2).

We captured bats in 35 of 41 survey grids, for a total of 495 bats representing 12 species (Table 2). The mean number of bats captured per site was 11.79 ± 2.48 (range: 0-65). The four most commonly captured species were little brown myotis (33%), silver-haired bats (*Lasionycteris noctivagans*; 22%), big brown bats (*Eptesicus fuscus*; 13%), and hoary bats (*Lasiurus cinereus*; 12%) with the remaining eight species comprising 20% of total captures (Table 2). For all species combined, more males (76%) were captured than females (24%; Table 3). Half the captured bats were non-reproductive adults (50%), while 14% were reproductive females (i.e., pregnant, lactating, or post-lactating), 32% were males with descended testes, and 4% were juveniles (Table 3). Means of standard morphometric measurements (i.e., forearm length, thumb length, ear length, and weight) are reported for each species in Table 4.

Overall, bat captures were well distributed throughout the study area, although density of bat captures was highest in the Black Hills followed by the northern Bighorn Mountains (Fig. 3). We also recorded locations not listed in the Department’s Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming (Orabona et al. 2009). We recorded new latilong locations for observations of big brown bats, eastern red bats (*Lasiurus borealis*), northern myotis (*Myotis septentrionalis*), fringed myotis (*Myotis thysanodes*), and Yuma myotis (*Myotis yumanensis*; Table 5). We also observed evidence of reproduction for big brown bats, silver-haired bats, eastern red bats, hoary bats, fringed myotis, and long-legged myotis (*Myotis volans*) in new latilong locations (Table 5). Maps of individual species' capture distributions are shown in Figures 4-15.

## DISCUSSION

Previous studies throughout North America have documented all captured species in forested habitats (Lacki et al. 2007). Although we did not capture 2 of 12 resident species, Townsend's big-eared bats (*Corynorhinus townsendii*) are adept at avoiding capture in nets (O'Farrell and Gannon 1999), and pallid bats (*Antrozous pallidus*) are more commonly associated with lower elevation habitat (Hester and Grenier 2005). We also captured four eastern red bats and one Yuma myotis, listed as peripheral species in Wyoming. It is not surprising we did not capture more peripheral or accidentally known species, given the extent of their range and unpredictable chance of occurrence.

We captured more individuals and a greater diversity of species than previous surveys in western Wyoming (Filipi et al. 2009, Johnson and Grenier 2010). Additionally, nearly half the bats captured were in reproductive condition or showed evidence of past reproduction. However, male captures were still overrepresented, consistent with previous surveys. Sexual segregation of bats is common during the reproductive season, with females commonly found at lower elevations and males at higher elevations (Cryan et al. 2000, Ford et al. 2002, Ibáñex et al. 2009, but see Solvesky and Chambers 2009, Kurta 2010). Lower elevations are associated with warmer temperatures, which may result in increased foraging opportunities, increased thermoregulatory ability, and decreased energy expenditure for females during the energetically costly gestation and lactation stages (Cryan et al. 2000). Males more often utilize torpor as a means of conserving energy during the summer months, and would benefit from higher, cooler elevations (Bogan et al. 1996, Cryan et al. 2000, Ford et al. 2002). This sexual segregation by altitude may be responsible for the male-biased captures recorded in this and previous studies in Wyoming, as our survey grids and netting locations were in high-elevation forests.

When comparing results between years and among sites, we cannot rule out the influence of annual variation in weather patterns and prey availability on bat numbers and reproduction. Variations in weather conditions, intra-seasonal behavior, prey availability, and netting locations may also cause noticeable differences on capture success for each survey night (Hester and Grenier 2005). This inventory encompassed a large geographic area in a relatively short time period, which should be considered when interpreting results. We attempted to distribute surveys throughout study area over the course of the summer, although replications of surveys were not feasible. As a result, it is difficult to assess exact distribution, relative abundance, and diversity of bat species in forests of northeastern Wyoming. However, since such 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.

Current management practices may affect habitat in 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 of interest 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, mountain pine beetle infestations, and energy production in Wyoming (Hester and Grenier 2005).

## ACKNOWLEDGMENTS

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Table 1. Bat species documented in Wyoming, listed by scientific and common name, Wyoming residency status (as listed in A Conservation Plan for Bats in Wyoming compiled by Wyoming Bat Working Group [WBWG] and Wyoming Game and Fish Nongame Program, R = resident [year-round or seasonally], P = peripheral, A = accidental occurrence), and Wyoming Game and Fish Department's Native Species Status (NSS of 1, 2, 3, or 4 for Species of Greatest Conservation Need, as listed in Wyoming Game and Fish Department's Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming, updated April 2009). Species captured during the 2010 survey are denoted by *.

| Scientific Name | Common Name | WBWG status | Native Species Status (NSS) |
|---|---|---|---|
| *Antrozous pallidus* | pallid bat | R | NSS2 |
| *Corynorhinus townsendii* | Townsend's big-eared bat | R | NSS2 |
| *Eptesicus fuscus** | big brown bat | R | NSS3 |
| *Euderma maculatum** | spotted bat | R | NSS2 |
| *Lasionycteris noctivagans** | silver-haired bat | R | NSS4 |
| *Lasiurus borealis** | eastern red bat | P | NSS4 |
| *Lasiurus cinereus** | hoary bat | R | NSS4 |
| *Myotis californicus* | California myotis | P | - |
| *Myotis ciliolabrum** | western small-footed myotis | R | NSS3 |
| *Myotis evotis** | long-eared myotis | R | NSS2 |
| *Myotis lucifugus** | little brown myotis | R | NSS3 |
| *Myotis septentrionalis** | northern myotis | R | NSS2 |
| *Myotis thysanodes** | fringed myotis | R | NSS2 |
| *Myotis volans** | long-legged myotis | R | NSS2 |
| *Myotis yumanensis** | Yuma myotis | P | - |
| *Nyctinomops macrotis* | big free-tailed bat | A | - |
| *Pipistrellus subflavus* | eastern pipistrelle | A | - |
| *Tadarida brasiliensis* | Brazilian free-tailed bat | P | - |

Table 2. Number of individual bats captured with mist-nets for each species in northeastern Wyoming, June – August 2010. Data are summarized by netting location. EPFU: *Eptesicus fuscus*, EUMA: *Euderma maculatum*, LANO: *Lasionycteris noctivagans*, LABO: *Lasiurus borealis*, LACI: *Lasiurus cinereus*, MYCI: *Myotis ciliolabrum*, MYEV: *Myotis evotis*, MYLU: *Myotis lucifugus*, MYSE: *Myotis septentrionalis*, MYTH: *Myotis thysanodes*, MYVO: *Myotis volans*, MYYU: *Myotis yumanensis*, UNK: unknown species.

| Netting Location | EPFU | EUMA | LANO | LABO | LACI | MYCI | MYEV | MYLU | MYSE | MYTH | MYVO | MYYU | UNK | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1* | | | | | | | | 2 | | | 1 | | | 3 |
| *2* | 2 | | 1 | | | | | | | | 3 | | | 6 |
| *3* | | | | | | | | | | | | | | 0 |
| *4* | | | | | | | | | | | | | | 0 |
| *5* | | | | | 3 | | | 20 | | | | | | 23 |
| *6* | 2 | | 6 | | 2 | | | 7 | | | | | | 17 |
| *7* | | | | | | | 1 | 1 | | | | | | 2 |
| *8* | 2 | | | | 3 | | 1 | 4 | | | 5 | | | 15 |
| *9* | | | | | | | | | | | | | | 0 |
| *10* | | | | | | | | 6 | | | | | | 6 |
| *11* | | | 1 | | | | | 6 | | 1 | | | | 8 |
| *12* | | | | | | | | | | | | | | 0 |
| *14* | | | | | | | | | | | | | | 0 |
| *15* | 3 | | | | 3 | | | 1 | | | | | | 7 |
| *16* | | | | | | | | | | | | | | 0 |
| *17* | | | | | 3 | | | 1 | | | | | 1 | 5 |
| *18* | 1 | | | | | | | 2 | | 1 | | | | 4 |
| *19* | | | | | | | | 13 | | | | | | 13 |
| *20* | | | 1 | | | | | 6 | | | | | | 7 |
| *21* | | | 1 | | | | | | | | 1 | | | 2 |
| *22* | | | | | | | | 1 | | | | | | 1 |
| *23* | | 2 | | | | | | 1 | | | 5 | | | 8 |
| *26* | 2 | | 1 | | | | | | | 2 | | | | 5 |
| *27* | 1 | | | | 1 | | | | | | | | | 2 |
| *28* | | | | | 1 | 2 | | | | | | | | 3 |
| *29* | 1 | | 1 | | | | | | | | | | | 2 |
| *30* | 1 | | | | | | | | | | | | | 1 |
| *31* | 5 | | | | | | | 14 | | | | | | 19 |

Table 2. Continued.

| Netting Location | EPFU | EUMA | LANO | LABO | LACI | MYCI | MYEV | MYLU | MYSE | MYTH | MYVO | MYYU | UNK | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *32* | 1 | | | | | | | 3 | | | | | | 4 |
| *33* | 10 | | 4 | | 4 | | | 8 | 1 | 1 | 3 | | | 31 |
| *34* | | | | | | | | 2 | | 1 | | | | 3 |
| *35* | 1 | | | | 1 | | | | | | | | | 2 |
| *36* | 7 | | 5 | | 2 | | | 7 | 7 | 4 | 7 | | | 39 |
| *37* | | | | | | | | | | | | | | 0 |
| *38* | 2 | | 4 | | 3 | | 1 | 2 | 4 | 3 | 1 | | | 20 |
| *39* | 2 | | | | | | | 1 | | | | | | 3 |
| *40* | 5 | | 26 | 2 | 5 | | | 1 | 9 | 1 | 7 | | | 56 |
| *41* | 3 | | 35 | 1 | 14 | | | 1 | 3 | 1 | 7 | | | 65 |
| *42* | 3 | | 23 | 1 | 3 | | | 11 | 2 | 1 | 3 | | | 47 |
| *43* | 2 | | 1 | | | | | 36 | | 1 | | | | 40 |
| *44* | 5 | | | | 12 | | | 1 | | | | | | 18 |
| *45* | 2 | | | | 1 | | | 3 | 1 | | | 1 | | 8 |
| Total | 63 | 2 | 110 | 4 | 61 | 2 | 3 | 161 | 27 | 17 | 43 | 1 | 1 | 495 |

Table 3. Demographic parameters (i.e., sex, age, and reproductive ratios) for bats captured with mist nets, northeastern Wyoming, June – August 2010. Data are summarized by species. One *Lasionycteris noctivagans* and one *Myotis volans* escaped before sex and age determination and are not represented in the data.

| Species | Capture Total | Sex Ratio (Male:Female) | Age Ratio (Adult:Juvenile) | Reproductive Ratio (No:Yes) |
|---|---|---|---|---|
| *Eptesicus fuscus* | 63 | 1.9:1 | 63:0 | 0.8:1 |
| *Euderma maculatum* | 2 | 1:1 | 2:0 | 2:0 |
| *Lasionycteris noctivagans* | 110 | 9:1 | 109:1 | 0.5:1 |
| *Lasiurus borealis* | 4 | 0.3:1 | 0:4 | 4:0 |
| *Lasiurus cinereus* | 61 | 1.4:1 | 4:1 | 1.3:1 |
| *Myotis ciliolabrum* | 2 | 0:2 | 2:0 | 1:1 |
| *Myotis evotis* | 3 | 3:0 | 3:0 | 3:0 |
| *Myotis lucifugus* | 161 | 5.2:1 | 161:0 | 1.4:1 |
| *Myotis septentrionalis* | 27 | 1.5:1 | 27:0 | 3.5:1 |
| *Myotis thysanodes* | 17 | 1.3:1 | 17:0 | 7.5:1 |
| *Myotis volans* | 43 | 2:1 | 20:1 | 1.5:1 |
| *Myotis yumanensis* | 1 | 1:0 | 1:0 | 1:0 |
| Total | 494 | 3.1:1 | 25:1 | 1.1:1 |

Table 4. Means of morphometric measurements (i.e., forearm length, thumb length, ear length, and weight) of bats captured with mist nets in northeastern Wyoming, June – August 2010. Data are summarized by species. EPFU: *Eptesicus fuscus*, EUMA: *Euderma maculatum*, LANO: *Lasionycteris noctivagans*, LABO: *Lasiurus borealis*, LACI: *Lasiurus cinereus*, MYCI: *Myotis ciliolabrum*, MYEV: *Myotis evotis*, MYLU: *Myotis lucifugus*, MYSE: *Myotis septentrionalis*, MYTH: *Myotis thysanodes*, MYVO: *Myotis volans*, MYYU: *Myotis yumanensis*.

| Species | Forearm length | | Thumb length | | Ear length (mm) | | Weight (g) | |
|---|---|---|---|---|---|---|---|---|
| | (mm) | ± SE (*n*) | (mm) | ± SE (*n*) | (mm) | ± SE (*n*) | (g) | ± SE (*n*) |
| EPFU | 45.5 | ± 0.42 (*42*) | | | 14.0 | ± 0.16 (*37*) | 17.5 | ± 0.68 (*23*) |
| EUMA | 51.4 | ± 1.55 (*2*) | | | 35.5 | ± 0.50 *(2)* | 15.4 | ± 2.05 *(2)* |
| LANO | 41.0 | ± 0.14 (*77*) | | | 12.4 | ± 0.17 (*46*) | 11.9 | ± 0.22 (*37*) |
| LABO | 40.0 | ± 1.01 *(4)* | | | 10.0 | ± 0.41 *(4)* | 14.2 | ± 1.39 *(4)* |
| LACI | 53.7 | ± 0.35 (*50*) | 11.3 | ± 0.24 (*4*) | 14.0 | ± 0.24 (*41*) | 26.5 | ± 0.86 (*39*) |
| MYCI | 33.1 | ± 0.15 (*2*) | 4.7 | ± 0.05 (*2*) | 12.0 | ± 0.00 (*2*) | 5.4 | ± 0.13 (*2*) |
| MYEV | 38.1 | ± 1.14 (*3*) | | | 18.7 | ± 0.33 (*3*) | 6.3 | ± 0.49 (*3*) |
| MYLU | 37.1 | ± 0.09 (*149*) | | | 12.8 | ± 0.06 (*144*) | 7.2 | ± 0.09 *(77)* |
| MYSE | 34.8 | ± 0.28 *(27)* | | | 15.9 | ± 0.14 (*27*) | 6.1 | ± 0.30 (*13*) |
| MYTH | 39.4 | ± 0.39 (*17*) | | | 18.5 | ± 0.29 (*17*) | 6.7 | ± 0.21 (*16*) |
| MYVO | 38.7 | ± 0.20 *(40)* | | | 10.9 | ± 0.14 (*36*) | 7.7 | ± 0.15 (*36*) |
| MYYU | 35.5 | ± n/a (*1*) | | | 15.0 | ± n/a (*1*) | 7.7 | ± n/a (*1*) |

Table 5. Updates to distribution status of bats in the Wyoming Game and Fish Department's Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming by latilong, based on individuals captured with mist nets and summarized by species, northeastern Wyoming, June – August 2010. B = Breeding, including dependent young, juvenile animals, lactating or post-lactating females, or males in breeding condition observed; O = Observed but due to 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.

| Species | Latilong | Current status | Updated status |
|---|---|---|---|
| *Eptesicus fuscus* | 6 | h | O |
| | 7, 14 | O | B |
| *Lasionycteris noctivagans* | 4, 5, 7, 14 | O | B |
| *Lasiurus borealis* | 7 | — | B |
| *Lasiurus cinereus* | 4, 7, 14 | O | B |
| *Myotis septentrionalis* | 14 | — | O |
| *Myotis thysanodes* | 5 | O | B |
| | 6 | — | O |
| *Myotis volans* | 4 | O | B |
| *Myotis yumanensis* | 14 | — | O |

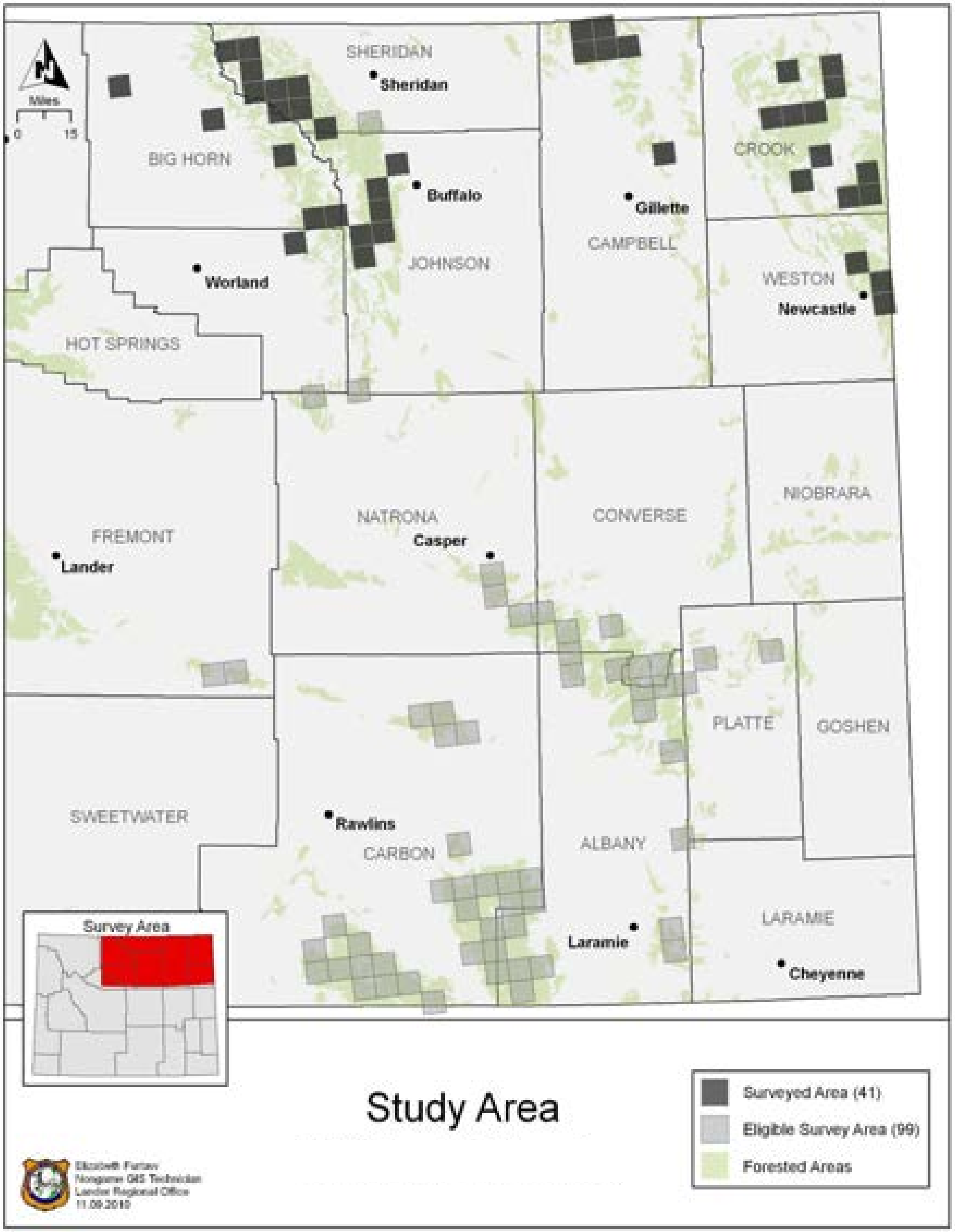


Figure 1. Study area and survey grids for inventorying forest bats in eastern Wyoming. The 2010 survey focused on survey grids in northeastern Wyoming.

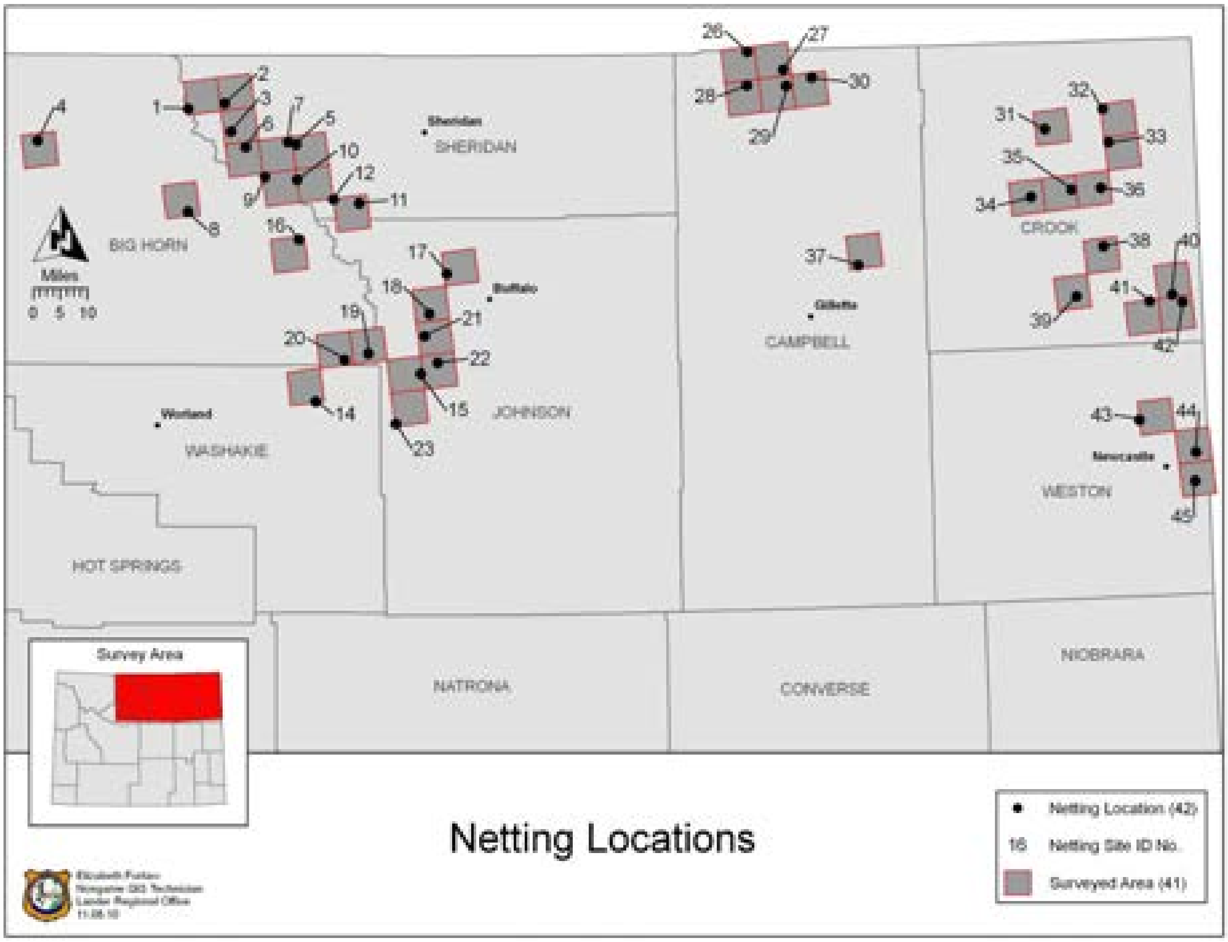


Figure 2. Netting locations for forest bats shown within respective survey grids in northeastern Wyoming, June – August 2010. Netting locations within grids are identified by arbitrarily assigned site numbers to facilitate tracking.

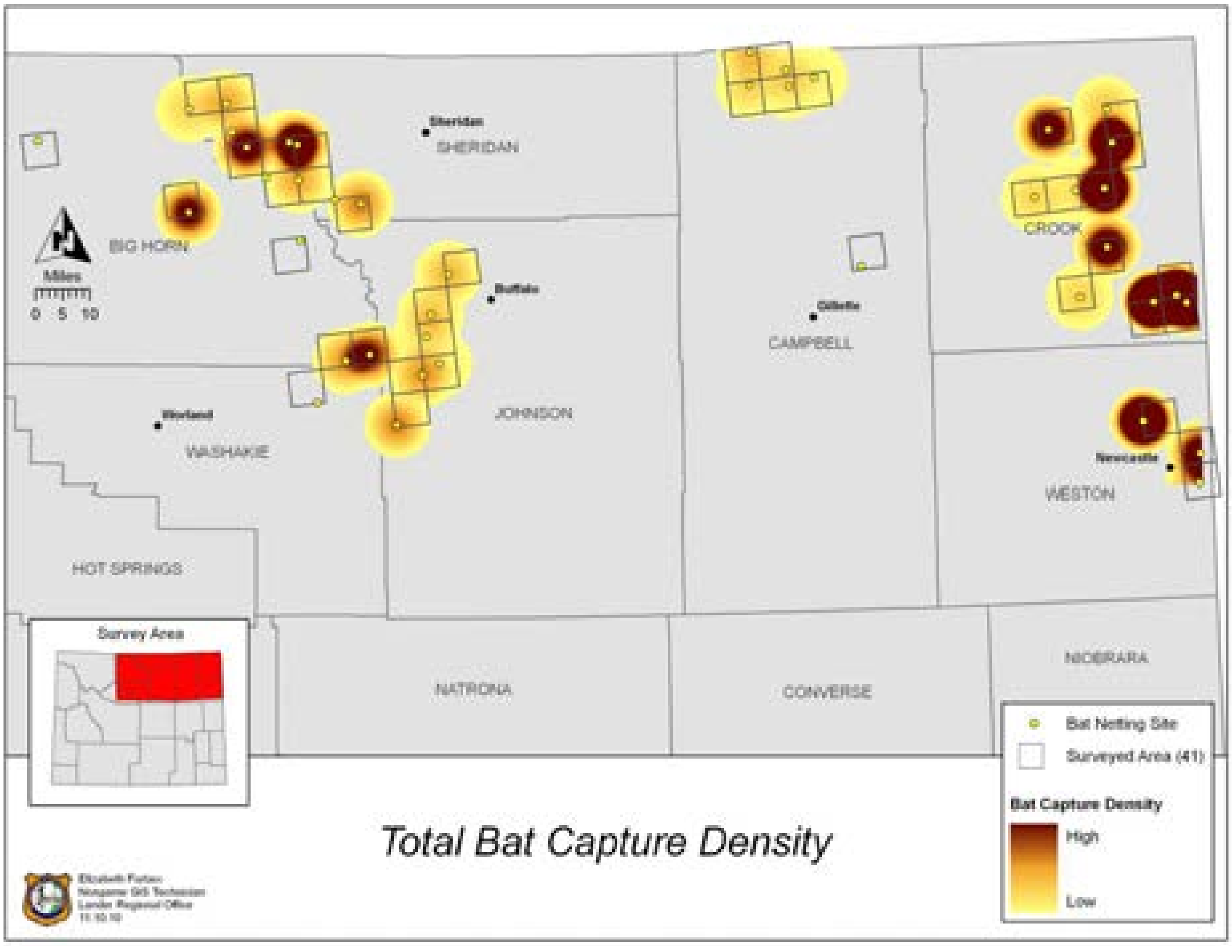


Figure 3. Density of forest bats captured in northeastern Wyoming, June – August 2010.

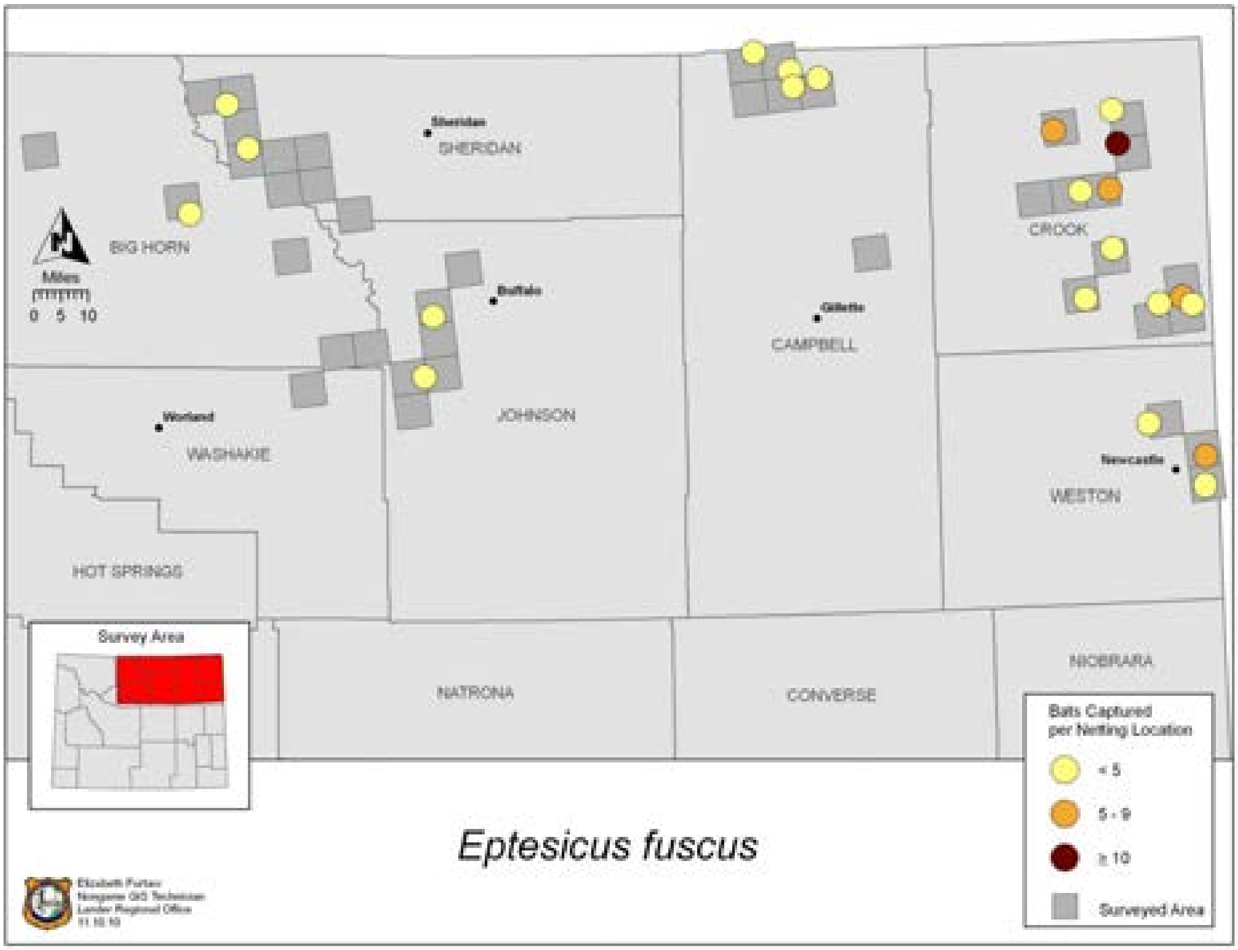


Figure 4. Approximate distribution of big brown bats (*Eptesicus fuscus*) captured in northeastern Wyoming, June – August 2010.

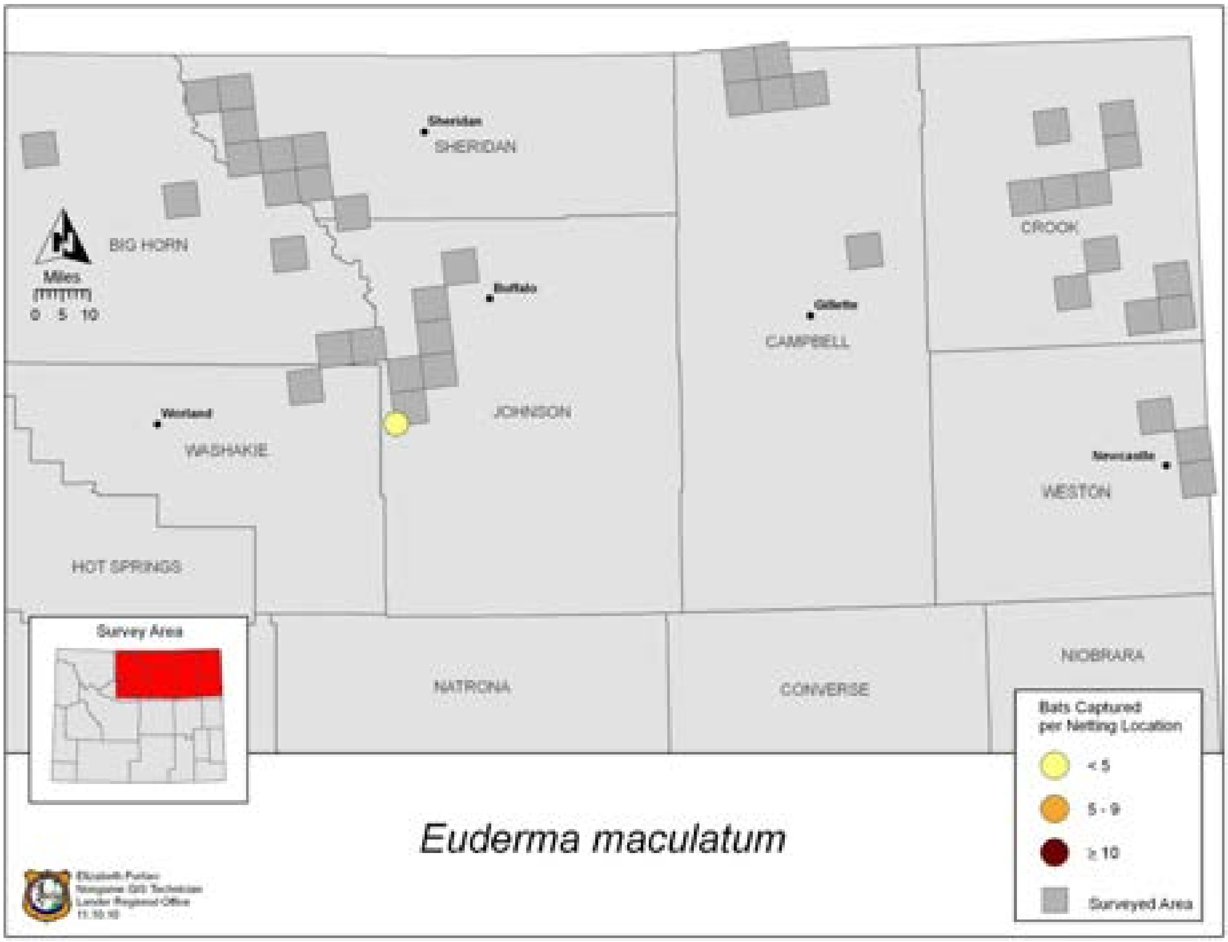


Figure 5. Approximate distribution of spotted bats (*Euderma maculatum*) captured in northeastern Wyoming, June – August 2010.

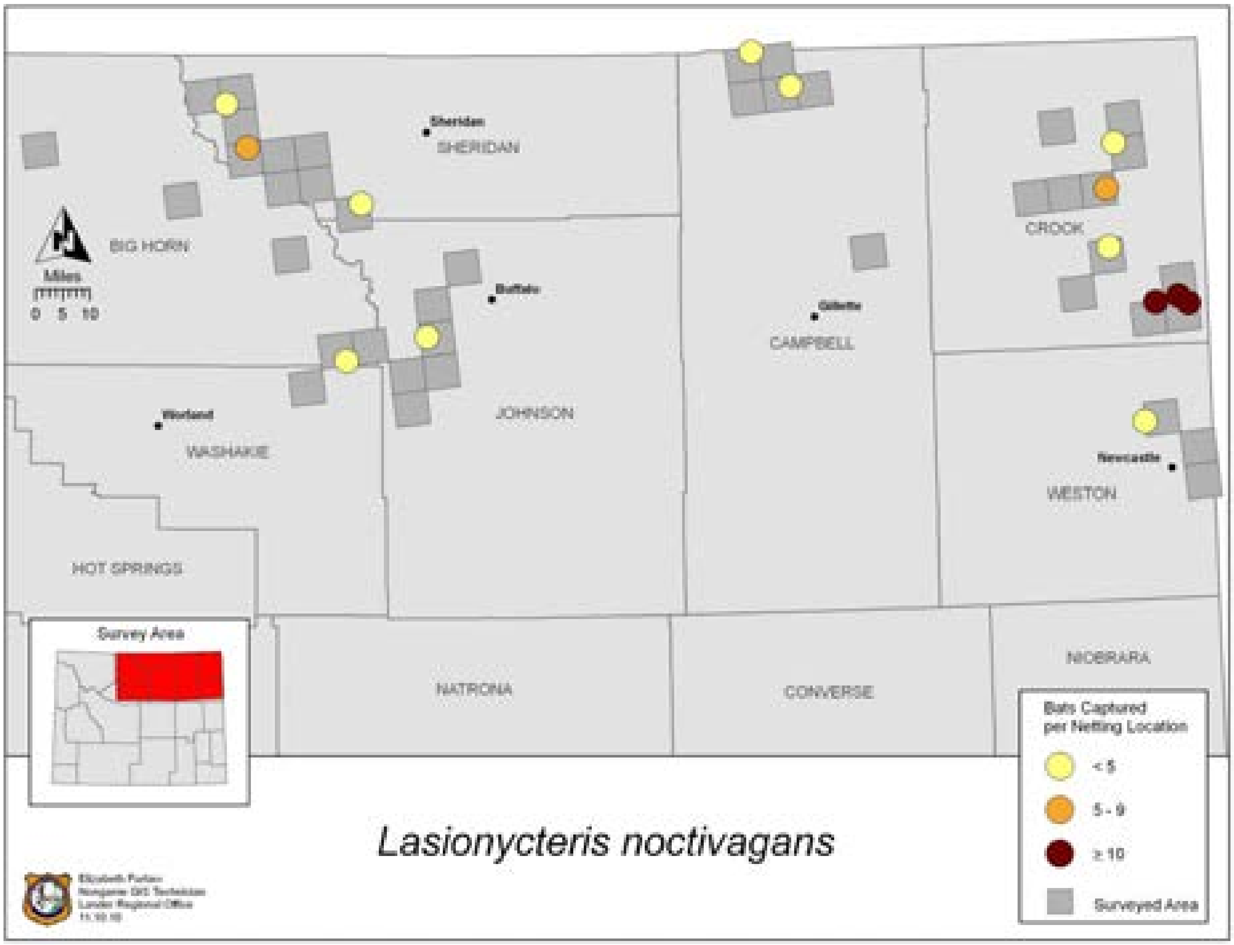


Figure 6. Approximate distribution of silver-haired bats (*Lasionycteris noctivagans*) captured in northeastern Wyoming, June – August 2010.

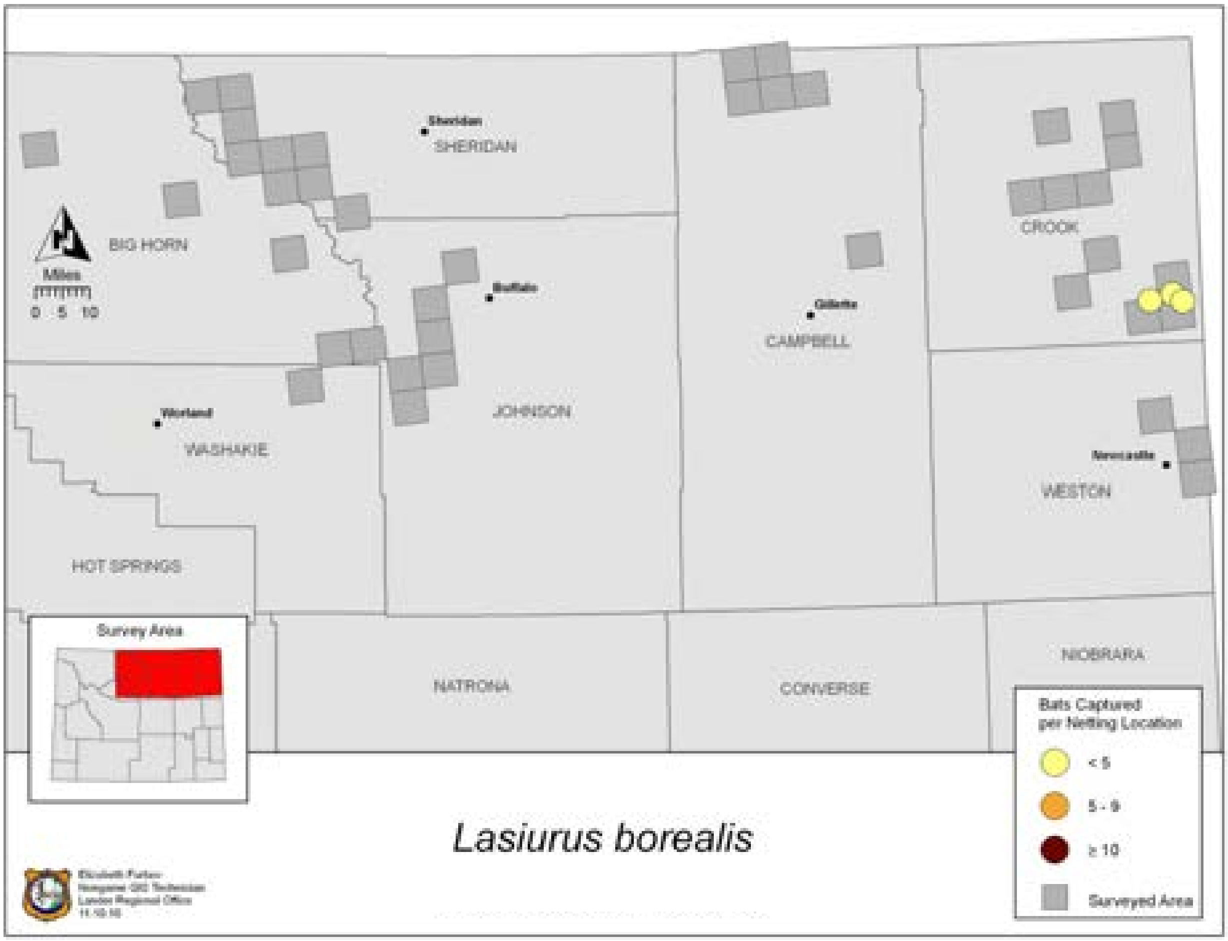


Figure 7. Approximate distribution of eastern red bats (*Lasiurus borealis*) captured in northeastern Wyoming, June – August 2010.

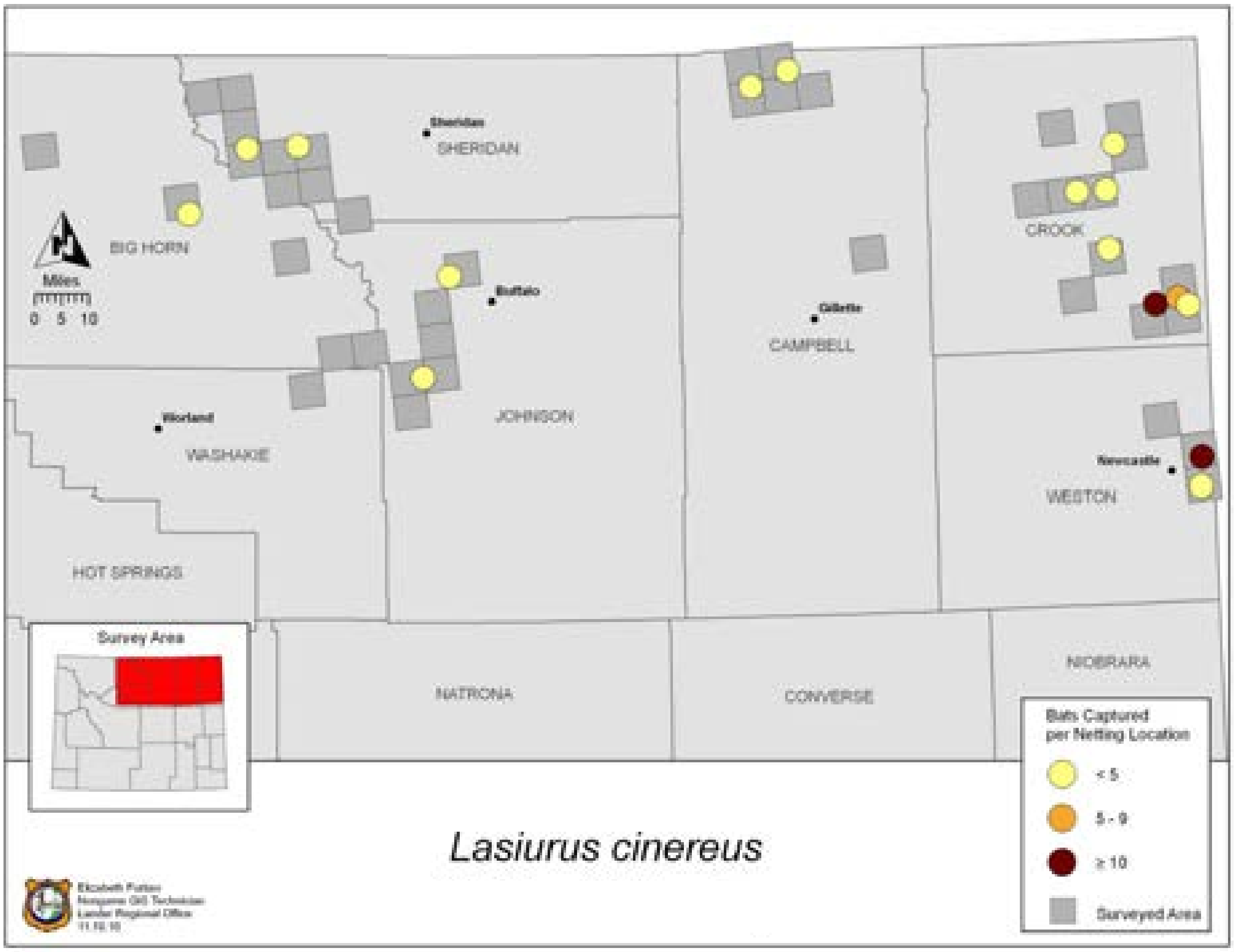


Figure 8. Approximate distributions of hoary bats (*Lasiurus cinereus*) captured in northeastern Wyoming, June – August 2010.

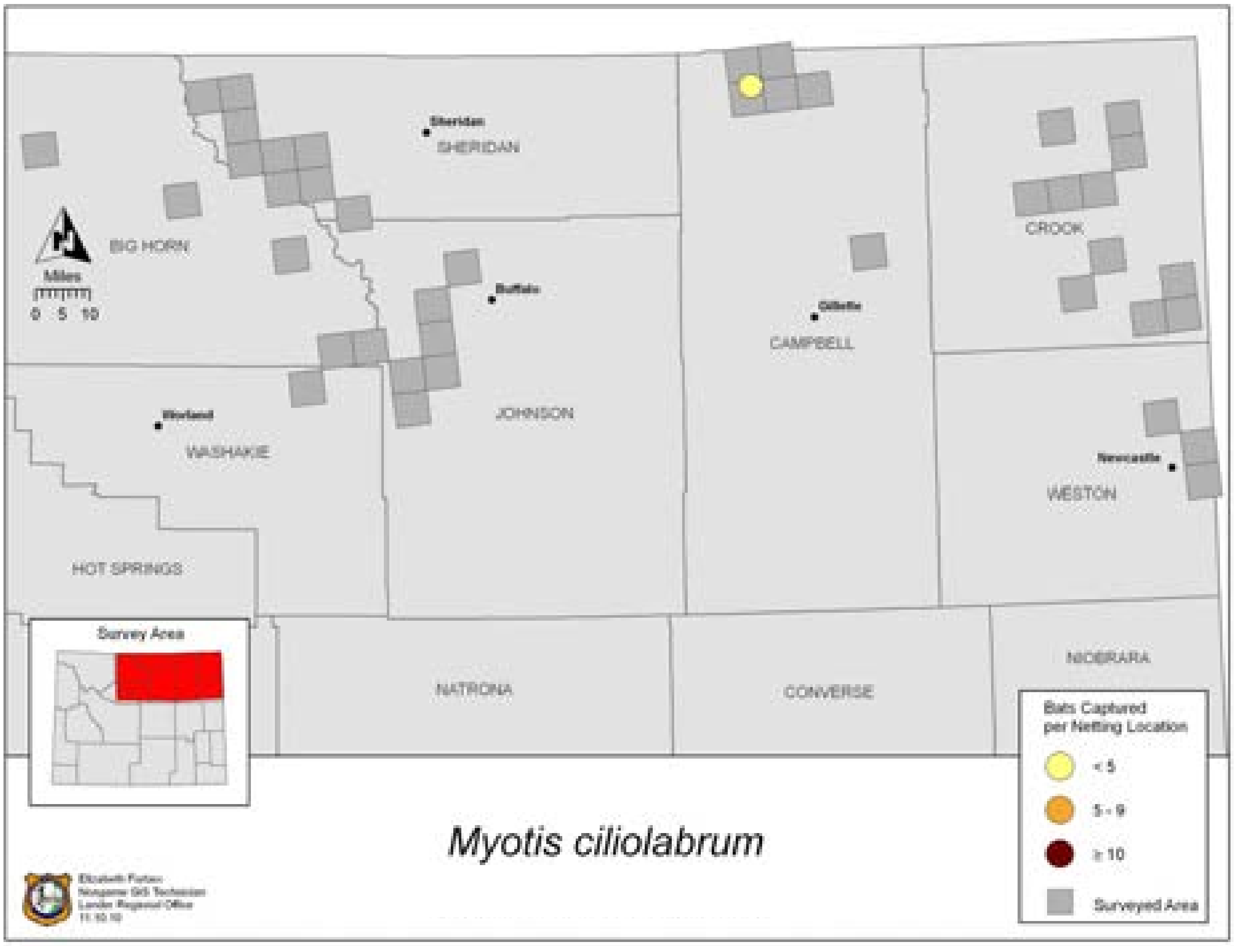


Figure 9. Approximate distribution of western small-footed myotis (*Myotis ciliolabrum*) captured in northeastern Wyoming, June – August 2010.

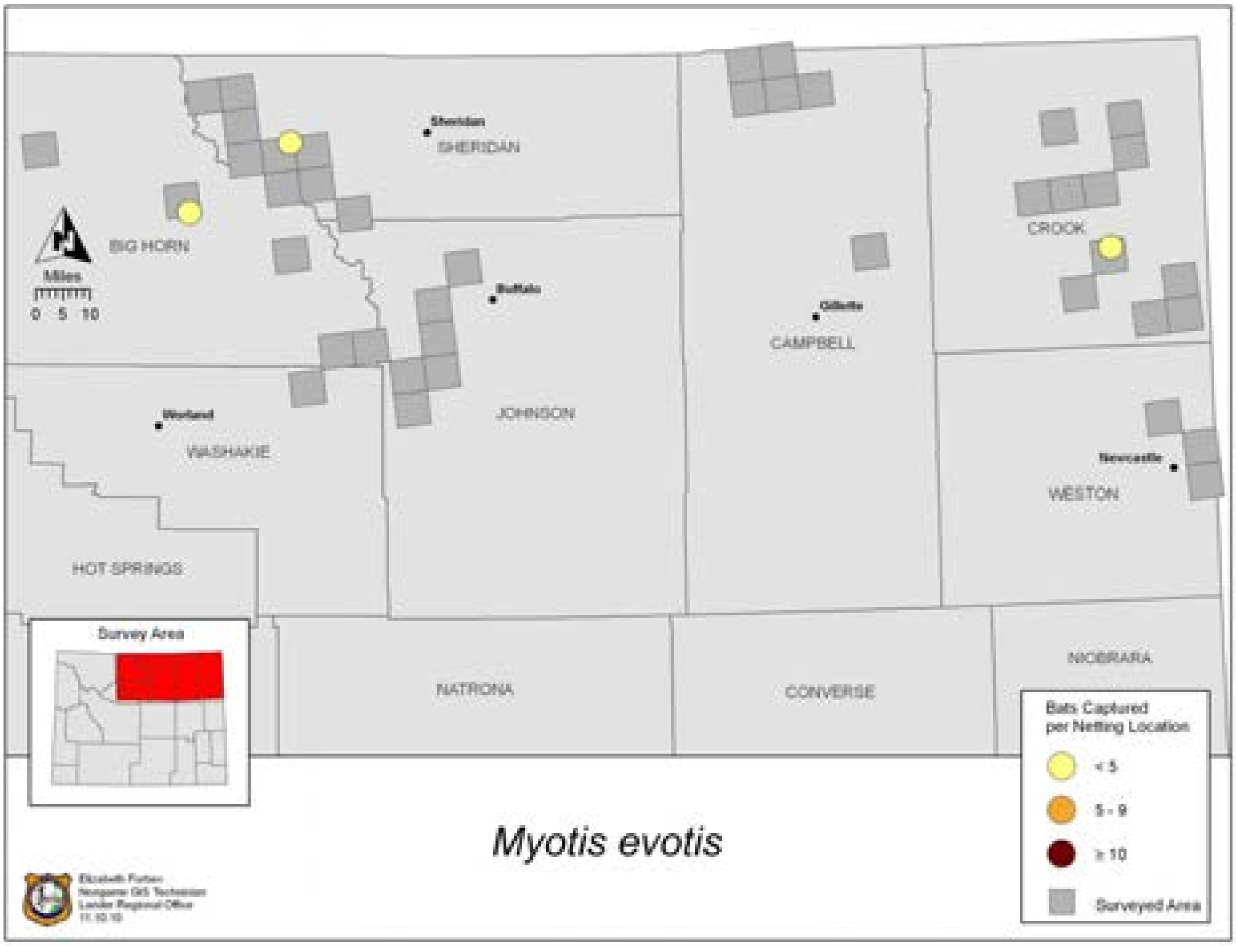


Figure 10. Approximate distribution of long-eared myotis (*Myotis evotis*) captured in northeastern Wyoming, June – August 2010.

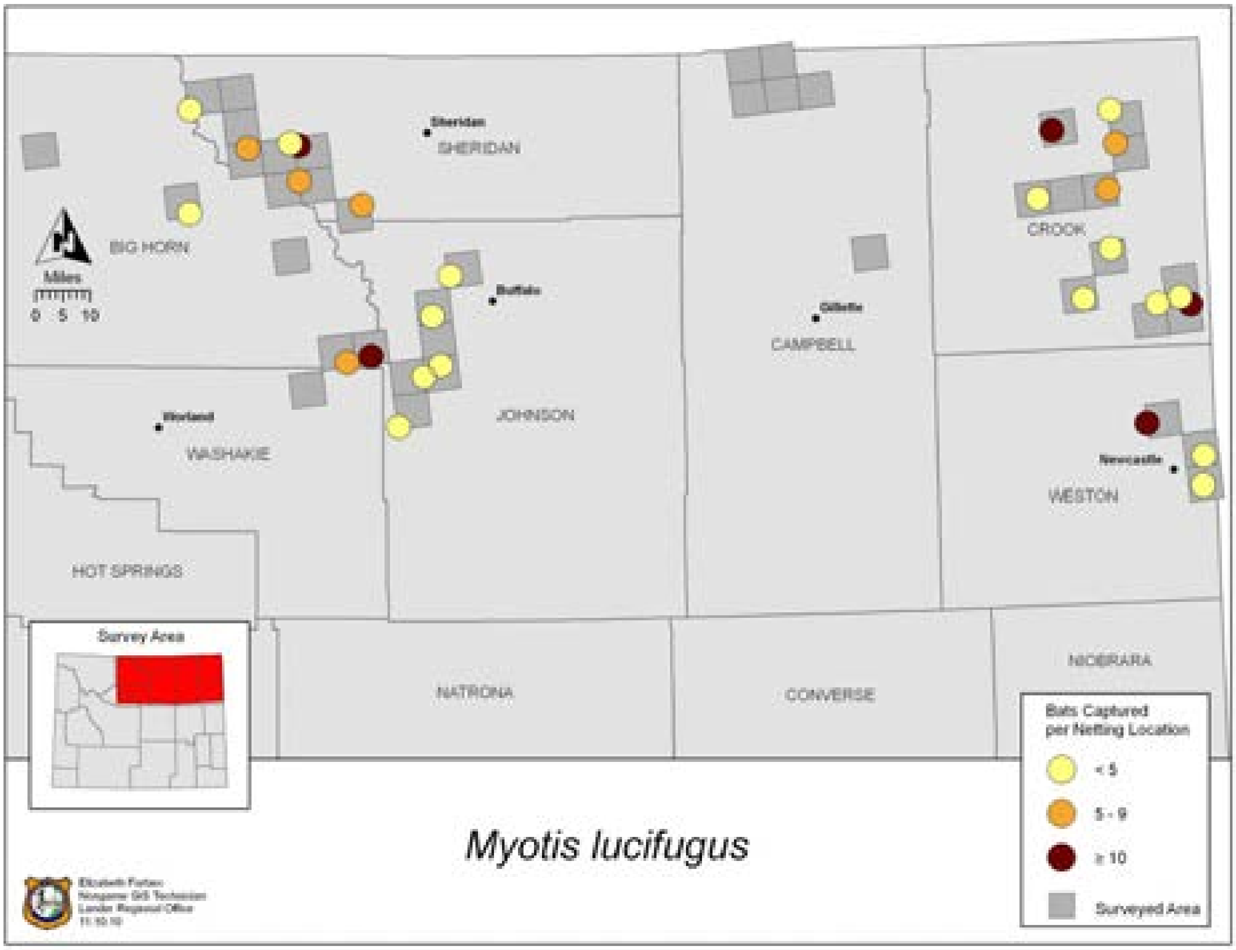


Figure 11. Approximate distribution of little brown myotis (*Myotis lucifugus*) captured in northeastern Wyoming, June – August 2010.

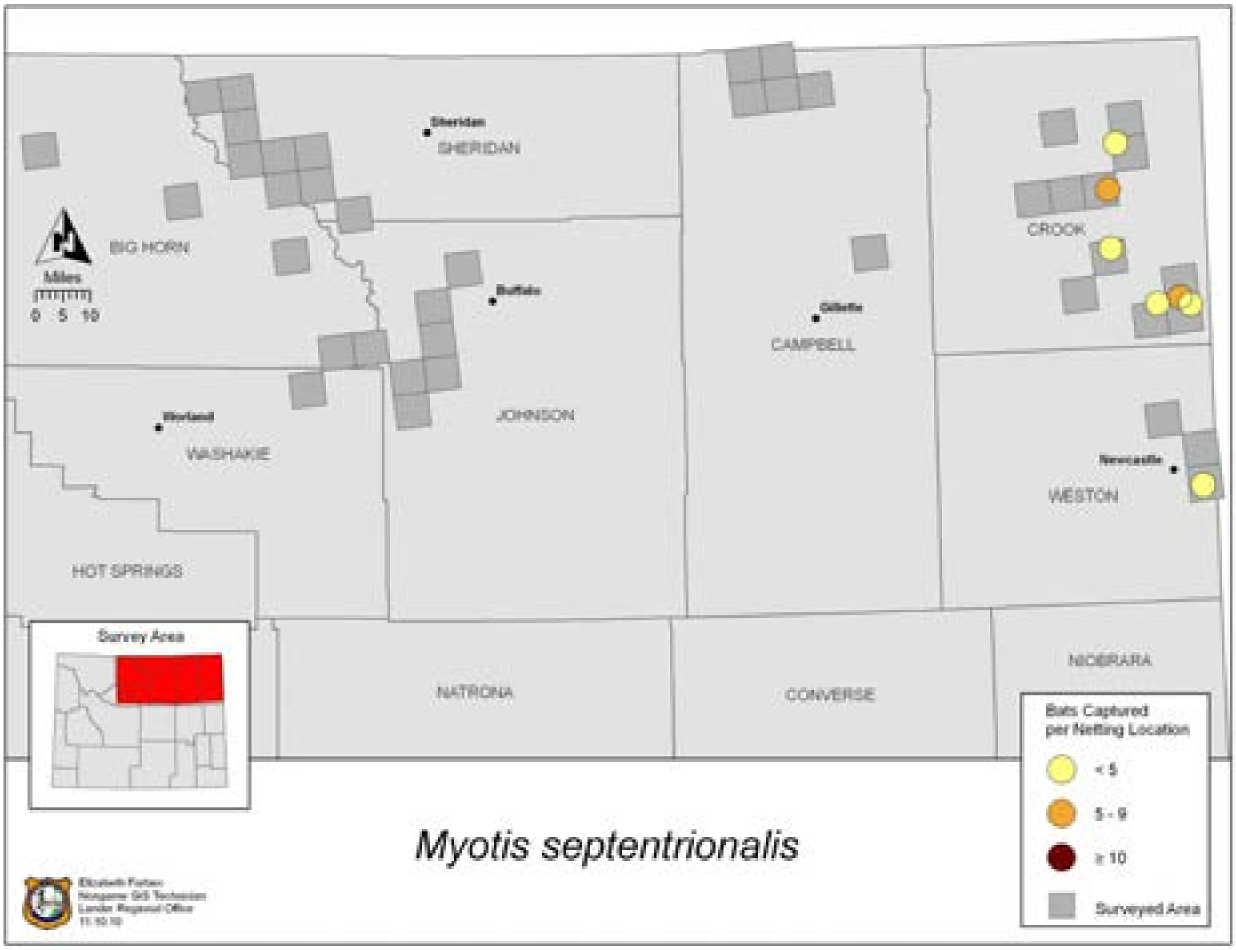


Figure 12. Approximate distribution of northern myotis (*Myotis septentrionalis*) captured in northeastern Wyoming, June – August 2010.

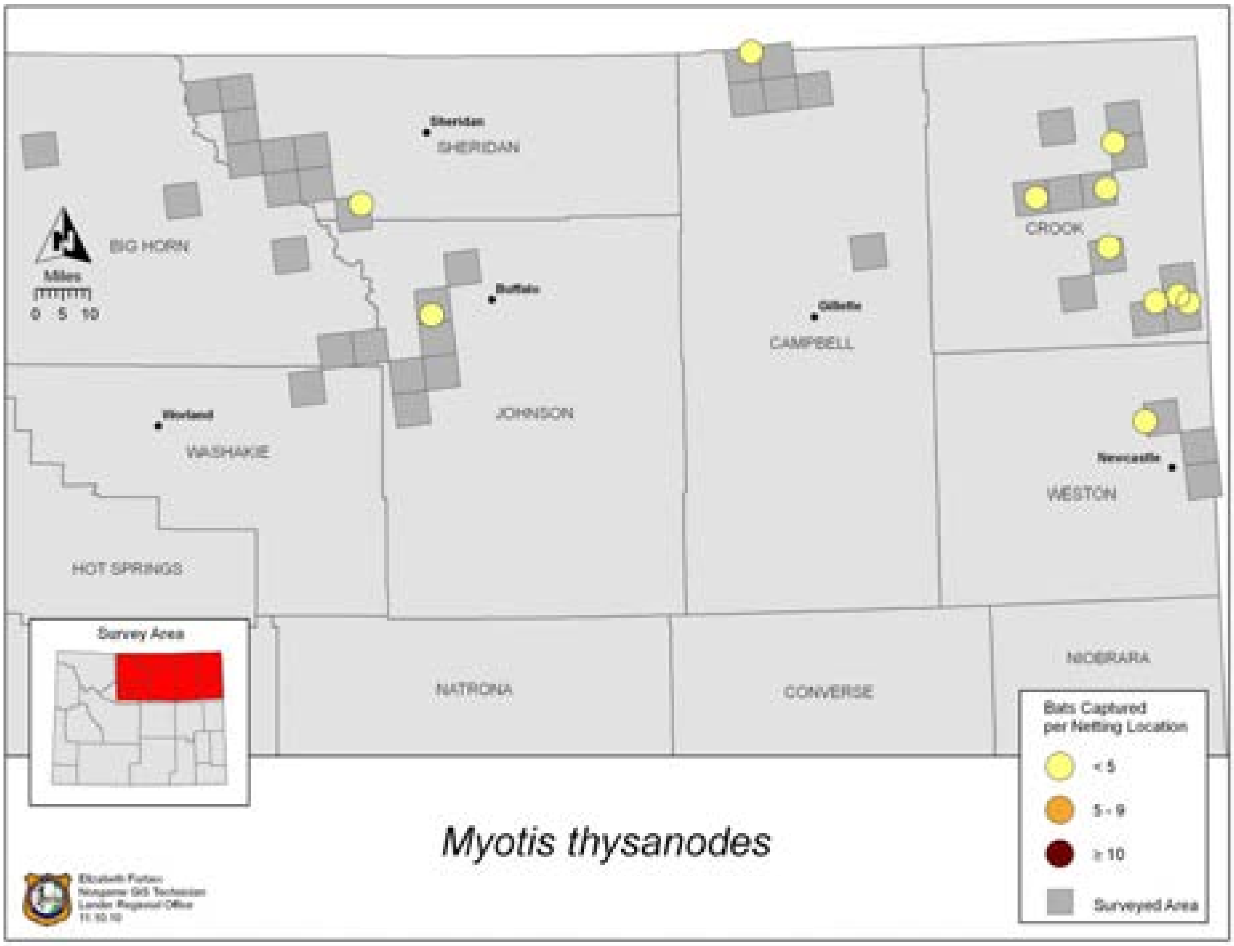


Figure 13. Approximate distributions of fringed myotis (*Myotis thysanodes*) captured in northeastern Wyoming, June – August 2010.

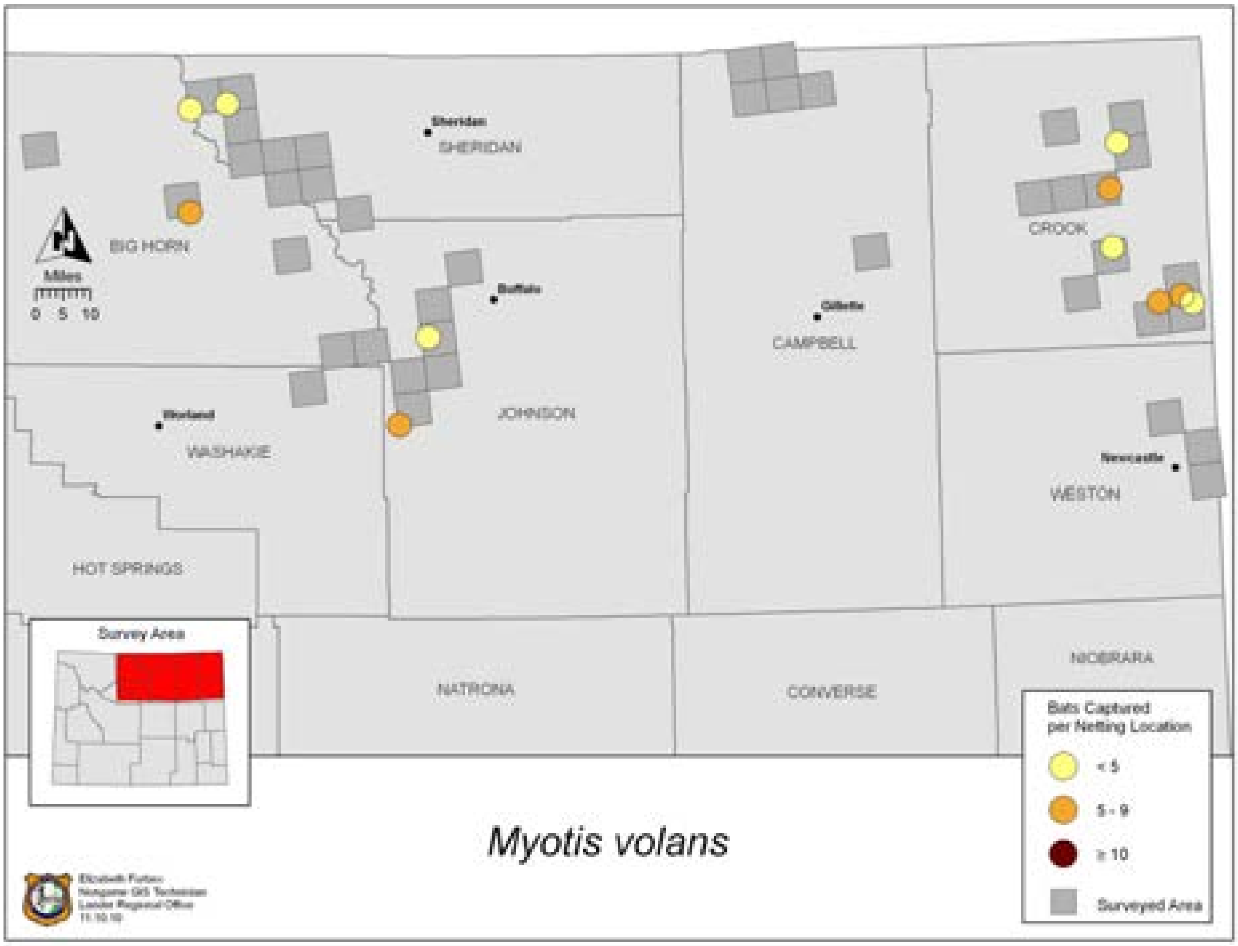


Figure 14. Approximate distribution of long-legged myotis (*Myotis volans*) captured in northeastern Wyoming, June – August 2010.

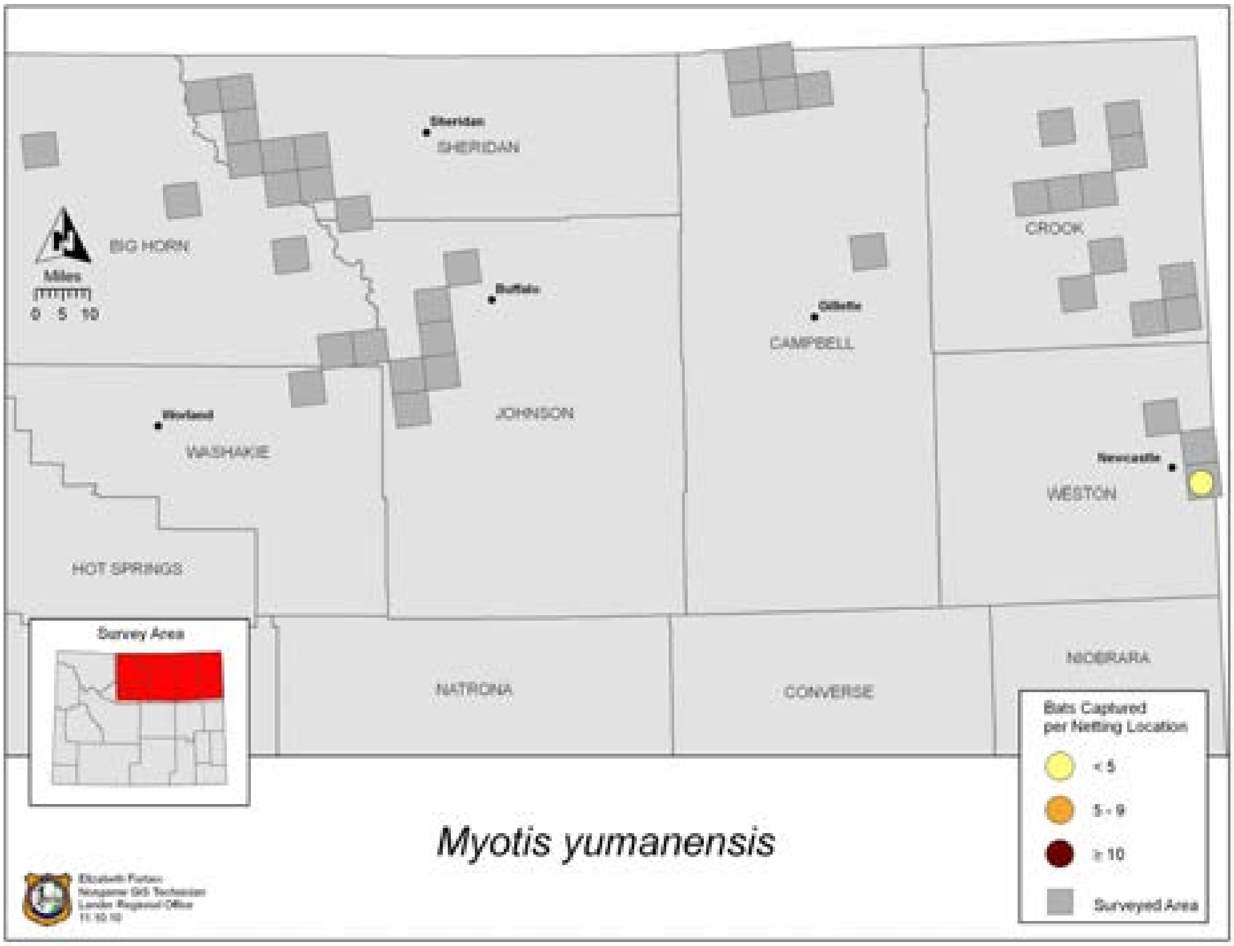


Figure 15. Approximate distributions of Yuma myotis (*Myotis yumanensis*) captured in northeastern Wyoming, June – August 2010.

**INFLUENCE OF ENERGY DEVELOPMENT ON SAGEBRUSH SMALL MAMMALS**

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need / Sagebrush Small Mammals – Sagebrush Vole, Olive-Backed Pocket Mouse, Deer Mouse, Northern Grasshopper Mouse, Dwarf Shrew, Least Chipmunk, Western Harvest Mouse, Northern Pocket Gopher

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants

PROJECT DURATION: Masters Thesis Research

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Ian M. Abernethy, 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.

Ecosystems are experiencing anthropogenic disturbances at a global scale, resulting in widespread habitat loss, fragmentation, and alteration. Yet, we know little about how local habitat attributes may interact with landscape-scale human disturbance to influence wildlife communities. Sagebrush habitats range-wide have been highly altered. In the past two decades, energy development has increased in sagebrush habitats in the Intermountain west of North America. While the effects of energy development have been documented in game animals such as the greater sage-grouse (*Centrocercus urophasianus*) and mule deer (*Odocoileus hemionus*), studies documenting responses of nongame mammals are lacking. We examined the effects of habitat characteristics in areas with and without energy development on the abundance and diversity of small mammals in sagebrush steppe. Data were collected in 2009 and 2010 within two natural gas fields and adjacent control areas in the Upper Green River Basin, WY. Small mammals were live-trapped across a gradient of sagebrush cover and height within energy development and adjacent control areas. While accounting for important habitat metrics, small mammal abundance varied marginally across gradients of sagebrush cover and height. Specifically, the density of deer mice (*Peromyscus maniculatus*), western harvest mice (*Reithrodontomys megalotis*), and reproductively active individuals increased with increasing sagebrush cover and height. Conversely, northern grasshopper mouse (*Onychomys leucogaster*)

and sagebrush vole (*Lemmiscus curtatus*) density was inversely related to sagebrush cover and height. In addition, the density of deer mice, western harvest mice, northern grasshopper mice, juvenile individuals, and species richness increased at sites with energy development. Population estimates of deer mice showed a significant interaction between our sagebrush habitat gradient and energy development.

Our results demonstrated both independent and interactive effects of habitat and disturbance on the small mammal community in a sagebrush-energy development system, suggesting that consideration of local habitat structure may be critical for accurate evaluation of human disturbance effects. Responses were highly species-specific, however, which further suggests that small mammal species (similar to big game species) may need to be evaluated and managed on a species-by-species basis.

## POPULATION INVENTORIES OF JUMPING MICE (*ZAPUS* SPP.) IN SOUTHEASTERN WYOMING

STATE OF WYOMING

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

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations, Wyoming Governor's Endangered Species Account Funds, United States Fish and Wildlife Service Cooperative Agreements

PROJECT DURATION: 1 July 2009 – 30 June 2012

PERIOD COVERED: 15 April 2010 – 14 April 2011

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

## ABSTRACT

The subspecies designation of the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) was validated in 2006 through the use of genetic testing; however, it is nearly indistinguishable from the western jumping mouse (*Z. princeps*) in the field. Although the subspecies was removed from the Endangered Species List in 2008, the Wyoming Game and Fish Department classifies it as a Species of Greatest Conservation Need in the 2010 State Wildlife Action Plan (WGFD 2010). To evaluate distribution of the species, the Wyoming Game and Fish Department contracted with Western Ecosystems Technology, Inc. to sample potential habitat throughout southeastern Wyoming. Western Ecosystems Technology Inc. captured 13 *Zapus* and 262 non-target species in 2010. Catch per effort varied from 0 – 0.77 *Zapus* per 100 trap nights across 11 sites. Genetic samples (i.e., tissue and blood) were collected from 10 *Zapus* individuals. Genetic analysis is pending and will be conducted by U.S. Geological Survey; consequently, implications for these results will be included in another report.

## INTRODUCTION

Definitive records of 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 subspecies is nearly indistinguishable from the closely related western jumping mouse (*Z. princeps*) in the field. Furthermore, the genetic validity of the subspecies 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 until taxonomy issues were clarified. King et al. (2006) resolved the taxonomic debate and concluded that PMJM deserves specific status as a subspecies.

In July 2008, the PMJM was removed from the Endangered Species List. The Department continues to classify PMJM as a Species of Greatest Conservation Need with a Native Species Status of 4 (NSS4). In Wyoming, the species is restricted to the southeastern portion of the state and occupies structurally diverse plains riparian vegetation and grasslands near water below 8,000 ft. Western Ecosystems Technology, Inc. (WEST) was contracted by the Department to conduct population inventories for PMJM throughout southeastern Wyoming. In 2010, the objective was to sample potentially suitable habitat throughout the southeastern region of the state, focusing primarily in the Laramie Range, to document occurrence of PMJM through photographs and genetic sampling.

## METHODS

We obtained previously documented PMJM locations from the Wyoming Natural Diversity Database (2009) and mapped locations using ArcGIS. We also used known habitat characteristics of PMJM (i.e., heavily vegetated riparian areas near water at elevations of 4650-7600 ft; WYGAP 1996) to map drainages with potentially suitable habitat. Within target area of Laramie Range, we visited potentially suitable habitats identified on maps and aerial photographs prior to the trapping season to assess sites for legal access and verify suitability. We marked sites considered at least minimally suitable for later trapping. The final list of sites was distributed throughout the Laramie Range (Fig. 1). We trapped no more than one site within the same drainage.

We sampled sites according to methods described in USFWS guidelines (USFWS 2004). Sherman live-traps were arranged in parallel transects through suitable habitat. Typically, we located one transect on each side of the creek channel, with transects spaced approximately 10 m apart. We spaced traps 5 m apart along individual transects and baited traps with livestock feed (Ranchway Feeds, Inc. Laramie 3-Way) and a 2.54 cm ball of polyester fiber for bedding material. We set traps in late afternoon (within 3 hrs of sunset) and checked early morning (within 3 hrs of sunrise). Each set of paired transects consisted of 235-275 traps. We trapped for 3 or 4 nights, until we recorded ≥750 trap nights or captured ≥2 *Zapus* individuals.

We recorded data nightly, including locality data for each transect (i.e., start and stop UTMs), survey date, collector, and demographic data for captured individuals. We also recoded general descriptions of survey sites, and recorded UTMs in NAD27 in the field, which we converted to NAD83. These data were presented in Excel spreadsheets for each individual site and a summary table of all sites. We documented trap mortalities with detailed information on location, species, age, sex, and reproductive status; specimens were double bagged, frozen, and delivered to the Department with the final report.

Because PMJM are easily confused with western jumping mouse, we photographed each captured *Zapus* against a sheet of white paper for identification, including ventral and lateral views. We recorded date and location (i.e., UTM) with each photo (i.e., on the white background). Photos were in digital format, recorded on compact disc, and delivered to the Department with the final report.

We collected genetic material from each *Zapus* captured, including both tissue and blood samples. We used a 2-mm diameter ear punch to collect tissue samples from an ear. We disinfected the ear punch with a 10% bleach solution between samples and stored ear punch samples in small (2.5 ml) vials containing 95% ethyl alcohol. Samples were clearly labeled with appropriate capture details (e.g., date, location, specimen no.), stored in a cool dry environment, and delivered to the Department with the final report.

We used Whatman FTA Cards to collect blood samples; however, due to the lack of availability and delayed delivery of FTA cards ordered prior to the field season, we did not use FTA cards during the first two trapping sessions. We pressed FTA cards against the wound created by ear punch to collect a blood sample and labeled each card with appropriate capture details. 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.

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

## RESULTS

We sampled 11 sites for PMJM between June and August 2010; we captured *Zapus* at six of the 11 locations (Table 1; Fig. 1). At sites where *Zapus* were captured, capture success varied from 0–2 *Zapus* captures per night. Catch per effort varied from 0–0.77 *Zapus* per 100 trap nights across all 11 sites. We captured 13 *Zapus* and 262 non-target species during the course of all trapping; we collected genetic samples from 10 individuals. We documented three trap fatalities for non-target species, including one deer mouse (*Peromyscus maniculatus*), one shrew (*Sorex* sp.), and one juvenile weasel (*Mustela* sp.). There were no *Zapus* fatalities.

## DISCUSSION

Jumping mice appear to be common and widespread throughout southeastern Wyoming. Surveys conducted in 2009 covered a larger portion of the suspected range of PMJM in Wyoming than those in 2010, which were located within the predicted distribution of PMJM (WGFD 2010). Although survey effort was similar between years, capture success and catch per unit effort were both greater in 2009, with genetic samples collected from 30 individuals

(Thompson and Grenier 2009). However, genetic analysis for the 40 *Zapus* individuals for which samples were collected in 2009 and 2010 was pending when this report was written. Genetic analysis results are presented by Cudworth and Grenier (2011). Upon completion of genetic analysis, future trapping efforts will focus within those drainages known to contain PMJM in order to explore if an elevational gradient exists between PMJM and the western jumping mouse and provide information on potential geographic differentiation of these species.

## LITERATURE CITED


Cudworth, N. and M. Grenier. 2011. Genetic differentiation and distribution of Preble's meadow jumping mouse (*Zapus hudsonius preblei*) and western jumping mouse (*Z. princeps*) in southeastern Wyoming. Pages 156-162 *in* Threatened, endangered, and nongame bird and mammal investigations (M.B. Grenier, Editor). Wyoming Game and Fish Department Nongame Program, Lander, USA.

King, T.L., M.S. Eackles, and C.C. Young. 2006. Microsatellite DNA markers for assessing phylogeographic and population structure in Preble's meadow jumping mouse (*Zapus hudsonius preblei*) and cross-amplification among neighbouring taxa. Molecular Ecology Notes 6:670-673.

Thompson, J. and M. Grenier. 2009. Live trapping of jumping mice in southeastern Wyoming completion report. Pages 197-200 *in* Threatened, endangered and nongame bird and mammal investigations (A.C. Orabona, Editor). Wyoming Game and Fish Department Nongame Program, Lander, USA.

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Wyoming Natural Diversity Database. 2009. Unpublished report. University of Wyoming, Laramie, USA.

[WYGAP] Wyoming Gap Analysis. 1996. Landcover for Wyoming, 2nd Edition. University of Wyoming, Laramie, USA.

[WGFD] Wyoming Game and Fish Department. 2010. State wildlife action plan. Wyoming Game and Fish Department, Cheyenne, USA.

Table 1. Locations of watersheds trapped for meadow jumping mouse (*Zapus* spp.) in southeastern Wyoming between June and August 2010. We captured meadow jumping mice at six of the 11 watersheds.

| Watershed | *Zapus* Captured | General Location (T,R, S) | County |
|---|---|---|---|
| Willow Creek | Yes | 13N, 73W, S 36 | Albany |
| Duck Creek | No | 28N, 73W, S 1 | Albany |
| School House Creek | Yes | 17N, 72W, S 36 | Albany |
| Horseshoe Creek | No | 28N, 71W, S 12 | Albany |
| Le Bonte Creek | No | 28N, 73W, S 8 | Albany |
| Friend Creek | Yes | 26N, 72W, S 4 | Albany |
| Rabbit Creek | Yes | 24N, 70W, S 17 | Platte |
| Deer Creek | Yes | 29N, 77W, S 9 | Natrona |
| Elk Horn Creek | Yes | 29N, 76W, S 28 | Converse |
| Boulder Creek | No | 28N, 75W, S 34 | Albany |
| Wagon Hound Creek | No | 31N, 72W, S 29 | Converse |

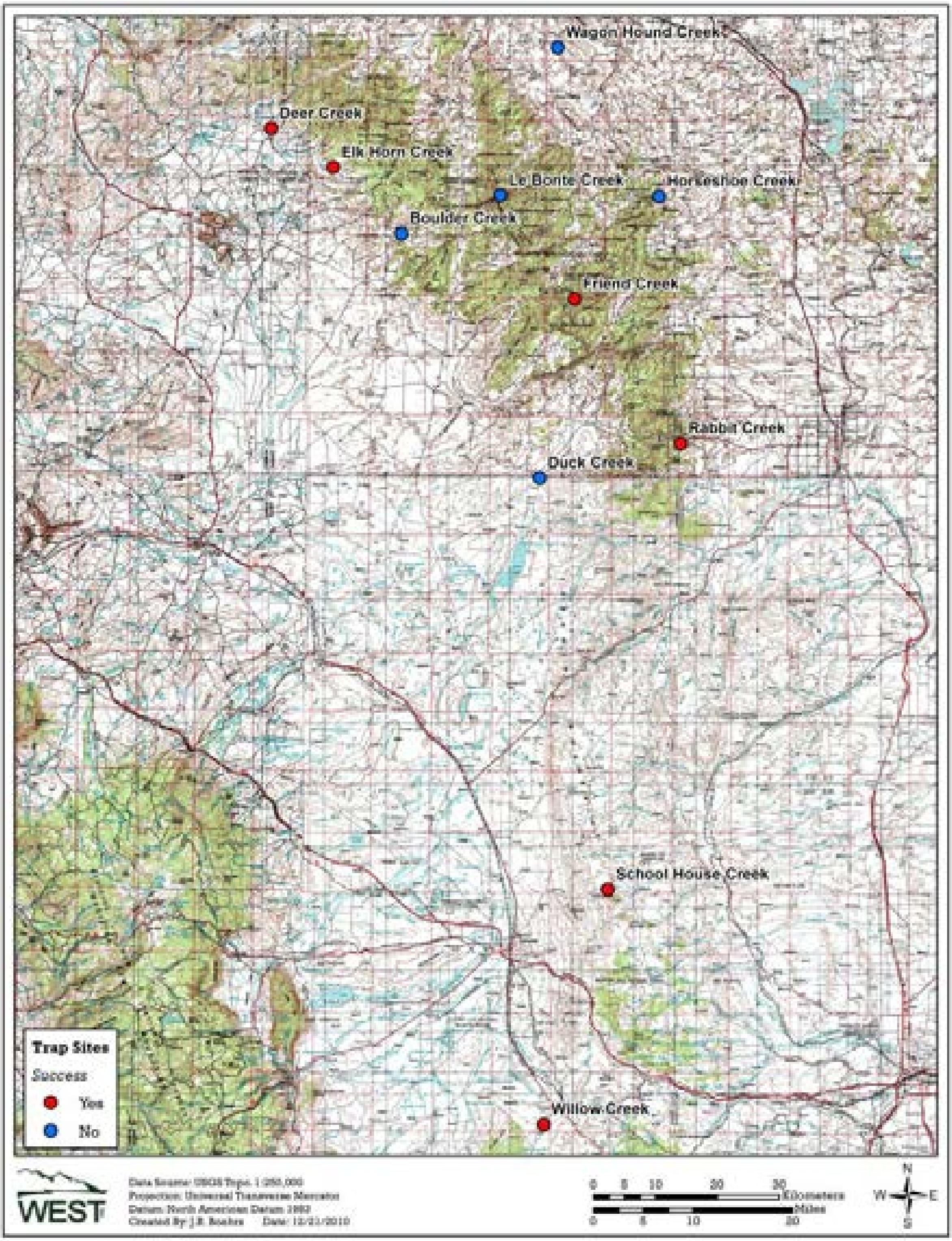


Figure 1. Locations of watersheds trapped for meadow jumping mouse (*Zapus* spp.) in southeastern Wyoming between June and August 2010. Successful sites had ≥1 *Zapus* capture.

## GENETIC DIFFERENTIATION AND DISTRIBUTION OF PREBLE'S MEADOW JUMPING MOUSE (*ZAPUS HUDSONIUS PREBLEI*) AND WESTERN JUMPING MOUSE (*Z. PRINCEPS*) IN SOUTHEASTERN WYOMING

STATE OF WYOMING

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

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations, Wyoming Governor's Endangered Species Account Funds, United States Fish and Wildlife Service Cooperative Agreements

PROJECT DURATION: 1 July 2009 – 30 June 2012

PERIOD COVERED: 1 June 2009 – 14 April 2011

PREPARED BY: Nichole Cudworth, Nongame Biologist
Martin Grenier, Nongame Mammal Biologist

### ABSTRACT

The Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is classified as a Species of Greatest Conservation Need by the Wyoming Game and Fish Department; however, definitive records of the subspecies in the state are lacking. Identification is further complicated by the sympatric western jumping mouse (*Z. princeps*), which is nearly indistinguishable in the field. To remedy this dearth of information, the Wyoming Game and Fish Department contracted Western Ecosystems Technology, Inc. and the United States Geological Survey to collect samples and conduct genetic analyses for *Zapus* spp. throughout southeastern Wyoming. Of the 40 individuals captured in 2009 and 2010, only three individuals were classified as *Z. h. preblei*; the remaining individuals were classified as *Z. princeps*. The small number of *Z. h. preblei* captured suggests that Preble's meadow jumping mouse may not be as widely distributed as previously hypothesized. Our results highlight the need to increase survey efforts of *Z. h. preblei* throughout its predicted distribution.

### 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 subspecies is nearly impossible to distinguish from the sympatric and closely related western jumping mouse (*Z. princeps*) in the field. Furthermore, the genetic validity of the subspecies 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 until taxonomy issues were clarified. King et al. (2006) resolved the taxonomic debate and concluded that PMJM deserves specific status as a subspecies. In July 2008, the U.S. Fish and Wildlife Service removed Wyoming portion of the PMJM population from protection under the Endangered Species Act (USFWS 2011). The PMJM remains federally threatened in Colorado and is classified as a Species of Greatest Conservation Need in Wyoming, where the subspecies is restricted to marshy areas and moist riparian corridors in the southeastern section of the state (WGFD 2010, USFWS 2011).

In order to determine current distribution and population structure of PMJM in Wyoming, the Department contracted Western Ecosystems Technology, Inc. (WEST) to collect genetic samples from *Zapus* individuals throughout predicted range and core distribution of PMJM in southeastern Wyoming. Our objectives were to document and verify locations of captured PMJM in order to update current maps of range and distribution. Trapping results are presented in an additional report (Thompson et al. 2010); here we provide results from genetic analysis of individuals collected in 2009 and 2010.

## METHODS

We described live-trapping and genetic sampling procedures in this and previous annual completion reports (Thompson and Grenier 2009, Thompson et al. 2010). WEST collected a combination of hair and blood samples from 40 *Zapus* individuals (30 individuals in 2009; 10 individuals in 2010). The lab of Dr. Tim King, U.S. Geological Survey, conducted both nuclear and mtDNA genetic analysis for each sample following protocol outlined by King et al. (2006).

## RESULTS

The nuclear and mtDNA variation in each specimen were identical for each genome in all compared samples. Of the 40 samples submitted for genetic analysis, only three individuals (7.5%) were positively identified as *Z. h. preblei*; the remaining individuals were identified as *Z. princeps* (Table 1). Both individuals captured at the Laramie River and Tunnel Road site in Albany County in 2009 and the only individual captured at the Rabbit Creek site in Platte County in 2010 were classified as PMJM (Figure 1). Notably, both of these records occurred within the same 10-digit Hydrological Unit Code.

## DISCUSSION

WEST Inc. selected sampling locations based on previously known or suspected PMJM locations from the Wyoming Natural Diversity Database (2009). Surveys conducted in 2009 covered a larger portion of the predicted range of PMJM in Wyoming than those in 2010, which were located within the predicted core distribution of PMJM (WGFD 2010). However, original distributions were based on previously observed and captured individuals that were believed to be PMJM but were not genetically verified. Classification of only 3 of 40 total individuals as PMJM suggests the Preble's meadow jumping mouse is likely less abundant in Wyoming than originally predicted.

The low capture success of PMJM in areas suspected to provide ideal habitat in Wyoming is interesting. With potential changes in federal status designations in Wyoming, documenting and updating the distribution of PMJM is especially critical. Trapping efforts in 2011 will be even more localized to those areas originally designated as Critical Habitat in Wyoming by the U.S. Fish and Wildlife Service in 2003 (Hoffman 2003). Although *Z. princeps* is known to occur in similar areas and habitats as PMJM, the degree of sympatry is unknown. Therefore, WEST Inc. will focus on trapping multiple locations within drainages in order to explore if an elevational gradient exists between PMJM and the western jumping mouse and provide information on potential geographic differentiation of these species.

## ACKNOWLEDGMENTS

Funding was provided by the Wyoming State Legislature General Fund Appropriations and the Governor's Endangered Species Account Funds as well as the United States Fish and Wildlife Service Cooperative Agreements, for which the Department is extremely grateful. We also wish to thank J. Thompson, from WEST Inc., and Dr. T. King, from U.S. Geological Survey, for their assistance in trapping and genetic analyses.

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Table 1. Individual identification numbers, year, capture location and species designation for *Zapus* spp. captured in drainages in southeastern Wyoming from 2009 – 2010.

| Individual ID number | Year | Location | Species |
|---|---|---|---|
| 2A24a | 2009 | Dale Creek Tributary | *Z. princeps* |
| 3A11a | 2009 | Dale Creek Tributary | *Z. princeps* |
| 5B23a | 2009 | Dale Creek Tributary | *Z. princeps* |
| 5B24a | 2009 | Dale Creek Tributary | *Z. princeps* |
| 5A24a | 2009 | Encampment River site | *Z. princeps* |
| 2B7a | 2009 | Jack Creek site | *Z. princeps* |
| 5A20a | 2009 | Jack Creek site | *Z. princeps* |
| 5A24a | 2009 | Jack Creek site | *Z. princeps* |
| 5A4a | 2009 | Jack Creek site | *Z. princeps* |
| 5A6a | 2009 | Jack Creek site | *Z. princeps* |
| 6A22a | 2009 | Jack Creek site | *Z. princeps* |
| 1A4b | 2009 | La Prele Creek | *Z. princeps* |
| 3A8a | 2009 | La Prele Creek | *Z. princeps* |
| 2B4a | 2009 | Laramie River/Tunnel Road site | *Z. hudsonius* |
| 3B6a | 2009 | Laramie River/Tunnel Road site | *Z. hudsonius* |
| 5A11a | 2009 | North Brush Creek | *Z. princeps* |
| 5A19a | 2009 | North Brush Creek | *Z. princeps* |
| 5B20a | 2009 | North Brush Creek | *Z. princeps* |
| 1A7a | 2009 | South Lodgepole Creek site | *Z. princeps* |
| 2B25a | 2009 | South Lodgepole Creek site | *Z. princeps* |
| 4B10b | 2009 | South Lodgepole Creek site | *Z. princeps* |
| 5B10a | 2009 | South Lodgepole Creek site | *Z. princeps* |
| 5B12a | 2009 | South Lodgepole Creek site | *Z. princeps* |
| 6A14a | 2009 | South Lodgepole Creek site | *Z. princeps* |
| 1A12a | 2009 | Spring Creek site | *Z. princeps* |
| 1A18a | 2009 | Spring Creek site | *Z. princeps* |
| 1A20a | 2009 | Spring Creek site | *Z. princeps* |
| 2A12a | 2009 | Spring Creek site | *Z. princeps* |
| 2B1a | 2009 | Spring Creek site | *Z. princeps* |
| 4B23b | 2009 | Stinking Creek site | *Z. princeps* |
| 1B25b | 2010 | Deer Creek site | *Z. princeps* |
| 5A5a | 2010 | Deer Creek site | *Z. princeps* |
| 1B9a | 2010 | Elk Horn Creek site | *Z. princeps* |
| 6A15a | 2010 | Elk Horn Creek site | *Z. princeps* |

Table 1. Continued.

| Individual ID number | Year | Location | Species |
|---|---|---|---|
| 3B23a | 2010 | Friend Creek site | *Z. princeps* |
| 5B20a | 2010 | Friend Creek site | *Z. princeps* |
| 2B18a | 2010 | Rabbit Creek site | *Z. hudsonius* |
| 4B19b | 2010 | School House Creek site | *Z. princeps* |
| 5A11a | 2010 | School House Creek site | *Z. princeps* |
| 2A9a | 2010 | Willow Creek site | *Z. princeps* |

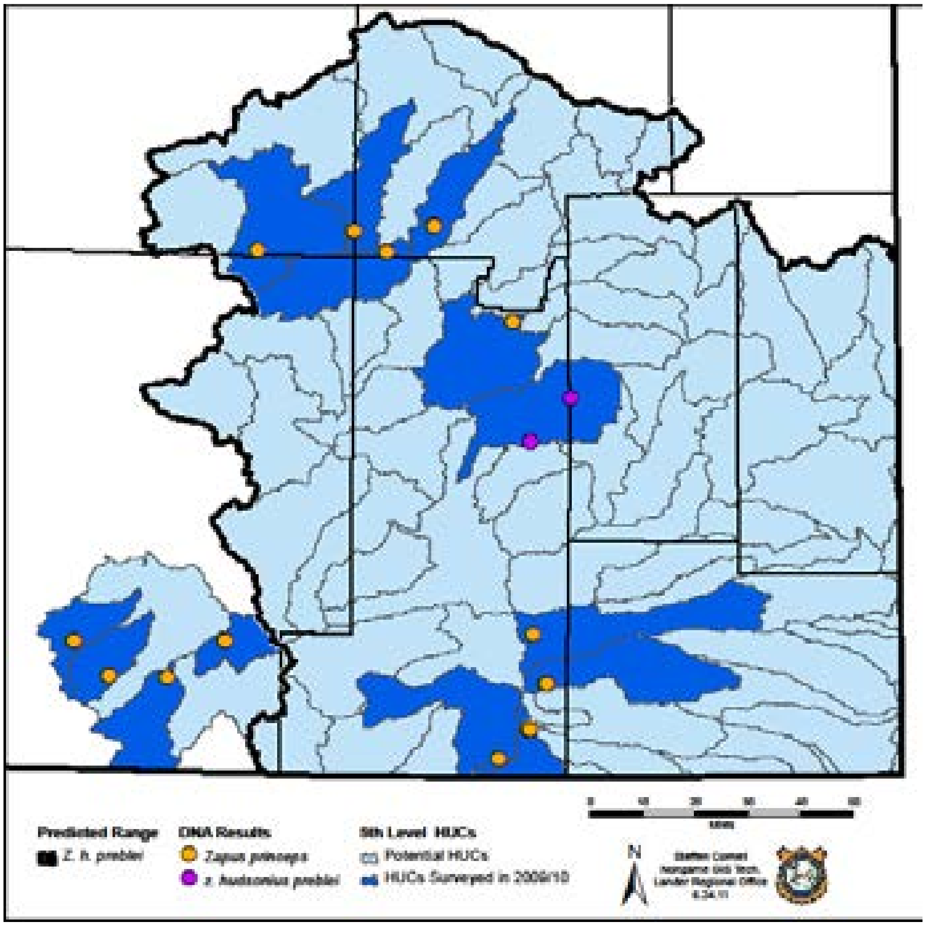


Figure 1. Locations of areas we captured jumping mice in southeastern Wyoming 2009 and 2010. The 5th level Hydrological Unit Codes (HUC) that intersect the predicted range of Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei;* PMJM) are presented in light blue. All HUCs we surveyed are presented in dark blue. Orange points ($n$ = 13) represent locations where we captured western jumping mice (*Zapus princeps*) while purple points ($n$ = 2) represent PMJM. The U.S. Geological Survey completed the DNA analysis for the Wyoming Game and Fish Department.

## THUNDER BASIN GRASSLANDS PRAIRIE ECOSYSTEM ASSOCIATION SMALL MAMMAL TRAPPING 2009-2010

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need

FUNDING SOURCE: Wyoming Governor's Endangered Species Account Funds

PROJECT DURATION: 1 July 2009 – 30 June 2010

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Nichole Cudworth, Nongame Biologist

## ABSTRACT

In an on-going effort to monitor habitat management treatments in the Thunder Basin Grasslands Prairie Ecosystem Association project area, Thunderbird Wildlife Consulting, Inc. was contracted to quantify species richness and abundance of small mammals in pastures treated in 2008 and 2009. Thunderbird Wildlife Consulting, Inc. used line transects to survey pastures across a variety of habitats (i.e., sagebrush shrubland, upland grassland, breaks, bottomland, and riparian) for small mammals in September 2009 and June 2010. Capture rates were higher in September (5.5 individuals per trap night) than June (3.6 individuals per trap night), potentially due to a greater sampling of juveniles in the fall. In total, 401 individuals representing seven species were captured over the entire survey; deer mice (*Peromyscus maniculatus*) were consistently the most common species recorded. Although overall capture rates were low during the study, values were within the range of comparable studies in Wyoming, Montana, and South Dakota. Species richness tended to be similar among vegetation types. However, species abundance was highest in breaks and sagebrush shrubland and lowest in upland grassland, likely reflecting the greater structural diversity of breaks and sagebrush areas. Overall, the species present in the Thunder Basin Grasslands Prairie Ecosystem Association project area are representative of those found in similar habitats throughout the region. For more information, the full report from Thunderbird Wildlife Consulting, Inc. follows. The complete report is available from the Nongame Mammal Biologist in Lander, Wyoming.

**MONITORING TRENDS AND DOCUMENTING DISTRIBUTION OF SWIFT FOX IN WYOMING**

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Swift Fox

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants

PROJECT DURATION: 1 July 2009 – 30 June 2011

PERIOD COVERED: 15 April 2010 – 14 April 2011

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

## ABSTRACT

Swift fox (*Vulpes velox*) abundance and distribution declined greatly in the late 19$^{th}$ and 20$^{th}$ centuries due to loss of native prairie habitat and widespread predator control. The Wyoming Game and Fish Department classifies the swift fox as a Species of Greatest Conservation Need because statewide population trends are unknown and the species is at risk from habitat loss and secondary poisoning. From September through November 2010, we used remote infrared cameras on 95 grids to document occupancy and update the current distribution of swift fox in eastern Wyoming. Detection probabilities varied from 0.24 to 0.73 and were negatively correlated with behavior and positively correlated with amount of grassland within the grid. Probability of occupancy was positively correlated with amount of suitable slope (i.e., <10%) within the grid and averaged 0.43 (± 0.05). Detections outside the current predicted distribution suggest swift fox are likely expanding their distribution westward in the state. Repeated surveys will allow biologists to monitor trends in swift fox occupancy, and future collection of habitat data will help determine specific habitat and vegetation characteristics important to swift fox occupancy and refine the current distribution model.

## INTRODUCTION

The swift fox (*Vulpes velox*) is a small canid that historically occupied the short- and mixed-grass prairies from northern Texas to southern Canada (Scott-Brown et al. 1987). Historically, the range covered 12 states, including areas east of the Continental Divide in Wyoming. Swift fox densities and distribution declined greatly in the late 19$^{th}$ and 20$^{th}$ 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. However, swift fox remains classified as a Species of Greatest Conservation Need with a Native Species Status of 4 (NSS4) by the Wyoming Game and Fish Department (Department). Although distribution of swift fox is secure and the species is widely distributed, data on population status for majority of the state are lacking (WGFD 2010).

Several conservation efforts and planning processes for the swift fox are currently underway. The Department has identified multiple objectives under the State Wildlife Action Plan (SWAP; WGFD 2010) 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 revise the known distribution and determine population trends of swift fox in Wyoming. In 2009, Department biologists investigated multiple methodologies to accomplish these objectives in eastern Wyoming. Our objectives for the 2010 study were to utilize field methods described by Knox and Grenier (2010) to develop a baseline occupancy model to monitor trends in swift fox populations, revise the known distribution, and record new observations in the state.

## METHODS

We divided the eastern $2/3^{rd}$ of Wyoming into grids of 31 $km^2$. Grids were classified as available to survey if the they were composed of ≥45% suitable slope (i.e., <10%) and ≥25% suitable habitat (i.e., dry-land crops, mixed-grass prairie, short-grass prairie, and/or sagebrush). We randomly selected 100 grids from all available grids and contacted county assessors and regional wildlife personnel for initial information on land ownership. We randomly selected a replacement grid to survey if ownership could not be determined or if landowners could not be reached or declined to participate. We contacted landowners twice, once to obtain initial permission to access or set up cameras on their property and again a week prior to conducting the survey. All surveys were completed between 12 September and 23 November 2010 to coincide with juvenile dispersal in an attempt to maximize detection probabilities (Finley et al. 2005).

We used a total of 90 infrared cameras (Reconyx, PC800, HC500, and PM35, Holmen, WI) to conduct surveys, following protocol outlined by Knox and Grenier (2010). We used an array of five cameras per grid, one camera located in the center of the grid and one camera in the center of each quadrant of the grid, to allow for even dispersion. When necessary, we moved cameras slightly within the grid to accommodate issues of accessibility and landowner requirements. Each camera was secured with rebar and set approximately 2.5 m from a wooden stake that served as a base for the lure as well as a focal point for the camera. We created a skunk-based attractant by heating 385 ml of petroleum jelly to liquid form, adding 15 ml of skunk essence (F&T Fur Harvester's Trading Post, Alpena, MI), and allowing the lure to solidify. We applied approximately 15 ml of the attractant to the top of the stake and a few sprays of fish oil to the base. We programmed cameras to take three photos every 10 s each time the camera was triggered. Cameras were programmed to take pictures from 1800 to 0600 when possible. We left each array to take photos for five consecutive nights. On the sixth day, we collected cameras, downloaded pictures, and erased memory cards. We recorded all target and non-target captures, as well as GPS coordinates, precipitation, habitat code, and total number of photos taken for each camera.

We combined data from each of the five cameras to develop an encounter history for each grid and used program PRESENCE (Hines 2010) to develop occupancy models. Models included the probability of occupancy ($\Psi$) and five detection probabilities ($p$) for the five trapping nights. Additional occupancy covariates included the percentage of the grid composed of grassland, the percentage of the grid composed of suitable slope (i.e., <10%), and their interaction; we standardized covariates before inclusion in the model (Franklin 2001). Detection probability covariates included those for occupancy as well as time and behavior (i.e., a change in detection probability following the first detection of an individual on the grid). We developed additive models including all possible combinations of covariates, for a total of 100 models. We used AIC for model selection (Burnham and Anderson 1998) and model averaging for all models with $\Delta$AIC <1.5. Once top models were selected, we performed a MacKenzie-Bailey goodness of fit test (MacKenzie and Bailey 2004) to test for overdispersion. We used SigmaPlot Version 11.0 (SYSTAT Software, Inc.) to conduct a power analysis to test our ability to detect a change in the probability of occupancy of 0.10, 0.15, and 0.20. We used the paired t-test option with $\alpha$ = 0.025 and standard deviation and sample size values from the 2010 survey. We report detection probabilities and average occupancy (± *SE*) from model averaged results.

## RESULTS

We completed 95 of 100 survey grids, for a total of 2,340 camera nights. We recorded 106 unique detections (i.e., photographs of swift fox >1 hr apart) on 25 grids. Two of these grids resulted in updates to the Department's Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming (Orabona et al. 2009). Because of the low number of grids with detections, we restricted occupancy analysis to grids located within the known distribution of swift fox (WGFD 2010). This narrowed our data set to 48 grids, 20 of which were known to be occupied. We identified two top models with $\Delta$AIC <1.5. In the top model, probability of occupancy was influenced by the percentage of the grid composed of suitable slope, and detection probability was influenced by behavior and the percentage of the grid composed of grassland (AIC = 197.5, AIC wt = 0.515, $\chi 2$ = 27.12, $P$ = 0.40). Probability of occupancy was also influenced by slope in the second model, and detection probability was influenced by the percentage of the grid composed of grassland (AIC = 197.6, AIC wt = 0.485, $\chi 2$ = 23.86, $P$ = 0.78).

Detection probabilities were negatively correlated with behavior (i.e., whether an individual had been captured previously; Fig. 1) and positively correlated with the percentage of the grid composed of grassland (Fig. 2). When models were averaged, detection probabilities varied from 0.24 (± 0.10) to 0.73 (± 0.10). Probability of occupancy was positively correlated with the percentage of the grid composed of suitable slope (Fig. 3) and ranged from 0.07 on a grid with 49.1% suitable slope to 0.62 on a grid with 98.2% suitable slope. Across all grids, probability of occupancy averaged 0.43 (± 0.05), suggesting that 20.6 (± 2.4) grids were occupied, as opposed to the 20 grids on which we detected swift fox. With 48 survey grids, the power to detect a change in the probability of occupancy of 0.10 (i.e., a reduction from 0.43 to 0.33) was only 37.7%. However, the power to detect a change of 0.15 was 74.2%, and the power to detect a change of 0.20 was 94.6%.

## DISCUSSION

Detection probability was influenced by behavior and the percentage of the grid composed of grassland. Swift fox were less likely to be detected on a grid if they had been detected a previous night. This behavioral influence resulted in nearly a 10% decrease in detection probability following the first detection, potentially due to a lack of curiosity in the lure following initial investigation. The presence of scat at a number of our lure stations may also indicate that foxes marked these areas during their first investigation and thus did not need to return again to re-investigate the lure. The percentage of the survey grid composed of grassland, however, was positively correlated with detection probability. This has also been observed in a similar study of swift fox occupancy in Colorado (Finley et al. 2005). Swift fox have been shown to preferentially select short-grass prairies, presumably for the increased maneuverability and visibility provided by these vegetation types (Kamler et al. 2003). Coyotes are known predators of swift fox and can be major causes of mortality (Sovada et al. 1998, Kitchen et al. 1999, Olson and Lindzey 2002); shorter vegetative structure may be essential in allowing swift fox to detect these predators (Kamler et al. 2003). In Wyoming, grasslands, as opposed to habitats composed of Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle and Young) and dry-land crops, may provide greater visibility of the surrounding landscape. Consequently, foxes in grasslands may be more willing to explore unique and novel scents, thus leading to the increased detection probability observed in these areas.

The probability of occupancy was positively correlated with the percentage of suitable slope in the survey grid. Dens of swift fox are most often associated with areas of low slope (Jackson and Choate 2000), potentially for the increased visibility provided by flatter landscapes (Kilgore 1969). Because swift fox have been characterized as "one of the most burrow-dependent canids in North America" (Egoscue 1979:3), suitable habitat for denning may be a key factor influencing occupancy. Interestingly, the percentage of the grid composed of grasslands was not a major factor in predicting occupancy, as was observed by Finley et al. (2005). In fact, we recorded multiple swift fox detections in grids where the majority of the habitat was Wyoming big sagebrush. In southeastern Wyoming, Olson and Lindzey (2002) observed higher survival and larger litter sizes in areas interspersed with sagebrush < 1 m tall than in other portions of swift fox range. However, the vegetation layer we used in developing our habitat model only has a single designation for Wyoming big sagebrush and does not differentiate between canopy densities and heights of sagebrush plants. Additional collection of habitat characteristics in sagebrush areas where we detected swift fox will help improve our understanding of specific vegetative characteristics important to occupancy. These results can be used refine the swift fox distribution model in the future.

Although accounting for detection probability did have an impact on the number of grids classified as occupied, the difference was slight. Additionally, the power to detect decrease in occupancy of 0.20 was nearly 95%. This likely indicates that our methods were appropriate for detecting swift fox on grids where they were present (MacKenzie et al. 2002) and provide a suitable design for monitoring population trends of swift fox in Wyoming. Most detections were within the predicted distribution of swift fox for SWAP (i.e., 97 of 106 detections). Therefore, future survey efforts should focus in this area when attempting to monitor changes in swift fox occupancy rates. However, we still documented swift fox on five grids located outside the current predicted distribution of swift fox in Wyoming; two grids resulted in updates to the Department's Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming. The majority of these grids were located west of the current distribution of swift fox. These observations and other reliable reports of sightings in Fremont and Sublette Counties suggest swift fox are likely expanding their distribution westward in the state. Consequently, these areas should continue to be surveyed in order to keep the swift fox range map current as well as monitor and record these and any other range expansions or contractions.

## ACKNOWLEDGMENTS

Funding for this project was provided by the U.S. Fish and Wildlife Service through State Wildlife Grants funds, for which the Department is extremely grateful. The Trophy Game program generously provided cameras. We also extend a special thanks to the county assessors and the Department's game wardens and regional biologists for their assistance in our efforts to contact private landowners. We are especially thankful to the many private landowners who graciously provided access to their lands to assist this project. Wyoming Game and Fish Department nongame GIS technician E. Furtaw and nongame biologist D. Wilckens provided invaluable assistance throughout all stages of the project.

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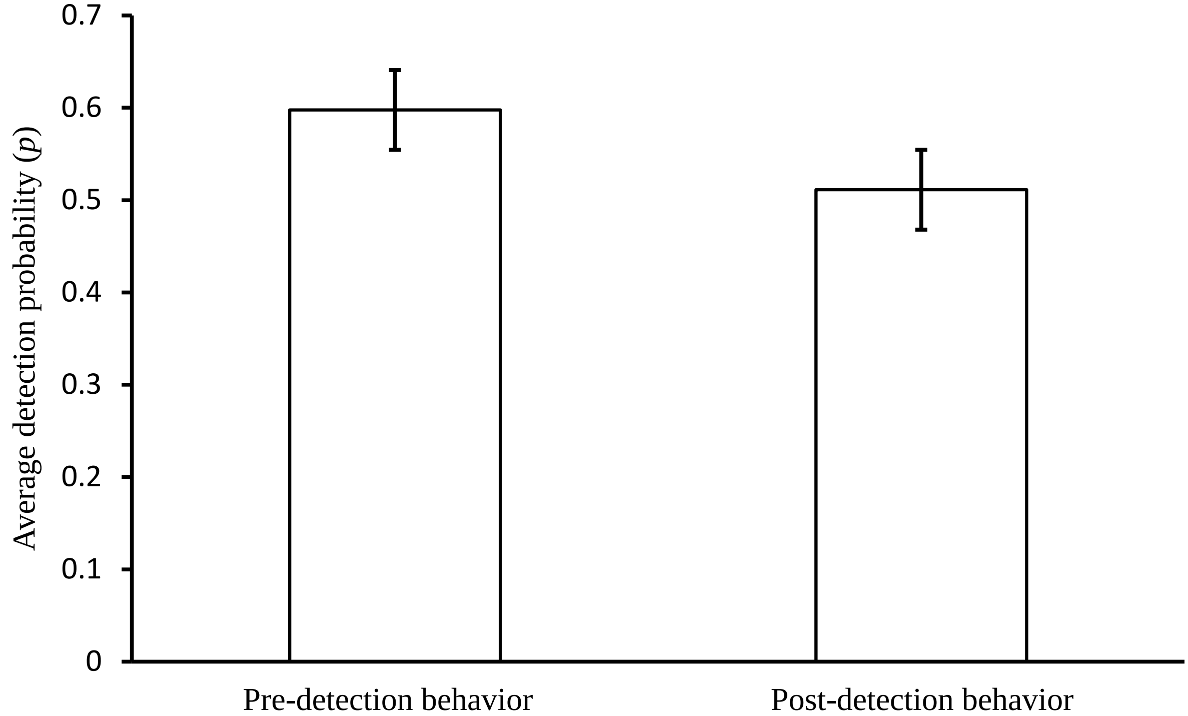


Figure 1. Average detection probabilities ($p$; ± *SE*) of grids known to contain swift fox (*Vulpes velox*; $n$ = 20) before and after first detection, eastern Wyoming, September-November 2010.

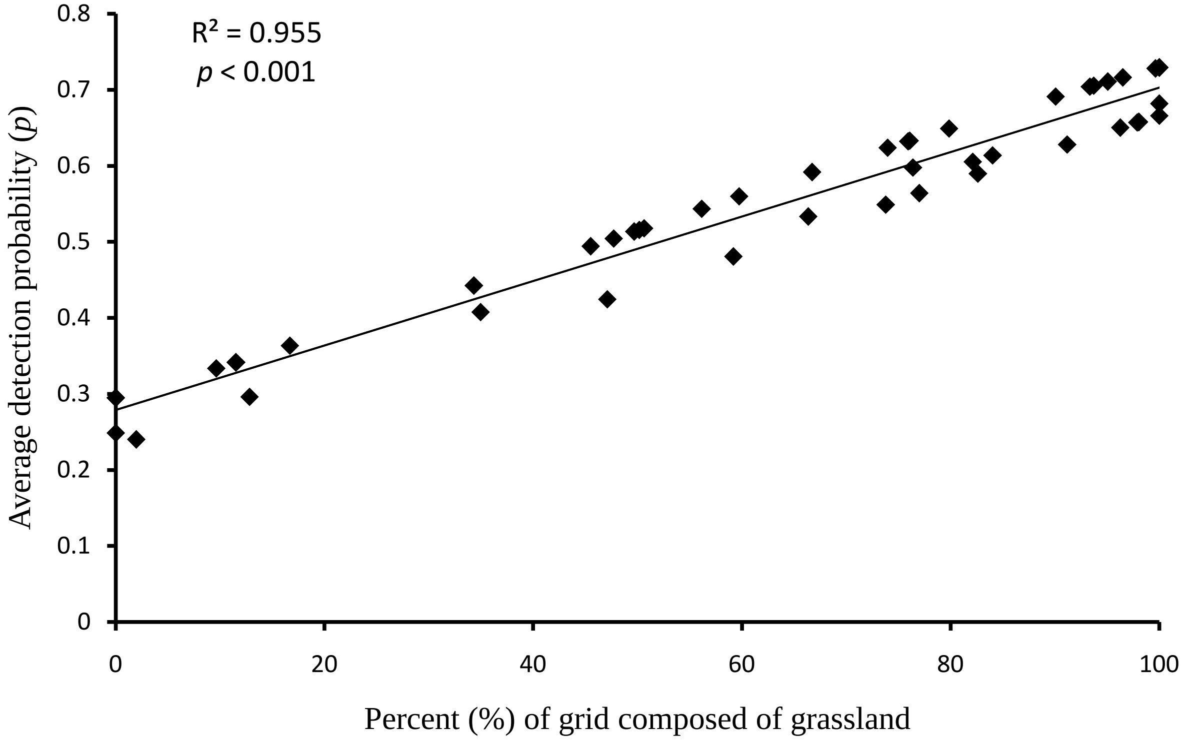


Figure 2. Average detection probabilities ($p$) of swift fox (*Vulpes velox*) for all grids ($n$ = 48) as a function of the percentage of the grid composed of mixed-grass prairie, eastern Wyoming, September-November 2010.

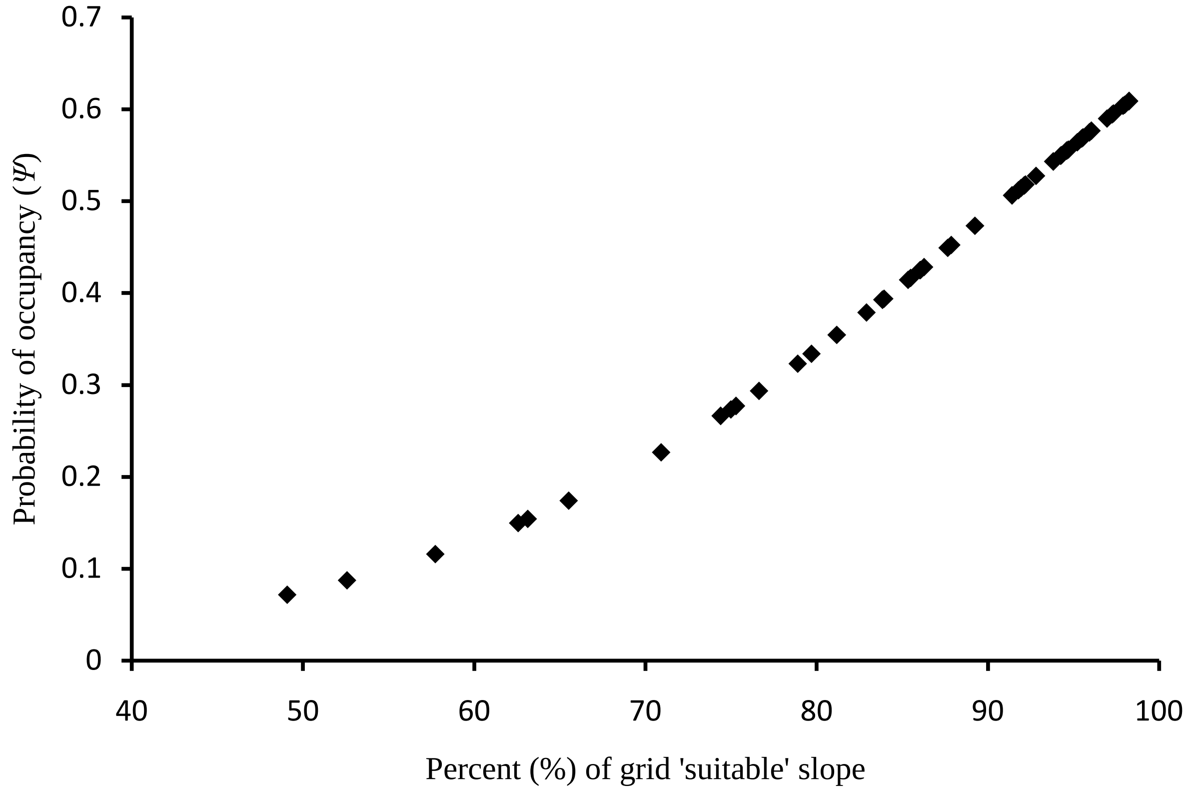


Figure 3. Probability of occupancy (*Ψ*) of swift fox (*Vulpes velox*) for all grids (*n* = 48) as a function of the percentage of the grid composed of suitable slope (i.e., <10%), eastern Wyoming, September-November 2010. Average occupancy (± *SE*) was 0.43 ± 0.05.

**DEVELOPING PROTOCOLS FOR LONG-TERM MONITORING OF NORTHERN RIVER OTTER IN SOUTHWEST WYOMING**

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need / Northern River Otter

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants

PROJECT DURATION: Masters Thesis Research

PERIOD COVERED: April 4 2010 – April 4 2011

PREPARED BY: Merav Ben-David, Zoology and Physiology Department, University of Wyoming

## SUMMARY

This is a Department of Zoology and Physiology Department 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.

Exploration and extraction of natural gas in the Intermountain West has been steadily increasing since the 1980's. In southwestern Wyoming, the Pinedale Anticline and Jonah Field contain some of the largest gas reserves in the Intermountain West and have been in development since the 1990's (Bureau of Land management; BLM 2000). Federal ownership of lands and the current National Energy Policy will likely lead to continued large-scale development of mining operations in this area. The Green River is the largest tributary for the Colorado River and the Green River Basin contains many reservoirs and lakes, which provide essential water resources for agriculture and urban use within the catchment area as well as down river (Wyoming State Water Plan 2008). Therefore, any disturbance to the flow of the river and any reduction in water quality from natural gas developments (Wang and Yang 2006) may have negative effects on this critical resource.

Northern river otters (*Lontra canadensis*) are semi-aquatic piscivorous mustelids, which inhabit freshwater lakes and streams throughout North America and are ubiquitous in nearshore waters along the Atlantic Seaboard and the Pacific Northwest (Lariviere and Walton 1998, Melquist et al. 2003). River otters are particularly sensitive to environmental degradation, pollution (Bowyer et al. 2003,), and human disturbance (Gaydos et al. 2007). As such, they serve as an ideal sentinel species to monitor the health of aquatic ecosystems.

Northern river otters are both elusive and difficult to recapture, making a population census via direct observation or mark-recapture approaches impractical. These challenges can be overcome using indirect sampling of hair and feces for genetic analyses (Hansen et al. 2008, Guertin et al. in press). River otters visit latrine sites with a high degree of fidelity (Crait and Ben-David 2007), sites are easy to identify in a variety of habitats (Bowyer et al. 1995; 2003, Ben-David et al. 2005, DePue and Ben-David in press), sample collection is non-invasive, and Northern river otters are not disturbed or displaced by researcher activity at latrine sites (Ben-David and Golden 2007).

Our objectives in this project are:

1. Estimate the abundance of Northern river otters along sections of the Green River and tributaries in Wyoming via hair and fecal DNA analysis and capture re-capture models.
2. Estimate survival of Northern river otters along sections of the Green River and tributaries in Wyoming via hair and fecal DNA analysis and capture re-capture models.
3. Assess the optimal sampling design for obtaining an unbiased and precise estimate of Northern river otter abundance and survival in the Green River Basin of Wyoming.
4. Develop a monitoring protocol for Northern river otter abundance and survival in the Green River Basin of Wyoming.

The first field season was conducted between 15 May and 14 August, 2010. Three river sections in the Green River Basin were surveyed following the requirements of a Robust Design capture-recapture model (Pollock 1982). Each section was surveyed three times during the summer (Table 1; Fig. 1). Within each primary occasion, latrine sites along each river section were sampled on four consecutive secondary occasions, each lasting two days. Thus, each site was visited 12 times during the sampling period. River sections surveyed were in Seedskadee National Wildlife Refuge below the Fontenelle Reservoir (SDK), the upper Green River directly above the Fontenelle Reservoir (UGR), and the New Fork River (NF), a large tributary flowing into the Green River above the upper Green River section.

For all three river sections, a total of 302 scat samples and 18 hair samples were collected (Table 2). The majority of samples were collected from the Seedskadee National Wildlife Refuge, and few from the New Fork River section, despite no observable difference in habitat and vegetation along the bank. To evaluate the potential effects of water quality, water samples were collected on all three river sections. Samples will be analyzed for dissolved carbon levels and metal concentrations. In addition, readings of water temperature and conductivity were taken on all three river sections (Table 2).

Sieving of scats has been completed. DNA extraction and amplification of scat and hair samples will begin in January and conducted through March 2011. Similarly, analyses of dissolved carbon levels and metal concentrations in water samples will be conducted through March 2011.

Preparation for the 2011 field season will commence in January 2011 and the fieldwork will begin in May 2011. The field season will continue until August 2011. River sections for the 2011 field season will be selected in consultation with M. Grenier from the Wyoming Game and Fish Department.

Our accomplishments deviate from our original proposals in two ways. Originally, we proposed to survey four sections of river within the Green River Basin. Nonetheless, because it took two days to float each section of river per occasion, we were only able to survey three sections. In addition, we originally planned to survey a section above the confluence of the New Fork and the Green River but were unable to obtain permission from more than half of the private land owners in that section of the river. Therefore, we were forced to survey a section below the confluence of the two rivers.

Success of hair trapping was lower than expected, yielding a low number of hair samples. Because successful extraction of DNA is more common in hair than scat samples, we need to improve our hair snaring success in the future. Placement of hair snares will be adjusted in the 2011 field season following recommendations by J.R. Crait who used these traps in Yellowstone Lake.

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Table 1. Total length (km) and dates of primary survey occasions for three river sections surveyed in 2010 for river otter latrine sites within the Green River Basin of Wyoming. Seedskadee National Wildlife Refuge (SDK), Upper Green River (UGR), New Fork River (NF)

| River section | Total length (km) | Dates of primary occasions |
| --- | --- | --- |
| SDK | 38.6 | 16 to 24 May, 18 to 25 June, 15 to 23 July |
| UGR | 35.4 | 31 May to 8 June, 27 June to 4 July, 25 July to 2 August |
| NF | 32.2 | 9 to16 June, 6 to 13 July, 3 to 12 August |

Table 2. Number of river otter latrines, scat, hair, water samples, and number of stations sampled for water temperature and conductivity along three river sections surveyed in 2010 within the Green River Basin of Wyoming. Seedskadee National Wildlife Refuge (SDK), Upper Green River (UGR), New Fork River (NF)

| River section | No. of latrines | No. of scats | No. of hair samples | No. of water samples | No of stations sampled for temperature and conductivity |
|---|---|---|---|---|---|
| SDK | 24 | 234 | 16 | 3 | 24 |
| UGR | 17 | 57 | 1 | 3 | 17 |
| NF | 6 | 11 | 1 | 3 | 15 |

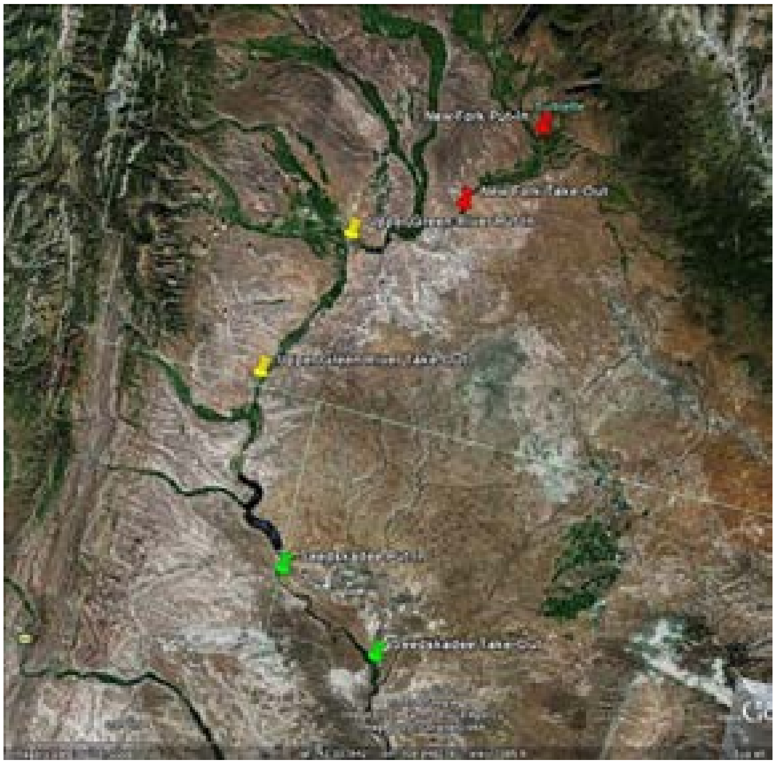


Figure 1. Location of three river sections surveyed for river otter latrine sites in the Green River Basin, Wyoming, May to August 2010.

# GEOGRAPHIC INFORMATION SYSTEMS

# GIS ACTIVITIES FOR SPECIES OF GREATEST CONSERVATION NEED

STATE OF WYOMING

TERRESTRIAL NONGAME: Species of Greatest Conservation Need – GIS PROJECTS

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants

PROJECT DURATION: 1 July 2008 – 30 June 2011

PERIOD COVERED: 15 April 2009 – 14 April 2011

PREPARED BY: Martin Grenier, Nongame Mammal Biologist
Elizabeth Furtaw, Nongame GIS Analyst
Steffen Cornell, Nongame GIS Analyst

## INTRODUCTION

State Wildlife Grant funds were allocated to hire a 12-month AWEC GIS Analyst to facilitate the revision of the Wyoming Game and Fish Department's State Wildlife Action Plan (SWAP) for 2010 and to create digital products that would facilitate conservation efforts for Species of Greatest Conservation Need (SGCN). During the last two years, this position has made several valuable contributions both to individual species and broader statewide levels. All projects were accomplished using ArcGIS 9.3 (ESRI, Redlands, CA). Species specific conservation efforts are present throughout this and previous Annual Completion Reports. Since many of these SGCN conservation efforts utilized GIS resources during various phases of the project and details are discussed within individual reports, we decided not to reiterate them here. Many of the final products will be presented in SWAP. Please refer to other SGCN, Threatened, and Endangered species reports in this document for additional information or contact the Nongame Program directly. Below we summarize only the major statewide contributions that were accomplished during the last year. Contact the Nongame Program for all final products and metadata.

### Anthropogenic Disturbance Assessment

Using methods described by Copeland et al. (2007), we evaluated the impacts of human activities on the landscape in Wyoming. We combined existing methods in GIS landscape ecology with new innovative approaches (e.g., decay functions, etc.) for the assessment. We collected eight GIS datasets representing different anthropogenic impacts within the state of Wyoming. The datasets included, agricultural lands, mines, oil and gas pipelines, oil and gas wells, power lines, residential development, roads, and wind turbines. The layers were combined, summed, and normalized to create the final product (Figure 1).

### Key Nongame Wildlife Areas

Using 2006 NAIP imagery, we delineated and digitized a dataset identifying Key Nongame Wildlife Areas for avian and mammalian fauna of interest in Wyoming. The 30 delineated polygons identify important areas (e.g., habitats) for Species of Greatest Conservation Need (SGCN). We identified Key Areas by considering faunal diversity, uniqueness of habitat, intactness of habitat, and their importance to maintaining native SGCN fauna in Wyoming. Landownership and habitat vulnerability of these areas were only loosely considered (Figure 2).

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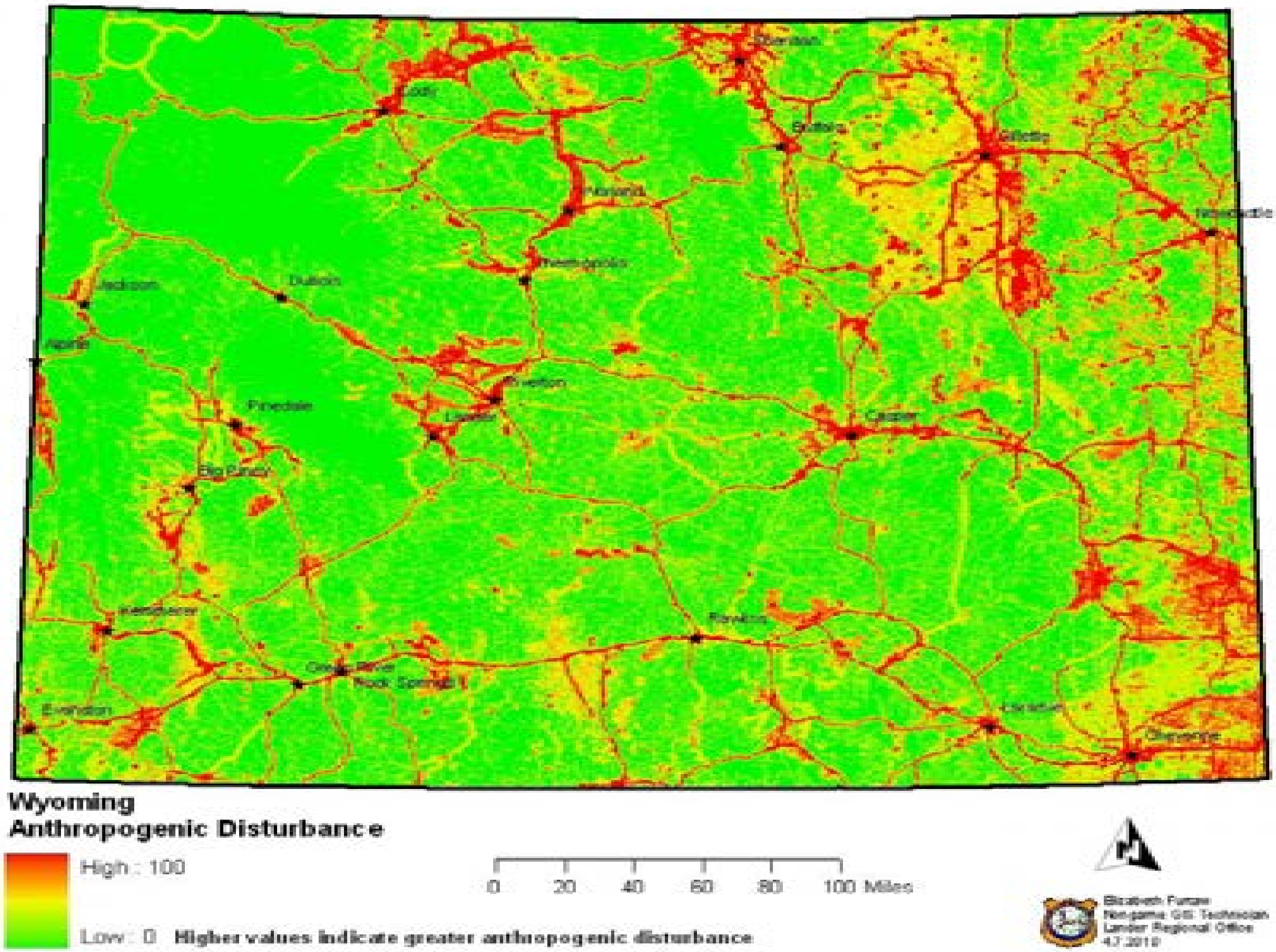


Figure 1. Anthropogenic disturbance assessment combines human disturbances for eight impacts (e.g., oil and gas, roads, wind, etc.). Impact values were normalized so that green represents areas of low human disturbance, while red represents areas of high human disturbance.

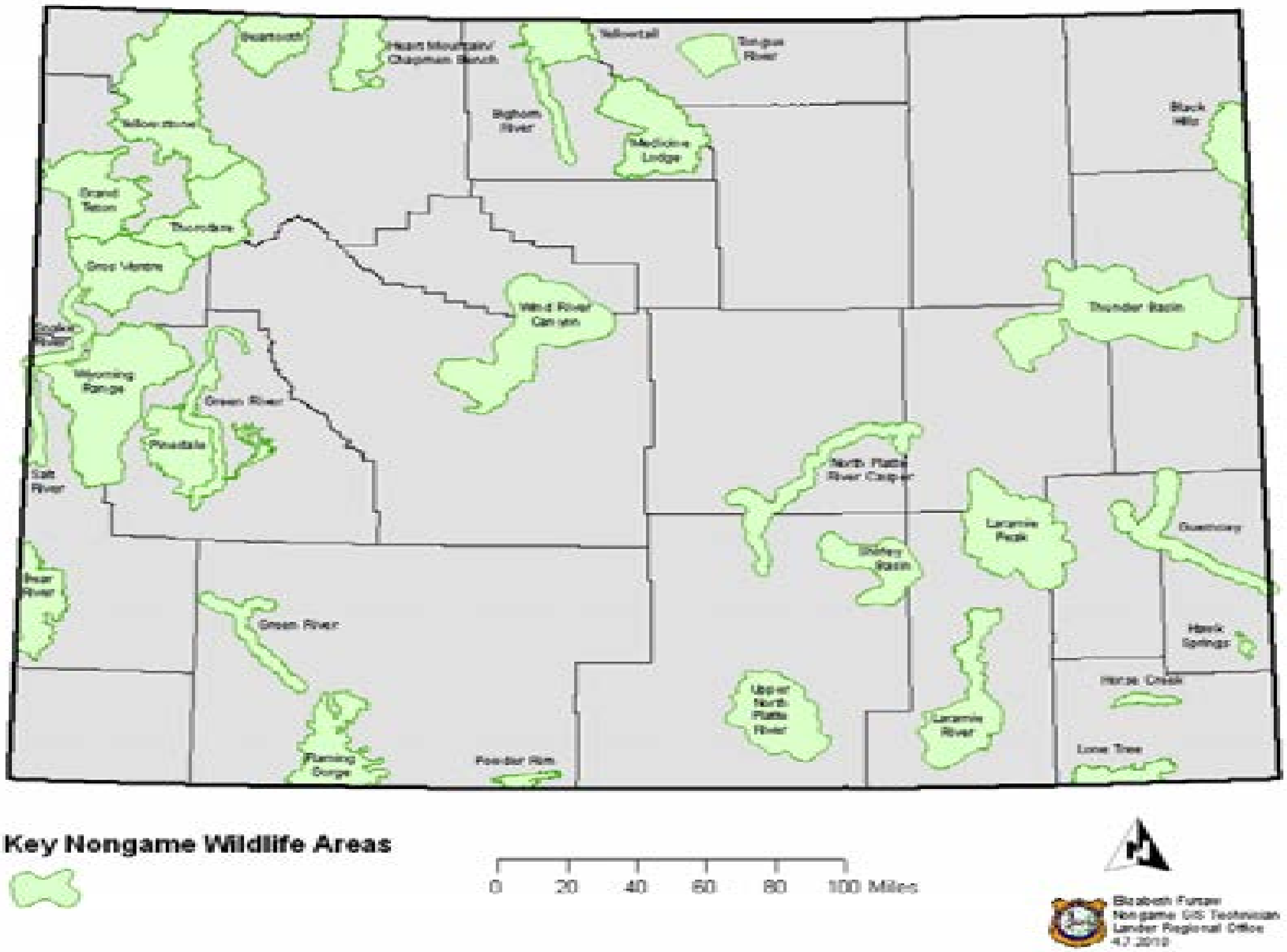


Figure 2. Key Nongame Wildlife Areas represent areas that have unique fauna or flora that are important to maintaining the presence of Species of Greatest Conservation Need in Wyoming. Areas were delineated using expert knowledge and remote sensing techniques.

# HARVEST REPORTS

## HARVEST OF RAPTORS FOR FALCONRY

STATE OF WYOMING

NONGAME BIRDS: Raptors

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations, Wyoming Governor's Endangered Species Account Funds

PROJECT DURATION: Annual

PERIOD COVERED: 1 January 2010 – 31 December 2010

PREPARED BY: Nichole Cudworth, Nongame Biologist
Kyle Lash, Permitting Officer

## SUMMARY

In 2010, the Wyoming Game and Fish Department (Department) issued a total of 19 falconry capture licenses. The number of licenses issued is similar to those issued in 2009 (i.e., 15), but represented a decrease in licenses issued from 2007 (i.e., 39) and 2008 (i.e., 33). Twelve resident and seven nonresident licenses were issued; however, only nonresidents captured birds, with five of these seven licenses being filled in 2010. Capture success for nonresidents was 71.4%. Ferruginous Hawks and Merlins were the most common captured species, with two individuals each, followed by Northern Goshawks, with only one capture (Table 1). The number of birds captured in 2010 was lower than the mean number of captures from 1981-2009 (23.8 ± 1.5 birds), reflecting the decrease in the number of licenses issued. However, the capture success rate in 2010 (26%) was also lower than the mean capture success rate from 1981-2009 (47.5% ± 2.4%; Table 2).

Table 1. Species and number of captured raptors by residents and nonresidents for falconry in Wyoming, 2010.

| Species captured | Number of resident captures | Number of nonresident captures | Total captures |
|---|---|---|---|
| Ferruginous Hawk | 0 | 2 | 2 |
| Northern Goshawk | 0 | 1 | 1 |
| Merlin | 0 | 2 | 2 |

Table 2. Number of individuals captured and yearly capture success rate (%) for raptors taken for falconry in Wyoming, 1981-2010.

| Year | Number of raptors captured | Capture success 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 |
| 2010 | 5 | 26 |

# OTHER NONGAME

## USING THE BREEDING BIRD SURVEY TO MONITOR POPULATION TRENDS OF AVIAN SPECIES IN WYOMING

STATE OF WYOMING

NONGAME BIRDS: Other Nongame

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations, Wyoming Governor's Endangered Species Account Funds, National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, Bureau of Reclamation

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

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

## ABSTRACT

The Breeding Bird Survey has provided long-term monitoring of a variety of avian species in Wyoming since 1968. In 2010, volunteers surveyed 54 routes across the state. Overall, survey effort and the number of detections along survey routes have decreased, while the number of species detected along routes has increased. Of the 190 species detected in 2010, we are able to monitor population trends of 55 species. Most species demonstrate stable populations, while 7 are increasing and 12 are decreasing. Consistent with region-wide trends, species in coniferous forests and grasslands are among those with decreasing populations. With diminishing survey effort and decreasing avian populations, recruiting knowledgeable volunteers to conduct surveys is critical to ensuring the continued success of the Breeding Bird Survey. Our ability to continue to monitor breeding bird populations using roadside surveys also depend on these volunteers.

## INTRODUCTION

Forty-four nongame avian species are listed as Species of Greatest Conservation Need (SGCN) by the Wyoming Game and Fish Department (Department; WGFD 2010). However, only a small number of these are monitored with species-specific surveys. Consequently, the Department utilizes data from other large-scale, multi-species surveys to monitor trends in avian populations in Wyoming. The Breeding Bird Survey (BBS) is used to monitor trends of breeding birds across North America. The 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. The USGS-BRD has conducted detailed statistical analyses of data for the BBS since the survey's inception in 1966 in the East and 1968 in the West. From these analyses, population trends for individual species are examined on a continental, geographic region, statewide, and physiographic region scale. The Department's Nongame Bird Biologist serves as the state BBS coordinator in the State.

Over 4,400 routes are located throughout the Unites States and Canada, with 108 available routes in Wyoming. The Department uses these data from the BBS to monitor populations of multiple avian species, especially terrestrial species whose population trends can be tracked using this survey method, including many SGCN. The objectives of the 2010 BBS were to add to the past 42 years of survey data and interpret current trends of breeding birds in Wyoming.

## METHODS

Volunteers typically conduct surveys on established routes for the BBS in June, when birds are breeding and most vocal. Each route is 39.4 km long and consists of 50 stops spaced every 0.8 km. Beginning ½-hr before sunrise, observers record birds seen within a 0.4-km radius and all birds heard at each stop during a 3-min period. Each route is surveyed once annually and data are submitted to the USGS-BRD for analysis. Species that have sufficient data to infer trends by the BBS are those that are detected on ≥14 routes, with a regional abundance of >1.0 bird per route, and robust data that enable our ability to detect a ≥3% change in abundance per year (Sauer et al. 2010). To view these data and additional route information, visit the BBS website at www.pwrc.usgs.gov/bbs. We report means ± SE for all summary statistics.

## RESULTS

In 2010, observers surveyed 2,423 of 3,485 (70%) available routes in the United States. In Wyoming, observers agreed to survey 73 of the 108 (68%) available routes in 2010. However, only 54 (74%) of these routes were completed. Seven (10%) were completed but were not included in the data analysis at this time due to a late return date on the data and 12 (16%) were not surveyed (Table 1). From 1990 to present, the number of survey routes completed has decreased by 0.86 routes per year ($R^2$ = 0.511; Fig. 1). Consistent with this trend, the number of routes completed in 2010 ($n$ = 54) was fewer than the average number of routes completed from 1990–2009 (66.6 ± 1.6 routes).

Observers detected a total of 27,650 individual birds representing 190 different species in 2010 in Wyoming for which data are currently available (Table 2). From 1990 to present, the number of individuals detected per route has decreased by 3.8 individuals per route per year ($R^2$ = 0.40; Fig. 2), but the number of species detected per route has increased by 0.04 species per route per year ($R^2$ = 0.51; Fig. 3). Also consistent with observed trends, the number of individuals detected in 2010 (i.e., 512.1 individuals per route) was fewer than the average number of individuals detected from 1990–2009 (i.e., 537.4 ± 8.4 individuals per route), but the number of species detected (i.e., 3.65 species per route) was greater than the average number of species detected from 1990–2009 (i.e., 2.94 ± 0.07 species per route).

Of the 190 species detected, 55 have sufficient data for trend analysis (Table 3). This includes four SGCN, all of which demonstrated stable populations from 1968–2009, the Sage Thrasher, Brewer's Sparrow, Sage Sparrow, and Grasshopper Sparrow. Of the 19 species for which we are able to determine a directional trend (Table 3), only four species differ from survey-wide trends. The Lark Sparrow, Lincoln's Sparrow, and Brown-headed Cowbird are increasing in Wyoming but decreasing survey-wide, and the American Robin is decreasing in Wyoming but increasing survey-wide.

## DISCUSSION

A complete history of the BBS observers and years routes were surveyed in Wyoming from 1968 through 2010 are available from the Department's Nongame Bird Biologist in the Lander Regional Office. Fewer than 20 routes have been run continuously, or with minimal interruptions, for >10 years. A majority of routes contain gaps of ≥2 years or have had >1 observer. Because the primary purpose of the BBS is to monitor population trends of avian species, it is important each route is conducted annually, preferably by the same observer. Ensuring that the same observer conducts each route annually is a primary goal of BBS coordinators.

Overall, survey effort has decreased in the last 20 years. On average, the number of routes completed decreased by 0.86 routes per year, with 2010 recording the lowest number of routes completed since 1987. Additionally, the number of individual detections has decreased steadily in the last 20 years. However, the number of species detected per route has increased, with 2010 recording the greatest number of species per route since 1987. This increase may result from increased detections of uncommon or peripheral species, but is more likely an artifact of decreasing survey effort.

Data were available for the BBS to evaluate population trends for 55 species in Wyoming. Thirty six of these species demonstrated stable population trends. Directional trends in Wyoming species tend to agree with survey-wide trends, with only a few exceptions. Of the 12 species demonstrating declining populations, half are associated with coniferous forests (i.e., Yellow-rumped Warbler, Chipping Sparrow, and Pine Siskin) or grasslands (i.e., Horned Lark, Vesper Sparrow, and Lark Bunting). Both of these habitats are at high risk for habitat degradation, alteration, or loss, with grasslands listed among the most imperiled habitats in the United States (WGFD 2010). The majority of the seven species with increasing populations can be classified as habitat generalists (i.e., Red-tailed Hawk, Common Raven, Lark Sparrow, and Brown-headed Cowbird), suggesting flexibility in habitat selection may buffer losses of habitat or allow for colonization of more disturbed areas. The four SGCN that demonstrated stable populations and are generally associated with sagebrush-steppe (i.e., Sage Thrasher, Brewer's Sparrow, and Sage Sparrow), with the exception of the Grasshopper Sparrow, which is associated with grasslands.

Population trends developed using data from the BBS allow for large-scale, long-term monitoring of a variety of avian species. These trends are not only useful for monitoring individual species across a variety of local, state, and regional scales, but also to highlight similar population trends for a suite of species, such as the precipitous decline observed for grassland birds nationwide (WPIF 2002). However, population trend analysis data are only significant for species occurring on ≥14 survey routes with a regional abundance >1 individual per route. Notably, the number of routes completed has been steadily decreasing in Wyoming since 1990. Consequently, recruiting knowledgeable volunteers to conduct surveys on established routes across the state is critical to maintaining our ability to monitor breeding birds along roadside surveys.

## ACKNOWLEDGEMENTS

We would like to thank the volunteers and biologists from this and other natural resources management agencies for their valuable contributions to the 2010 Breeding Bird Survey (see names in Table 1). 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.

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Table 1. Observer and number of avian species and individuals recorded for each Breeding Bird Survey route in Wyoming, 2010.

| Route Number – Name | Latilong | Observer | Species | Individuals |
|---|---|---|---|---|
| 1 – NE Entrance, YNP | 1 | Lisa Baril | 48 | 403 |
| 2 – Cody | 2 | Grace Nutting | 45 | 414 |
| 3 – Otto | 3 | Observer needed | | |
| 4 – Basin | 4 | N/A – discontinued | | |
| 5 – Wyarno | 5 | John Berry | 42 | 1449 |
| 6 – Clarkelen | 6 | N/A – discontinued | | |
| 7 – Sundance | 7 | Jennifer Adams | 54 | 594 |
| 8 – Colter Bay | 8 | N/A – discontinued | | |
| 9 – Dubois | 9 | Jazmyn McDonald | 57 | 326 |
| 10 – Midvale | 10 | Jim Downham | Not available | Not available |
| 11 – Nowood | 11 | Donna Walgren | 41 | 391 |
| 12 – Natrona | 12 | N/A – discontinued | | |
| 13 – Bill | 13 | Observer needed | | |
| 14 – Redbird | 14 | N/A – discontinued | | |
| 15 – Fontenelle | 15 | Carol Deno | 53 | 468 |
| 16 – Elk Horn | 16 | Brad Meyer | Not conducted | Not conducted |
| 17 – Bear Creek | 17 | Andrea Orabona | 15 | 249 |
| 18 – Ervay | 18 | Jazmyn McDonald | 34 | 306 |
| 19 – Brookhurst | 19 | Bruce Walgren | 63 | 684 |
| 20 – Glenrock | 20 | N/A – discontinued | | |
| 21 – Dwyer | 21 | Martin Hicks | Not conducted | Not conducted |
| 22 – Cumberland | 22 | Carol Deno | 31 | 240 |
| 23 – McKinnon | 23 | N/A – discontinued | | |
| 24 – Patrick Draw | 24 | Laurie Van Fleet | 19 | 389 |
| 25 – Savery | 25 | Marie Adams | 39 | 337 |
| 26 – Riverside | 26 | Steve Loose | 44 | 738 |
| 27 – Buford | 27 | Suzanne Fellows | 31 | 360 |
| 28 – Yoder | 28 | Jim Lawrence | 49 | 926 |
| 29 – Canyon | | N/A – discontinued | | |
| 30 – Mammoth, YNP | 1 | Lisa Baril | 59 | 625 |
| 31 – West Thumb | -- | N/A – discontinued | | |
| 32 – Hunter Peak | 2 | Kathryn Hicks | 70 | 464 |
| 33 – Clark | 2 | Kathryn Hicks | 61 | 642 |
| 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 | Jazmyn McDonald | 56 | 422 |
| 39 – Ten Sleep | 4 | C.J. Grimes | 54 | 618 |
| 40 – Dayton | 4 | Tracey Ostheimer | 58 | 675 |
| 41 – Bald Mountain | 4 | Observer needed | | |

Table 1. Continued.

| Route Number – Name | Latilong | Observer | Species | Individuals |
|---|---|---|---|---|
| 42 – Crazy Woman | 5 | Grace Nutting | 47 | 262 |
| 43 – Schoonover | 5 | Observer needed | | |
| 44 – Arvada | 5 | Donald Brewer | 34 | 739 |
| 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 | 27 | 688 |
| 50 – Moskee | | N/A – discontinued | | |
| 51 – Alpine | 8 | Susan Patla | Not available | Not available |
| 52 – Wilson | 8 | Observer needed | | |
| 53 – Horse Creek | 9 | Eva Crane | 50 | 280 |
| 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 | Jazmyn McDonald | 45 | 359 |
| 59 – Arminto | 11 | Justin Binfet | 17 | 396 |
| 60 – Lysite | 11 | Greg Anderson | 24 | 469 |
| 61 – Worland | 11 | C.J. Grimes | 41 | 492 |
| 62 – Teapot Dome | 12 | Observer needed | | |
| 63 – Mayoworth | 12 | Deane Bjerke | 45 | 645 |
| 64 – Sussex | 12 | Bill Ostheimer | 45 | 842 |
| 65 – Harland Flats | 13 | Observer needed | | |
| 66 – Pine Tree | 13 | Observer needed | | |
| 67 – Highlight | | N/A – discontinued | | |
| 68 – Riverview | 14 | Observer needed | | |
| 69 – Newcastle | 14 | Laurie Van Fleet | Not conducted | Not conducted |
| 70 – Raven | 14 | Observer needed | | |
| 71 – Soda Lake | 15 | Observer needed | | |
| 72 – Buckskin Mountain | 15 | Lara Oles | Not conducted | Not conducted |
| 73 – Daniel | | N/A – discontinued | | |
| 74 – Boulder | 16 | Susan Patla | 55 | 462 |
| 75 – Big Sandy | 16 | Susan Patla | Not available | Not available |
| 76 – Farson | 16 | Observer needed | | |
| 77 – Fiddler Lake | 17 | Eva Crane | 39 | 281 |
| 78 – Sand Draw | 17 | Jazmyn McDonald | 33 | 410 |
| 79 – Sweetwater | 17 | Stan Harter | Not conducted | Not conducted |
| 80 – Gas Hills | 18 | Observer needed | | |
| 81 – Bairoil | 18 | Greg Hiatt | 24 | 355 |
| 82 – Lamont | 18 | Greg Hiatt | 34 | 372 |
| 83 – Pathfinder | 19 | Laurie Schwieger | 24 | 356 |

Table 1. Continued.

| Route Number – Name | Latilong | Observer | Species | Individuals |
|---|---|---|---|---|
| 84 – Leo | 19 | Donna Walgren | 36 | 330 |
| 85 – Shirley | 19 | Ann Hines | 16 | 169 |
| 86 – Warbonnet | 20 | Jim Lawrence | 46 | 342 |
| 87 – Fletcher Peak | 20 | Gloria Lawrence | 55 | 538 |
| 88 – Shawnee | 20 | Observer needed | | |
| 89 – Meadowdale | 21 | Martin Hicks | Not conducted | Not conducted |
| 90 – Lusk | 21 | Gloria Lawrence | 26 | 757 |
| 91 – Lingle | 21 | Observer needed | | |
| 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 | 27 | 207 |
| 98 – Black Rock | 24 | Andrea Orabona | 13 | 254 |
| 99 – no route | | N/A – no route | | |
| 100 – no route | | N/A – no route | | |
| 101 – Wamsutter | 25 | Observer needed | | |
| 102 – Rawlins | 25 | Patrick Parks | Not conducted | Not conducted |
| 103 – Baggs | 25 | Observer needed | | |
| 104 – Walcott | 26 | Frank Blomquist | 46 | 402 |
| 105 – Fox Park | 26 | Patrick Parks | Not conducted | Not conducted |
| 106 – Ryan Park | 26 | Observer needed | | |
| 107 – Sybille Canyon | 27 | Observer needed | | |
| 108 – Rock River | 27 | Observer needed | | |
| 109 – Harmony | 27 | Observer needed | | |
| 110 – Cheyenne | 28 | Alisa Coffin | Not conducted | Not conducted |
| 111 – Chugwater | 28 | Observer needed | | |
| 112 – Pine Bluff | 28 | Observer needed | | |
| 120 – Welch | 20 | Chris Michelson | 37 | 624 |
| 123 – Flaming Gorge | 23 | Kathleen Paulin | 22 | 363 |
| 147 – Rozet | 6 | Observer needed | | |
| 148 – Seely 2 | 7 | Mary Yemington | 49 | 863 |
| 150 – Government Valley | 7 | Jennifer Adams | 44 | 999 |
| 167 – Thunder Basin | 13 | Observer needed | | |
| 173 – Rye Grass | 15 | Observer needed | | |
| 192 – Carter | 23 | Observer needed | | |
| 195 – Seedskadee | 23 | Observer needed | | |
| 204 – Basin 2 | 4 | Observer needed | | |
| 206 – Caballa Creek | 6 | Sandra Johnson | 25 | 568 |
| 208 – Moran | 8 | Susan Wolff | 38 | 290 |
| 212 – Bucknum | 12 | Larry Keffer | Not available | Not available |

Table 1. Continued.

| Route Number – Name | Latilong | Observer | Species | Individuals |
|---|---|---|---|---|
| 214 – Hampshire | 14 | Observer needed | | |
| 250 – Moskee 2 | 7 | Jennifer Adams | 53 | 772 |
| 900 – Hayden Valley | | N/A – discontinued | | |
| 901 – Yellowstone, YNP | 1 | Lisa Baril | 49 | 1051 |
| 902 – Pryor Flats | 1 | Observer needed | | |

Table 2. Number of individuals and relative abundance of each species (in phyologenetic order) detected on Breeding Bird Survey routes in Wyoming, 2010. * indicates the 30 most abundant species detected in 2010.

| Order | Species | Number Detected | Relative Abundance (%) |
|---|---|---|---|
| Anseriformes | *Canada Goose | 690 | 2.50 |
| Anseriformes | Trumpeter Swan | 2 | 0.01 |
| Anseriformes | Wood Duck | 3 | 0.01 |
| Anseriformes | Gadwall | 18 | 0.07 |
| Anseriformes | American Wigeon | 33 | 0.12 |
| Anseriformes | Mallard | 170 | 0.61 |
| Anseriformes | Blue-winged Teal | 18 | 0.07 |
| Anseriformes | Cinnamon Teal | 6 | 0.02 |
| Anseriformes | Northern Shoveler | 9 | 0.03 |
| Anseriformes | Northern Pintail | 12 | 0.04 |
| Anseriformes | Green-winged Teal | 4 | 0.01 |
| Anseriformes | Canvasback | 4 | 0.01 |
| Anseriformes | Redhead | 3 | 0.01 |
| Anseriformes | Ring-necked Duck | 2 | 0.01 |
| Anseriformes | Lesser Scaup | 30 | 0.11 |
| Anseriformes | Bufflehead | 8 | 0.03 |
| Anseriformes | Barrow's Goldeneye | 33 | 0.12 |
| Anseriformes | Common Merganser | 24 | 0.09 |
| Anseriformes | Ruddy Duck | 10 | 0.04 |
| Galliformes | Chukar | 10 | 0.04 |
| Galliformes | Ring-necked Pheasant | 160 | 0.58 |
| Galliformes | Ruffed Grouse | 1 | 0.00 |
| Galliformes | Greater Sage-Grouse | 33 | 0.12 |
| Galliformes | Dusky Grouse | 2 | 0.01 |
| Galliformes | Sharp-tailed Grouse | 3 | 0.01 |
| Galliformes | Wild Turkey | 37 | 0.13 |
| Gaviiformes | Common Loon | 2 | 0.01 |
| Podicipediformes | Pied-billed Grebe | 4 | 0.01 |
| Podicipediformes | Eared Grebe | 8 | 0.03 |
| Podicipediformes | Western Grebe | 8 | 0.03 |
| Podicipediformes | Clark's Grebe | 1 | 0.00 |
| Pelecaniformes | Double-crested Cormorant | 41 | 0.15 |
| Pelecaniformes | American White Pelican | 78 | 0.28 |
| Ciconiiformes | American Bittern | 1 | 0.00 |
| Ciconiiformes | Great Blue Heron | 29 | 0.10 |
| Ciconiiformes | Turkey Vulture | 75 | 0.27 |
| Falconiformes | Osprey | 13 | 0.05 |
| Falconiformes | Bald Eagle | 5 | 0.02 |
| Falconiformes | Northern Harrier | 29 | 0.10 |

Table 2. Continued.

| Order | Species | Number Detected | Relative Abundance (%) |
|---|---|---|---|
| Falconiformes | Cooper's Hawk | 1 | 0.00 |
| Falconiformes | Northern Goshawk | 2 | 0.01 |
| Falconiformes | Broad-winged Hawk | 1 | 0.00 |
| Falconiformes | Swainson's Hawk | 26 | 0.09 |
| Falconiformes | Red-tailed Hawk | 82 | 0.30 |
| Falconiformes | Ferruginous Hawk | 14 | 0.05 |
| Falconiformes | Golden Eagle | 39 | 0.14 |
| Falconiformes | American Kestrel | 74 | 0.27 |
| Falconiformes | Peregrine Falcon | 2 | 0.01 |
| Falconiformes | Prairie Falcon | 6 | 0.02 |
| Gruiformes | Virginia Rail | 1 | 0.00 |
| Gruiformes | Sora | 6 | 0.02 |
| Gruiformes | American Coot | 30 | 0.11 |
| Gruiformes | Sandhill Crane | 61 | 0.22 |
| Charadriiformes | *Killdeer | 205 | 0.74 |
| Charadriiformes | Mountain Plover | 4 | 0.01 |
| Charadriiformes | American Avocet | 15 | 0.05 |
| Charadriiformes | Spotted Sandpiper | 59 | 0.21 |
| Charadriiformes | Willet | 16 | 0.06 |
| Charadriiformes | Upland Sandpiper | 30 | 0.11 |
| Charadriiformes | Long-billed Curlew | 8 | 0.03 |
| Charadriiformes | Wilson's Snipe | 153 | 0.55 |
| Charadriiformes | Wilson's Phalarope | 18 | 0.07 |
| Charadriiformes | Ring-billed Gull | 1 | 0.00 |
| Charadriiformes | California Gull | 67 | 0.24 |
| Columbiformes | Rock Pigeon | 131 | 0.47 |
| Columbiformes | Eurasian Collared-Dove | 40 | 0.14 |
| Columbiformes | *Mourning Dove | 639 | 2.31 |
| Cuculiformes | Black-billed Cuckoo | 1 | 0.00 |
| Strigiformes | Great Horned Owl | 7 | 0.03 |
| Strigiformes | Burrowing Owl | 5 | 0.02 |
| Strigiformes | Short-eared Owl | 1 | 0.00 |
| Caprimulgiformes | Common Nighthawk | 130 | 0.47 |
| Caprimulgiformes | Common Poorwill | 2 | 0.01 |
| Apodiformes | White-throated Swift | 64 | 0.23 |
| Apodiformes | Broad-tailed Hummingbird | 18 | 0.07 |
| Coraciiformes | Belted Kingfisher | 7 | 0.03 |
| Piciformes | Lewis's Woodpecker | 1 | 0.00 |
| Piciformes | Red-headed Woodpecker | 2 | 0.01 |
| Piciformes | Williamson's Sapsucker | 1 | 0.00 |

Table 2. Continued.

| Order | Species | Number Detected | Relative Abundance (%) |
|---|---|---|---|
| Piciformes | Red-naped Sapsucker | 19 | 0.07 |
| Piciformes | Downy Woodpecker | 8 | 0.03 |
| Piciformes | Hairy Woodpecker | 14 | 0.05 |
| Piciformes | Black-backed Woodpecker | 1 | 0.00 |
| Piciformes | Northern Flicker | 118 | 0.43 |
| Passeriformes | Olive-sided Flycatcher | 7 | 0.03 |
| Passeriformes | Western Wood-Pewee | 107 | 0.39 |
| Passeriformes | Willow Flycatcher | 21 | 0.08 |
| Passeriformes | Least Flycatcher | 12 | 0.04 |
| Passeriformes | Hammond's Flycatcher | 27 | 0.10 |
| Passeriformes | Gray Flycatcher | 2 | 0.01 |
| Passeriformes | Dusky Flycatcher | 63 | 0.23 |
| Passeriformes | Cordilleran Flycatcher | 24 | 0.09 |
| Passeriformes | Eastern Phoebe | 1 | 0.00 |
| Passeriformes | Say's Phoebe | 63 | 0.23 |
| Passeriformes | Western Kingbird | 157 | 0.57 |
| Passeriformes | Eastern Kingbird | 76 | 0.27 |
| Passeriformes | Loggerhead Shrike | 40 | 0.14 |
| Passeriformes | Plumbeous Vireo | 15 | 0.05 |
| Passeriformes | *Warbling Vireo | 293 | 1.06 |
| Passeriformes | Red-eyed Vireo | 10 | 0.04 |
| Passeriformes | Gray Jay | 5 | 0.02 |
| Passeriformes | Pinyon Jay | 52 | 0.19 |
| Passeriformes | Steller's Jay | 1 | 0.00 |
| Passeriformes | Blue Jay | 5 | 0.02 |
| Passeriformes | Clark's Nutcracker | 75 | 0.27 |
| Passeriformes | *Black-billed Magpie | 323 | 1.17 |
| Passeriformes | *American Crow | 242 | 0.88 |
| Passeriformes | *Common Raven | 251 | 0.91 |
| Passeriformes | *Horned Lark | 1741 | 6.30 |
| Passeriformes | Tree Swallow | 137 | 0.50 |
| Passeriformes | *Violet-green Swallow | 225 | 0.81 |
| Passeriformes | Northern Rough-winged Swallow | 70 | 0.25 |
| Passeriformes | Bank Swallow | 87 | 0.31 |
| Passeriformes | *Cliff Swallow | 1436 | 5.19 |
| Passeriformes | *Barn Swallow | 206 | 0.75 |
| Passeriformes | Black-capped Chickadee | 48 | 0.17 |
| Passeriformes | Mountain Chickadee | 109 | 0.39 |
| Passeriformes | Red-breasted Nuthatch | 76 | 0.27 |
| Passeriformes | White-breasted Nuthatch | 7 | 0.03 |
| Passeriformes | Pygmy Nuthatch | 14 | 0.05 |

Table 2. Continued.

| Order | Species | Number Detected | Relative Abundance (%) |
|---|---|---|---|
| Passeriformes | *Rock Wren | 247 | 0.89 |
| Passeriformes | Canyon Wren | 3 | 0.01 |
| Passeriformes | *House Wren | 214 | 0.77 |
| Passeriformes | Marsh Wren | 7 | 0.03 |
| Passeriformes | Blue-gray Gnatcatcher | 2 | 0.01 |
| Passeriformes | American Dipper | 1 | 0.00 |
| Passeriformes | Golden-crowned Kinglet | 3 | 0.01 |
| Passeriformes | *Ruby-crowned Kinglet | 208 | 0.75 |
| Passeriformes | Mountain Bluebird | 168 | 0.61 |
| Passeriformes | Townsend's Solitaire | 29 | 0.10 |
| Passeriformes | Veery | 16 | 0.06 |
| Passeriformes | Swainson's Thrush | 36 | 0.13 |
| Passeriformes | Hermit Thrush | 78 | 0.28 |
| Passeriformes | *American Robin | 1039 | 3.76 |
| Passeriformes | Gray Catbird | 41 | 0.15 |
| Passeriformes | Northern Mockingbird | 1 | 0.00 |
| Passeriformes | *Sage Thrasher | 643 | 2.33 |
| Passeriformes | Brown Thrasher | 6 | 0.02 |
| Passeriformes | *European Starling | 452 | 1.63 |
| Passeriformes | Cedar Waxwing | 5 | 0.02 |
| Passeriformes | Chestnut-collared Longspur | 21 | 0.08 |
| Passeriformes | McCown's Longspur | 37 | 0.13 |
| Passeriformes | Orange-crowned Warbler | 3 | 0.01 |
| Passeriformes | Virginia's Warbler | 2 | 0.01 |
| Passeriformes | *Yellow Warbler | 299 | 1.08 |
| Passeriformes | Chestnut-sided Warbler | 2 | 0.01 |
| Passeriformes | Yellow-rumped Warbler | 275 | 0.99 |
| Passeriformes | American Redstart | 39 | 0.14 |
| Passeriformes | Ovenbird | 84 | 0.30 |
| Passeriformes | MacGillivray's Warbler | 26 | 0.09 |
| Passeriformes | Common Yellowthroat | 73 | 0.26 |
| Passeriformes | Wilson's Warbler | 8 | 0.03 |
| Passeriformes | Yellow-breasted Chat | 21 | 0.08 |
| Passeriformes | *Green-tailed Towhee | 204 | 0.74 |
| Passeriformes | Spotted Towhee | 131 | 0.47 |
| Passeriformes | *Chipping Sparrow | 330 | 1.19 |
| Passeriformes | Clay-colored Sparrow | 24 | 0.09 |
| Passeriformes | *Brewer's Sparrow | 865 | 3.13 |
| Passeriformes | *Vesper Sparrow | 1110 | 4.01 |
| Passeriformes | *Lark Sparrow | 279 | 1.01 |
| Passeriformes | *Sage Sparrow | 413 | 1.49 |

Table 2. Continued.

| Order | Species | Number Detected | Relative Abundance (%) |
|---|---|---|---|
| Passeriformes | *Lark Bunting | 2097 | 7.58 |
| Passeriformes | Savannah Sparrow | 170 | 0.61 |
| Passeriformes | Grasshopper Sparrow | 95 | 0.34 |
| Passeriformes | Fox Sparrow | 1 | 0.00 |
| Passeriformes | Song Sparrow | 135 | 0.49 |
| Passeriformes | Lincoln's Sparrow | 80 | 0.29 |
| Passeriformes | White-crowned Sparrow | 59 | 0.21 |
| Passeriformes | Dark-eyed Junco | 165 | 0.60 |
| Passeriformes | Western Tanager | 76 | 0.27 |
| Passeriformes | Black-headed Grosbeak | 42 | 0.15 |
| Passeriformes | Blue Grosbeak | 5 | 0.02 |
| Passeriformes | Lazuli Bunting | 21 | 0.08 |
| Passeriformes | Dickcissel | 5 | 0.02 |
| Passeriformes | Bobolink | 22 | 0.08 |
| Passeriformes | *Red-winged Blackbird | 1441 | 5.21 |
| Passeriformes | *Western Meadowlark | 4024 | 14.55 |
| Passeriformes | Yellow-headed Blackbird | 29 | 0.10 |
| Passeriformes | *Brewer's Blackbird | 786 | 2.84 |
| Passeriformes | Common Grackle | 186 | 0.67 |
| Passeriformes | *Brown-headed Cowbird | 397 | 1.44 |
| Passeriformes | Orchard Oriole | 1 | 0.00 |
| Passeriformes | Bullock's Oriole | 64 | 0.23 |
| Passeriformes | Pine Grosbeak | 2 | 0.01 |
| Passeriformes | Cassin's Finch | 32 | 0.12 |
| Passeriformes | House Finch | 6 | 0.02 |
| Passeriformes | Red Crossbill | 173 | 0.63 |
| Passeriformes | Pine Siskin | 137 | 0.50 |
| Passeriformes | American Goldfinch | 78 | 0.28 |
| Passeriformes | House Sparrow | 99 | 0.36 |
| | *Total Individuals* | *27,650* | -- |
| | *Total Species* | *190* | -- |

Table 3. Population trends (i.e., % change per year) and relative abundance (i.e., individuals per route) of avian species in Wyoming that have sufficient data to infer trends (i.e., ≥14 survey routes with detections and relative abundance >1 bird per route) by the Breeding Bird Survey, 1968–2009 (Sauer et al. 2010). Species with increasing population trends are denoted in blue with light shading; species with decreasing populations are denoted in orange with dark shading. [a] N = total number of survey routes (1968–2009) in the analysis. * indicates those species listed as Species of Greatest Conservation Need (SGCN) by the Department.

| Species | Trend | 95% C.I. | | Relative Abundance | N[a] |
|---|---|---|---|---|---|
| Red-tailed Hawk | 2.0 | 1.5 | 3.1 | 1.0 | 115 |
| American Kestrel | -1.0 | -2.1 | 0.0 | 1.7 | 112 |
| Killdeer | -1.6 | -2.5 | -0.8 | 7.6 | 113 |
| Mourning Dove | -0.9 | -1.7 | -0.1 | 15.6 | 117 |
| Common Nighthawk | -0.6 | -2.0 | 0.8 | 3.7 | 111 |
| Northern Flicker | -1.1 | -2.3 | 0.0 | 2.6 | 106 |
| Western Wood-Pewee | 1.4 | -0.1 | 2.9 | 1.8 | 76 |
| Say's Phoebe | 0.3 | -1.1 | 1.8 | 1.2 | 92 |
| Western Kingbird | 4.8 | 3.3 | 6.3 | 1.8 | 72 |
| Eastern Kingbird | 0.1 | -1.3 | 1.4 | 1.2 | 81 |
| Loggerhead Shrike | -1.4 | -2.9 | 0.1 | 1.2 | 84 |
| Warbling Vireo | 1.1 | -0.1 | 2.3 | 2.3 | 58 |
| Clark's Nutcracker | 0.0 | -3.3 | 2.6 | 2.2 | 44 |
| Black-billed Magpie | 0.1 | -1.4 | 1.5 | 7.6 | 98 |
| Common Raven | 5.5 | 3.8 | 7.1 | 1.8 | 79 |
| Horned Lark | -1.7 | -2.5 | -0.7 | 100.7 | 106 |
| Tree Swallow | -0.6 | -2.2 | 0.9 | 1.9 | 71 |
| Violet-green Swallow | 1.2 | -1.1 | 3.5 | 3.2 | 80 |
| Cliff Swallow | 4.0 | -1.6 | 10.5 | 0.3 | 107 |
| Barn Swallow | -1.5 | -2.7 | -0.3 | 4.4 | 107 |
| Mountain Chickadee | -1.0 | -2.7 | 0.6 | 2.5 | 29 |
| Rock Wren | 0.0 | -1.2 | 1.1 | 5.1 | 103 |
| House Wren | 2.0 | 0.8 | 3.2 | 1.2 | 81 |
| Ruby-crowned Kinglet | 0.1 | -1.3 | 1.6 | 2.9 | 40 |
| Mountain Bluebird | 0.0 | -1.4 | 1.4 | 5.9 | 104 |
| Hermit Thrush | -0.5 | -2.6 | 1.6 | 1.6 | 24 |
| American Robin | -0.7 | -1.2 | -0.2 | 14.4 | 110 |
| *Sage Thrasher | 0.8 | -0.4 | 1.9 | 50.0 | 87 |
| European Starling | 1.4 | -0.4 | 3.0 | 6.2 | 99 |
| Yellow Warbler | 0.4 | -0.5 | 1.2 | 4.7 | 90 |
| Yellow-rumped Warbler | -2.2 | -3.7 | -0.8 | 2.6 | 45 |
| Western Tanager | -0.7 | -2.8 | 1.2 | 1.1 | 54 |
| Green-tailed Towhee | -0.1 | -2.1 | 1.3 | 5.2 | 73 |

Table 3. Continued.

| Species | Trend | 95% C.I. | | Relative Abundance | N[a] |
|---|---|---|---|---|---|
| Spotted Towhee | 0.2 | -1.4 | 1.8 | 1.1 | 59 |
| Chipping Sparrow | -1.5 | -3.5 | -0.2 | 2.1 | 88 |
| *Brewer's Sparrow | 0.0 | -1.3 | 1.2 | 53.1 | 112 |
| Vesper Sparrow | -1.1 | -2.0 | -0.2 | 35.5 | 117 |
| Lark Sparrow | 1.4 | 0.1 | 2.8 | 3.6 | 98 |
| *Sage Sparrow | 2.1 | -0.3 | 4.3 | 17.2 | 61 |
| *Lark Bunting | -3.8 | -6.7 | -1.4 | 404.4 | 103 |
| Savannah Sparrow | 2.1 | -0.5 | 4.7 | 2.4 | 88 |
| *Grasshopper Sparrow | 0.1 | -2.9 | 2.9 | 2.3 | 64 |
| Song Sparrow | 1.0 | -2.0 | 2.2 | 1.8 | 89 |
| Lincoln's Sparrow | 3.0 | 0.1 | 5.8 | 1.1 | 33 |
| White-crowned Sparrow | 1.1 | -0.8 | 3.0 | 3.6 | 45 |
| Dark-eyed Junco | -1.4 | -3.0 | 0.2 | 3.5 | 42 |
| Lazuli Bunting | -1.6 | -3.9 | 0.9 | 1.1 | 56 |
| Red-winged Blackbird | -0.2 | -0.9 | 0.5 | 19.2 | 109 |
| Western Meadowlark | 0.4 | -0.3 | 1.1 | 163.8 | 113 |
| Yellow-headed Blackbird | -1.3 | -4.2 | 1.3 | 6.7 | 76 |
| Brewer's Blackbird | -0.5 | -1.8 | 0.8 | 50.9 | 116 |
| Common Grackle | 0.0 | -2.0 | 1.8 | 3.2 | 85 |
| Brown-headed Cowbird | 1.9 | 0.4 | 3.5 | 3.2 | 109 |
| Pine Siskin | -2.7 | -5.2 | -0.1 | 6.1 | 46 |
| House Sparrow | -0.8 | -2.8 | 1.0 | 6.3 | 70 |

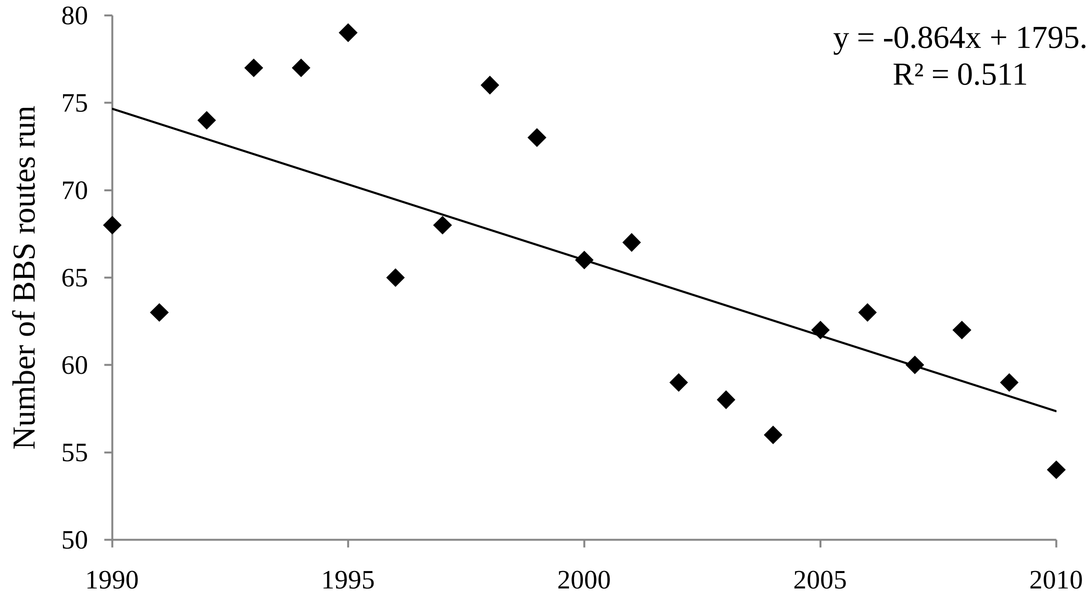


Figure 1. Number of Breeding Bird Survey routes completed in Wyoming, 1990–2010. The trend line is shown for reference.

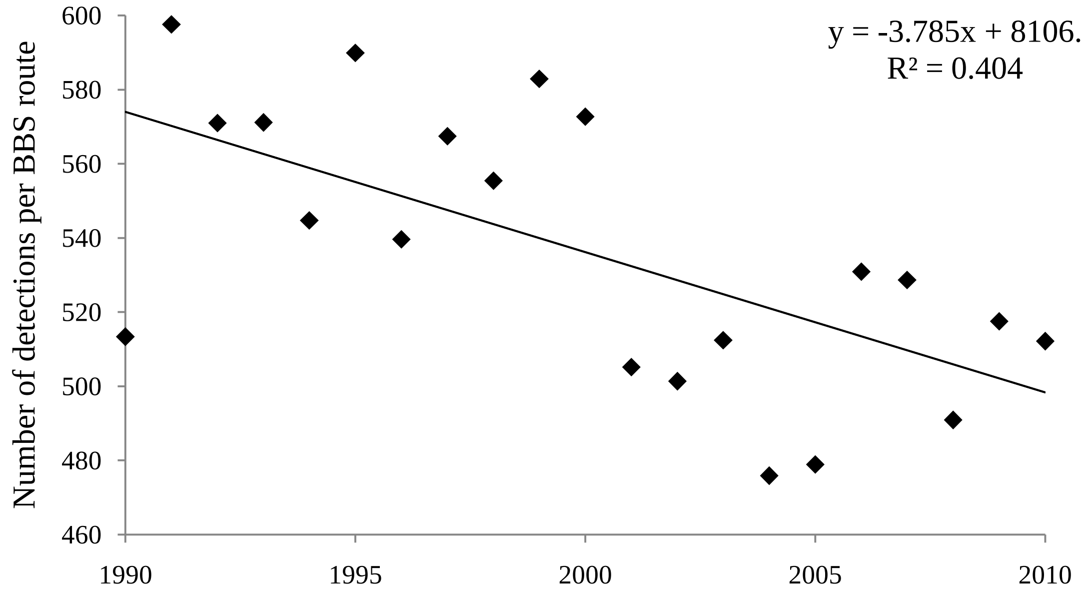


Figure 2. Number of individual detections of birds per Breeding Bird Survey route in Wyoming, 1990–2010. The trend line is shown for reference.

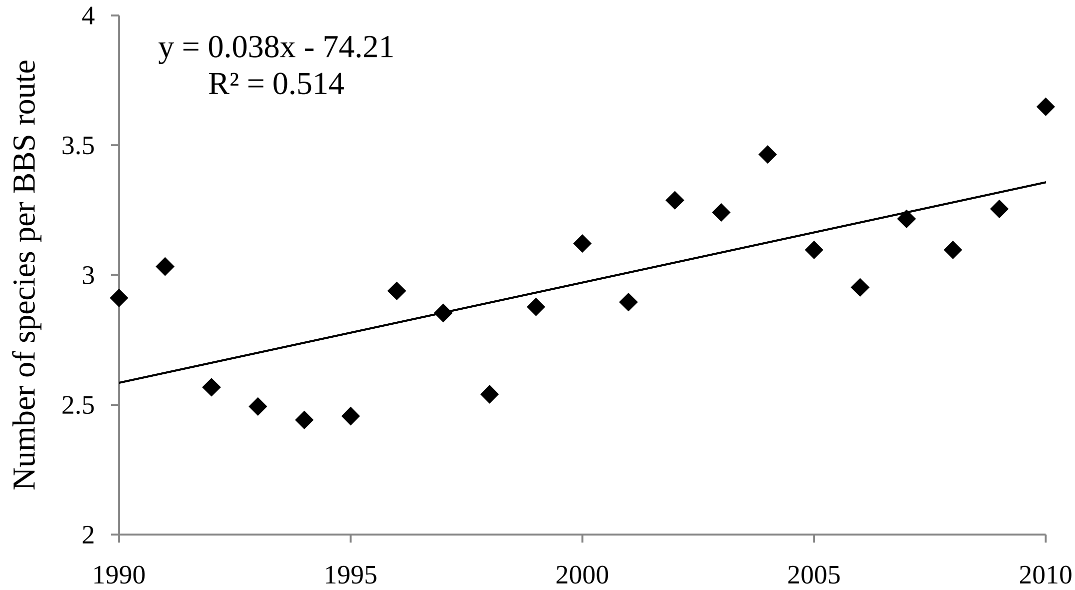


Figure 3. Average number of species detected per Breeding Bird Survey route in Wyoming, 1990–2010. The trend line is shown for reference.

## WYOMING PARTNERS IN FLIGHT AND INTEGRATED MONITORING IN BIRD CONSERVATION REGIONS

STATE OF WYOMING

NONGAME BIRDS: Species of Greatest Conservation Need

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriation, Wyoming Governor's Endangered Species Act Fund, Bureau of Land Management Cooperative Agreement #L08AC13184

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Andrea Orabona, Nongame Bird Biologist
Nichole Cudworth, Nongame Biologist
Chris White, Rocky Mountain Bird Observatory
David Hanni, Rocky Mountain Bird Observatory

### ABSTRACT

Landbird populations have declined due to a variety of influences, both natural and human-caused. The Partners In Flight program was initiated in 1990 to address these declines through comprehensive bird conservation planning efforts. The State's working group, Wyoming Partners In Flight, produced the Wyoming Bird Conservation Plan, Version 2.0, which presents avian population objectives, habitat objectives, Best Management Practices to benefit birds, and recommendations to ensure the viability of birds and their habitats (Nicholoff 2003). Monitoring is a key component of the Wyoming Bird Conservation Plan. Through cooperative funding via Wyoming Partners In Flight, we have implemented the Integrated Monitoring in Bird Conservation Regions (i.e., formerly Monitoring Wyoming's Birds) program, which allows us to estimate density, population size, occupancy, and detection probabilities for numerous avian species, including Species of Greatest Conservation Need (WGFD 2010). In 2010, we completed 2,309 point counts on 197 of 203 transects within 5 Bird Conservation Regions in Wyoming, and detected 158 species, including 27 Species of Greatest Conservation Need. We determined density estimates for 12 Species of Greatest Conservation Need, 6 of which provided robust density estimates, and 102 additional avian species, 59 of which provided robust density estimates. We determined occupancy for 15 Species of Greatest Conservation Need, 6 of which provided robust occupancy estimates, and 72 additional avian species, 38 of which provided robust occupancy estimates. The Integrated Monitoring in Bird Conservation Regions design allows us to monitor trends of avian Species of Greatest Conservation Need that may be overlooked or under-represented by other survey techniques, permits slight modifications to the

design in order to investigate other priority species as needs arise, and reduces monitoring costs through coordination and collaboration with monitoring partners.

## INTRODUCTION

Long-term data analyses indicate that trends for many populations of North American landbirds have declined due to land use changes; habitat loss, fragmentation, and deterioration; pesticide use; and human influences and disturbance (Robbins et al. 1989, Peterjohn et al. 1995, Sauer et al. 1996, Boren et al. 1999, Donovan and Flather 2002). The international Partners in Flight (PIF) program was initiated in 1990 to address and reverse these declines. The PIF mission is to help species at risk and to keep common birds common through voluntary partnerships for birds, habitats, and people. State, regional, national, and international Bird Conservation Plans comprehensively address the issues of avian and habitat conservation on a landscape scale. The North American Bird Conservation Initiative (NABCI) was initiated in 1998 to ensure the long-term health of North America's native bird populations through effective conservation initiatives, enhanced coordination among the initiatives, and increased cooperation between the governments and citizens of Canada, the United States, and Mexico (www.nabci-us.org/about.htm).

The state PIF working group, Wyoming Partners In Flight (WYPIF), was established in 1991 and 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 (WYNDD), University of Wyoming, and The Nature Conservancy. The Department's Nongame Bird Biologist has served as the state's WYPIF chairperson since its inception. As a group, WYPIF produced the Wyoming Bird Conservation Plan, Version 2.0 (Plan; Nicholoff 2003). The Plan presents objectives for populations of birds and major habitat groups in the state, Best Management Practices to benefit birds, and recommendations to ensure that birds and the habitats they require remain intact and viable into the future through proactive and restorative management techniques.

One of the highest priority objectives for populations of birds throughout the Plan is to implement Monitoring Wyoming's Birds: The Plan for Count-based Monitoring (Leukering et al. 2001). Monitoring of populations is an essential component of effective wildlife management and conservation (Witmer 2005, Marsh and Trenham 2008). Besides improving distribution data, monitoring allows us to evaluate populations of target species and detect changes over time (Thompson et al. 1998, Sauer and Knutson 2008), identify species that are at-risk (Dreitz et al. 2006), and evaluate responses of populations to management actions (Alexander et al. 2008, Lyons et al. 2008) and landscape and climate change (Baron et al. 2008, Lindenmayer and Likens 2009).

For the 10$^{th}$ consecutive year, biologists from the Department, BLM, RMBO, USFS, Audubon Wyoming, and WYNDD have collectively implemented a BLM cooperative assistance agreement that provides funding for this collaborative effort. The agreement allows us to execute a statewide monitoring program for birds, and revise the distribution and estimate abundance of numerous avian species, including Species of Greatest Conservation Need (WGFD 2010; SGCN). Funding is also provided to develop educational materials and improve outreach opportunities that focus on birds in Wyoming. The RMBO is responsible for implementing the monitoring program, which originally focused on six habitats in Wyoming (i.e., aspen, grassland, juniper woodland, mid-elevation conifer, montane riparian, and shrub-steppe). This monitoring program, called Integrated Monitoring in Bird Conservation Regions (IMBCR), now incorporates a region-wide approach using a stratified, spatially balanced, grid-based design (Hanni et al. 2009). The USFS contributes funding to the program, and WYNDD assists in program monitoring. Audubon Wyoming assists with inventory and monitoring for those species that require techniques other than point-counts (e.g., Monitoring Avian Productivity and Survivorship bird banding stations), producing and distributing educational materials on birds and their habitats, and providing nature-based outreach opportunities for the public. The Department conducts annual monitoring for SGCN that require species-specific survey methods (e.g., Common Loon [*Gavia immer*], American Bittern [*Botaurus lentiginosus*] , Long-billed Curlew [*Numenius americanus*], and raptors), prints and distributes Partners In Flight educational materials, and provides point data via our Wildlife Observation System database.

## METHODS

In Wyoming's portion of the IMBCR, surveys were conducted within five Bird Conservation Regions (BCRs; Fig. 1). The five BCRs that occur in Wyoming, plus an additional two in other states (i.e., BCRs 11 and 34), comprised the IMBCR sampling frame for 2010.

Within these seven BCRs, all monitoring partners collaborated to define strata and super-strata based on smaller-scale areas to which we wanted to make inferences (e.g., National Forests, BLM lands, individual states). Within each stratum, the IMBCR design used a spatially balanced sampling algorithm (i.e., generalized random-tessellation stratification) to select sample units (Stevens and Olsen 2004). We overlaid BCRs with a grid comprised of 1-km$^2$ sample units. Sample units were randomly selected and 16 survey points were established within each sample unit using a 4 × 4 array spaced 250 m apart (Hanni et al. 2009)

Prior to surveys, field technicians completed an intensive training program covering protocols, bird identification, and distance estimation. Field technicians conducted point counts using IMBCR sampling protocols established by RMBO (Buckland et al. 2001, Hanni et al. 2009). RMBO surveyed transects in the morning from ½ hr before sunrise to 1100 hrs. In 2010, duration at each survey point was extended from 5 to 6 min to facilitate estimation of site occupancy. For each bird detected, field technicians recorded species, sex, horizontal distance from the observer, minute of detection, and type of detection (e.g., song, call, visual). Other information, such as flyovers, clusters, and the presence of species difficult to detect, was also noted. Time, ambient temperature, cloud cover, precipitation, and wind speed were recorded at the start and end of each transect. Vegetation data were recorded within a 50-m radius of each survey point and included dominant habitat type, structural stage, relative abundance, percent cover and mean height of trees, species of shrubs, grass height, and groundcover. Distance from a road, if within 100 m, was also recorded.

Biometricians from RMBO used Distance 6.0 to estimate detection probabilities (Thomas et al. 2010). They used the SPSURVEY package in Program R to estimate density, population size, and its variance for each bird species (T. Kincaid, unpublished data). Lastly, they estimated detection probability for each species using a removal design (MacKenzie et al. 2006).

## RESULTS

Between 14 May and 21 June 2010, field technicians completed 2,308 point counts on 197 of 203 transects that were planned for surveys within 5 BCRs in Wyoming. A total of 158 species were detected, including 27 SGCN. RBMO was able to estimate density for 12 SGCN, 6 of which provided robust estimates (i.e., CV <50%; Table 1). Density was estimated for an additional 102 avian species, 59 of which provided robust density estimates. RMBO estimated occupancy for 15 SGCN, 6 of which provided robust occupancy estimates (i.e., CV <50%; Table 2). Occupancy was determined for an additional 72 avian species, 38 of which provided robust occupancy estimates.

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

## DISCUSSION

The methods used by RMBO to monitor avian populations for the IMBCR provided an estimation of detection probability. The results were then used to estimate both density and occupancy for each species if sample sizes were large enough. These robust data not only allow for continuous monitoring of species trends, but also provide information on species abundance and distribution, habitat associations, and evaluation of land management activities (White et al. 2011). The IMBCR provides density and occupancy estimates for a number of avian SGCN at risk in Wyoming due to habitat loss or alteration or for which data on population and trends are lacking. Consequently, the IMBCR provides the Department with an opportunity to monitor trends of avian SGCN that may be overlooked or under-represented by other survey techniques.

The 2010 IMBCR provides robust density and occupancy estimates for six avian SGCN in Wyoming, all of which help fill gaps in current monitoring efforts by the Department. Data on these species help address a number of management challenges, including data deficiencies, habitat loss or degradation, and population declines. Specifically, the American Three-toed Woodpecker (*Picoides tridactylus*) is found in higher elevation mature and old-growth coniferous forests, and is classified as a Native Species Status Unknown (NSSU) due to unknown population status and trends resulting from inadequate monitoring techniques (WGFD 2010). The IMBCR provides a quantified approach for monitoring this species. Three species, Brewer's Sparrow (*Spizella breweri*), Sage Sparrow (*Amphispiza belli*), and Sage Thrasher (*Oreoscoptes montanus*), are considered sagebrush obligates, and the Grasshopper Sparrow (*Ammodramus savannarum*) and Lark Bunting (*Calamospiza melanocorys*) are associated with grasslands. Both of these habitats are at high risk for degradation, alteration, or loss, with grasslands listed among the most imperiled habitats in the United States and exhibiting dramatic declines in avian populations (WYPIF 2002, WGFD 2010). Consequently, monitoring these SGCN can provide an indication of trends for a suite of sagebrush and grassland-obligate species that are not monitored.

The IMBCR's spatially-balanced sampling design is more efficient than simple random sampling and can increase precision in density, occupancy, and detection probability estimates (Stevens and Olsen 2004, White et al. 2011). Additionally, this sampling design provides the flexibility to generate population estimates at various scales relevant to land and wildlife management agencies. It also allows sampling of all habitats, which enables managers to relate changes in bird populations to changes on the landscape over time. The results support both local and regional conservation efforts in Wyoming. Moreover, the IMBCR design allows us to monitor trends of avian SGCN that may be omitted or inadequately represented by other survey techniques, permits slight modifications to the design in order to investigate other priority species as needs arise, and reduces monitoring costs through coordination and collaboration with monitoring partners.

## ACKNOWLEDGEMENTS

We wish to thank BLM biologists, M. Gorges and D. Saville, for their tireless efforts and invaluable assistance in securing funding for the IMBCR program. We also thank the RMBO for implementing the IMBCR program, particularly J. Birek, J. Blakesley, F. Cardone, D. Hanni, M. McLaren, D. Pavlacky, J. Rehm-Lorber, R. Sparks, J. Stenger, N. Van Lanen, C. White, and the many field technicians that assisted with the surveys. We also greatly appreciate the collaborative efforts of the regional IMBCR team in making this program a success. Finally, we would like to thank all the individuals who contribute to the success of Wyoming Partners In Flight through their respective agencies and organizations; WYPIF thrives because of our collective efforts.

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Table 1. Estimated density (i.e., individuals per $km^2$), population size ($\widehat{N}$), percent coefficient of variation (% CV), and number of independent detections (*n*) of avian Species of Greatest Conservation Need on 197 transects surveyed in Wyoming in 2010. Density estimates are robust if CV <50%.

| Species | Density | $\widehat{N}$ | % CV | *n* |
|---|---|---|---|---|
| American Three-toed Woodpecker | 0.46 | 115,320 | 36 | 28 |
| Brewer’s Sparrow | 28.70 | 7,218,186 | 14 | 806 |
| Chestnut-collared Longspur | 0.43 | 107,128 | 54 | 6 |
| Grasshopper Sparrow | 3.27 | 821,896 | 31 | 130 |
| Lark Bunting | 14.01 | 3,524,112 | 26 | 828 |
| McCown’s Longspur | 1.56 | 391,224 | 51 | 36 |
| Pygmy Nuthatch | 0.05 | 12,001 | 81 | 2 |
| Sage Sparrow | 5.14 | 1,293,024 | 23 | 262 |
| Sage Thrasher | 1.55 | 390,118 | 20 | 201 |
| Sandhill Crane | 0.00 | 750 | 62 | 9 |
| Swainson’s Hawk | 0.04 | 10,558 | 65 | 5 |
| Upland Sandpiper | 0.17 | 41,977 | 75 | 16 |

Table 2. Estimated proportion of sample units occupied ($\psi$), percent coefficient of variation (% CV), and number of transects with ≥1 detections (*n*) of avian Species of Greatest Conservation Need on 197 transects surveyed in Wyoming in 2010. Occupancy estimates are robust if CV <50%.

| Species | $\psi$ | % CV | *n* |
|---|---|---|---|
| American Three-toed Woodpecker | 0.034 | 34 | 12 |
| Ash-throated Flycatcher | 0.000 | 71 | 1 |
| Black Rosy-Finch | -- | -- | 5 |
| Brewer's Sparrow | 0.541 | 9 | 80 |
| Chestnut-collared Longspur | 0.033 | 64 | 3 |
| Grasshopper Sparrow | 0.128 | 28 | 27 |
| Lark Bunting | 0.199 | 18 | 37 |
| McCown's Longspur | 0.045 | 52 | 5 |
| Mountain Plover | 0.000 | 71 | 1 |
| Pygmy Nuthatch | 0.001 | 59 | 2 |
| Sage Sparrow | 0.191 | 20 | 24 |
| Sage Thrasher | 0.252 | 18 | 34 |
| Swainson's Hawk | 0.017 | 101 | 2 |
| Upland Sandpiper | 0.038 | 77 | 5 |
| Willow Flycatcher | 0.060 | 67 | 4 |

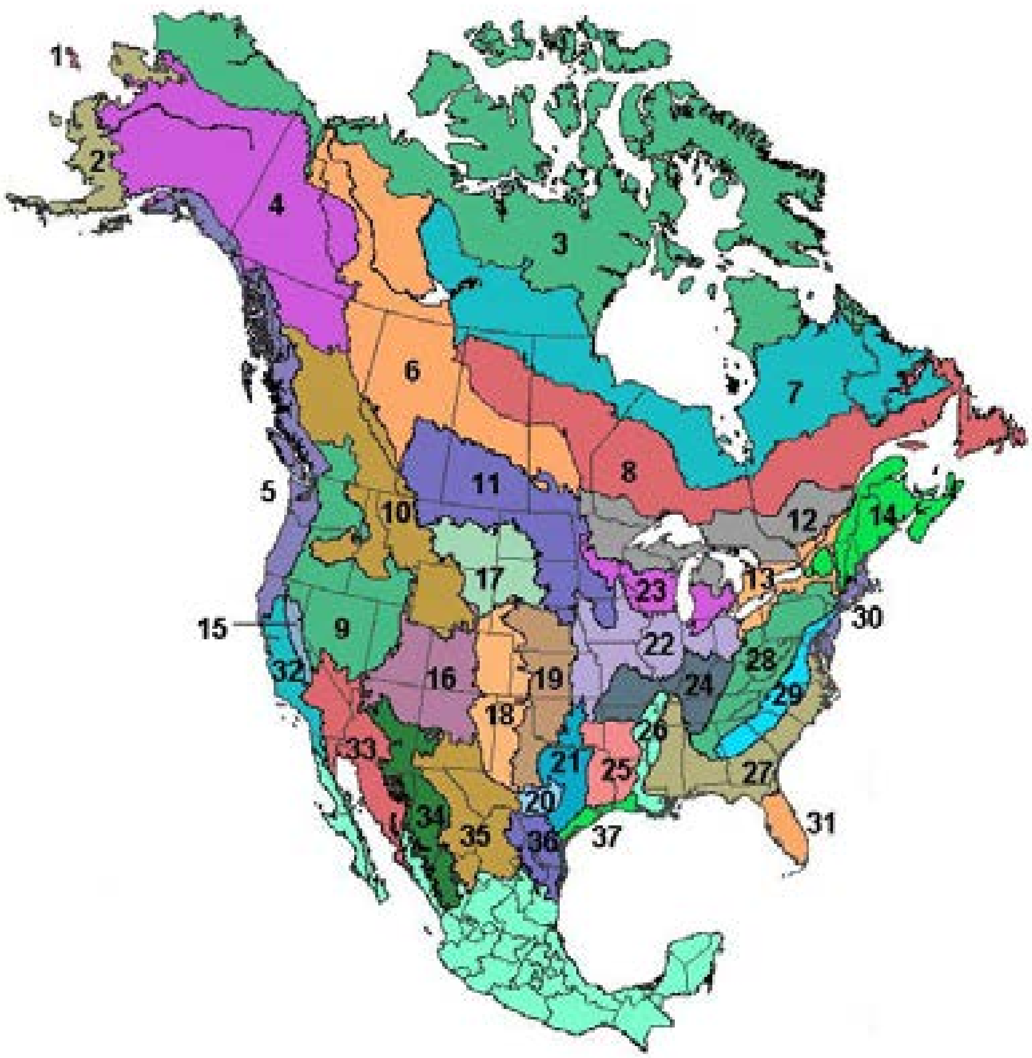


Figure 1. The North American Bird Conservation Region (BCR) map. Portions of BCRs 9 – Great Basin, 10 – Northern Rockies, 16 – Southern Rockies/Colorado Plateau, 17 – Badlands and Prairies, and 18 – Shortgrass Prairie, all occur in Wyoming and were part of the sampling frame in 2010.

# TECHNICAL COMMITTEES AND WORKING GROUPS

**A 5-YEAR REVIEW OF THE CENTRAL AND PACIFIC FLYWAY NONGAME MIGRATORY BIRD TECHNICAL COMMITTEES**

STATE OF WYOMING

NONGAME BIRDS: Nongame Migratory Birds

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2006 – 14 April 2011

PREPARED BY: Andrea Orabona, Nongame Bird Biologist
Joe Bohne, Staff Biologist

**SUMMARY**

The Central Flyway Council (CFC) and Pacific Flyway Council (PFC) were established in 1951 and 1948, respectively, to coordinate management among states that occur within each Flyway. The CFC includes representative from 10 states (i.e., Montana, Wyoming, Colorado, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas) and three Canadian provinces (i.e., Saskatchewan, Alberta, and the Northwest Territories). The PFC includes representatives from Washington, Oregon, California, Arizona, New Mexico, Colorado, Wyoming, Idaho, Montana, Alaska, Nevada, and Utah. The Canadian Wildlife Service and British Columbia are active participants in the Pacific Flyway. The function of the Central and Pacific Flyway Councils is to work with the U.S. Fish and Wildlife Service (USFWS), in conjunction with the Councils of the Atlantic and Mississippi Flyways, in the cooperative management of North American migratory game birds. Specific responsibilities include the annual process of setting migratory bird hunting regulations. Along with their Technical Committees, the CFC and PFC also conduct and contribute to a wide variety of migratory bird research and management programs throughout the United States, Canada, and Mexico.

Considerable technical information is required for the Flyway Councils to fulfill their objectives. Therefore, various Technical Committees (TCs) have been established to accomplish this role. The Central Flyway Waterfowl TC and the Pacific Flyway Study Committee were established in 1953 and 1948 respectively. The Central Management Unit TC was formed in 1966 to provide technical input on Mourning Dove management and research issues. In 1967, the scope of this TC was broadened to include species other that doves, and the name was changed to the Central Migratory Shore and Upland Game Bird TC. In 1999, the name was changed to the Central Flyway Webless Game Bird TC, and in 2001, the name was again changed to the Central Flyway Webless Migratory Game Bird TC. The Central Management

Unit Mourning Dove TC was established in 2003, and its name was changed to the Central Management Unit Dove TC in 2007 to recognize responsibility for all dove species with regulated hunting seasons. In 2006, the Central and Pacific Flyway Councils established the Central and Pacific Flyway Nongame Migratory Bird TC to address a growing number of regulatory issues for migratory birds that were not currently addressed by the other TCs, and to broaden the Flyway Councils' focus beyond traditional game birds.

It is the intent of the CFC, PFC, and TCs that the division of responsibilities for avian species follows the definition for game birds as defined in the migratory bird conventions with Canada and Mexico. The Central Flyway Waterfowl TC is responsible for the families Anatidae (i.e., ducks, geese, and swans) and Rallidae (i.e., American Coots). The Central Flyway Webless Migratory Bird TC is responsible for the families Rallidae (i.e., rails, gallinules, and other coots), Gruidae (i.e., cranes), Charadriidae (i.e., plovers and lapwings), Haematopodidae (i.e., oystercatchers), Recurvirostridae (i.e., stilts and avocets), Scolopacidae (i.e., sandpipers, phalaropes, and allies), Corvidae (i.e., jays, crows, and their allies), and Columbidae (i.e., pigeons). The Central Management Unit Mourning Dove TC is responsible for the Columbidae family (i.e., doves only). The Central Flyway Nongame Migratory Bird TC is responsible for all migratory birds (as per the Migratory Bird Treaty Act) not included in the above division of responsibilities. Members of various TC do recognize that they may need to collaborate on some issues. For example, the webless TCs may coordinate with the nongame TC on issues related to non-hunted shorebirds, rails, and federally threatened or endangered species.

The state, provincial, and territorial representatives to the TCs are usually biologists with considerable training and experience in the field of waterfowl, migratory shore and upland game bird, dove, or migratory nongame bird management and research, respectively. The function of the TCs is to serve the CFC and PFC, with primary responsibility for the technical information needs of the Flyway Councils related to management of migratory game birds, wetland resources and nongame migratory birds. The TCs may also recommend research projects, surveys, and management programs to the Flyway Councils for their collective consideration and/or implementation. The Wyoming Game and Fish Department's Nongame Bird Biologist, Andrea Orabona, and Nongame Biologist, Susan Patla, serve as the state's representatives on the Central and Pacific Nongame Migratory Bird TCs, respectively.

Since the TC inception, the CFNMBTC has submitted 7 recommendations to the CFC for signing and submission. A summary of each recommendation is presented below (Table 1).

Table 1. Summary of recommendations submitted to the Central Flyway Council (CFC) by the Central Flyway Nongame Migratory Bird Technical Committee, 2007-2011. United States Fish and Wildlife Service (USFWS). Central Management Unit (CMU).

| Date | Recommendation no. | Pertaining to | Recommendation |
|---|---|---|---|
| March 20, 2007 | 10 | Selection of shorebird species for Avian Influenza surveillance. | The CFC recommends that the USFWS prohibit lethal collection of certain shorebird species during avian influenza surveillance activities. Samples from highly imperiled species should be taken by nonlethal means. |
| March 20, 2007 | 11 | Comment period during proposed rule stage. | The CFC recommends that the USFWS allows for comment periods for all nongame migratory bird regulations to be 90 days, but no less than 60 days, and considers the option of establishing nongame migratory bird regulatory cycles similar to that which exists for the Waterfowl, Webless, and CMU Technical Committees. |
| March 20, 2007 | 12 | Finalization of MOU for the Cooperative Exchange, Interpretation, and Evaluation of Data and Information Used for Developing Migratory Bird Regulations. | The CFC recommends that the MOU listed above be finalized and signed by the Director of the USFWS and the Chairperson of the CFC. |

Table 1. Continued.

| Date | Recommendation no. | Pertaining to | Recommendation |
|---|---|---|---|
| March 17, 2009 | 14 | Allocation of passage Peregrine Falcon take for falconry purposes in the United States east of 100° W longitude. | The CFC recommends an equitable distribution of 36 first-year migrant peregrine falcon take permits among the Central (FC), Mississippi (MF), and Atlantic (AF) flyways for the 20 September to 20 October 2009 trapping season; 12 permits each for the CF, MF, and AF. Of the Central Flyway's allocation, the CFC recommends 10 first-year migrant peregrine falcons for Texas and 2 first-year migrant peregrine falcons for Oklahoma for the 20 September to 20 October 2009 trapping season only. |
| March 23, 2010 | 14 | Allocation of the take of passage immature Peregrine Falcons for falconry purposes in the United States east of 100° W longitude. | The CFC recommends that 12 of the 36 first-year migrant Peregrine Falcon take permits be allocated to the Central Flyway for the fall of 2010 trapping season, with 11 of the 12 permits designated for TX and 1 of the 12 permits designated for OK for the fall 2010 trapping season only. |
| March 15, 2011 | 14 | Participation in the USFWS Eagle Technical Assessment Group. | The CFC recommends that a CFNMBTC representative is included on the USFWS's Eagle Technical Assessment Group. |

Table 1. Continued.

| Date | Recommendation no. | Pertaining to | Recommendation |
|---|---|---|---|
| March 15, 2011 | 15 | Peregrine Falcon allocation for falconry purposes. | The CFC recommends adoption of Alternative A (allocation of 12-12-12) for allocation of permits for the take of passage immature Peregrine Falcons for falconry, and that states consider the use of a quota system to provide additional opportunity where the probability of take is expected to be less than 1 permit:1 falcon captured. |

## WYOMING BIRD RECORDS COMMITTEE

STATE OF WYOMING

NONGAME BIRDS: Rare and Unusual Birds

FUNDING SOURCE: Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: Annual

PERIOD COVERED: 1 January 2010 – 31 December 2010

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 other material relevant to the birds of Wyoming.
2) To review records of new or rare species or species difficult to identify and offer a well informed, 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 birders in Wyoming with increasing their knowledge and skills.

The WBRC is interested in promoting and maintaining quality and integrity in the reporting of bird observations in Wyoming, and it treats all bird records as important 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 2010, the WBRC has reviewed 1,146 reports of rare and unusual birds in Wyoming. Of the 1,146 reports, 920 (80%) have been accepted and 226 (20%) have not. Nineteen 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. All WBRC reports for 2010, as well as Rare and Unusual Bird Forms are available from the Nongame Bird Biologist in the Lander regional office.

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: J. Adams, G. Johnson, J. Lawrence, C. Michelson, and S. Patla.

## BLACK-FOOTED FERRET RECOVERY AND IMPLEMENTATION TEAM ANNUAL SUMMARY

STATE OF WYOMING

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

FUNDING SOURCE: United States Fish and Wildlife Service Section 6 Funds, Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Martin Grenier, Nongame Mammal Biologist

## SUMMARY

The Black-footed Ferret Recovery and Implementation Team (BFFRIT) was created in 1996 by the U.S. Fish and Wildlife Service (USFWS) to serve as an interstate advisory group to the USFWS on management issues for the black-footed ferret (*Mustela nigripes*; ferret). BFFRIT replaced the advisory group (i.e., Black-footed Ferret Advisory Team) created by the Wyoming Game and Fish Department in 1986. BFFRIT is comprised of the Executive Committee, and several subcommittees, Species Survival Plan, Conservation, and Education and Outreach. Each subgroup is comprised of representatives from several federal and agencies, non-governmental agencies, and native American tribes.

The Wyoming Game and Fish Department's Deputy Directory of External Affairs is currently serving as chair of the BFFRIT Executive Committee. Within the last year, considerable effort has been expended in developing the framework for landowner incentive program to benefit the recovery of the ferret. The framework is still in the early developmental stages; however several meeting between BFFRIT Executive Committee and heads of many federal agencies have been favorable. A working draft is expected later this year.

The Wyoming Game and Fish Department's Nongame Mammal Biologist is currently serving as the chair of the BFFRIT Conservation Subcommittee (CS). The CS meets annually to discuss recent developments, needs, and current status of reintroduction efforts nationwide. Ferrets have been reintroduced to eight states and nearly 20 different attempts have been initiated in North America. Currently, at least four reintroduction sites are believed to contribute towards the delisting goal for the ferret, by sustaining a minimum of 30 breeding adults.

**SWIFT FOX CONSERVATION TEAM ANNUAL SUMMARY**

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Swift Fox

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants, Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Martin Grenier, Nongame Mammal Biologist

**SUMMARY**

The Swift Fox Conservation Team (Team) was created in 1995 following the petition to list the swift fox (*Vulpes velox*) as Threatened or Endangered under the Endangered Species Act of 1973 (ESA). State agencies within the historic range of the swift fox created the Team in an effort to coordinate management across the species range. The Team is comprised of representative from various state and federal agencies, and enjoys participation from several non-governmental organizations as well as native American tribes.

Since its inception the Team has worked diligently to remove the swift fox from the ESA and to preclude future relisting of the species. In recent years, in collaboration with Kansas, Colorado, and Wyoming, swift fox have been reintroduced into western and central South Dakota. The Team produces an annual report available from their website maintained by Colorado Division of Wildlife at
http://wildlife.state.co.us/WildlifeSpecies/GrasslandSpecies/SwiftFoxAdditionalResources.htm

During 2010, the Team, co-chaired by South Dakota and Montana have revised and updated the Conservation Assessment and Conservation Strategy for the Swift Fox in the United States. It is available from the above website. The Team meets biennially. In 2010, the Team met for three days in Laramie, Wyoming to discuss and coordinate management of swift fox across the species range. One day of the meeting was spent in the field exploring current management challenges in Wyoming (e.g., rural sprawl and wind energy development).

**WYOMING BAT WORKING GROUP ANNUAL SUMMARY**

STATE OF WYOMING

NONGAME MAMMALS: Species of Greatest Conservation Need – Bats

FUNDING SOURCE: United States Fish and Wildlife Service State Wildlife Grants, Wyoming State Legislature General Fund Appropriations

PROJECT DURATION: Annual

PERIOD COVERED: 15 April 2010 – 14 April 2011

PREPARED BY: Martin Grenier, Nongame Mammal Biologist

## SUMMARY

The Wyoming Bat Working Group (WYBWG) is a subgroup of the larger Western Bat Working Group that coordinates management and conservation of bats in the western US. Both group were formed in the mid 1990s to address growing concern over Townsend's big-eared bat (*Corynorhinus townsendii*; COTO). After the development of the COTO Conservation Assessment and Strategy (Pierson et al. 1999), emphasis broadened to include all bat species. The WYBWG is comprised of representatives from Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. Forest Service, Washakie Conservation District, Wyoming Department of Environmental Quality, and Wyoming Game and Fish Department. Bill Munro of the U.S. Forest Service is the current chair for the WYBWG, prior to 2010 the Wyoming Game and Fish Department's Nongame Mammal Biologist was the chair.

During the last two years the WYBWG has focused considerable resources on addressing potential threats to populations of bats in Wyoming. In 2009 and 2010 Wyoming was targeted for unprecedented wind energy development. As a response, WYWBG drafted recommendations for minimizing impacts to populations of bats associated with wind energy development (Munro and Grenier 2010). Since then, the Governor of Wyoming has successfully curbed the anticipated development rate. More recently, many populations of bats in the eastern U.S. have become vulnerable to White Nose Syndrome (WNS). Severe declines in abundance have been reported at many hibernacula in the eastern U.S. Notably, the implications for populations in the western U.S. are unknown and a coordinated management response was lacking for Wyoming. Consequently, the WYBWG drafted a strategic plan to guide and coordinate management response to this potential threat in Wyoming (Abel and Grenier 2010). The plan provides guidance on addressing this new threat and standardizes management actions to facilitate detection of the fungus.

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